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Editorial

Suomen Pankki – Finlands Bank initiated this workshop series dedicated to emerging market economies and also hosted the first two workshops in Lapland in 2003 and in Helsinki in 2004. In 2005, the third workshop organized by Banco de España in Madrid focused on Latin America and in 2006 the workshop series returned to Finland again.

This publication comprises the papers presented at the 5th Emerging Markets Workshop held at the OeNB from March 5 to 6, 2007, in Vienna. In line with the OeNB's specific strategic research focus, the program concentrated on "Emerging Markets: Any Lessons for Southeastern Europe?" Since the region is of particular importance for the Austrian economy, the OeNB has always closely observed the economic developments in Southeastern Europe (SEE) as well as in the broader region. A few facts will illustrate this: In 2005, Austrian banks assets' in Central, Eastern and Southeastern Europe (CESEE) amounted to around 16% of their total assets, while contributing some 35% of pre-tax profits, Austria shows the highest share of exports to CESEE countries within the EU-15 and holds an outstanding FDI position in many of these countries – it ranks first among foreign investors in Bosnia-Herzegovina, Bulgaria, Croatia and Slovenia. Overall, it is estimated that the Austrian economy has benefited from CEE integration by a growth bonus of about 3½ percentage points in total since 1990.

This year's workshop was also dedicated to the memory of Olga Radzyner, former Head of the OeNB's Foreign Research Division, who would have celebrated her 50th birthday in 2007.

The economic literature does not provide a generally accepted definition of emerging market economies (EMEs). Still, one may describe such markets as middle income countries where – over a longer period – economic growth rates are higher than in industrialized countries, thus enabling them to catch up in terms of GDP per capita. Such an approach would indeed imply that a typical emerging market economy was based on secondary and tertiary sectors rather than on extraction and export of commodities. Other salient features of emerging markets are important FDI inflows and the subsequent build-up of strong export capacities. Given these characteristics, the question arises whether SEE countries can still be qualified as emerging market economies. Yet there is no straightforward answer to that question for the following reasons: Some of these SEE countries have perhaps not fully turned into emerging markets as economic growth has only picked up recently and as they are still at a very early stage of the catching-up process. It can be expected though that they will establish themselves as EMEs in the longer run as FDI has started to flow in and as exports have begun to grow stronger. Others can be viewed as EMEs, as they have been recording stable economic growth rates for some time already. Finally, one special case has to be highlighted: Slovenia, which adopted the euro on January 1, 2007, has achieved a large degree of nominal and real convergence with respect to the euro area. It is therefore difficult to argue that the country is still an EME, particularly if compared to some other member states of monetary union.

The workshop primarily dealt with the question of what EMEs in SEE had in common with EMEs elsewhere and what separated them from the latter. They share indeed a number of common features: First, following the former periods of crisis financial dollarization (in this particular case euroization) in SEE is substantial. Second, fighting inflation has been a general problem, which still persists in a number of countries. Third, political uncertainty is a non-negligible issue. Finally, public finances and the banking sector used to be a source of macroeconomic instability for some of these countries (but this is no longer the case for most of them).

Despite these common features, SEE economies differ to some extent very much from other emerging markets: First, EMEs in SEE are in most cases small economies, especially when comparing them to countries like Brazil, Argentina and Turkey. Consequently, export-led growth is a straightforward way toward economic convergence. Second, external debt is only a problem for some countries of the region (where debt amounted to about 70% to 80% of GDP in 2006) but not for the others. Third, European integration provides an economic and political anchor for SEE countries and euro adoption (via ERM II membership and fulfillment of the convergence criteria) is a realistic exit strategy from existing monetary policy strategies, which is not available for non-European countries.

In his keynote contribution, *Dimitri Demekas (IMF)* provided a number of additional explanations for these differences: SEE countries have undergone strong unconditional convergence, they have recorded important capital (in)flows and current account deficits associated with growth. These developments can mainly be attributed to financial integration, to the prospect of EU accession and/or euro membership, and to threshold effects. All this mitigates the traditional risks of capital flow volatility and sudden stops. Thus, superficial international comparisons often miss the point. Nevertheless, overvaluation and balance sheet risks are still present in SEE countries.

The other papers of this conference volume are grouped around four major topics: (i) industrial restructuring and financing, (ii) exposure of the nonfinancial corporate sector, (iii) restructuring of the banking sector and credit expansion and (iv) exchange rate issues, including depreciation as a possible adjustment strategy in boom-bust cycles.

- The three papers of the first group look at industrial restructuring and financing structures. Industrial restructuring and the role of FDI is an important issue as some SEE countries are struggling with the restructuring of the nonfinancial corporate sector or are still at a very early stage of the process. In this context, *Peter Havlik (Vienna Institute for International Economic Studies – wiiw)* documents the very fast productivity growth in the New Member States (NMS) and in the Commonwealth of Independent States (CIS). He argues that this fast growth is largely a jobless growth as employment elasticity to GDP growth is very low. *Adam Geršl (Ceská národní banka), Ieva Rubene and Tina Zumer (both ECB)* report mixed and thus somewhat disappointing evidence of productivity spillovers from FDI in the CEECs during the last six to seven years, while *Evgeni Peev* and *Burcin Yurtoglu (University of Vienna)* present the main features of corporate financing in the NMS.

- The second group of papers focuses on the effect that the public sector's debt structure and the corporate sector's foreign exchange exposure have on the external vulnerability of emerging markets, which constitutes an important issue for SEE. *Aitor Erce (Banco de España)* argues that looser international conditions favor domestic debt restructuring. Similarly, domestic financial market deepening and issuance clustering facilitate the financing of domestic debt on international markets. *Katalin Bodnár (Magyar Nemzeti Bank)* illustrates in her survey-based paper that although a weakening of the Hungarian forint would have a negative impact on small and medium-sized enterprises (SMEs), many of these SMEs are not even aware of this fact. In addition, they often lack foreign exchange risk management tools and two-thirds of domestic foreign exchange-denominated loans are not naturally hedged. *Enrique Alberola*, *Paloma Acevedo and Carmen Broto (Banco de España)* focus on the evolution of the public debt-to-GDP ratio and the share of foreign exchange debt, both of which have declined in emerging markets as a result of favorable financial conditions and authorities' proactive debt management strategies.
- The third set of papers looks at the restructuring of the banking sector and the ensuing credit expansion. *Dubravko Mihaljek (Bank for International Settlements)* concentrates on a number of challenges connected to the presence of foreign banks. He presents survey-based evidence that the quality of banking supervision in emerging markets increases with the presence of foreign banks. The essential questions are: What would happen if a foreign-owned bank that is important for the domestic banking system but of marginal interest for the parent company ran into difficulties? Who would rescue it? How to deal with the effects of mergers of parent institutions on the domestic market? And how should banking supervision react if domestic banks merged as a result of their foreign activities?

High credit growth has indeed been a permanent issue in Croatia and has started to become a major policy concern in other SEE countries. In this context the following questions arise: Are SEE countries different from CEE countries? And when is credit growth really excessive? *Balázs Égert, Peter Backé, (both OeNB)* and *Tina Zumer (ECB)* attempt to provide answers. By using small open OECD countries as a benchmark, they show that there is a large amount of uncertainty when it comes to determining the equilibrium level of the private credit-to-GDP ratio for CEE and SEE economies. Bearing this caveat in mind, their results indicate that some countries are very close or even above the estimated equilibrium levels, while others are still well below.

- In the fourth group of papers, *Reiner Martin* and *Ludger Schuknecht (both ECB)* present the results of an event study examining 23 countries that have experienced boom-bust episodes, distinguishing between countries that pursued an external adjustment strategy (depreciation) during busts and countries that relied on internal adjustment. The findings for CEE indicate that the boom is likely (to continue) but that it seems quite uncertain what will follow. Therefore, awareness of the associated policy challenges is essential and close monitoring is necessary in some areas, such as external balances and balance-sheet risks.

Some of the SEE countries (Albania, Croatia, Romania and Serbia) use foreign exchange interventions to achieve the ultimate goal of monetary policy, that is price stability. It is therefore interesting to see the effectiveness of foreign exchange interventions and the way how they are sterilized in markets which are at different stages of development. The paper by *Darko Bohnec (Banka Slovenije)* and *Marko Košak (University of Ljubljana)* points out that some central banks have been relatively successful in opting for a managed floating exchange rate regime and have implemented adequate sterilization policies. In this respect Banka Slovenije serves as a good example as it combined market-related instruments and capital controls with new instruments developed to compensate for underdeveloped financial markets and the lack of securities.

Among the other contributions dealing with exchange rate issues, *Iikka Korhonen* and *Tuuli Juurikkala (Suomen Pankki – Finlands Bank)* analyze the real exchange rate of oil producing countries. Their results show that the Balassa-Samuelson effect is not a relevant factor for these countries. Furthermore, the elasticity of the real exchange rate with respect to real oil prices is usually quite close to 0.5. The oil price has a direct effect on the equilibrium exchange rate in oil-producing countries, over and above the possible effect stemming from higher per capita GDP.

Markus Pramor (Center for Financial Studies) and *Natalia Tamirisa (IMF)* study co-movements of CEE and euro area exchange rate volatility against the dollar. According to their results, the Slovak koruna’s long-term volatility has been closest to that of the euro, whereas the Polish złoty has been the least correlated currency. The study also highlights the fact that the correlation of volatility developments between the euro area and the CEEs has increased over time.

Finally, *Gunther Schnabl (University of Leipzig)* elaborates on the effect of foreign exchange rate volatility on economic growth in Eastern Europe and in East Asia. His results show that countries with a fixed exchange rate regime have grown on average faster than countries with flexible exchange rate regimes. An explanation might be that fixed regimes promote trade and macroeconomic stability and thus reduce macroeconomic uncertainty.

The contributions presented at the 5th Emerging Markets Workshop in Vienna gave a comprehensive overview of a large number of issues which are highly relevant for emerging markets and which stimulated lively discussions while at the same time raising further promising research questions related to recent economic policy challenges in SEE. Given the workshop's success and its very positive assessment, participants are already looking forward to meeting again at the 6th EME Workshop in 2008!

Peter Mooslechner
Doris Ritzberger-Grünwald
Peter Backé

Economic Restructuring in the New EU Member States and Selected Newly Independent States: Effects on Growth, Employment and Productivity[1]

Peter Havlik

Vienna Institute for International Economic Studies

Executive Summary

This paper provides an overview of longer-term structural developments in the New EU Member States (NMS) from Central and Eastern Europe NMS and in selected newly independent states (NIS: Belarus, Russia and Ukraine). It analyses structural changes in both groups of countries and patterns of productivity catching-up at both macro level and within the individual industries. With the transformational recession of early 1990s left behind, the majority of NMS and NIS embarked on a path of rapid economic growth. The NMS, and recently also NIS, have experienced an impressive productivity catching-up, at both macroeconomic level and in manufacturing industry in particular. Structural changes observed during the past decade brought the NMS' economies nearer to the economic structure observed in the EU-15, but the shifts of labor among individual sectors or industries themselves did not have any marked impact on aggregate productivity growth. Similar to EU-15, the recent productivity catching-up observed in both the NMS and NIS resulted overwhelmingly from across-the-board productivity improvements in individual sectors of the economy while employment shifts among sectors had only a negligible effect on aggregate productivity growth. Notwithstanding fast productivity catching-up, the estimated productivity levels indicate that NMS (and even more so the NIS) are in this respect still considerably lagging behind advanced West European economies, implying a huge catching-up potential. The shadow side of productivity catching-up is a difficult situation on the labor market. Estimated elasticity of employment

[1] Paper prepared within the 6th EU Framework Programme project "Industrial Restructuring in the NIS: Experience of and Lessons from the New EU Member States" (INDEUNIS, No. 516751).

to GDP growth suggest that economic growth below 5% per year will not be sufficient to generate additional jobs. The required further productivity convergence may thus be in conflict with urgently needed employment growth.

Keywords: Structural change, economic growth, productivity, employment, EU integration, Central and Eastern Europe, Newly Independent States
JEL classification: E24, F43, J21, J60, O11, P52

1. Development of GDP, Employment and Macro-Productivity in NMS

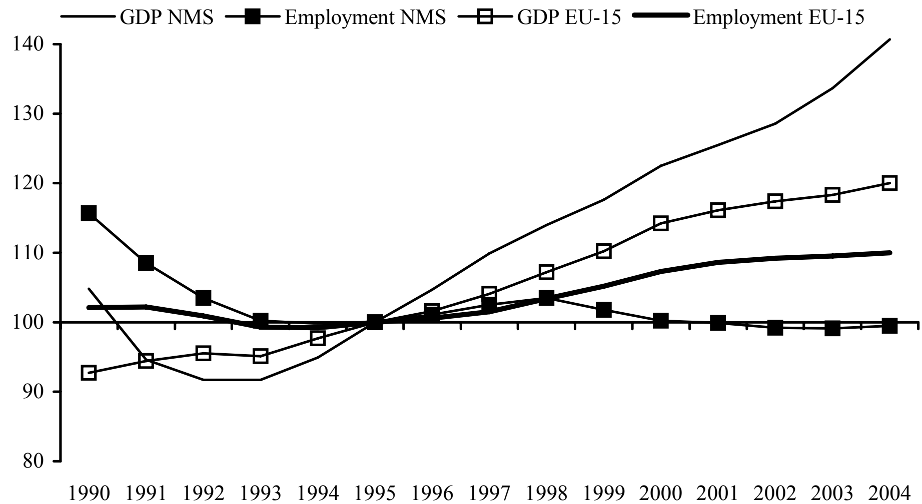
The Central and Eastern European countries which became members of the EU on 1st May 2004 – the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, the Slovak Republic and Slovenia (the New EU Member States – NMS) went through the dramatic phase of the "transitional recession" in the first half of the 1990s. In this period their GDP and employment recorded considerable declines (chart 1), due to supply as well as demand shocks caused by the loss of traditional export markets, the disruption of existing supply chains and decision-making structures, sudden trade liberalisation and restrictive macroeconomic policies. During 1990–1995, the NMS experienced a cumulated decline of real GDP by 4.6%. This translated into a substantial *negative* growth differential ("falling behind" by more than 12 percentage points) for the NMS vis-à-vis the EU-15 which grew by nearly 8% during that period (chart 1 and table 1).[2]

From 1993/94 onwards (in Poland already in 1992), economic recovery gained momentum in the NMS and their average growth began to exceed that of the EU-15.[3] However, a closer look reveals that most of these countries experienced further – at times sharp – interruptions in their growth processes due to delayed/failed corporate restructuring and occasional financial crises (often called "secondary transformational recessions") and/or macroeconomic imbalances, sometimes caused by unsustainable current account or fiscal deficits. Also, the growth process became more differentiated across the region, with the two candidate countries, Romania and Bulgaria, lagging behind significantly (see in the Appendix). For the period 1995–2004, the average annual growth rate of GDP was 3.9% for the NMS. GDP growth accelerated moderately after 1995 in the EU-15 as well, with an average annual growth rate of 2% over the period 1995–2004. The growth differentials thus turned in favour of the NMS: it reached more than 20 percentage points in cumulative terms and 1.8 percentage points per annum for

[2] For the NMS, this paper draws on the author's earlier study undertaken on request of EU DG Employment, Social Affairs and Equal Opportunities during 2004 (see Havlik, 2005).
[3] Data on individual countries can be found in the Appendix.

the NMS. Taking into consideration the whole period 1990–2004, there has been just a small difference in cumulative GDP growth for the NMS relative to the EU-15 (less than 5 percentage points and therefore hardly any catching-up (table 1).

Chart 1: GDP, Employment and Productivity in the EU–15 and the NMS



Note: 1995 = 100.

Source: wiiw database incorporating national statistics and AMECO, wiiw estimates (weighted averages).

Employment in the NMS declined even more strongly than GDP in the first years of transition (–13% between 1990 and 1995) and did not fully recover even afterwards (chart 1 and table 1). For the whole period 1990–2004, the cumulated employment decline in the NMS reached 14% (nearly 6 million jobs were lost) – again with notable differences across the region. In the more recent period for which comparable data are available (after 1995), declining employment in Poland has been the main contributor for the dismal labor market performance of NMS as a group (see Landesmann and Vidovic, 2005). In the EU-15, overall employment declined in the first half of the 1990s as well, but to a much lesser extent than in the NMS. In the second half of the 1990s and early 2000s, EU-15 employment has been moderately growing (1.1% annually), resulting in a cumulated increase of employment throughout the whole period 1990–2004 by almost 8%.

Table 1: Long-Term Productivity Catching-Up of NMS and NIS vis-à-vis EU-15

Country groups	1990–1995				1995–2004				1990–2004				2000–2004			
	growth rate in %		growth differential against EU-15 in pp		growth rate in %		growth differential against EU-15 in pp		growth rate in %		growth differential against EU-15 in pp		growth rate in %		growth differential against EU-15 in pp	
	cumu-lated	annual average	cumu-lated	annual average	cumu-lated	annual average	cumu-lated	annual average	cumu-lated	annual average	cumu-lated	annual average	cumu-lated	annual average	cumu-lated	annual average
NMS[1]																
GDP	-4.6	-0.9	-12.4	-2.5	40.7	3.9	20.7	1.8	34.2	2.1	4.8	0.3	14.9	3.5	9.8	2.3
Employment	-13.5	-2.9	-11.5	-2.5	-0.5	-0.1	-10.5	-1.1	-14.0	-1.1	-21.8	-1.6	-0.7	-0.2	-3.2	-0.8
Macro-productivity	10.3	2.0	0.3	0.0	41.4	3.9	32.3	3.0	56.0	3.2	35.9	1.9	15.7	3.7	13.2	3.1
Belarus																
GDP	-33.9 [2]	-9.8 [2]	-41.7	-11.4	77.0	6.5	57.0	4.5	17.0 [3]	1.2 [3]	-12.4	-0.6	30.1	6.8	25.0	5.6
Employment	-12.2 [2]	-3.2 [2]	-10.2	-2.8	-2.5	-0.3	-12.5	-1.3	-14.4 [3]	-1.2 [3]	-22.2	-1.7	-3.2	-0.8	-5.7	-1.4
Macro-productivity	-24.7 [2]	-6.9 [2]	-34.8	-8.8	81.5	6.8	72.4	5.9	36.6 [3]	2.4 [3]	16.6	1.1	34.4	7.7	31.9	7.1
Russia																
GDP	-34.7 [2]	-10.1 [2]	-42.5	-11.6	37.1	3.6	17.1	1.5	-10.4 [3]	-0.8 [3]	-39.8	-2.7	26.6	6.1	21.5	4.8
Employment	-13.1 [2]	-3.5 [2]	-11.1	-3.1	5.0	0.5	-5.0	-0.5	-8.8 [3]	-0.7 [3]	-16.5	-1.2	4.9	1.2	2.3	0.6
Macro productivity	-24.8 [2]	-6.9 [2]	-34.9	-8.8	30.5	3.0	21.4	2.0	-1.8 [3]	-0.1 [3]	-21.9	-1.5	20.7	4.8	18.2	4.2
Ukraine																
GDP	-47.7 [2]	-14.9 [2]	-55.5	-16.5	27.8	2.8	7.8	0.7	-33.1 [3]	-3.0 [3]	-62.5	-4.9	41.1	9.0	36.0	7.7
Employment	-3.5 [2]	-0.9 [2]	-1.5	-0.5	-15.9	-1.9	-25.9	-3.0	-18.8 [3]	-1.6 [3]	-26.6	-2.1	0.6	0.1	-1.9	-0.5
Macro productivity	-45.8 [2]	-14.2 [2]	-55.8	-16.1	52.0	4.8	42.9	3.8	-17.6 [3]	-1.5 [3]	-37.7	-2.8	40.3	8.8	37.8	8.2
EU-15																
GDP	7.8	1.5	-	-	20.0	2.0	-	-	29.4	1.9	-	-	5.1	1.3	-	-
Employment	-2.0	-0.4	-	-	10.0	1.1	-	-	7.8	0.5	-	-	2.5	0.6	-	-
Macro productivity	10.1	1.9	-	-	9.1	1.0	-	-	20.1	1.3	-	-	2.5	0.6	-	-

Notes: 1) NMS: Central and Eastern European New EU Member States, comprising the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, the Slovak Republic and Slovenia (data for individual NMS – see in the Appendix). 2) 1991–1995.–3) 1991–2004.

Sources: wiiw Database incorporating national statistics, CISSTAT, wiiw calculations using AMECO.

Turning now to aggregate developments of productivity, *macro-productivity* in the NMS rose on average at a similar pace as in the EU-15 in the period 1990–1995 (table 1).[4] But productivity gains in the NMS during that period resulted solely from massive labor shedding which overcompensated the fall in output. Thus, productivity gains reflected at that time the painful adjustment process going on in these countries rather than a successful restructuring and modernisation of their economies.

In the second half of the 1990s and early 2000s, the rise of macro-productivity strongly accelerated in the NMS and this time productivity growth was supported by fast rising GDP at relatively constant employment levels in most NMS (Poland was the main exception). During 1995–2004, productivity growth was significantly higher in the NMS than in the EU-15 (3.9% per annum as compared to 1% in the EU-15). The process of impressive "productivity catching-up" of the NMS after 1995 (more than 30 percentage points) is clearly demonstrated in chart 1 by a difference between GDP and employment lines. The cumulated "productivity gain" of the NMS vis-à-vis the EU-15 over the whole period 1990–2004 reached nearly 36 percentage points, almost all of which was achieved after 1995 (table 1).

2. Development of GDP, Employment and Macro-Productivity in Selected NIS

Effects of transformational recession on the Newly Independent States (NIS) were even more pronounced that in the Central and Eastern European NMS and lasted longer since they were compounded by the break up of the Soviet Union, occasional civil conflicts as well as by delayed reforms or reform setbacks. The Central Asian and Caucasian former Soviet republics (Azerbaijan, Georgia, Kyrgyzstan and Tajikistan were hit hardest; where GDP fell by half between 1991 and 1995). Severe GDP declines occurred in Moldova and Ukraine as well. On average, CIS (12 republics of the Commonwealth of Independent States) GDP fell by nearly 40% between 1991 and 1995 and did not fully recover until 2004.[5]

Developments in the three NIS analysed in this paper– Belarus (BY), Russia (RU) and Ukraine (UA) – are shown in U-shaped lines in chart 2. During the first half of 1990s, the most dramatic fall in GDP was recorded by Ukraine (almost 50%); Belarus and Russia suffered a bit less (–35%). NIS GDP decline was much bigger than in Central and Eastern European NMS; the fact that Baltic States

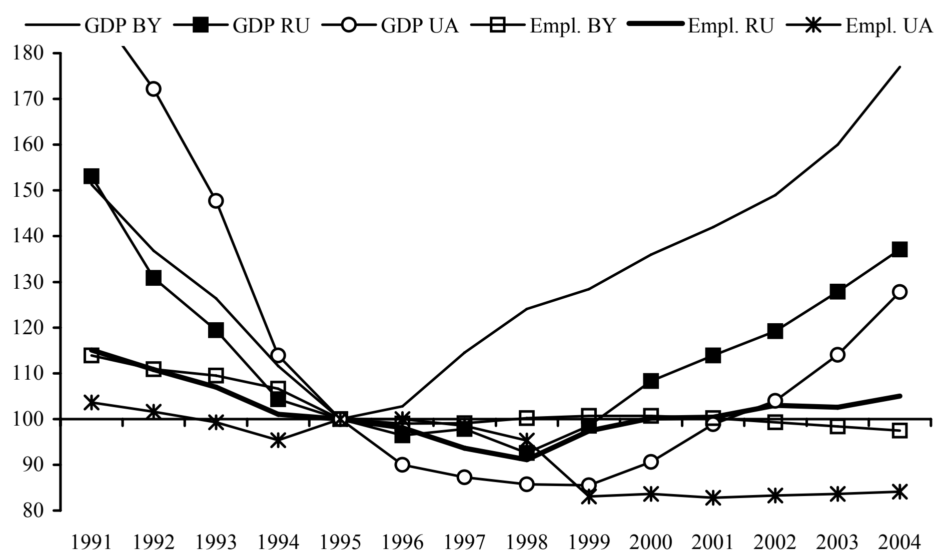
[4] Macro-productivity is defined as GDP per employed person – employees and self-employed.

[5] Several former Soviet republics suffered from GDP declines even before 2001. It is interesting to note that Belarus, Uzbekistan and Kazakhstan, with cumulative GDP declines between 20-30%, fared relatively better during the early transition period - see CIS Statistical Yearbook, CISSTAT, Moscow, 2005.

suffered to a similar extent suggests than disintegration of the Soviet Union was the main culprit. The two latter countries, Belarus and Russia, experienced a drop in employment of similar magnitude like the NMS during this period. In contrast, employment decline in Ukraine was much less pronounced – a possible indication of delayed reforms. Yet delayed (active) restructuring is visible in all three NIS: it is demonstrated by enormous falls in labor productivity – in contrast to NMS where productivity increased more or less in line with EU-15 in the first half of 1990s (table 1).

After 1995, the NIS GDP started to recover (although the recovery was interrupted in 1998 by the Russian financial crisis), and the economic growth even strengthened in early 2000s. The fastest GDP growth – at least according to official statistics – was recorded in Belarus (6.5% per year on average during 1995–2004), followed by Russia and Ukraine (table 1). Yet both latter countries (and especially Ukraine) performed worse in terms of GDP growth than NMS in this period. However, in terms of productivity growth Belarus and Ukraine outperformed the NMS (Ukraine partly thanks to labor shedding). Russian productivity growth was least impressive – as employment started to recover.

Chart 2: GDP, Employment and Productivity in Selected NIS

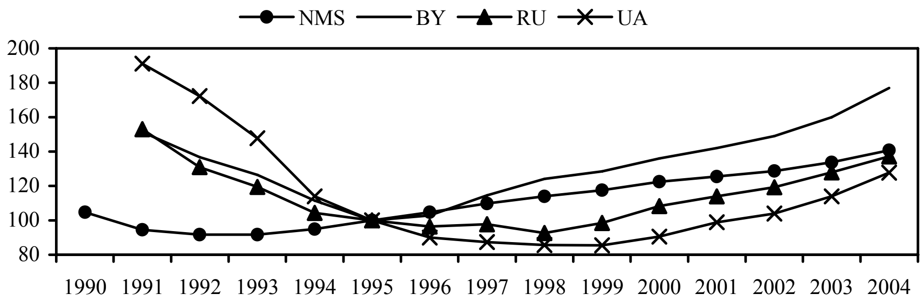


Note: 1995 = 100.

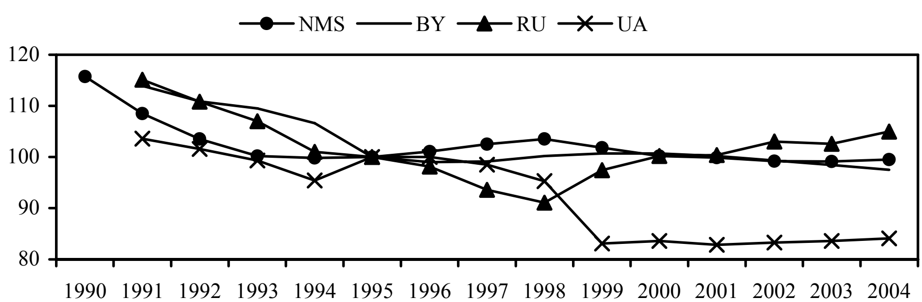
Source: wiiw Database incorporating national statistics and CISSTAT.

Chart 3: GDP, Employment and Macro-Productivity in the NMS and Selected NIS

GDP

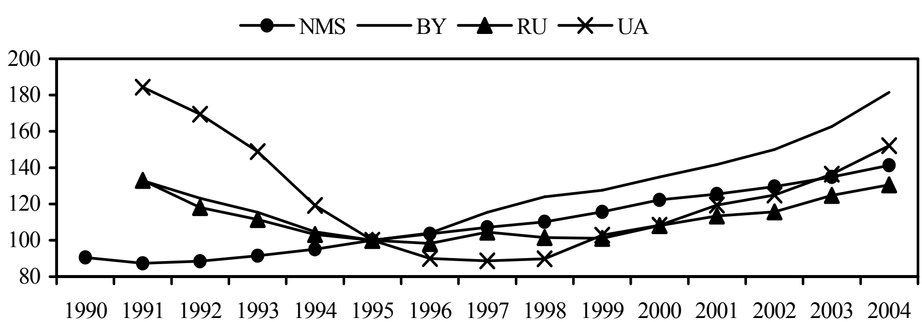


Employment*



**) employees and self-employed.*

Macro-productivity
(GDP per persons employed)



Note: 1995=100.

Source: wiiw Database incorporating national statistics, CISSTAT.

Over the whole transition period (1990–2004), the NIS economic performance has been largely disappointing. Their cumulated economic growth has been not only lower than in NMS, but Russia and especially Ukraine even fell back in terms of GDP and productivity.[6]

Compared to EU-15, all three NIS fell back in terms of GDP (contrary to catching-up of NMS). Only Belarus enjoyed somewhat higher productivity growth than EU-15, yet even in this respect the NMS performance had been much better (table 1). The aggregate picture of comparative economic developments in NMS and NIS in the whole transition period 1990–2004 (illustrated in chart 3) thus suggests not only a worse relative performance of the NIS, but even their widening gap vis-à-vis EU-15 (with the exception of productivity catching-up in Belarus).

Our hypothesis regarding delayed restructuring in the NIS seems to be supported by looking at the more recent macroeconomic performance (during 2000–2004 – see table 1). In this period, both Belarus, Russia and especially Ukraine (but other NIS as well) enjoyed rapid GDP growth and strong productivity improvements which were not only bigger than in EU-15 but even substantially higher than the majority of NMS. Yet whether this is a reflection of first positive restructuring effects, belated accommodation to Soviet disintegration or simply a reflection of low starting levels (and therefore of a higher potential for catching-up in line with Gerschenkron hypothesis) remains to be seen.[7]

3. Estimated Income and Productivity Gaps: EU-15, NMS and Selected NIS

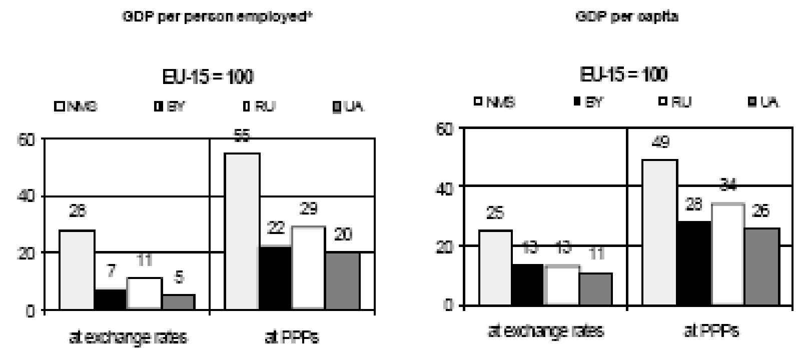
Despite a remarkable productivity catching-up, the level of macro-productivity in the NMS is still very low compared to the EU-15 average, leaving ample space for further growth and catching-up. In the year 2004, the average level of macro-productivity (compared at current exchange rates) for all Central and Eastern European NMS was only 28% of the average EU-15 level. Measured at purchasing power parities (PPPs), which correct for undervalued currencies still prevailing in most NMS, the average level of macro-productivity in NMS reached about 55% of the EU-15 average (chart 4).[8]

[6] By end-2004, only Armenia, Belarus, Kazakhstan and Uzbekistan have surpassed their respective GDP levels of 1991 – see CISSTAT, op. cit.

[7] Baltic States (Estonia, Latvia and Lithuania) also display high catching-up rates of GDP and productivity growth.

[8] However, for the more advanced NMS such as Slovenia and the Czech Republic, macro-productivity measured at exchange rates has already reached between 50 % and 60 % of the EU-15 level, resp. between 70% and 80%, if PPPs were used for conversion. At the same time, even the least developed NMS (Latvia, Lithuania and Poland) have higher productivity and income levels than NIS (Russia).

Chart 4: Levels of Macro-Productivity and of GDP per Capita in the NMS and Selected NIS, year 2004



**) employees and self-employed; PPPs = purchasing power parities.*

Source: wiiw calculations using national statistics, CISSTAT and AMECO database.

Per capita real incomes (a crude measure of economic development level) in the NMS are even lower than productivity due to their relatively low employment rates (and high unemployment). In the NIS, crude estimates (especially for Belarus which does not participate in international PPP comparisons) of macro-productivity and per capita incomes suggest even lower levels than in NMS and thus also a huge potential for catching-up. NIS productivity gaps behind the NMS are of similar magnitude as the NMS gap vis-à-vis EU-15 (chart 4). However, contrary to the NMS, relative per capita incomes in the NIS are somewhat higher that relative productivity levels. Again, the main explanation for this are employment rates (which are relatively high in the NIS – at least according to the official statistics).[9]

4. Changes in Broad Sectoral Structures

Economic developments in the transition countries were characterized by large shifts in the sectoral composition of GDP and employment, indicating a clear tendency of adjustment towards the broad economic structures in the more advanced countries. The NMS started off in 1990 with a larger agricultural and industrial sector on the one hand and a smaller services sector than the more advanced EU-15 countries on the other hand (charts 5 and 6; see also Havlik, 2005;

[9] Belarus PPP with respect to EUR was estimated by the author after extrapolation with GDP price deflators from intra-CIS PPP comparison for 2000 using Russia as a bridge (27.1 BYR per RUR in 2000 - see: www.gks.ru/bgd/free/b02_18/IswPrx.dll/Stg/d000/i030860r.htm).

Landesmann and Vidovic, 2005).[10] Similar broad patterns of structural change have been underway in the NIS as well (although comparable data are available for later period only). The broad shifts occurring after 1990 in the transition countries can thus be summarized under the headings of *de-agrarianization, de-industrialization and tertiarization*. However, there are a few recent interesting cases of "re-agrarianization" and "re-industrialization" as well. But while the former are considered to be of a transitory nature, the latter may become a more common phenomenon in the future – at least for some NMS.

An overall tendency for de-agrarianization, de-industrialization and tertiarization can be observed in the EU-15 throughout this period as well, but here it has been much less pronounced than in the NMS. There has been one example of *re-industrialization* within the EU-15 as well, namely that of Ireland, where the share of industrial value added in GDP increased from 32% in 1990 to 37% in 2001 – yet employment shares remained constant (European Commission, 2003).

4.1 De- and Re-Agrarianization

In all NMS, the shares of agriculture in GDP *and* in employment fell dramatically during 1990s ("de-agrarianization").[11] Employment in agriculture declined significantly in absolute terms as well.

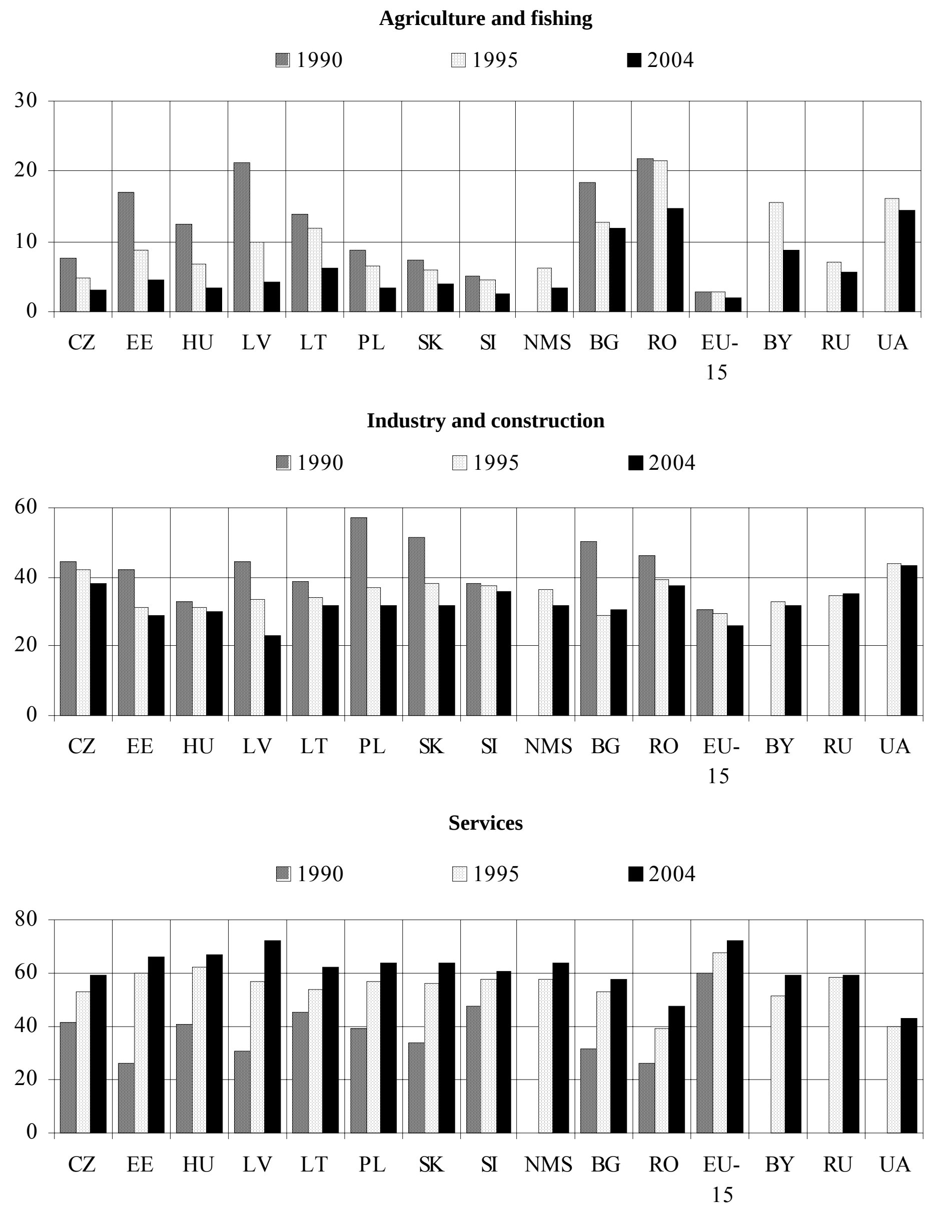
Despite massive de-agrarianization in the NMS, the shares of agriculture in both GVA and employment of these countries is on average still higher than in the EU.[12] In the more advanced NMS such as the Czech Republic, Hungary and Slovenia, the difference to the EU-15 was minimal in the share of gross value added (GVA), though not in terms of employment shares. In general, the differences between GVA shares and employment shares in agriculture are larger in the NMS than in

[10] Under the previous regime, industry was emphasized at the expense of services and, furthermore, service activities were often supplied within big industrial combines, which meant that they were classified under "industry" and to some extent "agriculture" as well. Most services were considered "unproductive" and their contribution to the efficient functioning of the economy was neglected. Also, many modern services that play an important role in market economies (such as marketing, financial services, real estate and other business services) were simply not needed under socialism.

[11] Sector shares in this section are defined as gross value added (GVA) of agriculture (industry, services) in gross domestic product (GDP). Because of the so-called "Financial intermediation services indirectly measured" (FISIM), which are included in GDP but not in gross value added, the so defined shares of the three sectors will not add up exactly to 100 %.

[12] In Poland, Bulgaria and Romania the share of employment in agriculture has been very high (25% and more than 40%, respectively). This results from the severe employment crises due to the dramatic decline in industrial employment and the so far limited absorption capacity of the services sectors.

Chart 5: Comparison of NMS, NIS and EU-15 Gross Value Added Structures in 1990, 1995 and 2004, % of GVA



Note: GVA = gross value added.

Sources: wiiw Database incorporating national statistics and CISSTAT; wiiw calculations using AMECO.

the EU-15, due to the relatively low productivity in NMS' agriculture as compared to the other sectors of the economy. With competitive pressures rising and modernization in agriculture accelerating after accession, we may thus expect agricultural employment in the NMS to fall. This is particularly relevant for Poland, some of the Baltic countries and for the candidate countries Bulgaria and Romania, where the differences between GVA shares and employment shares in agriculture are huge (compare charts 5 and 6), and productivity levels particularly low (chart 4).

Shares of agriculture in NIS' output and employment declined during the last decade as well. Yet GVA shares are still higher than in NMS (especially in Ukraine), but lower than in Bulgaria and Romania. Except Ukraine, employment shares are lower than in less advanced NMS (Latvia, Lithuania and Poland), and also lower than in Bulgaria and Romania. Overall, the process of de-agrarianization is underway in the NIS as well.

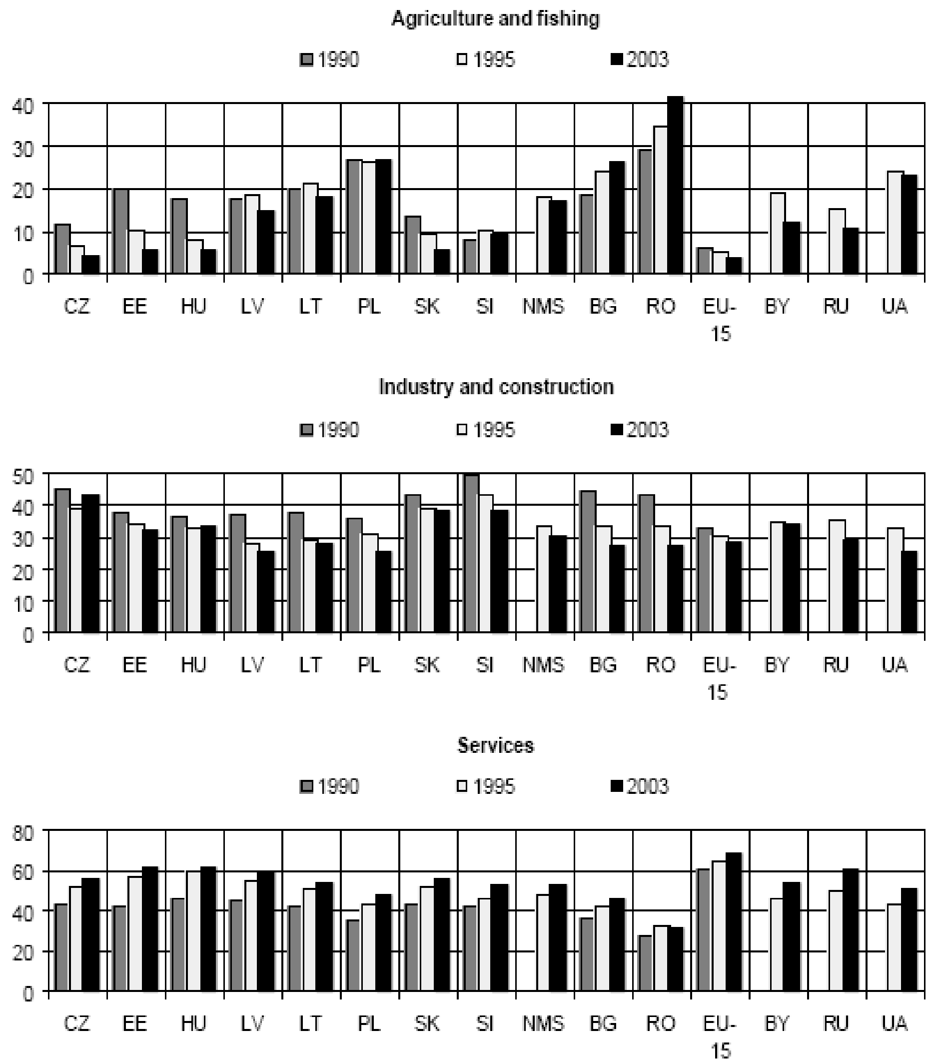
4.2 De- and Reindustrialization

The share of industry (comprising manufacturing, mining, water & electricity supply and construction) declined in terms of both GVA and employment in most NMS. This decline was sharper in the first years of transition and levelled off after 1995. Yet industrial employment dropped strongly in absolute terms even after 1995 (by nearly 1.3 million persons between 1995 and 2004, nearly 1 million of them in Poland). However, by around 1998/1999, labor shedding in industry bottomed out and employment started to rise slightly in some NMS (e.g. in Hungary, in the Czech and Slovak Republics; Poland is again an exception). On average, the shares of industry and construction in both GVA and employment in the NMS still tend to be somewhat higher than in the EU-15 (30% and 27%), with some countries having particularly high employment shares of industry (e.g. Czech Republic, Slovakia, Slovenia – chart 6).

NIS output shares of industry were fairly stable (at least after 1995); they are also somewhat higher than in the NMS. Except Belarus, NIS industry employment shares declined, implying a strong rise in labor productivity (however, this may be related to a structural shift towards resource- and capital-intensive industries in Russia and Ukraine – see below). The share of industrial employment in several NMS (particularly in Poland) and in Ukraine is even lower than in EU-15. However, this is not a sign of a "progress towards post-industrial society", but rather results from a severe industrial crisis in the former countries.

In contrast, (as illustrated by the recent example of Hungary and the Czech Republic), there is a possibility for a few additional NMS (e.g. Slovakia) to experience some kind of re-industrialization in the future. Low labor costs and the pool of skilled labor make the NMS an attractive location for FDI in export-oriented manufacturing productions and, as demonstrated by many south-east

Chart 6: Comparison of NMS, NIS and EU-15 Employment Structures in 1990, 1995 and 2003, % of total



Sources: wiiw Database incorporating national statistics and CISSTAT; wiiw calculations using AMECO.

Asian economies, strong export orientation might well lead to a higher share of industry in both GDP and employment than would be typical for a certain stage of economic development. However, whether this process will lead to the creation of a substantial number of additional jobs is not sure. [13]

4.3 Tertiarization

The *share of services,* in both GVA and employment, has increased significantly in most NMS since the beginning of transition – and indication of a clear structural "catching-up". However, during early stages of transition, the rise of GVA and employment shares of services was mainly of a "passive nature", reflecting a less pronounced decline of employment in services than in both industry and agriculture. Only when growth of the overall economy gained momentum, employment in services started to rise in absolute terms as well: between 1995–2004 about 1 million new services jobs were created in the NMS. Despite rapid expansion, the shares of services in GVA and especially in employment in the NMS are still distinctly lower than in the EU-15.[14] Moreover, in all NMS the gap vis-à-vis the EU-15 is largest in the field of financial and other business services (marketing, consulting, auditing etc.). Within the services sector, employment gains were due to job creation in the market services segment (especially in trade, tourism and real estate – see Landesmann and Vidovic, 2005). The services sector thus may become the major provider of new employment. But again, whether this process will lead to the creation of additional jobs is not sure. Parts of the service sector (especially financial services and retail trade) currently experience a restructuring process (as witnessed by industry earlier) which is associated with considerable efficiency improvements and layoffs of redundant workers.[15]

In the NIS, the services sector has been expanding as well, yet its GVA shares are lower than in both EU-15 and the NMS. Interestingly, shares of employment in services in Belarus and in Russia are even higher than in the NMS (chart 6). This may reflect an underdevelopment (or under-reporting) of higher value added segment of services (financial services), or a bloated government sector (public services), for instance in Russia where services share in GVA did not change between 1995 and 2004 (chart 5).

[13] See Landesmann and Vidovic (2005) for more details; Stehrer (2005) for development scenarios.
[14] Services shares are particularly low in the second-round accession countries, Bulgaria and Romania.
[15] The evidence for productivity gains in NMS' services sectors has been mixed so far. Moreover, a proper assessment is plagued by numerous conceptual and statistical problems (Wölfl, 2004). Rough estimates of labor productivity growth in services is provided in section 4 below.

In general, there seem to be no marked differences in broader structural developments between NMS and the NIS (and especially between the less advanced NMS like Latvia, Lithuania and Poland on the one hand and more advanced NIS like Belarus, Russia and Ukraine on the other hand).

5. Structural Change and Productivity Growth

In this section we will look in more detail at patterns of structural change during the recent phase of transition. We will examine in particular the effects of structural changes on NMS and NIS labor productivity growth which – as shown above – has been quite impressive in all countries concerned. The traditional assumption of the growth accounting literature considers structural change as an important source of growth and overall productivity improvements. The standard hypothesis assumes a surplus of labor in some (less productive) parts of the economy (such as agriculture), thus shifts towards higher productivity sectors (e.g. industry) are beneficial for aggregate productivity growth. Even within industry shifts towards more productive branches should boost aggregate industrial productivity. On the other hand, structural change may have a negative impact on the aggregate productivity growth if labor shifts to industries with slower productivity growth (parts of services sector). The "structural bonus and burden" hypotheses were examined on example of Asian economies by Timmer and Szirmai (2000), on a large sample of OECD and developing countries (Fagerberg, 2000), and more recently by Peneder and EU DG Employment for USA, Japan and EU member states (Peneder, 2002, European Commission, 2003b). A recent paper by the present author examined productivity growth patterns in Central and Eastern European NMS (Havlik, 2005).

The overall developments regarding output, employment and productivity described above mask substantial structural changes within NMS' economy and its individual sectors. Structural changes reflect *inter alia* different speeds of restructuring and resulting efficiency gains or losses at branch level. The impact of structural change on NMS' and NIS' aggregate productivity growth will be evaluated by a frequently applied shift-share analysis (see Havlik (2005), in analogy with Timmer and Szirmai (2000), Fagerberg (2000), Peneder (2002) and others). Shift-share analysis provides a convenient tool for investigating how aggregate growth is linked to differential growth of labor productivity at sectoral level and to the reallocation of labor between industries. It is particularly useful for the analysis of productivity developments in the NMS and NIS where data limitations prevent us to use more sophisticated econometric approaches (see box 1).[16]

[16] Even this kind of analysis encounters a number of serious statistical problems. Several NMS and NIS do not publish longer time series on sectoral value added data at constant

Box 1: Decomposition of Aggregate Labour Productivity Growth

Using the same notation as presented in Peneder (2002), we decompose the aggregate growth of labor productivity into three separate effects:

$$growth(LP_T) = \frac{LP_{T,fy} - LP_{T,by}}{LP_{T,by}} = \frac{\overbrace{\sum_{i=l}^{n} LP_{i,by}(S_{i,fy} - S_{i,by})}^{I:static\ shift\ effect} + \overbrace{\sum_{i=l}^{n}(LP_{i,fy} - LP_{i,by})(S_{i,fy} - S_{i,by})}^{II:dynamic\ shift\ effect} + \overbrace{\sum_{i=l}^{n}(LP_{i,fy} - LP_{i,by})S_{i,by}}^{III:within\ growth\ effect}}{LP_{T,by}} \quad (1)$$

where LP=labor productivity; by=base year, fy=final year; T=Σ over industries i; S_i=share of sector i in total employment.

First, the structural component is calculated as the sum of relative changes in the allocation of labor across industries between the final year and the base year, weighted by the value of sector's labor productivity in the base year. This component is called the static shift effect. It is positive/negative if industries with high initial levels of productivity (and usually also high capital intensity) attract more/less labor resources and hence increase/decrease their share of total employment. The standard structural bonus hypothesis of industrial growth postulates a positive relationship between structural change and economic growth as economies upgrade from low to higher productivity industries. The structural bonus hypothesis thus corresponds to an expected positive contribution of the static shift effect to aggregate growth of labor productivity:

The structural bonus hypothesis:

$$\sum_{i=l}^{n} LP_{i,by}(S_{i,fy} - S_{i,by}) > 0 \quad (2)$$

Second, dynamic shift effects are captured by the sum of interactions of changes in employment shares and changes in labor productivity of individual sectors/industries. If industries increase both labor productivity and their share of total employment, the combined effect is a positive contribution to overall productivity growth. In other words, the interaction term becomes larger, the more labor resources move toward industries with fast productivity growth. The interaction effect is however negative, if industries with fast growing labor productivity cannot maintain their shares in total employment. Thus, the interaction term can be used to evaluate Baumol's hypothesis of a structural burden of labor reallocation. This hypothesis predicts that employment shares shift away from progressive industries towards those with lower growth of labor productivity (Baumol, 1967). We would expect to confirm the validity of structural burden hypothesis in the NMS and NIS due to the above sketched shifts from industry to services (with lower productivity levels)

prices. Owing to the lack of sector-specific price indexes we have applied GDP price deflators to calculate series at constant prices. Moreover, the measurement of output in certain services sectors is especially problematic (Wölfl, 2004). We hope to refine productivity analysis with more detailed data in the later stage of the project.

at the macro level, respectively due to shifts from heavy (and capital-intensive) to light industries within manufacturing.

The structural burden hypothesis:

$$\sum_{i=l}^{n}(LP_{i,fy}-LP_{i,by})(S_{i,fy}-S_{i,by})<0 \tag{3}$$

The third component, the "within growth" effect, corresponds to a growth in aggregate labor productivity under the assumption that no structural shifts in labor have ever taken place and each industry (sector) has maintained the same share in total employment as in the base year. We must, however, recall that the frequently observed near equivalence of within growth effect to the aggregate productivity growth cannot be used as evidence against differential growth between industries. Even in the case that all positive and negative structural effects net out, much variation in productivity growth can be present at the more detailed level of activities.[17]

Table 2 shows a decomposition of productivity growth in the NMS (as well as in Bulgaria and Romania) and in selected NIS at both macro level (total gross value added) and in manufacturing industry for the period 1995–2004. As far as the economy as a whole is concerned, structural bonus hypothesis is mostly confirmed, though the contribution of labor shifts from low to high productivity growth sectors to aggregate productivity growth was in most cases rather small, in Romania and Belarus even negative. A more substantial structural bonus effect (contributing more than 10% of total productivity growth) is observed only in Bulgaria, Poland and Russia. In most countries, agriculture and industry reduced the static shift effect on productivity growth as labor moved away from these sectors and employment shares declined (see also chart 6 above). In several NMS, there was also a decline in employment shares (and therefore a negative static shift effect) in education. And nearly everywhere one can observe highly positive static shift

[17] As productivity has a robust tendency to grow, the within growth effect is practically a summation over positive contributions only. Conversely, for each industry the sign of the contribution to both static and dynamic shift effects depends on whether labor shares have increased or decreased. The shift effects therefore capture only that comparatively small increment to aggregate growth which is generated by the net difference in productivity performance of the shifting share of the labor resources. Even that increment can either be positive (structural bonus) or negative (structural burden). In short, offsetting effects of shifts in employment shares of industries with high and low levels of labor productivity, as well as high and low productivity increases, explain why shift share analyses regularly fail to reveal substantial direct contributions of structural change to aggregate growth.

effects of real estate and, paradoxically, of public administration as well (the latter also in Russia).

Except for Bulgaria, dynamic shift effects play an even smaller role as far as the contribution to aggregate productivity growth is concerned; structural burden (a small negative dynamic shift effect) was detected only in Slovenia, Romania and Ukraine. In the majority of both NMS and NIS, the contribution of agriculture and industry to the dynamic shift effect was negative since – as mentioned above – employment shares of these sectors declined. It is therefore not surprising that the overwhelming part (more than 90%, except Poland: 74%) of aggregate productivity growth in both NMS and NIS during the period 1995–2004 can be attributed to *productivity growth within individual economic sectors*. This is broadly in line with productivity developments observed in advanced market economies,[18] but still somewhat surprising given the major restructuring that had occurred in the NMS and NIS in that period. Obviously, aggregate productivity growth in transition countries has resulted almost exclusively from productivity improvements within individual sectors and their across the board productivity catching-up. In this respect, both NMS and NIS economies display similarities with the more advanced EU-15 member states (Peneder, 2002, European Commission, 2003b) yet their overall productivity growth has been much more impressive (except Bulgaria – see table 2).

Having in mind the above mentioned data caveats regarding sectoral price deflators and productivity measurement in the services sector, a detailed inspection of sectoral productivity performance gives a widely heterogeneous picture.[19] In most NMS and NIS, agriculture, construction, trade, hotels and restaurants, as well as health and social work sectors recorded *below average* labor productivity growth (chart 7a). On the other hand, data would suggest positive contributions of industry, transport (including telecommunications), real estate and other (community and social services) activities to aggregate productivity growth.

Data presented in the second part of table 2 reveal that structural features of productivity growth in manufacturing industry were somewhat different.[20] The evidence for individual NMS is mixed again, but a structural bonus (positive static shift effect) was detected only for Poland, Slovenia, Latvia and Lithuania. The negative static shift effect present in the remaining NMS (and in Bulgaria and Romania) means that labor moved away from (initially) high productivity

[18] Peneder (2002) and European Commission (2003b) have found similar results for EU-15 countries and the USA in the period 1995-1999.

[19] Owing to the lack of sectoral price deflators, nominal GVA growth in individual sectors was converted to constant prices with GDP price deflator. The measurement of output (and productivity) in services sector – especially in trade, real estate and financial intermediation poses serious problems – see O'Mahony and van Ark (2003), Wölfl (2004).

[20] Manufacturing industry output was deflated with "proper" sectoral price deflators.

manufacturing branches (which are usually more capital intensive and use more intermediate inputs) like coke and refined petroleum, chemicals and basic metals branches.[21] Structural burden hypothesis – a negative dynamic shift effect – could be confirmed for half of NMS. In Hungary (and to a lesser degree also Poland, Slovakia and Slovenia), dynamic shifts were dominated by simultaneous productivity improvements and growing employment shares in just a few branches (usually in electrical, optical equipment and transport equipment). Nevertheless, the aggregate productivity growth in NMS' manufacturing was again clearly dominated by productivity improvements within individual manufacturing branches. Havlik (2003a), Hunya (2002), as well as the various case studies (see EU DG Employment study), provide some evidence for the key role played by foreign direct investments in productivity improvements and restructuring of NMS' manufacturing. Van Ark and Piatkowski (2004) show that the main contribution to productivity growth in selected NMS (the Czech Republic, Hungary, Poland and Slovakia) during 1993–2001 came from ICT-using manufacturing and non-ICT manufacturing. Contrary to EU-15 and USA, the contribution of ICT-producing branches to aggregate productivity growth was much lower in the NMS (with the exception of Hungary).

In the NIS, comparable industry-specific data are so far available only for Russia (years 1995–2002) and Ukraine (2000–2004). For Russia, the shift and share analysis confirms both the structural burden and bonus hypotheses with positive values of the static shift effect and a negative dynamic shift effect (table 2). Three industries contributed most to the "structural bonus" which size has been unique among the analysed countries: food and beverages, chemicals and basic metals. Nevertheless, even in Russia a larger part of the total productivity growth originated from "within growth" effect, the biggest contributors being coke and refined petroleum, basic metals and transport equipment (the only industry where productivity declined was machinery and equipment n.e.c.). Structural features of manufacturing productivity growth in Ukraine during the more recent (and shorter) period are similar to NMS, yet its productivity growth has been extraordinary high.

Decomposition of manufacturing industry productivity growth thus again shows similar characteristics to those observed for EU-15 countries. For these countries, Peneder (2002) found only a weak evidence for the reallocation of labor towards high productivity branches (at more detailed 3-digit NACE level) and could not confirm the structural bonus hypothesis even for a longer time period (1985–1998). Similar findings were obtained earlier by Timmer and Szirmai (2000) for a small sample of Asian economies, as well as by Faberberg (2000) for a number of OECD and developing countries. In this respect, we may conclude that the recent industrial restructuring in the NMS did not differ too much from the earlier

[21] Note that due to limited data availability we use gross production as a measure of output. The negative static shift effect was particularly large in Bulgaria and Romania.

experience of other countries since shifts of labor among individual (2 digit NACE) industries apparently did not play a major role in total productivity improvements.

Chart 7a: Productivity Growth in NMS and NIS by eEconomic Sectors, 1995–2004 (Annual Averages, Relative to Total Gross Value Added per Employed Person)

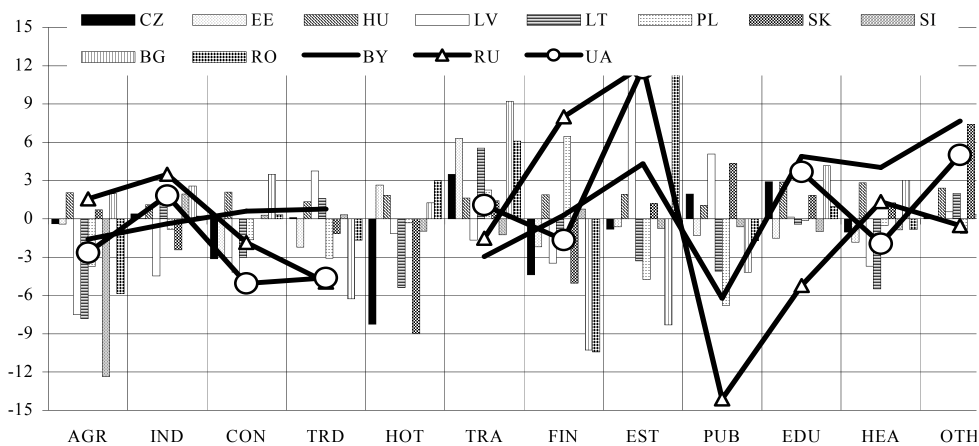
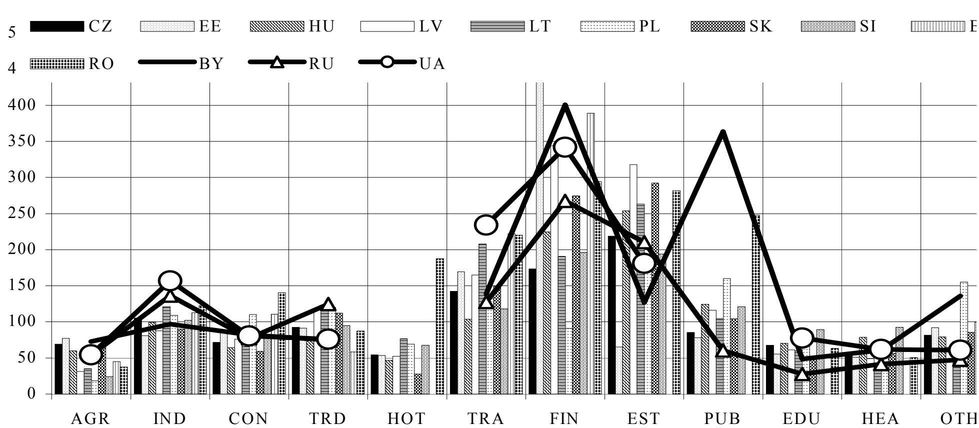


Chart 7b: Productivity Levels in NMS and NIS Economic Sectors, 2004 (Total Gross Value Added per Employed Person =100)



Sectors: AGR: Agriculture, forestry and fishing; IND: Mining, quarrying, manufacturing, electricity, gas and water supply; CON: Construction; TRD: Wholesale, retail trade; HOT: Hotels and restaurants; TRA: Transport, storage and communications; FIN: Financial intermediation; EST: Real estate, renting and business activities; PUB: Public administration and defence; EDU: Education; HEA: Health and social work; OTH: Other activities.

Source: wiiw calculations based on wiiw Database and CISSTAT Database.

Table 2: Decomposition of Productivity Growth in NMS and Selected NIS (Shift-Share Analysis), 1995–2004

		Percentage of total labor productivity growth explained by:			Total productivity	
		static shift effect LPby*(Sfy-Sby)/LPby	**dynamic shift effect (LPfy-LPby)*(Sfy-Sby)/LPby**	**within growth effect (LPfy-LPby)*Sby/LPby**	**effect**	**growth** in % p.a.
Bulgaria, gross value added	1996-2003	48.4	-39.9	91.5	100.0	2.3
Bulgaria, manufacturing output	1995-2004	-15.7	-72.2	187.9	100.0	3.3
Czech Republic, gross value added	1995-2004	2.3	0.3	97.4	100.0	6.1
Czech Republic, manufacturing output	1995-2004	-0.7	-11.5	112.3	100.0	5.0
Hungary, gross value added	1995-2003	5.5	2.9	91.6	100.0	12.4
Hungary, manufacturing output	1995-2004	-2.2	27.8	74.4	100.0	9.0
Poland, gross value added	1995-2003	16.7	9.3	74.1	100.0	9.8
Poland, manufacturing output	1995-2004	3.1	2.5	94.3	100.0	10.0
Slovak Republic, gross value added	1995-2003	5.0	1.5	93.4	100.0	7.0
Slovak Republic, manufacturing output	1995-2004	-0.9	2.1	98.8	100.0	8.0
Slovenia, gross value added	1995-2003	3.3	-2.6	99.4	100.0	7.5
Slovenia, manufacturing output	1995-2004	6.9	5.8	87.3	100.0	3.3
Romania, gross value added	1995-2003	-0.4	-0.7	101.1	100.0	10.0
Romania, manufacturing output	1995-2004	-13.1	-23.4	136.5	100.0	5.0
Estonia, gross value added	1995-2004	2.9	0.3	96.8	100.0	9.6
Estonia, manufacturing output	1995-2003	-7.6	-4.3	112.0	100.0	9.5
Latvia, gross value added	1995-2003	2.5	8.5	89.1	100.0	9.8
Latvia, manufacturing output	1995-2003	6.4	-1.0	94.6	100.0	7.1
Lithuania, gross value added	1997-2003	5.0	1.8	93.2	100.0	7.5
Lithuania, manufacturing output	1995-2001	10.1	-2.9	92.7	100.0	8.9
Belarus, gross value added	1995-2003	-0.2	1.9	98.3	100.0	9.3
Belarus, manufacturing output	.	.	.	.	.	.
Russia, gross value added	1995-2004	10.4	0.8	88.8	100.0	9.2
Russia, manufacturing output	1995-2002	24.0	-6.6	82.5	100.0	4.1
Ukraine, gross value added	1995-2003	0.4	-4.9	104.6	100.0	8.8
Ukraine, manufacturing output	2000-2004	6.4	2.8	90.8	100.0	19.3

Notes: *Aggregate productivity based on gross value added at constant prices (without FISIM) and employment according to LFS statistics: Bulgaria: 12 NACE 1-digit sectors (1996–2003), Czech Republic: 12 sectors (1995–2004), Hungary and Poland: 12 sectors (1995–2003), Slovak Republic: 12 sectors (1995–2003), Slovenia: 12 sectors (1995–2003), Romania: 12 sectors (1995–2003), Estonia: 12 sectors (1995–2004), Latvia: 12 sectors (1995–2003), Lithuania: 12 sectors (1995–2003), Belarus: 11 sectors (1995–2003), Russia: 11 sectors (1995–2004). Ukraine: 10 sectors (1995–2003). Constant prices data estimated with GDP price deflators. FISIM: Financial intermediation services indirectly measured. Manufacturing labor productivity based on gross output at constant prices and employment for 14 NACE 2-digit manufacturing sectors.*

Sources: wiiw Database incorporating national statistics; CISSTAT, UNIDO and wiiw Industrial Database.

There is some evidence of a structural burden effect in NMS' manufacturing since employment shifts towards slower productivity growth industries had, on average, slightly negative impact on aggregate productivity growth in manufacturing. The overwhelming part of overall manufacturing productivity growth in the NMS can be attributed to *productivity improvements taking place in nearly all manufacturing industry branches (albeit at widely different rates)* – a process stimulated particularly by effects of FDI. In several NMS (especially in Hungary, Poland, Slovakia and Estonia), manufacturing labor productivity has recently expanded even faster than it did in the "Asian Tigers" countries during their rapid catching-up period.

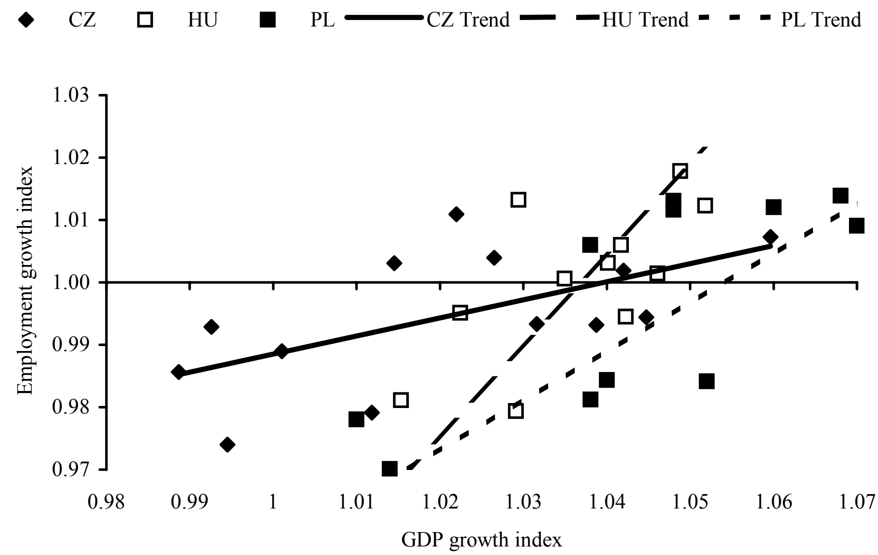
In contrast to most NMS, in Russian manufacturing industry, both structural bonus and burden hypotheses, were confirmed though the bulk of overall productivity growth also resulted from the "within growth" effect. Nevertheless, a fairly large part of productivity growth (24%) was attributed to labor shifts toward more productive industries (especially to food and beverages, chemicals and basic metals at the expense of textiles and transport equipment). And compared to NMS, the growth of productivity in manufacturing was not really impressive (4.1% per year during the period 1995–2002). In Ukraine, we get a picture similar to the NMS; the measured productivity growth in 2000–2004 is exceptionally high – almost 20% per year. There are no comparable data for manufacturing industry in Belarus.

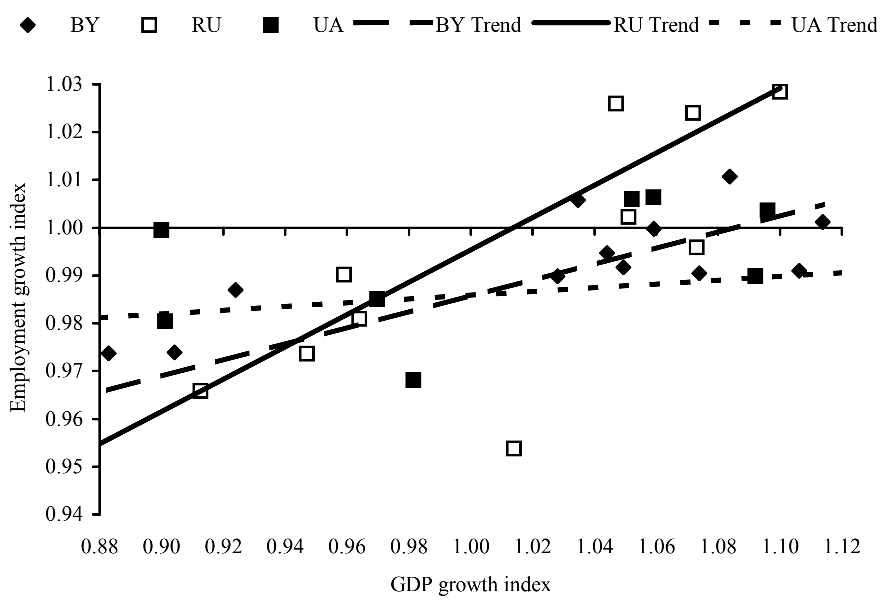
6. Productivity Catching-Up and Employment Growth Dilemmas

Productivity growth recorded in most transition countries, both the NMS and NIS, in the period after 1995 has been associated with only meagre increases of employment (in manufacturing industry even with considerable job losses – see Havlik, 2005). In the context of the EU Lisbon Strategy which aims at both improved competitiveness and high employment growth, the NMS thus face an even greater challenge than the EU-15 Member States. Focusing on both targets simultaneously (i.e. fast productivity growth and employment growth) may be conflicting.[22] Taking into account that NMS are confronted with a situation of low productivity levels (about half of the EU-15 average – see above) and, at the same time of high unemployment (on average nearly twice the EU-15 level), they need to foster both productivity and employment growth simultaneously. Realistically, the main accent of economic policies in these countries should focus on at least keeping existing jobs while simultaneously maintaining the recent pace of productivity catching-up.

[22] Policies aiming at higher employment may have negative consequences for labor productivity growth at least in the short run – see O'Mahony and van Ark et al., 2003.

Chart 8: Employment Elasticity of GDP Growth in Selected NMS and NIS, 1992–2004





Source: wiiw calculations from wiiw Database based on national statistics and CISSTAT.

This is a formidable task. The relation between employment and production growth (employment elasticity to output growth – see Employment in Europe, 2002) in the NMS and NIS has been rather disappointing. Even in the recent period of relatively robust economic growth (that is after 1995) there has been little effect on the job creation; the employment elasticity to GDP growth has been much below unity. This is illustrated in chart 8 where indexes of GDP and employment growth (and the respective trend lines for the period 1992–2004) are plotted for selected NMS and NIS. There are differences between individual countries: a constant employment would require GDP growth of at least 3.5% in Hungary, yet about 4% in the Czech Republic and more than 5% in Poland (even higher GDP growth would be required in Belarus and Ukraine).

Regression estimates covering a sample of all NMS (that is without Bulgaria and Romania) for the time period 1995–2004 show that the average critical rate of GDP growth which would prevent further employment decline in the NMS has been about 5% per year in the period 1995–2004, which is again much more than the GDP growth actually achieved during that period (the regression model II with lagged GDP as an explanatory variable gives a better fit – table 3, see also table 1 above).[23] As shown in chart 8, there are differences in estimated critical growth rates among individual NMS. However, regression estimates with country-specific dummies did not yield statistically significant parameters, even dummy variable for NIS was not statistically significant (see Appendix for several variants of estimated regressions).

For the manufacturing industry, the same estimation method yielded even more disturbing results: the critical rate of production growth was here more than 10% per year, nearly twice as high as the average manufacturing growth rate actually achieved during the (high growth) period of 1995–2004. Seen from this angle, and taking into account the expected rates of economic growth and evolving economic structures, the prospects for rising employment outside of services are not very encouraging. Without a substantial acceleration of their economic growth and/or significant job creation in the services sector, the NMS seem to be condemned either to remain substantially less productive than the EU-15 Member States, or to face the challenge of an even higher unemployment in the future.[24]

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[23] This compares with a critical GDP growth rate of just 0.5% estimated for the same period for the EU, USA and Japan, respectively 1.3% GDP growth estimated for these countries for the period 1992-2002.

[24] Similar conclusions have been made by Gabrisch and Buscher (2006) who analyze relationship between unemployment and output in NMS. During the last couple of years, the only sectors where additional jobs were created in the NMS are trade, hotels and restaurants, real estate, public administration and other activities – see Landesmann and Vidovic (2005) for more details. A recent ILO study shows that Asian countries are

Table 3: Regression Estimates of NMS Employment Elasticity to GDP Growth, 1995–2004

Model I: Employment (vEMP) and GDP growh (vGDP)

Source	SS	df	MS			
				Number of obs	=	80
				F(1, 78)	=	8.14
Model	.005349622	1	.005349622	Prob > F	=	0.0055
Residual	.051258319	78	.000657158	R-squared	=	0.0945
				Adj R-squared	=	0.0829
Total	.056607941	79	.000716556	Root MSE	=	.02564

vEmp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
vGDP	.2835475	.09938	2.85	0.006	.0856971	.481398
_cons	.7007948	.1041376	6.73	0.000	.4934727	.9081169

Note: The estimated regression equation for a sample of 8 NMS was:

*vEMP = const + b*vGDP*

where:

vEMP: index of employment growth,

vGDP: index of GDP growth.

Min. estimated GDP growth index (critical growth rate)needed for employment staying at least constant (vEMP = 1) is thus: ((1-cons)/b) = 1.058.

Model II: Employment (vEMP) and GDP growth lagged one year (vGDPl)

Source	SS	df	MS			
				Number of obs	=	80
				F(1, 78)	=	19.60
Model	.011366897	1	.011366897	Prob > F	=	0.0000
Residual	.045241044	78	.000580013	R-squared	=	0.2008
				Adj R-squared	=	0.1906
Total	. 056607941	79	.000716556	Root MSE	=	. 02408

vEmp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
vGDPl	.3220141	.0727399	4.43	0.000	.1772	.4668282
_cons	.6614394	.0760293	8.70	0.000	.5100767	.812802

Min. estimated GDP growth index (critical growth rate)needed for employment staying at least constant (vEMP = 1) is thus: ((1-cons)/b) = 1.051.

Source: Author's calculations, wiiw Database.

facing a similar problems of "jobless growth" – see *International Herald Tribune*, 1 February 2006, p. 12.

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Appendix

Table A1: Long-Term Productivity Catching-Up of NMS and Selected NIS vis-à-vis the EU

GDP, constant prices, 1995=100	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
Czech Republic	105.0	92.8	92.3	92.3	94.4	100.0	104.2	103.4	102.2	103.5	107.5	110.3	112.0	115.5	120.6
Estonia	143.9	124.3	106.7	97.3	95.7	100.0	104.4	116.0	121.1	121.5	131.1	139.5	149.6	159.6	172.1
Hungary	112.8	99.3	96.3	95.7	98.5	100.0	101.3	106.0	111.1	115.8	121.8	126.5	130.9	134.7	140.4
Latvia	201.6	180.6	117.7	100.2	100.8	100.0	103.8	112.4	117.7	121.6	129.9	140.3	149.4	160.5	174.2
Lithuania	172.4	162.7	128.1	107.3	96.8	100.0	104.7	112.0	120.2	118.1	122.8	130.6	139.4	152.9	163.2
Poland	89.7	83.4	85.6	88.8	93.5	100.0	106.0	113.2	118.6	123.5	128.5	129.7	131.5	136.6	143.9
Slovak Republic	115.7	98.8	92.4	89.0	94.5	100.0	106.1	111.0	115.6	117.4	119.7	124.3	130.0	135.8	143.3
Slovenia	103.0	93.8	88.7	91.2	96.1	100.0	103.6	108.6	112.4	118.7	123.3	126.6	130.8	134.1	140.3
NMS-8	**104.8**	**94.6**	**91.7**	**91.7**	**94.9**	**100.0**	**104.7**	**109.9**	**114.0**	**117.6**	**122.5**	**125.5**	**128.6**	**133.7**	**140.7**
Cyprus	79.7	80.3	88.0	88.6	93.9	100.0	101.9	104.2	109.2	114.4	120.1	124.9	127.4	129.9	
Malta	78.3	81.4	85.2	89.0	94.1	100.0	104.0	109.0	112.8	117.3	124.9	123.4	125.5	126.0	
NMS-10	**104.3**	**94.3**	**91.6**	**91.6**	**94.9**	**100.0**	**104.7**	**109.8**	**113.9**	**117.5**	**122.4**	**125.4**	**128.6**	**133.6**	**137.4**
Bulgaria	118.4	104.6	97.0	95.5	97.2	100.0	90.6	85.5	88.9	91.0	95.9	99.9	104.8	109.5	115.6
Romania	111.4	97.0	88.5	89.8	93.3	100.0	103.9	97.6	92.9	91.8	93.7	99.0	104.1	109.5	118.6
NMS-8 plus BG, RO	**106.7**	**95.6**	**91.4**	**91.5**	**94.7**	**100.0**	**103.8**	**106.8**	**109.8**	**112.6**	**117.1**	**120.5**	**124.0**	**129.1**	**136.3**
NMS-12: NMS-10 plus BG, RO	**106.2**	**95.3**	**91.3**	**91.5**	**94.7**	**100.0**	**103.8**	**106.8**	**109.8**	**112.7**	**117.2**	**120.5**	**124.0**	**129.1**	**133.7**
EU-15	**92.7**	**94.4**	**95.5**	**95.1**	**97.7**	**100.0**	**101.6**	**104.1**	**107.2**	**110.2**	**114.2**	**116.1**	**117.4**	**118.3**	**120.0**
Belarus		**151.3**	**136.8**	**126.4**	**111.6**	**100.0**	**102.8**	**114.5**	**124.1**	**128.4**	**136.0**	**142.0**	**149.0**	**160.0**	**177.0**
Russia		**153.1**	130.9	119.4	104.3	100.0	96.4	97.8	92.6	98.5	108.3	113.9	119.2	127.9	137.1
Ukraine		**191.1**	172.2	147.7	113.9	100.0	90.0	87.3	85.7	85.5	90.6	98.9	104.0	114.0	127.8

Employment, 1000 persons

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Czech Republic	5351	5059	4927	4874	4927	4963	4972	4937	4866	4764	4732	4750	4765	4733	4707
Estonia	826	807	761	699	675	633	619	617	607	579	573	578	586	594	596
Hungary	5052	4534	4083	3827	3752	3679	3648	3646	3698	3812	3849	3860	3871	3922	3900
Latvia	1409	1397	1294	1205	1083	970	952	993	991	973	944	965	980	985	990
Lithuania	1853	1898	1855	1778	1675	1644	1659	1669	1656	1648	1586	1522	1583	1607	1600
Poland	16280	15326	14677	14330	14475	14735	15021	15439	15800	15374	15018	14924	14590	14469	14600
Slovak Republic	2459	2152	2175	2118	2110	2147	2225	2206	2199	2132	2102	2124	2127	2165	2170
Slovenia	910	839	784	756	746	745	742	743	745	758	768	779	783	777	800
NMS-8	**34139**	**32011**	**30556**	**29587**	**29443**	**29516**	**29837**	**30251**	**30561**	**30039**	**29571**	**29500**	**29285**	**29252**	**29363**
Cyprus	257.2	258	269.3	268.7	272.8	285.1	287.8	287.0	289.9	293.7	301.9	307.6	311.8	313.4	
Malta	119.72	122.02	123.58	124.66	125.28	129.23	131.14	131	131.7	131.1	134.2	136.5	136.1	134.1	
NMS-10	**34516**	**32391**	**30949**	**29980**	**29841**	**29930**	**30256**	**30669**	**30982**	**30464**	**30007**	**29945**	**29732**	**29700**	
Bulgaria	4097	3564	3274	3222	3242	3282	3286	3157	3153	3088	2980	2968	2992	3097	3200
Romania	10893	10813	10622	10260	10037	9752	9436	9201	8918	8616	8525	8596	8600	8643	8600
NMS-8 plus BG, RO	**49129**	**46387**	**44451**	**43069**	**42721**	**42550**	**42559**	**42609**	**42631**	**41743**	**41075**	**41065**	**40877**	**40992**	**41163**
NMS-12: NMS-10 plus BG, RO	**49505**	**46767**	**44844**	**43462**	**43119**	**42964**	**42978**	**43027**	**43052**	**42168**	**41512**	**41509**	**41325**	**41440**	
NMS-7 (= NMS-8 minus Poland)	**17859**	**16684**	**15879**	**15257**	**14968**	**14781**	**14817**	**14812**	**14760**	**14666**	**14553**	**14577**	**14695**	**14783**	
EU-15	159447	159686	157557	155105	154966	156219	157208	158633	161498	164291	167580	169680	170636	171034	
Belarus		5022.5	4891.4	4827.7	4700.9	4409.6	4364.8	4369.9	4416.6	4442	4441	4417.4	4380.8	4339	4300
Russia		73848	71068	68642	64785	64149	62928	60021	58437	62475	64255	64400	66071	65800	67383
Ukraine		24995	24505.0	23945.0	23025.0	24125	24114	23756	22998	20048	20175	19972	20091	20163	20296

Employment, 1995=100

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Czech Republic	107.8	101.9	99.3	98.2	99.3	100.0	100.2	99.5	98.0	96.0	95.3	95.7	96.0	95.4	94.8
Estonia	130.4	127.3	120.2	110.3	106.6	100.0	97.8	97.4	95.8	91.5	90.4	91.2	92.4	93.8	94.1
Hungary	137.3	123.2	111.0	104.0	102.0	100.0	99.2	99.1	100.5	103.6	104.6	104.9	105.2	106.6	106.0
Latvia	145.2	144.0	133.4	124.2	111.6	100.0	98.1	102.4	102.1	100.3	97.3	99.5	101.1	101.6	102.0
Lithuania	112.7	115.5	112.9	108.2	101.9	100.0	100.9	101.6	100.8	100.2	96.5	92.6	96.3	97.8	97.3
Poland	110.5	104.0	99.6	97.3	98.2	100.0	101.9	104.8	107.2	104.3	101.9	101.3	99.0	98.2	99.1
Slovak Republic	114.5	100.2	101.3	98.7	98.3	100.0	103.6	102.8	102.4	99.3	97.9	98.9	99.1	100.8	101.1
Slovenia	122.1	112.6	105.2	101.4	100.1	100.0	99.5	99.8	100.0	101.8	103.1	104.5	105.1	104.3	107.3
NMS-8	**115.7**	**108.5**	**103.5**	**100.2**	**99.8**	**100.0**	**101.1**	**102.5**	**103.5**	**101.8**	**100.2**	**99.9**	**99.2**	**99.1**	**99.5**
Cyprus	90.2	90.5	94.5	94.2	95.7	100.0	100.9	100.7	101.7	103.0	105.9	107.9	109.4	109.9	0.0
Malta	92.6	94.4	95.6	96.5	96.9	100.0	101.5	101.4	101.9	101.5	103.8	105.6	105.3	103.8	0.0
NMS-10	**115.3**	**108.2**	**103.4**	**100.2**	**99.7**	**100.0**	**101.1**	**102.5**	**103.5**	**101.8**	**100.3**	**100.0**	**99.3**	**99.2**	**0.0**
Bulgaria	124.8	108.6	99.7	98.2	98.8	100.0	100.1	96.2	96.1	94.1	90.8	90.4	91.2	94.4	97.5
Romania	111.7	110.9	108.9	105.2	102.9	100.0	96.8	94.3	91.4	88.4	87.4	88.1	88.2	88.6	88.2
NMS-8 plus BG, RO	**115.5**	**109.0**	**104.5**	**101.2**	**100.4**	**100.0**	**100.0**	**100.1**	**100.2**	**98.1**	**96.5**	**96.5**	**96.1**	**96.3**	**96.7**
NMS-12: NMS-10 plus BG, RO	**115.2**	**108.9**	**104.4**	**101.2**	**100.4**	**100.0**	**100.0**	**100.1**	**100.2**	**98.1**	**96.6**	**96.6**	**96.2**	**96.5**	**0.0**
EU-15	**102.1**	**102.2**	**100.9**	**99.3**	**99.2**	**100.0**	**100.6**	**101.5**	**103.4**	**105.2**	**107.3**	**108.6**	**109.2**	**109.5**	**110.0**
NMS-7	**120.8**	**112.9**	**107.4**	**103.2**	**101.3**	**100.0**	**100.2**	**100.2**	**99.9**	**99.2**	**98.5**	**98.6**	**99.4**	**100.0**	
Belarus		**113.9**	**110.9**	**109.5**	**106.6**	**100.0**	**99.0**	**99.1**	**100.2**	**100.7**	**100.7**	**100.2**	**99.3**	**98.4**	**97.5**
Russia		**115.1**	**110.8**	**107.0**	**101.0**	**100.0**	**98.1**	**93.6**	**91.1**	**97.4**	**100.2**	**100.4**	**103.0**	**102.6**	**105.0**
Ukraine		**103.6**	**101.6**	**99.3**	**95.4**	**100.0**	**100.0**	**98.5**	**95.3**	**83.1**	**83.6**	**82.8**	**83.3**	**83.6**	**84.1**

GDP per employed person (macro-productivity) , 1995=100

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Czech Republic	97.3	91.0	92.9	94.0	95.1	100.0	104.0	103.9	104.2	107.8	112.7	115.2	116.6	121.1	127.2
Estonia	110.4	97.6	88.7	88.2	89.7	100.0	106.8	119.0	126.5	132.9	145.0	153.0	161.9	170.1	182.9
Hungary	82.1	80.6	86.7	92.0	96.6	100.0	102.2	106.9	110.6	111.7	116.4	120.5	124.4	126.4	132.4
Latvia	138.9	125.5	88.2	80.7	90.3	100.0	105.8	109.8	115.3	121.2	133.5	141.1	147.8	158.1	170.7
Lithuania	153.0	140.9	113.5	99.2	95.0	100.0	103.7	110.3	119.3	117.8	127.2	141.0	144.8	156.4	167.6
Poland	81.2	80.2	85.9	91.4	95.1	100.0	104.0	108.1	110.6	118.4	126.0	128.1	132.9	139.1	145.3
Slovak Republic	101.0	98.6	91.2	90.2	96.2	100.0	102.4	108.0	112.9	118.2	122.3	125.6	131.2	134.7	141.8
Slovenia	84.3	83.3	84.3	89.9	95.9	100.0	104.1	108.8	112.5	116.6	119.6	121.1	124.4	128.6	130.7
NMS-8	**90.6**	**87.3**	**88.5**	**91.5**	**95.1**	**100.0**	**103.6**	**107.2**	**110.1**	**115.6**	**122.2**	**125.5**	**129.6**	**134.9**	**141.4**
Cyprus	88.3	88.7	93.2	94.1	98.1	100.0	100.9	103.6	107.4	111.0	113.4	115.8	116.5	118.2	
Malta	84.5	86.2	89.1	92.3	97.1	100.0	102.5	107.6	110.6	115.6	120.3	116.8	119.2	121.5	
NMS-10	**90.4**	**87.2**	**88.5**	**91.5**	**95.2**	**100.0**	**103.5**	**107.1**	**110.0**	**115.5**	**122.1**	**125.4**	**129.4**	**134.6**	
Bulgaria	94.9	96.3	97.2	97.3	98.4	100.0	90.5	88.9	92.6	96.7	105.6	110.5	114.9	116.1	118.6
Romania	99.7	87.5	81.2	85.4	90.7	100.0	107.4	103.4	101.6	103.9	107.2	112.4	118.0	123.5	134.5
NMS-8 plus BG, RO	**92.4**	**87.7**	**87.4**	**90.4**	**94.4**	**100.0**	**103.8**	**106.7**	**109.5**	**114.8**	**121.3**	**124.8**	**129.0**	**134.0**	**140.9**
NMS-12: NMS-10 plus BG, RO	**92.2**	**87.6**	**87.5**	**90.4**	**94.4**	**100.0**	**103.8**	**106.7**	**109.5**	**114.8**	**121.3**	**124.8**	**129.0**	**133.8**	
EU-15	**90.9**	**92.3**	**94.6**	**95.7**	**98.5**	**100.0**	**101.0**	**102.6**	**103.7**	**104.8**	**106.4**	**106.9**	**107.5**	**108.0**	**109.1**
Ameco orig	91.6	92.0	94.4	95.7	98.4	100.0	101.1	102.7	103.9	105.1	106.8	107.3	108.0	108.7	109.7
Belarus		132.8	123.3	115.5	104.7	100.0	103.9	115.5	123.9	127.5	135.0	141.7	150.0	162.6	181.5
Russia		133.0	118.1	111.6	103.3	100.0	98.3	104.5	101.6	101.1	108.2	113.4	115.7	124.7	130.5
Ukraine		184.4	169.5	148.8	119.3	100.0	90.0	88.6	89.9	102.9	108.3	119.5	124.9	136.4	152.0

Notes: No GDP data available for Malta 1990. A rough wiiw estimate was used for calculating the aggregate GDP of NMS-8, NMS-10 and NMS-12.
– Employment including employees and self-employed.

Source: NMS: wiiw Annual Database; EU, Cyprus, Malta: AMECO and national statistics.

Table A2: Additional Regression Estimates of Employment Elasticity to GDP Growth, 1995–2004

Model I: Employment (vEMP) and GDP growth (vGDP); sample of 8 NMS, BG, RO, 3 NIS (BY, RU, UA)

Source	SS	df	MS		
				Number of obs =	130
				F(1, 128) =	9.99
Model	.006982492	1	.006982492	Prob > F =	0.0020
Residual	.089454875	128	.000698866	R-squared =	0.0724
				Adj R-squared =	0.0652
Total	.096437367	129	.000747576	Root MSE =	.02644

vEmp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
vGDP	.1657639	.0524423	3.16	0.002	.0619978	.2695299
_cons	.8245711	.0545756	15.11	0.000	.7165839	.9325583

Model II: Employment (vEMP) and GDP growth (vGDP); sample of 8 NMS, BG, RO, 3 NIS (BY, RU, UA) (NIS dummy)

Source	SS	df	MS		
				Number of obs =	130
				F(2, 127) =	4.97
Model	.007003088	2	.003501544	Prob > F =	0.0083
Residual	.089434279	127	.000704207	R-squared =	0.0726
				Adj R-squared =	0.0580
Total	.096437367	129	.000747576	Root MSE =	.02654

vEmp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
vGDP	.164774	.0529595	3.11	0.002	.0599767	.2695714
DUM	-.0009504	.0055574	-0.17	0.864	-.0119475	.0100466
_cons	.8258196	.0552681	14.94	0.000	.7164541	.9351851

Model III: Employment (vEMP) and lagged GDP growth (vGDPl); sample of 8 NMS, BG, RO, 3 NIS (BY, RU, UA)

Source	SS	df	MS		
				Number of obs =	130
				F(1, 128) =	10.01
Model	.006995345	1	.006995345	Prob > F =	0.0019
Residual	.089442022	128	.000698766	R-squared =	0.0725
				Adj R-squared =	0.0653
Total	.096437367	129	.000747576	Root MSE =	.02643

vEmp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
vGDPl	.1329142	.0420081	3.16	0.002	.0497941	.2160343
_cons	.8598375	.0433882	19.82	0.000	.7739864	.9456885

Model IV: Employment (vEMP) and lagged GDP growth (vGDPl); sample of 8 NMS, BG, RO, 3 NIS (BY, RU, UA) (NIS dummy)

Source	SS	df	MS
Model	.007065691	2	.003532846
Residual	.089371676	127	.000703714
Total	.096437367	129	.000747576

Number of obs	=	130
F(2, 127)	=	5.02
Prob > F	=	0.0080
R-squared	=	0.0733
Adj R-squared	=	0.0587
Root MSE	=	.02653

vEmp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
vGDPl	.1365025	.0436575	3.13	0.002	.0501122	.2228928
DUM	.0018081	.0057188	0.32	0.752	-.0095083	.0131245
_cons	.8557193	.045448	18.83	0.000	.7657859	.9456527

Model V: Employment (vEMP), GDP growth (vGDP) and lagged GDP growth (vGDPl); sample of 8 NMS

Source	SS	df	MS
Model	.013722409	2	.006861204
Residual	.042885532	77	.000556955
Total	.056607941	79	.000716556

Number of obs	=	80
F(2, 77)	=	12.32
Prob > F	=	0.0000
R-squared	=	0.2424
Adj R-squared	=	0.2227
Root MSE	=	.0236

vEmp	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
vGDP	.1940474	.0943572	2.06	0.043	.0061581	.3819367
vGDPl	.2850295	.0735131	3.88	0.000	.1386462	.4314128
_cons	.4968122	.1093566	4.54	0.000	.2790554	.7145691

Model VI: Employment (vEMP), GDP growth (vGDP) and lagged GDP growth (vGDPl); sample of 8 NMS (NMS dummies)

Source	SS	df	MS			
Model	.023702004	9	.002633556	Number of obs	=	80
Residual	.032905936	70	.000470085	F(9, 70)	=	5.60
				Prob > F	=	0.0000
Total	.056607941	79	.000716556	R-squared	=	0.4187
				Adj R-squared	=	0.3440
				Root MSE	=	.02168

vEmp	Coef.	Std. Err	t	P>|t	[95% Conf.	Interval]
vGDP	.354271	.0948158	3.74	0.000	.16516	.5433751
vGDPl	.3113643	.0694653	4.48	0.000	.1728201	.4499084
DUMcountry1	.0071376	.0099683	0.72	0.476	-.0127436	.0270188
DUMcountry2	-.0195508	.0098465	-1.99	0.051	-.0391891	.0000875
DUMcountry3	.0087011	.0097871	0.89	0.377	-.0108186	.0282208
DUMcountry4	-.016589	.0098719	-1.68	0.097	-.036278	.0031
DUMcountry5	-.0189547	.0099885	-1.90	0.062	-.0388762	.0009668
DUMcountry6	-.0036834	.009741	-0.38	0.706	-.0231112	.0157445
DUMcountry7	.0123968	.0097566	1.27	0.208	-.0070621	.0318557
DUMcountry8	(dropped)					
_cons	.3052912	.1127265	2.71	0.008	.0804654	.5301171

Model VII: Employment (vEMP), GDP growth (vGDP) and lagged GDP growth (vGDPl); sample of 8 NMS (NMS and time-specific dummies)

Source	SS	df	MS
Model	.030301358	18	.001683409
Residual	.026306583	61	.000431255
Total	.056607941	79	.000716556

Number of obs	=	80
F(18, 61)	=	3.90
Prob > F	=	0.0000
R-squared	=	0.5353
Adj R-squared	=	0.3982
Root MSE	=	.02077

vEmp	Coef	Std Err.	t	P>|t|	[95% Conf.	Interval]
vGDP	.4064047	.1000702	4.06	0.000	.2063018	.6065075
vGDPl	.2607078	.0703854	3.70	0.000	.1199634	.4014522
DUMcountry1	.0063903	.0095826	0.67	0.507	-.0127712	.0255519
DUMcountry2	-.0207065	.0094611	-2.19	0.032	-.0396251	-.0017879
DUMcountry3	.0079877	.0093844	0.85	0.398	-.0107776	.026753
DUMcountry4	-.0180978	.0094863	-1.91	0.061	-.0370669	.0008712
DUMcountry5	-.0200459	.0096254	-2.08	0.041	-.0392931	-.0007986
DUMcountry6	-.00433	.009339	-0.46	0.645	-.0230045	.0143444
DUMcountry7	.0117864	.0093517	1.26	0.212	-.0069135	.0304863
DUMcountry8	(dropped)					
DUMyear1	(dropped)					
DUMyear2	(dropped)					
DUMyear3	(dropped)					
DUMyear4	.0025919	.0104	0.25	0.804	-.0182041	.023388
DUMyear5	.0102987	.0105836	0.97	0.334	-.0108646	.0314619
DUMyear6	.0128129	.010758	1.19	0.238	-.0086991	.0343249
DUMyear7	.0196529	.0107504	1.83	0.072	-.0018439	.0411496
DUMyear8	.0181758	.0109365	1.66	0.102	-.0036931	.0400447
DUMyear9	(dropped)					
DUMyear10	.0215946	.0106242	2.03	0.046	.0003502	.0428391
DUMyear11	.029626	.0105394	2.81	0.007	.0085512	.0507009
DUMyear12	.0269578	.0105059	2.57	0.013	.0059501	.0479656
DUMyear13	.0219043	.0105448	2.08	0.042	.0008187	.0429899
_cons	.2880442	.1165777	2.47	0.016	.0549327	.5211557

Foreign Direct Investment and Productivity Spillovers in the Central and Eastern European Countries

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Abstract

The paper discusses the inflows of foreign direct investment into the Central and Eastern Europe (CEE) countries and focuses on analysis of productivity spillovers. Overview of the relevance of foreign firms in the CEE economies is presented. Using firm-level data on manufacturing industries for the period 2000–2005, total factor productivity of domestic firms is estimated using Petrin and Levinsohn (2003) method and subsequently related within a panel data model to foreign presence in the same industry and in the industries linked via production chain. Presence of productivity spillovers is tested across several breakdowns to detect possible conditionalities.

Keywords: foreign direct investment; productivity; spillovers
JEL: F21, D24, L60

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1. Introduction

Over the past years, economic growth in the CEE countries has been rather impressive.[2] Baltic countries stand out as top performers, with average annual real growth rates of more than 7% since 1999, but also other countries of the Central and Eastern Europe have been growing relatively fast, on average by around 4%.

The increased productivity has been usually identified as the main driver of economic growth in the CEE countries. Using the growth accounting approach, Schadler et al. (2006) estimated that the increase in total factor productivity has accounted for between 50% and 75% of the average GDP growth between 1995 and 2004. The second most important driver of growth was capital accumulation, while the contribution of labour input was assessed as either very small or negative. Also Arratibel et al. (2007) find that total factor productivity was the most important driver of growth in 8 CEE countries, while the contributions of capital and in particular labour were much smaller or negative.

Foreign direct investment (FDI) is often mentioned as an important driver of productivity, investment and economic growth. In general, FDI typically supports the internationalisation of production and thus spurs trade openness of an economy, which is believed to have a positive impact on growth[3]. FDI increases competitive pressures in markets and stimulates technology and knowledge transfers and innovation. In this respect, FDI supports a better diffusion of foreign technology. Furthermore, FDI can provide financial sources which may sometimes be scarce in the recipient countries and thus ease credit constraints that may limit investment. Altogether, these aspects of FDI are likely to improve the host country's long-term growth prospects (see for example Lim, 2001 and OECD, 2002).

The CEE countries have been attracting FDI successfully during 1990s, given the privatization in these countries, the lack of domestic capital needed for economic transition and EU accession prospects. Differences in the timing of privatisation and the degree of openness to foreign investment help to explain country-specific differences in FDI inward stock positions. More recently, other determinants of FDI, such as cost factors, the size and location of the market and FDI policies have gained in importance. Since 2000, the intense inward FDI has continued, averaging to 5% of the GDP.

As discussed, FDI brings substantial benefits to the host economy (see also Jones and Colin, 2006). Looking at the firms level, a foreign-owned company,

[2] In this note, the CEE (Central and Eastern European) countries include the Czech Republic, Hungary, Poland, Slovakia, Slovenia, Estonia, Lithuania, Latvia, Bulgaria and Romania.

[3] For instance, Frankel and Romer (1999) find empirical evidence of this effect, but some controversies with regard to its significance and magnitude exist in the literature – see, for example, Rodrik *et al.* (2004)

usually being part of a multinational enterprise, is larger, more capital intensive, has more skilled labour, higher technological knowledge and a greater productivity level compared to domestic companies. In addition, foreign firms have usually better access to financing, either from the parent company or from the banks given their superior performance. Thus, attracting FDI brings benefits for the host economy in terms of higher investment, employment and output of these firms, with resulting effect on the overall GDP growth (so-called direct effects).

Next to these direct effects, FDI can have indirect effects on the host economy, mainly through technology or productivity spillovers from foreign-owned firms to domestic firms (Blomstrom and Kokko 1998). These spillovers can take place both within an industry (horizontal spillovers), for example, via imitation of foreign company's technology by domestic firms, or across industries (vertical spillovers), via technology transfer to domestic sub-suppliers or customers in the production chain. Through productivity spillovers, FDI can have multiplier effect and increase overall productivity of the host economy. Empirical studies show that a substantial part of the increase in productivity levels in the CEE countries can be attributed to direct effects of FDI, but some indirect effects might have played a role as well. [4]

In this paper, we focus on the role of indirect effects of FDI in the CEE countries in terms of productivity spillovers to domestic companies. The main reason to analyse the spillovers is that the direct effects last only if the foreign companies stay in the host economy. Given that a number of firms invested in the CEE countries to relocate production to a country with lower labour costs (as opposed to the servicing-the-market motive), the investment may be again relocated to other countries after the current host country loses the comparative advantage. If the FDI also indirectly contributed to improved productivity of domestic firms, the effect of the liquidation of the FDI would not be that adverse.

In line with the recent literature, the analysis of productivity spillovers is done using firm-level data. We estimate total factor productivity of the domestic firms, which is subsequently related to foreign presence by using the Levinsohn and Petrin (2003) methodology that controls for endogeneity of input selection. In order to detect on what are spillovers conditional upon, we split the sample to sub-samples using several breakdowns and investigate whether the potential for spillovers differs across different groups of firms (depending on specified conditions). We analyse manufacturing firms only, mainly due to two reasons: first, manufacturing sector received high volume of FDI over the past years (around 40% of existing FDI stock in the CEE countries) and, second, the risk of liquidation of FDI due to further relocation is more severe in the manufacturing rather than in

[4] A recent study has found that FDI has generated, on average, three quarters of the economic growth registered in 13 Central and Eastern European countries during the period 1994–2002 (see Deutsche Bank Research, EU Monitor, Reports on European Integration No. 26/2005).

services, financial intermediation or other sectors where the servicing-the-market motive prevails.

In comparison with recent research in this area, represented mainly by Merlevede and Schoors (2005, 2006), Javorcik (2004), Javorcik and Spatareanu (2003), and Javorcik et al. (2004), this paper provides value added in two areas: first, it analyses the recent data over the period 2000–2005, while most of the last literature focused on the late 1990s. Second, we focus on all ten CEE countries, while the other literature usually focuses only on one selected country. The last overview study of all ten CEE countries was done by Damijan et al. (2003) who concentrated on the period 1995–1999.

The paper is structured as follows: Section 2 provides an overview of the FDI inflows and FDI inward positions in the CEE countries. Section 3 reviews the channels through which spillovers from FDI to productivity of domestic firms can work and discusses several conditions that can influence the emergence of spillovers. Section 4 analyses the foreign presence in the manufacturing sectors of these countries using the micro-level data. Section 5 describes the estimation strategy. Section 6 presents the estimation results and section 7 concludes.

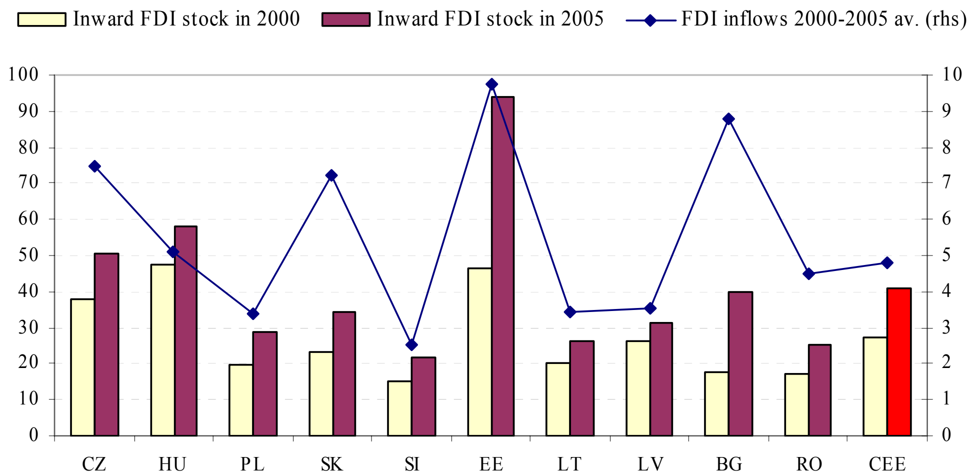
2. Foreign Direct Investment Inflows to the CEE Countries

The CEE countries have been successful at attracting FDI, which is reflected in strong FDI inflows and high inward FDI positions.

Since the early stages of their transition, the CEE countries have received substantial FDI inflows, which continued in the first half of 2000s. Annual FDI inflows have averaged around 5% of GDP between 2000 and 2005 although the pattern varied strongly across countries, with the highest being in Estonia, Bulgaria, the Czech Republic and Slovakia (chart 1). In 2005, FDI inflows in the CEE amounted to 33 billion euro, while since 2000 they accumulated to 150 billion euro.

Overall, FDI inflows as share of GDP remained broadly stable since 2000 and in line with strong FDI inflows, FDI inward positions have been growing fast in most CEE countries (chart 1). FDI inward stock in the CEE grew to 41% of GDP in 2005 from 27% of GDP in 2000. In 2005, Estonia had the highest accumulation of FDI (around 95% of GDP), followed by Hungary and the Czech Republic. In all other countries, FDI inward stock as percentage of GDP was below the CEE average, with the lowest being in Slovenia (22% of GDP in 2005). In absolute terms, the Czech Republic, Hungary and Poland accumulated about 70% of total inward FDI stock in EU10.

Chart 1: FDI Net Inflows and Inward FDI Stock, % of GDP



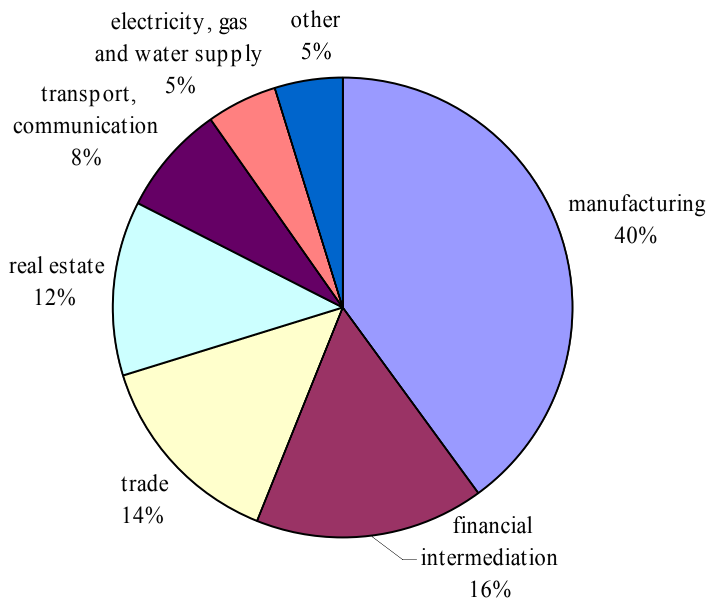
Note: The ordering of countries here and further in the paper is as follows: Visegrad countries (i.e. central Europe CZ, HU, PL, SK ordered alphabetically + SI), Baltic countries (EE, LT, LV) and the 2007 EU entrants (BG, RO).

Source: WIIW (Wiener Institut für Internationale Wirtschaftsvergleiche).

Turning now to the sectoral developments, the majority of FDI in the CEE went into the services sector, while manufacturing comprises around 40% of inward FDI stock by the end of 2004 (chart 2).

Among the services sectors financial intermediation, trade, real estate and transport are the largest receivers, with around 50% of the total FDI inward stock. As mentioned before, FDI in the service sector is usually motivated by market seeking and supplying cost optimisations, even though outsourcing and FDI in export oriented services seem to have become an important factor recently. The bulk of FDI in services can be associated with privatisation in these countries, as for example foreign investors took over a large proportion (in some countries majority) of the banking sector and telecommunications during the 1990s.

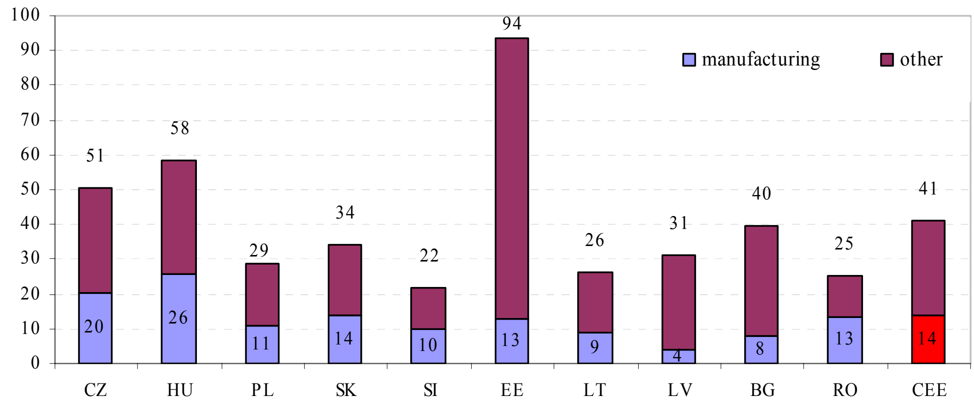
Chart 2: Inward FDI Stock in the CEE by Economic Activities (End of 2004)



Source: WIIW.

FDI in manufacturing, on the other hand, is usually motivated by low input costs and production cost economisation. However, as FDI in manufacturing has also been driven by privatisation, the motivation often was first to serve the domestic market, but may have afterwards led to expanding business activity of investing firms due to cost-savings and increased competitiveness. The accumulated inward FDI stock in manufacturing varies across CEE countries (chart 3).

Chart 3: Inward FDI Stock in Manufacturing Sector Relative to the Other Sectors in 2005, % of GDP



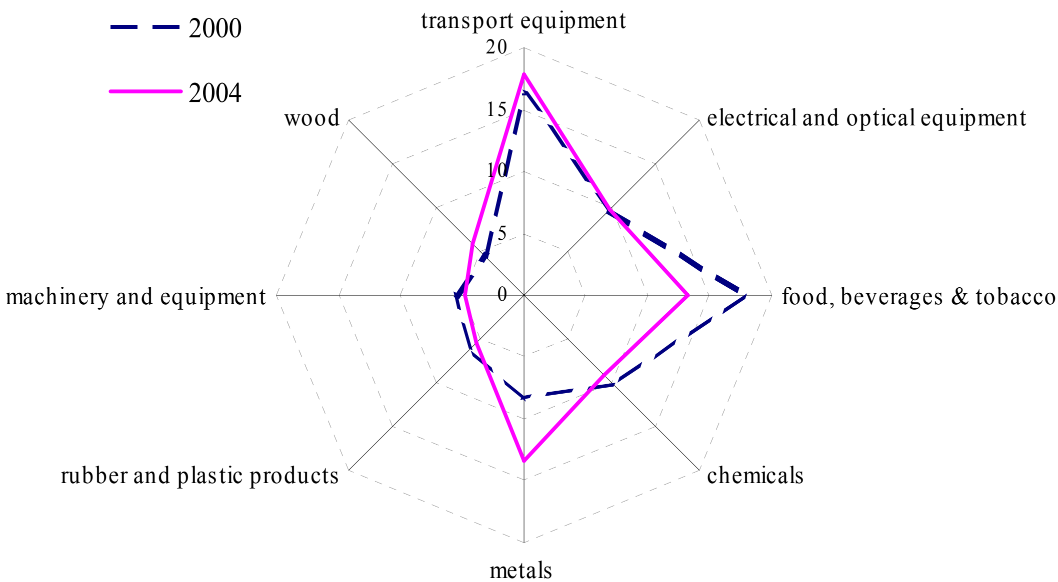
Source: WIIW.

On average, manufacturing sector had accumulated around 35% of total inward FDI stock in CEE by the end of 2005. Highest share of FDI stock in manufacturing sector by the end of 2005 was in Romania (52%) followed by Slovenia, Hungary, Czech Republic and Slovakia (on average 40%). Smallest share of inward FDI stock in manufacturing in Latvia and Estonia, 2.5% and 13.6%. of to the total inward FDI stock respectively.

Available data suggest that in the manufacturing sector foreign investors' activity has been concentrated in a few industries, notably, transport equipment, food, metals, electrical and optical equipment, which have received about 65% of the total FDI in manufacturing (chart 4).

Looking over the period 2000–2005, metal industry has gained in importance, while FDI in the food industry has become relatively less important, as this has mostly related to privatisation and the buying of existing firms and less to relocation.

Chart 4: Inward FDI Stock in the CEE by Manufacturing Industry



Source: WIIW.

3. Spillovers of Foreign Direct Investment on Productivity of Local Firms

There are several channels through which FDI can influence productivity of local firms when there is interaction between foreign and domestic firms in the host economy. As mentioned earlier, we differentiate between direct effects of FDI and indiriect effects. These indirect effects of foreign presence are called spillovers (Merlevede and Schoors, 2005). Two main kinds of spillovers are usually discussed in the literature: productivity spillovers (i.e. transfer of technology in a broader sense, including organizational and managerial practices and know-how) and market access spillovers (i.e. possibility for local firms to access new markets via marketing and business networks of foreign companies with which local firms interact). Clearly, the latter spillover may reinforce the former, as the chance to compete in the foreign markets puts pressure on the local firms to increase productivity. However, in our paper, we focus on the productivity spillovers only.

Two types of productivity spillovers are usually identified in the literature (Javorcik, 2004): when local firms benefit from the presence of foreign companies in their sector, we refer to horizontal spillovers, while if local firms benefit from interaction with foreign firms upstream or downstream in the production chain, we refer to vertical spillovers. In this sense, backward spillovers denote spillovers from the foreign firm to its local sub-supplier (upstream in the production chain), while forward spillovers refer to the spillovers from foreign firms to their local customers (downstream in the production chain).

As regards horizontal spillovers, three main channels through which horizontal spillovers may run are demonstration channel, labour market channel and competition channel (Kokko, 1992). Within the demonstration channel, local firms may try to imitate foreign firm's technology. Of course, informed foreign companies will try to prevent technology leakage to the local competitors, so that the potential for the spillover running via this channel may be limited. Another strategy of foreign firms to prevent imitation by local competitors is not to bring their state-of-the-art technologies, but those technologies that are only slightly more advanced than those of the local firms (Glass and Saggi, 1998). This would also adversely affect the potential for horizontal spillovers. The labour market channel works via labour turnover from foreign firms' trained workers to local firms (Fosfuri et al., 2001). However, foreign presence can have also detrimental effect on the local firms through this channel, as it can brain drain local talents from the local firms to the foreign affiliates (Balock and Gertler, 2004). Within the competition channel, entry of foreign firms increases competition in the host economy and forces local firms to use existing resources more efficiently and to adopt better technologies (Blomstrom and Kokko, 1998). On the other hand, if the competition induced by the entry of foreign firms is too high, less productive local firms may be driven out of the market (market stealing effect, see Aitken and Harrison, 1999).

To turn now to vertical spillovers, backward vertical spillovers emerge when foreign firms intentionally assist local sub-suppliers to deliver high-quality inputs and share with them superior technology. There are two conditions under which the incentive to help local sub-suppliers exists: first, the transportation costs between the home and the host country must be rather high so that the foreign firm does not have incentive to source its inputs in its home country. Second, the foreign firm must refrain to induce sub-suppliers from its home country to invest in the host country as well, as this would create an isolated enclave of mutually linked foreign firms with limited interaction with the local firms and thus limited potential for spillovers. Being a sub-supplier to a foreign firm provides the local firm with a stable demand for inputs and allows the local firm to invest into appropriate physical capital, build up a stock of experienced workers and accumulate necessary experience, all prerequisites for increased productivity via usage of advanced technology (Merlevede and Schoors, 2005). However, if local sub-suppliers are not able to maintain the quality standards for the inputs as required by the foreign customer, backward vertical spillovers may also be negative, as the foreign firm may turn back to its home country sub-suppliers.

Forward vertical spillovers appear when higher quality inputs produced by foreign firms are used in the production chain by the local firms. In principle, forward vertical spillover may be also negative. For example, if the inputs produced by foreign companies are more expensive and not adapted to the local conditions, in which case they are used only by more productive foreign enterprises that are better equipped to handle the high-quality inputs. This would increase the productivity difference between local and foreign companies.[5]

Given the possible ambivalent net effect of horizontal and vertical productivity spillovers, some studies assume that the spillovers may be non-linear, meaning that the net effect on domestic companies' productivity changes with the degree of foreign presence (Damijan et al., 2003; Merlevede and Schoors, 2005, 2006). For example, relatively moderate presence of foreign companies may induce positive horizontal spillovers via demonstration channel, but further substantial increase of foreign presence may trigger brain drain and lead to market stealing effect, driving local companies out of the market, meaning negative horizontal spillovers. In other words, foreign presence contributes to an increase in domestic productivity, but if foreign presence increases beyond some threshold, its impact on local productivity turns negative.

Recent literature also focuses on conditions or characteristics that make domestic companies sensitive to spillovers, so-called conditional spillovers (Schoors and van der Tol, 2002; Javorcik and Spatareanu, 2003; Javorcik, 2004; Merlevede and Schoors 2005, 2006). Main characteristics of a firm or industry that affect the conditional spillovers are: absorptive capacity of a firm, export orientation, import competition, sectoral competition, firm size and the level and origin of foreign ownership.

A number of studies showed that absorptive capability of local firms is high if the technological gap vis-à-vis foreign firms is small (Blomstrom, 1986; Kokko et al., 1996). Thus, the level of technology of local firms in comparison to the level of technology of foreign firms is often used as a proxy for absorptive capacity. Indeed, if a local firm has well developed human capital and the technology gap is small, it can better handle and implement the advanced technology brought by foreign affiliates. If the technology gap is large and human capital low, the absorptive capacity is low, as the foreign technology might not be relevant for the

[5] Merlevede and Schoors (2006) introduce another spillover, following the theoretical model of Markusen and Venables (1999), namely the supply-backward spillover, arguing that foreign presence in downstream sectors may cause local sub-suppliers to increase their productivity and provide high-quality inputs that may positively influence also the productivity of their local customers

local firms or too difficult to implement.[6] However, taking into account nonlinearities when investigating the effect of absorptive capacity on productivity spillovers, firms both too close to and too far from the foreign technology frontier will benefit least from foreign presence, as firms with low technology level will lack resources to absorb new technologies (negative spillovers), while for firms with advanced technology level the potential to gain from spillovers is rather limited. The highest potential for spillovers hence exists for firms with medium technological level.

Similarly, export orientation of industries or firms has been found to affect the sensitivity of local companies to spillovers in both ways (Schoors and van der Tol, 2002; Sinani and Meyer, 2004). On the one hand, export-oriented firms are used to higher competition on foreign markets, are usually more productive than firms serving only local markets and, thus, may be better prepared to adapt advanced technologies. On the other hand, exporters may already be at a technology frontier that is comparable to the one of the foreign companies, reducing the potential for spillovers. Additionally, the export orientation of an industry, even if only foreign firms are exporting, creates a possibility for the market access spillovers. If, for example, a local firm is able to hire workers previously employed by a foreign company, it can use his or her knowledge about the foreign markets and increase the share of exports, which in turn puts pressure on productivity improvements. As a result, we do not have a clear guidance ex ante on whether we should expect export-oriented firms to benefit more from foreign presence.

Import competition arises when imported products are similar to those produced in the local economy. Consequently, competition in the market is higher in the sectors with high import competition compared to the sectors with lower import competition (Sjoholm, 1999). This can have two opposite effects on the potential for spillovers. On the one hand, competition forces domestic firms to produce more efficiently and increase their productivity, thus being more sensitive also to potential spillovers from foreign firms. On the other hand, if the competition from imports is too high, local firms may encounter problems to sell their products in local markets and suffer losses, a situation that decreases sensitivity to productivity spillovers. The effect of import competition on existence of spillovers has not been empirically tested enough to have a clear empirical evidence about the sign and size of this effect.

The effect of sectoral competition on the sensitivity to spillovers is similar to the effect of import competition, with most studies finding positive impact of competition on productivity (Kokko, 1994, 1996; Sjoholm, 1999).

[6] Some studies also use the level of R&D as a proxy for absorptive capability, arguing that it stimulates innovation and increases firm's ability to adapt to advanced technologies (Cohen and Levinthal 1989; Kinoshita 2001; Sinani and Meyer 2004).

Regarding the firm size, larger firms have greater resources, thus they are more capable to exploit innovative opportunities and benefit more from adapting advanced technology (Merlevede and Schoors, 2006). On the other hand, small and medium-sized companies are more flexible to adapt to new organizational and managerial practices and are an important source of innovations (Sinani and Meyer 2004). Thus, we cannot ex ante predict what type of firms will be more prone to spillovers.

Some studies investigated whether the degree of foreign ownership in firms defined as foreign (i.e. minority, majority or 100% ownership) and origin of foreign investors affects spillovers (Javorcik and Spatareanu, 2003; Javorcik 2004, Merlevede and Schoors, 2006). Local participation means higher potential for technology leakages and thus positive horizontal spillovers, but this in turn prevents foreign firms to bring the state-of-the-art technology, reducing the scope for spillovers.

In sum, the complexity of the channels trough which spillovers could arise, together with the uncertainty about their direction and possible non-linearities in the relationships make the estimation of spillovers very difficult.[7] In this paper, we focus on three selected conditions, namely absorptive capability, export orientation and the firm size.

4. Data Description and Analysis of Foreign Presence in the Manufacturing Sector

Database "Amadeus" provided by Bureau van Dijk (September 2006 release) is used as a source of firm-level data on CEE corporate sector. The data on companies' balance sheet items, profit and loss account and ownership constitute an unbalanced panel over the period 2000–2005.[8] We focus on manufacturing companies (NACE Rev. 1.1 2-digit industries 15–36) with minimum of 10 employees and fixed assets and turnover of at least 10,000 USD. The coverage of firms in Amadeus database differs across countries, with the firms' aggregated turnover representing between 40% and 100% of total manufacturing sector's production and between 30% and 90% of total manufacturing sector's employment (see chart 5).[9]

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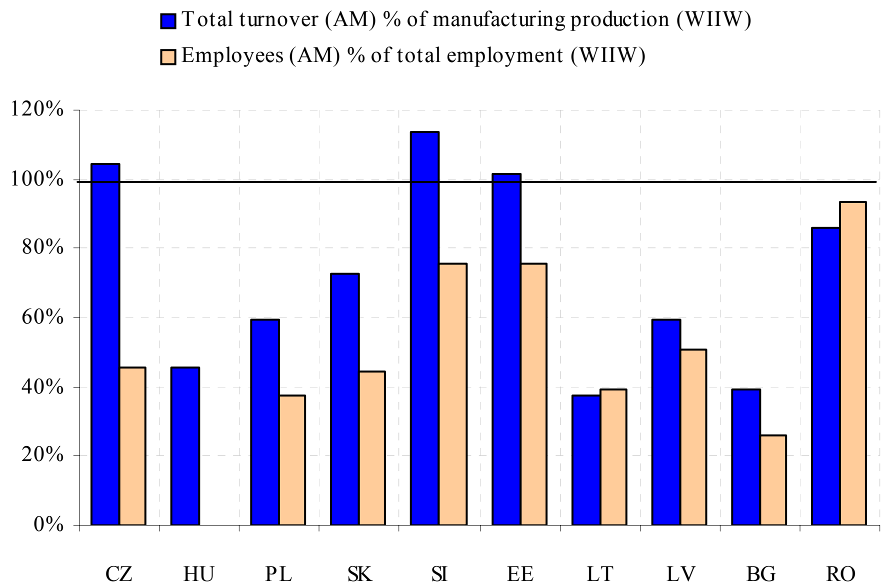
7 Merlevede and Schoors (2005, 2006) explore the effect of interaction of different conditions on the existence of spillovers.

8 Unfortunately, a given release of the Amadeus database does not include history of ownership information, thus the most recent information about the ownership status is used (i.e. as of September 2006) and assumed to be valid over the whole period of analysis.

9 Figures higher than 100% are possible as the industrial manufacturing production in WIIW database includes only sales of goods classified as manufacturing, while the

Chart 5: The Coverage of Firms in Amadeus Database



Note: The chart shows total turnover and employment compared with WIIW database (in %)

Source: Amadeus, WIIW database.

In the countries with the best coverage in terms of manufacturing turnover (the Czech Republic, Slovenia, Estonia and Romania), the distribution of turnover according to the Amadeus data by individual NACE sectors is almost identical to the distribution reported by WIIW for aggregate figures (see table A1 in Appendix A). Furthermore, distributions of Amadeus and WIIW data are also comparable in the remaining countries, thus the used sample from Amadeus database is relatively representative of the actual manufacturing industries in the CEE countries.

Foreign companies are our proxy for FDI, despite the methodological difference (FDI is traditionally defined as a share of at least 10% of company's capital hold by non-residents). The Amadeus database allows defining foreign companies in many different ways. For the scope of this note, we define foreign company as a company with the global ultimate owner from a country outside the host country, or with immediate shareholders of the company from countries outside the host country which have a share of at least 51% of company's capital. The main reason to use the majority-ownership definition as a proxy for FDI is that most of the FDI

turnover data for firms in Amadeus represent total turnover, including also revenues from sales of non-manufacturing products and services.

related to relocation of production are majority-owned foreign companies and that the probability of technology transfer from foreign parent company to its subsidiary is higher if the parent company holds control over its subsidiary.

The number of foreign companies covered in our sample varies across the countries (table 1). Foreign firms represent from around 1% (Slovenia) to around 70% (Bulgaria) of the number of firms in the new EU countries.

Table 1: Relevance of Foreign Companies (in 2004)

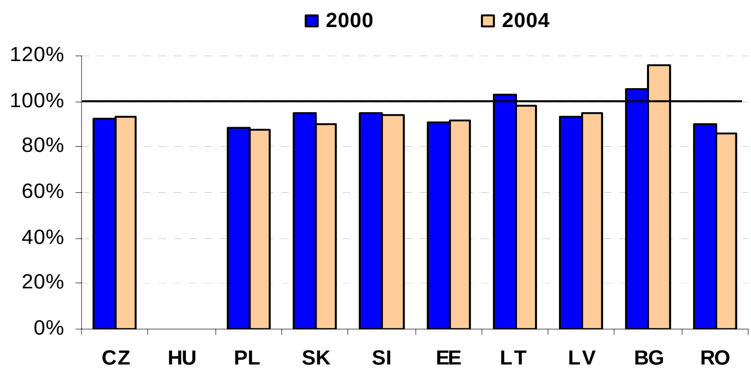
			% of foreign firms (2004) in:			
	No. of firms	of which: foreign firms	number of firms	total assets	turnover	employment
CZ	5011	618	12.3	38.9	37.1	23.4
HU	1625	57	3.5	26.7	29.2	n.a.
PL	5035	1131	22.5	56.4	56.8	35.1
SK	767	35	4.6	59.7	57.7	19.7
SI	1215	15	1.2	8.3	10.2	3.9
EE	1762	885	50.2	73.5	72.0	66.6
LT	921	584	63.4	71.2	73.5	67.7
LV	580	79	13.6	31.5	25.5	18.6
BG	1338	929	69.4	46.2	45.9	50.3
RO	13108	6053	46.2	78.0	75.0	65.1

Source: Amadeus.

In terms of total assets, the share of foreign firms is higher (between 8% in Slovenia and 78% in Romania in 2004) than in the number of firms and the same holds for the share of total turnover, employment and stock of investment, indirectly indicating that foreign firms are on average larger than domestic firms. However, over the period 2000–2004, foreign companies did not considerably increase their shares in total assets, turnover, employment or investment in many countries. This might indicate that domestic firms were able to compete or co-operate within the production chain with the foreign firms (charts A1 in Appendix A).

When comparing the average size of domestic and foreign firms in terms of total assets, stock of investment, employment and turnover, foreign companies are on average bigger, have more fixed assets, employ more people, and produce more (table A2 in Appendix A). This holds for all countries except Bulgaria, where the number of foreign firms as share in total number of firms is the highest. In most countries (except Slovakia, Slovenia and Romania), foreign companies are also more profitable (table A2).

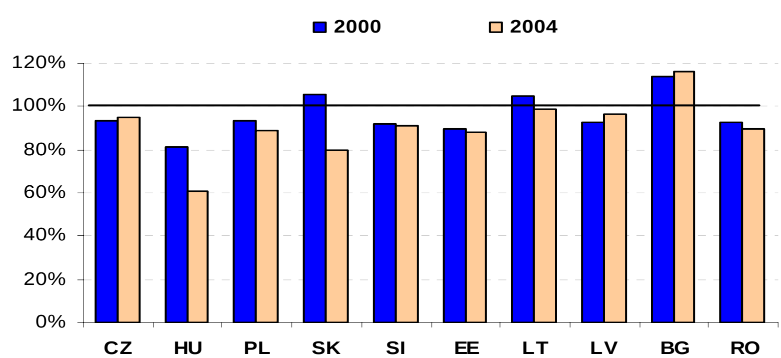
Chart 6: Average Labour Productivity of Domestic Firms (in % of Average Labour Productivity of Foreign Firms)



Note: Labour productivity for HU is missing due to insufficient coverage of data for employees in the Amadeus database.

Source: Amadeus.

Chart 7: Average Total Factor Productivity of Domestic Firms (in % of Average Total Factor Productivity of Foreign Firms)



Note: TFP = ln (total factor productivity) computed via Levinsohn and Petrin (2003) technique for individual industries or groups of industries for all firms.

Source: Amadeus.

Moreover, in most of the countries foreign companies have on average higher labour and total factor productivity (charts 6–7).

Tables A3 and A4 in Appendix A provide a detailed overview of manufacturing production across industries (14 NACE 2-digit sectors) and foreign versus domestic ownership of the firms. According to these tables almost all industries have foreign penetration. However, while foreign companies drive almost all industries' output in Estonia, Lithuania, Poland and Romania, domestic companies dominate in almost all industries' turnover in Czech Republic, Latvia, Hungary, and Slovenia. In Slovakia and Bulgaria some sectors are dominated by foreign whereas some are dominated by domestic companies.

As mentioned in Section 3 the role of export orientation of firms or industry is a factor that may contribute to higher sensitivity of domestic firms to spillovers. Table 2 highlights five most important industries in terms of exports. According to table 2, industries with higher value added and level of technology (such as machinery and equipments, electrical and optical equipment or transport equipment) belong to the most important exporters in the most countries. In these industries, stronger potential for spillovers exists. Nevertheless, in some countries the low-value-added industries are also important exporters.

Table 2: Exports by Manufacturing Industries (as % of Total Manufacturing Export to the EU-25 in 2004)

	CZ	EE	LV	LT	HU	PL	SK	SI	BG	RO
DA Food products, beverages and tobacco	3.1	6.5	**6.2**	**9.4**	4.3	7.1	2.8	1.2	**6.2**	1.3
DB Textiles and textile products	5.3	**10.1**	**7.7**	**15.9**	3.9	5.6	4.1	4.3	**28.9**	**31.3**
DC Leather and leather products	0.5	1.0	0.3	0.5	0.9	0.7	2.2	1.3	5.4	**11.0**
DD Wood and wood products	1.5	**10.5**	**24.3**	5.8	0.8	3.2	1.8	2.2	1.9	3.6
DE Pulp, paper and paper products; publishing and printing	3.2	1.4	1.4	0.9	1.3	3.1	3.3	3.3	1.1	0.5
DF Coke, refined petroleum products and nuclear fuel	1.1	**11.8**	**29.2**	**25.1**	1.6	2.8	**6.8**	0.1	2.1	2.4
DG Chemicals, chemical products and man-made fibres	**5.8**	4.5	4.8	**8.7**	**5.4**	5.6	5.7	8.4	5.4	2.8
DH Rubber and plastic products	5.3	2.1	1.5	3.3	2.8	4.4	4.1	4.0	1.4	2.5
DI Other non-metallic mineral products	3.1	1.6	1.4	0.8	1.2	2.3	2.1	2.1	2.1	1.4
DJ Basic metals and fabricated metal products	**13.6**	**10.3**	**10.3**	6.6	**6.0**	**13.2**	**14.8**	**14.3**	**26.1**	**10.2**
DK Machinery and equipment n.e.c.	**12.7**	4.1	2.5	2.3	**7.7**	**7.1**	**7.4**	**13.7**	**7.9**	6.3
DL Electrical and optical equipment	**21.4**	**22.5**	4.1	**9.5**	**40.4**	**13.2**	**13.2**	**10.5**	**6.4**	**13.3**
DM Transport equipment	**19.6**	8.0	1.9	3.7	**22.1**	**22.9**	**29.4**	**25.7**	1.4	**6.8**
DN Manufacturing n.e.c.	3.7	5.6	4.3	7.3	1.7	**8.8**	2.3	**8.9**	3.6	6.6
Total	100	100	100	100	100	100	100	100	100	100

Note: Shadow indicates top five industries in terms or export share in total manufacturing exports to the EU-25.

Source: WIIW.

5. Estimation Strategy

Estimating direct effects of FDI is not easy as we lack the data on past ownership of firms to test the additional effect of foreign entry into domestic market. In addition, foreign firms are usually targeting larger and more productive firms, thus a selection bias arises when just comparing the performance of foreign versus domestic firms[10]. Thus, in line with the objective of this paper stated in the beginning, we focus on indirect effects only.

Traditional approach when analyzing productivity is to estimate a production function and use the residuals not explained by the input factors (capital, labour) as a proxy for total factor productivity (Solow residuals). However, as Levinsohn and Petrin (2003) point out, when estimating the production function, one must account for the correlation between input levels and productivity, as profit-maximizing firms respond to increase in productivity by increase of usage of factor inputs. Thus, methods that ignore this endogeneity such as OLS or the fixed-effects estimator inevitably lead to inconsistent estimates of the parameters of the production function.

In line with recent literature, we employ a semi-parametric approach suggested by Olley and Pakes (1996) and modified by Levinsohn and Petrin (2003). This method allows for firm-specific productivity differences that exhibit idiosyncratic changes over time. The technique is described in detail in Appendix B. Using this technique, we estimate a log-linear transformation of a Cobb-Dougals production function:

$$va_{it} = \beta_0 + \beta_l l_{it} + \beta_k k_{it} + \varepsilon_{it} \tag{1}$$

where va_{it} is log of value added of a firm i, l_{it} is log of labour input, k_{it} is log of capital. The estimation is done for each manufacturing sector j (at a 2-digit NACE level) separately, using a sample of domestic firms only.[11] Value added enters the equation as real value added, computed as real turnover minus real material costs.[12] The data on operating turnover were deflated by the producer price index for the corresponding 2-digit NACE sector, while material costs were deflated by

[10] Some studies use Heckman-correction model to account for the selection bias (Damijan et al., 2003) or have information on past ownership (Arnold et al., 2006).

[11] Following Arnold et al. (2006), we group similar 2-digit sectors together to get a larger number of observations. For CZ, HU, PL, SI, LT and RO 15 manufacturing sectors were constructed (NACE 15+16, 20+21+36, 23+24, 30+31, 32+33 and 34+35 were grouped), while for SK, EE, LV and BG 7 manufacturing sectors were constructed (NACE 15+16, 17+18+19, 20+21+22+36, 23+24+25+26, 27+28, 30+31+32+33 and 29+34+35 were grouped).

[12] In SI and LT, the data on material costs were not available, thus a proxy for material costs was used: for SI, the proxy was computed as operating turnover minus EBIT minus depreciation minus costs of employees, while for LT the proxy "costs of goods sold" was used.

unweighted average of total manufacturing producer price index and import price index. Labour input refers to number of employees.[13] For capital input, the stock of fixed assets was used, deflated by the average of the deflators for the following NACE sectors: machinery and equipment (29), office machinery and computing (30), electrical machinery and apparatus (31), motor vehicles, trailers and semi-trailers (34) and other transport equipment (35).[14]

A measure of log of total factor productivity tfp_{it} is obtained as the difference between log of value added and log of capital and log of labour, multiplied by their estimated coefficients:

$$tfp_{it} = va_{it} - \hat{\beta}_l l_{it} - \hat{\beta}_k k_{it\,t} \tag{2}$$

In the second step, we relate total factor productivity to foreign presence variables (horizontal, backward and forward) and other control variables (Herfindahl index as a proxy for the level of concentration and thus competition within the sector and year and firm fixed effects), estimating an unbalanced panel of local firms via fixed-effects estimator.[15]

$$tfp_{ijt} = \alpha_0 + \alpha_1 horizontal_{jt} + \alpha_2 backward_{jt} + \alpha_3 forward_{jt} + \\ + hhi_{jt} + \alpha_i + \alpha_t + \varepsilon_{ijt} \tag{3}$$

While the estimation of *tfp* is done on sectoral level, the fixed-effects estimation of spillovers is done on the level of the entire sample of domestic firms.

The $horizontal_{jt}$ variable is a proxy for foreign presence in the same sector and is defined as the share of foreign firms' output in total sector output:

$$horizontal_{jt} = \frac{\sum_{i \in j} foreign_{it}\, x\ turnover_{it}}{\sum_{i \in j} turnover_{it}} \tag{4}$$

The variable *foreign* is a dummy variable that equals 1 if the company *i* is a foreign company, and 0 otherwise. The higher the value of output produced by foreign

[13] In HU, the data on number of employees was missing, thus the costs of employees deflated by CPI was used instead, an approach followed for example by Arnold et al. (2006).

[14] This approach follows Javorcik (2004). Alternatively, then capital could be deflated using the GDP deflator, see Damijan et al. (2003), or even capital stock deflator if available, see Arnold et al. (2006).

[15] Most studies on spillovers use fixed effects estimator, both due to economic reasoning (heterogeneity among firms due to managerial skills etc.) and econometric assumptions (possible correlation between regressors and firm effects). A notable exception is Jarolím (2000) who uses random effects model. However, the Hausman test showed that in our case the hypothesis of no correlation between regressors and individual effects can be rejected, thus fixed-effects model is appropriate.

firms and the higher the number of foreign firms in the sector j, the higher is the variable *horizontal* and thus the potential for horizontal spillovers.

The variables $backward_{jt}$ and $forward_{jt}$ are proxies for the potential for vertical spillovers. The variable *backward* stands for foreign presence in linked downstream sectors (to which a local company supplies its inputs). Ideally, one would need the share of firm's output sold to foreign firms. As this information is not available, we use input-output tables to trace inter-industry supply linkages and proxy the share of firm's output sold to foreign companies by the share of sector's output for intermediate consumption within the domestic economy sold to foreign companies in downstream sectors. The input-output tables reveal the information about the amount supplied by the sector j to its sourcing sector k. In addition, we employ the information about the foreign presence in sector k (the variable *horizontal*). Thus, variable $backward_{jt}$ is defined as

$$backward_{jt} = \sum_{k \; if \; k \neq j} \gamma_{jkt} horizontal_{kt} \tag{5}$$

where γ_{jkt} is the proportion of sector j's output supplied to sourcing sectors k and is calculated using the input-output table for domestic intermediate consumption (i.e. excluding imports).[16] In addition, intra-industry supplies are not accounted for, as this effect is captured by the variable *horizontal*.

Similarly, the variable $forward_{jt}$ captures the potential for forward vertical spillovers to local firms that buy inputs from foreign firms and is defined as

$$forward_{jt} = \sum_{l \; if \; l \neq j} \delta_{jlt} horizontal_{lt} \tag{6}$$

where δ_{jlt} is the proportion of sector j's inputs purchased from upstream sectors l. Nor in this case is it accounted for intra-industry supplies, as this effect is captured by the variable *horizontal*. Note that for both cases, the weights γ_{jkt} and δ_{jlt} are calculated using the proportion in total output for intermediate consumption (or total input used), not only the output (input) supplied to (bought from) the manufacturing sectors (thus, the sum of γ_{jkt} or δ_{jlt}, respectively, is not equal to 1).

To capture possible non-linear impact of all three variables representing foreign presence in the economy, we in addition include squared *horizontal*, *backward* and *forward*:

[16] Ideally, one would need a series of I-O tables to capture the dynamics of inter-industry trade. Due to data limitation, we employ the last available I-O table for domestic intermediate consumption (CZ 2003, HU 2000, PL 2000, SI 2001, EE 2000, LT 2000) or – if only the use tables including imports are available – the use tables (SK 2000, BG 2001, RO 2003). For LV, I-O tables after 2000 were not available, thus the I-O table for domestic intermediate consumption for the last available year 1998 was used.

$$\begin{aligned} tfp_{ijt} &= \alpha_0 + \alpha_1 horizontal_{jt} + \alpha_2 horizontal_{jt}^2 + \alpha_3 backward_{jt} + \\ &+ \alpha_4 backward_{jt}^2 + \alpha_5 forward_{jt} + \alpha_6 forward_{jt}^2 + hhi_{jt} + \alpha_i + \alpha_t + \varepsilon_{ijt} \end{aligned} \tag{7}$$

6. Estimation Results

As we have seen above, foreign firms outperform local firms in productivity levels, so there is some potential for spillovers we are interested in within our analysis.

Table 3 presents the results of estimation of equation (3). First, the vertical effects tend to be higher and thus economically much more important than horizontal effects. This is similar to findings by Merlevede and Schoors (2005, 2006) or Javorcik (2004).

Table 3: Horizontal and Vertical Spillovers (Linear Effects)

	CZ	HU	PL	SK	SI	EE	LT	LV	BG	RO
horizontal	-0.285**	-0.040	0.347**	-0.046	0.119	0.141	-1.030***	0.156	-0.480**	-0.855***
backward	-0.272	1.446	0.283	0.609	1.071***	4.326**	1.616	-11.344***	-0.911	2.547*
forward	0.219	-4.151***	-1.587	-0.729	-22.584***	0.162	-0.579	0.882	-0.905	0.478
hhi	0.107	-0.061	-0.172	0.202	-0.060	-0.233	-1.048**	0.315	-0.487	-1.665***
Obs.	11386	6864	10267	1772	4667	3580	1177	2186	2075	31831
Firms	3850	2581	3159	641	1287	898	444	575	428	7143
R-squared	0.10	0.01	0.03	0.01	0.11	0.00	0.08	0.07	0.02	0.01

*Note: Dependent variable: ln TFP; * significant at 10%; ** significant at 5%; *** significant at 1%. Estimated with firm and year fixed effects.*

Second, horizontal effects seem to be negative in a number of countries (the Czech Republic, Lithuania, Bulgaria and Romania,). They are found to be positive only in Poland, while in other countries they are insignificant. This is contrary to the findings by Damijan et al. (2003) who found rather positive albeit small horizontal spillovers when analyzing these countries in the late 1990s.[17] Our findings indicate a potential for the market stealing effect after 2000 and some crowding-out of the domestic firms, but they might also be reflecting continued FDI inflow in these countries (i.e. purchases of more productive local firms by foreign companies). Furthermore, it is interesting to note that horizontal spillovers turned significant in the Czech Republic, Poland, Lithuania, Bulgaria, Romania, i.e. countries where the potential for horizontal spillover is higher (i.e. countries with the largest number of

[17] However, it is in line with Torlak (2004) who found small and negative horizontal spillovers as well in the late 1990s for the Czech Republic and Romania.

foreign firms and highest share of foreign firms' turnover), with exception being Estonia, and to a lesser extent Slovakia (which also have relatively large potential).

Third, we find that backward spillovers tend to be positive (if they are significant as is the case in Slovenia, Estonia and Romania), while forward spillovers tend to be negative (significant in Hungary and Slovenia). This finding corresponds to finding by Damijan et al. (2003), who also found positive backward and negative forward spillovers to domestic companies, although for partly different countries than we did (both positive backward spillovers and negative forward spillovers were found for the Czech Republic, Poland and Slovenia, for other countries the vertical effects were insignificant). In line with the theoretical reasoning underlying the spillover channels, our findings suggest that being a sub-supplier to foreign companies has a beneficial effect on a firm's productivity development. On the other hand, larger foreign presence in upstream sectors affects negatively the productivity of local firms, suggesting that inputs produced by foreign companies are probably mostly used by foreign companies, thus the gap in total factor productivity between local and foreign firms may increase. This might be also in line with some anecdotic evidence from these countries in some supply networks such as automotive or ICT industries (European Commission, 2003).

Concentration as measured by Herfindahl index in our results is significant only for Lithuania and Romania, with the effect of concentration on productivity being negative, suggesting that less concentrated sectors (i.e. sectors with more competition) benefit more in terms of productivity increases.

Table 4 presents the results with non-linear effects. The findings can be summarized as follows: first, if horizontal spillovers exist, they tend to be highly non-linear. Interestingly, in the Czech Republic the effect is positive up to a certain level of foreign ownership, but turns negative after the foreign presence exceeds a certain threshold (around 50%). In other countries (Hungary, Bulgaria and Romania), the effect is just opposite: it starts negative, eventually turning positive with an increasing level of foreign presence. For Romania, the result is in line for late 1990s by Merlevede and Schoors (2005).

Table 4: Horizontal and Vertical Spillovers (Non-Linear Effects)

	CZ	HU	PL	SK	SI	EE	LT	LV	BG	RO
horizontal	0.721**	-0.967**	0.534	0.037	-0.235	-1.201	0.874	-0.068	-2.583***	-2.625***
horizontal^2	-1.468***	1.033**	-0.214	-0.075	0.413	1.077	-1.515	0.772	2.431***	1.337*
backward	4.188**	0.993	2.433	0.333	2.195	2.819	-18.591	-33.968***	4.798	-53.211***
backward^2	-10.976***	13.184	-4.935	0.604	-2.035	2.356	30.114*	125.548**	-12.454	96.549***
forward	1.851*	-3.767**	-6.410*	1.105	-23.114**	-0.630	-12.096*	6.747*	-2.627	9.352***
forward^2	-5.973*	-0.666	14.377	-3.633	5.892	2.106	23.530*	-18.039	3.043	-5.759
hhi	0.642***	-0.159**	-0.146	0.226	-0.135	-0.475	-1.013**	0.145	-1.078**	-1.394***
Obs.	11386	6864	10267	1772	4667	3580	1177	2186	2075	31831
Firms	3850	2581	3159	641	1287	898	444	575	428	7143
R-squared	0.03	0.01	0.07	0.06	0.13	0.00	0.00	0.06	0.01	0.01

*Note: Dependent variable: ln TFP; * significant at 10%; ** significant at 5%; *** significant at 1%. Estimated with firm and year fixed effects.*

Second, for the backward spillovers, we find opposite effects for the Czech Republic compared to Latvia and Romania. In the Czech Republic, backward spillovers are again positive up to a certain threshold of foreign presence in downstream sector (around 40%) after which the effect turns into negative. In Latvia and Romania, on the contrary, the effect starts as negative, turning into positive after a certain threshold (in Latvia around 30% and in Romania of around 50%). Third, in those countries where the forward spillovers are non-linear (the Czech Republic, Lithuania) the effect again differs. In the Czech Republic, spillovers are first positive and then turn negative with an increasing foreign presence in the upstream sectors. In Lithuania, on the other hand, the effect first is negative and then turns positive when foreign presence is higher. In most countries, however, forward effects are found to be just linear and rather negative than positive (with exception of Romania).

Interestingly, in this specification the effect of concentration is positive for the Czech Republic (i.e. lower competition is beneficial for productivity) while for four other countries it is negative (i.e. higher competition is beneficial).

In the following three estimations (results presented in tables A5 – A10 in Appendix A), we split the sample by a certain characteristic in order to detect differences in the pattern of spillovers across different groups of firms (so-called conditional spillovers). We employ the breakdown by absorptive capability, export orientation, and firm size. We always estimate the equation (3) with linear effects only in order to make interpretation easier.

We define absorptive capability in terms of relative productivity performance of domestic companies vis-à-vis foreign companies in the same sector. Following

Merlevede and Schoors (2005), we apply the Levinsohn and Petrin (2003) technique on the whole sample of firms (including foreign firms) and retrieve the total factor productivity for individual firms. Again, this estimation is done by industries (in the same grouping of industries as in the estimation done on domestic companies only). The absorptive capability AC_{ijt} for a firm *i* and the year *t* is then defined as the distance between firm's *i* total factor productivity in the year *t-1* (to avoid endogeneity) and the "foreign productivity frontier" that is defined as the 90 percentile productivity of foreign firms in the sector *j* and time *t-1*.

We split the sample into three groups by the absorptive capability. In the group with low *AC*, firm-years were placed with *AC* below 25 percentile of average *AC* distribution across all firms. Medium *AC* group contains firm-years with *AC* between 25 and 75 percentile, while high *AC* group includes firm-years with *AC* above the 75 percentile.

Tables A5 and A6 present the results. Again, the results are rather mixed across countries. According to theory, we expected some positive spillovers in the group of firms with medium absorptive capability, as these have most probably a productivity gap to fill and at the same time some basic level of technology that enables them to adapt to better technologies. In five out of the ten countries, we indeed find positive spillovers, in Romania both horizontal and vertical, while in other countries just some of them. Negative or insignificant spillover effects were expected in the groups with both low and high absorptive capability, a fact only partly confirmed by the results. However, there are also many negative spillovers in all groups of firms, including those with high absorptive capability, suggesting that some "brain drain" effects are likely to be taking place.

Tables A7 and A8 present the results by export orientation of sectors. As low export orientation industries are identified those NACE 2-digit sectors with exports to EU-25 as a share of sectoral output below 25 percentile of export share. Sectors with medium export orientation have export shares between 25 and 75 percentile, while sectors with high export orientation have export shares above 75 percentile.

Following the theoretical reasoning, we expected firms in more export-oriented sectors to be more prone to positive spillovers. However, the results support this hypothesis only in the Czech Republic, and partly in Estonia. In most other countries, negative spillovers are detected also for the sectors with high exports. This seems to indicate that exports are largely driven by foreign rather than domestic companies, and, as a result, the productivity gap between domestic and foreign firms increases with higher export orientation of the industry.

Tables A9 and A10 present the results by the firm size. We differentiate between small firms (up to 50 employees), medium-sized firms (between 50 and 250 employees) and large firms (more than 250 employees).[18] We expected medium-sized companies to be able to benefit most from spillovers. This

[18] For Hungary, reliable data on number of employees were not available.

hypothesis is supported only partly for the Czech Republic, Poland, Slovakia and Romania, while in other countries the pattern of spillovers across firm sizes differs.

7. Conclusions

In this paper, we discussed the inflow of foreign direct investment into the CEE countries and analysed indirect effects of FDI on productivity, so-called productivity spillovers from foreign to domestic firms. Using firm-level data and techniques that control for simultaneity bias due to the effect of unobservable productivity shocks on the level of input choice, we recovered total factor productivity of domestic firms and linked it to foreign presence in the same sector (horizontal spillovers) and in the sectors linked via production chain (vertical spillovers).

We find that vertical effects tend to be higher and thus economically much more important than horizontal effects, which is in line with previous studies. In addition, we found that in many cases the spillovers are negative, thus foreign presence might have also some adverse impact on productivity of local firms, for example via brain drain or market stealing effects.

Furthermore, we found strong nonlinearities in the effect of foreign presence on local firms' productivity. In addition, we found that spillovers depend on number of industry and firm-level characteristics including the relative technological level vis-à-vis foreign firms (absorptive capacity), export orientation, or firm size. Theory and anecdotic evidence often support both positive and negative effect of horizontal and vertical spillovers. However, according to our results the existence of horizontal and vertical spillovers using different breakdowns according to characteristics differ across CEE countries, and no common pattern was detected. While some part of the difference might be due to different quality of the data and the degree of coverage, some economic and institutional variables may still play a role in explaining these differences. Additionally, the definition of the foreign company is very narrow in our study and further investigation by expanding sample including companies with smaller than 51% foreign ownership would shed additional light on the issue.

This study, focusing on the period after 2000, further supports the mixed evidence on spillovers discussed in the literature focusing on the 1990s. The CEE countries, now members of the EU, have been successful in attracting FDI at least over the past decade and experienced surprisingly positive economic developments since 2000. However, the effects of foreign firms on the host economies and indirect effects on the local firms are different across countries and depend also on other conditions and characteristics on the firm-, industry- and national level as well on the nature of FDI, issues that have to be analysed more thoroughly.

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Appendix A

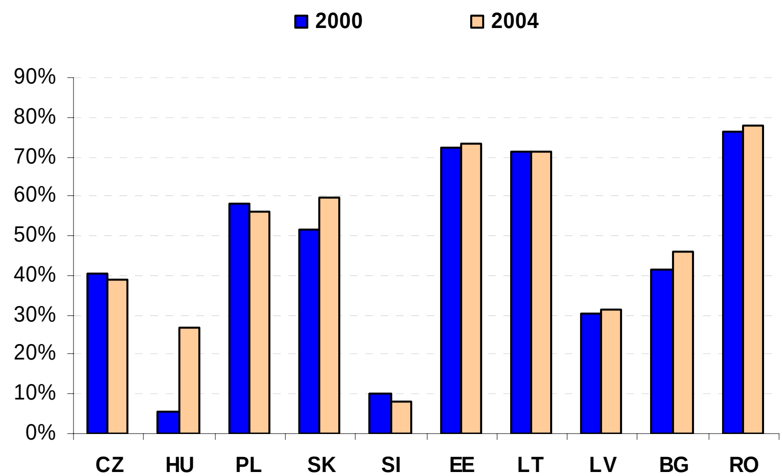
Table A1: Distribution of Manufacturing Turnover by NACE Sectors in 2004

	CZ		HU		PL		SK		SI		EE		LT		LV		BG		RO	
	Am	WI	Am	WI	Am	WI	Am	WI	Am	WI	Am	WI	Am	WI	Am	WI	Am	WI	Am	WI
DA	14.4	11.5	13.7	14.1	25.8	20.2	8.1	9.0	10.3	10.8	18.5	17.2	28.2	19.3	32.8	24.8	16.8	19.2	20.8	19.1
DB	2.5	2.8	2.0	2.3	2.4	3.5	1.6	2.0	6.6	4.8	9.5	8.9	7.5	10.6	8.4	6.2	7.5	9.7	8.1	7.9
DC	0.1	0.2	0.2	0.4	0.3	0.6	1.1	1.4	2.0	1.5	0.5	0.6	0.5	0.3	0.1	0.1	0.8	0.9	2.1	2.2
DD	1.5	1.9	0.5	1.1	3.0	3.6	0.7	1.3	2.0	2.7	15.6	16.7	9.0	6.3	19.2	23.4	2.2	2.2	3.5	3.7
DE	4.5	4.1	3.9	3.6	5.7	6.0	6.0	4.5	5.8	6.6	5.7	6.3	6.0	4.1	5.3	6.5	9.7	4.3	3.5	3.1
DF	4.3	2.8	0.0	5.0	1.9	5.9	16.3	8.1	0.1	0.1	1.0	0.0	0.4	25.4	0.0	0.0	0.0	14.4	6.7	11.7
DG	6.4	5.9	6.1	7.0	7.3	7.1	3.1	3.9	12.9	12.4	5.6	4.9	4.2	5.3	2.4	2.8	6.2	6.4	5.9	7.4
DH	6.7	6.2	17.5	3.6	4.7	5.5	6.5	4.3	6.5	5.4	4.4	3.9	7.8	3.9	4.1	3.1	3.5	2.9	4.3	3.1
DI	5.4	5.3	3.8	2.6	4.2	4.8	2.8	4.0	3.5	4.0	5.1	5.3	4.3	2.9	5.7	4.1	4.4	5.1	4.6	4.3
DJ	10.9	15.3	6.4	8.7	8.6	12.6	14.6	15.5	15.2	14.9	9.3	9.0	6.2	3.4	7.9	4.5	35.8	19.0	17.8	16.7
DK	7.7	7.8	2.9	5.2	7.3	5.4	4.2	7.3	10.8	12.2	3.1	3.3	3.2	2.6	1.9	3.1	3.1	7.2	5.1	4.1
DL	15.8	15.1	36.0	30.4	7.9	7.2	5.0	10.9	10.6	9.0	10.1	9.9	14.0	7.8	5.0	3.1	7.7	4.6	6.2	4.3
DM	17.2	17.7	5.7	14.8	17.5	12.2	28.1	24.5	10.1	10.6	4.5	5.3	3.4	2.1	2.6	3.3	0.9	1.7	7.7	7.0
DN	2.6	3.4	1.5	1.1	3.3	5.4	1.8	3.2	3.7	4.9	7.2	8.7	5.3	6.1	4.5	15.0	1.4	2.4	3.8	5.2
Average absolute difference	0.9		3.0		2.0		2.2		0.8		0.7		4.3		2.6		3.7		1.2	

Note: In % of total manufacturing turnover; Amadeus versus WIIW.

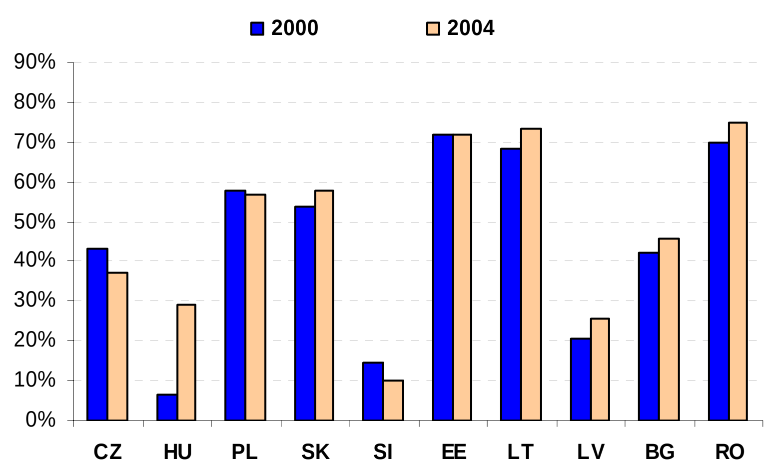
Source: WIIW, Amadeus.

Chart A1: Share of Foreign Firms in Total Assets (in %)



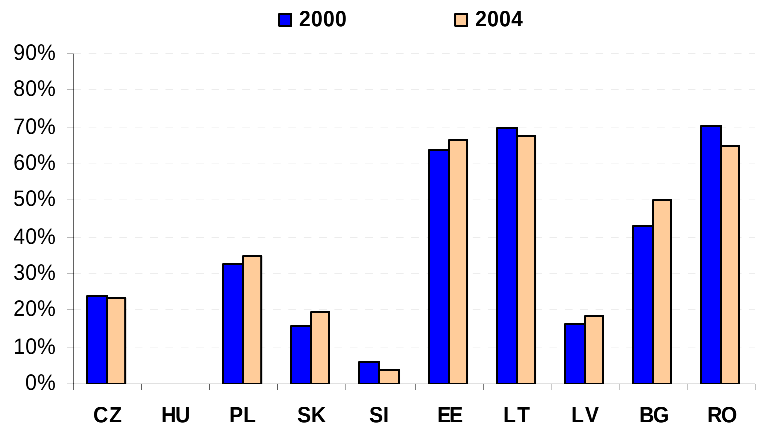
Source: Amadeus.

Chart A2: Share of Foreign Firms in Total Turnover (in %)



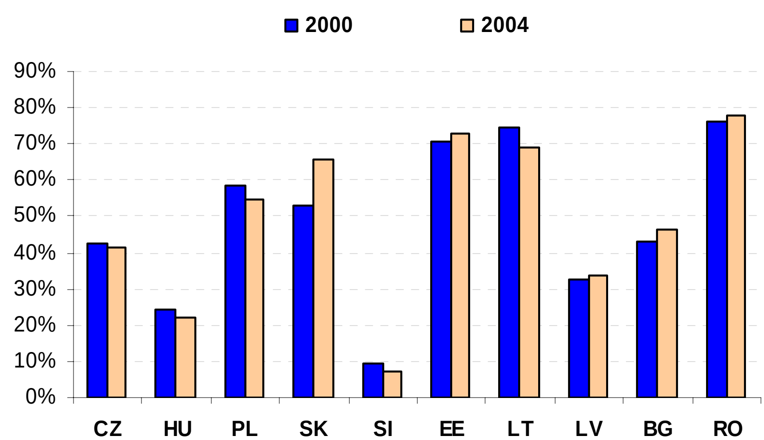
Source: Amadeus.

Chart A3: Share of Foreign Firms in Employees (in %)



Source: Amadeus.

Chart A4: Share of Foreign Firms in Fixed Assets (in %)



Source: Amadeus.

Table A2: Descriptive Statistics by Ownership Status (in National Currency or %, as of 2004)

	CZ	HU	PL	SK	SI	EE	LT	LV	BG	RO
average total assets domestic	195.4	1989.1	22.8	261.7	2908.5	16.2	7932.6	1596.5	12.4	3.2
average total assets foreign	886.6	16211.8	101.7	8108.6	21100.1	44.5	11338.9	4674.1	4.7	13.3
domestic as % of foreign	22.0%	12.3%	22.4%	3.2%	13.8%	36.3%	70.0%	34.2%	262.2%	24.3%
average stock of investment domestic	92.3	487.9	11.3	139.4	1670.7	8.6	4633.3	796.5	7.0	1.8
average stock of investment foreign	462.5	3054.8	47.4	5581.4	10425.4	23.2	5921.0	2549.7	2.7	7.1
domestic as % of foreign	20.0%	16.0%	23.8%	2.5%	16.0%	37.1%	78.3%	31.2%	258.5%	24.8%
average employment domestic	155.3	184.7	162.3	253.9	140.1	39.7	83.0	126.8	190.1	69.0
average employment foreign	335.4	2913.4	292.6	1023.9	447.2	84.3	100.5	184.5	84.8	150.5
domestic as % of foreign	46.3%	6.3%	55.5%	24.8%	31.3%	47.1%	82.5%	68.7%	224.1%	45.8%
average turnover domestic	320.9	2850.7	37.7	400.4	3063.5	25.0	8.6	2.5	12.6	4.5
average turnover foreign	1347.7	32415.5	171.6	11403.0	27768.2	63.6	13.8	5.4	4.7	15.8
domestic as % of foreign	23.8%	8.8%	22.0%	3.5%	11.0%	39.2%	62.4%	46.0%	267.3%	28.6%
average ROE domestic	19.4	12.9	21.9	12.3	11.2	6.0	11.9	15.2	10.5	44.6
average ROE foreign	23.9	38.2	29.8	3.3	10.4	11.5	16.7	41.6	21.0	40.0
domestic as % of foreign	81.3%	33.7%	73.7%	369.1%	107.8%	52.2%	71.3%	36.5%	50.0%	111.5%

Note: ROE = return on equity; for SI, RO computed using P/L for period, otherwise P/L before tax is used.

Source: Amadeus.

Table A3: Total Turnover – Domestic versus Foreign Ownership Breakdown across Industries (2004, : D = domestic firms, F = Foreign Firms)

	CZ			HU			PL			SK			SI		
	Total	of which:		Total	of which:		Total	of which:		Total	of which:		Total	of which:	
		D	F		D	F		D	F		D	F		D	F
DA	14.4	67.4	32.6	13.7	77.1	22.9	25.8	53.9	46.1	8.1	85.3	14.7	10.3	95.6	4.4
DB	2.5	83.9	16.1	2.0	39.2	60.8	2.4	72.6	27.4	1.6	100.0	0.0	6.6	94.4	5.6
DC	0.1	96.3	3.7	0.2	100.0	0.0	0.3	73.6	26.4	1.1	90.2	9.8	2.0	100.0	0.0
DD	1.5	95.8	4.2	0.5	98.0	2.0	3.0	62.9	37.1	0.7	100.0	0.0	2.0	100.0	0.0
DE	4.5	67.2	32.8	3.9	98.2	1.8	5.7	41.2	58.8	6.0	89.9	10.1	5.8	88.1	11.9
DF	4.3	90.2	9.8	0.0	100.0	0.0	1.9	33.8	66.2	16.3	0.0	100.0	0.1	100.0	0.0
DG	6.4	77.0	23.0	6.1	69.1	30.9	7.3	46.3	53.7	3.1	65.1	34.9	12.9	89.7	10.3
DH	6.7	54.4	45.6	17.5	97.4	2.6	4.7	40.6	59.4	6.5	99.9	0.1	6.5	99.3	0.7
DI	5.4	54.2	45.8	3.8	58.8	41.2	4.2	47.5	52.5	2.8	76.6	23.4	3.5	96.5	3.5
DJ	10.9	70.1	29.9	6.4	89.8	10.2	8.6	64.3	35.7	14.6	35.6	64.4	15.2	96.0	4.0
DK	7.7	82.3	17.7	2.9	94.8	5.2	7.3	49.6	50.4	4.2	87.5	12.5	10.8	100.0	0.0
DL	15.8	70.3	29.7	36.0	53.7	46.3	7.9	27.0	73.0	5.0	86.8	13.2	10.6	87.5	12.5
DM	17.2	26.0	74.0	5.7	38.8	61.2	17.5	12.6	87.4	28.1	8.5	91.5	10.1	48.0	52.0
DN	2.6	60.7	39.3	1.5	100.0	0.0	3.3	49.4	50.6	1.8	23.6	76.4	3.7	100.0	0.0
Total	100.0	62.9	37.1	100.0	70.8	29.2	100.0	43.2	56.8	100.0	42.3	57.7	100.0	89.8	10.2

Source: Amadeus.

Table A4: Total Turnover – Domestic versus Foreign Ownership Breakdown across Industries (2004, : D = domestic firms, F = Foreign Firms)

	EE			LT			LV			BG			RO		
	Total	of which:		Total	of which:		Total	of which:		Total	of which:		Total	of which:	
		D	F		D	F		D	F		D	F		D	F
DA	18.5	34.9	65.1	28.2	28.6	71.4	32.8	81.0	19.0	16.8	59.9	40.1	20.8	34.0	66.0
DB	9.5	17.4	82.6	7.5	23.9	76.1	8.4	79.7	20.3	7.5	62.6	37.4	8.1	29.6	70.4
DC	0.5	38.3	61.7	0.5	35.8	64.2	0.1	100.0	0.0	0.8	69.7	30.3	2.1	24.4	75.6
DD	15.6	32.8	67.2	9.0	19.2	80.8	19.2	59.2	40.8	2.2	85.9	14.1	3.5	37.0	63.0
DE	5.7	42.0	58.0	6.0	29.6	70.4	5.3	83.1	16.9	9.7	60.6	39.4	3.5	29.4	70.6
DF	1.0	67.4	32.6	0.4	0.0	100.0	0.0	n.a.	n.a.	0.0	0.0	100.0	6.7	2.7	97.3
DG	5.6	7.2	92.8	4.2	19.1	80.9	2.4	85.3	14.7	6.2	68.1	31.9	5.9	18.6	81.4
DH	4.4	30.8	69.2	7.8	41.7	58.3	4.1	78.8	21.2	3.5	32.6	67.4	4.3	29.4	70.6
DI	5.1	40.8	59.2	4.3	27.9	72.1	5.7	25.5	74.5	4.4	31.0	69.0	4.6	22.3	77.7
DJ	9.3	25.7	74.3	6.2	26.1	73.9	7.9	87.7	12.3	35.8	48.7	51.3	17.8	17.5	82.5
DK	3.1	37.9	62.1	3.2	54.4	45.6	1.9	58.8	41.2	3.1	51.1	48.9	5.1	27.2	72.8
DL	10.1	12.5	87.5	14.0	12.0	88.0	5.0	84.4	15.6	7.7	54.2	45.8	6.2	27.7	72.3
DM	4.5	19.1	80.9	3.4	23.2	76.8	2.6	88.4	11.6	0.9	70.1	29.9	7.7	19.6	80.4
DN	7.2	28.0	72.0	5.3	35.4	64.6	4.5	87.5	12.5	1.4	31.4	68.6	3.8	36.9	63.1
Total	100.0	28.0	72.0	100.0	26.5	73.5	100.0	74.5	25.5	100.0	54.1	45.9	100.0	25.0	75.0

Source: Amadeus.

Table A5: Spillovers by Absorptive Capability

	CZ			HU			PL			SK			SI		
	low ac	medium ac	high ac	low ac	medium ac	high ac	low ac	medium ac	high ac	low ac	medium ac	high ac	low ac	medium ac	high ac
horizontal	-0.759	-0.467*	-0.267	5.418	1.151	-0.046	0.739*	0.048	0.558	0.407	-0.239	-0.282	-6.065***	1.736***	0.614
backward	-3.016	-0.787	-1.822	-9.807	2.177	1.196	10.546**	-1.074	0.867	-10.607	1.701	0.491	-67.009**	-1.569	0.658
forward	1.812	1.636***	0.071	-21.777***	-5.998	-4.728***	-3.562	-3.105*	0.420	-10.712	-307	-0.241	-23.645	4.764	-28.381***
hhi	1.251*	0.414	-0.206	-22.737**	-1.459	-0.079	-1.262**	-0.085	-0.756	1.297**	0.156	0.118	-3.429***	0.357	0.054
Observations	1683	3409	6294	396	910	5558	1874	3550	4843	181	366	1225	276	646	3745
Firms	1034	1946	3850	322	695	2581	1013	1770	3159	126	237	641	178	345	1287
R-squared	0.08	0.18	0.01	0.02	0.02	0.01	0.01	0.03	0.03	0.01	0.02	0.01	0.01	0.07	0.10

*Note: Dependent variable: ln TFP; ac = absorptive capability defined as industry-specific distance to foreign productivity frontier, estimated via Levinsohn and Petrin (2003) technique on previous years; low ac = firm-years with ac below 25 percentile of ac distribution; medium ac = firm-years with ac between 25 and 75 percentile; high ac = firm-years with ac above 75 percentile; * significant at 10%; ** significant at 5%; *** significant at 1%. Estimated with firm and year fixed effects.*

Table A6: Spillovers by Absorptive Capability

	EE			LT			LV			BG			RO		
	low ac	medium ac	high ac	low ac	medium ac	high ac	low ac	medium ac	high ac	low ac	medium ac	high ac	low ac	medium ac	high ac
horizontal	1.660	1.224***	-0.210	-1.648	-0.337	-1.050***	-0.115	-0.478	-0.258	0.374	0.238	-0.593	0.646	1.269***	-1.661***
backward	17.401***	5.348**	5.487	-13.557	-2.506	2.055	-13.208	-17.040***	-6.864*	-6.036	-6.054	3.709	-11.759*	6.478***	0.937
forward	38.551**	1.834	-2.888	2.816	-5.771	-2.440	4.449	6.362***	-4.840**	-2.658	0.067	-0.369	-1.921	2.781***	-0.807
hhi	3.164	0.076	-0.544	4.102	-3.958**	-0.873*	3.803	3.561***	0.032	-2.408*	0.211	-0.493	-1.594	-3.860***	-0.109
Observations	556	1316	1708	143	324	710	284	746	1156	364	799	912	5476	11457	14898
Firms	321	554	898	123	243	444	177	330	575	165	296	428	2694	4948	7143
R-squared	0.01	0.01	0.01	0.08	0.02	0.04	0.16	0.15	0.06	0.01	0.01	0.01	0.01	0.01	0.01

*Note: Dependent variable: ln TFP; ac = absorptive capability defined as industry-specific distance to foreign productivity frontier, estimated via Levinsohn and Petrin (2003) technique on previous years; low ac = firm-years with ac below 25 percentile of ac distribution; medium ac = firm-years with ac between 25 and 75 percentile; high ac = firm-years with ac above 75 percentile; * significant at 10%; ** significant at 5%; *** significant at 1%. Estimated with firm and year fixed effects.*

Table A7: Spillovers by Export Orientation

	CZ			HU			PL			SK			SI		
	low exp	medium exp	high exp	low exp	medium exp	high exp	low exp	medium exp	high exp	low exp	medium exp	high exp	low exp	medium exp	high exp
horizontal	0.083	-1.674***	1.178***	1.316*	0.440	0.597	-2.630	-0.994**	0.150	-0.110	-0.132	-0.617*	-13.371***	3.786**	-1.208*
backward	-6.751**	-4.451*	4.732***	221.099	-2.523	-0.508	-198.876**	-5.119	-7.419***	-4.436	-0.224	-3.259*	-34.785***	1.376***	7.127**
forward	1.999**	5.674***	-0.307	-137.813	-2.973***	3.269	89.123**	-8.575***	0.199	-0.511	0.224	-3.542*	-18.376	-57.672***	-22.075***
hhi	1.397***	-1.947***	1.259**	-1.907***	2.242***	-0.293	-1.825	-0.664	-0.985**	-1.210	0.07	2.152***	2.117***	-1.884**	1.776***
Observations	4212	4901	2273	1126	3839	1899	2749	4858	2660	763	567	442	1458	1678	1531
Firms	1962	2481	1473	775	1789	898	857	1675	1090	305	251	298	699	779	762
R-squared	0.02	0.17	0.03	0.00	0.17	0.09	0.01	0.02	0.15	0.05	0.01	0.07	0.19	0.11	0.05

*Note: Dependent variable: ln TFP; exp = export orientation defined as share of NACE 2-digit sectoral exports to EU-25 to its total turnover; low exp = year-sectors with exp below 25 percentile; medium exp = year-sectors with exp between 25 and 75 percentile; high exp = year-sectors with exp above 75 percentile; * significant at 10%; ** significant at 5%; *** significant at 1%. Estimated with firm and year fixed effects.*

Table A8: Spillovers by Export Orientation

	EE			LT			LV			BG			RO		
	low exp	medium exp	high exp	low exp	medium exp	high exp	low exp	medium exp	high exp	low exp	medium exp	high exp	low exp	medium exp	high exp
horizontal	1.844	-1.023	0.571	-0.191	-0.281	-4.938**	-0.055	0.371	-0.415	2.942	-1.838***	-0.580	1.047	-1.282***	-9.201***
backward	22.232*	2.319	6.237**	-44.419***	0.544	30.504		-22.021***	-8.461	5.572	-5.433	-2.101	-773.033***	25.667***	-53.530***
forward	-21.760	-6.761	-5.218	0.338	4.183	-16.917		-3.245	5.464	-1.969	-2.002	-2.777**	-30.095**	7.029***	0.187
hhi	-4.607*	-2.302*	0.239	-3.715	0.956	-3.513	2.490	-0.274	0.422	-5.230**	-0.993	-0.534	-2.114	-0.697	15.418***
Observations	1056	1513	1011	518	458	201	411	1218	557	527	868	680	6238	19033	6560
Firms	365	502	354	228	218	127	717	495	306	182	245	317	2087	5397	1658
R-squared	0.01	0.05	0.07	0.21	0.07	0.01	0.04	0.05	0.01	0.01	0.01	0.37	0.18	0.07	0.02

*Note: Dependent variable: ln TFP; exp = export orientation defined as share of NACE 2-digit sectoral exports to EU-25 to its total turnover; low exp = year-sectors with exp below 25 percentile; medium exp = year-sectors with exp between 25 and 75 percentile; high exp = year-sectors with exp above 75 percentile; * significant at 10%; ** significant at 5%; *** significant at 1%. Estimated with firm and year fixed effects.*

Table A9: Spillovers by Firm Size

	CZ			HU			PL			SK			SI		
	small	medium-sized	large	small	medium-sized	large	small	medium-sized	large	small	medium-sized	large	small	medium-sized	large
horizontal	-0.118	-0.213	-0.353*				0.441	0.187	0.734**	0.660	0.167	-0.421	-0.449	0.419	0.101
backward	-0.279	-0.820	-0.004				-4.412	3.818*	1.675	-2.079*	0.883*	1.308*	1.335**	0.891	1.713
forward	-0.654	1.213**	0.426				-4.292	-0.752	-3.971**	0.913	-0.639	-1.359	-17.817***	-22.169***	-30.283***
hhi	0.260	0.047	0.197				-0.299	-0.193	0.350	0.648	0.168	0.23	-0.591*	-0.312	0.493
Observations	3985	5558	1843				2681	5491	2095	383	970	419	2148	1754	765
Firms	1712	1958	617				1001	1804	689	179	358	141	738	534	186
R-squared	0.01	0.12	0.11				0.01	0.01	0.06	0.01	0.01	0.05	0.20	0.06	0.10

*Note: Dependent variable: ln TFP; small firms = up to 50 employees; medium-sized firms = up to 250 employess; large firms = more than 250 employees; * significant at 10%; ** significant at 5%; *** significant at 1%. Estimated with firm and year fixed effects.*

Table A10: Spillovers by Firm Size

	EE			LT			LV			BG			RO		
	small	medium-sized	large	small	medium-sized	large	small	medium-sized	large	small	medium-sized	large	small	medium-sized	large
horizontal	0.784**	-1.658**	-6.309**	-0.369	-0.988**	0.542	-0.574	0.566	1.116	-0.272	-0.190	0.600	-0.450	-1.389***	-1.771***
backward	4.335*	5.864	-15.307	-0.977	0.737	-18.613**	-12.358**	-8.378**	-29.133***	4.175	-1.204	0.354	0.826	3.943*	17.517***
forward	-2.759	6.279	-23.114	-0.504	-0.761	-12.532	-0.295	0.626	-4.951	-2.509***	0.078	-0.091	-0.356	2.181***	3.093**
hhi	-0.183	-1.059	-14.306*	-2.897***	-0.343	-2.901	0.152	-0.142	2.613***	-1.786**	0.352	1.854***	-2.629***	0.717	0.325
Observations	2851	667	62	578	531	68	850	1051	285	780	827	468	23157	7091	1583
Firms	754	215	22	268	206	27	297	301	80	208	225	122	5815	2202	453
R-squared	0.01	0.01	0.03	0.07	0.05	0.30	0.05	0.03	0.01	0.01	0.01	0.01	0.01	0.06	0.04

*Note: Dependent variable: ln TFP; small firms = up to 50 employees; medium-sized firms = up to 250 employess; large firms = more than 250 employees; * significant at 10%; ** significant at 5%; *** significant at 1%. Estimated with firm and year fixed effects.*

Appendix B: The Levinsohn and Petrin (2003) Estimator of Productivity

The Levinsohn and Petrin (2003) technique assumes a Cobb-Douglas production technology:[1]

$$v_t = \beta_0 + \beta_l l_t + \beta_k k_t + \omega_t + \eta_t \tag{B1}$$

where v_t is log of value added, l_t is log of freely variable labour input, k_t is log of the state variable capital. The error has two components, the transmitted productivity component ω_t and an error term η_t that is uncorrelated with input choice. The key difference between ω_t and η_t is that the former is a state variable and thus impacts the firm's choice of inputs. As ω_t is not observed by the econometrician but is known to the firm, it leads to the simultaneity problem in production function estimation and yields inconsistent results.

Olley and Pakes (1996) developed an estimator that uses investment as a proxy for this unobservable shock. However, Levinsohn and Petrin (2003) argue that investment is very lumpy and thus the investment proxy may not smoothly respond to productivity shocks under substantial adjustment costs. Instead of investment, Levinsohn and Petrin (2003) suggested that intermediate inputs can better serve as a proxy for productivity shocks, as they are not typically state variables and are easily available from computation of value added (while investment is often truncated to zero in many datasets and thus not available).

Levinsohn and Petrin (2003) assume that the demand for the (log of) intermediate input, materials m_t, depends on the firm's state variables k_t and ω_t:

$$m_t = m_t(k_t, \omega_t) \tag{B2}$$

Making mild assumptions about the firm's production technology (Levinsohn and Petrin 2003, Appendix A), the demand function is monotonically increasing in ω_t. This allows inversion of the intermediate demand function, so ω_t can be written as a function of k_t and m_t:

$$\omega_t = \omega_t(k_t, m_t) \tag{B3}$$

[1] This part draws heavily from Levinsohn et al. (2003).

The unobservable productivity term is now expressed solely as a function of two observed inputs. Final identification restriction assumes that productivity follows a first-order Markov process:

$$\omega_t = E[\omega_t \mid \omega_{t-1}] + \xi_t \tag{B4}$$

where ξ_t is an innovation to productivity that is uncorrelated with k_t.
Thus, (1) can be rewritten as

$$v_t = \beta_l l_t + \phi_t(k_t, m_t) + \eta_t \tag{B5}$$

where

$$\phi_t(k_t, m_t) = \beta_0 + \beta_k k_t + \omega_t(k_t, m_t) \tag{B6}$$

By substituting a third-order polynomial approximation in k_t and m_t in place of $\phi_t(k_t, m_t)$, it is possible to consistently estimate parameters of the equation (1) using OLS as

$$v_t = \delta_0 + \beta_l l_t + \sum_{i=0}^{3}\sum_{j=0}^{3-i} \delta_{ij} k_t^i m_t^j + \eta_t \tag{B7}$$

where β_0 is separately identified from the intercept of $\phi_t(k_t, m_t)$. Out of this first stage of the estimation, an estimate of β_l and an estimate of ϕ_t (up to the intercept) are available.

The second stage of the estimation begins by computing the estimated value for ϕ_t using

$$\hat{\phi}_t = \hat{v}_t - \hat{\beta}_l l_t = \hat{\delta}_0 + \sum_{i=0}^{3}\sum_{j=0}^{3-i} \hat{\delta}_{ij} k_t^i m_t^j - \hat{\beta}_l l \tag{B8}$$

For any candidate value β^*_k, one can compute (up to a scalar constant) a prediction for ω_t for all periods t using

$$\hat{\omega}_t = \hat{\phi}_t - \beta_k^* k_t \tag{B9}$$

Using these values, a consistent (non-parametric) approximation to $E[\omega_t \mid \omega_{t-1}]$ is given by the predicted values from the regression

$$\hat{\omega}_t = \gamma_0 + \gamma_1 \omega_{t-1} + \gamma_2 \omega_{t-1}^2 + \gamma_3 \omega_{t-1}^3 + \varepsilon_t \tag{B10}$$

which will be called $\hat{E}[\omega_t \mid \omega_{t-1}]$. Given $\hat{\beta}_l, \beta_k^*$ and $\hat{E}[\omega_t \mid \omega_{t-1}]$, the estimate $\hat{\beta}_k$ is defined as the solution to minimization of squared sample residuals of the production function

$$\min_{\beta_k^*} \sum_t (v_t - \hat{\beta}_l l_t - \beta_k^* k_t - \hat{E}[\omega_t \mid \omega_{t-1}])^2 \tag{B11}$$

Standard errors are estimated via bootstrap procedure, but may be also derived analytically.[2]

[2] Levinsohn and Petrin (2003) methodology is available as an ado file for Stata program where a bootstrap technique is used to derive standard errors, see Levinsohn et al. (2003).

Corporate Financing in the New Member States: Firm-Level Evidence for Convergence and Divergence Trends[1]

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Abstract

The paper presents results of an ongoing research project on corporate financing patterns in Central and Eastern Europe (CEE) since 1999. It addresses three broad issues. Which are the specifics of corporate financing in CEE compared to countries in Western Europe? Which country institutional and company factors may explain the similarities and differences of capital structures in the EU-15 and New Member States (NMS)? Which are the major convergence and divergence trends in corporate financing patterns in an enlarged Europe? The study analyzes the interactions between country institutional differences, firm ownership structures, other firm-specific characteristics and corporate financial patterns in both the EU-15 and NMS. It summarizes the firm-level evidence and outlines several unresolved questions and major dimensions for further research.

1. Introduction

Emerging capital markets in Central and Eastern Europe (CEE) have experienced fast changes over the last decade and since 1999 become gradually integrated into

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the EU financial market. However, despite the potential importance of financial sector for the corporate growth in an enlarged Europe, the research on the corporate financial patterns in CEE region is still scarce. First, studies on capital structures traditionally investigate the listed companies in the developed countries. A few studies examine developing and transition countries.[2] Second, studies on capital structures in transition economies focus mostly on the early transition period in the 1990s.[3] Third, the research of the impact of country institutional and company ownership structures on leverage decisions in transition economies is also scarce.[4]

This paper presents firm-level evidence about the emerging corporate financing patterns in Central and Eastern Europe since 1999. It addresses three broad issues. Which are the specifics of corporate financing in CEE compared to countries in Western Europe? Which country institutional and company factors may explain the similarities and differences of capital structures in the EU-15 and NMS? Which are the major convergence and divergence trends in corporate financing patterns in an enlarged Europe?

One contribution of the paper is that it extends the traditional analysis of institutional factors including company ownership structures and their association with leverage in CEE. The second contribution is that it focuses on control theories of capital structures to explain corporate financing choices among firms in CEE region. The goals of the paper are: (i) to present stylized facts about the evolution of corporate financing patterns in Central and Eastern Europe, (ii) to analyze the interactions between country institutional differences, firm ownership structures, other firm-specific characteristics and corporate financial patterns in both the EU-15 and NMS, and (iii) to outline the convergence and divergence trends of corporate financial developments in the NMS.

Section 2 presents stylized facts about corporate finance patterns in transition countries. Section 3 discusses institutional factors for country differences in capital structures in both the EU-15 and NMS. Section 4 analyses the association between firm ownership structures and leverage. Section 5 focuses on other firm-specific factors correlated with leverage. Section 6 discusses the link between ownership, firm-specific factors and leverage. Section 7 concludes with main results and unresolved questions for further research.

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[2] For a survey on developed countries, see Rajan and Zingales (1995); for a survey on developing countries, see Booth *et al.* (2001).
[3] But see Haas and Peeters (2006).
[4] The previous research examines only state-owned, domestic and foreign firms.

2. Corporate Financing Patterns in Transition Economies

2.1 Early Transition

Most studies on capital structures in CEE examine the early transition period in the 1990s.[5] There are few studies that extend the data coverage including more recent years.[6] Some studies examine the effects of ownership structures on leverage. However, all these studies focus on only three ownership categories, namely: state, domestic and foreign.

The previous research reveals several major features of the emerging financial patterns in the early post-communist transition. (1) A number of papers find lower leverage rate for companies in CEE countries compared to their counterparts in G7 countries (see e.g. Hussain and Nivorozhkin (1997) for Poland; Nivorozhkin (2002) for Hungary). This low leverage rate was also observed in the second half of the 1990s during the period 1997–2001. (2) Studies also reveal negligible long-term debt rates and the practical absence of bond markets in CEE region. (3) Several studies focus on the importance of the supply side effects on the capital structure decisions, mainly the failure of the emerging financial sector to allocate efficiently external finance. Banks were reluctant to provide loans to both newly established private firms that have not developed reputation and to state-owned firms accumulated bad loans from the communist times. Banks were also possibly not efficient in screening and monitoring under the new market conditions. Thus, the low debt levels are partly explained by the supply side of the market (Cornelli, Porter and Schaffer (1996); Revoltella (2001); Nivorozhkin, 2002). (4) Studies reveal the importance of soft loans to both state-owned and private firms due to the soft budget constraint. The environment of soft budget constraint distorted banks-firms credit relations in the early transition years. Open remains the question how fast was the process of hardening the budget constraint by countries over transition years. In some countries, the introduction of special institutional arrangements (e.g. currency board) led to a change from a regime of excessive lending rates to a severe credit decline.[7]

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[5] E.g. Revoltella (2001) uses data on 665 listed firms in the Czech Republic for the period 1993-95; Hussain and Nivorozhkin (1997) study 27 listed firms in Poland over the years 1991-94; Nivorozhkin (2002) examines 25 listed companies in Hungary over the period 1992-1995; Cornelli, Porter and Schaffer (1996) focus on Hungarian and Polish firms from the early 1990s; Colombo (2001) studies 1100 Hungarian firms for the period 1992-96.

[6] Haas and Peeters (2006) focus on ten transition economies for 1994-2001. Nivorozhkin (2004) examines data on five transition economies over the period 1997-2001. Nenovsly, Peev and Yalamov (2003) investigate banks-firms relations in Bulgaria for the period 1998-2003.

[7] See e.g. for the case of Bulgaria, Nenovsly, Peev and Yalamov (2003).

2.2 Late Transition

We use data on CEE, EU-15 and other developed economies, and developing countries over the period 2000–2004. Our principal data source for country specific macroeconomic variables such as the lending rate, consumer price index, GDP growth rate, and bank deposits is the International Financial Statistics database provided by the IMF.

The literature on corporate financing usually explores the difference between bank-based and market-based financial systems classified by the size or the power of the banking sector in any country. The prevailing "conventional wisdom" in the early transition years in Central and Eastern Europe stressed on the development of securities markets and moving to Anglo-Saxon (market-based) financial system. The view that the development of the financial system is closely related to its financial funding performance was challenged by Mayer (1988, 1990).[8] He reveals that while the British financing sector has produced a myriad of new financial instruments and services for savers, its role for channeling funds from savers to non-financial companies is rather moderate. Mayer (1990) presents ten stylized facts about corporate finance in developed countries, among them observing that retentions are the dominant source of finance and banks are dominant source of external finance in all countries and in no country do companies raise a substantial amount of finance from securities markets. He suggests that in the early stages of development of both economies and firms an efficient banking system may be an essential requirement for expansion, but securities markets are unlikely to be effective substitutes. The author's policy conclusion sharply contradicts the "conventional wisdom" in the early transition years in CEE for the priority development of securities markets.

Table 1 presents data about the importance of the banking sector, stock market, and bond market in financing firms in both CEE and EU-15 countries. At the bottom part of the table, data on developing countries, the United States and Japan are also used for comparative purposes. All ratios are calculated for 2003. In CEE region, the size of the banking sector (measured by the ratio of bank deposits to the GDP) is about three times larger than the size of the stock market. The bond market is less important for all CEE countries, especially the bond market for the private sector. Estonia is the only country with a larger stock market than its banking sector. In fact, despite the tremendous efforts of policy-makers and contrary to the "conventional wisdom" how to develop local stock exchanges, the securities markets have remained fragile in CEE.

In the EU-15 region, on average, we observe a similar type of financial system. The size of the banking sector (66% of GDP) is higher than the stock market (58% of GDP), but the bond market is much more developed than in CEE countries.

[8] For a critical view, see Mankiw (1988).

Among EU-15, Anglo-Saxon countries (UK, Ireland), the Netherlands, Finland, and Sweden have bigger stock market than banking sector. When comparing CEE and EU-15 countries, the difference is striking. The CEE region, on average, has about twice less developed banking sector (32% of GDP) and more than four time lower total stock market capitalization (12% of GDP).

Table 2 provides data on capital structure ratios in both CEE and EU-15 countries. Recently, the received wisdom that companies in Continental Europe (bank-based financial system) are more highly leveraged than companies in Anglo-American economies (market-based financial system) was questioned by Rajan and Zingales (1995). They apply an innovative approach studying in detail institutional structures of the G-7 countries and suggest that the leverage differences are very sensitive to the way leverage is defined. The authors find out that at an aggregate level, firm leverage is fairly similar across the G-7 countries. Table 2 confirms these findings. We use three measures of leverage, namely: the long term-debt (defined as the ratio of the long-term debt to total assets), short-term debt (measured as the ratio of the short-term debt to total assets), and total debt (the ratio of the sum of the long-term and short-term debt to total assets).[9] The leverage rates are similar among developed countries in Continental Europe, the UK, Ireland, Japan, and the United States. However, in CEE countries the rates of total debt and long-term debt are still much lower than in the EU-15. The long-term debt in CEE (10.2%) is about twice lower than in both the EU-15 (26.5%) and developing countries (22.2%). Among CEE countries, only Poland (58%) has total debt ration comparable with some EU-15 countries like Austria (57.8%), Greece (58.6%), Spain (60.2%) and the Netherlands (60.7%). In the CEE region, the total debt ratio varies from a low of 32.9% in Slovenia to a high of 58% in Poland.

Table 3 shows the developments of the debt ratio by regions over the period 2000–2004. In the CEE region, we observe slightly increasing long-term debt ratio from 9% in 2000 to about 11% in 2004. For the same period, the short-term debt decreases and the overall change of the total debt is negligible. On average, both the EU-15 and developing countries show no practical change of their total debt ratios.

In the next three sections, we explain the observed corporate financing patterns examining the effects of country institutional factors, firm ownership and other firm characteristics in both the NMS and EU-15.

[9] We use averages based on firm-level data. See section 4 for the source of our data.

3. Country Institutional Differences

3.1 Country Institutional Variables

Rajan and Zingales (1995) find out that the factors identified to be related to leverage in the United States may also explain leverage in other G7. They suggest, however, that the theoretical underpinnings of the observed correlations are still largely unresolved. The authors focus on several country institutional factors correlated with leverage, namely the size of the banking sector, tax code, bankruptcy laws, the state of development of bond market, and patterns of ownership. Booth *et al.* (2001) examine developing countries and include macroeconomic factors like inflation and real GDP growth rates as important determinants of capital structure choices. In a seminal study on developing countries, Singh (1995) examines also the cost of debt and cost of equity as country capital market conditions influencing leverage. Finally, two recent papers focus on the protection of creditor rights, enforcement and development of the financial sector (Giannetti, 2002) and the legal system and corruption, tax system, and the size of the banking and life insurance sectors (Fan *et al.,* 2005) as institutional determinants of capital structure.

We follow the previous literature and identify six broad groups of country factors possibly important for affecting leverage in CEE, namely (1) the development of post-communist external capital markets, especially the banking sector, (2) the tax code and macroeconomic factors (inflation, GDP growth and the like), (3) capital markets conditions (lending rate, cost of equity), (4) the quality of country governance institutions, (5) legal system, law enforcement and especially bankruptcy laws[10], and (6) patterns of ownership structures.[11]

The supply side effects on capital structures were documented in several studies on transition economies. The development of the banking sector is related to the availability of external finance for non-financial firms and is assumed to be a major factor explaining cross-country differences in capital structures. We measure the size of the banking sector by the ratio of bank deposits to GDP calculated using the IMF IFS database.

The tax code is other important factor that influences the company capital structure (Graham, 2003). However, for an empirical study of the effects of taxation on capital structures one needs also data on both personal and corporate tax rates, and assumptions about the marginal investor's tax rate. This kind of precise tax rates calculation requires additional data collection, a task usually beyond many studies on leverage. In our research, we use the tax rates compiled by

[10] In this research, we have no data on legal indicators in CEE region and do not discuss legal factors.

[11] Ownership structures and leverage are discussed in the Section 4.

the KPMG's annual survey of corporate tax rates (KPMG, 2003). The survey, which started in 1993, currently covers 68 countries, including the 30 member countries of the OECD, and many others in the Asia Pacific and Latin America regions. Data on tax rates collected by the local KPMG tax offices are used for this survey.

Main macroeconomic factors that influence capital structure choices are the real economic growth and inflation. Booth *et al.* (2001) find out that higher economic growth tends to cause capital structure to increase and higher inflation causes it to decrease.

Several studies show the importance of the cost of debt and equity for capital structure decisions in both developed and developing countries. For developed countries, Baker and Wurgler (2002) reveal that capital structure is the cumulative outcome of past attempts to time the equity markets. For developing countries, in seminal contributions Singh and Hamid (1992) and Singh (1995) examine largest listed companies in developing countries and observe puzzling facts that contradict the traditional pecking order theory.[12] According to this theory, companies finance new investment rising funds first internally, then with low-risk debt, and finally with equity only as a last resort (Myers and Majluf, 1984). The authors find out that the developing country corporations rely very heavily on external funds and on new issues of shares to finance their growth of net assets. They suggest that these results are historically specific for the 1980s and stress on the institutional and conjuncture differences, e.g. the rise of share prices and the increase of the cost of debt.[13] We control for the market conditions in CEE countries measuring the cost of debt by average country annual lending rate and the cost of equity proxied by the change of the composite share price index in local currency terms of the individual country. Both measures are calculated using the IMF IFS database.

Recent studies examine the importance of the legal system, law enforcement and corruption on the corporate financing decisions (Fan *et al.,* 2005; Giannetti, 2002). We measure the quality of country institutions calculating a general index which is measured as the sum of six indexes: (1) Voice and Accountability, (2) Political Stability, (3) Government Effectiveness, (4) Regulatory, (4) Quality, (5) Rule of Law, and (6) Control of Corruption. The indicators are constructed using an unobserved components methodology described in detail in Kaufmann, Kraay and Mastruzzi (2005). The six governance indicators are measured in units ranging from about –2.5 to 2.5, with higher values corresponding to better governance outcomes.

[12] Gugler, Mueller and Yurtoglu (hereafter GMY) (2003) offer an alternative explanation for Singh's findings.

[13] The authors also point out the role of the country governments for development of security markets and the more active involvement of international institutional investors.

3.2 Differences between the EU-15 and NMS

Table 4 presents correlation coefficients among all the country institutional variables and leverage (long-term debt) for both the EU-15 and CEE. This exercise shows a high degree of collinearity between the lending rate and inflation (positive), the tax rate and economic growth (negative), and the share price index, on the one hand, and both institutional variables, the index of institutional quality and the size of banking sector, on the other. Inflation has the predicted negative association with leverage. The real economic growth rate has the expected positive link with leverage only for the NMS sub-sample, but a negative one with the EU-15. The change of the share price index (proxy for the cost of equity) is correlated significantly negatively with debt finance for the whole sample of firms, but the coefficient is not significant for both the sub-samples of the EU-15 and NMS.

Table 5 shows the results of cross-section regressions with long-term debt ratio dependent variable, and independent variables the two institutional variables. For controlling variables we use also lending and tax rates, but exclude the other variables described above due to collinearity problems. The number of observations for the whole sample is 20 and for the sub-sample of CEE countries it shrinks to 9. For this small number of observations, the standard errors of the coefficients are too large for the coefficients to be estimated precisely at usual levels. Despite the obvious caveat, the specifications reveal important differences between the EU-15 and NMS. In Table 4, the correlation between debt ratio and the index of institutional quality is significantly positive for the EU region, but significantly negative for the sub-sample of the NMS. Specifications 1–3 in Table 5 confirm this unexpected significantly negative coefficient for the NMS.

To control for country variations, chart 1 presents the association between leverage and the quality of country institutions by countries. The differences are striking. In the NMS sub-sample, all the advanced CEE countries are clustered in a group with a low debt (5–15%) and average institutional quality (coefficient 0.5 – 1.0). The obvious outliers are Romania (low debt-low institutional quality) and Bulgaria and Croatia, both with average debt (15–20%) and low institutional quality (coefficient less 0.5). In the EU-15 sub-sample, we separate also three groups of countries. The bulk of countries are clustered in a group with high debt (20–40%) and a very high institutional quality (coefficient 1.5 –2). Greece (debt ratio about 20%) and Italy (about 31%) form the group with a high debt and an average institutional quality (coefficient 0.5–1). The third group (Portugal, France and Spain) are in between with high debt and an average institutional quality (coefficient 1–1.5).

In specifications 4–6 in Table 5, we use the development of the banking sector as a proxy for the country institutional effects on debt financing. The results confirm the expectations about the importance of the banking sector. The debt ratios vary positively with the size of the banking sector in both EU-15 and NMS, but are significant only for the total EU sample. Finally, the coefficient on lending rate has the expected negative sign for all the specifications. The tax rate has the predicted positive association with the debt ratio and is significant for the EU-15 sub-sample. For the NMS, however, the effect of the tax rate on leverage is significantly negative. As other studies also stated, additional data collection and calculations are needed for more decisive conclusions about the effects of taxes on leverage dcisions (Rajan and Zingales, 1995).

4. Ownership Categories and Leverage

Recent research shows that ownership identity and ownership concentration have important implications for company performance. However, there is less research and correspondingly a much fewer number of stylized facts on the impact of ownership structure on the capital structure choices that companies make. On the one hand, following the Modigliani-Miller approach to corporate financing choices, one can argue that ownership structure is irrelevant to their analysis.[14] In a recent empirical study, Mayer (1990) finds out similar patterns of investment finance (overwhelming reliance on retentions and a tiny use of new equity), despite the obvious institutional differences between Anglo-Saxon countries (companies with dispersed ownership and active takeover market) and the Continental Europe (concentrated ownership and negligible hostile acquisitions).

On the other hand, many studies focus on the agency conflicts within firms as an important determinant of leverage.[15] In these free-cash flow views, debt is a corporate governance mechanism restricting the availability of free cash flow at a manager's disposal and constraining the manager from pursuing personal utility maximization strategies. Debt like other governance mechanisms (e.g. CEO compensations) has to be designed to alleviate the agency problems in publicly traded companies. However, as recent research on CEO compensation stated this kind of governance instruments seem to reflect managerial rent-seeking rather than the provision of efficient incentives.[16] Zwiebel (1996) presents a model of dynamically consistent capital structure which is a result of the trade-off between managerial empire-building ambitions and the need to ensure efficiency to prevent takeover. In a similar vein, Mueller (2003) suggests an investment model where the

[14] As Merton Miller wrote about the Modigliani-Miller approach to the firm: " We opted for a Fisherian rather than the standard Marshallian representation of the firm. Irving Fisher's view of the firm – now the standard one in finance, but then just becoming known – impounds the details of technology, production, and sales in a black box and focuses on the underlying net cash flows. The firm for Fisher was just an abstract engine transforming current consumable resources, obtained by issuing securities, into future consumable resources payable to the owners of securities" (Miller, 1988, pp. 103).

[15] See for a survey e.g. Harris and Raviv (1990).

[16] Bebchuk and Fried (2003).

investment decision presents a trading off between the managerial utility from growth and disutility from the rise of probability of takeover caused by this investment. According to the managerial discretion theory of investment, in firms with cash flows and insufficient investment opportunities cash flow is favored by a growth-oriented management, because its implicit cost is lower than that of external finance. In these and other similar models, takeover market plays a crucial rile for constraining the managerial opportunism. A strong pressure from the market for corporate control forces managers to increase leverage (Rajan and Zingales, 1995). However, for the emerging markets in Central and Eastern Europe we may expect the disciplining role of the takeover market to be less important. Thus, *ceteris paribis*, we predict lower leverage rates for the companies with dispersed ownership in NMS than in their counterparts in the EU-15.

Empirical evidence on the effects of managerial control on capital structure is scarce. Friend and Lang (1988) find out that the debt ratio is negatively related to management' shareholding in public companies with dispersed ownership. The authors show that unless there is a non-managerial principal shareholder, no substantial increase of debt can be realized. Unfortunately, there is no data about the managerial shareholdings in both the EU-15 and NMS countries. We use the dispersed ownership as a proxy for the lack of non-managerial principal shareholder and predict lower leverage rates for the companies with dispersed ownership than the other companies in both the EU-15 and NMS.

In this section, we analyze whether ownership identity and managerial control based on dispersed ownership have an impact on the observed leverage ratios in our sample of EU-15 and NMS.

4.1 Firm-Level Data

Our data source is the OSIRIS data bank provided by Bureau van Dijk. The industrial company financial data on OSIRIS is provided by World'Vest Base (WVB) and some regionally specialized providers such as Multex and Edgar Online for the USA. This company dataset contains standardized and as reported financials, including restated accounts on approximately 24,700 listed and 900 unlisted companies, the data base also includes 2,600 delisted companies.

OSIRIS contains basic balance sheet and income statement data for most of the listed companies and the names, country of origin, type and%age of direct owners.While for some European and USA companies the financial data goes back for up to 20 years, there is generally much less information on NMS countries. As a result we restrict our attention to the period 2000–2004, where most of the necessary data on both financial and ownership indicators are available for the EU-15 and NMS samples. We are interested in the financing choices made by the largest companies, hence we focus our attention to the largest 100 companies in the

EU-15 and NMS. We also employ data from USA, Japan and developing countries for comparative purposes in some of our tables.

We classify firms using six ownership categories, namely: state, financial firm, family, mutual fund[17], non-financial firm, dispersed. In doing that, we follow the existing literature and employ two ownership criteria for categorizing companies – the largest shareholder owns 10% or more of the company's shares, and a 20% cut off.[18] The differences in results between the two definitions were modest, and thus in Table 6 we report only those for the 20% criterion. Under each heading there are two entries. The first entry for each ownership category represents the mean leverage ratio for that category. Thus, state controlled firms in EU-15 have a mean leverage ratio of 34.1%. The second entry is the mean leverage ratio for the remaining companies in that country group. Thus, the mean leverage ratio for all EU-15-origin companies that were not state controlled is 27.7%. The > (<) separating these two numbers indicates that the first entry is greater (less) than the second entry at a 5% level significance test or better (two-tailed test). If there is no statistically significant difference between the entries, we use ≈ to show it.

Table 6 shows that all leverage ratios for the six ownership categories in the EU-15 are greater than their NMS counterparts. Only five out of 12 possible comparisons are statistically different.

4.2 State

Studies on developed countries reveal that leverage of government firms exceeds that of private firms (Dewenter and Malatesta, 2001). Most studies on the early transition also document that state-owned firms have leverage increases due to soft-budget constraint (Kornai *et al.*, 2003).

Our results show that the state controlled companies in both EU-15 countries and NMS have higher leverage ratios than other types of companies in their respective samples. The differences are both economically and statistically significant; state controlled companies in the EU-15 have a mean leverage ratio of 34.1% whereas other firms have only a 27.7% leverage ratio, which amounts to an almost 25% difference. A much dramatic difference is found for companies from the NMS. Namely state controlled companies have a mean leverage ratio of 23.7%, which is almost 70% higher compared to the leverage ratio of other types of

[17] This category has been included to highlight its special importance as an owner category in the NM sample.

[18] There exists an important caveat measuring ownership concentration in both EU-15 and NMS countries. The usual estimates are based on the share of the *direct* largest shareholder, but the major unresolved problem is rather who are the actual *ultimate* owners. For discussion on transition economies, see e.g. Mueller, Dietl and Peev (2003) for the case of Bulgaria.

firms (14.1%). Indeed, state owned firms in NMS countries have the largest leverage ratio in six possible ownership categories. These differences are consistent with a number of existing results from the previous research.

4.3 Financial Firm

Our second set of comparisons is between companies owned by a financial company (bank, insurance company or other financial companies except mutual funds). In the CEE region, the role of these owners has gradually increased.[19] We expect that companies controlled by financial firms should have higher leverage ratios, because having a financial firm as the largest shareholder would weaken the asymmetric information problems and reduce the transaction costs of using debt. While EU-15 firms under financial control exhibit a slightly higher leverage ratio than other firms, the difference is modest in magnitude and also statistically insignificant (29.2 vs. 27.7%). On the other hand, when we restrict our attention to companies from the NMS sample, we see that finance controlled companies have even lower leverage ratios than other types of firms, while this difference is also insignificant.

4.4 Family

It is often argued that family controlled firms are subject to more severe asymmetric information problems than other firms (GMY, 2006). Consistent with this argument, we expect to find lower levels of leverage for these types of firms in both the EU-15 and NMS samples. This prediction is confirmed in the EU-15 sample; family controlled firms' leverage ratio is 23.5% compared to a leverage ratio of 28.5% by all other types of firms. On the other hand, we find no statistically significant difference in the NMS sample.

4.5 Non-Financial Firm and Mutual Fund

In contrast to the latter three ownership categories, we believe that it is hard to make any predictions about the leverage ratios of firms controlled by other companies and mutual funds due to the conflicting goals of these owners concerning the performance and financial structure of the companies they control. We do, however, present tests of whether these ownership categories are associated with systematic differences in leverage ratios. Companies under corporate control in both the EU-15 and NMS do not have different leverage ratios from other

[19] For a recent study on the investment performance of companies with financial owners in CEE countries, see e.g. Mueller and Peev (2006).

companies in their respective samples. The differences are both economically and statistically insignificant. We estimate similar results for firms controlled by mutual funds in the NMS sample, where the difference of 1% is statistically insignificant (15.2 vs. 14.2%). On the other hand, firms controlled by mutual funds in the EU-15 sample, have higher leverage ratios. While the difference of 2.5% points is not dramatic, it is statistically significant at the five% level.

4.6 Dispersed Ownership

The final comparison is between firms that have a dispersed ownership structure (defined at the 20% level) and firms which have a direct shareholder with at least 20% of the outstanding shares. Table 6 shows a striking difference between the two sub-samples. In the NMS, firms with dispersed ownership have statistically significant leverage ratio of 9.7%, which is almost 50% lower than the leverage ratio of other types of firms (15%). Firms with dispersed ownership in NMS countries have the lowest leverage ratio among the six ownership categories that corroborate our predictions about the negative effects of managerial discretion on leverage. This leverage rate is also lower than in firms with dispersed ownership in the sub-sample of the EU-15 countries. The result confirms the expectations about the inefficient disciplining role of the takeover market for managers in the CEE region. However, the expectations about the lower leverage for companies with dispersed ownership in the EU-15 were not corroborated. There is no significant difference between these companies and the rest of the firms in the EU-15 sub-sample. Are markets for corporate control in the EU-15 countries so efficient to constrain managerial discretion in firms with dispersed ownership? Are there country differences between Anglo-Saxon and the Continental European countries? These questions need to be addressed by further research.

We have examined six ownership categories identified by *direct* ownership and reveal that three of them, the state, family and dispersed ownership have association with leverage rates. The state and family are also *ultimate* owners of the companies. An important path for further research is to identify the ultimate owners of all the public companies in the NMS and their influence on the corporate financing choices.

5. Firm-Specific Factors Correlated with Leverage

Myers (2001) argues that there is no universal theory of the debt-equity choice and no reason to expect one. While some papers concentrate on a specific story of the financing choices, in general there are three useful conditional theories (1) the static trade-off theory, (2) the pecking-order theory, and (3) the agency theory.

The static trade-off theory suggests that leverage ratios reflect a trade-off between the marginal value of interest tax shields on additional debt and the potential cost of financial distress that the additional debt will cause. The nature of the firm's assets, its risk profile and profitability will also affect leverage ratios.

In the pecking-order theory, firms issue debt before issuing equity to minimize the cost of asymmetric information. This theory implies that both the firm's investment opportunities and its profitability are important determinants of leverage. While highly profitable firms will prefer internal funds, firms with lower profitability will choose debt financing. In our empirical work, we use the return on assets (ROA) as the measure of profitability, which is defined to be the earnings before tax divided by total assets.

The agency problems between shareholders and managers are likely to have a material impact on leverage ratios. The use of debt can have two opposite effects under this theory depending on the height of the investment opportunities. As Jensen (1986) argues debt can be an important disciplinary device for firms that generate large cash flows and have no good investment opportunities (see also Stulz, 1990 and Berger, Ofek and Yermack, 1997). The managers under Jensen's free cash flow hypothesis are assumed to be growth maximizers, which are not subject to control due to the dispersed ownership structures of their companies.[20]

On the other hand it is well known that debt can generate its own agency costs in that a highly levered firm forgoes positive NPV projects due to the debt overhang problem (Jensen and Meckling, 1976; Myers, 1977). In this case, the agency costs of debt are the foregone NPV and the costs of enforcing contractual provisions, which are likely to be a function of the institutional environment such as the bankruptcy code and the strength of law enforcement. In the agency framework, better investment opportunities lead to higher agency costs of debt suggesting a negative relationship running from investment opportunities to leverage. Since we lack market-to book ratios for most of the NMS sample and our data sources do not report R&D expenditures, we hope that our measure, the%age growth of sales, serves as a good proxy for growth opportunities. The tangibility of the firm's assets serves as a proxy for agency costs in the agency model. We define tangibility as the ratio of total fixed assets to the total assets of the firm. We also use the firm size as further right hand side variable by defining it as the (natural) logarithm of total assets of the firm. Firm size is likely to be an inverse proxy for the bankruptcy risk and it is also related to the agency costs of debt and equity.

Table 7 reports the means and standard deviations of these four variables that we employ to explain leverage ratios. In the final two columns, we also report the concentration of the shareholdings by the largest direct shareholder irrespective of his/her identity. The table suggests important differences between the samples of

[20] On the other hand, Jung, Kim and Stulz (1996) show that equity finance is the preferred choice of growth maximizing managers and their shareholders, when firms have valuable investment opportunities.

EU-15 and NMS companies. The profitability in the EU-15 sample is higher than in the NMS sample by about 1.2%. As one might expect EU-15 companies are much larger than the NMS companies as indicated by the logarithm of the total assets. Important differences also emerge in comparing the tangibility of the firms' assets in both samples. The NMS sample has a much larger ratio of fixed assets to total assets than the EU-15 companies. In terms of sales growth, on average, both samples are similar, while there are countries which exhibit high average growth rates such as Spain (41.1%) and Greece (29.6%) in the EU-15 and Lithuania (42.8%) in the NMS sample. We also note that the NMS companies exhibit a much more concentrated ownership structure measured by direct ownership with a mean largest shareholding of about 53% than the EU-15 sample (34.3%). The next step is to analyze whether these differences also have different impact on the leverage choices of companies.

In all reported regression equations the ratio of long-term debt to total assets is used as the dependent variable. We control for industry and time specific effects by including a full set of time and industry dummies defined at the level of two-digit NACE codes.

To the extent that each of these theories applies to different types of firms, choosing variables in empirical work suggested by any or all of them will guide us little in identifying which theory really explains leverage. Leaving this theoretical warning of Myers (2001) aside, in table 8 we first present the coefficient estimates from a pooled OLS regression for the full sample of companies in the EU-15 and NMS.[21] The estimated coefficient of ROA is negative and significant suggesting that profitable firms use less debt. The size and the tangibility of the firms' assets both have a positive and highly significant effect on leverage ratios. Sales growth has a negative albeit small negative effect in the pooled sample. The equation, which includes a full set of country, industry and time dummies explains about 43% of the variation in 2998 firm-year observations on the leverage ratios from both the EU-15 and NMS companies.

The second column in Table 8 shows the results for the sample of companies from the EU-15. ROA and sales growth have the same negative and significant effect, while size and tangibility have a significantly positive effect on leverage. One important difference of the EU-15 results is the substantially higher coefficient on tangibility for the EU-15 sample. On the other hand, the coefficient estimates for the NMS sample suggest three important differences to the EU-15. First we observe that size has a much smaller impact on leverage (0.009 vs. 0.039) and it is much less significant. Second, we note that tangibility of the firms' assets is now insignificantly related to leverage (note also the much smaller coefficient on this variable). The third difference is observed in the much more negative albeit

[21] The Appendix contains the ownership structures and regression results by individual countries.

insignificant role of sales growth of the NMS sample companies. While one might expect smaller t-statistics due to the smaller sample size for the NMS companies, we nevertheless have a total of 1124 observations. The lower fit of the model to the data suggests that the NMS sample is much more heterogeneous than the EU-15 sample.

6. Discussion

6.1 Ownership and Firms Specific Factors in the EU-15 and NMS

Following the previous literature on capital structure, we use various firm-specific factors correlated with leverage, namely tangibility of assets, sales growth (a proxy for investment opportunities), company size and profitability. However, in their excellent survey Rajan and Zingales (1995) conclude that from the theoretical standpoint, empirical evidence is still puzzling for the correlations of tangibility and market-to-book ratio (investment opportunities) with leverage and explicitly state that they do not really understand why size is correlated with leverage. The effects of profitability on leverage are also ambiguous due to the dual role of profitability as a proxy for both the amount of internally generated funds and the quality of investment opportunities.

We discuss a possible missing link suggesting additional institutional variables (e.g. ownership categories) to clarify the effects of the firm-specific factors in both the EU-15 and NMS region. Table 9 presents preliminary results about the effects of both ownership categories and firm-specific factors on leverage. The table outlines several major differences. First, for the sub-sample of the NMS, only profitability and tangibility of assets seem important explaining leverage. However, in the EU-15 sub-sample all the four factors are important in most of ownership categories, except the state-owned firms.

Another striking result is the statistical and economic significance of the tangibility of assets in the NMS by *some* ownership categories. The coefficients on tangibility are statistical and economic significant only for family-controlled firms (0.318), firms controlled by mutual funds (0.356) and firms with dispersed ownership (0.151). A possible reason could be that these firms suffer from potentially severe asymmetric information problems with the external providers of finance. The cost of debt is also higher for these ownership categories. In contrast, we find that in the NMS tangibility seems to be no major factor for financial choices in state-owned firms, companies under financial control, and firms controlled by other non-financial firms. The results corroborate the expectations that these firms have easier access to external finance and less cost of debt.

Third, the results show that profitability has different effects *conditional* on ownership structures. For firms controlled by other non-financial firms, the coefficient on profitability is negative and significant in both the EU-15 (–0.420) and NMS (–0.353). This negative sign is reported in many studies on developed countries. Open remains the question why the same ownership category in the NMS shows similar pattern of performance.

Fourth, for family-controlled firms, the coefficient on profitability is significant and with opposite signs – negative for the EU-15 (–0.283), and highly positive (0.435) – for the NMS. These opposite effects of leverage could be explained by the importance of different institutional factors. In the NMS sub-sample, we suggest that the supply side effects play a major role. The family-bank relations are less developed in the CEE region that in the Western Europe. Banks prefer lending to firms with current cash flows. While in the EU-15 sub-sample, the negative link between profitability and cash flow could be due to other reasons. The first is the possible asymmetric information problems with the external capital markets. Thus, the pecking order theory can partly explain this negative relationship. The second and, perhaps, more plausible explanation for the Western Europe is that old family firms with a good reputational capital and a long-truck record with banks have a high discretion of the controlling shareholder on internally generated cash flows. The firms prefer internal cash flows at a low cost to issuing debt. We need additional variables in order to separate and test these two different effects.

6.2 Ownership Concentration and Non-Linear Relationship with Capital Structures

After the analysis of the differential impact of the firm specific factors under these five different owner identities and dispersed ownership, we now move to the question whether ownership concentration has a material impact on the leverage ratios.

There is a long and well-known literature on the impact of ownership concentration on the performance of companies (for surveys see Shleifer and Vishny, 1997; GMY, 2004). Most of these papers point to the fact that the impact of ownership concentration on performance will be nonlinear due to different net effects of the incentive alignment and entrenchment effects of corporate ownership. A similar argument has been put forward and supported by a few empirical studies on the relationship between ownership concentration and financing choices (Brailsford, Olive and Pua, 1999; Du and Dai, 2005). There are also few studies on the effects of ownership concentration on leverage in transition economies. Hussain and Nivorozhkin (1997) find out negative and insignificant effects for listed firms in Poland. Nivorozhkin (2004) reports that in Estonia and Bulgaria, the presence of a shareholder with the ownership stake over 49.9% lead to a lower debt ratio, but the effect of ownership concentration is insignificant in Poland, the Czech Republic, and Romania.

To analyze potential nonlinearities in our data, we augment our basic regression equation by including the linear and squared terms of the shareholdings by the direct largest shareholder (SH1). While we estimate this equation for all ownership categories, we report in Table 10 only the results for family-owned and corporate controlled companies both in the EU-15 and NMS samples. We start with an OLS estimation and then instrument SH1 using industry and country dummies along with other regressors in the equation to account for the potential endogeneity of the size of the largest shareholding and other variables (profitability and size in the first place).

In the EU-15 sample, we find an inverted-U pattern for family-owned firms, suggesting that leverage starts increasing at lower levels of family ownership and then declines, reaching its maximum at about 50% of family ownership in the OLS estimation. While less significant, instrumental variables (IV) estimation suggests a similar turning point at 55% ownership by families. On the other hand, family ownership in the NMS sample does not exhibit any impact on leverage using both the OLS and IV methods.

Turning now to the impact of ownership concentration by corporations, we observe that the linear SH1 has a negative and significant impact in both the OLS and IV estimation (albeit marginally in the IV estimation) for the EU-15 sample. The squared term is positive in both equations, hence implying a U-pattern. The OLS coefficients imply that as ownership concentration by corporate shareholders increases, leverage decreases up to a shareholding of 47.3% and starts increasing after that point. The IV coefficients imply a somewhat higher turning point at about 52.2%. For corporate shareholders in the NMS, we observe exactly the *opposite* pattern, namely leverage increases as ownership by corporate shareholders increases and declines after an ownership level of 45.3% (62.7% in the IV estimation).

We depict these relationships in the graphs 2–4 after controlling for the fact that ownership concentration is a declining function of the firm size. We first compute the averages of all the right-hand side variables for deciles of ownership concentration and then multiply the interval means with the estimated coefficients obtained from the IV estimation. In this way, we obtain nine observations in the predicted leverage−SH1 space, and then use a quadratic form to fit SH1 in the predicted leverage series. The graphs 2–4 are connected scatter plots of this relationship.

It is worth to mention that in all three cases, ownership concentration has a substantial impact on leverage ratios. As family ownership in the EU-15 increases, the relationship depicted in chart 2 suggests that leverage starts increasing from about 27% to almost 34%, reaching its maximum at about 50% ownership. Leverage starts to decline gradually after that point reaching a level of 20% at very high levels of family ownership.

The charts 3 and 4 depict the relationship between ownership concentration and leverage for the sample of companies with a corporate shareholder. Again ownership concentration has a dramatic influence on debt ratios. For the NMS sample leverage starts increasing from 10% when ownership is in the range of 20–30%, reaching its maximum of almost 19% at about 50% ownership and from that point on declines to a level of 12%. The opposite pattern is found for firms under corporate ownership in the EU-15 sample. While these companies exhibit dramatically higher debt ratios starting at about 30% when ownership is low, leverage declines when ownership increases having a minimum of about 23% in the range of 55–60% ownership and from that point on increases till it reaches 28% at very high levels of corporate ownership.

While these patterns are interesting in there own right, it is hard to reconcile then with existing theories of capital structure without making further assumptions concerning the investment opportunities and the nature of agency relationships observed in these countries. We leave a finer analysis of this issue to future work.

7. Summary: Convergence and Divergence Trends

We summarize our major findings focusing on the observed convergence and divergence trends in the evolution of the corporate financing patterns between the EU-15 and the NMS.

Emerging Bank-Based Financial System in the NMS

In Central and Eastern Europe (CEE), the size of the banking sector (measured by the ratio of bank deposits to the GDP) is about three times larger than the size of the stock market. The bond market is less important for all CEE countries, especially the bond market for the private sector. Thus, despite the tremendous efforts of policy-makers and contrary to the “conventional wisdom” how to develop local stock exchanges, the securities markets had remained fragile in CEE.

In the EU-15 region, on average, we observe a similar type of financial system. The size of the banking sector (66% of GDP) is higher than the stock market (58% of GDP), but the bond market is much more developed than in CEE countries.

When comparing CEE and EU-15 countries, the difference is striking. The CEE region, on average, has about twice less developed banking sector (32% of GDP) and more than four time lower total stock market capitalization (12% of GDP).

Corporate Financing Patterns

In the CEE region, the total debt ratio varies from a low of 32.9% in Slovenia to a high of 58% in Poland. In CEE countries, the rates of total debt and long-term debt are still much lower than in the EU-15. The long-term debt in CEE (10.2%) is about twice lower than in both the EU-15 (26.5%) and developing countries (22.2%). Among CEE countries, only Poland (58%) has total debt ration comparable with some EU-15 countries like Austria (57.8%), Greece (58.6%), Spain (60.2%) and the Netherlands (60.7%).

In the CEE region, we observe a slight increase of the long-term debt ratio from 9% to about 11% for the period 2000–2004. For the same period, the short-term debt decreases and the overall change of the total debt is negligible. On average, both the EU-15 and developing countries show no practical change of their total debt ratios for the same period.

Country Institutional Factors

The correlation between debt ratio and the index of institutional quality is significantly positive for the EU region, but significantly negative for the NMS. There is a high degree of heterogeneity by countries. In both sub-samples, most countries are clustered in a main group and outliers. In the NMS sub-sample, all the advanced CEE countries are clustered in a group with a low debt (5-15%) and average institutional quality (coefficient 0.5–1.0). Outliers are Romania (low debt-low institutional quality) and Bulgaria and Croatia, both with average debt (15–20%) and low institutional quality (coefficient less 0.5).

In the EU-15 sub-sample, the bulk of countries are clustered in a group with high debt (20–40%) and a very high institutional quality (coefficient 1.5–2). Greece (debt ratio about 20%) and Italy (about 31%) form a group with a high debt and average institutional quality (coefficient 0.5–1). The third group (Portugal, France and Spain) is in between with high debt and an average institutional quality (coefficient 1–1.5). Definitely, further research is needed to identify the convergence models (1) among some countries in the MNS, and (1) among countries in the two sub-samples of the EU-15 and NMS.

The results confirm the expectations about the importance of the banking sector. The debt ratios vary positively with the size of banking sector in both EU-15 and NMS, but are significant only for the total EU sample.

Ownership Categories and Leverage

The state controlled companies in both EU-15 countries and NMS have higher leverage ratios than other types of companies. State controlled companies in the EU-15 have a mean leverage ratio of 34.1% whereas other firms have only a 27.7% leverage ratio, which amounts to an almost 25% difference.

A much dramatic difference is found for companies from the NMS. Namely state controlled companies have a mean leverage ratio of 23.7%, which is almost 70% higher compared to the leverage ratio of other types of firms (14.1%). Indeed, state owned firms in NMS countries have the largest leverage ratio among the six studied ownership categories. These findings are consistent with a number of existing results from both developed and developing countries (see e.g., Dewenter and Malatesta, 2001).

The expectations that family controlled firms have lower levels of leverage were confirmed in the EU-15 sample. Family controlled firms' leverage ratio is 23.5% compared to a leverage ratio of 28.5% by all other types of firms. However, we find no statistically significant difference in the NMS sample. Only further research on the differences between family firms in the EU-15 and NMS (size, reputational capital, long-term relations with the banks, and the like) will tell us more.

The study reveals a striking difference for the dispersed ownership between the two sub-samples. In the NMS, firms with dispersed ownership have statistically significant leverage ratio of 9.7%, which is almost 50% lower than the leverage ratio of other types of firms (15%). These firms have the lowest leverage ratio among the six ownership categories that corroborate our expectations about the negative effects of managerial discretion on leverage. This leverage rate is also lower than in firms with dispersed ownership in the sub-sample of the EU-15 countries. The result confirms the expectations about the inefficient disciplining role of the takeover market for managers in the CEE region.

However, the expectations about the lower leverage for companies with dispersed ownership in the EU-15 were not corroborated. Are markets for corporate control in the EU-15 countries so efficient to constrain managerial discretion in firms with dispersed ownership? Are there country differences between Anglo-Saxon and the Continental Europe countries? These questions need to be addressed by further research.

We examine six ownership categories identified by *direct* ownership and reveal that three of them, the state, family and dispersed ownership have potential association with leverage rates. The state and family are also *ultimate* owners of the companies. An important path for further research is to identify the ultimate owners of all the public companies in the NMS and their influence on the corporate financing choices.

Firm-specific factors correlated with leverage

For the sample of companies from the EU-15, profitability (ROA) and sales growth have a negative and significant effect, while size and tangibility have a significantly positive effect on leverage. One important difference of the EU-15 results is the substantially higher coefficient on tangibility for the EU-15 sample.

On the other hand, the coefficient estimates for the NMS sample suggest three important differences to the EU-15. First we observe that size has a much smaller impact on leverage and it is much less significant. Second, tangibility of the firms' assets is now insignificantly related to leverage. The third difference is observed in the much more negative albeit insignificant role of sales growth of the NMS sample companies. The lower fit of the model to the data suggests that the NMS sample is much more heterogeneous than the EU-15 sample. Again, further research is needed to focus on these country differences within the NMS.

Other Unresolved Questions

We finish with the most preliminary part of our research, the joint effects of ownership and other firm characteristics on leverage and the possible non-linear relationship between ownership concentration and leverage.

We discuss a possible missing link suggesting additional institutional variables (e.g. ownership categories) to clarify the effects of the firm-specific factors in both the EU-15 and NMS region. The preliminary results show a statistical and economic significance of the tangibility of assets in the NMS for *only* family-controlled, firms controlled by mutual funds and firms with dispersed ownership. In contrast, we found that tangibility seems to be no important determinant of leverage for state-owned, firms under financial control, and firms controlled by other non-financial firms. One may suggest that asymmetric information plays important role explaining these differences.

The results also show that profitability has different effects on leverage conditional on ownership structures. The coefficient on profitability is negative and significant for firms controlled by other non-financial firms in both the EU-15 (– 0.42) and NMS (–0.35).

For family-controlled firms, the coefficient on profitability is significant and with opposite sign – negative for the EU-15, and positive – for NMS. These opposite effects of leverage could be explained by the importance of different institutional factors. In the NMS sub-sample, we suggest that the supply side effects play a major role. While in the EU-15 sub-sample, the negative link between profitability and cash flow could be due to other reasons. The first is the possible asymmetric information problems with the external capital markets. The second – the high managerial discretion of the controlling shareholder on internally generated cash flows. Both lead to a negative link between profitability and leverage, but we need additional variables in order to separate and test these two different effects.

Finally, we find a non-linear relationship between ownership concentration and leverage. It is interesting that this non-linearity is observed for companies under the control of corporations in both the EU-15 and NMS samples. Regression results indicate that the EU-15 companies exhibit a U-pattern, while the pattern is an inverted-U in the NMS sample. While this result may be obscured by the fact that corporations are not the ultimate owners, it is hard to reconcile the inverted-U pattern that we find for the family-owned firms in the EU-15 sample. These findings also suggest that the impact of ownership concentration can be quite substantial. On the other hand, we do not find any (either linear or non-linear) relationship between ownership concentration by families and leverage in the NMS sample. In the absence of potentially helpful proxies for agency costs and investment opportunities, we leave further extensions and interpretations of these results to further research.

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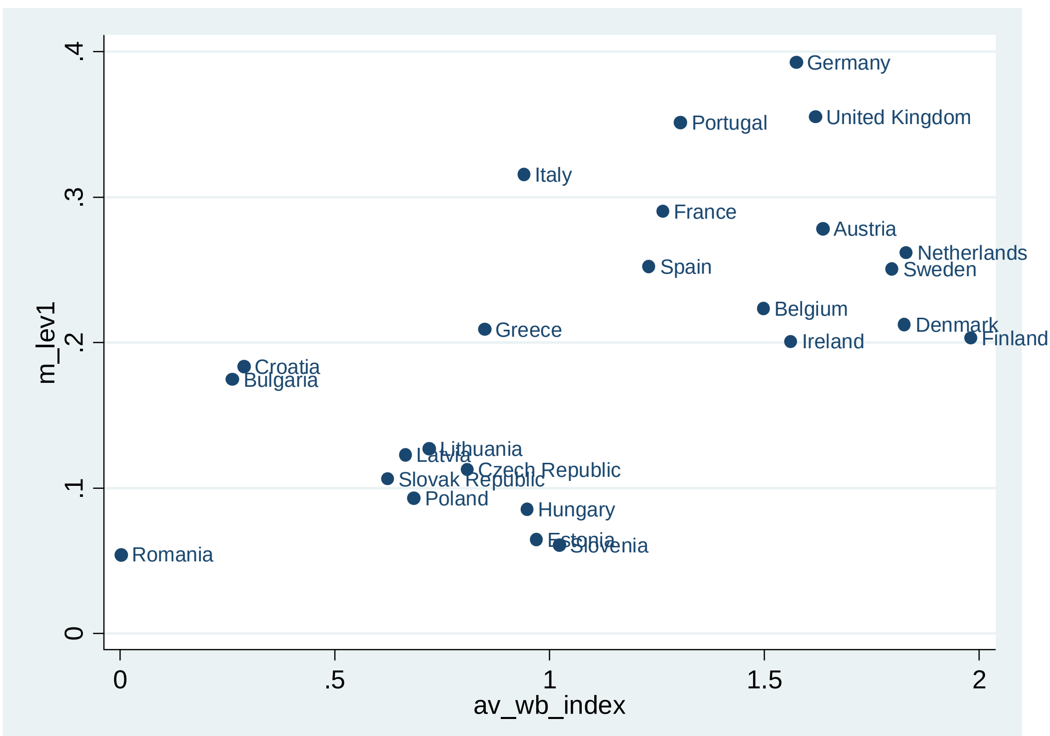
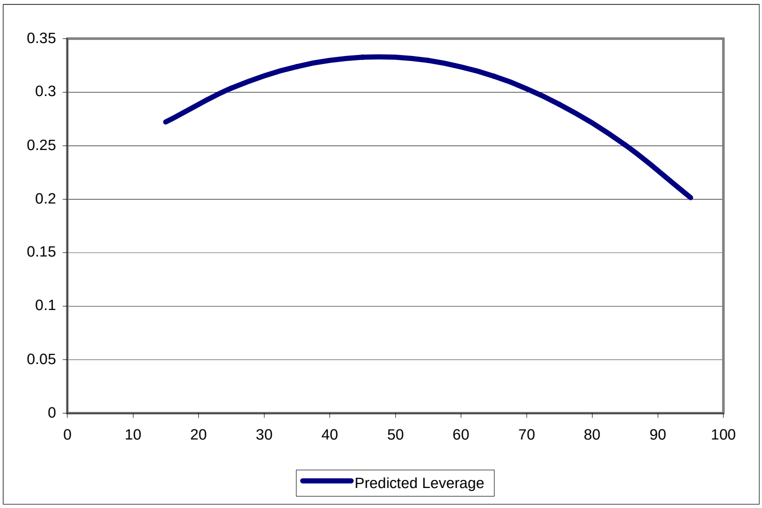
Chart 1: The Relationship between Leverage and Institutional Quality across Countries

This chart presents the relationship between leverage (measured as the mean of the long-term debt to total assets ratio of all firms in our sample) and institutional quality (av_wb_index), which is measured as the sum of six measures: (1) Voice and Accountability, (2) Political Stability, (3) Government Effectiveness, (4) Regulatory, (4) Quality, (5) Rule of Law, and (6) Control of Corruption. The indicators are constructed using an unobserved components methodology described in detail in Kaufmann, Kraay and Mastruzzi (2005). The six governance indicators are measured in units ranging from about –2.5 to 2.5, with higher values corresponding to better governance outcomes.



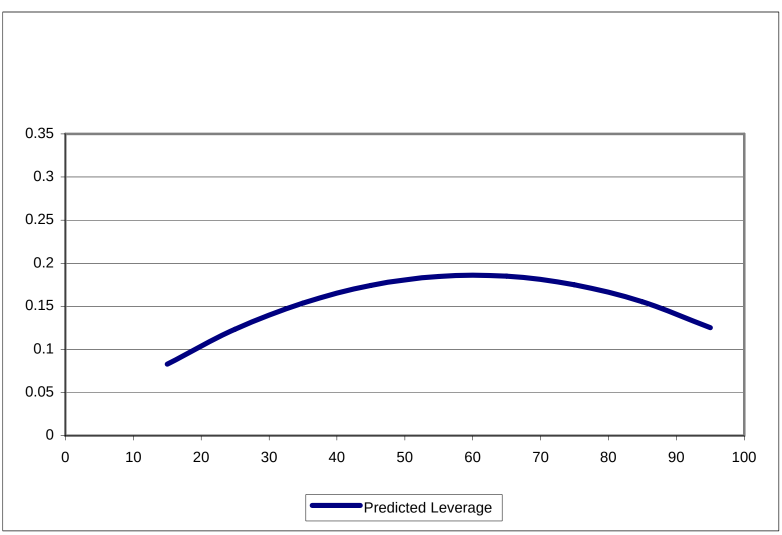
Source: Authors' calculations.

Chart 2: The Predicted Relationship between Leverage and Shareholder Concentration of Families in the EU-15



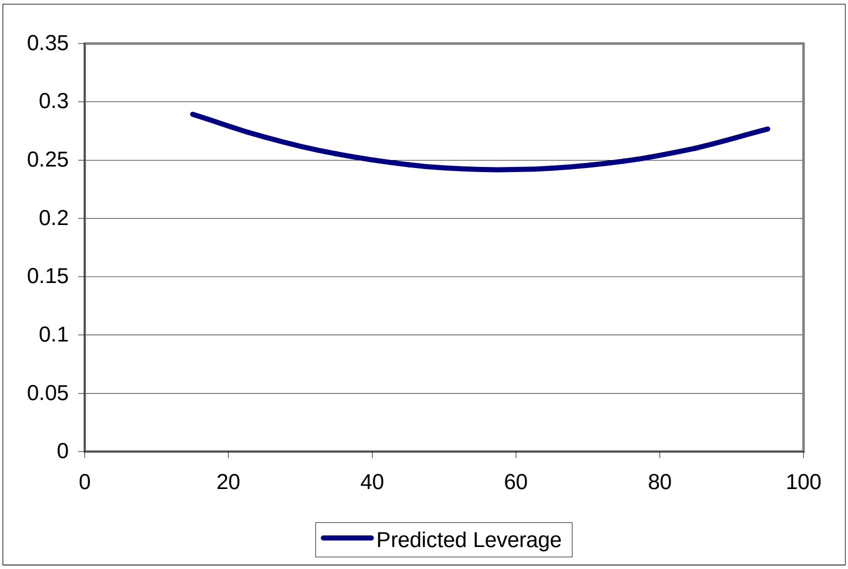
Source: Authors calculations.

Chart 3: The Predicted Relationship between Leverage and Shareholder Concentration of Corporations in the NMS



Source: Authors' calculations.

Chart 4: The Predicted Relationship between Leverage and Shareholder Concentration of Corporations in the EU-15



Source: Authors' calculations.

Table 1: Size of Capital Markets

Country	Bank deposits to GDP	Stock market capitalization to GDP	Private bond market cap. to GDP	Public bond market cap. to GDP
Austria	0.8086	0.1441	0.3137	0.3173
Belgium	0.7339	0.575	0.485	10.096
Denmark	0.5246	0.4437	10.459	0.5536
Finland	0.5039	0.8681	0.2964	0.2822
France	0.6056	0.5583	0.46	0.3829
Germany	0.736	0.3682	0.4937	0.2769
Greece	0.6097	0.4531	0.0204	0.7118
Ireland	0.606	0.6072	0.0709	0.3304
Italy	0.535	0.3179	0.336	0.9027
Netherlands	0.8336	0.9596	0.369	0.453
Portugal	0.8763	0.3009	0.1729	0.402
Spain	0.6748	0.5026	0.1696	0.419
Sweden	0.4006	0.8313	0.4844	0.4384
United Kingdom	0.8631	12.997	0.156	0.2993
EU-15	**0.6612**	**0.5873**	**0.3481**	**0.4842**
Bulgaria	0.3702	0.0445		
Croatia	0.3819	0.1493		
Czech Republic	0.5785	0.2114	0.0412	0.2234
Estonia	0.2304	0.2937		
Hungary	0.375	0.1657	0.0149	0.2651
Latvia	0.1829	0.0627		
Lithuania	0.158	0.124		
Poland	0.2876	0.0999	0	0.2819
Romania	0.1907	0.0384		
Slovak Republic	0.5359	0.062	0	0.1198
Slovenia	0.3634	0.1217		
CEE-Total	**0.3293**	**0.122**	**0.014**	**0.2225**
Developing - Total	0.4854	0.6461	0.074	0.1888
Japan	10.598	0.7305	0.4409	0.6913
United States	0.5602	10.791	0.9049	0.5135

Source: IMF, IFS. Data are for 2003.

Table 2: Debt Ratios

Country	Long-term debt ratio	Short-term debt ratio	Total debt ratio
Austria	0.2632	0.3139	0.5771
Belgium	0.2227	0.3283	0.551
Denmark	0.2012	0.3238	0.525
Finland	0.2087	0.3112	0.5199
France	0.3015	0.3904	0.692
Germany	0.3813	0.3031	0.6844
Greece	0.203	0.3834	0.5863
Ireland	0.1412	0.3204	0.4616
Italy	0.2841	0.3686	0.6526
Netherlands	0.2577	0.3495	0.6072
Portugal	0.3373	0.3978	0.7351
Spain	0.2536	0.3479	0.6016
Sweden	0.2619	0.2982	0.5601
United Kingdom	0.3407	0.3358	0.6765
EU-15	**0.2646**	**0.3427**	**0.6073**
Bulgaria	0.1574	0.3407	0.4981
Croatia	0.1697	0.2656	0.4353
Czech Republic	0.0941	0.2934	0.3875
Estonia	0.0645	0.3029	0.3674
Hungary	0.0603	0.3152	0.3756
Latvia	0.0888	0.1847	0.2735
Lithuania	0.1655	0.2373	0.4019
Poland	0.0957	0.4821	0.5805
Romania	0.0512	0.3393	0.3905
Slovak Republic	0.0958	0.3489	0.4447
Slovenia	0.0536	0.2755	0.329
CEE-Total	**0.1029**	**0.3043**	**0.4074**
Developing-Total	0.2221	0.2968	0.5191
Japan	0.2975	0.3908	0.6883
United States	0.4209	0.2079	0.6288

Source: OSIRIS database. Data are for 2003. The long term-debt is defined as the ratio of the long-term debt to total assets. The short-term debt is measured as the ratio of the short-term debt to total assets. Total debt is the ratio of the sum of the long-term and short-term debt divided by total assets.

Table 3: Debt Ratios by Years

Region	**2001**	**2002**	**2003**	**2004**	**Total**
EU-15					
Long-term debt	0.2638	0.2677	0.2767		0.2646
Short-term debt	0.3472	0.3353	0.3353		0.3427
Total debt	0.611	0.603	0.612		0.6073
CEE					
Long-term debt	0.0908	0.0983	0.113	0.1104	0.1029
Short-term debt	0.3207	0.2989	0.2982	0.3011	0.3043
Total debt	0.4112	0.3978	0.4112	0.4116	0.4074
Developing					
Long-term debt	0.2191	0.239	0.211		0.2221
Short-term debt	0.291	0.2952	0.3026		0.2968
Total debt	0.5111	0.5341	0.5135		0.5191
United States					
Long-term debt	0.4549	0.4979	0.4741		0.4209
Short-term debt	0.2191	0.203	0.1897		0.2079
Total debt	0.674	0.7009	0.6638		0.6288
Japan					
Long-term debt	0.2977	0.3052	0.2897		0.2975
Short-term debt	0.395	0.3962	0.381		0.3908
Total debt	0.6927	0.7013	0.6707		0.6883

Source: OSIRIS database.

Table 4: Correlation Matrix

	Long-term debt	**Lending rate**	**Tax_rate**	**Bank deposits/GDP**	**CPI**	**Real GDP growth**	**Index of institut-ional quality**
EU region							
Long-term debt	1						
Lending rate	-0.5212	1					
	0						
Tax rate	0.6309	-0.3993	1				
	0.0022	0.0656					
Bank deposits/GDP	0.699	-0.3015	0.6356	1			
	0	0	0.0008				
Inflation rate	-0.3639	0.5734	-0.0882	-0.1214	1		
	0.0013	0	0.682	0.0743			
Real GDP growth	-0.4479	0.2481	-0.8419	-0.4792	0.1064	1	
	0.0001	0.0184	0	0	0.2919		
Index of institutional quality	0.5744	-0.4243	0.4685	0.5608	-0.1897	-0.4116	1
	0	0	0.021	0	0.0043	0	
Share price change	-0.3121	0.3354	-0.463	-0.3593	0.2097	0.4324	-0.4081
	0.009	0	0.03	0	0.0024	0	0

Table 4 continued: Correlation Matrix

	Long-term debt	**Lending rate**	**Tax_rate**	**Bank deposits/GDP**	**CPI**	**Real GDP growth**	**Index of institut-ional quality**
EU-15							
Long-term debt	1						
Lending rate	-0.0511	1					
	0.781						
Tax rate	0.5454	0.2757	1				
	0.0666	0.362					
Bank deposits/GDP	0.4746	-0.2162	0.2167	1			
	0.003	0.0246	0.4568				
Inflation rate	0.0319	0.3796	-0.3448	0.2054	1		
	0.8511	0	0.2273	0.0256			
Real GDP growth	-0.3128	0.1416	-0.8063	-0.0815	0.5991	1	
	0.0595	0.3268	0.0005	0.5506	0		
Index of institutional quality	-0.1929	-0.3911	-0.2835	-0.0451	-0.4229	-0.1098	1
	0.2527	0	0.3261	0.5262	0	0.4206	
Share price change	0.1094	0.3586	0.1876	-0.075	0.1267	0.1082	-0.3495
	0.5192	0.0001	0.5206	0.2909	0.1574	0.4273	0

Table 4 continued: Correlation Matrix

	Long-term debt	**Lending rate**	**Tax_rate**	**Bank deposits/GDP**	**CPI**	**Real GDP growth**	**Index of institutional quality**
CEE							
Long-term debt	1						
Lending rate	-0.0362	1					
	0.8341						
Tax rate	-0.4744	-0.05	1				
	0.197	0.8983					
Bank deposits/GDP	-0.0305	-0.0222	0.5155	1			
	0.856	0.8355	0.1273				
Inflation rate	-0.3858	0.592	0.1587	-0.0635	1		
	0.0167	0	0.6615	0.5324			
Real GDP growth	0.2768	-0.3363	-0.6733	-0.4654	-0.2517	1	
	0.0925	0.0338	0.0328	0.0015	0.0993		
Index of institutional quality	-0.4173	-0.2397	0.1708	0.1569	-0.1983	0.0571	1
	0.0091	0.0229	0.637	0.0671	0.0491	0.7127	
Share price change	0.2217	0.1788	-0.5985	-0.1925	0.1702	0.469	-0.061
	0.2226	0.1329	0.117	0.0411	0.1288	0.0039	0.4824

Note: For data sources and definitions of the variables, see Section 3.

Table 5: Institutional Influences on Leverage

The table presents the coefficients of a regression equation estimated for the full sample of EU-15 and new member state companies, and for separate samples of EU-15 and new member state companies. The dependent variable is the long-term debt to total assets ratio. The independent variables are as follows. Institutional quality is measured as the sum of six measures: (1) Voice and Accountability, (2) Political Stability, (3) Government Effectiveness, (4) Regulatory, (4) Quality, (5) Rule of Law, and (6) Control of Corruption. The indicators are constructed using an unobserved components methodology described in detail in Kaufmann, Kraay and Mastruzzi (2005). Bank deposits/GDP is the ratio of bank deposits to GDP. Lending rate is the average country annual lending rate. Tax rate is measured by the tax rates compiled by the KPMG's annual survey of corporate tax rates (KPMG, 2003). The absolute values of the t-statistics are under the coefficients.

	Full Sample	**EU-15**	**NMS**	**Full Sample**	**EU-15**	**NMS**
Institutional quality	0.006	-0.039	-0.146			
	0.12	-0.64	-6.48			
Bank deposits/GDP				0.176	0.089	0.299
				2.34	1.08	1.50
Lending rate	-0.015	-0.022	0.000	-0.011	-0.013	-0.006
	-1.59	-1.39	-0.07	-1.76	-0.97	-0.68
Tax rate	0.006	0.006	-0.001	0.003	0.005	-0.009
	2.39	2.19	-0.64	1.14	2.03	-2.06
Observations	20	11	9	20	11	9
Adj-R-Sq.	0.46	0.22	0.87	0.59	0.30	0.19

Source: Authors' calculations.

Table 6: Ownership Categories and Leverage

This table presents comparisons of long-term debt levels as a fraction of total assets across direct ownership categories. We define a company as state-owned, if the largest direct shareholdings are held by the state and are at least 20%. Other types of ownership are defined similarly. Dispersed companies are those with no shareholder holding 20% of the outstanding shares. The comparisons are based on the means of the long-term debt ratio. For example, the state owned firms in the old member states (EU-15) have a 34.1% long-term debt ratio, whereas the same ratio is 27.7% for all other types of firms in the EU-15. The signs between the two means indicate the statistical significance of the debt levels (>: significantly greater at the 5% or better, <: significantly smaller at the 5% or better, and ≈: insignificantly different at the 5% significance level or better).

	EU 15				**NMS**		
State	0.341	>	0.277		0.237	>	0.141
Financial	0.292	≈	0.277		0.105	≈	0.144
Family	0.235	<	0.284		0.164	≈	0.147
Corporations	0.279	≈	0.276		0.145	≈	0.140
Mutual Funds	0.302	>	0.277		0.152	≈	0.142
Dispersed	0.283	≈	0.275		0.097	<	0.150

Source: Authors' calculations.

Table 7: Summary Statistics by Country in the EU-15 and NMS Samples

	ROA		**Size**		**Tangibility**		**Sales growth**		**SH1**	
Country	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Austria	0.046	0.095	12.869	1.716	0.348	0.212	0.203	0.243	50.01	17.38
Belgium	0.048	0.075	12.552	1.499	0.327	0.262	0.226	0.302	45.19	22.86
Denmark	0.034	0.117	12.251	1.458	0.326	0.181	0.168	0.419	26.91	16.63
Finland	0.036	0.113	12.355	1.813	0.309	0.208	0.276	0.381	30.00	21.24
France	0.062	0.042	15.319	1.091	0.225	0.163	0.193	0.157	44.77	21.96
Germany	0.063	0.059	14.874	1.111	0.294	0.167	0.223	0.526	46.11	30.32
Greece	0.073	0.062	12.218	1.244	0.313	0.180	0.296	0.427	42.54	19.69
Ireland	0.126	1.368	11.897	1.972	0.285	0.252	0.289	0.647	19.51	14.20
Italy	0.047	0.056	14.085	1.126	0.275	0.195	0.278	0.305	40.52	19.91
Netherlands	0.047	0.083	13.838	1.437	0.236	0.186	0.159	0.244	27.81	25.78
Portugal	0.010	0.097	12.756	1.723	0.321	0.178	0.173	0.176	39.72	23.85
Spain	0.064	0.051	13.577	1.563	0.356	0.204	0.411	1.402	29.33	19.73
Sweden	0.032	0.116	13.171	1.558	0.255	0.200	0.207	0.231	27.30	16.00
United Kingdom	0.073	0.067	15.472	0.456	0.346	0.275	0.161	0.246	11.51	10.45
EU-15	0.052	0.282	13.520	1.812	0.296	0.209	0.207	0.271	34.36	23.41

Table 7contintued: Summary Statistics by Country in the EU-15 and NMS Samples

	ROA		**Size**		**Tangibility**		**Sales growth**		**SH1**	
Country	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Bulgaria	0.026	0.072	9.682	0.904	0.509	0.190	0.207	0.501	63.620	23.525
Croatia	0.027	0.063	11.061	0.913	0.563	0.255	0.203	0.360	54.842	27.626
Czech Republic	0.044	0.095	12.159	1.202	0.562	0.211	0.149	0.348	58.263	32.305
Estonia	0.080	0.088	10.301	0.505	0.301	0.218	0.263	0.244	54.199	23.558
Hungary	0.052	0.073	11.768	1.720	0.431	0.185	0.264	0.893	34.261	26.760
Latvia	0.042	0.126	9.929	1.414	0.547	0.172	0.189	0.535	51.347	18.566
Lithuania	0.054	0.063	10.877	1.274	0.598	0.183	0.428	0.885	59.973	24.631
Poland	0.053	0.062	11.218	0.898	0.368	0.194	0.138	0.417	37.118	20.425
Romania	0.071	0.094	9.985	1.122	0.505	0.142	0.250	0.444	60.265	24.774
Slovak Republic	0.024	0.059	9.085	1.275	0.523	0.179	0.229	0.273	54.017	23.941
Slovenia	0.048	0.041	10.784	1.189	0.473	0.136	0.241	0.224	36.963	32.434
NMS	0.040	0.073	10.484	1.428	0.499	0.207	0.214	0.455	52.795	26.954
EU-15 & NMS	0.048	0.228	12.386	2.230	0.371	0.230	0.208	0.366	39.47	25.80

Source: Authors' calculations.

Table 8: The Determinants of Leverage in the EU-15 and the New Member States

The table presents the coefficients of a regression equation estimated for the full sample of EU-15 and new member state companies, and for separate samples of EU-15 and new member state companies. The dependent variable is the long-term debt to total assets ratio. The independent variables are defined as follows: ROA is the return on assets, defined as the ratio of earnings before interest and taxes to total assets. Size is the (natural) logarithm of total assets. Tangibility is the ratio of total fixed assets to total assets. Sales growth is the percentage change in sales. All equations include a full set of time, industry and country dummies. The absolute values of the t-statistics are under the coefficients.

	Full Sample	**EU-15**	**NMS**
ROA	-0.135	-0.167	-0.152
	(4.55)	(4.59)	(2.89)
Size	0.034	0.039	0.009
	(17.24)	(17.16)	(2.32)
Tangibility	0.132	0.181	0.028
	(9.68)	(10.55)	(1.19)
Sales Growth	-0.0002	-0.0002	-0.0035
	(2.08)	(2.18)	(1.00)
Country dummies	Yes	Yes	Yes
Time dummies	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes
Observations	2998	1874	1124
Adj- R-Sq	0.43	0.38	0.18

Source: Authors' calculations.

Table 9: The Impact of Ownership Identity

Table 9 presents the coefficient estimates of our basic model to explain the variation in the long-term debt to asset ratios for companies under State ownership, Financial company ownership, Family ownership, Non-financial corporate ownership, Mutual Fund ownership and with dispersed ownership structures. For each ownership category, we report the results for the full sample (All), for the sample of companies in the EU-15 countries (EU-15), and for the NMS. All equations include a full set of time and industry dummies, with the exception of state owned companies in the NMS sample, where we drop the industry dummies due to the number of degrees of freedom in such a small sample. The (absolute values) of the t-statistics are reported under the coefficients. The cut-off point for defining ownership identity is 20%.

	State			Financial			Family			Non-financial firm			Mutual fund			Dispersed		
	All	EU-15	NMS	All	EU-15	NMS	All	EU-15	NMS	All	EU-15	NMS	All	EU-15	NMS	All	EU-15	NMS
ROA	0.386	0.341	0.555	0.149	-0.234	0.473	-0.078	-0.283	0.435	-0.367	-0.420	-0.353	-0.621	-0.607	-0.267	-0.164	-0.147	0.149
	(0.60)	(0.29)	(0.61)	(0.56)	(0.65)	(0.83)	(0.76)	(2.46)	(1.96)	(6.41)	(5.63)	(4.27)	(3.49)	(2.75)	(0.96)	(2.63)	(2.23)	(0.89)
Size	0.057	0.095	-1.17	0.046	0.041	0.104	0.044	0.049	-0.010	0.044	0.043	-0.005	0.029	0.027	0.016	0.042	0.035	-0.004
	(2.85)	(2.85)	(-2.40)	(5.64)	(4.45)	(0.89)	(8.96)	(7.42)	(0.59)	(18.23)	(12.37)	(0.78)	(4.00)	(3.19)	(0.74)	(16.00)	(11.91)	(0.36)
Tangibility	0.502	0.004	0.968	0.150	0.233	-0.056	0.220	0.243	0.318	0.083	0.221	-0.055	0.005	0.058	0.356	0.100	0.133	0.151
	(2.23)	(0.01)	(0.53)	(2.34)	(3.10)	(0.16)	(4.41)	(3.34)	(3.65)	(3.54)	(7.49)	(1.40)	(0.007)	(0.48)	(2.92)	(3.93)	(5.02)	(1.74)
Sales Growth	-0.100	-0.204	-0.093	0.001	0.0007	-0.099	-0.007	-0.008	-0.011	0.004	0.012	-0.004	0.051	0.169	0.009	-0.0003	-0.0002	-0.033
	(0.88)	(1.33)	(-0.74)	(0.19)	(0.08)	(0.67)	(0.75)	(0.72)	(0.64)	(0.94)	(1.96)	(0.62)	(1.53)	(2.05)	(0.29)	(3.29)	(3.04)	(-1.31)
Observations	53	39	14	130	108	22	319	205	114	1140	639	501	131	89	42	800	705	95
Adj- R-Sq	0.57	0.28	0.43	0.56	0.54	0.47	0.31	0.35	0.32	0.31	0.39	0.15	0.54	0.52	0.67	0.39	0.37	0.66

Table 10: Non-Linear Impact of Shareholder Concentration

	Family				**Corporate**			
	EU-15		**NM**		**EU-15**		**NM**	
	OLS	**IV**	**OLS**	**IV**	**OLS**	**IV**	**OLS**	**IV**
SH1	0.005	0.0044	0.0013	-0.001	-0.0016	-0.0027	-0.0012	0.006
	(2.88)	(1.73)	(0.63)	(0.65)	(1.84)	(1.67)	(0.89)	(2.04)
SH1_2	-0.000054	-0.00004	-0.00001	0.00001	0.00001	0.00002	0.00001	-0.00005
	(2.81)	(1.50)	(0.79)	(0.43)	(1.99)	(1.67)	(1.16)	(2.02)
ROA	-0.267	-0.230	0.256	0.056	-0.340	-0.253	-0.328	-0.328
	(2.61)	(2.41)	(1.26)	(0.21)	(5.07)	(3.14)	(3-98)	(3.07)
Size	0.048	0.046	-0.003	-0.0008	0.038	0.042	-0.0005	-0.0028
	(8.88)	(11.54)	(0.23)	(0.06)	(11.76)	(14.84)	(0.07)	(0.55)
Tangibility	0.210	0.152	0.283	0.213	0.244	0.287	-0.049	0.098
	(3.30)	(2.95)	(3.64)	(3.79)	(8.88)	(11.07)	(1.28)	(3.12)
Sales Growth	-0.009	-0.016	-0.008	0.014	-0.0002	-0.0003	-0.008	-0.0018
	(0.84)	(2.67)	(0.54)	(0.85)	(2.77)	(11.54)	(1.27)	(0.50)
Obs.	239	239	136	136	748	748	523	523
Adj. R-Sqd	0.41	0.372	0.30	0.10	0.38	0.34	0.13	0.03

Source: Authors' calculations.

Appendix

Table 1A: Ownership Structure by Country and Region
(the Fraction of Companies under the Six Ownership Categories in Each Country)

Country	State	Financial	Families	Corporate	Mutuals	Dispersed
Austria	7.55%	3.77%	17.12%	50.00%	0.00%	20.75%
Belgium	0.00%	17.28%	4.48%	40.23%	5.95%	32.01%
Denmark	1.51%	2.26%	8.68%	34.34%	13.96%	38.49%
Finland	6.11%	1.93%	14.24%	31.19%	3.54%	42.44%
France	0.58%	4.09%	7.02%	38.30%	5.85%	44.15%
Germany	1.24%	4.95%	15.10%	40.87%	2.48%	34.06%
Greece	0.00%	2.13%	37.56%	34.57%	4.26%	19.68%
Ireland	0.00%	0.00%	11.84%	19.67%	6.56%	59.02%
Italy	11.18%	15.59%	7.54%	45.29%	0.88%	19.12%
Netherlands	2.45%	7.36%	3.75%	25.15%	1.53%	59.20%
Portugal	0.00%	8.79%	9.89%	53.85%	5.49%	21.98%
Spain	0.00%	3.85%	6.59%	49.18%	1.10%	39.29%
Sweden	0.28%	3.35%	18.31%	28.77%	13.41%	35.47%
United Kingdom	0.00%	3.14%	1.69%	7.06%	2.75%	85.10%
Total	**2.19%**	**6.21%**	**10.59%**	**35.70%**	**4.95%**	**39.74%**
Bulgaria	0.00%	2.27%	9.92%	84.42%	0.00%	3.40%
Croatia	3.67%	1.33%	18.90%	49.00%	12.00%	13.33%
Czech Republic	0.00%	11.54%	0.00%	57.69%	11.54%	19.23%
Estonia	0.00%	0.00%	33.33%	66.67%	0.00%	0.00%
Hungary	0.00%	0.00%	0.00%	42.86%	14.29%	42.86%
Latvia	0.00%	0.00%	26.67%	63.64%	0.00%	0.00%
Lithuania	0.00%	6.45%	9.38%	74.19%	3.23%	6.45%
Poland	4.70%	1.88%	20.49%	42.01%	3.76%	24.14%
Romania	2.33%	4.65%	5.00%	63.95%	12.79%	4.65%
Slovak Republic	0.00%	0.00%	0.00%	100.00%	0.00%	0.00%
Slovenia	0.00%	0.00%	0.00%	46.88%	0.00%	53.13%
Total	**1.90%**	**2.85%**	**9.92%**	**60.80%**	**5.64%**	**13.72%**

Table 2A: Regression Results by Individual Countries in the EU-15 Sample

	AT	BE	DK	FI	FR	DE	GR	IE	IT	NL	PT	ES	SE	UK
ROA	0.146	-0.304	-0.094	-0.071	-0.801	-0.636	-0.423	0.350	-0.307	0.119	-0.432	-0.468	-0.135	-0.326
	0.62	-2.01	-0.86	-0.83	-2.64	-3.66	-1.39	2.67	-1.44	1.05	-2.34	-2.23	-0.94	-1.90
Size	0.038	0.032	0.012	0.012	0.060	0.006	0.066	0.038	0.044	0.064	0.083	0.048	0.025	0.010
	1.59	3.95	1.39	2.24	5.38	0.81	4.82	2.72	4.92	9.26	5.78	5.55	2.83	0.32
Tangibility	0.233	0.196	0.245	0.247	0.276	0.300	-0.068	-0.146	0.304	0.079	-0.200	0.235	0.163	0.177
	0.88	3.90	3.18	4.41	3.71	4.17	-0.48	-1.00	4.96	1.26	-1.79	3.84	2.01	2.15
Sales Growth	-0.076	-0.001	0.025	0.027	0.015	-0.013	-0.013	0.006	-0.004	-0.071	-0.111	0.017	0.000	-0.114
	-0.76	-1.34	1.13	1.30	0.21	-0.90	-1.25	0.17	-0.54	-1.88	-1.16	2.53	-1.69	-1.89
Intercept	-0.293	-0.248	-0.024	-0.012	-0.660	0.256	-0.555	-0.235	-0.408	-0.642	-0.625	-0.458	-0.120	0.166
	-1.08	-2.39	-0.20	-0.17	-3.57	2.18	-3.30	-1.34	-3.13	-6.51	-3.31	-3.95	-0.98	0.33
N	52	155	134	155	154	167	92	66	158	180	90	169	169	133
Adj. R-Sqd	0.62	0.38	0.4	0.59	0.44	0.55	0.53	0.6	0.5	0.48	0.52	0.45	0.35	0.54

Table 3A: Regression Results by Individual Countries in the NMS Sample

	BG	HR	CZ	EE	HU	LV	LT	PL	RO	SK	SI
ROA	-0.394	-0.331	-0.371	-0.651	-0.117	0.087	-0.077	0.113	-0.281	-0.325	-0.521
	-2.04	-1.76	-3.43	-1.54	-0.62	0.75	-0.26	0.79	-1.56	-2.24	-2.54
Size	0.004	0.008	-0.006	0.400	0.007	-0.055	0.019	-0.025	0.043	-0.019	0.016
	0.23	0.69	-0.41	2.07	0.4	-1.32	0.69	-2.64	2.91	-2.04	2.31
Tangibility	-0.153	0.061	0.292	0.533	0.412	-0.303	-0.068	0.297	-0.017	-0.134	-0.014
	-2.02	1.07	3.43	1.23	1.9	-1.32	-0.42	6.1	-0.13	-2.19	-0.26
Sales Growth	-0.007	-0.001	-0.004	-0.150	-0.002	0.012	-0.007	0.008	0.016	0.062	-0.006
	-0.71	-0.12	-0.16	-1.81	-0.15	0.37	-0.24	0.66	0.5	1.99	-1.91
Intercept	0.231	0.060	0.032	-4.062	-0.187	0.848	-0.027	0.257	-0.351	0.344	-0.071
	1.42	0.43	0.17	-2.03	-1.07	1.55	-0.08	2.39	-2.01	3.39	-0.84
N	235	182	92	17	22	31	58	169	97	146	75
Adj. R-Sqd	0.07	0.44	0.35	0.79	0.27	0.51	0.09	0.29	0.10	0.15	0.30

Central Bank Sterilization Policy: The Experiences of Slovenia and Lessons for Countries in Southeastern Europe[1]

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1. Introduction

It is well known that countries in the Southeastern European (SEE) region have experienced a substantial and gradually intensified inflow of foreign capital during the entire period of economic transition (Markievicz, 2006). Central banks in those countries had to adapt their monetary policy operations and exchange rate regimes to the changing conditions. Especially in those countries that responded by implementing a managed floating exchange rate regime, central banks had to find viable solutions in order to support the "consistency triangle" policy framework (Bofinger and Wollmershaeuser, 2001). Advocates of the "consistency triangle" policy framework claim that simultaneous determination of the optimum interest rate level and the optimum exchange rate path is possible. Effective sterilization procedures need to be activated by the central bank in order for the policy framework to be operational.

The experiences of some developing countries in the 1990s confirm the viability of sterilization as a key element of the central bank's monetary policy in circumstances of intensified inflow of foreign capital (Lee, 1996). However, certain limitations to this kind of strategy exist, which in most cases central banks need to address properly by developing alternative procedures and instruments instead of classical open-market operations. Namely, the use of classical open-market operations does not happen to be a feasible strategy in most countries, since

[1] The views expressed are those of the authors and do not necessarily reflect those of the institutions with which the authors are affiliated.

money markets and money market instruments in developing/transition economies are usually underdeveloped.

In this paper we first review some sterilization practices and general characteristics of sterilization-based monetary policy approaches presented in the literature to date. The main objective of the paper is to elaborate sterilization practices implemented by Banka Slovenije in the period from the introduction of Slovenian tolar as the national currency at the beginning of the 1990s, till entry into the ERM2 mechanism and consequent adoption of the euro. The case of the Slovenian central bank is analysed in comparison to five central banks in countries of the SEE region, by using an approach based on decomposition of stylized central bank balance sheets. Some innovative approaches to sterilization operations conducted by Banka Slovenije could be employed in other countries in the SEE region, especially in those facing intensified foreign capital inflow.

The rest of the paper is structured as follows: first, we give a brief overview of the general findings published so far regarding central banks' sterilization practices in developing countries (section 2). In section 3 we discuss the relevance of sterilization policies for a select set comprising Slovenia and five SEE countries. This is followed by a more detailed presentation of Bank of Slovenia sterilization practices and lessons that can be drawn from Slovenian experiences (section 4). The paper concludes in section 5 with a summary of the main conclusions and findings.

2. The Role of Sterilization in Central Banks of Developing Countries

As long as the financial sector is relatively closed and dominated by commercial banks, central banks can exercise monetary control by the setting of two parameters: reserve requirements against demand deposits at commercial banks, and the discount rate on bank borrowing from the central bank (Van't Dack, 1999). Eastern European economies faced this kind of circumstances in the pre-transition period, while the beginning of the transition accelerated the opening of the economy and the development of the financial sector. Both processes decisively affected the operations of central banks in those countries, since central banks needed to make adjustments in their monetary policy frameworks and supporting operations.

Because of the high inflation environment and greater economic openness in most transition countries at the beginning of the 1990s, the choice of the exchange rate regime became of great significance for central banks in these countries. The so-called "inconsistency triangle" has traditionally provided a framework for analysis of the relevant arrangements in exchange rate policy. Following this framework, a country can choose between three different options (Bofinger and Wollmershaeuser, 2001):

- a fixed exchange rate without an autonomous interest rate policy and free capital mobility;
- an autonomous interest rate policy with a freely floating exchange rate and free capital mobility; or
- capital controls and a combination of fixed exchange rate and autonomous interest rate policy.

However, the inconsistency triangle framework is based on three-corner solutions, which involve only two diametrically opposed foreign exchange solutions: either completely fixed or completely flexible exchange rates. It does not say anything about the policy of managed floating, where the exchange rate is neither fixed nor flexible. Floating exchange rate arrangements mean that the exchange rate is targeted along an unannounced path and the central bank intervenes in order to keep the exchange rate close to the target path (Bofinger and Wollmershaeuser, 2001).

The concept of the floating exchange rate regime turns the "inconsistency triangle" framework into the "consistency triangle" framework. Advocates of the latter claim that simultaneous determination of the optimum interest rate level and the optimum exchange rate path is possible (Bofinger and Wollmershaeuser, 2001). The case of Central and Eastern European (CEE) countries shows that many transitional countries entered the transition process with pegged exchange rates, while during the 1990s many of them gradually opted for more flexible exchange rate strategies (Markiewicz, 2006). However, some countries (e.g. Slovenia and Romania) have stuck to managed floating exchange rate arrangements from the very beginning of the transition and have not altered exchange rate policies substantially.

In most transition economies, decisions on suitable foreign exchange rate regimes were tightly related to the external balance situations. Namely, considerable external imbalances due to substantial capital inflow and current account deficits made central banks concentrate heavily on foreign exchange policies. Capital inflow can become a serious threat to monetary stability, especially if a central bank decides to maintain a target rate that is higher than the equilibrium (market) rate, since the excess supply of foreign currency has to be purchased by the central bank in exchange for domestic currency. Consequently, the optimal level of domestic reserves in the banking sector can be exceeded, stimulating credit extension over the desired levels. As a result, the central bank needs to withdraw excess liquidity through the use of sterilization measures.

In principle, a central bank can operate to set policy with either *ex ante* shortages or surpluses. Generally central banks prefer to operate with *ex ante* reserve shortages, which means that they act in the market as net creditors. To the contrary, if central banks operate with *ex ante* reserve surpluses, they act in the market as net debtors. In a shortage situation, the central bank finds itself in a monopoly position as a lender to the market; as a monopoly supplier of reserves, it is able to engage in credit transactions with counterparties as a price setter, thereby setting the marginal price of the commercial banks' liabilities (Ganley, 2002).

In the instance that the banking system experiences a surplus, the central bank intervenes to withdraw reserves. It can do this by running down its assets, and/or it may sell foreign currency or financial assets, such as central bank bills. These transactions impact the asset side of commercial bank balance sheets, and therefore the central bank can influence the yield on commercial bank assets, rather than the value of their liabilities.

The key difference between reserve shortage and reserve surplus situations is that in the case of the latter, the central bank is not a monopoly supplier of financial assets per se (Ganley, 2002). As a result, in a liquidity surplus situation, where commercial banks actually have improved liquidity, they are not compelled to participate in reserve absorption operations conducted by the central bank. Commercial banks have the option, but not the obligation, to purchase financial assets offered by the central bank. Therefore the participation of commercial banks in central bank absorption operations depends on the commercial banks' asset demand preferences, which also depend on alternative investment opportunities in the market and their returns. The central bank can raise the attractiveness of absorption operations either by offering higher returns on financial assets offered to the market, or by acting as an exclusive provider of specific financial assets demanded by commercial banks, usually as reserve assets. In this respect the central bank can typically act on the market as a monopoly supplier of risk-free assets, especially in environments with undeveloped money markets. If commercial banks see the central bank as a monopoly provider of risk-free assets, then it is much easier to get the banks to participate in liquidity withdrawal operations.

So, if a central bank decides in favour of managed floating exchange rate arrangements and at the same time operates in an environment of permanent external imbalances, especially characterized by a constant inflow of foreign capital, the implementation of efficient sterilization operations is an inevitable task.

The experience of some developing countries in the 1990s confirms the viability of sterilization as a key element of the central bank's monetary policy in the case of an increased inflow of foreign capital (Lee, 1996). The study made a detailed analysis of six developing countries (Chile, Colombia, Indonesia, Korea, Spain and Thailand) which faced severe surges in capital inflow back in the 1990s. The main findings can be summarized as follows:

- Sterilization instruments could not be applied continuously, as the outstanding stock of open-market bills rose sharply in most countries during the inflow episode.
- The size of open-market sales for sterilization purposes was limited by the absorptive capacity of the domestic economy and especially by the stage of development of local securities markets (thin and illiquid markets prevented

the continuous implementation of open-market operations as the main instrument of monetary policy).

- Operations proved to be extremely costly for central banks in terms of the loss of operating income.
- In some instances the implementation of sterilization procedures resulted in higher domestic interest rates, which attracted additional capital inflow.

Due to all the aforementioned reasons, most countries gradually stopped using open-market sales in their sterilization operations. Subsequently, the authorities in these countries began to supplement their initial response with changes in underlying policies, such as fiscal adjustment, easing of restrictions on capital outflows, acceleration of trade liberalization, and a more flexible exchange rate policy that allowed for nominal appreciation. Some countries introduced more novel sterilization measures, such as swap operations in the foreign exchange market (Indonesia) or adjustment of government deposits (Thailand). Many sought to combine the (first-best) indirect instruments of monetary policy with some direct controls on capital inflow, although other controls were more in indirect forms.

Studying the cases of the six developing countries, Lee (1996) further tries to find answers to two additional questions:

- What are the practical limits on the use of sterilization as a monetary policy strategy?
- Can the scope of sterilization be expanded or its costs reduced through new or unconventional instruments?

As regards practical limits on the use of sterilization, Lee (1996) identifies four key factors that limit the effective range of open-market sterilization procedures:

1. The ability to sterilize capital inflow is inversely related to the degree of international capital mobility. With increasing international capital mobility the effectiveness of sterilization operations can deteriorate, since sterilization efforts are usually quickly overwhelmed by continuing inflows. Lee (1996) even claims that in the extreme, when capital is perfectly mobile, sterilization is completely ineffective.
2. Sterilization policy fundamentally cannot work over an extended period of time when shocks are durable, because sterilization seeks to deal with the effects, rather than the underlying causes of shocks. So practically any particular sterilization can be useful as a temporary measure to be employed until the primary cause of the inflow can be identified and more fundamental policy measures curing the primary cause can be implemented.
3. Particularly in developing countries, the scope of classical open-market operations can be severely restricted by the underdeveloped state of financial markets and the fiscal costs which these operations entail. These restrictions can be summarized as follows:

   a. Sterilization instruments are usually not perfect substitutes for the financial assets which market participants (investors) wish to hold. As a result, sterilization efforts may push up the interest rates on sterilization instruments, and thus also the required market rate of return.

b. Authorities' sterilization capacities are usually limited by an inadequate supply of marketable instruments, which means that the central bank needs to develop sterilization instruments.

c. The scale of sterilization operations can be limited by thin and segmented markets – conditions that usually accompany an inadequate supply of marketable instruments.

4. Heavy fiscal costs may eventually curtail sterilization operations. Lee (1996) divides fiscal costs into three categories: debt-service burden costs, possible operating losses at the central bank, and potential vulnerability to capital flow reversal.

Because of the aforementioned practical limits, it is desirable for monetary authorities to seek techniques and instruments which could expand the scope of effective sterilization operations. In practice it may be necessary to use classical open-market operations in combination with some supplementary sterilization measures (e.g. discount policy and direct lending, reserve requirements, government deposits, foreign exchange swap), or even with more direct controls on capital inflows, such as a variable deposit requirement on foreign borrowings or an interest equalization tax on certain capital transactions.

Before we turn to the case of Slovenia and the presentation of techniques and instruments employed by Banka Slovenije to provide effective sterilization, we shall examine some challenges to sterilization in selected SEE countries.

3. Relevance of Sterilization Issues in Selected SEE Countries

As the implementation of sterilization procedures, in terms of magnitude and structure, is tightly related to the issue of surplus reserves in the banking system, we need to understand the formation of the reserves position in the banking system in order to be able to discuss the implementation of adequate sterilization measures.

According to Ganley (2002), "A thorough appreciation of the workings of the central bank balance sheet is fundamental to an understanding of the way in which surplus reserves arise in practice." Regardless of the central banks' choice of operating target, each central bank relies on its ability to manage the balance sheet (Schaechter, 2001). Depending on the targeting approach, a central bank's balance sheet adjustments appear as endogenous or, alternatively, exogenous. Namely, when targeting interest rates, the adjustments on the balance sheet are only a reflection of the quantities needed to achieve a predetermined rate. Alternatively, when a central bank targets quantities, it determines and steers the quantity and accepts the resulting interest rate, which becomes endogenous (Schaechter, 2001). So, in the case of price targeting, changes in the central bank balance sheet become endogenous, while they are exogenous in the case of quantity targeting (Ganley, 2002).

As a rule, central banks in transitional and/or emerging economies have to deal with surplus instead of deficit liquidity positions in the banking system, since these economies often attract a sizeable capital inflow as they open and undergo privatization (Ganley, 2002). Generally, two major types of changes on central bank balance sheets can be a source of surplus reserves in the banking sector:

1. increases in net foreign assets, which are linked to current account balance and exchange rate, and/or to capital account inflow; and
2. increases in net lending to the government, which are a direct consequence of the monetization of the fiscal deficit.

In the rest of this section, we shall try to identify developments in the net liquidity positions of central banks in Slovenia and five countries in the SEE region that could be considered prospective euro area members (Bulgaria, Romania, Croatia), or at least strong aspirants for such a status in the more distant future (Macedonia, Albania). Decomposition of central bank balance sheets is used as a tool for the detection of liquidity positions (surplus or deficit) and identification of approaches (instruments) used by central banks for the management of their liquidity positions.

The data presented later in this section clearly show that all central banks included in this study primarily need to deal with surplus liquidity positions, and therefore to employ instruments (approaches) for mopping up excess liquidity from the banking sector. To this end, they can use market-based or non-market approaches. Market-based approaches involve any financial transaction between a central bank and its counterparties which leads to the withdrawal of liquidity. Liquidity absorption transactions should create a regular shortage in the market, but in practice this is rarely achieved (Ganley, 2002). The non-market approach involves quantitative barriers, rules or restrictions on market activity, which try to keep potential injections of liquidity outside the banking system. The latter of the two approaches involves increases in reserve requirements as well. Of course neither of the approaches, non-market nor market-based, is likely in itself to remove the underlying causes of surplus reserves (Ganley, 2002).

In order to analyze the magnitude and dynamics of surplus reserves in the banking sectors of individual countries, we shall use a simple decomposition of central bank balance sheets. By using IFS statistics, we first try to construct a stylized central bank balance sheet for each country, as depicted in table 1.

Table 1: A Stylized Central Bank Balance Sheet

Assets	***Liabilities***
Net foreign assets (NFA)	Cash in public circulation (Cash)
Net lending to government (NLG)	Bank reserves
Net lending to banks (NLB)	–
Net other items	–

Source: Ganley (2002).

Based on the stylized balance sheet, we are able to calculate the "cumulative autonomous liquidity position"[2] for each country on a quarterly basis. The cumulative position depicts the historical activities of the central bank as they are reflected in individual central bank balance sheet items. So, for example, the stock of "net foreign assets" (NFA) reflects the cumulative injection (if "foreign assets" > "foreign liabilities") or cumulative withdrawal (if "foreign assets" < "foreign liabilities") of liquidity in the banking system to date. Similarly, the stock of "net lending to government" (NLG) reflects the cumulative injection (if "claims on government" > "government deposits") or cumulative withdrawal (if "claims on government" < "government deposits") of liquidity in the banking system to date.

$$\begin{aligned}
&\textit{Cumulative Autonomous position} = \\
&\quad = (\textit{Foreign Assets} - \textit{Foreign Liabilities}) + \\
&\quad + (\textit{Claims on Central Government} - \textit{Central Government Deposits}) + \\
&\quad + (-\textit{Currency Outside Banks}) + \\
&\quad +/- \textit{Other Items}\ (\textit{net})
\end{aligned}$$

Developments in the three main contributing factors (net foreign assets, net lending to government, cash in public circulation) to the cumulative autonomous position in selected countries are displayed in tables 2 and 3. All three contributing factors are expressed relatively in terms of GDP, so we can compare three different ratios: NFA to GDP, NLG to GDP, and cash to GDP.

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[2] Borio (1997) and Ganley (2002) define the autonomous liquidity position (ALP) as a result of changes in major sub-segments of the central bank balance sheet:

$$ALP = \Delta NFA + \Delta NLG + \Delta\ \text{Other net items} - \Delta\ \text{Cash}$$

Therefore we have chosen to denote the net positions calculated on the levels as cumulative net position.

Four major conclusions can be drawn by observing the ratios:

1. In all six countries the NFA to GDP ratio has increased dramatically in the period from the beginning of the 1990s to the end of 2005. With only a few exceptions (e.g. Albania and Romania in the first half of the 1990s), NFA positions have always been positive, meaning that the NFA continuously contributed to the injection of liquidity into the banking sectors of individual countries.
2. NFA positions strongly dominated NLG positions in all countries after the year 2000. These characteristics clearly indicate the crucial importance of foreign currency capital flows for domestic liquidity in all observed countries.
3. The NLG to GDP ratio has demonstrated quite different dynamics and directions of movement in different countries and different sub-periods. In some countries, NLG cumulatively provided an injection of additional liquidity into the system (e.g. Albania), while in other countries (e.g. Slovenia) the government cumulatively was a net depositor with the central bank and therefore did not increase the cumulative net liquidity position of the banking system.
4. The cash-in-circulation to GDP ratio as an important absorption factor has cumulatively increased in most of the countries, the only exception being Romania, although this growth has not been as strong as in the case of the NFA to GDP ratio.

Table 2: Autonomous Components of the Cumulative Autonomous Position Expressed as a Percent of GDP in Slovenia, Croatia and Macedonia

	Slovenia			Croatia			Macedonia		
Year	NFA/GDP	NLG/GDP	CASH/GDP	NFA/GDP	NLG/GDP	CASH/GDP	NFA/GDP	NLG/GDP	CASH/GDP
1992	4.4%	0.3%	-1.6%	0.1%	0.0%	-0.1%	0.0%	0.0%	0.0%
1995	9.2%	-0.7%	-2.2%	8.4%	-0.3%	-3.1%	4.1%	0.6%	-2.9%
2000	16.6%	-1.1%	-2.6%	16.5%	-0.6%	-3.9%	14.7%	-3.8%	-3.4%
2005	25.1%	-1.2%	-2.7%	23.7%	-0.3%	-5.4%	18.7%	-4.5%	-5.0%

Source: IFS and authors' calculations.

Table 3: Autonomous Components of the Cumulative Autonomous Position Expressed as a Percent of GDP in Albania, Bulgaria and Romania

	Albania			Bulgaria			Romania		
Year	NFA/GDP	NLG/GDP	CASH/GDP	NFA/GDP	NLG/GDP	CASH/GDP	NFA/GDP	NLG/GDP	CASH/GDP
1992	0.0%	0.0%	0.0%	3.2%	2.7%	-7.4%	-0.7%	0.1%	-5.3%
1995	-5.4%	18.4%	-15.2%	5.7%	4.2%	-5.7%	-0.2%	-1.2%	-3.9%
2000	11.1%	13.7%	-17.0%	14.7%	0.4%	-7.7%	6.0%	1.6%	-2.7%
2005	15.2%	7.0%	-16.6%	29.8%	-5.3%	-11.9%	20.3%	-1.9%	-3.5%

Source: IFS and authors' calculations.

Evidently, in all countries except Albania, NFAs strongly dominate NLG in their contribution to the cumulative liquidity position in the banking sector. Further inspection of data as they are presented in table 4 and chart 1 reveals the annual dynamics of contributing factors across countries. It is very obvious that in the Slovenian banking sector, net foreign exchange inflows have represented the heaviest burden for the national central bank relatively speaking, because the share of NFAs in the GDP has risen to more than 25%. Clearly Banka Slovenije was compelled to develop adequate offsetting operations enabling it to manage excess liquidity efficiently.

When observing NFA dynamics, the growth trend of the proportion of NFA in GDP can be clearly identified for all six countries in the sample. Likewise, one can easily recognize important differences across countries. So, for example, the NFA of Banka Slovenije amounted to 4.4% of GDP in the beginning of the observation period, while Albanian, Croatian, Romanian and Macedonian banks at the same time experienced NFA-to-GDP ratios close to zero. Only in the case of the Bulgarian central bank, with 3.2%, did the situation happen to be similar to that of Slovenia. In the first half of the 1990s, only the Slovenian and Croatian central banks experienced steady growth in the NFA-to-GDP ratio, which in the case of Banka Slovenije climbed to 10%, and in case of the Croatian National Bank to 9.7% by the end of the year 1996. In rest of the countries, including Bulgaria, the ratio stayed at levels close to 5% or substantially less.

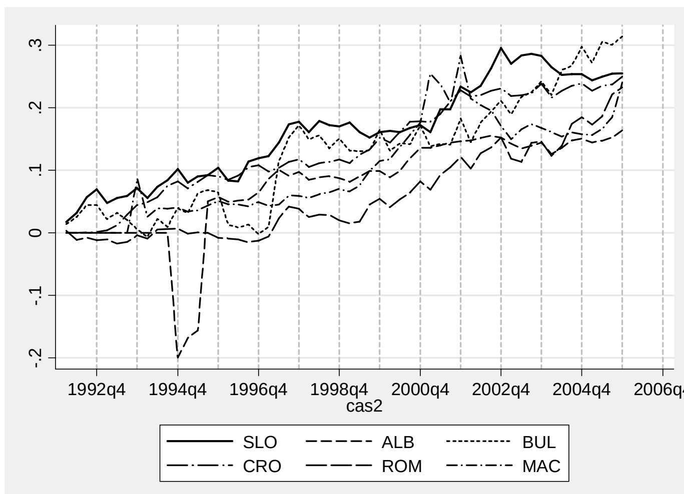
Table 4: Proportion of NFA in GDP in Individual Countries for the Period 1992–2005

	SLO	ALB	BUL	CRO	ROM	MAC
1992	4.4%	0.0%	3.2%	0.1%	-0.7%	0.0%
1993	5.9%	0.0%	2.0%	2.2%	-1.2%	2.2%
1994	7.9%	-5.0%	1.6%	6.6%	0.2%	3.6%
1995	9.2%	-5.4%	5.7%	8.4%	-0.2%	4.1%
1996	10.0%	5.5%	0.8%	9.7%	-1.2%	4.6%
1997	15.4%	9.4%	11.2%	10.8%	2.4%	5.2%
1998	17.0%	8.8%	14.8%	11.2%	2.6%	6.3%
1999	16.3%	9.2%	14.0%	13.0%	3.3%	8.9%
2000	16.6%	11.1%	14.7%	16.5%	6.0%	14.7%
2001	19.7%	14.2%	15.1%	20.1%	9.7%	24.6%
2002	25.4%	15.1%	18.1%	22.4%	13.0%	19.6%
2003	28.0%	14.0%	21.8%	22.5%	13.0%	16.4%
2004	25.6%	14.0%	26.1%	22.9%	15.5%	15.8%
2005	25.1%	15.2%	29.8%	23.7%	20.3%	18.7%
Period 92-05	16.2%	7.6%	12.8%	13.6%	5.9%	10.3%

Source: International Financial Statistics.

Central banks confronted by surplus cumulative liquidity positions need to react adequately to those positions in order to equilibrate liquidity in the banking system. Again, the cumulative consequences of these reactions are always, directly or indirectly, reflected on the central bank balance sheet. In order to observe different types of central bank reactions, we shall again analyze stylized central bank balance sheets in the six selected countries.

Chart 1: Proportion of NFA in GDP in Individual Countries for the Period 1992–2005



Source: IFS and authors' calculations

In tables 5 through 9 we can see cumulative autonomous liquidity positions expressed as a share of GDP.[3] Ratios are calculated across countries for each five years of the entire observation period. The size of the autonomous position actually determines the volume of the necessary offsetting sterilization measures. Namely, net foreign assets and net lending to government first need to be adjusted for the currency in circulation outside banks. Currency not possessed by deposit money banks is also considered to be an autonomous factor, and it usually works in just the opposite direction as NFAs or NLG. The resultant position can be considered a sterilization target for each central bank.

In all countries except Bulgaria and partially Albania, the share of the individual country's cumulative autonomous liquidity position in GDP has increased since the

[3] The table for Romania is not displayed because of the unavailability of data on the autonomous position's offsetting factors. Proportions of the autonomous position in GDP are as follows: in 1992, –1.1%; in 1995, –3.7%; in 2000, 4.8%; and in 2005, 15.4%.

beginning of 1990s, reaching its peak values after the year 2000. This kind of dynamics closely followed the dynamics of NFAs in individual countries, where accelerated privatization processes and intensified foreign investments were a reason for increased NFAs. The increase of cash outside banks as the most important offsetting factor obviously has not had a significant impact on movements in the total cumulative autonomous liquidity position.

A brief comparison of the cumulative autonomous liquidity positions across countries reveals that the Slovenian central bank had to confront the largest autonomous positions, which represented 20.9% of GDP at the year end 2005. Similarly, the autonomous position as a share in GDP was relatively high in the case of the Croatian National Bank (18.2% of GDP at the end of 2005) and somewhat lower in the case of the Romanian central bank (15.4% at the end of 2005) and the case of the Bulgarian central bank (10.8% at the end of 2005). In Albania and Macedonia, cumulative autonomous positions represented less than 10% of GDP at the end of 2005. Obviously the Slovenian central bank in particular was confronted with a most challenging situation as regards the need for sterilization of excess liquidity in the banking sector, stemming mostly from NFAs.

Data presented in tables 5 through 9 also describe the type and intensity of offsetting activities of the central banks, which had to react to the autonomous positions. Of course we need to be aware of all the limitations of comparisons, since the IFS data enabled us to construct only stylized central bank balance sheets, which means that not necessarily all peculiarities of specific central bank operations could be captured in their entirety.

Nevertheless, the information on deposit money bank reserves with the central bank is available for all central banks, and likewise the information on central banks' capital. Other central bank balance sheet items representing offsetting operations varied across the countries. In any case, we can detect the main characteristics of sterilization procedures in the selected central banks.

As in the case when we analyzed factors contributing to the formation of cumulative autonomous positions in central banks, we can again easily observe the very specific situation of the Slovenian central bank if compared to other central banks in the selected pool of countries. Banka Slovenije proved a unique case due to the relatively low proportion of commercial bank reserves in the total cumulative autonomous liquidity position, which amounted to only 9.9% in 2005 and was even negative at the beginning of the 1990s.[4] In the case of the Albanian central bank, the share of commercial bank reserves amounted to 87%, and in the case of the Croatian central bank, 87.5% of the cumulative autonomous liquidity position in the year 2005. These percentages were somewhat lower with the Bulgarian (61%) and Macedonian central banks (58.1%) at the end of 2005. These data clearly show

[4] A negative sign indicates that the central bank was a net supplier of liquidity to the banking system through its lending operations.

that central banks in general rely to a large extent on reserve requirements as an instrument of excess liquidity reduction in the banking system.

On the other side, the specific situation of Banka Slovenije reveals a somewhat different approach, where central bank sterilization procedures rest on alternative instruments. In the particular case of the Slovenian central bank, securities issued by the central bank itself represent such an alternative instrument, which accounted for more than 75% of the cumulative autonomous liquidity position in the banking sector at the year end 2005. This proportion of the central bank's securities was even larger back in the 1990s, when it exceeded 80% of the cumulative autonomous liquidity position of the banking system.

Table 5: Autonomous Position of the Central Bank and Offsetting Factors: Slovenia

SLOVENIA (structure in %)	Autonomous position as % of GDP	Autonomous position	DMB's reserves w/ central bank	CB's securities	CB's capital
1992	3.0%	100.0%	-6.8%	81.9%	24.9%
1995	6.1%	100.0%	-1.4%	81.1%	20.4%
2000	12.7%	100.0%	14.6%	62.4%	23.0%
2005	20.9%	100.0%	9.9%	75.4%	14.6%

Source: Authors' calculations and IFS.

Table 6: Autonomous Position of the Central Bank and Offsetting Factors: Albania

ALBANIA (structure in %)	Autonomous position as % of GDP	Autonomous position	DMB's reserves w/ central bank	Other liabilities to banks	CB's capital
1994	3.4%	100.0%	43.6%	0.0%	56.4%
1995	9.7%	100.0%	45.0%	0.0%	55.1%
2000	8.8%	100.1%	46.2%	10.6%	43.4%
2005	6.5%	100.0%	87.0%	0.9%	12.1%

Source: Authors' calculations and IFS.

Table 7: Autonomous Position of the Central Bank and Offsetting Factors: Croatia

CROATIA (structure in %)	Autonomous position as % of GDP	Autonomous position	DMB's reserves w/ central bank	DMB's FX deposits	CB's securities	CB's capital
1992	0.0%	100.0%	-39.7%	0.0%	2.0%	137.7%
1995	4.8%	100.0%	59.1%	0.0%	3.2%	37.8%
2000	12.1%	127.9%	52.1%	27.9%	21.4%	26.5%
2005	18.2%	131.5%	87.5%	31.5%	0.0%	12.5%

Source: Authors' calculations and IFS.

Table 8: Autonomous Position of the Central Bank and Offsetting Factors: Bulgaria

BULGARIA (structure in %)	Autonomous position as % of GDP	Autonomous position	DMB's reserves w/ central bank	Other liabilities to banks	CB's capital
1992	8.5%	100.0%	24.7%	0.0%	75.3%
1995	16.6%	100.0%	17.4%	16.3%	66.3%
2000	7.1%	100.0%	41.8%	0.0%	58.2%
2005	10.8%	100.0%	61.0%	0.0%	39.0%

Source: Authors' calculations and IFS.

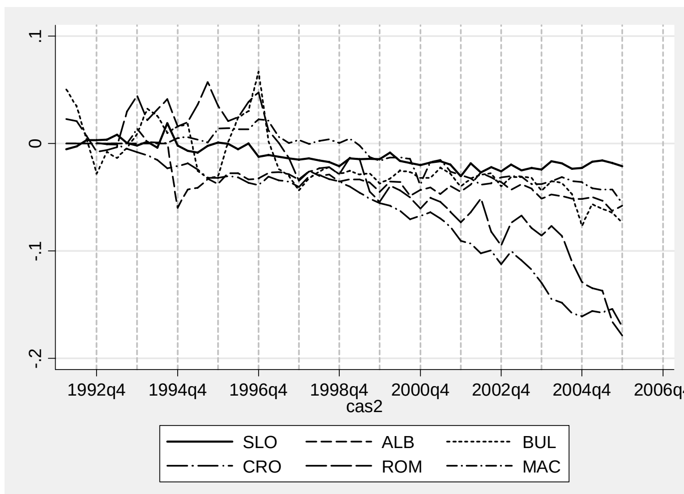
Table 9: Autonomous Position of the Central Bank and Offsetting Factors: FYR Macedonia

MACEDONIA (structure in %)	Autonomous position as % of GDP	Autonomous position	DMB's reserves w/ central bank	CB's capital
1993	1.7%	96.4%	-20.3%	116.7%
1995	2.1%	100.0%	-85.5%	185.5%
2000	6.6%	100.0%	44.9%	55.1%
2005	7.9%	100.0%	58.1%	41.9%

Source: Authors' calculations and IFS.

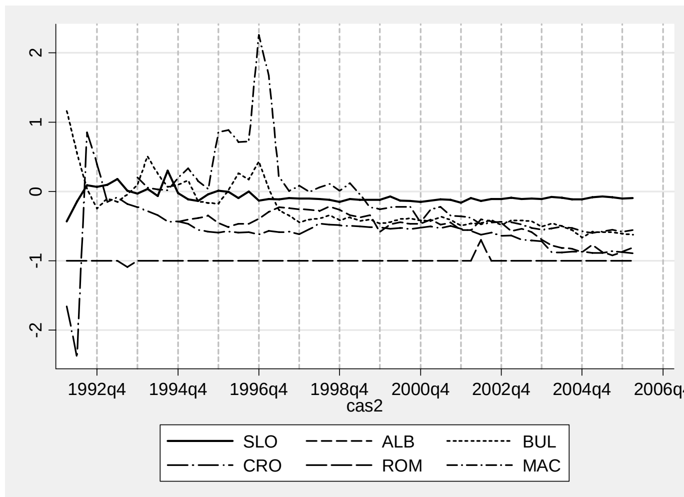
Other countries' central banks have relied much less on alternative instruments for the withdrawal of liquidity out of the banking system. However, IFS data and stylized central bank balance sheets indicate the use of such instruments in Albania, Croatia and Bulgaria, while the stylized balance sheets for Romania and Macedonia do not disclose the implementation of any instruments that would be recorded on the balance sheets of those central banks. In any case, alternative instruments in the form of "other liabilities to banks" (Albania, Bulgaria) and "foreign exchange deposits" and "central bank securities" (Croatia) have not been used to a large extent, and besides that their employment was restricted to limited sub-periods (e.g. in the case of Bulgaria, before the introduction of the currency board).

Chart 2: Proportion of Deposit Money Bank Reserves in GDP in Six Countries in the Period 1992–2006



Source: IFS and authors' calculations.

Chart 3: Proportion of Deposit Money Bank Reserves in Cumulative Autonomous Liquidity Positions in Individual Countries in the Period 1992–2006



Source: IFS and authors' calculations.

Charts 2 and 3 graphically summarize one of the main features of sterilization policies in the selected set of six countries. Both figures disclose the prevalent role of reserve requirement instruments in most of the countries except Slovenia, where Banka Slovenije evidently has not used mandatory reserves as an essential sterilization instrument. This fact also indicates the early decision of Banka Slovenije to minimize the role of non-market instruments and to lean on instruments that could be classified as market-based instruments, thereby also supporting the development of the money market and its accompanying instruments.

4. Effective Sterilization: the Case of Slovenia and Lessons for Other Countries in the Region

4.1 Historical Development of Banka Slovenije's Sterilization Instruments

In the period between 1992 and 2005, Slovenia was exposed to net foreign exchange inflows of different sources and intensity. Before we introduce the different instruments used for the purpose of sterilization, we shall try to split the whole period into sub-periods.

In the first three years (period I: 1992–1994), the net foreign exchange inflow originated from the surplus in the current account and to small extent also from borrowing abroad. It is also related to privatization in the housing sector financed by foreign currency savings in cash.

In the next three-year period (period II: 1995–1997) the current account was almost balanced and borrowing, together with direct and portfolio investments by non-residents, intensified. At the end of the rehabilitation process of the two biggest Slovenian banks, the NFA of the central bank also increased due to liquidity provisioning to the banks based on purchase of their foreign assets.

In the period of the Russian and Asian crisis (period III: 1998–2000) the supply of foreign financing diminished substantially. At the same time, due to the introduction of VAT and the appreciation of the tolar, the current account was temporarily in deficit. These years served as "breathing" period before the next wave of foreign exchange inflow.

In the remaining years (period IV: 2001–2005), the final steps of financial liberalisation were made. In these years financial outflow neutralised a large portion of financial inflow. Nevertheless, NFAs as a proportion of GDP increased by another ten percentage points, mainly due to foreign direct investment, banks raising loans abroad and the inflow of DEM cash into banks when euro banknotes and coins were introduced in 12 EU Member States.

In the previous section, the important role of central bank securities was put forward in the case of Slovenia as a way to drain excess liquidity from the banking sector. In this section, in the following paragraphs the most important financial instruments offered by Banka Slovenije shall be presented.

Foreign currency bills were transferable, registered non-series securities (i.e. certificates of deposit), available as a standing facility to banks and via banks to other legal entities, with a maturity between two months and 360 days. The main purpose of the instrument being offered was to drain excess foreign exchange from the foreign exchange market. The instrument was effective for two reasons. Banks were obliged to hold minimum reserves in foreign exchange (a part of it in foreign currency bills as a less risky investment) against the foreign currency deposits of households. The second reason lays in the fact that enterprises (mostly those importing and exporting goods and services) invested in foreign currency bills as a substitute for foreign currency claims on banks. Foreign currency deposits for enterprises previously had not been allowed. This instrument was introduced in January 1992, at first denominated only in German marks and later available also in US-dollars. From the year 2000 on, when foreign currency deposits were allowed for enterprises, foreign exchange bills were sold to banks only. This facility was available until the very end of the tolar monetary policy. Foreign currency bills served banks as eligible collateral for almost any kind of Bank of

Slovenia loans (lombard, liquidity and short-term loans, and also for repurchase operations).

Twin bills were short-term transferable securities issued to the bearer in hard copy. They comprised a tolar part, the face value being indexed by inflation, and a foreign currency part, denominated in DEM. Both parts were sold for tolars at a discount, each part at a different discount rate. At maturity one part was redeemed in tolars and the second part in DEM. Subscription was available to banks and via banks to households and enterprises. On the secondary market, each of the two parts could be traded separately. By introduction of this instrument in the second half of 1992, Banka Slovenije offered safe investment opportunities to non-banks as well. Through this instrument, the demand for foreign exchange by households and enterprises was satisfied to some extent. It also served as a learning opportunity to compare yields on tolar- and DEM-denominated investments in a period of a high level of "dollarization" in the banking sector. In fact, banks slowly experienced a sizable restructuring of deposits in favour of tolar-denominated deposits. The final (12th) issue of twin bills took place in April 1999, with redemption in March 2000.

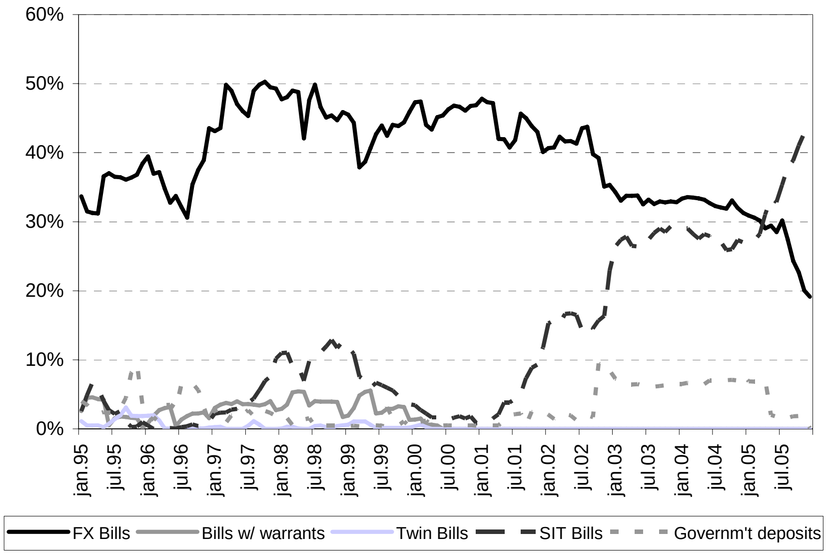
One of the most structured instruments ever designed by Banka Slovenije was the bill with warrants. These bills were transferable securities issued to the bearer, at first in hard copy and later on as dematerialized book-entry securities. In the year 1994, financial instruments were still widely indexed or denominated in foreign currencies. So Banka Slovenije decided to offer short-term securities with a maturity of six months, which were sold at a discount calculated in relation to the nominal interest rate. One to five warrants were attached to the tolar bill, depending on the duration of the investment (one warrant for each month until maturity). Each warrant acted as a hedge against higher inflation or a smaller rate of tolar depreciation than projected by the terms of the issued series of security. In this way inflation and nominal depreciation targeting was performed publicly, and owners of warrants were rewarded by extra discounts in the case of different results than projected. Bills with warrants were sold at auction, which served as a good basis for testing expectations about the accuracy of the central bank's projections, as well as for raising interest among investors for developments in the inflation and exchange rate. In the months when inflation was higher than projected (as a monthly average), holders of warrants could realize a bonus by buying tolar bills (without warrants) at an extra discount. Furthermore, in the months when tolar depreciation was smaller than projected, holders of warrants could realize an extra discount by purchasing foreign currency bills with a maturity of 180 days or more. In the period between June 1994 and December 1999, 14 series of bills with warrants were issued (the last issue was a bill without warrants; it served only for the purpose of realizing possible discounts based on previously issued warrants).

By the year 2001 central bank securities became available only to the banking sector, and they were transferable only among domestic banks. There were two major reasons for such a change in policy: the bank interest rate margin normalized, and under financial liberalization it was difficult to prevent new foreign investments in central bank securities. To drain excess liquidity from banks, central bank tolar bills with a maturity of 60 days were offered regularly to banks as a standing facility. Bills with 270 days of maturity were offered at weekly auctions. For a limited period of time (at the time of the major takeover of one Slovenian pharmaceutical company by a foreign company), 360-day tolar bills were offered only to the banks which participated in an agreement concerning foreign exchange market intervention. For the reinvestment of proceeds paid out at maturity of the 360-day bills, Banka Slovenije offered long-term floating rate deposit with maturity falling into the year 2007, after the date of the planned introduction of the euro. The same long-term deposit also was used to drain excess liquidity which followed the reduction of the rate of reserve requirement.

For the proceeds of the state’s 34% stake in the biggest Slovenian bank, sold to KBC bank in 2002's privatization process, the Ministry of Finance and Banka Slovenije agreed on a time deposit under the same conditions as offered to the banks by the 270-day bills. Based on these financial resources, in the environment of lower long-term interest rates the Ministry of Finance began the process of restructuring existing government bonds originally issued with a call option, effectively resulting in savings for the government in terms of lower costs of debt financing. Finally, the time deposit of the Ministry of Finance was used to repay euro bonds at the date of maturity in May 2005, with a net neutral effect on the foreign exchange market by the two transactions at different times.

Banka Slovenije signed an agreement with the Ministry of Finance in April 2001 stipulating coordination between the two institutions on developing the money market. One measure for the development of the money market was the introduction of a one-month Treasury bill, issued by the Ministry of Finance in co-operation with Banka Slovenije. The proceeds of the subscription were deposited by Ministry of Finance at Banka Slovenije in a cost-neutral way. The overall bonus of the instrument was to provide a regular weekly indication of the one-month interest rate of the money market. The bonus for the Ministry of Finance was in having liquidity facility at hand when needed (based on the rules of forecasting requirements), and the bonus for Banka Slovenije was in broadening its capacity to sterilize. This instrument was abolished in November 2005, well after the stability of the exchange rate was safely established within ERM 2.

Chart 4: Liquidity Absorbing Instruments of Banka Slovenije in the Period 1995–2005, Expressed as Percent of the Bank's Total Assets



Source: Banka Slovenije and authors' calculations.

The evolution of relative importance of the major groups of liquidity absorbing instruments is depicted in chart 4. As already previously explained in this section, foreign exchange bills represented relatively the most important sterilization instrument throughout the observed period and amounted to even as much as 50 % of Banka Slovenije's total assets in some sub-periods. Bank of Slovenia's bills denominated in Slovenian tolars on the other hand represented analogous sterilization instrument that has gradually gained its relative importance after year 2001 and remained in use till the adoption of euro. The rest of the sterilization instruments, although important due to their specific design (e.g. twin bills, bills with warrants), usually represented up to 5% or mostly up to 10% of Banka Slovenije's total assets and their implementation used to be concentrated in specific sub-periods.

4.2 Responses of Banka Slovenije to Practical Sterilization Limits

It is desirable to consider how the four key obstacles that limit the effectiveness of open-market sterilization procedures (elaborated in section 2) could be circumvented in practice, taking into account the Slovenian experience. As stated by Lee (1996), these limitations should be taken into account in selecting and designing supplementary instruments and techniques to deal with financial inflows and their consequences.

First of all, the question arises of whether alternative kinds of operations compared to open-market operations are available. For open-market operations it is characteristic that monetary policy instruments are offered to counterparties – banks – through auctions. There are two possible alternate paths: to offer instruments (for sterilization purposes, we mean central bank liabilities such as central bank bills) to non-bank investors (e.g. enterprises and households), or to sell them as standing facilities.

Related to the four limitations brought forward in section 2, some stylized lessons from the case of Slovenia would be the following:

a) The ability to sterilize capital inflow is inversely related to the degree of international capital mobility.

Undesirable consequences of capital inflow can be avoided not only by sterilization efforts on the one hand, but also by reducing the mobility of capital with a form of indirect capital controls on the other hand. By the beginning of 1995 in Slovenia, banks and enterprises had to deposit at the central bank without interest 40% of loans raised abroad if the maturity was less than 5 years (at a later stage, less than 7 years). Another measure in a kind of tax with the effect of an extra cost on foreign financing was introduced by February 1997 on portfolio investments. The first capital control measure was abolished in 1999, and the second in 2001.

b) Sterilization policies cannot work for long when shocks are durable, because sterilization deals with the effects rather than the underlying causes of shocks.

The answer to this kind of limitation could be a very simple one: those countries that are more persistent in sterilization efforts are more likely to experience changes in shocks all at once. This was exactly the case in Slovenia when it came to the Asian and Russian crisis in 1998 and 1999. The effect of lower capital inflow occurred in exactly the same year as Banka Slovenije encountered the liquidity impact of sterilization costs that exceeded the potential growth of base money. This means that sterilization would also be needed for the portion of returns paid to investors for sterilization instruments. In the period of the Asian and Russian financial crisis, the need for sterilization diminished relatively due to the lower foreign capital supply.

c) The scope of classical open-market operations can be severely restricted by the underdeveloped state of financial markets and by fiscal costs.

It is true that less-developed financial markets make sterilization more difficult and more costly. On the other hand, in previous decades in completely different circumstances (compared to today's infrastructure) financial institutions and investors also dealt with securities. So it is possible. The first issues of Bank of Slovenia bills were issued in hard copy; they were sold to banks, and also to households and enterprises through the banks as intermediaries. The main reason to make banks compete with the non-banking sector was the fact that the interest rate margin in the banking sector was well over five p.p. By deciding to compete with banks for savings on the retail deposit market, Banka Slovenije did not affect the lending rates of banks and it avoided extra costs due to bank inefficiency.

d) Heavy fiscal costs may eventually curtail sterilization operations. These costs may also lead to operating losses at the central bank, which can have a negative effect on the independence of the central bank in monetary policy.

During the whole period between 1992 and 2005, Banka Slovenije was only once faced with an operating loss. That was in the year 1998, at the end of the second consecutive period of substantial growth of the NFA item on its balance sheet. This loss could easily be covered by accumulated general reserves from the previous large growth of NFAs, and consequently also with adequate sterilization challenges. In this period of time, the mix of monetary policy operations was designed to cope with the high costs of the sterilization operations. Three pillars of monetary policy operations were agreed with the vast majority of the banks on a voluntary basis. The first pillar enabled Banka Slovenije to signal the exchange rate at which banks would set deals on the retail foreign exchange market during a limited period of intervention (if so decided by the central bank). According to the second pillar, Banka Slovenije provided tolar liquidity mostly by purchasing foreign currency temporarily (instead of outright) by means of seven-days swaps offered to the banks (only those that had agreed to be parties to the agreement) as a standing facility. Central bank bills offered only to banks for the purpose of the sterilization of excess liquidity represented the third pillar. The difference between such an arrangement and classical outright foreign currency intervention could be summarized as follows:

- Short-term currency swaps allowed banks to manage their liquidity comfortably, but restrained them from extending long-term loans on the basis of very short-term funds.
- The use of foreign currency swaps enabled Banka Slovenije to compensate for a great deal of sterilization costs. The interest rate on the swap instrument was set according to the uncovered interest parity (UIP) principle: the rate was set taking into account the interest rate differential adjusted for the desired pace of depreciation and for the country’s risk premium. The main refinancing rate of Banka Slovenije was consequently the sum of the swap interest rate and the main refinancing rate of the ECB (as a proxy for EURIBOR).
- The short-term nature of the swap instrument and its flexible pricing deterred potential arbitrage and restrained the emergence of interest rate-sensitive capital inflow on one hand and, on the other, still provided some flexibility for Banka Slovenije’s own monetary policy needs.

5. Conclusions

The economic transition processes in Central and Eastern European countries have been characterized by the sizeable internal and external imbalances these economies had to deal with. Central banks in these economies had to adopt monetary policy strategies suitable to such vacillating economic conditions. One of the most controversial decisions all central banks in transition economies had to make was a decision on the appropriate foreign exchange rate regime. The existent theory was very much based on the so-called "consistency triangle" framework. This particular framework, which advocates three-corner solutions involving only two diametrically opposed foreign exchange solutions (either completely fixed or completely flexible exchange rates) turned out to be incompatible with policy solutions adopted by some central banks in developing/transition economies. Namely, contrary to the theoretical suggestions, some central banks relatively successfully opted for managed floating foreign exchange rate regimes. Lee (1996) elaborates experiences of such practices in six developing countries around the world.

In transition economies, only a few central banks decided to implement a managed floating exchange rate regime (e.g. Romania and Slovenia) at the very beginning of the transition. However, current account imbalances and especially intensified foreign capital inflow in most of these countries led their central banks to different conclusions regarding their foreign exchange policies. Any economy that opted for any form of managed floating exchange rate regime had to cope with rising net foreign assets on its central bank's balance sheet.

Analysis of stylized central bank balance sheets in six countries (Slovenia, Croatia, Bulgaria, Romania, Albania and Macedonia) reveals the tremendous importance of net foreign assets as a main contributing factor to the cumulative autonomous liquidity position of the banking sector in each of the observed countries. Central banks must respond to increasing autonomous liquidity positions by the implementation of adequate sterilization measures. The case of Banka Slovenije and its sterilization practices are further elaborated in this paper.

The analysis of practical limits on the use of sterilization as a monetary policy strategy is based on the example of Banka Slovenije. The past experience of the Slovenian central bank proves that it is possible to design a sterilization strategy which can work for longer periods of time. However, Banka Slovenije with its sterilization instruments had to compensate for a relatively underdeveloped financial market and the absence of risk-free securities suitable for sterilization operations traditionally known in financially more developed economies. So, at least in some sub-periods, the Slovenian central bank was compelled to combine market-based instruments with indirect capital controls. Additionally, Banka Slovenije decided to issue its own securities, which were offered not only to commercial banks as typical central bank counterparties, but also to non-financial companies and in some instances even to individual investors. By designing a more complex mix of monetary operations based on three pillars (exchange rate signalling, introduction of seven-days swaps, central bank bills), Banka Slovenije was capable of coping with the relatively high costs of sterilization operations. In many respects the rich experience of Banka Slovenije in the field of sterilization operations can be very instructive for central banks in the SEE region as well, especially if it proves necessary for countries in this region to deal with continuing foreign capital inflow.

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Appendix 1

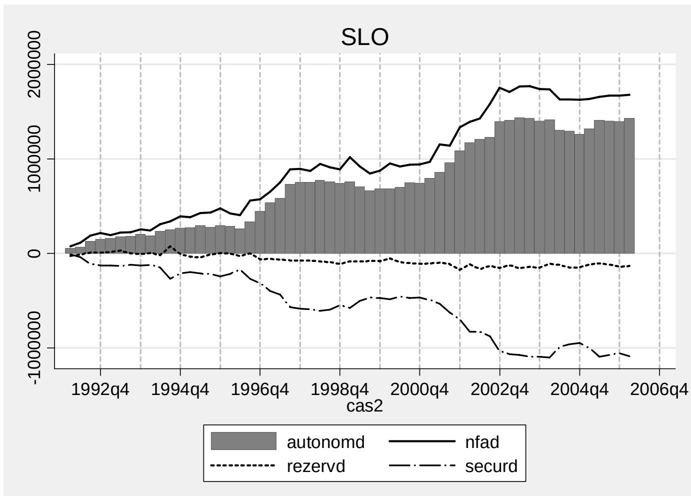
Table 1: Classification of Exchange Rate Regimes in Sample Countries

Exchange rate regime	Slovenia	Albania	Bulgaria	Croatia	FYR Macedonia	Romania
Currency board arrangements			**X** (since July 1997)			
Other conventional fixed peg arrangements (against a single currency)					**X** peg to EUR (before 1999, DEM)	
Pegged exchange rates w/in horizontal bands	**X** (from Jul 2004 till Jan 2007					
Managed floating with no predetermined path for the exchange rate	**X** (till 28 Jul 2004)			**X**		**X**
Independently floating		**X**				

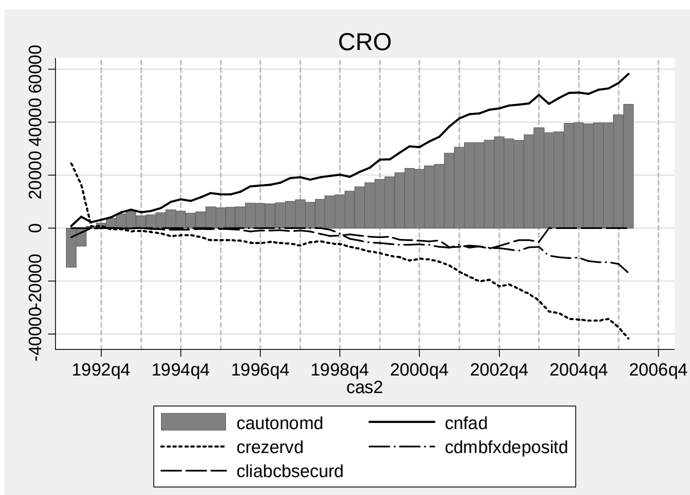
Source: IMF, De Facto Classification of Exchange Rate Regimes and Monetary Policy Framework.

Appendix 2

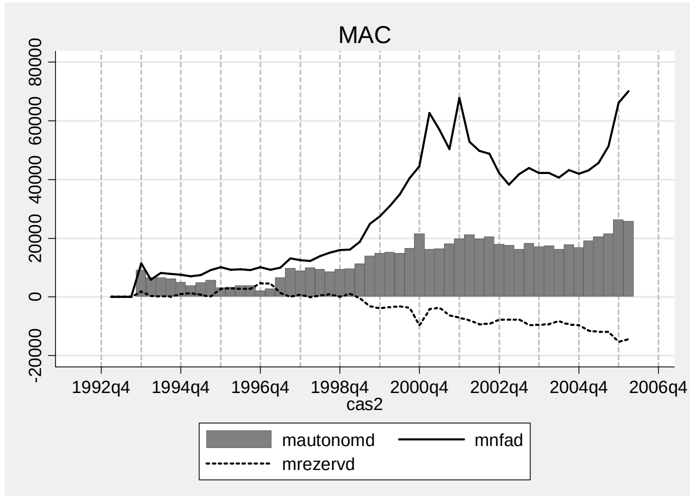
Graphical Presentation of Factors that Determine the Autonomous Liquidity Positions of Central Banks in Individual Countries



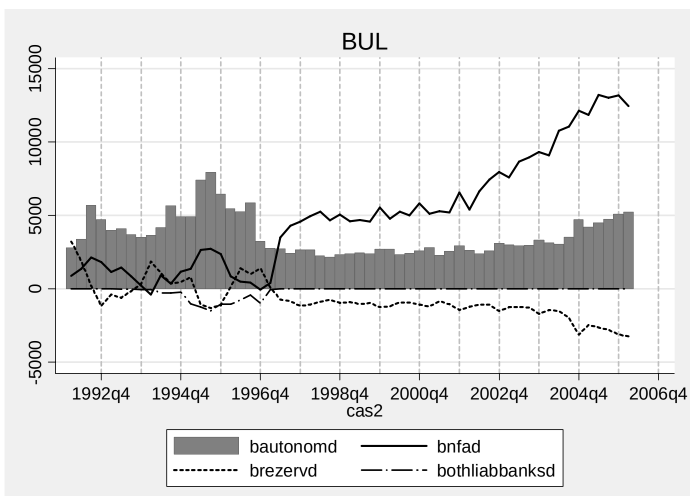
Abbreviations: autonomd – autonomous factors; nfad – net foreign assets; rezervd – reserves; securd – securities.



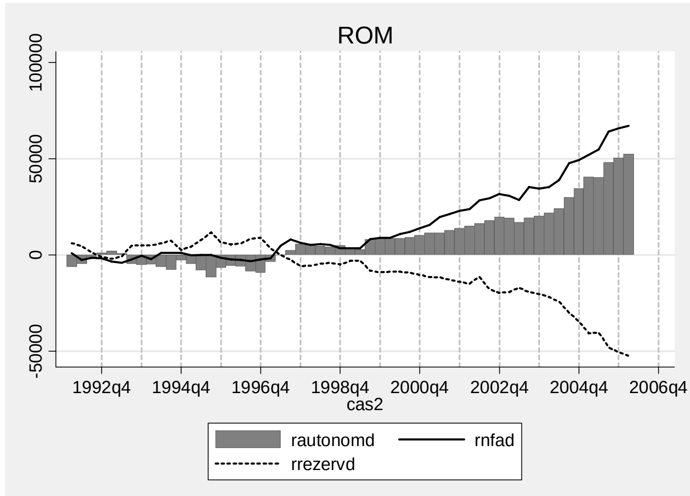
Abbreviations: cautonomd – autonomous factors; cnfad – net foreign assets; crezervd – reserves; cdmfxdepositd – domestic banks' FX deposits; cliabcbsecurd – central bank's securities (liabilities).



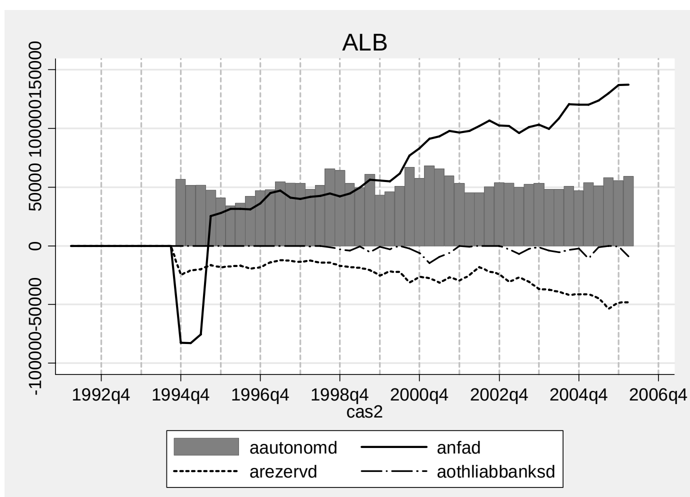
Abbreviations: mautonomd – autonomous factors; mnfad – net foreign assets; mrezervd – reserves.



Abbreviations: bautonomd – autonomous factors; bnfad – net foreign assets; brezervd – reserves; bothliabbanksd – other liabilities to banking institutions.



Abbreviations: rautonomd – autonomous factors; rnfad – net foreign assets; rrezervd – reserves.



Abbreviations: aautonomd – autonomous factors; anfad – net foreign assets; arezervd – reserves; aothliabbanksd – other liabilities to banks.

Are European Emerging Markets Different?

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There is no consensus today among analysts, investors, and policymakers on how to interpret the evolution and prospects of European emerging markets.[2] The choice seems to be limited to two opposing views, and developments in recent months have, if anything, polarized the debate further.

At the risk of oversimplifying, the first of these views is that, after a few disruptive years at the beginning of their transition from socialism to capitalism, these European emerging markets are now solidly on the path of growth and convergence with Western European economies. Though strewn with challenges, this path offers great benefits and even greater opportunities for the citizens of these countries and for foreign investors. The magnitude of these benefits and the prospects of EU accession propel these countries quickly but safely on a one-way street to prosperity. This view seems to have been in practice adopted by the majority of private investors in these economies, both domestic and foreign. Not surprisingly, it is also held by the governments of these countries.

The opposite view claims that the economic forces behind the process of convergence are generating mounting imbalances in these countries. Compared to

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[1] This paper draws heavily on work done by colleagues at the European Department of the International Monetary Fund. I am particularly indebted to Ashoka Mody, whose advice and research – to which I refer frequently – provided the inspiration for this paper, and to Gerwin Bell for helpful comments. The views expressed here, as well as any errors, are nevertheless mine and do not necessarily represent those of the International Monetary Fund.

[2] There is always a degree of arbitrariness in the definition of country groups. For the purposes of this paper, the "European emerging markets" include the European transition economies that are current or prospective European Union (EU) Member States, in other words the ten Central and Eastern European new EU members (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic, and Slovenia) and the Western Balkans (Albania, Bosnia and Herzegovina, Croatia, FYR Macedonia, Montenegro, Serbia, and the territory of Kosovo, currently under temporary UN administration). They do not include Russia, Ukraine, Belarus, Moldova, and Turkey. Although these countries have a fair claim to being both "European" and "emerging markets", they are distinct from the rest either because they do not have a firm EU perspective or – in the case of Turkey – because they are not transition economies.

other emerging markets, these imbalances look positively alarming. While all may still turn out well at the end, the risks are significant and growing, while policymakers are being irresponsibly complacent. Because the prospects of EU accession alone cannot defy economic laws, it will all probably come to grief sooner rather than later. This view is common among many academics and analysts, particularly those with a macroeconomic bend, and is supported by a thriving cottage industry of comparisons between European emerging markets today and Southeast Asian economies just before the crises of the late 1990s.

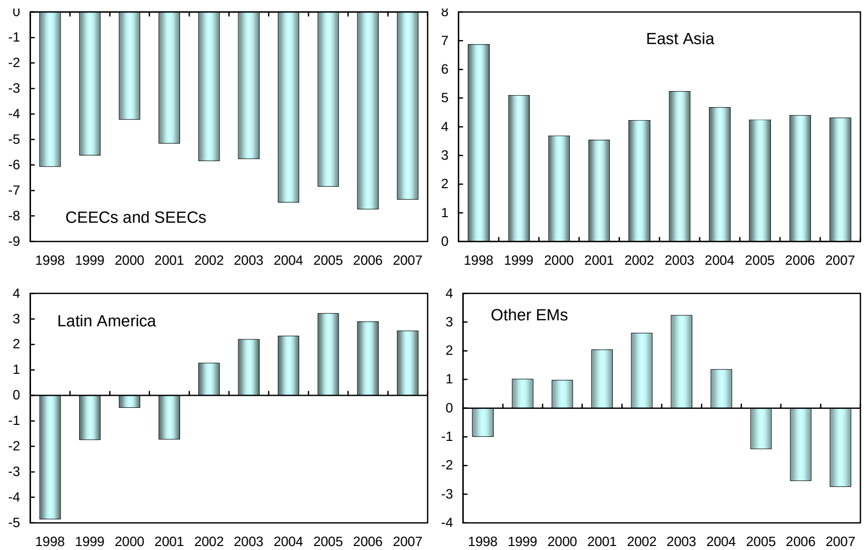
Who is right? And are these the only two possibilities?

In this paper, I argue that European emerging markets are different than other emerging markets, and therefore superficial comparisons with Southeast Asia are off the mark. I discuss two hypotheses that may explain these differences in terms of economic fundamentals. And I argue that, while these factors alleviate some of the traditional macroeconomic risks, they underscore a different set of policy challenges. These challenges are more micro- than macroeconomic and have a longer-term time horizon. This may make some macroeconomists uncomfortable, but does not render these challenges any less real or urgent. I conclude with some lessons for Southeastern European countries, in particular, which are in some ways the least advanced European emerging markets.

1. Recent Trends in European Emerging Markets

The growth record of the European emerging markets during the last decade has been good, matching broadly that in East Asian emerging markets and exceeding that in Latin American and other emerging markets (the latter group includes Russia, Turkey, and African and Middle Eastern emerging markets). But a combination of relatively high domestic investment with relatively low domestic savings rates has pushed their current account deficits to levels that are extraordinarily high by international standards. And this at a time when the other emerging markets as a group are generating current account surpluses (chart 1).

Chart 1: Average Current Account Balance, 1998–2007, (Unweighted average; % of GDP)



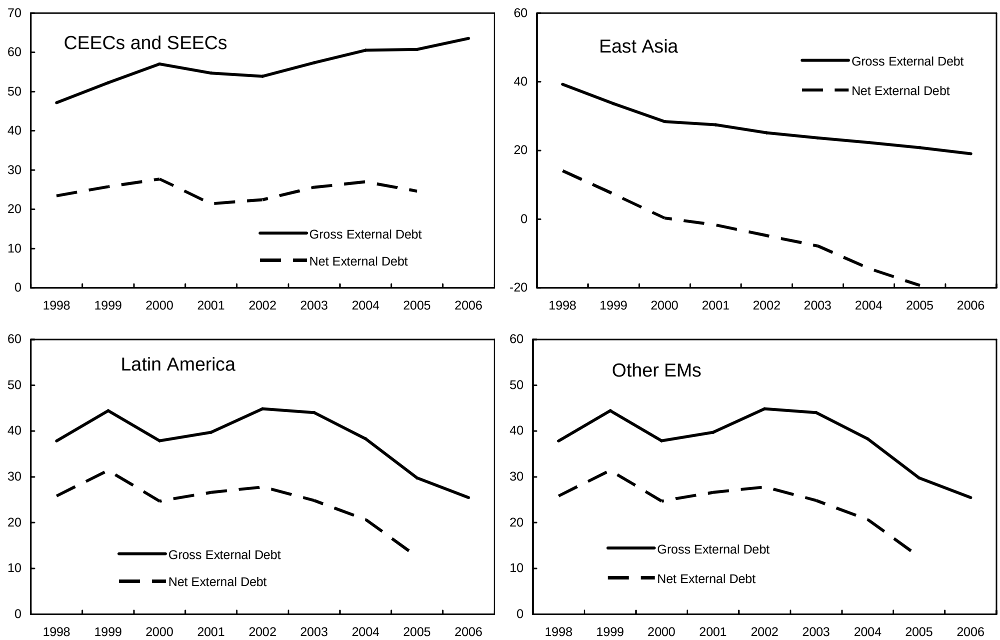
Note: CEECs = Central and Eastern European countries; SEECs = Southeastern European Countries.

Source: IMF, World Economic Outlook.

The counterpart of these large current account deficits has primarily been foreign direct investment (FDI) inflows. But debt-creating inflows, though much lower, are also substantial, and have been on an upward trend since 2003. This is again in contrast to the experience of other emerging market groups. As a result, European emerging markets are the only ones whose external indebtedness has not declined since the beginning of the current decade: their gross external debt has kept climbing, surpassing the 60% of GDP mark last year; and their net external debt has remained broadly stable in the 20–25% of GDP range. In contrast, gross and net debt-to-GDP ratios in all other emerging market groups have fallen significantly since the beginning of this decade and are now much lower than in European emerging markets. Indeed the average net external debt ratio of East Asian emerging markets has recently turned negative, as this region has become a net creditor to the rest of the world (chart 2).

Chart 2: External Debt

(% of GDP)



Sources: IMF, World Economic Outlook and International Financial Statistics.

Notes: Net external debt is the gross external debt net of foreign assets in central banks and the banking sector.

Large capital inflows and rising external indebtedness give rise to a litany of macroeconomic concerns. Capital inflows can cause real exchange rate overvaluation, the more so when the nominal exchange rate is inflexible. They can fuel asset price bubbles. The resulting foreign currency liabilities generate balance sheet risk for borrowers without natural or financial hedges. Debt-creating inflows, in particular, are subject to rollover risk, sudden stops, or reversals as a result of an abrupt shift in market sentiment. And reliance on foreign borrowing exposes the borrower to the risk of contagion, i.e., the possibility that market access may be severely disrupted because of adverse developments affecting another emerging market or a generalized shock affecting all emerging markets, regardless of where it originated. The risk of contagion is particularly pronounced in European emerging markets because a large part of debt-creating flows into the region are intermediated by a relatively small number of Western European banks.

Even more alarming for those who worry about the macroeconomic risks of large current account deficits and capital inflows is the fact that we may not have sufficient policy tools to contain them. Fiscal policy is rather a blunt instrument, and there are limits to the speed and degree to which it can be adjusted. And at a more fundamental level, it is not clear whether fiscal policy could or indeed should be used to mitigate risks arising from excess private sector demand. Monetary and exchange rate policy is severely constrained in emerging markets by a combination of "fear of floating" considerations (Calvo and Reinhart 2000), institutional weaknesses (shallow money markets and weak transmission channels), or currency substitution. And needless to say, using monetary and exchange rate policy is not even an option for countries with currency boards. On top of it all, in addition to the constraints affecting individual policies, Calvo (2005) has argued that domestic policies *in general* are fundamentally insufficient to manage what he termed "globalization risk", i.e., the risk arising from opening up the economy to the global financial market.

Beyond the "traditional" or garden variety macroeconomic risks, the sustained current account deficits of European emerging markets raise deeper questions about the sustainability of their recent growth. In a recent paper, Prasad, Rajan and Subramanian (2006) showed that, contrary to the prediction of the standard theory, since the mid-1990s capital has stopped flowing "downhill" and started flowing "uphill", i.e., not from rich to poor countries but vice versa. It is not the emerging markets that run current account deficits financed by capital inflows from advanced economies, but the advanced economies who finance their current account deficits with surplus savings generated in the emerging markets. Moreover, current account deficits are not associated with higher growth, as one might expect. On the contrary, a simple correlation between current account balances and growth shows a statistically-significant positive relationship in the global sample: the countries that grow faster are those with higher current account surpluses (or lower deficits).

So what is going on in European emerging markets? Why is their recent experience so different than that of other emerging markets? It is tempting to conclude that this difference is an aberration: ample international liquidity, irrational exuberance, and exaggerated expectations about the benefits of EU accession have flooded European emerging markets with foreign capital and given them a burst of growth. But this cannot last. Sooner or later these countries must revert to norm, this argument goes, and behave like all other emerging markets. Either there will be a current account correction or growth will run out of steam – or possibly both. Indeed the longer this aberration goes on, the closer the day or reckoning and the greater the pain it will bring.

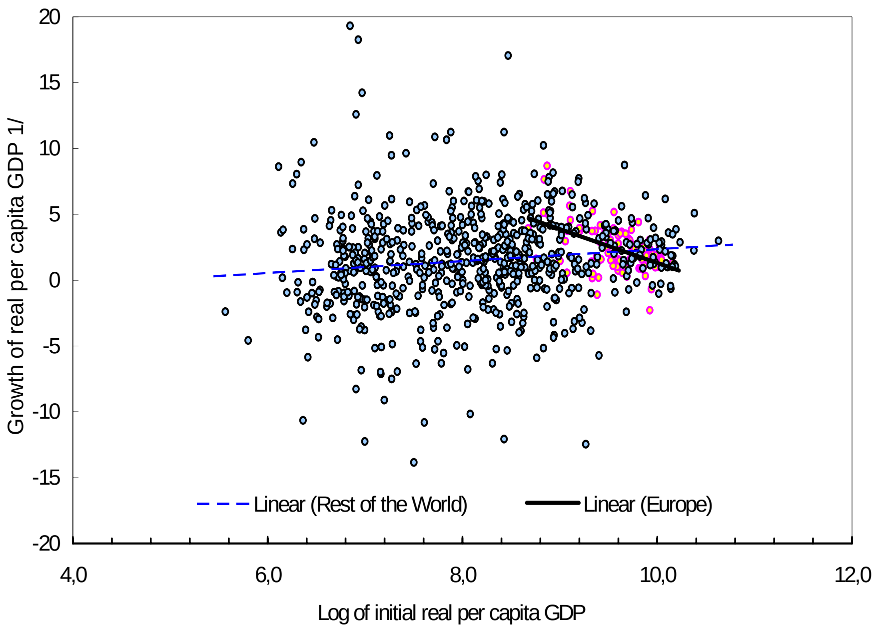
2. Europe is Different

While this gloomy conclusion is certainly plausible, it is far from compelling. Indeed there are good reasons to believe that Europe is different in a number of fundamental respects, and this could generate a sustainable divergence in economic outcomes between European and all other emerging markets that is consistent with the predictions of standard economic theory.

What are the differences?

First, Europe is a convergence story. In contrast to the rest of the world, in Europe per capita incomes of poor and rich countries have been converging. Indeed Europe is the only region where there is evidence of convergence even after controlling for other factors that influence growth in individual countries ("unconditional convergence"). Chart 3, showing the simple correlation between the level and growth rate of GDP per capita in a global sample for the last 30 years, illustrates this point.

Chart 3: "Unconditional" Convergence, Europe vs. Rest of the World, 1975–2004

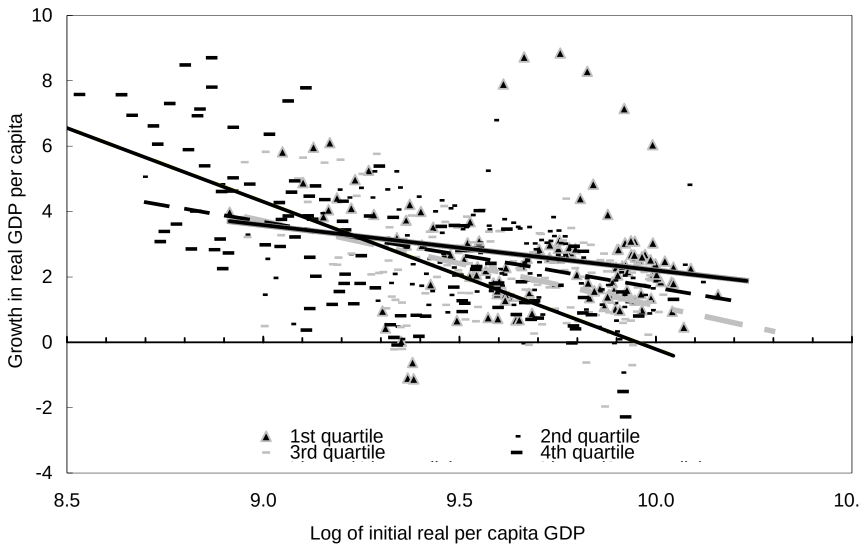


Note: 1/ Average annual growth over subsequent 5-year period (%).

Source: Abiad, Leigh and Mody (2007).

Secondly, in European countries foreign savings are associated with higher growth, just as theory predicts. Chart 4 shows the same correlation as before but with the sample now split in quartiles depending on the size of the current account deficit. The shift in the slope of the correlation line as we move from lower to higher quartiles suggests that higher current account deficits are associated with faster convergence. Prasad, Rajan and Subramanian (2006) also note that Europe is the exception to their puzzling finding that capital tends to flow "uphill". For some reason, the European continent seems to be less bound by the Feldstein-Horioka puzzle.

Chart 4: EU Current Account Deficits and the Speed of Convergence from 1960 to 2004



Note: 1960–2004 for EU-15 (excl. Luxembourg); 1995–2004 for New Member States (excl. Malta and Cyprus). Scatter plot observations are grouped by quartiles of the current account deficit, with the smallest deficits in the lowest quartile.

Source: Schadler et al. (2006).

Thirdly, although the inflow of foreign savings into emerging Europe has already been sizeable, the potential for additional inflows appears to be still very significant. In a slightly older paper, Lane, Lipschitz and Mourmouras (2002) attempted to estimate the capital flow that would be required to equalize the return to capital between Western and Eastern Europe. They calculated that the potential cumulative capital inflow into European transition economies could add up to six or seven times annual GDP during the first five years of transition. That actual inflows so far have been much lower led them to conclude that there was still a huge potential for continued inflows in the period ahead. In a more recent study focusing specifically on FDI, Demekas *et al*. (2007), after estimating an explanatory relationship for FDI, calculated the potential FDI for each emerging European country based on the actual values of gravity variables, which are exogenous to policymakers, and the "best" values of the policy variables that are found to have a significant influence on foreign investment. While the more successful European transition economies are now close to their potential, the gap between potential and actual FDI is still positive everywhere and, for Southeastern European countries in particular, quite large: for instance, if Serbia or Bosnia and Herzegovina get their policies right, they could expect at least half as much FDI in the near term as they have already received. These findings suggest that, far from having run their course, capital inflows into emerging Europe could continue for several years.

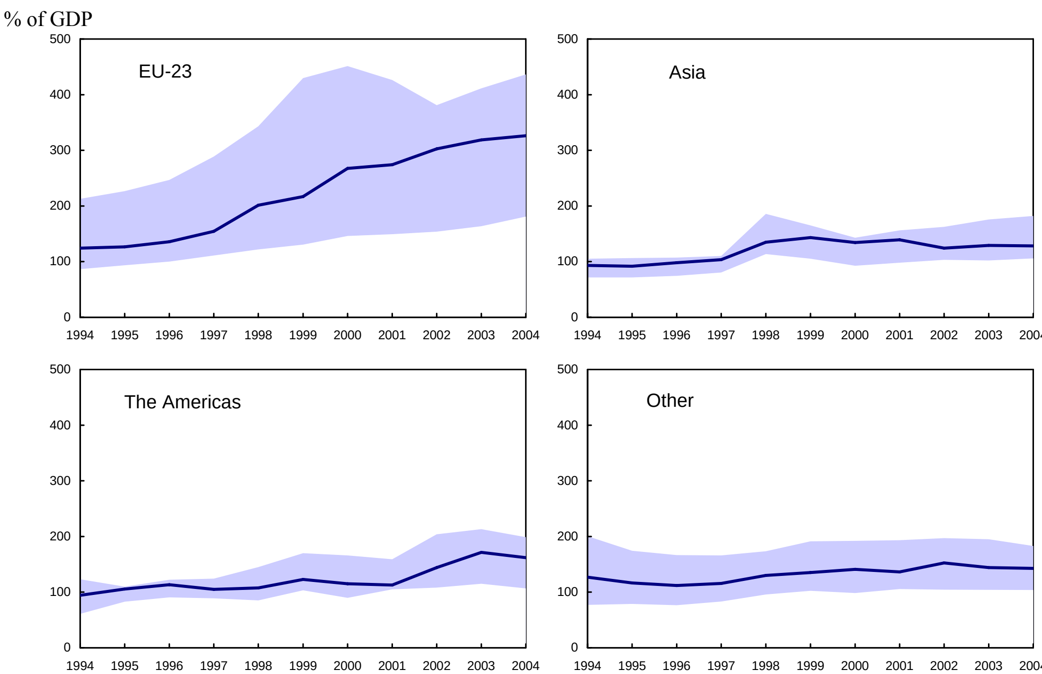
These differences indicate that the divergence between the recent experience of European emerging markets and the rest may not be an aberration but may reflect economic fundamentals. What could these fundamentals be? I want to discuss two hypotheses that could help explain why Europe is different. They are not mutually exclusive, and there may certainly be additional factors at play, but there is already some evidence that lends support to these two.

The first hypothesis is that the fundamental difference between European emerging markets and emerging markets elsewhere is the prospect of the former for membership in the EU and, eventually, in the euro area. Central, Eastern, and Southeastern European countries are part of an unprecedented historic experiment in economic, financial, and political integration that holds out the prospect of political stability and institutional convergence, large EU transfers and, eventually, adoption of the common currency. This implies a boost in future consumption – relative to emerging markets that are not prospective EU members – which consumers in these countries smooth by borrowing today. This is not reckless risk-taking behavior but sound economics: for the same reason, Ivy League undergraduates find it easier to get larger student loans than other students without paying a higher risk premium.

There is some indirect evidence for this hypothesis. European emerging markets have long been enjoying systematically lower external debt spreads (risk premia) in international capital markets than other emerging market economies. Although this difference has declined since 2004, it still remains positive. An econometric analysis of the debt spreads suggests that part of this bonus enjoyed by European emerging markets is not explained by economic fundamentals but reflects some non-quantifiable influence on markets' perception of risk. It is commonly assumed that the key factor behind this influence is the prospect of EU membership and euro adoption.

The second hypothesis has to do with the role of financial integration and has been advanced by Abiad, Leigh and Mody (2006). Europe is more advanced than any other region in terms of cross-border financial integration (chart 5), largely as the result of the expansion of the EU: the free movement of capital is one of the basic four freedoms that are the pillars of the Single Market. And as Blanchard and Giavazzi (2002) have shown, financial integration facilitates consumption smoothing and allows capital to flow "downhill". According to this hypothesis, the fundamental difference between European emerging markets and others is that financial development and integration in the former is more advanced, allowing them to leverage foreign savings more effectively in order to grow faster and converge. Moreover, since we saw earlier that lower initial per capita incomes and higher current account deficits are associated with faster convergence, this process is transitory and self-correcting: as European emerging markets converge, growth will moderate and current account deficits will decline.

Chart 5: Financial Integration in Different Regions, 1994–2004



Note: Financial integration measured as the sum of foreign assets and liabilities.

Sources: Lane and Millesi-Ferretti (2006); Abiad, Leigh and Mody (2007).

A variant to this hypothesis is based on the notion that the growth process is subject to nonlinearitities. Aghion and Howitt (2005), for example, have argued that these nonlinearities reflect the interaction of technological, institutional, and financial variables. Taking their analysis of financial integration in Europe a step further, Abiad, Leigh and Mody (2006) have suggested that financial sector development may be such a variable. In such a case, the difference between European emerging markets and others is not just that the financial sector is more developed in the former but that, having reached a critical mass, its role is now qualitatively different: it enables the Europeans to utilize foreign savings for economic growth and convergence in ways that are not (yet) possible for other emerging markets. The European emerging markets are therefore not just an exception – much less an aberration – but a bellwether: their recent experience is the shape of things to come in all other emerging markets once they pass the same threshold value of financial development and integration.

3. Lessons for Southeastern Europe

If the recent experience of European emerging markets is not an aberration but an equilibrium phenomenon reflecting fundamental differences from other emerging markets, it is tempting to dismiss the Cassandras and conclude that all is well.

This would be premature.

While the preceding discussion attenuates the concern about the sustainability of the European emerging markets' recent growth performance, as well as the "traditional" concerns about external imbalances, it does not completely eliminate them. To be sure, some of the risks associated with high external current account deficits and capital inflows (sudden stops, contagion, reversals, or exchange rate overvaluation) appear to be less pressing in European emerging markets than elsewhere. But they are still present, especially where the nominal exchange rate is not flexible, and should not be overlooked.

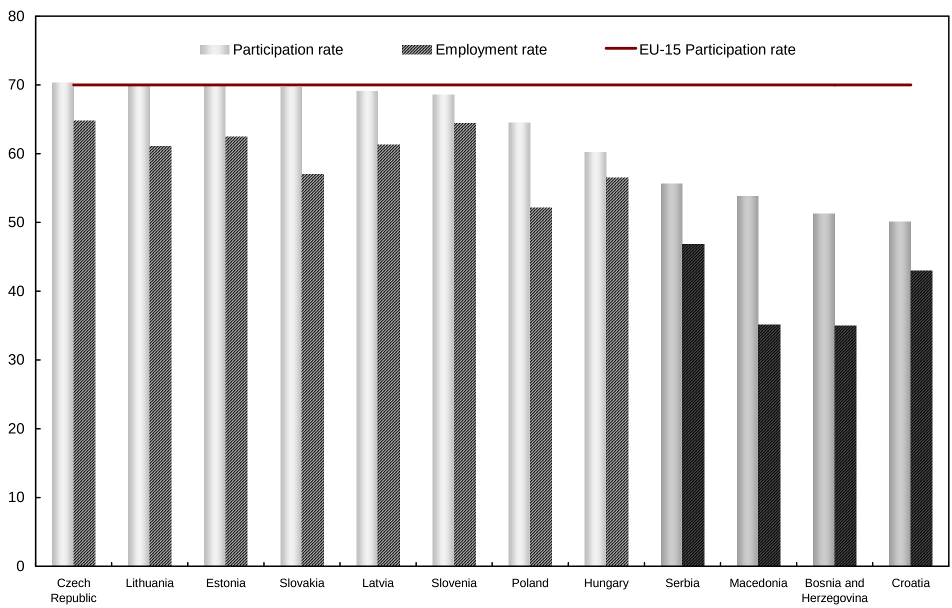
More importantly, the preceding analysis illuminates a new set of challenges. To validate investors' expectations, these countries must maintain high growth rates for years to come. And to secure the prospects for EU accession, as well as take advantage of possible threshold effects, they must keep the momentum in institutional progress. These are not the traditional macroeconomic concerns: they are more micro than macro, and their time horizon is considerably longer. Disconcertingly for macroeconomists, they also touch upon areas that we understand relatively little: the determinants of growth, the relationship between institutions and growth, and the political economy of institutional reform. But they are challenges that policymakers in European emerging markets – and those who advise them – cannot afford to disregard.

Elaborating a comprehensive policy agenda that would help European emerging markets tackle these challenges lies outside the scope of this paper. But in closing, I would like to highlight two points that I believe are particularly relevant for Southeastern Europe.

–One key factor for economic growth is labor force participation and employment rates. As chart 6 shows, the Central European and Baltic countries have already reached participation and employment rates that are close to those in the EU – although Poland and Hungary are somewhat behind the rest. Relatively little additional mileage can be expected in the future from raising these rates further. Southeastern European countries, however, lag significantly behind. Whether low participation and employment rates reflect socio-cultural factors (for example, as regards female participation), skills mismatches, discouraged worker effects, or a combination of the above, there is clearly a major growth payoff to be had by raising these toward Central or Western European levels.

Chart 6: Participation and Employment Rates, 2001–2005

(% of working age population)

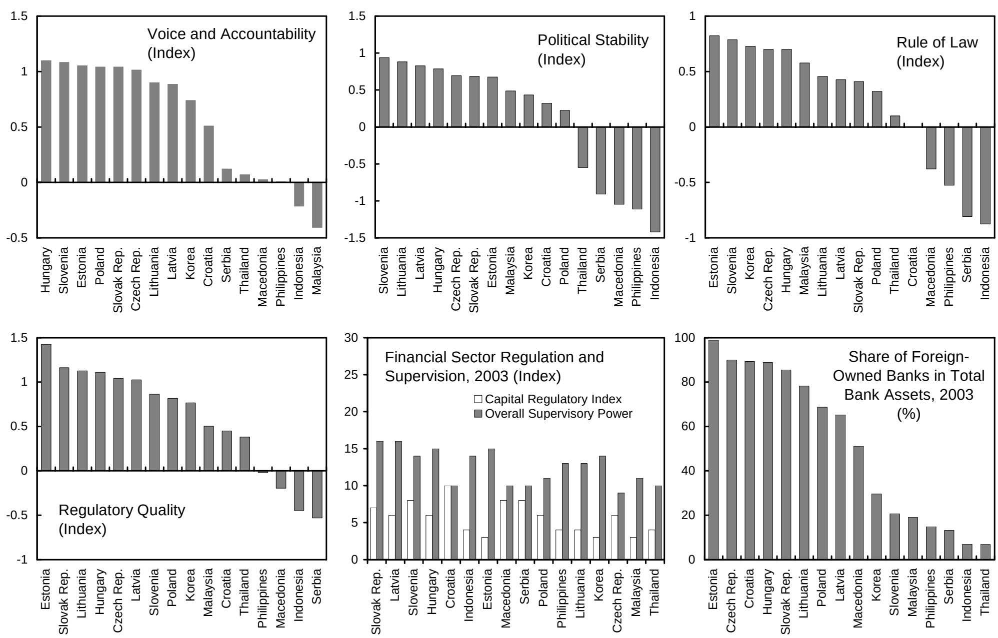


Sources: Eurostat and National Labor Force Surveys.

The other key factor for economic growth is total factor productivity (TFP). There is a considerable body of literature on the determinants of TFP, and I do not plan to summarize it here. One point of consensus is that institutions matter for productivity and growth. The channels through which institutions affect growth are manifold and not well understood. Strong institutions promote social peace; they stimulate innovation and efficiency in production; they attract foreign direct investment, which has positive spillover effects on the domestic economy and they facilitate and amplify the effect of macroeconomic stabilization policies. Finally, their impact may be nonlinear: the benefits of strong institutions may become apparent only after institutional development has surpassed a threshold value.

European emerging markets as a group are more advanced than other emerging markets across a number of different institutional dimensions: democracy, rule of law, protection of property rights, quality of regulations, financial sector development. If we look at the individual country level, however, it becomes clear that this reflects the progress in the Central European and Baltic countries; Southeastern European countries, in contrast, do not stand out relative to other emerging markets (chart 7). To ensure continued high TFP growth and take advantage of possible institutional threshold effects, policymakers in Southeastern Europe need to make institutional development a high priority on their agenda.

Chart 7: Selected Governance Indicators 2005



Note: Higher index numbers indicate better governance.

Source: World Bank Governance Database; World Bank Financial Regulation/Supervision Database.

Of course, raising labor force participation and accelerating institutional reform are not new ideas. They have long been part of the standard policy prescription of donors and international financial institutions to policymakers in European emerging markets. But the message is often drowned by the volume of concern expressed about the traditional macroeconomic risks of high external current account deficits and capital inflows. I have argued that there are good reasons to believe that these risks, while present, may not be very urgent in European emerging markets. It is to be hoped that by lowering the volume of these concerns a notch would allow policymakers – especially in Southeastern Europe – to focus more on microeconomic and institutional priorities.

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Assessing the Role of International and Domestic Financial Factors in the Sovereign Debt Structure[1]

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Abstract

The role that domestic and international financial conditions have in shaping the less developed countries' governments' debt structure is analyzed using data on individual bond issuance. First, the issuance decision is studied. Second, a structural model is used to estimate three key characteristics of sovereign bonds: issue size, maturity and spread. Identification is achieved through the use of demographics and financial conditions. Results show that better developed domestic financial markets and looser international financial conditions both raise less developed countries ability to tap the markets and, mainly through their effect on the spreads, are important determinants of the observed debt structure. There is evidence of an interaction between financial deepening and financing conditions in global markets.

Keywords: Sovereign debt structure, financial markets, international liquidity, structural analysis
JEL codes: F34, G12, C30

Introduction

How could the International Financial Architecture be reformed, to reduce the frequency and extent of financial crises? Commentators have pointed out that many

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of the last crises episodes in less developed countries (LDCs), have occurred after periods of accumulation of large quantities of debt on short maturities. Is it that LDCs have a preference for short term debt, or market conditions do not allow them to borrow otherwise? Already in 1995, the World Bank recommended Asian countries to develop their domestic bond markets. The subsequent crises taught that developing economies actually needed deeper and more liquid bond markets. These would help to reduce both maturity and currency mismatches.[3]

Along these lines, an empirical literature assessing the importance of domestic financial conditions has emerged. Eichengreen and Luengnaruemitchai (2004) or Jeanne and Guscina (2006) are excellent examples of this growing literature, that aims to link overall financial development with the sovereign debt structure, and financial crises. The present analysis follows that road. It sheds light on the link between financial markets, both domestic and international, sovereign debt structure and financial crises. Converse to previous studies, it does so focusing on individual sovereign bond issuances. This allows addressing the effect of different factors in the specific characteristics of this type of debt contracts. From the domestic side, special attention is paid to both the size and the level of activity of bond and stock markets. Regarding the international dimension, in addition to U.S. interest rates, an index reflecting international liquidity (investors' wealth) is used.

As a first step the issuance decision is analyzed by means of a probit model. This allows unmasks what factors are behind the ability of LDCs to tap the markets. Additionally, it is used to derive a control function that allows to correct sample selection biases when estimating the structural model.

Eichengreen et al. (2001), and Min et al. (2004) show that non fundamental factors, "market sentiment" in their terminology, are very important determinants of when and how LDCs borrow. The current analysis, by accounting for financial conditions, unmasks some factors behind that residual. This is done by estimating a fully fledged supply and demand model for spreads and maturities. Identification of the model is achieved through the use of exclusion restrictions, based on demographics, domestic policies and international financial conditions.

Results show that better developed domestic markets and increased global liquidity make it easier for LDCs to tap the international markets, and help improving the conditions of the debt. There are also signs of an interaction between domestic financial deepening and access to international financial markets. It is also shown that development of domestic bond markets and issuance clustering have an undoubtedly beneficial effect on the average maturity of domestic debt.

The next section gives an overview of past findings, and summarizes the main contributions of the paper. Section 3 presents the econometric strategy, with a detailed explanation of the identification strategy. In section 4 the data used is

[3] See Broner et al. (2004) or Bussiere et al. (2006), for models featuring these mismatches.

briefly described. Main results and robustness checks are introduced in section 5. Section 6 concludes. Main tables and data sources are presented in the Appendix.

1. What Do we Know about the Sovereign Debt Structure?

It has been long argued that LDCs borrowing strategy is at the basis of most of the last financial crises. The predominant view states that they overborrowed on a short term basis and/or in a strong (foreign denominated) currency. This inability to borrow on a long term basis using the domestic currency ("original sin" in the terminology of Eichengreen and Hausmann, 1999), leads to currency and maturity mismatches. These, when not adequately managed, have been a stepping stone into financial crises, and defaults.

The empirical literature has tried to understand what factors are behind the "original sin", and if it is *de facto* to be blamed on developing economies. Approaches have differed both in the econometric strategy and in the type of data used. Regarding the first aspect, econometric strategies range from standard OLS regressions in panels or cross-sections (see Min, 2004 or Lane, 2005), to structural (EHM, 2001) or disequilibrium models (Eaton and Gersovitz, 1981). On the other hand, while some papers have used macroeconomic aggregates, others have focused on individual issues. Macro data is useful to get an intuition about the big numbers of an economy. But, if the focus is on specific debt characteristics, it is necessary to use individual issues. However, this kind of data is scarce and incomplete. These may be the reasons why most of the analysis with micro data has pooled together public and private debt, in the form of both, bond or loans.

The broad picture that arises from these contributions is that sound economic aggregates, monetary stability, and the political and legal environment are the fundamental factors explaining the observed debt structure. Recent empirical macro evidence points also to the role of financial conditions. In Broner et al. (2004) investors holding bonds with long maturities are exposed to price risk, arising from the absence of liquid secondary markets. Therefore countries willing to issue long maturities must compensate investors for this risk, making long debt so expensive that sovereigns prefer shorter maturities, even at the cost of possibly facing sudden capital outflows.[4] As Eichengreen and Luengnaruemitchai (2004), this paper supports this view.

[4] Erce (2005) presents a similar mechanism, and shows how the interaction of both, illiquid markets and higher levels of short term debt, can give rise to unnecessary (panic based) crises.

1.1. The Macro Oriented Empirical Literature.

Interest rates in the U.S. are often seen as an important factor conditioning capital flows to LDCs. Antzulatos (2000) shows that the ongoing process of portfolio diversification has reduced their effect. The "original sin" is analyzed in great detail in Hausmann and Panizza (2003). They find little evidence that factors like the level of development, institutional quality or monetary credibility are at the basis of it. The role of institutional factors, in determining the currency composition of the debt, is examined in Claessens et al. (2003). They find evidence of scale effects, countries with a larger base of domestic investors issue longer debt denominated in domestic currency. Evidence relating fixed exchange rates with larger foreign denominated debt markets is presented. Lane (2005) finds a significant relation between openness and debt levels. In Mody and Taylor (2004) a model of market disequilibrium is estimated. This allows recovering a supply and a demand function for capital.[5] The results show that informational asymmetries are an important determinant of credit crunches. Eichengreen and Luengnaruemitchai (2004) shows that the slow development of bond markets in Asia is due to the combination of weak institutions, exchange rate volatility, and lack of competition in the banking industry. In line with this result, Boot and Thakov (1997) show that for a financial system to become mature the development of sources of credit different than bank lending is a must. The role of exchange rate volatility in generating large shares of short term debt is explored in Bussiere et al. (2006). Jeanne and Guscina (2006) present a new database on government debt in emerging countries. They report significant cross country differences, and attribute it especially to the different record of monetary stability.

The evidence, summarized above, shows how economic and political factors are important determinants of the debt structure and of the development of financial markets. However, this kind of analysis, due to its macroeconomic nature, is not helpful if the interest is in understanding the cost (spread) of the debt, which, as shown by Broner et al. (2004), is an important factor affecting the observed maturity of the debt.

1.2 The Micro Oriented Empirical Literature

When analyzing lending, there are three characteristics which are of capital importance: spread, maturity and size of the issue. There is a number of theoretical contributions which have managed to jointly analyze all three. However, empirical analyses are much harder to find, especially for developing economies. There are two main reasons for this. The first is a lack of data; markets for LDCs debt were

[5] Their model is based in the early work by Maddala and Nelson (1974). See Eaton and Gersovitz (1981) for another application of this methodology to debt markets .

basically inexistent prior to the nineties. Second, such an analysis, among many other empirical complications, implies the estimation of a simultaneous equation model. Achieving identification on such models is not an easy task. Eichengreen and Mody (1999) were the first to address concerns about sample selection. They estimated the determinants of bond and loan spreads, together with a probit to assess the factors determining bond issuance. Eichengreen, Hale and Mody (EHM hereafter, 2001), presented an econometric model where maturities and spreads were jointly analyzed, along with a probit to control for sample selection. In order to overcome the identification problem they assumed that, while the maturity affects the spread, the spread has no contemporaneous effect on the maturity. However, such strategy disregards cost considerations by the government when choosing the maturity. Their study made clear the importance of sound fundamentals, as they make the maturity of the debt longer, and relatively cheaper. However, it also showed that non fundamental factors, "market sentiment", are a very important determinant of LDCs borrowing. Hale (2001) shows that borrowers with high political and economic risk will issue only "junk" bonds, while those countries with low levels of both risks will issue investment grade bonds. The rest are more likely demand loans from the banking sector. Gelos et al. (2004) presents an analysis on the determinants of market access. Default does not seem to provoke a strong punishment in terms of lost of market access. The quality of policies and institutions is an important determinant of the ability of sovereigns to tap the markets. Min et al. (2004) provides panel data analysis of debt spread determinants, however it disregards both endogeneity and sample selection problems. Jeanneau and Perez Verdia (2006) investigates the link between the development of the domestic government bond market in Mexico and the government's debt composition. It shows how the development of a domestic bond market, has helped raising the maturity of the debt.

1.3 This Paper

The papers above focus on loans and bonds, both private and public. The first significant contribution of this paper is that it looks exclusively at public bonds. Bonds and loans are very different types of contracts. Private debt depends not only on macroeconomic characteristics, but also on specific firms' characteristics. If we want to understand the markets for public bonds, it is therefore important to look at the factors determining their characteristics without pooling them with other types of debt or issuers, as this could give a distorted picture.

The objective is to test how domestic and international financial conditions affect the borrowing strategy of LDCs' governments. The results shed light on how the specific contract characteristics are affected by financial factors. EHM (2001) argued that spreads and maturities reflect to a large extent market sentiment (risk aversion). This paper shows that financial conditions can explain part of this residual.[6]

The international financial situation is represented by the use of U.S. T-bill rates, an index that proxies global liquidity, and a variable reflecting the growth rate of the previous index. These last variables, whose construction is explained in detail in section 3, can be seen as directly related with investors' risk attitude.[7] An increase in the level of international liquidity, by increasing the money available in the hands of investors, reduces their (relative) risk aversion.

To understand the role of domestic financial conditions different variables, obtained from the Financial Structure Database, were used. Main focus was domestic bonds and stocks markets. The first was represented by the size of the public debt bond market relative to GDP. This same variable was used in Eichengreen and Luengnaruemitchai (2004).[8] It reflects the level of development of the domestic bond market for public debt. One would expect this market to have a significant effect on sovereigns' borrowing strategy. To represent stock markets two variables were included: the stock market capitalization over GDP, and the stock market turnover. The first measure gives an idea of the relative size of the stock market. The last variable represents the level of liquidity/activity on that market. To assess the robustness of the results, the analysis was also performed using two different data sets. One with data on financial conditions collected by La Porta et al. (LLSV, 1999), and other with data obtained from the World Development Indicators (WDI).

Another contribution regards the econometric strategy. The simultaneous equation model is expressed as a supply and demand model, for which I can find exclusion restrictions based on previous theoretical and empirical contributions. Finally, the paper addresses concerns about the possible biases that could arise if borrowers would strategically time their issuances.

Results indicate that the identification mechanism works. When spreads raise, governments prefer to issue shorter maturities. Estimates also show that increased global liquidity both increases LDCs ability to tap the market and drives down the spreads. On the other hand, development of domestic financial markets appears to raise issuance, in larger maturities and/or with lower spreads. This signals the existence of an important link between domestic and international financial markets. Some evidence is provided about the role of issuance clustering. While

[6] In EHM (2001) international conditions were represented by interest rates in the U.S.A., and financial domestic factors by a measure of the domestic credit market.

[7] See Broner et al. (2004) for a sovereign debt maturity model in which more wealth implies reduced risk aversion.

[8] Another choice would be to include a variable measuring the bid-ask spread. Unluckily this kind of data is not available for many of the countries in our sample. Using bid-ask spreads also raises the issue of what bond to use (see Jeanneau and Perez Verdia, 2006).

clustering does not seem to bias the results obtained, it appears to have a positive effect on the maturity of the debt.

2. Econometric Strategy

The econometric analysis presented here, in addition to the sample selection concern, addresses two issues that were disregarded in previous studies. Enumeration of the explanatory variables included at each stage of the analysis is relegated to the next section.

First, when estimating the maturity-spread relation, the issued amount variable is treated as an endogenous variable. Previous work has assumed that the issued amount was unrelated with other bond characteristics. Such an assumption, if false, could give rise to endogeneity problems. Second, a strategy to estimate the maturity-spread system without relying on diagonalization is provided. The goal is to understand how spreads and maturity are jointly determined. The problem is restated in terms of supply and demand equations,

$$M_{it}^{\text{demand}} = \alpha S_{it} + \Theta_M X_{it} + \omega_{it}^D, \tag{1}$$

$$M_{it}^{\text{supply}} = \beta S_{it} + \Theta_S X_{it} + \omega_{it}^S, \tag{2}$$

$$M_{it}^{\text{supply}} = M_{it}^{\text{demand}} = M_{it}, \tag{3}$$

where S_{it} and M_{it} are the spread and maturity of a bond issued by country i at time t. These are the potentially endogenous variables of the system. X_{it} is a vector containing the exogenous variables. The errors are assumed to be well behaved, $E(\omega_{it}^D) = E(\omega_{it}^S) = E(\omega_{it}^D \omega_{it}^S) = 0$.

The supply equation explains the preferred maturity of the investors. The demand equation determines the preferred maturity for the government. This makes it easier to find a set of exclusion restrictions in Θ_S and Θ_D, needed to identify the structural parameters, and permits to relax the unpleasant assumption that spreads have no effect on observed maturities.

Simple manipulation of the system above leads to

$$Y_{it} = BY_{it} + \Gamma X_{it} + \varepsilon_{it} \tag{4}$$

$i \in \{1, \ldots N\}, t \in \{1, \ldots T\}$, where $Y_{it}' = \begin{pmatrix} M_{it} & S_{it} \end{pmatrix}$ contains the endogenous variables, X_{it} is a $kx1$ vector containing the k exogenous variables, B is a $2x2$ nonsingular matrix, Γ is a $2xk$ matrix, $\varepsilon_{it} \sim N(0,\Sigma)$ are $i.i.d.$ This is the model to be estimated.[9]

Along with the analysis of the characteristics of the bond, I study the issuance decision by means of a probit model. The dependent variable is access to financial markets in a given quarter. This quarterly indicator, I_{it}, takes value one when country i tapped the market on period t. The model, once that the issuance analysis is included is

$$Y_{it} = BY_{it} + \Gamma X_{it} + \varepsilon_{it} \quad if \quad I_{it} = 1$$

$$I^{*}_{it} = \Psi X^{I}_{it} + \upsilon_{it} \tag{5}$$

This is useful not only because it allows me to make an assessment of the factors determining the ability of LDCs to tap the financial markets, but also because it is a way to create the control function required to fix sample selection biases. As pointed out above, participation in the bond market has risen over time. This could imply that, OLS estimates of the relationship between specific country characteristics and spreads could be biased if these country characteristics not only affected the price of the debt, but also market access.[10]

2.1 Political Risk

Previous analyses have shown that political risk is an important determinant of both market access and LDCs borrowing strategy. Following Eichengreen and Mody (1999) and EHM (2001) an OLS estimation of the credit rating against a set of macroeconomic factors is performed,

$$rating_{it} = \theta X^{rating}_{it} + \varepsilon^{rating}_{it}$$

The OLS-residual of this regression, $\varepsilon^{rating}_{it} = rating_{it} - \hat{\theta} X^{rating}_{it}$, can be understood as a measure of political risk. By construction, a higher rating residual is associated with higher political risk. It will be used as an additional regressor in subsequent steps.

[9] The relation between the coefficients in equations (1) to (3), and those in equation (4) is,

$$B = \begin{pmatrix} 0 & \alpha \\ \frac{1}{\beta} & 0 \end{pmatrix} \quad \Gamma = \begin{pmatrix} \Theta_M \\ -\frac{\Theta_S}{\beta} \end{pmatrix} \quad \varepsilon_{it} = \begin{pmatrix} \omega^{D}_{it} \\ -\frac{\omega^{S}_{it}}{\beta} \end{pmatrix}$$

[10] This would be the case whenever $\operatorname{cov}(\varepsilon_{it}, \upsilon_{it}) \neq 0$.

2.2 Issuance

Once that $\varepsilon_{it}^{rating}$ has been obtained, the analysis moves to the estimation of the issuance decision, with $\varepsilon_{it}^{rating} \in X_{it}^{I}$.From this analysis the inverse mills ratio, $\lambda_{it} = \frac{\phi(\hat{\Psi} X_{it}^{I})}{\Phi(\hat{\Psi} X_{it}^{I})}$, is obtained. It should be noted that the mills ratio collects, not only the factors that affect the issue decision of credit rationed governments, but also voluntary decisions not to access the market.[11] As in EHM, to guarantee identification the probit model contains a variable only present at this stage of the estimation, the ratio of reserves to imports.

2.3 Size

As mentioned above, the issue size, Q_{it}, can be simultaneously determined with the other terms of the contract. Endogeneity problems could arise from the direct introduction of the variable in the system. To avoid this problem the extended system is made triangular, and the size of the issue is replaced by the estimated value obtained from an OLS regression using a set of variables that previous studies found significant,

$$Q_{it} = \theta_Q X_{it}^{Q} + \varepsilon_{it}^{Q}$$

where $\varepsilon_{it}^{rating}$ and $\lambda_{it} \in X_{it}^{Q}$. $\hat{Q}_{it} = \hat{\theta}_{it} X_{it}^{Q}$, is the predicted size.[12]

The ratio of short term debt to total debt and GDP were selected as exclusion restrictions for this step. The first gives an idea of the possible need of funds in the short run. The fact that larger countries tend to have larger financial needs motivates the introduction of the second.

[11] A natural extension would be to use disequilibrium models (see Maddala and Nelson, 1974) to understand when the sample selection arises due to credit rationing, and when due to a voluntary decision.

[12] If the amount is endogenous, the system can be redefined as $Z_{it} = AZ_{it} + DX_{it} + E_{it}$, where $Z_{it} = (Q_{it}, M_{it}, S_{it})$ The estimation strategy amounts to triangularise the system. In terms of the matrix A,

$$A = \begin{pmatrix} 0 & 0 & 0 \\ a & 0 & b \\ c & d & 0 \end{pmatrix}$$

This implies that, once a country can issue, the decision of how much debt to issue is not guided by the spreads or by the maturity. This is a quite restrictive statement, which may fit best countries who do not suffer from credit rationing.

2.4 Structural Model

Finally, the analysis moves to jointly determining spread and maturity.

In order to estimate the simultaneous equations system, a two steps procedure was chosen.[13] The way in which the procedure works is briefly summarized below. The first step amounts to estimate the reduced form parameters. We know that for the model (4) a reduced form always exists:

$$Y_{it} = \Pi X_{it} + u_{it}$$

where $\varepsilon_{it}^{rating}, \hat{Q}_{it}$ and $\lambda_{it} \in X_{it}$, $\Pi = \Gamma(I-B)^{-1}$ and $u_{it} = \varepsilon_{it}(I-B)^{-1}$.

This allows retrieving $\hat{Y}_{it} = \hat{\Pi} X_{it}$ where $\hat{\Pi}$ is the OLS estimates of Π.

The next step is to replace the endogenous variables by their first step estimate,

$$Y_{it} = B\hat{Y}_{it} + \Gamma X_{it} + \eta_{it} \tag{6}$$

where $\eta_{it} = \varepsilon_{it} + (\Pi - \hat{\Pi})BX_{it}$.

On each period of time there are countries for which no debt was issued, while others tapped the market more than once. The estimation is done by considering each issue as an individual observation, and then taking care of time and spatial effects by including periods and region dummies.

2.4.1. Model Identification

Identification of the system requires defining two sets of instruments. The first is used to identify the effect of the maturity on the spread equation. For this, variables which directly affect the preferred maturity of the government, but only affect the preferred maturity of the investors through the spread are needed. Two candidates are presented, pension reforms and the demographic structure. During the last decade, some LDCs financed reforms in their pension systems by issuing sovereign bonds.[14] The maturity of these bonds could be affected by the interest of the governments to match durations. An indicator which takes value one on debt issued up to three years after the reform was constructed. Given the high cost of these reforms, it makes sense to assume that they were financed over a number of years

[13] Also a three steps procedure was applied, yielding similar results.

[14] I focus in reforms that implied a change from a pay as you go system to one with individual accounts. These changes let the governments with the need of financing the retirement benefits of existing pensioners, and the ones to come in the near future, during the transtition process.

after the implementation. The next group of instruments is related with the demographic distribution in the population. Two variables reflecting the proportion of the population between 35 and 55, and above 55 were included. Governments, with a higher proportion of older people, can have political incentives to issue longer debt. This is a political economy argumentation, in order to guarantee the voting of the elder a government may have an incentive to issue longer debt to be repaid by future generations.[15]

The next step is to define the identification restrictions on the supply equation, needed to identify the effect of the spread on the maturity. Three different types of variables where included. They can be summarized as variables affecting investors wealth, political risk, and variables affecting investors outside option. Regarding the last, the 10 years U.S. T-bill rate was used. This is a standard variable in spread analyses (see Eichengreen and Mody, 1999 or Min et al., 2004). As for the first, the index of international liquidity mentioned above, which is defined in more detail in the next section, was chosen. It aims to reflect the level of wealth available for international investors. Theoretically, increases in this variable should make investors less concerned about liquidity issues, and hence require a lower premium. Finally the residual of the rating regression was used as a measure of political risk.

As the number of exclusion restrictions is larger than that of endogenous variables, the system can be overidentified. Sargan tests for overidentifying restrictions were performed for a variety of specifications. The specific results are presented in the next section.The null hypothesis was never rejected, suggesting that the model was correctly identified.

3. Data

The data on bond characteristics was obtained from Bondware (Dealogic). From there, data on maturity, spread, credit rating, issued amount and currency denomination was obtained. There are around 2000 observations of public bonds issued by LDCs between 1990–2005. A list of countries, for which the analysis was performed is contained in the Appendix. To show that the effects obtained were not driven by an ad-hoc choice of the explanatory variables the variables included in each part of the analysis are, as long as available, as in EHM (2001).

The macroeconomic variables reflecting both domestic and international conditions were obtained mostly from the International Financial Statistics and the World Development Indicators. T-bill rates were obtained from Datastream. Data on stock markets and bond markets was obtained from the Financial Structure Database. Exchange rates were obtained from Global Finance Data. Data on pensions reform was obtained from the U.S. Social Security Administration, which

[15] See Perotti and Alesina (1997), Persson et al. (2005) or Bassetto and Sargent (2005) for models of political economy yielding the argument presented here.

collects data from pensions reforms worldwide.[16] Data coming from both the World bank and the Paris club was used to construct an indicator of debt rescheduling process, which takes value one when on that specific year the country went through a debt rearrangement. The data about the demographic structure was obtained form the World Development Indicators. Two variables were used. One, which I labeled as "old", reflects the proportion of the population that is above 55. The other, under the name "adults" collects the proportion of the population with aged between 35 and 55. A full source description can be found in the appendix.

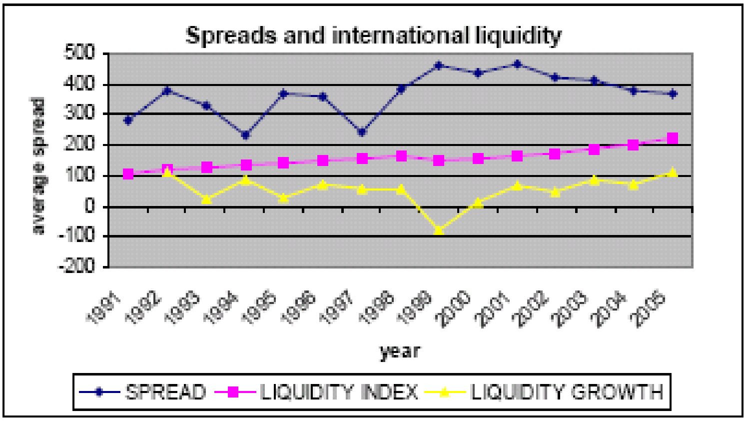
International Liquidity

"World" liquidity is hard to measure. More developed countries have higher liquidity ratios as measured by monetary aggregates (M1, M2, etc.) to GDP than less developed countries. Part of the change in liquidity measures of LDCs could thus simply indicate that they are becoming financially more sophisticated. It is hence difficult to aggregate measures over all countries in the world. Furthermore, strictly speaking, one would like to have only "narrow" money, but narrow money is often not available. However, in developing countries the monetary base is backed by international reserves. Hence, developments in foreign reserves can be used as a proxy for developments in narrow money. Therefore, the international availability of funds is proxied by an index with base in 1990, that adds together country by country data about the ratio of M2 (or reserves when M2 was not available) to GDP. Data for this index was obtained from IFS.[17]

[16] The data used is available at: http://www.ssa.gov/policy/docs/progdesc/ssptw/.

[17] The use of indices of this kind to measure world liquidity is common practice in Investment Banking. See for instance European Investment Bank (September, 2005) or IXIS (July, 2005).

Chart 1: Global Liquidity



Source: Dealogic and author´s calculations.

As shown in Chart 1, the process of yield compression that started with the new century has come hand in hand with large increases in global liquidity.

The critical role that international reserves play in the expansion – and potential contraction of global liquidity has received much attention recently. Arista and Griffith-Jones (2006) nicely explains the way in which increased U.S. dollar holdings at LDCs Central Banks, can give rise to increased liquidity back in the United States, as they are repatriated in exchange for U.S. Treasuries.

In order to minimize endogeneity issues, lagged values of all variables were used in the estimation procedure. Dummy variables to control for regional and time effects were constructed. Period dummies were constructed reflecting four different time periods. One accounts for issues until the Mexican crisis (1994), the next covers the period between the Mexican and the Asian crises (1995–1996), the next accounts for period between the Asian and the Russian crises (1997-1999), and the last runs from 2000 until 2005. To control for regional effects dummies were constructed reflecting the membership to the following regions: Latin America, East Europe, four Asian Tigers, New Giants (China and India), Middle East and Africa.

4. Results

In this section, the main results of the different parts of the analysis are reported step by step. The main focus is on the effect of financial conditions, on the identification strategy, and in results that contrast with previous findings. Tables containing some of the estimation results and the specification tests can be found in the Appendix.

4.1 Determinants of Credit Rating

The Standard and Poors definition of credit rating was used for this part of the analysis. The Appendix contains a table explaining the way in which the ratings were represented. By construction, higher values on the variable are associated with a worse rating. Results are very similar to those in EHM, and can be found in Table 1.[18]

Table 1: Regression for the Credit Rating

Variables	
Debt reschduled las period (dummy)	1.075**
Reserves over gdp	-9.649**
Total external detb over gdp	3.825**
Exports over gdp	-0.027**
Inflation	0.0007**
GDP growth	-1.387**
Latin american dummy	1.06**
East European Dummy	-0.617**
Tigers	1.024**
Orient	1.83**
Africa	0.109
constant	10.918**
No. of observations	1894
Adjusted R- squared	0.422

They show that previous debt rescheduling, higher total external debt over GDP, and higher inflation have a negative impact on the rating. On the other hand higher reserves over GDP, exports over GDP or GDP growth are associated with improving ratings.

4.2 The Issuance Decision

The analysis of the probability of issuance is performed by adding to the benchmark EHM probit specification, first the variables reflecting international availability of funds, then the ones representing the domestic financial conditions, and finally all together. Additionally, most of the regressions include dummies to collect the possible effects that crises would have. They take a value one on the specific quarter in which commentators claim the crises to have started and on the

[18] This is a comforting result because, while I used the S&P rating, EHM used data from Institutional Investors.

following three quarters. The results are reported in tables A1 and A2 in the appendix.

The first two columns in table A1 collect the results for the model that replicates the analysis in EHM, in the last column the results when the measures of international liquidity were included are presented.

Results are similar to those in previous studies. Larger size, as proxied by a larger GDP, lower political risk, and higher ratios of reserves to imports increase the probability of issuance. However, the sign of the last one changed when domestic financial variables were added to the regression. Previous debt rescheduling, higher external debt, and a lower debt service to exports ratio seem to reduce the probability of a country issuing debt. Increases in the growth of international liquidity, as expected, raise the probability of issuance. Regarding the crises dummies, although the significance was not always especially high, there are some indications that especially the Mexican and the Russian crises affected the probability of observing LDCs tapping the financial markets at a global level.

It is interesting to note that the international liquidity appears to be a more important determinant of issuance than the 10 year U.S. T-bill. As long as those two variables can be seen as reflecting quantity and price of the international funds, this result points to the fact that the quantity of funds available is more important for issuance than their cost (credit rationing).

The next set of results, when domestic financial conditions are taken into account are collected in table A2. First column adds to the EHM benchmark the selected variables. In the second column the international liquidity variables are added. The last column collects the results of the estimation that was used for computing the correction for the sample selection problem.[19], [20]

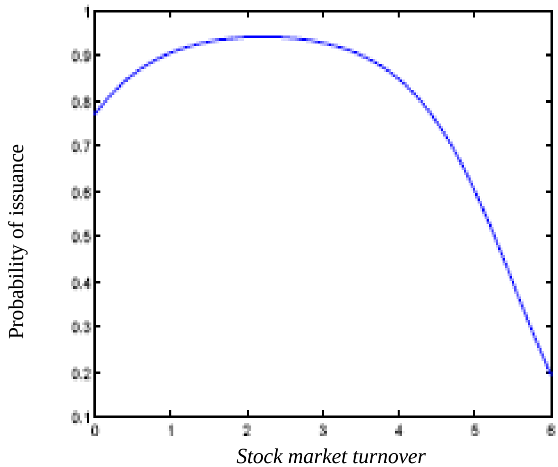
There are several consistent findings. First, a larger stock market capitalization is associated with a lower probability of issuance. A possible interpretation is that public and private agents are in competition for international funds. The larger stock market is the harder is for the government to place its bonds.[21] Second, if financial markets are liquid, as reflected by the turnover variable, it is easier for investors to hedge against risks and this makes it easier for the governments to place their debt in the market. However, this is a non linear relation, and for large levels of turnover the effect becomes negative. The non linear effect of stock market turnover on the issuance probability is represented in chart 2 below.

[19] Note that the amount of observations falls greatly when data about the Public bond market is used. In order to maximize the number of observations available for the next step I decided not to include it when obtaining the Mills ratio.

[20] The analysis was also performed by adding one variable at a time. Results were basically identical and are not reported here.

[21] This is of course on of the many explanations that one can think of. Other would be that as the stock markets develop the Government faces less often the need of raising funds directly as firms can do it through the stock exchange.

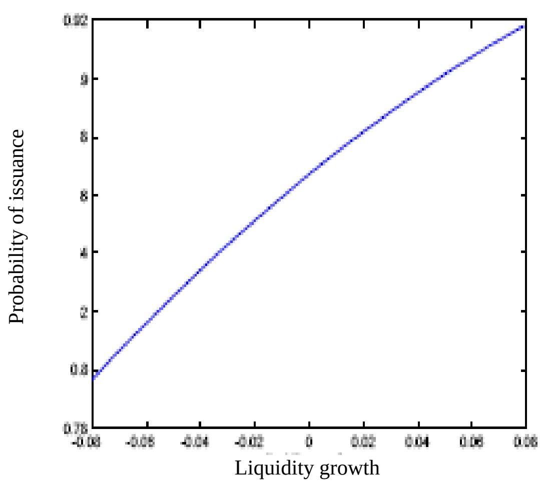
Chart 2: Issuance Probability and Stock Market Turnover



Source: Author's calculations.

Finally, the larger the market capitalization of the public bond market, the easier that a government will issue debt. One should be cautious in giving an interpretation to this result. This may imply that larger bond markets make it easier to issue additional debt, but it can also reflect the fact that countries which issued large quantities of sovereign debt in the past are more likely to do it in the present.

Chart 3: Issuance Probability and International Liquidity



Source: Author's calculations.

As can be seen in chart 3, changes in the international liquidity index have a positive effect on the issuance probability.

It should be noted, however, that the significance of the variables reflecting international liquidity was greatly reduced when the estimation included the measure about the size of the public bond market.

Determinants of the Size of the Issue

All the variables included in the analysis are based in previous analyses.[22] Most of those studies disregarded the role of financial conditions. An exception is Mody and Taylor (2004).The results are summarized in table A3.

There is strong evidence of a size effect, larger economies borrow larger amounts. The interest rate for the 10 years T-bill is negatively associated with the size of the issue. As before, when measures of international liquidity are introduced the significance of this variable drops down (see column 2). As one would expect, when the level of wealth in the hands of international investors raises, their appetite for LDCs bonds raises and with it the size of the observed issues. This can be seen also in the significance of the dummy reflecting issues since 2000 period on which the interest of investors for LDCs debt has grown together with the level of international liquidity (see chart 1). Dummies reflecting the currency denomination of the bond were introduced. Issues in U.S. dollars tend to be significantly larger, while issues denominated in domestic currency are smaller. This can be one of the factors explaining the recurrent use of international financial markets by LDCs. There is a group of explanatory variables whose effect changes when variables reflecting domestic financial conditions are introduced. This can be seen when comparing the coefficients in columns 1 and 2 with those in columns 3 and 4. The ratio of short term debt to total debt, the ratio of debt service to exports, the sample selection control, and the political risk indicator, which in the absence of domestic financial variables had a negative and significant sign, turn positive or insignificant when the financial variables are added. The first two can be understood of variables determining financial needs, but can also represent liquidity problems. Once we control for financial conditions in a rigorous way, they are collecting the fact that more resources may be needed and hence the positive effect on the amount issued. The ratio of exports to GDP and the dummy reflecting previous debt rescheduling have a negative coefficient.

Domestic financial conditions have a significant effect on the amount of debt. As the turnover in the stock market increases, i.e., as the liquidity in domestic financial markets rises, the size of the issues becomes smaller. This result can be related to the positive effect of turnover on issuance. When financial markets are

[22]See Antzulatos (2000), Mody and Taylor (2004), Lane (2004), Hale (2001), or Eaton and Gersovitz (1981).

more liquid, governments can tap the market more often and they do it in smaller amounts. Additionally, a non-linear effect from the relative size of the public bond market on the size of the issues was found. Increasing public bond markets seem to be associated with larger issues, however as the size keeps growing this effect becomes negative. When public bond markets become more developed issuance becomes easier, and as before this may give an incentive to governments to launch smaller issues at a time.

4.3 Determinants of the Maturity and Spread

As with the issuance decision, the joint analysis of spreads and maturities is performed in steps, adding to the benchmark specification (EHM, 2001) the variables reflecting financial conditions. Given that EHM (2001) analysis is closest to this, it seems the best way to proceed to stick to their specification as much as possible.

As in EHM, a first step was to test for the existence of a non linear relation of maturities and spreads with the credit rating.[23]

The results signal to such relation, and as in previous studies, the analysis was performed by separating the observations in two categories, investment grade and non-investment grade bonds.[24]

The results for the maturity are presented in table A4, and those for the spread in Table 6. The first column from both tables reproduces the analysis in EHM, but introducing the variables aimed to identify the system and therefore avoiding the simplifying assumption of a triangular system. The next columns, [4.2] and [4.2], report the results when controlling for the endogeneity of the amount issued. The main difference is the significance of the parameter associated with the effect of the spread once that endogeneity is accounted for. The rest of the results are (as expected) fairly similar. Next two columns, [4.3], [4.4], [5.3], and [5.4], explore the effect that domestic factors have in the determination on the spread and maturity of the bonds.

Robustness

To asses the robustness of these results I decided to construct two alternative measures representing the domestic financial conditions. The first one was

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[23] A simple OLS regression shows that,

$$M_{it} = 0.456 * rating_{it} - 0.026 * (rating_{it})^2. \quad R^2 = 0.11$$

Standard errors are reported under parenthesis. Hale (2001) makes a related point.

[24] Unluckily, the number of observations with an investment grade rating was too small to perform the structural analysis. Here, I present only the analysis for the non-investment grade bonds.

constructed by obtaining the first principal component of data on the total value of the stocks traded and the turnover ratio, coming from the World Development Indicators. The second measure was constructed using two measures of financial market efficiency constructed by La Porta et al. (LLSV, 1998). The variables were the ratio of turnover to net interest margin and the ratio of turnover to overhead costs. For both data sets, one factor was enough to collect most of the information available.[25] The results of the analysis are reported in Columns 5 and 6 from tables A4 and A5. The Eigen values and factor loadings for both factors are presented in Tables A7 and A8 in the appendix.

Identification

Comfortingly the variables proposed to identify the system were significant. This is always true for the variable representing the proportion of the population above 55. For many of the different specifications Sargan tests for over-identifying restrictions were performed. The results for the test were almost always positive, in the sense that the system was correctly identified. Therefore, the structural parameters obtained are to be trusted. Table A9 in the Appendix summarizes the results of the tests, and explains how they were performed.

4.3.1 Maturity

The results do not show any direct relation between the observed maturity of the debt and the indicators of the domestic financial conditions. Not for the original variables, nor for the additional factors mentioned above. There is evidence of a negative relation between the spread and the maturity. This result is on line with the theoretical insights presented in Broner et al. (2004) and Erce (2005). When the cost of the debt, as represented by the spread, rises, governments have an incentive to issue shorter maturities.

Other factors affecting the maturity are previous debt rescheduling and (surprisingly) the growth rate of GDP, both having a negative influence on the observed maturity. On the other hand as the ratio of reserves to short term debt increases, the maturity also raises. In the absence of liquidity needs in the short run, governments prefer to issue debt in longer maturities. Also the size of the issue affects positively the maturity of the bond. In general, issues in U.S. dollar have a larger maturity than the rest. Finally, regarding the identification variables. While the pensions reform variables do not seem to affect the maturity, the results show a positive and highly significant relation between the proportion of population above 55 and the maturity of the issued bonds. The first result may be due to the fact that

[25]The rule to select the number of factors was the standard one. Add those factors with an eigen value well above one.

most of the bonds available for this part of the analysis were denominated in foreign currencies and issued in international markets, while pensions' reform tended to be financed with domestic debt.

4.3.2 Spread

Overall results point to a significant effect of domestic financial factors. More developed, in the sense of larger and/or more liquid domestic financial markets, drive down the observed spread, and this leads governments to issue larger maturities. This can be seen in columns 3 to 6 from Table A5. The coefficients for the value and squared value of the size of the public bond market, the size of the stock market, and those for the factors obtained from both WDI and LLSV data have a highly significant and negative coefficient.

Also the international liquidity index has a consistent negative effect on the spreads. Wealthier investors have an increased appetite for LCDs debt, and this is reflected in the premium they ask for, which is reduced.

On the other hand, higher external debt, higher political risk, lower GDP growth, and a higher ratio of reserves to GDP, lead investors to ask for a higher yield, increasing the observed spread. As in EHM a negative relation of both the 10 years U.S. T-bill and the mills ratio with the spreads was found. U.S. dollar denominated issues are not only associated with larger maturities, but also with larger spreads.

Overall, the results above point to a relation between domestic financial factors and the conditions under which LDCs can borrow in international markets. Better developed domestic markets help improving financing conditions abroad. In addition, through the effect that the spread has on the preferred maturity of the government, they lead to larger maturities.

4.4 Simultaneous Issuance

Although the use of individual issuance data was to some point reassuring, throughout the paper I have tried to overcome a variety of sources of endogeneity by using both, lags and exclusion restrictions. In this section I explore another possible miss-specification of the model, issuance clustering. Table A1 below presents the quarterly average maximum maturity observed for two groups. One containing those observations for which no other issue was observed that quarter (unique). The other contains the maximum maturity in periods when more than one bond was issued (clustered). It shows that "simultaneous" issuance is a more common practice in domestic markets, while it is accompanied by a longer range of maturities in international markets.

Table 2: Issuance Clustering in Domestic and Foreign Markets

Maximum maturity		***Average***	***Standard Deviation***	***% of cases***
domestic issue	unique	8.94	6.63	31
	clustered	9.21	6.22	69
foreign issue	unique	9.18	6.65	62
	clustered	11.73	7.70	38

When LDCs cluster issuance in determined periods of time the same fundamentals need to explain a variety of maturities and spreads. In addition, it sounds reasonable that, by offering a more diverse spectrum of assets, investors are better able to diversify their portfolio, which could make their willingness to hold larger maturities increase and/or reduce the premium to be paid. Not accounting for this could lead to biased estimates. The importance of issuance clustering for the observed debt structure, and the concerns about estimation biases are analyzed below.

How far into the future? The case for strategic issuance

As just argued the scope of this section is twofold. On the one hand, it will allow me to check if the results obtained in the previous section are robust. On the other hand, by assessing the effects of issuing a variety of bonds in specific periods on the terms of the same, we are investigating if there is a case for LDCs to strategically comprise their debt issuance in specific periods. The strategy followed was to choose for every period for every country the bond with the largest maturity. In this way for each country at each point in time there is at most one bond. Additionally to control for the effect that offering a variety of bonds can have, an indicator (a variety dummy) was constructed which takes a value one when in that specific period a country issued more than one bond. As argued above, significance of this coefficient may be associated with effects arising from allowing investors to diversify their portfolio.

The results for a variety of specifications are presented in table A6. Remarkably the results are basically identical to those obtained before. This indicates that previous estimates did not suffer from biases arising form simultaneous issuance. As before, more developed domestic financial markets reduce the spread to be paid, and this raises the observed maximum maturity. Additionally, I find a significant effect of the variety dummy on the maximum maturity observed. When countries offer the market a variety of bonds they are able to place bonds with larger maturities.

These are important results. First, it shows that countries can benefit from timing the issuances and offering a variety of alternatives. Second, this reinforces the argument of the benefits of developing the domestic financial markets. Results show how they help to enlarge the maximum maturity for which bonds can be issued.

5. Conclusion

This paper adds to a large list of studies trying to understand what factors drive the borrowing strategy followed by LDCs. Data on individual bond issuance by sovereign governments was used to asses in what way financial conditions affect the terms of sovereign debt contracts. The paper presents an estimation strategy which allowed identification of the structural parameters in a model of the simultaneous determination of maturities and spreads. Results regarding the effect of the usual macroeconomic aggregate variables are in line with previous studies. The estimates point to a significant effect of both domestic and international conditions. This effect affects both the timing and the form of sovereign borrowing. When the level of liquidity international markets is high, LDCs governments find it easier to tap the market, and can do so with better conditions. On the other hand, better functioning domestic financial markets, both for stocks and for bonds, seem to affect the conditions that investors impose on international bonded debt. Results suggest that well developed domestic bond markets and more liquid financial markets help reducing spreads, and this creates incentives for issuing bonds with longer maturities.

To address concerns about miss-specification, the effect of issuance clustering was analyzed. Comfortingly this effect, although significant, does not seem to be driving the rest of the results. The results give a significant role to issuance clustering. When a variety of bonds is offered to investors, governments seem to be able to issue debt on larger maturities. LDCs should try to take advantage from this by strategically clustering their debt issuance.

Appendix

Table A1: Result for the Issuance Probit Analysis. EHM and International Liquidity

Variable	(1)	(2)	(3)
Rating residual	-0.041**	-0.043**	-0.043**
10 years U.S. T-Bill rate	-0.296	-0.432	-0.337
U.S. Treasury Yield Curve (10y-1y)	0.09	0.043	0.09
External debt to GDP	-0.278	-0.301	-0.298
Debt service to exports ratio	0.011**	0.012**	0.012**
Debt rescheduled last year (dummy)	-0.49**	-0.483**	-0.482**
Exports over GDP	-0.003	-0.003	-0.003
Reserves to imports ratio	0.311**	0.288*	0.307*
Reserves to short term debt ratio	-0.0001	0.0001	0.00002
GDP (/e-11)	0.207**	0.206**	0.207**
Domestic credit (/e-8)	-0.143**	-0.145**	-0.145**
Level of international liquidity	-	-	-0.002
Growth on international liquidity	-	-	**3.164** **
Latin America	0.705**	0.705**	0.707**
East Europe	1.3**	1.295**	1.301**
Four Asian Tigers	0.723**	0.731**	0.733**
Orient	0.714**	0.712**	0.714**
Africa	0.207	0.178	0.189
Before Mexican crises	-0.455**	-0.543**	-0.681**
Mexican to Asian crises	-0.199*	-0.217	-0.24
New century	0.091	-0.016	0.047
Mexican crisis	-	-0.33*	-0.347*
Asian crisis	-	-0.158	-0.116
Russian crisis	-	-0.385**	-0.146
Argentinian crisis	-	-0.121	-0.135
Constant	-0.985*	-0.592	-0.401
No. observations	1766	1766	1766
Pseudo R-squared	0.155	0.16	0.162
Predicted probability of issuance	0.3192	0.3913	0.3195
Observed probability	0.321	0.321	0.321

Table A2: Result for the Issuance Probit Analysis. Domestic Financial Conditions

Variable	(1)	(2)	(3)	Mills
Rating residual	-0.027	-0.036	-0.041	-0.074**
10 years U.S. T-bill rate	-0.811**	-1.138**	-0.771	-0.273
U.S. Treasury yield curve (10y-1y)	0.125	0.041	0.03	0.133*
External debt to GDP	-1.719**	-1.942**	-1.912**	-0.172
Debt service to exports ratio	-0.008	-0.007	-0.006	0.009**
Debt rescheduled last year (dummy)	-0.296*	-0.276	-0.25	-0.47**
Reserves to imports ratio	-0.393	-0.466*	-0.509*	0.296*
Reserves to short term debt ratio	-0.003	-0.007	-0.005	-0.004**
Exports over GDP	-0.002	-0.002	-0.002	0.003
GDP (/e-11)	0.944**	0.086**	0.008**	0.199**
Domestic credit (/e-8)	0.0104	0.003	-0.004	-0.166**
Level of international liquidity	-	-	0.006	-0.0001
Growth on international liquidity	**-**	**-**	2.856	**3.541****
Capitalization public bond market over GDP	**1.946****	**1.967****	**1.971****	**-**
Stock Market capitalization over GDP	**-0.015****	**-0.016****	**-0.016****	**-0.01****
Stock market turnover	**0.775****	**0.802****	**0.781****	**0.747****
Squared stock market turnover	**-0.178***	**-0.183***	**-0.177***	**-0.169****
Latin America	1.875**	1.893**	1.874**	1.413**
East Europe	1.522**	1.508**	1.451**	1.523**
Four Asian Tigers	1.781**	1.808**	1.77**	1.32**
Orient	2.256**	2.282**	2.277**	1.171**
Africa	1.787**	1.723**	1.737**	2.5**
Before Mexican crises	-0.716**	-0.951**	-0.747**	-0.562**
Mexican to Asian crises	-0.099	-0.179	-0.104	-0.013
New century	0.037	-0.144	-0.163	0.165
Mexican crisis	-	-0.535**	-0.441*	-0.305
Asian crisis	-	-0.301	-0.258	0.003
Russian crisis	-	-0.779**	-0.58*	-0.065
Argentinian crisis	-	-0.375**	-0.28	-0.232*
Constant	0.857	1.858*	0.175	-1.659
No. observations	767	767	767	1445
Pseudo R-squared	0.25	0.265	0.269	0.185
Predicted probability of issuance	0.464	0.465	0.465	0.37
Observed probability	0.467	0.467	0.467	0.372

Table A3: Analysis of the Issued Amount

Variables	[1]	[2]	[3]	[4]
GDP(e-10)	0.028	0.027	0.017	0.022
	(8.97)**	(8.58)**	(4.35)**	(4.64)**
Short term debt over total debt	-0.018	-0.020	0.009	0.010
	(5.89)**	(6.40)**	(1.91)*	(2.24)**
Debt service over exports	-0.017	-0.016	-0.003	0.001
	(7.39)**	(7.05)**	(0.91)	(0.25)
Exports over GDP	0.002	0.003	-0.010	-0.008
	(0.72)	(1.21)	(4.21)**	(3.11)**
10 years U.S. T-bill rate	-0.526	-0.118	-0.895	-0.832
	(2.40)**	(0.46)	(4.18)**	(3.42)**
Debt rescheduled last period	-0.046	-0.068	-0.286	-0.420
	(0.36)	(0.53)	(2.23)*	(2.93)**
Reserves to short term debt ratio	-0.001	-0.001	-0.069	-0.060
	(0.58)	(0.61)	(2.73)**	(2.36)**
Inv. Mills Ratio	-0.379	-0.310	0.391	0.929
	(2.07)**	(1.53)	(1.47)	(2.47)**
Rating residual	-0.076	-0.087	0.023	0.000
	(4.19)**	(4.67)**	(1.09)	(0.02)
Level of international liquidity		**0.009**		**0.005**
		(3.10)**		**(1.72)***
Growth in international liquidity		-0.184		1,913
		(0.13)		(1.43)
SMTO			**-0.445**	**-0.303**
			(4.27)**	**(2.44)****
SMC			0.002	-0.002
			(0.87)	(0.46)
PBMC			**2,588**	**2,486**
			(2.48)**	**(2.38)****
Squared PBMC			**-2,988**	**-3,260**
			(1.58)*	**(1.72)***
Four Asian Tigers	0.188	0.138	-1,552	-1,105
	(0.67)	(0.49)	(4.09)**	(2.49)*
East Europe	0.179	0.196	-0.909	-0.370
	(0.61)	(0.66)	(2.34)*	(0.79)
Latin America	0.773	0.808	-0.940	-0.432
	(2.69)**	(2.76)**	(2.51)*	(0.96)
Orient	1,132	1,170	-0.438	-0.009
	(3.70)**	(3.76)**	(1.23)	(0.02)
Africa	1,149	1,208	-1,847	-0.860
	(2.98)**	(3.13)**	(2.74)**	(1.05)
Before Mexico	-0.438	-0.195	-0.368	-0.336
	(2.53)**	(1.01)	(2.21)**	(1.78)*
New century	0.490	0.406	0.531	0.534
	(5.46)**	(4.30)**	(5.67)**	(5.58)**
Mexico-Asia	-0.123	-0.019	-0.146	-0.103
	(0.89)	(0.13)	(1.24)	(0.82)
Domestic currency	-1,770	-1,760	-0.983	-0.965
	(12.12)**	(11.96)**	(7.13)**	(6.94)**
USD	0.239	0.232	0.282	0.287
	(2.06)**	(2.01)**	(2.85)**	(2.92)**
Non-investment grade	-0.470	-0.452	0.001	-0.007
	(5.36)**	(5.13)**	(0.01)	(0.07)
Constant	6,770	4,562	7,673	5,529
	(12.41)**	(5.10)**	(11.45)**	(4.54)**
No. of observations	1717	1717	1215	1215
Adj. R-squared	0.503	0.51	0.53	0.54

*Source: Absolute value of t statistics in parentheses. * significant at 10%, ** significant at 5%.*

Table A4: Structural Model Results – Maturity.

Variables	[4.1]	[4.2]	[4.3]	[4.4]	[4.5]	[4.6]
Spread	-0.007	-0.013**	-0.011*	-0.013**	-0.01	-0.013**
DC to GDP	1.59	2.09	0.908	1.79	1.62	1.86
Debt rescheduled	-3.57**	-3.16**	-3.65**	-3.43**	-3.73**	-2.78**
Inflation	-0.001	-0.001	-0.0001	0.0001	-0.792	-1.05*
U.S. T-bill YC	-0.67	-0.97	-0,99*	-0.627	-0.0007	-0.0004
ED to GDP	-2.15	5.14	0.95	2.93	-0.948	6.75
GDP growth	-6.78**	-8.37**	-8.3**	-9,91**	-9.57**	-8.52**
DS to X	-0.002	-0.022	-0.039	-0.012	-0.03	-0.03
RES to ST debt	1.09**	1.03*	0.822	1.045*	0.678	0,97*
Log amount	2,77**	-	-	-	-	-
Est. amount	-	5.07**	3,9**	5.28**	3,94*	5.62**
Inv. Mills Ratio	0.95	-1.4	-0.98	-0.368	-0.765	-2.26
PBMC	-	-	10.85	-	-	-
SMTO	-	-	-	1.63	-	-
SMC	-	-	-	0.021	-	-
Financial Factor WDI	-	-	-	-	1.392	-
Financial Factor LLSV	-	-	-	-	-	-3.31
Pensions reform	-1.25	-0.6	-	-	-	-
Proportion of old	***0.504****	***0.67*****	***0.65*****	***0.701*****	***0,63****	***0.58****
Proportion of adult	*-0.64*	***-1.03***	*-1.08*	*-1.09*	*-1.12*	***-1.14****
Latin America	2.75	2.21	7.39	5.75	4.04	2.46
East Europe	-1.77	0.62	6.29	4.62	4.34	1.48
Orient	0.69	-0.25	5.05	2.12	0.58	0.54
Four Asian Tigers	-1.59	-3.4	1.87	0.59	0.48	-3.16
Before Mexico	-1.55	-0.46	-1.38	-1.11	-1.53	-0.18
Mexico-Asia	-1.32	-0.3	-0.88	-0.65	-0.92	-0.2
New century	0.84	-1.35	-0.83	-1.44	-0.59	-1.43
USD	3,1**	3.49**	3,68**	3,47**	2,83**	3,29**
EUR	-1.54	-1.22	-0.99	-1.23	-1.57	-1.35
constant	27.92	39.45	46.02	37.71	53.28	43.04
No. of observations	292	292	292	292	254	292
R- squared	0.31	0.26	0.27	0.254	0.245	0.253

DC: Domestic credit (billions)
ED to GDP: External debt to GDP
DS to X: Debt service to exports
PBMC: Public Bond Market Capitalization over GDP
SMC: Stock market capitalization over GDP
SMTO: Stock market turnover
US T-bill YC:US Treasury yield curve (10y-1y)
RES to ST debt: Reserves to short term debt
Estimated amount (1) was used.

Table A5: Structural Model Results – Spreads

Variables	[5.1]	[5.2]	[5.3]	[5.4]	[5.5]	[5.6]
Maturity	-9.25	-9.66	-6.06	-7.03	-15.69	-8.73
DC to GDP	43,84**	44,52**	42,44**	47,21**	73,92**	20.34
Debt rescheduled	-1.76	1.81	3.67	1.21	-9.44	29.91
Inflation	0.05	0.058	0.05	0.049	0.046	0.048
U.S. T-bill YC	-13.58	-17.88	-11.8	-15.49	-33,28*	-20.34
ED to GDP	250,95**	251,07**	276,33**	316,52**	339,79**	419,99**
GDP growth	-306,5**	-326,07**	-290,61**	-292,31**	-326,21**	-296,6**
DS to X	1,63**	1,21*	1.64**	1,47**	0.21	-0.1
RES to ST debt	-14.23	-18.37	-26.68**	-16.67	-15.37	-14.36
Log amount	30.52	-	-	-	-	-
Est. amount	-	11.05	-13.76	55.62	37.3	74.65
Inv. Mills Ratio	104,48**	71,3*	99,34**	114,62**	9.66	-16.04
PBMC	-	-	**624,38***	-	-	-
Squared of PBMC	-	-	**-1119,8****	-	-	-
SMTO	-	-	-	27.41	-	-
SMC	-	-	-	**-1.41***	-	-
Financial factor WDI	-	-	-	-	**-100,3****	-
Financial factor LLSV	-	-	-	-	-	**-238,1****
Rating residual	***23,51****	***22,51****	***21,65****	***18,74****	***23,04****	***18,43****
10-y US T-bill rate	***-527,3****	***-513,02****	***-541,15****	***-483,05****	***-463,18****	***-450,78****
International liquidity	***-2,92****	***-2,76****	***-2,67****	***-3.06****	***-2.45***	***-3.51****
Liquidity growth	*-160.5*	*-179.04*	*-105.04*	*-46.73*	*-404.34*	*-362.2*
Latin America	140,02**	147,76**	193,04*	-38.38	84.16	140,1**
East Europe	140,5*	170,96**	114.48	-80.05	59.13	117.9
Orient	62.76	63.83	63.17	-148.73	56.95	78.1
Four Asian Tigers	-63.6	-55.42	-116.1	-219.15	-206.52	-24.08
Before Mexico	-126,9**	-125,9*	-128,74**	-133,64**	-79.29	-96,04*
Mexico-Asia	-26.8	-23.44	-19.88	-20.71	-12.39	-15.11
New century	20.88	29.79	36.18	13.77	19.27	13.92
USD	93,28**	104,05**	98,98**	79,98**	104,26**	81,42**
EUR	44,46*	47,49***	53,35**	40.68	22.44	30.48
constant	1253,3**	1357,34**	1431,9**	1208,8**	1122,4**	948**
No. of observations	292	292	292	292	254	292
R- squared	0.53	0.52	0.59	0.576	0.35	0.55

Table A6: Structural Analysis of the Maximum Maturity

Table A6.1: Maturity

Variables	[1]	[2]	[3]	[4]
Spread	-0,022**	-0,025**	-0,021**	-0,025**
DC toGDP	1.28	1.35	0.58	0.645
Debt rescheduled	-3,85**	-3,94**	-4,18**	-2.96
Inflation	0.0005	0.001	0.001	0.001
Variety dummy	-	**3,48****	**3,4****	**3,48****
U.S. T-bill YC	-1.37	-1.42	-1.42	-1,67*
ED to GDP	15.02	15,96*	12.23	20,19*
GDP growth	-12,57**	-13,16**	-12,28**	-13,18**
DS to X	0.014	-0.009	-0.02	-0.03
RES to ST debt	1,46**	1,39**	1,29*	1,3*
Estimated amount	8,47**	8,07**	7,04**	9,66**
Inv. Mills Ratio	-0.91	-0.9	-0.96	-3.12
PBMC	-	-	6.16	-
FFLLSV	-	-	-	-7.86
Proportion of old	***1,4****	***1,25****	***1,17****	***1,06****
Proportion of adults	*-1.07*	*-0.77*	*-0.78*	*-1.07*
Latin America	1.95	2.65	5.26	2.86
East Europe	-2.73	-2.63	0.265	-1.04
Orient	-0.59	-1.07	1.52	0.6
Four AsianTigers	-2.73	-2.17	0.86	-1.58
Before Mexico	-0.72	-0.16	-0.484	0.94
Mexico-Asia	-0.03	0.39	0.073	0.802
New century	-3.45	-2.79	-2.46	-3.23
USD	3,52**	3,4**	3,37**	2,97*
EUR	-1.15	-1.41	-1.41	-1.6
Constant	18.16	2.11	6.8	10.41
No. of observations	157	157	157	157
R- squared	0.32	0.35	0.37	0.35

PBMC: Public Bond Market Capitalization over GDP
FFLLSV: Financial Factor LLSV.

Table A6.2: Spread

Variables	[1]	[2]	[3]	[4]
Maturity	5.55	3.76	4.73	0.54
DC toGDP	49,14*	47,41*	37.17	3.58
Debt rescheduled	30.16	23.43	12.14	40.4
Inflation	0,084*	0,08**	0,08*	0.06
Variety dummy	-	**23.21**	**22.71**	**27.54**
U.S. T-bill YC	0.44	-1.9	2.36	-15.99
ED to GDP	197.34	214.12	212.64	545,12**
GDP growth	304,8**	-316,29**	-295,21**	-277,81**
DS to X	1,99**	1,81*	1,99*	-0.26
RES to ST debt	-30,74*	-27.3	-37,6**	-15.15
Estimated amount	-63.84	-52.98	-83.19	88.14
Inv. Mills Ratio	75.85	70.24	101,9*	-61.1
PBMC	-	-	**785,04***	-
Squared of PBMC	-	-	**-1306,88***	-
FFLLSV	-	-	-	**-360,73****
Rating residual	***25,59****	***26,28****	***26,34****	***17,9****
10-y U.S. T-bill rate	***-602,72****	***-571,17****	***-594,86****	***-439,53****
International liquidity	***-4,06****	***-3,98****	***-3,53****	***-4,43****
Liquidity growth	*-181.17*	*-141.02*	*-63.96*	*-428.61*
Latin America	147,12**	146,72**	192.7	131,65**
East Europe	191,22*	182,79*	241,33*	91.33
Orient	107.87	97.93	131.85	104.45
Four AsianTigers	-75.39	-71.91	-100.8	-7.24
Before Mexico	-193,76**	-180,8**	-184,32**	-100.1
Mexico-Asia	-56.12	-51.41	-47.53	-21.7
New century	50.51	47.55	57.9	-1.97
USD	50.48	53,5*	62,34*	31.47
EUR	55.59	51.42	58.22	23.41
Constant	2056,9**	1913,3**	1955,1**	902.76
No. of observations	157	157	157	157
R- squared	0.585	0.62	0.61	0.68

Table A7: Domestic Financial Conditions (WDI) – Factor Analysis

Method: Unrotated principal components	
Factor	**Eigenvalue**
Factor 1	***1.066***
Factor 2	-0.228

Factor loadings	
Variable	**Factor 1**
Stocks traded, total value (% of GDP)	0.73
Stocks traded, turnover ratio (%)	0.73

Table A8: Domestic Financial Conditions (LLSV) – Factor Analysis

Method: Unrotated principal components	
Factor	**Eigenvalue**
Factor 1	***1.563***
Factor 2	0.437

Factor loadings	
Variable	**Factor 1**
Overall efficiency 3: turnover / net interest margin	0.565
Overall efficiency 4: turnover / overhead costs	0.565

Table A9: Sargan Test for Overidentifying Restrictions

Compare model (a) with model (b)

Under Ho: Model (b) is consistent and Model (a) is consistent
Under Ha: Model (b) is inconsistent but Model (a) is consistent

(b)	(a)	j	Prob>chi2	Result
unreported*	(2) Table 5	20	1	**Accept Ho**
unreported**	(2) Table 6	21	1	**Accept Ho**
unreported**	(2) Table 7	21	1	**Accept Ho**
unreported**	(3) Table 7	21	-	-

Accept Ho, under specification (a) the model is overidentified

*Note: * Did not include pensions, adults nor the two measures of international liquidity.*
*** Did not include the adults variable nor the two measures of international liquidity.*

Table A10: Countries and Regional Dummies

Country	Region
Czech Republic	1 (East Europe)
Mexico	2 (Latin America)
China	3 (New Giants)
Thailand	4 (Four AsianTigers)
Saudi Arabia	5 (Orient)
Morocco	6 (Africa)
Bulgaria	1
Croatia	1
Hungary	1
Latvia	1
Lithuania	1
Poland	1
Singapore	4
Slovenia	1
Russia	1
Slovak Republic	1
Bahrain	5
Malaysia	4
Romania	1
Ukraine	1
Egypt	5
Sri Lanka	5
Domenican Republic	2
Brasil	2
Pakistan	5
Lebanon	5
Uruguay	2
Argentina	2
Botswana	6
Chile	2
Colombia	2
Costa Rica	2
Cyprus	1
Ecuador	2
El Salvador	2
Estonia	1
Guatemala	2
India	3
Indonesia	4
Kazakhstan	5
Korea	4
Republic of Mauritius	6
Moldova	1
Panama	2
Peru	2
Serbia	1
South Africa	6
Congo	6
Philippines	4
Trinidad and Tobago	2
Turkey	5
Venezuela	2

Table A11: Credit Ratings

AAA	1
AA+	2
AA	3
AA-	4
A+	5
A	6
A-	7
BBB+	8
BBB	9
BBB-	10
BB+	11
BB	12
BB-	13
B+	14
B	15
B-	16
CCC+	17
CCC	18

Table A12: Data Sources

Variables	Source	Frequency
Bonds characteristics	Bondware	
US T-bill 1 year. Const. maturities-middle rate (1)	Datastream	Quarterly
US T-bill 10 year. Const. maturities-middle rate (2)	Datastream	Quarterly
Yield curve = (2) - (1)	Datastream	Quarterly
Stock market capitalization to GDP	FSD (WB)	Yearly
Public bond market capitalization (% of GDP)	FSD (WB)	Yearly
Stocks traded, turnover ratio (%)	FSD (WB)	Yearly
External debt, total (DOD, current USD)	WDI (WB)	Yearly
GDP (current USD)	WDI (WB)	Yearly
Exports as a % of GDP	WDI (WB)	Yearly
Imports as a % of GDP	WDI (WB)	Yearly
Short-term debt (% of total external debt)	WDI (WB)	Yearly
Total debt service (% exports of goods and services)	WDI (WB)	Yearly
Total reserves (current USD)	WDI (WB)	Yearly
Inflation	WDI (WB)	Yearly
Proportion of population above 55	WDI (WB)	Yearly
Proportion of the population between 35–55	WDI (WB)	Yearly
Stocks traded, total value (% of GDP)	WDI (WB)	Yearly
Stocks traded, turnover ratio (%)	WDI (WB)	Yearly
Total amount of debt rescheduled (USD)	GDF (WB)	Yearly
Domestic Credit (national currency, millions)	IFS (IMF)	Yearly
GDP (National Currency, Millions)	IFS (IMF)	Yearly
Various Exchange rates	GFD	Quarterly
Turnover / net interest margin	LLSV	
Turnover / overhead costs	LLSV	
Data on pensions reform	USSSA	
Data about debt agreements	Paris Club	

WDI: World Development Indicators
FSD: Financial Structure Database
GDF: Global Development Finance
IFS: International Financial Statistics
GFD: Global Financial Data
USSSA: US Social Security Administration
LLSV: La Porta et al. (1996)

Assessing the Effect of Financial Conditions on the Sovereign Debt Structure

$$M = \alpha S + \beta Z + \Phi_M X_M$$
$$S = \gamma M + \delta Z + \Phi_S X_S$$

where Z is the variable whose effect I want to study.

Simple manipulation of the equations above leads to the two following equations:

$$M(1-\alpha\gamma) = (\beta + \alpha\delta)Z + REST$$
$$S(1-\alpha\gamma) = (\gamma\beta + \delta)Z + REST$$

From here it is straight forward to obtain the marginal effect of an increase in Z on both variables,

$$\frac{\partial M}{\partial Z} = \frac{(\beta + \alpha\delta)}{(1-\alpha\gamma)}$$
$$\frac{\partial S}{\partial Z} = \frac{(\gamma\beta + \delta)}{(1-\alpha\gamma)}$$

Marginal effects

	Spread	Maturity
Liquidity	<0	>0
Bond market development		
Low	>0	<0
High	<0	>0
Stock market development	<0	>0
LLSV – Financial Mkt. Liquidity	<0	>0

Increases in the availability of funds on international markets are followed by rising maturities along with decreasing spreads. Increases on the liquidity of domestic financial markets raise the maturity of the debt, and this raises the spread.

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Survey Evidence on the Exchange Rate Exposure of Hungarian SMEs

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Abstract

Currently, one of the greatest risks faced by the Hungarian banking sector is the expansion of foreign exchange lending. In the past, however, a detailed analysis of this issue has not been possible in relation to corporate lending on the basis of the data available on bank loan stocks. Firms may have different foreign exchange (FX) positions and they may hedge their exposures, in respect of which we did not have any information. Therefore, a survey was conducted in the autumn of 2005 on indebtedness, exchange rate exposure and the management of exchange rate risks at small and medium-sized enterprises. A significant number of the companies surveyed had direct foreign exchange exposure, but only few of them were aware of the risk or provide hedging for exchange rate exposure. The survey indicated that shifts in the exchange rate can produce an unexpected negative effect on domestic small and medium-sized enterprises (SMEs). This holds true particularly in relation to companies which are indebted in foreign exchange vis-à-vis resident banks.

JEL: C42, F31, G21, G30

Key words: exchange rate exposure, liability dollarisation, FX risk management, survey

1. Introduction

It is widely acknowledged that in an open economy, the exchange rate constitutes the most important price. Nevertheless, this fact and the potential effect of exchange rate changes are not obvious in several cases. The existence of exchange rate exposure, if realised too late, can be very painful as examples from several emerging economies have shown.

This paper was motivated by the increasing role of foreign exchange debt in financing small and medium-sized enterprises. FX debt, if not hedged, exposes firms to depreciation, which may result in losses for the banking sector as well. Nevertheless, there are other channels through which the credit risk of corporations is also influenced by exchange rate changes. Financial crisis and exchange rate exposure literature is reviewed to highlight the significance of this issue.

In Hungary, FX borrowing by micro SMEs has raised financial stability concerns for several reasons, including the rapid growth of banks' exposure to SMEs, the weak export activity of these firms, the position of the exchange rate in the intervention band and its potential volatility, as well as the well-known reliance of SMEs on domestic financial institutions. This indirect foreign exchange risk borne by financial institutions is what makes exchange rate exposure important from a financial stability perspective.

Aggregated data are often not enough to be able to analyse these aspects. Data from the individual level are more suitable for the purposes of analysis, but are rarely available. One of the methods used to investigate exchange rate exposure is to carry out a survey of firms, in order to collect missing data and reveal firms' behaviour patterns. To this end, a survey was conducted in the autumn of 2005, within the framework of which data and information was collected on the behaviour of SMEs in three specific areas: 1) indebtedness, 2) exchange rate exposure and 3) management of exchange rate risks. The questionnaire served the objective of investigating the impact of possible exchange rate changes on SMEs and thereby the repayment of SMEs' debts vis-à-vis domestic banks.

In the first chapter, I provide a brief overview of the literature on exchange rate exposure. I then proceed to review the potential methods of measuring exchange rate exposure and describe other surveys. In the third chapter, I present some stylised facts about the topic. Following this, I describe the survey and analyse the data using descriptive statistics and probit regressions. The conclusion summarises the main findings and provides some points of departure for further research.

2. Exchange Rate Exposure from a Financial Stability Perspective

The literature on exchange rate exposure started to grow rapidly in the wake of the financial crises in the 1990s. These crises made it clear that exchange rate changes may have significant real economy effects. Accordingly, the majority of papers analyse the macro effects of exchange rate changes and the reasons why these effects differ from country to country. Another group of papers concentrates on exchange rate exposure and its management at the micro level.

2.1 Sources of Exchange Rate Exposure in the Corporate Sector

Exchange rate exposure (or FX exposure) exists if changes in the exchange rate influence the net value of certain items of economic agents. By contrast, *exchange rate risk (or FX risk)* is the product of the probability of an exchange rate change and exchange rate exposure (Douch, 1996) (see chart 1). It can be stated that if there *is* exchange rate exposure, but the exchange rate cannot change (to a significant degree), then exchange rate risk is insignificant. I will come back to the importance of this distinction later.

Chart 1: Exchange Rate Risk and Exchange Rate Exposure

		Exchange rate exposure				Exchange rate changes
Exchange rate risk	=	Net value of items exposed to exchange rate changes	*	Sensitivity to exchange rate changes	*	Probability of exchange rate changes
ρ	=	V	*	$\frac{\delta V/V}{\delta X/X}$	*	$p(\frac{\delta X}{X})$

According to the literature, there are different sources of exchange rate exposure (Schafer and Pohn-Weidinger, 2005; Nydahl, 1999; etc.). These are considered according to the "items" influenced by exchange rate shifts. The main sources or types of exchange rate exposure are as follows:

- *translation exposure*: the possibility that accounting positions may change as a result of different denomination of assets and liabilities and/or income and expenditures. In other words, translation exposure is the currency mismatch in the balance sheet or income statement of enterprises (and also that of households);
- *transaction exposure* arises from the possibility that the future cash flow (from external trade contracts, foreign investment, etc.) may change as a result of exchange rate changes;
- *operational exposure* refers to the possibility that market position of a firm may change through the effect of exchange rate changes on competition, relative prices, quantities, demand;
- *contingency exposure* refers to a potential revaluation of future possible liabilities (for example in the case when a company submits an offer on a tender); and
- finally, total *or economic exposure,* which is often defined as a result of exchange rate changes through all of the above channels on the profit or value of a firm.

The last three channels pertain to all enterprises, even if they have no FX denominated items in their balance sheets or income statements. However, the first two types are present only at enterprises with currency mismatch. As a whole, *currency mismatch* means that net assets or net income are exposed to exchange rate changes as a result of different denomination (Goldstein and Turner, 2004). There are two types of currency mismatch: stock currency mismatch can be measured by net FX assets, while flow currency mismatch is measured by net FX income or their exchange rate sensitivity. Exchange rate sensitivity can, however, be measured by using time series data, and it is possible to examine open positions in a cross-sectional aspect.

Through the aforementioned channels, the position of the corporate sector may change as a result of exchange rate changes. In the event of a devaluation of the domestic currency, output may increase or decrease, and in extreme cases of the latter situation, an exchange rate crisis may lead to a banking crisis and recession, causing macro costs. In theory, appreciation of the currency also may result in different (sometimes extreme) results.

Based on theories of corporate finance, we expect that optimising enterprises assess their exchange rate exposure and attempt to decrease it, thus maximising the value of the enterprise and the utility of stakeholders. Nevertheless, from an individual point of view it may also be rational to bear the risk, for example if the risk is low and hedging is more costly, or if economic agents speculate. However, it is important to highlight that bearing exchange rate risk increases systemic risk, in case enterprises underestimate their risk. This occurs when moral hazard arises as a result of low exchange rate volatility. If this is true, it may be rational to accept the risk over the short run from an individual point of view, but unexpected exchange rate changes may increase systemic risk and result in real economic costs.

The financial sector may have indirect exchange rate exposure if it finances economic agents with currency mismatches. In the event of an exchange rate shock and significant exchange rate exposure enterprises may become unable to service their loans and in extreme cases banks (and other financial institutions) may go bankrupt (of course, this depends on several other factors as well). This is the reasoning behind the examination of exchange rate exposure from a financial stability point of view.

The second reason of why a central bank is interested in FX indebtedness is that monetary policy may face a trade-off. If the ratio of FX debts is high, monetary policy may want to prevent exchange rate depreciation and to raise the domestic interest rate. In such a case, loans denominated in domestic currency will become more expensive relative to FX loans and thus FX indebtedness will be stimulated further. Pass-through of monetary policy decisions is also influenced by the denomination of assets and liabilities.

2.2 What Can We Learn from the Experience of Emerging Economies?

In the aftermath of financial crises in emerging economies, the number of analyses on the link between currency mismatches and financial fragility has increased. These papers are based on the fact that the liability dollarisation of emerging countries has increased steadily, simultaneously with an increase in the frequency and costliness of financial crises. The problem is aggravated by the fact that liability dollarisation is more present in the retail (household and SME) sectors, which are more vulnerable to shocks than large enterprises.

Dollarisation means that foreign currency is used for some monetary functions instead of the local currency. The connection between dollarisation and currency mismatches is not symmetrical: It is probable to be dollarised without currency mismatch, but in the event of liability dollarisation assets or income are often not dollarised, which leads to currency mismatches.

The connection between currency mismatches and financial stability is not straightforward. Liability dollarisation may increase fragility to international flows of capital, but it may have positive effects as well, mainly in liquidity restrained, underdeveloped economies. Potential positive effects include the following: financial dollarisation facilitates the deepening of intermediation, it may alleviate contractionary effect of shocks (for example through its effect on risk management by banks and enterprises) and "*financial dollarisation may allow a greater integration with international capital markets and a richer menu of financial instruments, which may imply efficiency gains for financial intermediation*" (Arteta, 2003, p. 5.).

Goldstein and Turner (2004) emphasise that currency mismatch is the most important reason behind financial crises and that this can be cured only in case economic policy problems are solved. *Claessens, Djankov and Xu* (2000), based on the examination of firms' performance in the East-Asian crisis found that financial fragility of firms contributed to depth and severity of crises, thus also pointing out the importance of individual firms' examination.

As a whole, empirical works highlight the above mentined double-edged feature of dollarisation. Most researchers find that currency mismatches contribute to the probability, costliness and length of financial crises, but that it is also positively connected to economic growth (see Table 1). To summarise, dollarisation makes rapid financial growth and integration possible, resulting in the lessening of liquidity constraints and also a high level of risk-taking, rendering the economy more fragile. According to some authors, however, economic policy and institutional factors may play at least as important role as dollarisation.

Table 1: Empirical Papers on the Connection between Financial Stability and Dollarisation

	Liability dollarisation	**Dollarisation of deposits**	**Currency mismatch**
Probability and costliness of financial crises	No connection *(Arteta, 2003)* Positive connection *(Yeyati, 2005)*	Positive connection *(De Nicoló – Honohan – Ize, 2003)*	Positive connection *(Goldstein – Turner, 2004)*
Financial development	Positive connection *(Arteta, 2003)*	Positive connection *(De Nicoló – Honohan – Ize, 2003)*	–
Monetary policy trade-off	–	–	Positive connection *(Goldstein – Turner, 2004)*
Flexibility of exchange rate	–	–	Negative connection *(Goldstein – Turner, 2004)*
Economic growth	Positive connection *(Arteta, 2003)* Negative connection *(Yeyati, 2005)*	–	–

3. Methods for Measuring Exchange Rate Exposure

There are several questions worth examining in relation to exchange rate exposure. To what degree are enterprises exposed to exchange rate changes and what corporate characteristics explain this exposure? Do enterprises assess their exposure and are they able to determine its degree? Do they manage their exchange rate risk, and if not, what is the reason? What determines exchange rate risk management techniques?

We found two main methods[1] to examine the above questions: the first one is based on an examination of the reaction of market returns to exchange rate changes (based on the CAPM model). Papers using this methodology measure total exchange rate exposure and explain this by company characteristics. One advantage of this methodology is the availability of long time-series data. Nevertheless, as market returns are influenced by many factors, there is uncertainty in this methodology and – mainly in case of emerging countries – the data available are not representative for the whole economy.

The second method is to use surveys to obtain information on exchange rate exposure. With surveys, one can obtain a cross-sectional view on the accounting or cash-flow exposure of enterprises. One advantage here is that this method can be used on a representative sample, and currency mismatch can be directly analysed.

[1] There are other methods, for example: estimations on accounting data (ECM, VAR (Clarida, 1997)), general equilibrium or partial equilibrium models (Tornell and Westermann, 2002) These are not possible to carry out because of the lack of data.

Information on risk awareness, hedging activity and other characteristics can also be gathered. However, exchange rate exposure cannot be examined in time-series, and thus total exposure is left unexplained.

We used papers with CAPM methodology to present international evidence on how exchange rate exposure is influenced by different company-specific and country-specific characteristics. The main findings are that exchange rate exposure is

- not constant over time;
- not linear – it depends on the magnitude of the exchange rate changes; and
- not symmetrical: a depreciation and an appreciation of the same magnitude may have effects of different magnitude.

This makes forecasting difficult, mainly because based on a period with low exchange rate volatility nothing can be said on the possible effects of an exchange rate shock.

There are, however, works concentrating on shock periods, while others focused on normal periods. All the surveys we found belong to the latter category. The majority of the papers examined exchange rate depreciations because of the relevance to financial crises. Works on appreciation or symmetry of exposure are quite rare. Moreover, exchange rate exposure literature is not connected to the literature on currency mismatches.

Table 2: Surveys on Exchange Rate Exposure

Author, date	Countries examined	Sample size	Focus	Data analysis
Norges Bank, 2004	Norway	128 enterprises from sectors exposed to exchange rate changes	FX risk management	Descriptive statistics
Alkeback – Hagelin –Pramborg, 1996 and 2003	Sweden	134 listed enterprises	Usage of derivatives	Descriptive statistics
Pramborg, 2003	Sweden and Korea	130 Swedish, 60 Korean listed enterprises	Comparison of FX risk management	Descriptive statistics, frequency analysis, logit regressions
Aabo, 2003	Denmark	52 listed enterprises	FX loan as an alternative of foreign currency derivatives	Descriptive statistics, ordered probit regressions
Keloharju – Niskanen, 2001	Finland	44 Finnish listed enterprises	Causes of enterprises borrowing in foreign currency	Descriptive statistics, probit regressions
Reserve Bank of Australia and statistical office, 2001	Australia	232 foreign trader enterprises	Sectoral analysis of exchange rate exposure	Descriptive statistics
Loderer – Pichler, 2000	Switzerland	96 multinational, listed enterprises	FX risk management	Descriptive statistics
Bodnar – Marston – Hayt, 1998	USA	399 listed enterprises	Usage of derivatives, risk management	Descriptive statistics
Bodnar – Gebhardt, 1995 and 1997	USA and Germany	197 American, 126 German large or listed enterprises	Usage of derivatives, risk management	Descriptive statistics
Magyar Nemzeti Bank (MNB), 2005	Hungary	580 non-financial SMEs	FX borrowing, exchange rate exposure, FY risk management	Descriptive statistics, probit and ordered probit regressions

The surveys summarised in table 2 concentrated on a segment of the corporate sector. The enterprises examined primarily included listed or large enterprises, or in some cases enterprises participating in foreign trade; SMEs were disregarded. The majority of papers focused on risk management by enterprises (not exclusively on exchange rate risk management). The main conclusions of these were the following:

- enterprises are unable or unwilling to hedge their total exposure (Loderer and Pichler, 2000);
- enterprises which hedge, only hedge part of their exposure (Loderer and Pichler, 2000; Bodnar, Hayt and Marston, 1998);
- exchange rate risk is hedged more often than other types of risk (interest rate, equity risk, product risk) (Bodnar, Hayt and Marston, 1998);
- as far as exchange rate risk is concerned, mainly translation exposure is hedged and enterprises hedge over the short term;
- enterprises in small, open economies hedge more often as they are more exposed to exchange rate changes;
- enterprises in more developed countries hedge more often as a consequence of more developed financial markets;
- due to the fixed cost of introducing exchange rate management tools, large enterprises are more willing to use sophisticated exchange rate management tools; and
- there are several potential reasons for not using derivatives: the exposure is to small to hedge, speculation, underestimation of risks or use of on-balance sheet tools (Alkeback, Hagelin and Pramborg, 2003; Loderer and Pichler, 2000).

Borrowing in foreign exchange may also be a tool for FX risk management. We found two papers on this topic. Aabo (2006) used a survey examining Danish firms and found that FX loans are used mainly to hedge longer term, more uncertain exchange rate movements or the activity of foreign subsidiaries. Keloharju and Niskanen (2001) examined the borrowing decisions of Finnish listed companies, with special emphasis on their decision on the denomination of loans. They mention three motives for borrowing in foreign exchange: it provides hedging for foreign exchange exposure; it may cost less than borrowing in the domestic currency; and there may also be speculative reasons, including the case that they do not expect the International Fisher Effect (unhedged interest rate parity) to hold.

Table 3: Surveys in CEE Countries: Main Results

Country, year (author)	Sample	Focus, main results
Latvia, 2001 (Strelcova)[1]		Usage of derivatives: derivatives are not popular as a result of demand problems (lack of knowledge about hedging tools), except for enterprises exposed to exchange rate changes to a large degree.
Poland, 1999 (Central European)[1]		FX risk management: as a result of low liquidity, underdeveloped market, and demand problems derivatives are not popular. Demand of firms and banks is correspondingly low.
Lithuania, 2003 (Jonuska – Samenaite)	28 large enterprises, banks, brokers	FX risk management: export firms hedge their FX risk by cash-flow management. Derivatives are not widespread; the reasons for this include high costs, underestimation of risks and lack of knowledge.
Hungary, 2001, 2002, 2003 (Tóth – Szabó)	196 exporting enterprises	How exchange rate appreciation affected exporting companies: FX risk was hedged by 31.4% of enterprises in 2003 by financial operations, while in 2001 this ratio was 12.5%. Appreciation of the exchange rate had a negative effect on most enterprises; profit or export revenues decreased for 80% of surveyed firms.
Hungary, 2004 (Tóth)	1461 enterprises	Effect of central bank rate on loan demand and investment activity of enterprises: In April 2004, 29% of enterprises had FX debt, 7% of which had exclusively FX debt. EUR-denominated current assets loans were more characteristic of larger enterprises. More than half of enterprises exporting at least 2/3 of their output and 3.4% of non-exporting enterprises had EUR-denominated current asset debt. A positive relationship was found between ratio of foreign ownership and FX current assets debt, as well as between export revenue and FX current assets debt. Only 2% of enterprises operating on the domestic market had exclusively FX loans. As a whole, exporting firms are more willing to raise debt. 35% of firms with long term debt had FX debt; EUR-denominated loans are more popular among larger enterprises.

[1] *Quoted by Jonuska and Samenaite (2003). pp. 9–10 (methodology, sample size, sample description is not known).*

In the period examined (1985–1991), Finnish interest rates were significantly higher than foreign interest rates and corporate leaders did not expect exchange rate depreciation. Additionally, competition between banks and non-bank financial intermediates was so fierce that on average the interest rate margin of the Finnish marka was negative and it was more profitable to grant foreign currency loans. It was mainly large enterprises which accumulated FX debt, partially from abroad, in connection with their foreign trade activity and their access to international capital markets. The denomination of the foreign currency debt was more or less the same as the FX income structure of the enterprises: both were dominated by US dollars, while the ratio of German mark was also significant. Hedging exchange rate exposure played an important role in borrowing decisions.

As far as CEE countries are concerned, there are only a few papers on the exchange rate exposure or risk management of corporations. In these countries, derivatives are not popular among non-financial enterprises, which can be explained by both demand and supply factors. Demand side factors include lack of knowledge, high costs and underestimation of FX risk, while supply factors are undeveloped markets and regulatory problems, as highlighted by the few surveys which have been conducted.

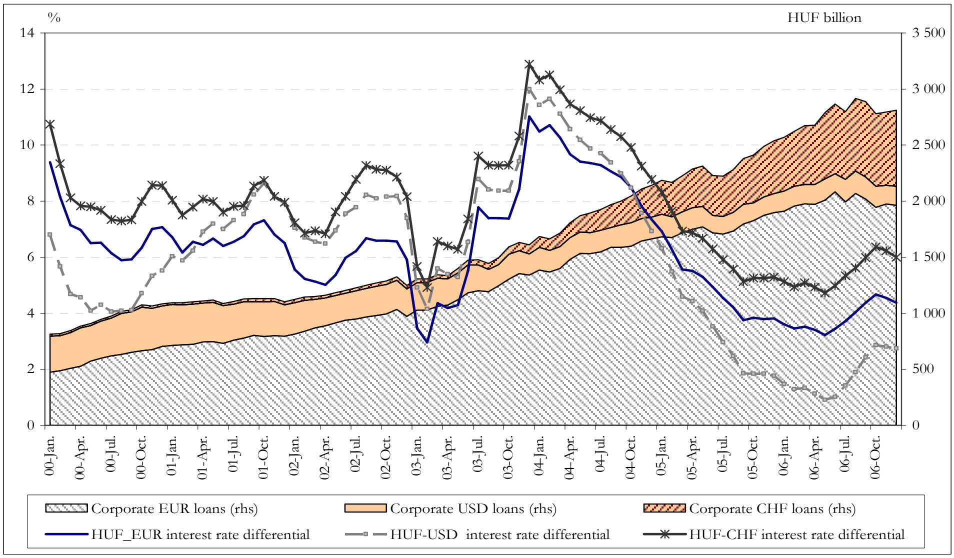
4. Stylized Facts

This chapter analyses some aggregated facts in relation currency mismatch. One sign of currency mismatch is an increasing FX debt ratio in the balance sheet of the Hungarian banks, simultaneously with a decreasing ratio of FX deposits. FX borrowing is prevalent in all sectors, which can be explained by several factors.

In a historical context, amongst large enterprises (which are mainly foreign owned and/or exporting companies) borrowing in FX has been wide-spread since the mid-1990s. Lending to the retail sector was restricted both in domestic and in foreign currency until the turn of the millennium. By that time the market of lending to large enterprises had become saturated and growth potential on this market decreased.

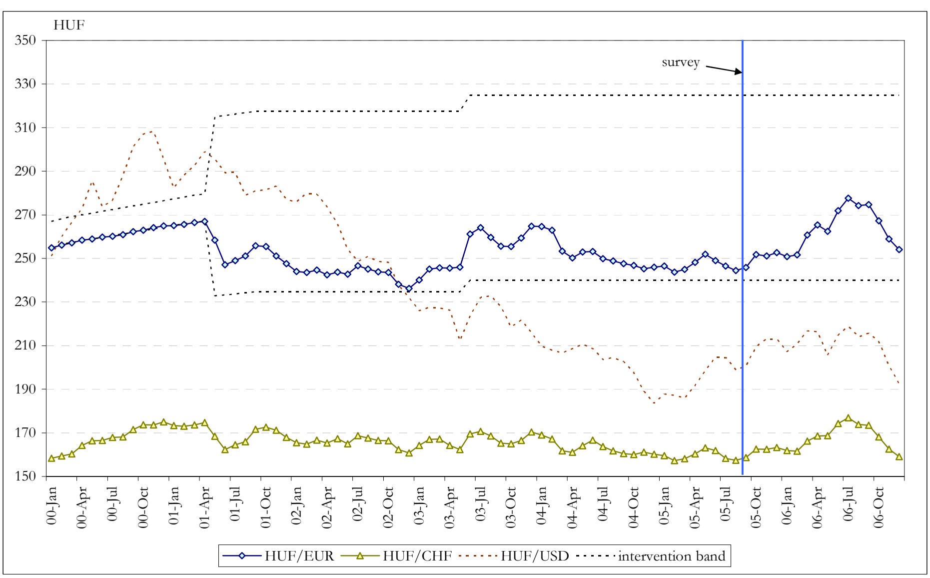
From 2001, lending to households was stimulated by a government subsidy scheme which decreased housing loan interest rates well below the market rate by paying interest rate subsidies to banks. The subsidy scheme was tightened in 2003, leaving banks with high growth and profitability plans and expectations from foreign owners. As a result of high domestic interest rates, these plans were unrealistic based on Hungarian forint lending. By that time, financial enterprises financed car purchases in foreign currency, with a good track record, which suggested to banks to do the same in respect to housing and consumer loans. At the same time, standard products for small and micro enterprises were developed, in line with their improving financial situations, subsidy schemes and EU support.

Chart 2: Interest Rate Differential and FX Loans Granted by Hungarian Banks to Enterprises



Source: Central banks' homepages, MNB.

Chart 3: Exchange Rates 2000–2005 (Monthly Averages)



Source: MNB.

In addition to the aforementioned two factors – supply by banks and the high interest rate differential – the low historical volatility of the exchange rate also supported FX borrowing. Despite the broad intervention band (30%), the nominal EUR/HUF exchange rate was very close to the stronger edge (see Chart 3). This made borrowing in foreign exchange more risky, as the repayment ratio can only increase from this point. EUR and CHF interest rates were also at historical lows when FX borrowing started to grow.

As a result of banks' loan supply, FX lending and other possible financing sources, it can be said that liquidity constraints have eased to a large degree in recent years for SMEs.[2] Their significance in the economy has also increased, and particularly micro and small enterprises have gained in both economic weight and in relevance to the banking system. This sector employs about 60% of the labour force and produces roughly half of Hungarian GDP. On the other hand, SMEs primarily operate on the domestic market, which makes them highly vulnerable to the domestic economic climate. They produce only 20% of total export revenue, a ratio positively depending on firm size.

It is an additional, general characteristic of the SME sector that their access to external funds is more limited than that of large enterprises. This is effectively reflected by the fact that large enterprises draw major amounts of funds from abroad, as well, while SMEs generally rely on domestic banks. In addition, these enterprises are more sensitive to monthly repayments than large enterprises, which is why they prefer FX loans to domestic currency debt. For this same reason, however, they are more exposed to shifts in the exchange rate.

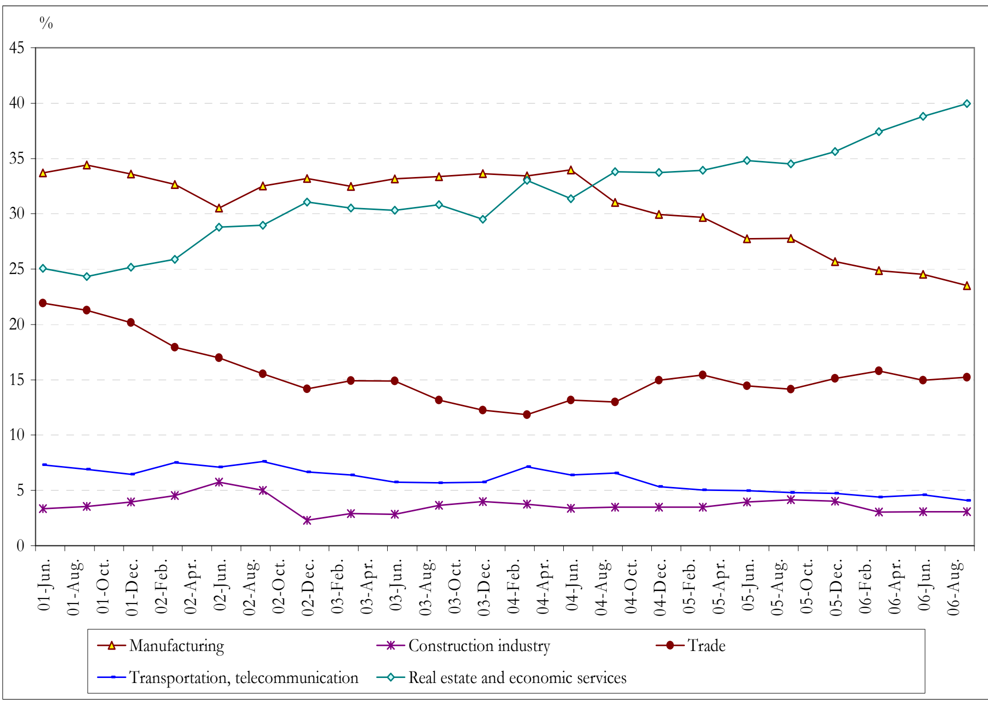
As the industry and size categories and foreign trade activity are not independent – namely, manufacturing enterprises are foreign traders and are much larger, while the majority of SMEs operate in the service sector on the domestic market – and industry data are more detailed, it is worth looking at industry-level data. With regard to domestic bank loans, both the tradable and non-tradable[3]

[2] Act XXXIV of 2004 on Small and Medium-sized Enterprises and the Support Provided to Such Enterprises defines small and medium-sized enterprises (SMEs), as follows:
"**3.** § (1) An enterprise is deemed to be an SME which *a)* employs a total of less than 250 employees, and *b)* its annual net sales revenue does not exceed the corresponding HUF amount of 50 million euro, or its balance sheet total does not exceed the corresponding HUF amount of 43 million euro. (2) Within the SME category, an enterprise is deemed to be a small enterprise which *a)* employs a total of less than 50 employees, and *b)* its annual net sales revenue or its balance sheet total does not exceed the corresponding HUF amount of 10 million euro. (3) Within the SME category, an enterprise is deemed to be a micro enterprise which *a)* employs a total of less than 10 employees, and *b)* its annual net sales revenue or its balance sheet total does not exceed the corresponding HUF amount of 2 million euro."

[3] Tradable sectors are manufacturing, agriculture, mining and energy sectors while all services as well as construction industry were taken as non-tradable.

sectors raise FX debt; the highest FX debt ratios are found in the non-tradable sectors (see Chart 4). The FX debt exposure of the domestic banking sector is the highest in the real estate sector followed by the manufacturing and trade sectors.

Chart 4: Industrial FX Debt Volumes as a Ratio of FX Loans to Corporates from Domestic Banks

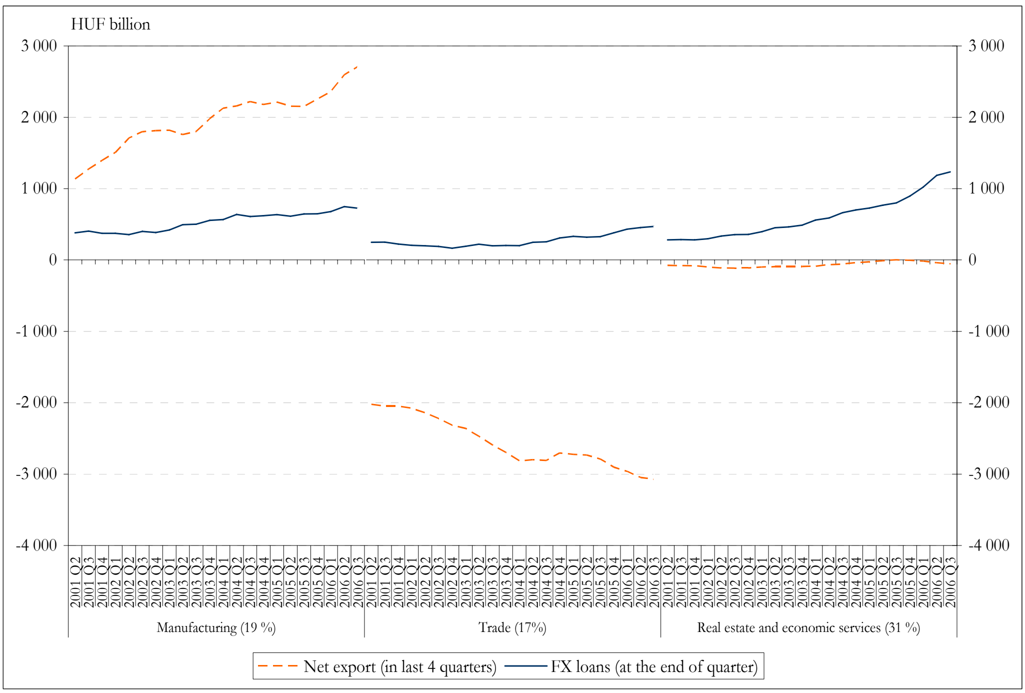


Source: MNB.

As a proxy of FX income at the industry level, I examined net export revenues and compared these with FX debt data, to gain a picture of industry-level currency mismatches. In this regard, it should be mentioned that enterprises may have non-export revenues in foreign exchange (for example, at real estate agencies and in tourism) and because of this, currency mismatch is over-evaluated. Based on this comparison, natural hedging of domestic FX debt is present on the aggregate level in tradable sectors, while net export revenue is negative in non-tradable sectors with an increasing ratio of FX debt.

In summary, as a result of rising loan demand and supply, the stock of resident bank loans to SMEs has increased significantly over recent years, and currently almost exceeds that of large enterprises. Hence, the banking sector is exposed to SMEs to the same degree as to large enterprises. An increasing proportion of SME loans, however, are granted in foreign exchange, while the share of SMEs in exports is quite low. The above implies that – although easier access to loans reflects a positive development – growing foreign exchange lending has led to a considerable exchange rate exposure of SMEs.

Chart 5: Industrial Net Export and Domestic Debt Volumes



Source: MNB, KSH (Central Statistical Office).

5. Survey Results

5.1 Sample Description and Methodology

The data used for the analysis was collected in a survey conducted in September and October 2005; the questions are related to 2004 data and developments. The questionnaire was filled in by resident, predominantly privately-owned non-financial corporations which were in operation in 2004, or for at least one financial year prior to the survey, had external funds and kept double-entry accounting. Data was recorded by data collection staff in the form of personal interviews. Inquiries were sent to about 2,000 enterprises, but the willingness to reply was quite low, at roughly 20% to 25%.

The survey contained questions on accounting exchange rate exposure, "exposure awareness" and on FX risk management. The aim was both to collect data and to examine the behaviour of enterprises. In the final database 580 SMEs were analysed. Data were re-weighted to represent industries and size categories (see Appendix 3).

Analysis of the data was conducted with a focus on three topics: indebtedness of enterprises, exchange rate exposure and risk management. In the last two points, the total sample and the sub-sample of FX debtors were examined separately. The analysis is based on descriptive statistics and probit and ordered probit regressions. Regression results are presented in Appendix 5. Explanatory variables used in the regressions are collected both intuitively and based on the relevant literature. The following table contains explanatory variables and the expected sign of the estimated parameters.

Table 6: Variables in Probit Regressions and the Expected Connection

Explained variables:	**FX borrowing**	**Exchange rate exposure***	**FX risk management**
Output of the enterprise:			
- tradable	positive relationship	positive relationship	positive relationship
- non-tradable	no relationship	no relationship	not straightforward
FX risk management tools			
- derivative tools	not straightforward	positive relationship	
- FX debt		positive relationship	
Company size	positive relationship	positive relationship	positive relationship
Profitability	positive relationship	positive relationship	positive relationship
Indebtedness	negative relationship	negative relationship	no relationship
Foreign owner	positive relationship	positive relationship	positive relationship
Exchange rate exposure*	positive relationship		positive relationship

*Note: * Exchange rate exposure (or currency mismatch) is taken without hedging activity.*

FX debt and hedging tools may be alternatives, but it is also possible that a firm hedges its exposure from FX debt. This is why their connection is not straightforward. We postulated that company size is positively related to all explained variables: as foreign trade is positively related to firm size, exchange rate exposure should be higher, FX borrowing is more motivated and as introduction of

FX risk management has fixed costs, large enterprises may be more willing to use these tools (and also they may incur larger losses). The same argument underlies the expected positive sign of foreign trade activity and tradable sector dummy. In the case of profitability and indebtedness, the table contains the sign of the relationship which is considered positive from a financial stability point of view.

5.2 Indebtedness of Surveyed Enterprises

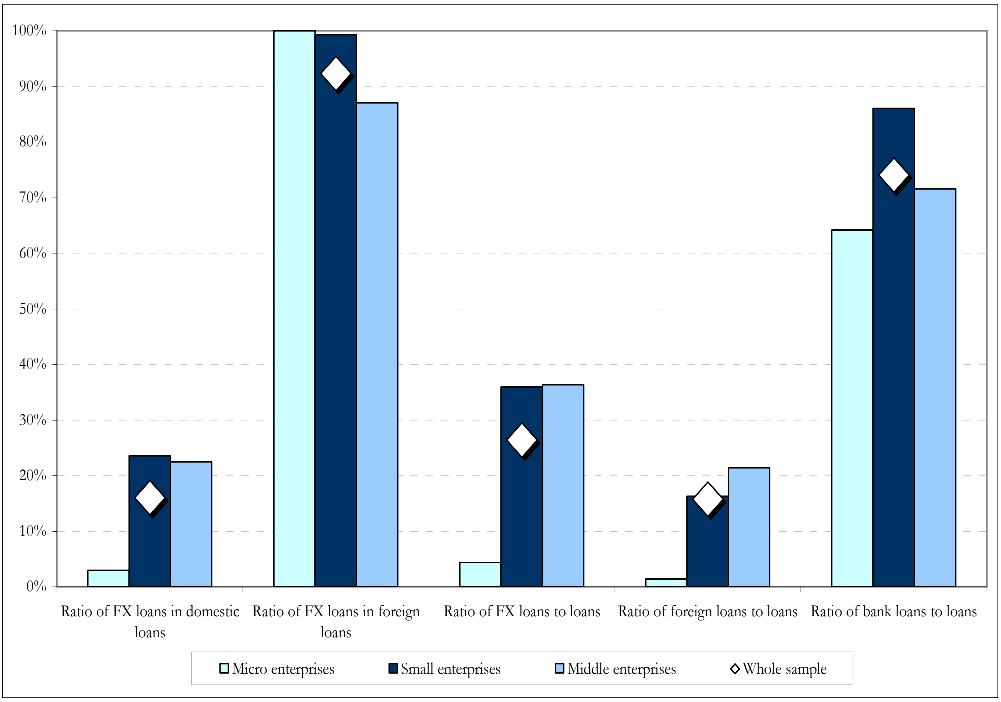
In this section, I analyse the denomination of corporate debt and the type of sources SMEs borrow from. Enterprises were asked to provide detailed data as well as explain the main factors influencing their decisions.

As far as the denomination of debt is concerned, approximately one quarter (27%) of the total debt of the companies examined is denominated in foreign exchange. Foreign loans (corresponding to 13% of total debt) are almost exclusively denominated in EUR. The HUF is dominant in relation to domestic debt, but the surveyed companies also draw loans from financial institutions denominated in EUR and CHF. A sharp difference is observed among companies with foreign exchange debts: only foreign trade companies and companies in foreign ownership draw loans abroad, while this does not apply to many enterprises raising FX debt from domestic sources. Thus, foreign trade companies or foreign-owned companies have easier access to funds from abroad. In addition, enterprises usually do not combine loans in various denominations (in different currencies), i.e. most of their debts arise in the same foreign exchange. In the case of FX debtors it means that usually the ratio of FX debt is over 80%.

In the regressions FX indebtedness is explained by foreign ownership, company size and foreign trade activity (both in probit and ordered probit regressions). If the left hand side variable is FX debt from domestic sources, the explanatory power of foreign trade activity disappears.

In line with expectations, the enterprises surveyed are mainly indebted to domestic banks. Approximately 80% of domestic debt (including trade credit) is borrowed from banks, while more than one third of foreign debt comes from foreign banks. Bank loans are followed by loans from the owner, mainly foreign parent companies.

Chart 7: Characteristics of Corporate Debt by Company Size



Source: Survey on the Exchange Rate Exposure of Hungarian SMEs.

Enterprises were asked about the factors they consider when choosing between HUF and FX loans and domestic and foreign sources. There was no difference in the ordering of the main aspects. SMEs base their debt decisions on the following factors: interest rate level, actual repayment ratio, their relationship with the lender, domestic prospects and interest rate differential. All enterprises without exception said interest rate was important in the borrowing decision which may be a sign of being liquidity constrained and also of FX loans easing these constraints.

Among enterprises with FX debt, 46% of respondents did not mention that the exchange rate level played a role in their decision and the ratio is 61% with regard to exchange rate volatility. Some 26% did not mention either of these factors, and thus it can be assumed that these firms did not take their potential exchange rate risk into account at the time of borrowing.

On the other hand, two thirds of enterprises without FX loans mentioned the exchange rate level and/or volatility as one of the five main factors in loan decisions. Half of the enterprises which regarded matching inflows and outflows important had no exchange rate exposure at all. It can be assumed that these enterprises consciously avoid borrowing in foreign exchange despite its cost-advantage.

5.3 Exchange Rate Exposure

This chapter focuses on the ratio and characteristics of enterprises which are exposed to exchange rate changes and also endeavours to carry out a kind of stress-test. As defined earlier, I examine the sign and measure of the net FX assets and net FX income based on the data provided by the enterprises. Firms were also asked about their opinion on their exchange rate exposure and expectations.

Unfortunately, there are distortions in the data which could not be corrected. As firms are not obliged to register the denomination of items in their books by the accounting system, the volume of FX items may be larger than reported. Firms are required to count export revenues and import expenditures, however, they may have FX income or expenditure from non-foreign trade type activity or they may have FX balance sheet items. This distortion is higher for FX assets and liabilities than for income statement items.

Enterprises were asked to state whether they had contracts with domestic partners in which prices were fixed in foreign currency. In several cases if they had such contracts they did not provide detailed data on such. Because of these reasons exchange rate exposure may be higher than measured by the questionnaire.

On the other hand, the exchange rate exposure perceived by firms is underestimated as a result of low volatility of the exchange rate in the period before the survey. It may easily be the case that firms projected this situation into the future, and thus felt they had no exchange rate risk at all.

5.3.1 Enterprises Exposed to Exchange Rate Changes

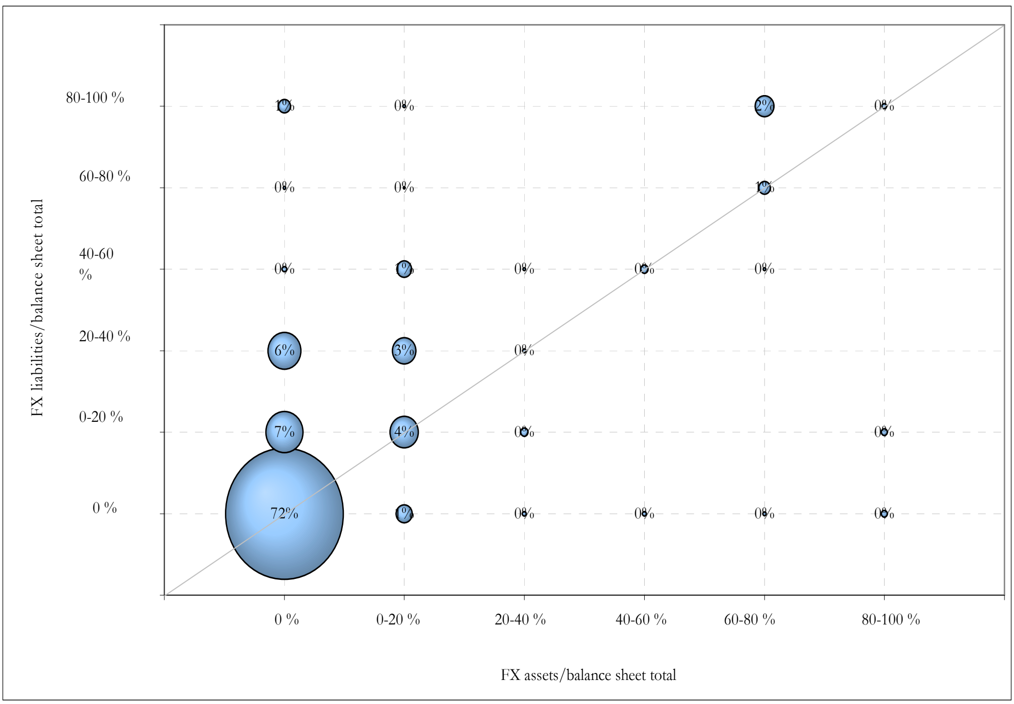
Let us turn to an examination of the stock and flow exchange rate exposure of the surveyed SMEs. Accounting exposure or currency mismatch (CM) is defined as follows:

Stock CM = HUF value of FX assets – HUF value of FX liabilities
Flow CM = HUF value of FX income – HUF value of FX expenditures

In the case of a negative currency mismatch, depreciation of the domestic currency would have negative effect, while appreciation would influence the net position positively. Enterprises may have exchange rate exposure even if currency mismatch is zero, if the scheduling of inflows and outflows differs. Nevertheless, because of yearly data, this kind of exposure is disregarded.

Some 40% of enterprises have non-zero stock of flow currency mismatch. As far as stock CM is concerned, two thirds of enterprises have neither FX income nor FX expenditure. In the total sample enterprises with negative net FX assets are in the majority; average stock exposure is about –8% of the balance sheet total (sum of net FX assets/sum of balance sheet totals).

Chart 8: Foreign Exchange Assets and Foreign Exchange Liabilities of Companies

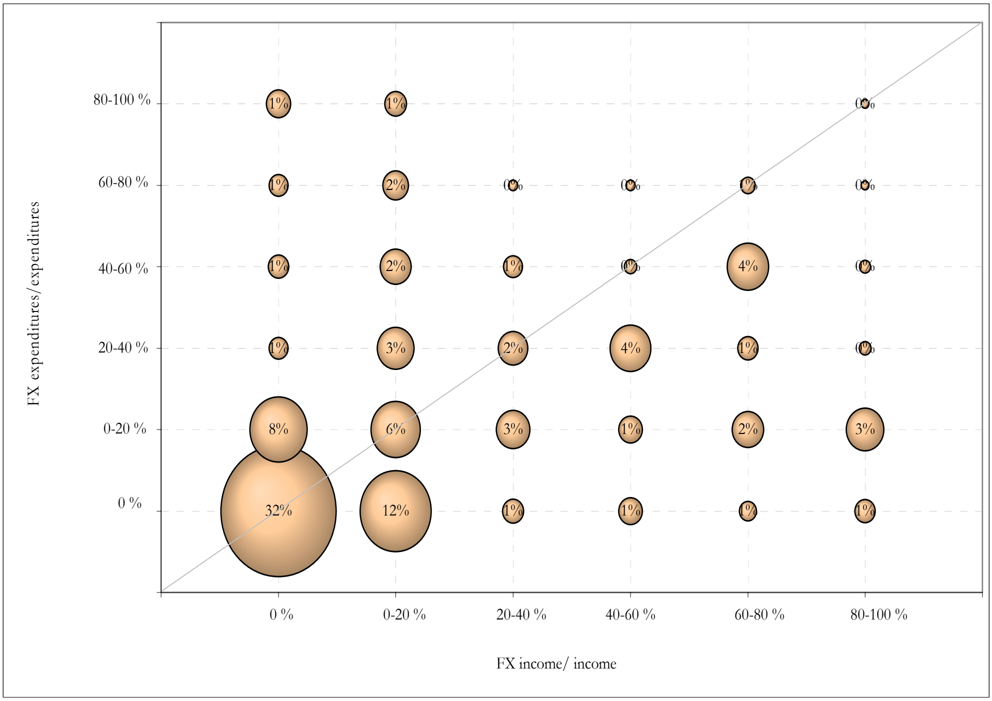


Source: Survey on the Exchange Rate Exposure of Hungarian SMEs.

Note: The size of circles indicates the ratio of the balance sheet total in the given category compared to the total sample.

The average flow currency mismatch is –2% (sum of net FX incomes to incomes) and it amounts to –19% of net income. However, the variance of flow CM is much higher than it was in the case of stock CM. According to their ratio of balance sheet total, 68% of enterprises have income or expenditures in foreign exchange. As a whole, there are more enterprises with positive flow CM than with negative flow. In terms of company size, in the micro segment firms with negative CM are in the majority, while in the other two size categories there are more positively exposed enterprises.

Chart 9: Foreign Exchange Revenues and Foreign Exchange Expenditures of Companies



Source: Survey on the Exchange Rate Exposure of Hungarian SMEs.

Note: The size of circles indicates the ratio of the balance sheet total of companies belonging to the given category compared to the total sample.

Regressions indicated that the exchange rate exposure of a firm is positively related to firm size, foreign ownership, foreign trade activity and FX indebtedness. In terms of sectors, the highest the ratio of firms exposed to exchange rate changes is found in the manufacturing sector, but in transportation and trade sectors the ratio is also higher than average.

5.3.2 Are Firms Aware of Their Exchange Rate Exposure?

The majority of companies interviewed are not prepared for changes in the exchange rate. On the basis of their answers, most of SMEs with exchange rate exposure do not assess their exchange rate exposure or deal with its magnitude, and generally believe that they have no exchange rate exposure or that it is negligible. Accordingly, the vast majority (50–75%) of respondents maintain the view that changes in the exchange rate do not affect their financial position or competitiveness.[4] Among those who believe that shifts in the exchange rate do have an impact on them, there are more who judge a weaker rate to be negative, rather than a stronger one.

As noted above, foreign exchange debt, as a means of natural hedging, may reduce exchange rate exposure, but if foreign exchange indebtedness is motivated by the reduction of costs (i.e. payment of lower interest rates upon borrowing, for example), the exchange rate exposure of the enterprise will grow. Our analysis implies that foreign exchange debt among the surveyed companies is rarely motivated by the hedging of foreign exchange revenues. Half of foreign exchange debt is held by companies with FX revenues, while the other half arises in relation to companies without positive net FX revenues. By limiting the examination to resident (mainly bank) foreign exchange debt, the rate of naturally unhedged debt is even higher, reaching two thirds of the stock of debt (chart 4). Thus, nothing offsets the negative impact of the exchange rate on foreign exchange debt in relation to the above rate of foreign exchange debt and foreign exchange debtor companies. We also observed that many companies have positive net foreign exchange revenues, suggesting that they would be better off with debts in foreign exchange than forints, yet they do not make use of this opportunity.

A large number of companies with foreign exchange debt disregard the potential effects of exchange rate shifts. This is supported by the fact that 70% to 80% of companies with foreign exchange debts claim that an exchange rate shift would not affect their debt burdens. The rate is similar in relation to companies with debt only in domestic currency. Thus, the denomination of debt does not account for any variation in assessing the expected impact of exchange rate changes.

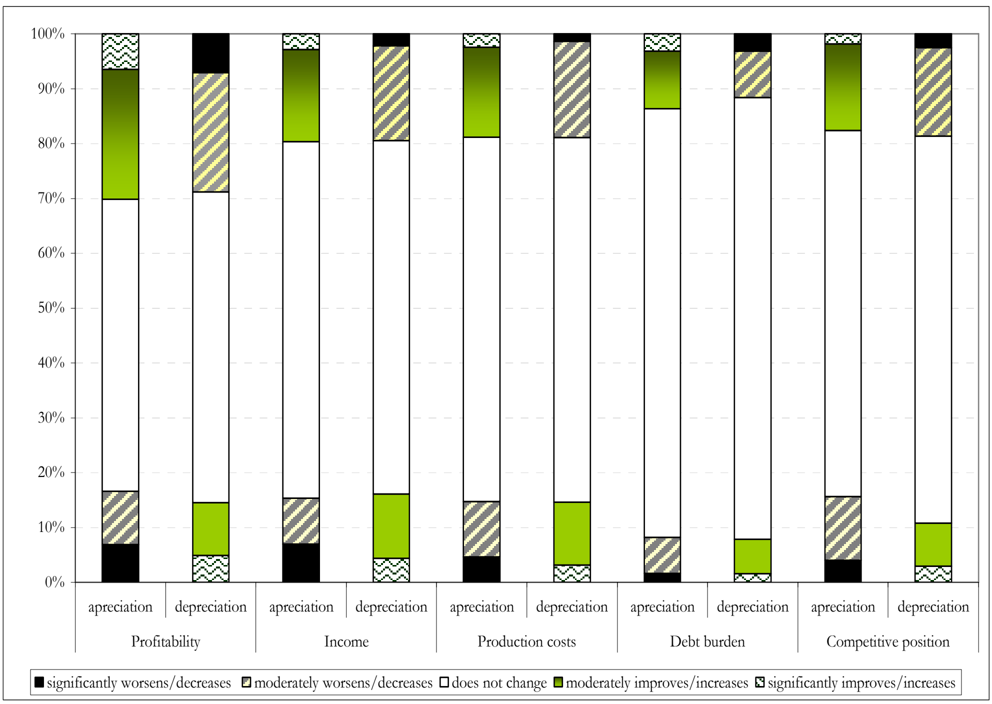
Several questions were posed in connection with assessing exchange rate exposure, expectations regarding the potential impact of the exchange rate on profitability, income, costs, debt and competitive position. Enterprises were asked to express their expectations on both the effects of appreciation and depreciation, as exchange rate exposure may be asymmetrical (see Chart 10).

Half of firms with non-zero CM gave answers, based on which it is clear that they are not aware of the existence of exposure or deem it to be insignificant. About 50% of these firms do not expect the exchange rate to affect any of the aforementioned variables. The other half of this group said they had exposure, but they do not manage it or the answers are contradictory. For example, firms answered that they had no exposure but expected they would be influenced by a change in the exchange rate.

[4] Enterprises were asked to consider a change in the exchange rate which they consider to be significant, and examine the impact of a change of a similar rate in relation to strengthening and weakening.

Firms which did not expect the exchange rate to influence their profitability or competitive position were in majority in the sample.[5] In the case of the different variables, the ratio of those who did not expect any influence of exchange rate changes was between 53 and 81%. This ratio was highest in respect of debt burden (81%), and most enterprises expected the exchange rate would influence their profitability. 39% of firms said that none of the variables mentioned would be affected by exchange rate changes.

Chart 10: Expectations of Enterprises in Case of a Potential Exchange Rate Change

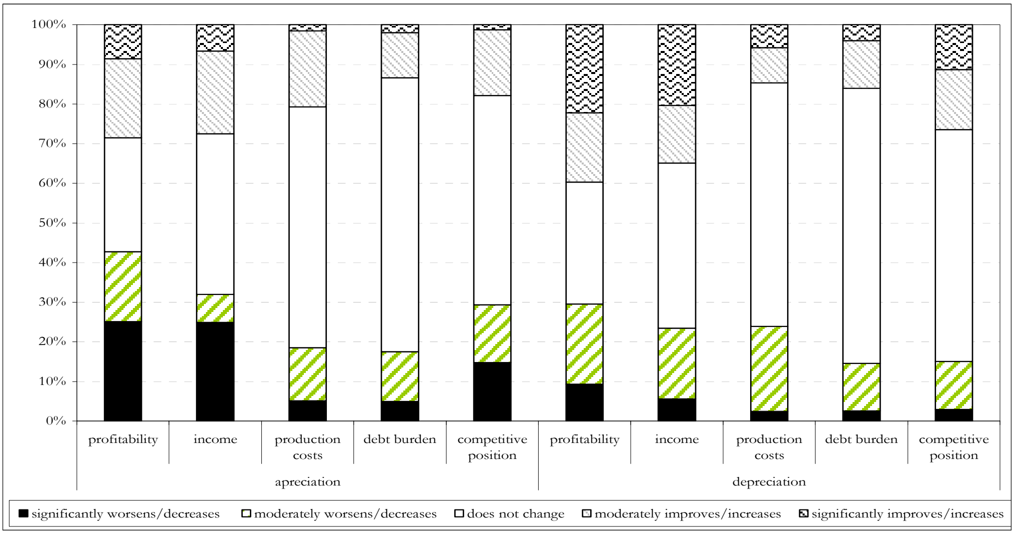


Source: Survey on the Exchange Rate Exposure of Hungarian SMEs.

The expectations of firms were examined according to sector and the presence and sign of the currency mismatch. There was no difference between tradable and non-tradable sectors, but some distinctions could be made on the basis of CM numbers. The ratio of firms which expected that appreciation (depreciation) would negatively affect their profitability and competitive position was higher among those with positive (negative) net FX income than in the whole sample.

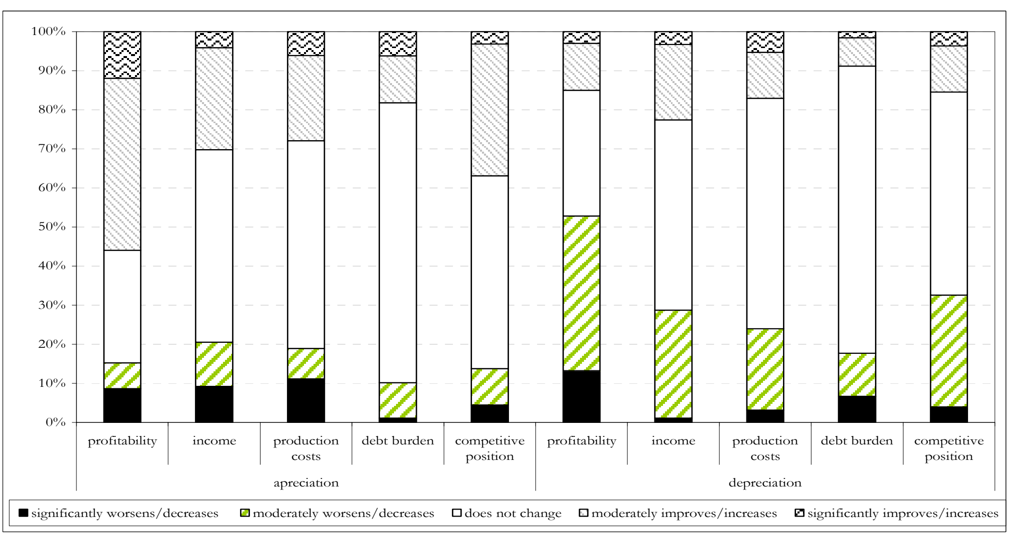
[5] We asked firms to think about an exchange rate change they think would be significant and that this should be the same in the case of appreciation and depreciation.

Chart 11: Expectations of Firms with Positive Net FX Income on the Effect of Potential Exchange Rate Changes



Source: Survey on the Exchange Rate Exposure of Hungarian SMEs.

Chart 12: Expectations of Firms with Negative Net FX Income on the Effect of Potential Exchange Rate Changes



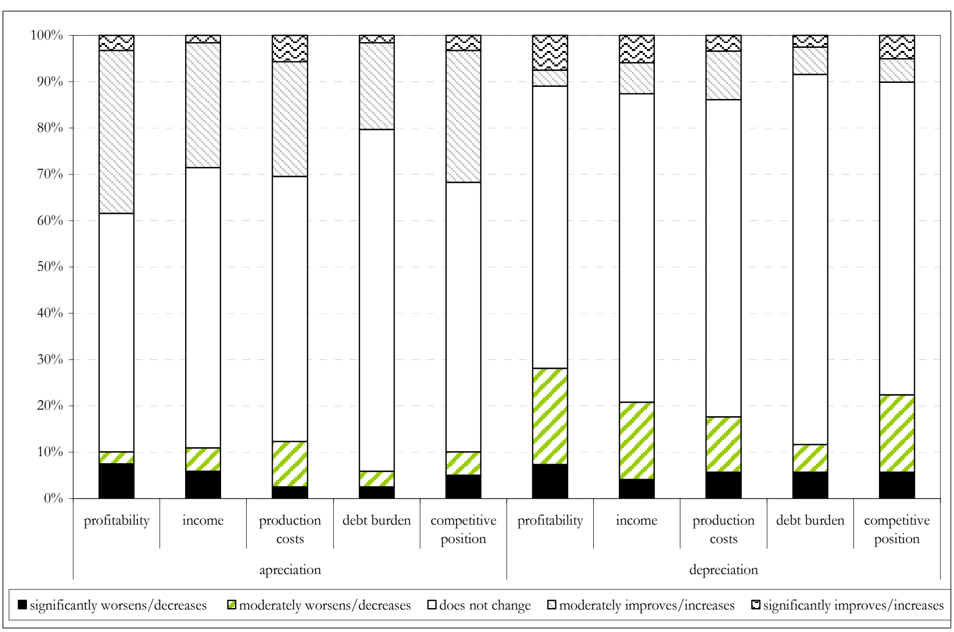
Source: Survey on the Exchange Rate Exposure of Hungarian SMEs.

Nevertheless, the ratio of those which did not expect any change was still very high in these sub-samples.

The survey contained questions on both appreciation and depreciation because exchange rate exposure may not be symmetrical. At the individual level, it seems that firms regard their exposure to be symmetrical: enterprises which expected a negative effect from appreciation also forecasted a positive effect from depreciation. The correlation between answers on exchange rate changes in different directions is highly and negatively correlated. The correlation is highest in the case of profitability and low in the case of production costs and debt burden.

At the aggregate level, however, exchange rate exposure is asymmetric: there are more enterprises which would be negatively affected by depreciation than by exchange rate appreciation. However, this also stems from the sign of the average currency mismatch. Nevertheless, it should be stressed that the real symmetry of exchange rate exposure can be examined in time-series data. In case of the questionnaire, taking into consideration the low exchange rate volatility before the survey was carried out, the uncertainty of the answers and the conclusions reached are high.

Chart 13: Expectations of Firms with FX Debt on the Effect of Potential Exchange Rate Changes



Source: Survey on the Exchange Rate Exposure of Hungarian SMEs.

The majority of companies with foreign exchange debt disregard the potential effects of exchange rate shifts. This is supported by the fact that 70 to 80% of companies with foreign exchange debts claim that an exchange rate shift would not affect their debt burdens. The rate is similar in relation to companies with debts only in domestic currency. Thus, the denomination of debt does not account for any variation in assessing the anticipated impact of exchange rate changes.

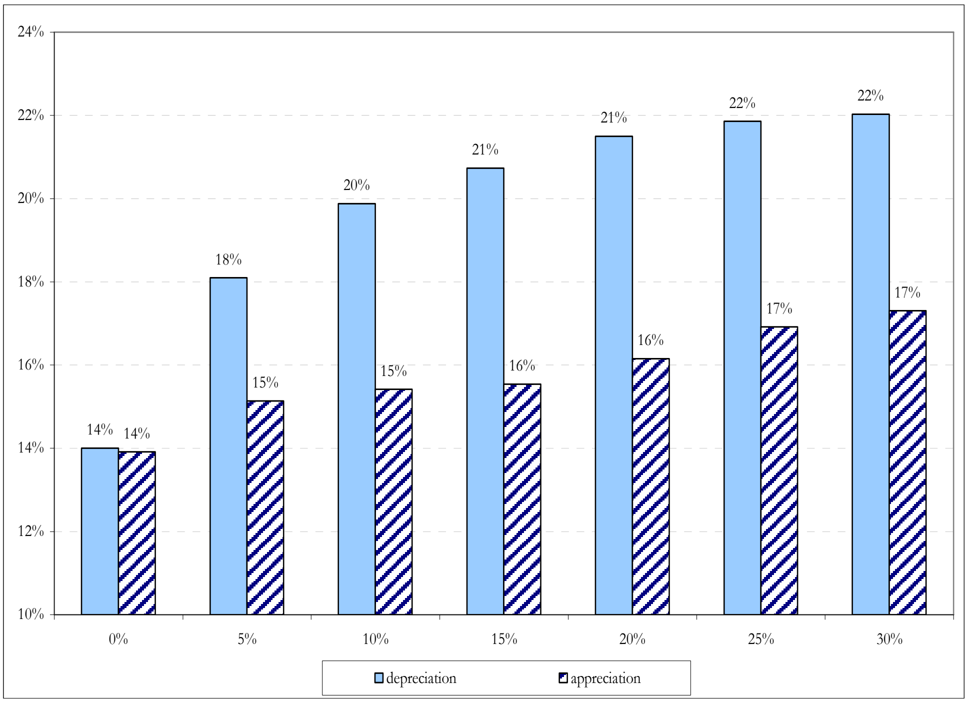
5.3.3 Exchange Rate Sensitivity

Under stringent assumptions and irrespective of the current exchange rate system, we attempted to numerically determine the effects of a possible exchange rate shock based on the data. Our analysis aimed to determine the share of companies participating in the survey which would incur losses as a result of exchange rate shifts of various degrees and directions, i.e. cases in which the added costs would exceed the added gains.

Since net foreign exchange revenue is a negative value for the whole sample, a possible weakening of the forint would negatively affect more companies than strengthening. The expectations of companies and the calculations also support this premise. In the basic state, 14% of the surveyed companies were unprofitable; this rate increased in response to both a strengthening and a weakening of the rate, although a weaker exchange rate led to losses in the case of more enterprises than a stronger rate. It is noteworthy that the effect of the exchange rate change is non-linear: a relatively larger jump was observed in response to a smaller shift in the exchange rate (5%, 10%), than was the case in response to additional changes in the exchange rate. In other words, a larger number of companies would become unprofitable in response to a 5%-shift in the exchange rate than those which would produce losses due to a further 5%-shift in the rate.

We also analysed exchange rate sensitivity using the above method in relation to the sub-group of foreign exchange debtors. In this case, the variation between foreign exchange debtors with natural hedging and non-hedged debtors could be clearly distinguished. For companies with no foreign exchange revenue the negative impact of a weaker exchange rate was clearly established, while companies with natural hedging were favourably affected by a weaker rate.

Chart 14: Ratio of Sample Enterprises Producing Losses upon Different Changes of the Exchange Rate



Source: Survey on the Exchange Rate Exposure of Hungarian SMEs.

It must be highlighted, however, that these calculations and the assertions derived from them are conditional. Companies' reactions, their bargaining position and rescheduling of debt is not taken into account; furthermore it is not taken into account that in some cases foreign exchange revenues and expenditures, and repayment of foreign exchange debt is not fully repriced in reaction to a change in the exchange rate. In addition, we did not consider adjustments of hedging activity. Therefore, the calculations overestimate exchange rate sensitivity. We also ignored the impact of the changing exchange rate on competitiveness, as this can modify the above results in either direction, and the possible effect of shifts in the exchange rate on domestic yields, producing a negative effect on forint debtors. For the above reasons, actual exchange rate sensitivity may vary in either direction from the rates calculated for the sample.

5.4 FX Risk Management

This chapter examines the use of natural and artificial hedge instruments and the possible reasons for the lack of FX risk management. All data are based on balance sheet weighted statistics.

Enterprises were asked how important they think exchange rate exposure is and whether they manage their exposure. Although the majority of enterprises consider management of exchange rate risk to be important, they do not measure their risks regularly. It can be presumed that SMEs do not have sufficient resources in this area. It also can be said that micro enterprises ascribe the lowest degree of importance to exchange rate exposure.

Only a small fraction of enterprises answered that they used FX risk management instruments; the majority of them used natural hedging. Among these on balance-sheet methods matching inflows and outflows was the most common. Only 7 enterprises answered they were intending to borrow in FX to hedge exchange rate risk.

In analysing natural hedging activity, it is important to distinguish between conscious and unconscious hedging. Many companies which have both revenues and expenditures in foreign exchange replied to the questionnaire that they do not apply any hedging techniques. These answers may imply that the companies are unaware that this can be a form of natural hedging. In many cases, the scheduling of inflows and outflows varies, and for liquidity reasons, the companies are indeed unable to apply natural hedging instruments. On the above grounds, in such cases I considered the answers of the companies to hold true, that is, I classified the respondents among non-hedgers.

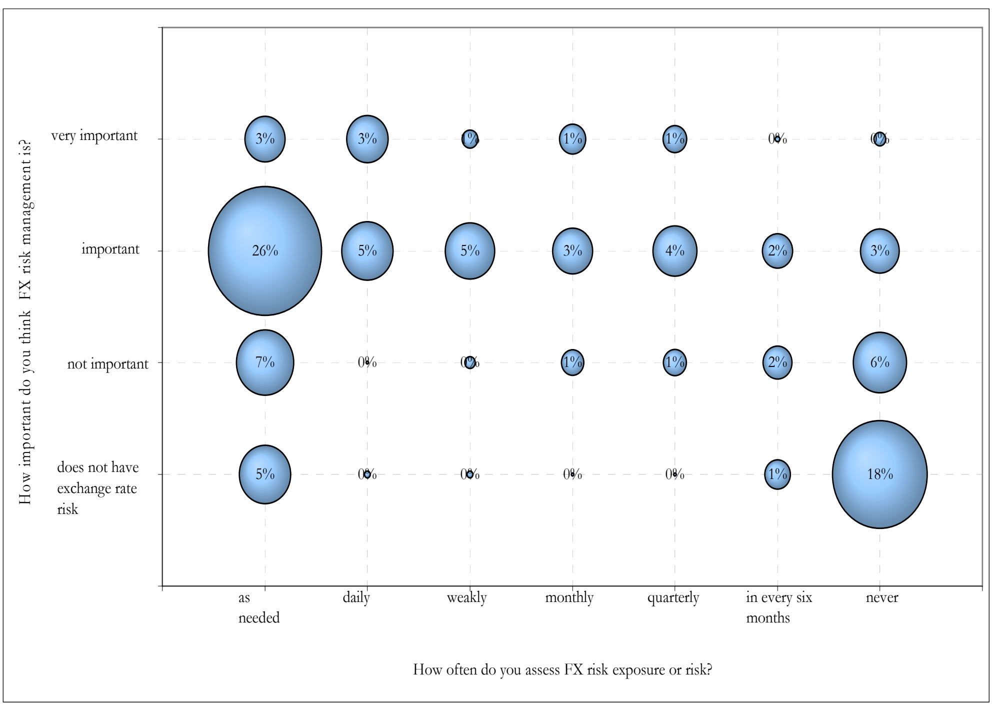
SMEs apply artificial hedging even to a lesser extent than natural hedging instruments. On the basis of the share in the balance sheet total, 4% of companies applied artificial hedging instruments. This result is in line with the results of surveys conducted in other countries. To a large extent, this can be explained by the composition of the sample, for in relation to most SMEs, the size of the company or the degree of exposure does not reach a level at which it is reasonable to invest in FX risk management methods or the establishment of organisation units dealing with such.

In the case of not using hedging tools, enterprises argued that they had no exposure or risk. However, according to my definitions, in fact they did. There may be two reasons behind these answers: first, they may not expect an exchange rate change, or they are unaware of their exposure. To a certain degree, the lack of conscious hedging can be explained by the sample as in case of SMEs company size or the measure of exposure is below the threshold above which it is worth it to invest in risk management. Nevertheless, as there is no need for investment to introduce on-balance sheet tools, the lack of these tools may be a sign of low risk-awareness.

It is of special interest to examine hedging activity of FX debtors, as FX debt can be a tool for natural hedging. Nevertheless, if the aim of FX borrowing is cost-reduction, FX debt increases currency mismatch. In this case, exposure is never hedged as the cost advantage would thus be lost. To put it differently, the lack of hedging activity by FX debtors may be a sign of borrowing in FX in order to reduce costs, and these firms may consider the saved costs to be higher than the potential losses on FX risk.

In the sample, half of the FX debt volume is not hedged naturally (see Chart 15). In respect of domestic FX debt accumulated by Hungarian banks, the ratio reaches two thirds of the debt volume. Among FX debtors, the ratio of enterprises which do not hedge at all is about 80%: they do not think they are exposed to exchange rate changes or think that hedging is too costly. Altogether, it seems as if the ratio of risk-aware enterprises is lower among FX debtors than in the whole sample.

Chart 15: Importance of Managing Exchange Rate Exposure and Frequency of Assessing Exposure

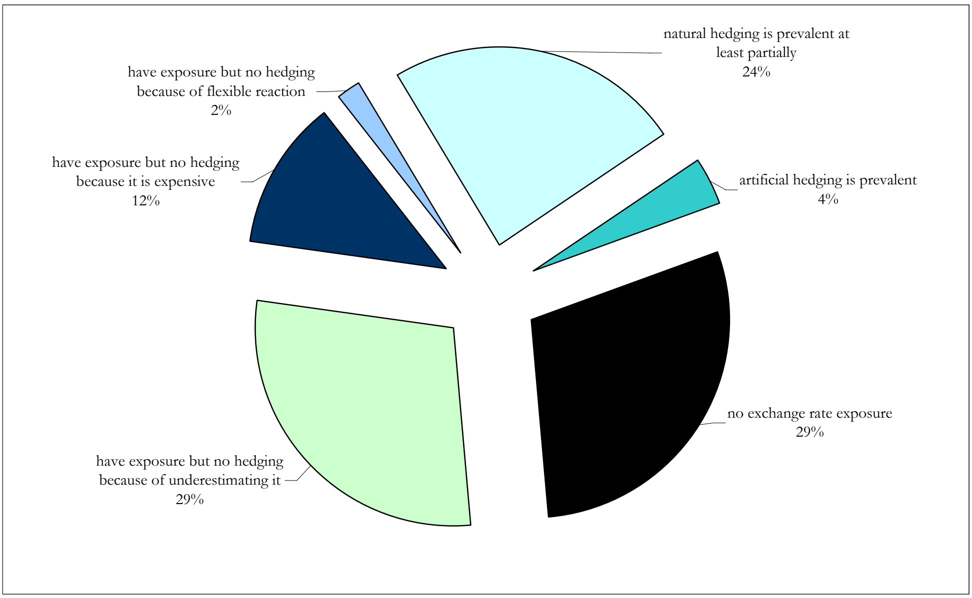


Source: Survey on the Exchange Rate Exposure of Hungarian SMEs.

Note: The size of circles indicates the ratio of the balance sheet total of companies belonging to the given category compared to the total sample.

Finally, I examined whether there are firms which borrow in domestic currency despite having FX income. The ratio of these enterprises – thus the share of firms denying both the possibility of hedging and of borrowing cheaper – is as high as 31% (weighted with the balance sheet).

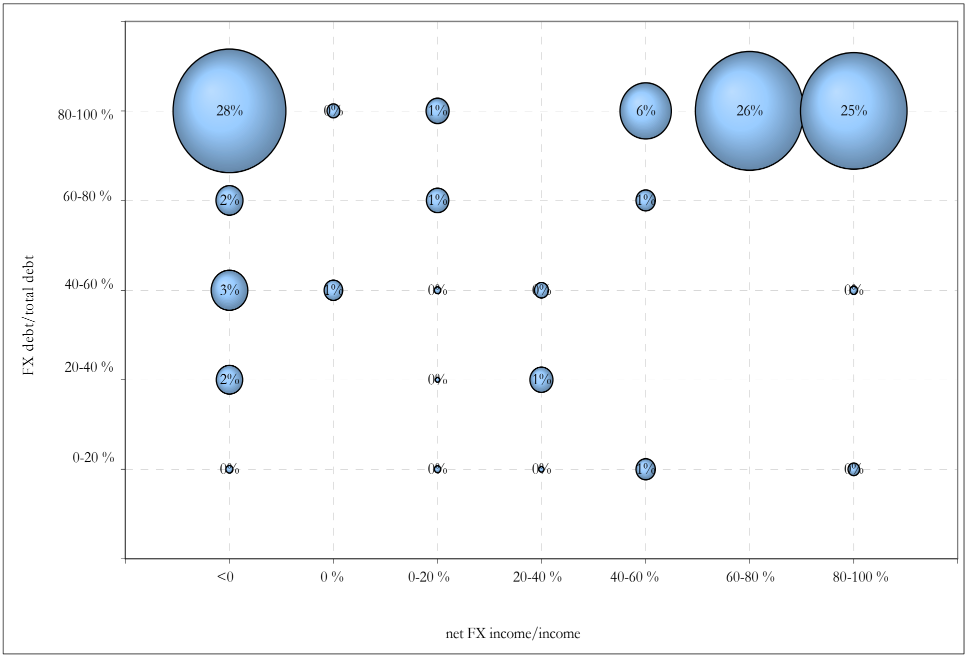
Chart 16: Characteristics of Companies Based on Exchange Rate Exposure and Hedging Activity



Source: Survey on the Exchange Rate Exposure of Hungarian SMEs.

Note: On the basis of share in the balance sheet total.

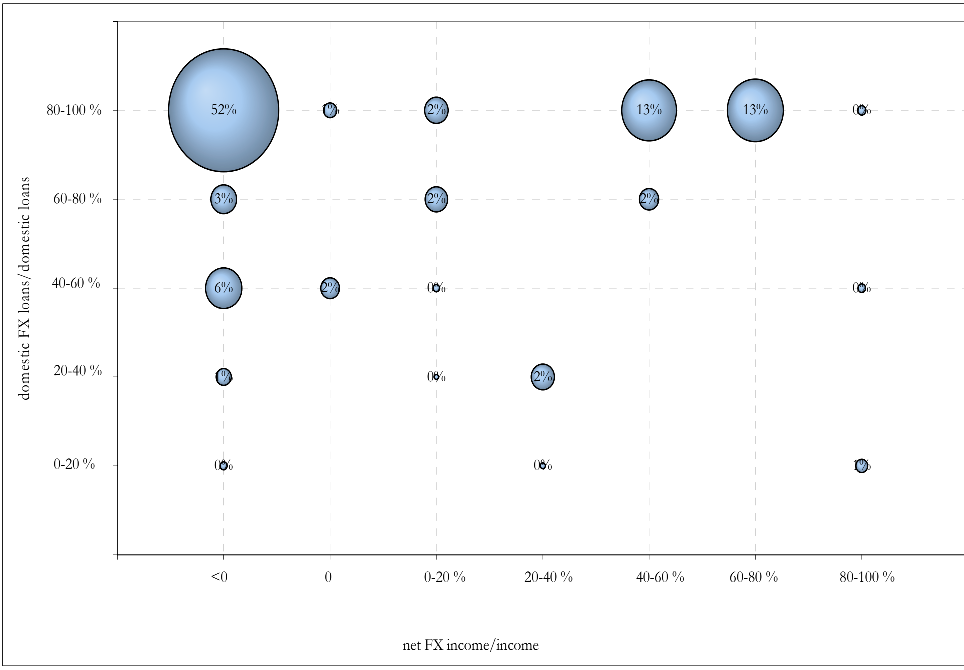
Chart 17: Ratio of FX Debt to Total Debt and Natural Hedging



Source: Survey on the Exchange Rate Exposure of Hungarian SMEs.

Note: The size of circles indicates the ratio of the balance sheet total of companies belonging to the given category compared to the total sample.

Chart 18: Rate of Domestic Foreign Exchange Debt within Domestic Debt and Natural Hedging



Source: Survey on the Exchange Rate Exposure of Hungarian SMEs.

Note: The size of the circles indicates the ratio of foreign exchange debt of companies belonging to the given category compared to total foreign exchange debt.

6. Conclusions

On the basis of the review of literature of financial crises, it can be said that small open economies are more exposed to exchange rate changes, and that in emerging countries devaluation often has negative effects. One of the main reasons behind this is dollarisation leading to currency mismatches. As in Hungary dollarisation of liabilities is increasing not only in case of exporting large firms but also in the retail sector, an examination of the potential risks was prepared.

A survey was carried out on the SME sector in the interests of conducting a detailed, micro-level analysis of the potential risks deriving from increasing FX lending by domestic banks, and in parallel, the risks of increased lending to SMEs. On the basis of the survey data, the characteristics of SMEs' indebtedness, exchange rate exposure and exchange rate risk management were analysed. When examining indebtedness, the dependence on domestic funds and bank sources can be established, and owner financing related to foreign-owned companies also reached a high rate. two factors motivating indebtedness in foreign exchange were analysed: hedging of foreign exchange revenues and cost reduction through the use of interest rate differences. The results of the questionnaire suggest that foreign exchange debt rarely functions as a hedging instrument, and that few companies are aware of the impact of the exchange rate on foreign exchange loans.

When analysing exchange rate exposure, I examined net foreign exchange assets and net foreign exchange revenues in numbers and their sensitivity to exchange rate shocks, as well as the expectations of companies. I observed that, on the basis of all aspects of analysis, a weakening of the domestic exchange rate would produce a negative effect as a whole, while a strengthening would produce a positive effect. Upon the comparison of the answers, we concluded that a large number of respondents underestimate their exposure to the exchange rate, or disregard such risks, which may be explained by their limited resources available for these purposes. However, the stability of the exchange rate in the period preceding the survey is likely to have played a role in determining the results.

A significant number of companies surveyed have direct foreign exchange exposure, but only few of these are aware of the risk or provide hedging for exchange rate exposure. Although natural hedging would be available in many cases, companies generally do not apply it consciously. Artificial hedging instruments are only employed in a few cases. The hedging of foreign exchange debt is also quite rare, particularly if we limit the analysis to foreign exchange debt granted by domestic banks. Most companies with foreign exchange debts from abroad are naturally hedged.

The credit risk of the banking system may be indirectly derived from the above results. The survey indicated that a shift in the exchange rate can produce an unexpected effect on domestic SMEs through two channels: directly through foreign exchange debt and indirectly through other foreign exchange items. The majority of companies underestimate their foreign exchange exposure and do not use any conscious risk management techniques. This holds true in particular in relation to companies which are indebted in foreign exchange vis-à-vis resident banks. The analyses did confirm, however, that a possible weakening of the exchange rate would generally adversely affect the SME sector. In addition to the rising credit loss of the banking system, this would likely result in a significant fall in aggregate credit demand and demand for foreign exchange loans.

As further research, a new survey will be carried out. This is motivated by three facts: first, in 2006 the volatility of the exchange rate increased to high levels, which could change behaviour of firms. Second, large enterprises should be included in the survey and their average behaviour should be compared to that of SMEs. The new survey would also aim at disclosing the reasons behind the low risk-awareness of firms: to what extent it is linked to low financial culture, exchange rate expectations, firms' other (e.g. liquidity) problems, or banks' behaviour. Finally, besides the potential effect of exchange rate on non-financial firms, its indirect effect on banking system portfolio should also be estimated.

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APPENDICES

Appendix 1: Empirical Works on Exchange Rate Exposure Based on CAPM Model

Author	Countries examined	Country-specific factors	Industry-specific factors	Firm-specific factors	Note
Jorion 1990	USA 1971–1987			Ratio of foreign sales to total sales	Time-variant exposure
Bodnar – Gentry 1993	Canada, Japan, USA 1979 (from 1983 for Japan) – 1988	Small open economies are more exposed	Industry-specific factors play important role in explaining exposure, diversification may decrease exposure	–	–
Bartov – Bodnar 1994	USA 1978–1989	–	–	–	Explains the underestimation of exposure by mispricing of investors, explains the underestimation of risks by restrained information about risks
Friberg-Nydahl 1997	Austria, Belgium, Denmark, France, Netherlands, Japan, Germany, Italy, Sweden, USA 1973–1996	Exposure is larger in larger countries	–	–	–

Appendix 1 Continued: Empirical Works on Exchange Rate Exposure Based on CAPM Model

Author	Countries examined	Country-specific factors	Industry-specific factors	Firm-specific factors	Note
He – Ng 1998	Japan	–	–	Export revenues and proxies of hedging incentives explain exposure	–
Nydahl 1999	Sweden 1992–1997	Small open economies are more exposed	–	Usage of derivatives decreases exposure while exposure is positively related to ratio of foreign sales	
Bodnar – Wong 2000	USA 1977–1996	–	–	–	Methodology paper, examining the effect of portfolio choice, macro factors and firm size
Ihrig 2001	USA 1995–1999	–	–	Exchange rate exposure is a function of the number of countries a company operates in	Differentiates between normal and shock periods
Dominguez – Tesar 2001	Chile, United Kingdom, France, Japan, Germany, Netherlands, Italy, Thailand 1980–99	–	–	Smaller and internationally operating firms are more exposed to exchange rate changes	Change of exchange rate influences exposure

Appendix 1 Continued: Empirical Works on Exchange Rate Exposure Based on CAPM Model

Author	Countries examined	Country-specific factors	Industry-specific factors	Firm-specific factors	Note
Doige – Griffin – Williamson 2002	Australia, Belgium, Denmark, United Kingdom, France, Netherlands, Hong Kong, Japan, Canada, Germany, Italy, Switzerland, Singapore, USA (1975–1999); Malaysia (1980–1999), Spain (1987–1999) New Zealand (1988–1999)		–	Firm size and ratio of foreign sales correlates negatively with exposure.	Non-linear exposure
Hagelin – Pramborg 2002	Sweden 1997–2000	–	–	International operation, usage of derivatives	Examines abnormal volatility periods
Koutmos – Knif 2003	Finland 1992–1998	–	Type and measure of exposure changes by industry.	Firm size explains type and measure of exposure	Asymmetrical, non-linear exposure
Chue – Cook 2004	Brazil, Chile, South Africa, India, Indonesia, Columbia, Korea, Mexico, Morocco, Pakistan, Philippines, Taiwan, Thailand, Turkey, Venezuela	Depreciation has negative effect in emerging countries	–	FX debt increases fragility of firms	
Priestley – Odegaard 2004	USA 1979–1998	–	–	–	Methodological paper

Appendix 1 Continued: Empirical Papers with Other Methodolgy than CAPM

Author	Countries examined	Country-specific factors	Industry-specific factors	Firm-specific factors	Note
Clarida 1997	USA 1975–1993	–	–	–	Asymmetric exposure, differentiation between valuation and quantity channels
Forbes 2002	Argentine, Australia, Austria, Belgium, Brazil, Chile, Czech Republic, Denmark, South Africa, South-Korea, United Kingdom, Finland, France; Philippines; Greece; Netherlands, Hong Kong, India, Indonesia, Ireland, Israel, Japan, Canada, China, Poland, Hungary, Malaysia, Mexico, Germany, Norway, Italy, Pakistan, Portugal, Spain, Switzerland, Sweden, Singapore, Taiwan, Thailand, Turkey, New Zealand, USA 1997–2000	Small open economies are more exposed	–	After depreciation performance correlated positively with foreign exposure, negatively with size and production of tradable products while the connection was not straightforward with production structure, debt ratio and profitability	–

Appendix 2: Questionnaire

Filtering questions

Is the company majority privately owned, i.e. its majority owner is not the government or a municipality?

Yes
No

Did the company operate during 2004 / has it closed at least one financial year?

Yes
No

Does it have credit, loan, other liability (e.g. trade credit, ownership loan, bond, etc.)?

Yes
No

Company data

A1 Please give the code of the main activity of the company

A2 Please give the statistical ID number of the company

A3 Please give the starting date of the business year

A4 Please give the legal form of the company

a. limited partnership
b. merger
c. limited corporation
d. general partnership
e. joint company
f. joint-stock company
g. co-operative society
h. other corporation with legal entity
i. other corporation without legal entity

A5 Please give the number of employees on 31 December 2004 ……………

A6 What is the ratio of foreign ownership in the company?
……………%

A7 Please state the balance sheet total for 2004:
……………HUF

A8 Please state the own capital for the end of 2004
……………HUF

A9 Please state the gross income of 2004
……………HUF

A10 Please state the gross expenditures of 2004
……………HUF

A11 Please state the after-tax profit of the companies for 2004
……………HUF

A11a Does your company have a subsidiary / subsidiaries?

a. yes
b. no

A11b If the firm has a subsidiary / subsidiaries:
Are the subsidiaries located abroad, in Hungary or both?

a. abroad
b. in Hungary
c. both abroad and in Hungary

A12 What proportion of income did the company derive from the main activity in 2004? …%

Financial questions

B1 Please state the ratio of the balance sheets, off-balance sheet items, income and expenditure denominated in different currencies as a percentage according to the following table (assets, liabilities, off-balance sheet items: stock at end-2004, income and expenditures: 2004).

	Assets	Liabilities	Off-balance sheet items		Income	Expenditures
			Assets	Liabilities		
HUF						
EUR						
USD						
CHF						
Other, pls. specify: __________						
Other, pls. specify: __________						
Other:						

B2 Please give the following data for end-2004 in million HUF:

- Stock of HUF cash
- Stock of FX cash
- Granted loans to domestic companies (included associated and holding companies, both long and short-term loans), in HUF
- Granted loans to domestic companies (included associated and holding companies, both long and short-term loans), in FX
- Receivables from delivery of goods and services to home buyers (including associated and holding companies)
- Receivables from delivery of goods and services to foreign buyers (including associated and holding companies)
- Liabilities from delivery of goods and services from home deliverers (including associated and holding companies)
- Liabilities from delivery of goods and services from foreign deliverers (including associated and holding companies)

B3 What ratio of the value of inputs used in your firm is imported?

…%

B4 What ratio of the value of outputs is exported?

…%

B5 What was the ratio of export income to gross income in 2004?

…%

B6 In what ratio of the contracts concluded with domestic partners in 2004 are prices fixed in FX?

…%

B7 How important does your firm think FX risk management is?

a. there is no FX risk
b. FX risk management is not important
c. FX risk management is important
d. FX risk management is very important

B8 How frequently does your firm value the FX risk or exposure of the company?

a. as needed
b. on a daily basis
c. on a weekly basis
d. on a monthly basis
e. quarterly
f. annually
g. never

B9 Does your firm hedge the FX risks deriving from the currency mismatch of income and expenditures and/or assets and liabilities?

a. yes
b. no
c. there is no FX risk

B10 Does your company hedge the FX risk of foreign subsidiaries?

a. yes
b. no
c. there is no FX risk at the subsidiary
d. no subsidiary

B11 If your company does hedge your own or the subsidiary's FX risk, please answer B11 and B12. Otherwise please continue with B13.
What methods does your company use to hedge FX risk?

a. derivatives
b. FX borrowing
c. FX depositing
d. granting FX loan
e. matching inflows and outflows
f. exchange rate fixed in the clause of sales contracts
g. inter-company cash-pooling or other contracts
h. other, please specify: …………………………………………….

B12 If your company uses derivatives:
What kind of derivatives do you use to hedge FX risk?

a. future contracts
b. forward contracts on the interbank market
c. FX options
d. other, please specify ………………………

B13 If you do not hedge the FX risk of your own company or that of the company's subsidiary. Otherwise please continue with question B14.

If your firm does not hedge its own exchange rate risk or that of the subsidiaries, what is the reason behind this?

a. there is no exchange rate exposure or it is very low
b. the costs of hedging exceed the expected benefits
c. if the exchange rate risk were realised, my firm would be able to react in a flexible way
d. the parent company manages my firms' exchange rate risk
e. other, please specify:

…………………………………………………………………

B14 The following question is related to the loans and credits of end-2004 raised from domestic partners.
Please give the following data (in the given currencies; in HUF if the currency is not given).

		HUF	EUR	USD	CHF	Other, please specify:
From domestic bank	With maturity more than one year					
	With maturity less than one year					
From domestic, non-bank financial institution	With maturity more than one year					
	With maturity less than one year					
From domestic commercial partner	With maturity more than one year					
	With maturity less than one year					
From domestic parent company	With maturity more than one year					
	With maturity less than one year					
From other domestic partner (included bonds issued)	With maturity more than one year					
	With maturity less than one year					

B15 The following question is related to the loans and credits of end-2004 raised abroad. Please give the following data (in the given currencies; in HUF if the currency is not given).

		HUF	EUR	USD	CHF	Other, please specify:
From foreign bank	With maturity more than one year					
	With maturity less than one year					
From foreign, non-bank financial institution	With maturity more than one year					
	With maturity less than one year					
From foreign commercial partner	With maturity more than one year					
	With maturity less than one year					
From foreign parent company	With maturity more than one year					
	With maturity less than one year					
From other foreign partner (included bonds issued)	With maturity more than one year					
	With maturity less than one year					

B16 What kind of loan did your company raise or plan to raise from domestic or foreign sources in 2005?

		HUF	Foreign currency, please specify: … … …
From domestic sources	With maturity more than one year		
	With maturity less than one year		
From foreign sources	With maturity more than one year		
	With maturity less than one year		

B17 From the list below, which aspects are most important for you in your decisions concerning borrowing? Please rank the five most important aspects!

	Borrowing in HUF or foreign currency	Borrowing from domestic or foreign sources
Bank connections		
Actual installment amount		
Interest rate level		
Interest rate differential		
Actual and expected level of foreign currency		
Volatility of the exchange rate		
Domestic economic expectations		
Foreign economic expectations		
Financing foreign investments		
Matching the denomination of inflows and outflows		
Matching the denomination of assets and liabilities		
Commitments towards parent company and/or holding company		
Other, please specify		

B18 Please give the potential effect of HUF appreciation (against the EUR) on your company's…

	considerably worsens / decreases	somewhat worsens / decreases	does not influence	somewhat improves / increases	considerably improves / increases
A. profitability					
B. HUF income					
C. production costs					
D. debt burden					
E. competitive position					

B19 Please give the potential effect of HUF depreciation (against the EUR) on your company's…

	considerably worsens / decreases	somewhat worsens / decreases	does not influence	somewhat improves / increases	considerably improves / increases
A. profitability					
B. HUF income					
C. production costs					
D. debt burden					
E. competitive position					

B20 Please hand in a copy of your not consolidated balance sheet of 2004 (with basis figures on 2003)

Appendix 3: Cleaning and Modification of Survey Data

1. Statistical code, foreign ownership, balance sheet total, equity, pre-tax profit, income, expenditures, import and export ratios, indebtedness:
Correction of data was based on comparison with tax agency data basis and examination of balance sheet and income statement identities.
2. Denomination of balance sheet and income statement items:
Income statement items were corrected with export revenue, import expenditures and FX debt data when stated.
3. Representativeness:
Since the ratio of value added in size and industry categories in the sample did not fit to those in the macro-economy, sample was re-weighted. The difference between the unweighted sample and macro data is described in the following table:

Macro-economy		Agriculture and mining	Manufacturing	Services	All sectors
Size	Micro enterprises	1.2%	12.5%	16.7%	30.3%
	Small enterprises	1.1%	11.5%	15.3%	27.8%
	Medium-sized enterprises	1.6%	17.3%	23.0%	41.8%
	Whole sample	3.8%	41.2%	54.9%	100%
Unweighted sample					
Size	Micro enterprises	0.4%	1.6%	8.9%	11.0%
	Small enterprises	1.5%	9.6%	23.0%	34.1%
	Medium-sized enterprises	2.3%	11.9%	40.8%	54.9%
	Whole sample	4.2%	23.1%	72.7%	100%

Note: Size ratios were counted on the basis of 2001 Ecostat data, while the industrial value added ratios are based on MNB sources. The corresponding ratios in the sample are based on balance sheet total numbers.

Appendix 4: Correlations

	Export ratio	Import ratio	Balance sheet total	Profit margin	Debt to balance sheet total ratio	Ratio of foreign ownership	Net FX assets to balance sheet total	Net FX income to balance sheet total	Ratio of FX debt to total debt	Ratio of bank loans	Ratio of foreign loans
Export ratio	1	0.14	0.16	-0.09	0.03	0.29	–0.01	0.2	0.23	0.08	0.13
Import ratio	0.14	1	0.01	–0.02	–0.04	0.24	–0.12	–0.35	0.13	–0.07	0.18
Balance sheet total	0.16	0.01	1	–0.01	–0.06	0.15	–0.07	0.03	0.05	0.12	0.01
Profit margin	–0.09	–0.02	–0.01	1	–0.18	–0.01	0	–0.02	–0.08	–0.1	–0.11
Debt to balance sheet total ratio	0.03	–0.04	–0.06	–0.18	1	0.06	–0.01	–0.04	0.13	0.03	0.39
Ratio of foreign ownership	0.29	0.24	0.15	–0.01	0.06	1	–0.16	–0.01	0.3	–0.02	0.45
Net FX assets to balance sheet total	–0.01	–0.12	–0.07	0	–0.01	–0.16	1	0.09	–0.23	0.04	–0.33
Net FX income to balance sheet total	0.2	–0.35	0.03	–0.02	–0.04	–0.01	0.09	1	0	0.1	–0.05
Ratio of FX debt to total debt	0.23	0.13	0.05	–0.08	0.13	0.3	–0.23	0	1	0.09	0.21
Ratio of bank loans	0.08	–0.07	0.12	–0.1	0.03	–0.02	0.04	0.1	0.09	1	–0.13
Ratio of foreign loans	0.13	0.18	0.01	–0.11	0.39	0.45	–0.33	–0.05	0.21	–0.13	1

Appendix 5: Regressions

Probit regressions

		FX indebtedness			**FX indebtedness towards domestic banks**			**Exchange rate exposure**			**FX risk management**		
Dependent variables:		**Variable**	**Frequency**	**Dummy**	**Variable**	**Frequency**	**Dummy**	**Variable**	**Frequency**	**Dummy**	**Variable**	**Frequency**	**Dummy**
		FX debtor	10%	1	FX debtor	10%	1	Exposed to exchange rate changes	41%	1	Hedge	14%	1
		No FX debt	90%	0	No FX debt	90%	0	Not exposed to exchange rate changes	59%	0	No hedge	86%	0
Explanatory variables		**Parameter estimations**											
	Constant	**-1.6*** **			**-1.77*** **			**-0.63*** **			**-1.57*** **		
	Tradable dummy							0.25***			-0.08		
	Export dummy	**0.57*** **			**0.58*** **						0.025		
	Import dummy	**0.24***			**0.40*** **								
	Company size (no. of employees)	**0.0036***			**0.005** **			**0*** **			0		
	Profitability	-0.223			0.10			-0.315			**0.38***		
	Indebtedness	-0.00006			0.00			-0.05					
	Foreign ownership	**0.01*** **			0.00			**0.02*** **			**0.006** **		
	Exchange rate exposure										**0.78*** **		
	FX debt							**2.15*** **			**-0.3***		
	Hedging							**0.89*** **					
Pseudo R2:		**0.1451**			**0.1142**			**0.2354**			**0.1006**		

Ordered probit regressions

		FX indebtedness			FX indebtedness towards domestic banks			Exchange rate exposure		
		Variable	Frequency	Dummy	Variable	Frequency	Dummy	Variable	Frequency	Dummy
Dependent variables		No FX debt	89%	1	No FX debt	91%	1	Negative	22%	1
		FX debt ratio is 0-80%	5%	2	FX debt ratio is 0-80%	4%	2	Zero	60%	2
		FX debt ratio is over 80%	6%	3	FX debt ratio is over 80%	6%	3	Positive	18%	3
		Parameter estimations								
Explanatory variables	Export dummy	0.53***			0.59***			2.33***		
	Import dummy	0.33*			0.41***			-2.24***		
	Company size (no. of employees)	0.0037**			0.005**			0		
	Profitability	-0.25			0.10			-0.2*		
	Indebtedness	-0.00006			0.00			0		
	Foreign ownership	0.008***			0.00			-0.006***		
	Exchange rate exposure									
	FX debt							-0.28**		
	Hedging				0.032					
Pseudo R2		0.1263			0.1053			0.2829		

Local Debt Expansion…Vulnerability Reduction? An Assessment for Six Crises-Prone Countries

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Abstract

During the last years, public debt has been reduced and its composition has been evolving toward domestic currency denominated in most emerging markets. This is a remarkable progress in terms of financial vulnerability, which has been underpinned by the favourable financing conditions and the related deepening of local debt markets. In this paper, we assess the vulnerability reduction –conveyed in the ratio of total debt to GDP – achieved in the last years for six selected emerging economies, focusing on the importance of exchange rate evolution relative to the proactive policies of fiscal authorities have implemented to reduce the external exposure of debt. We first disentangle both components in the current structure of debt to show that proactive debt management has been the dominant factor in the reduction of the foreign exchange (forex) debt share; then, a stress test within a debt sustainability analysis framework is performed. The results show that proactive debt management policies have reduced the vulnerability of debt in the case of financial turbulence, although, paradoxically, it has also limited the effective reduction in the debt ratio derived from the observed real exchange rate appreciation.

Keywords: External debt, local debt markets, financial crises, debt sustainability analysis

JEL Classification: H6, E6, F3

[1] This paper has been prepared in the context of the CGFS WG on local debt markets and financial stability of the BIS. The opinions expressed in this document are solely responsibility of the authors and do not represent the views of the Banco de España. Contact authors: paloma.acevedo@bde.es, alberola@bde.es, carmen.broto@bde.es. We would like to thank Jose Montero, Iikka Korhonen and participants in the "CGFS Workshop on Balance sheet effects and emerging markets bond spreads" at Bank of England (London) and the 5th Emerging Market Workshop at the Oesterreichische Nationalbank for helpful comments received. The usual disclaimers apply.

1. Introduction

The ratios of public debt and external debt to GDP constitute crucial indicators to assess the financial and fiscal vulnerability of a country. On the one hand, high ratios of public debt jeopardise its sustainability and the solvency position of the country and, on the other hand, a high proportion of exchange rate exposure in debt composition may abruptly worsen the sustainability position in times of financial stress, characterised by access problems to external markets and/or sharp exchange rate movements.

In emerging countries, external debt and the domestic debt denominated in foreign currency (both conveyed henceforth in under the concept of forex debt) have played an important role in the structure of public sector debt in some emerging markets, because they could not issue locally and/or in local currency, a phenomenon known in the literature as the original sin (Eichengreen and Hausman, 1999). In last years the decreasing trend of public debt over GDP has been accompanied simultaneously and more intensely in many countries by a decrease in the corresponding share of forex debt, coinciding with a period of widespread appreciation of exchange rates[2]. Thus, this evolution has been seen as signalling a breakthrough which improves their financial prospects by reducing their financial vulnerability. Our goal in this paper is to assess quantitatively this vulnerability reduction and its reversibility under financial turbulence.

Chart 1 displays the ratio of public sector debt to GDP for six selected countries in 2005 and in the year of the highest outstanding debt during the last decade which, in most cases, coincides with episodes of financial turmoil (see Manasse and Nouriel (2005) or de Bolle et al. (2006)) for a dating of financial crises). The graph shows both the gross debt holdings and debt net of international reserves (quasi-gross public debt onwards), which will be our preferred measure in the analysis that follows. This type of measure has been chosen in order to reach an homogeneous sample of data across countries and to pick up in the data the effect of the accumulation of reserves in the analysed countries, which is a central consideration, too[3].

The criterion to choose the countries and the concept of debt used –quasi-gross public debt – has been mainly based on data availability among the group of

[2] See, for instance, IDB (2006) report for a recent general view concerning public debt in emerging countries

[3] The choice between gross debt, net debt or any alternative type of measure of debt is not trivial. As stated in IDB (2007), despite many countries provide measures of net debt, the netting strategies differ across countries, so that net debt does not constitute an homogeneous measure, whereas gross debt doesn't capture the effect of international reserves. See Cowan *et al.* (2006) or *IMF* (2003) "External Debt Statistics: Guide for Compilers and Users" for other alternative debt definitions different from quasi-gross public debt.

countries undergoing crises in the last decade. In any case, the six selected countries – Brazil, Colombia, Indonesia, Russian Federation, Turkey and Uruguay – represent a rather adequate sample of emerging regions, trying to emphasize the generalization of the downward trend of public debt and forex debt. Due to the lack of existence of an homogeneous database that perfectly suits the period of time and disaggregation required by this research, data have been collected directly from the specific debt data release official institutions -except for Russia and Indonesia where data come from the IMF-. We decompose quasi-*gross debt* and decompose it into *foreign* (issued in international debt markets) versus *local* (issued in domestic debt markets) debt. Afterwards we have also distinguished between local *debt linked to exchange rate* and *local debt linked to local currency* in the cases where this second data distinction is available. Table 1 shows the sources and respective links used to create the database.

Russia is the most outstanding case of debt reduction. Quasi-gross public debt among the sample shrank about 99 percentage points (p.p.) of GDP between 1999 and 2005 to become negative, due to the large reserve accumulation[4]. In Turkey and Indonesia the reduction was of 34 p.p. and 24 p.p. of GDP, respectively, from 2001 to 2005[5]. Also Brazil constitutes a good example of these dynamics as in 2002 the quasi-gross public sector debt was 74% of GDP, whereas in 2005 it decreased to around 68% of GDP. In Uruguay and Colombia, the quasi-gross public sector debt fell from 2003 to 2005 around 13% and 6%, respectively, in terms of GDP. It is further remarkable that the reduction in debt has been accompanied by an overall reduction in the share of forex debt (either external debt or domestic in foreign currency or linked to the exchange rate). The reduction of the proportion of forex debt can be stated more clearly in chart 2. This last figure represents the evolution of the debt composition in terms of external debt, exchange rate linked domestic debt and domestic debt in local currency, for the same periods. The decline in the forex debt share is more dramatic in Brazil, Turkey and Colombia (40%, 28% and 18% respectively), and it is also noticeable the reduction in exchange rate linked domestic debt in both Latin American countries[6], to the point that in Brazil by 2006 exchange rate linked domestic debt

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[4] From this point on and only for the case of Russia we will develop the exercise of analysis of public debt in terms of gross public debt, instead of quasi-gross public debt. Otherwise, since quasi-gross debt is currently negative, the corresponding results for the rest of the analysis would be misleading.

[5] In Indonesia, 2001 is considered as the previous peak of public debt, mainly because of data availability, although according to other papers (i. e. Bolle et al., 2006) the most recent turmoil is traced back to 1998.

[6] See Jeanneau and Tovar (2006) for a recent document on the evolution of domestic markets in Latin America and Tovar (2005) for a detailed analysis of debt denominated in local currency in the three Latin American countries of the sample (Uruguay, Colombia and Brazil).

has been suppressed. Only in Indonesia the proportion of external debt has increased in the last years.

There are several reasons explaining the evolution of both the public debt and the forex debt but they can be summarized in two reasons. First, as observed in the evolution of the nominal exchange rate and the sovereign spreads in chart 3, the developments in public debt have been highly influenced by an international context of *very favourable financial conditions*, and second, the development of *proactive policies_to manage public debt*, which is closely related to the first reason, as we will see.

Regarding the favourable international financial context, some aspects are worth qualifying. For instance, just as exchange rate crises makes debt explosive in countries with a large share of forex debt, real exchange rate appreciations can dramatically decrease debt ratios and impact on the structure of debt. This is precisely what happened after the crises. The exchange rate recoveries were generalised, as shown in the real exchange rate evolutions in chart 4, where the magnitude of this appreciation for the Russian ruble (a 64% real appreciation between 1999 and 2005), the Turkish lira and the Brazilian real (27% and 22%, respectively, between 2002 and 2005). The weaker exchange rate evolution of the sample is the Indonesian rupiah, as from 2002 to 2005 is the only currency that depreciated (3%), precisely the only country where the share of forex debt has increased. The positive period for emerging financial markets is also confirmed by the dynamics of sovereign spreads that have narrowed in a context of increasing capital flows. In this sense, the EMBI Global Composite has decreased from January 1999 to October 2006 around 900 basic points and this reduction of sovereign spreads has been especially severe in emerging Europe, where in the same period it has narrowed around 2000 basic points.

Another factor contributing to this benign financial framework is the favourable behaviour of the rates growth of GDP in all emerging regions in a context of propitious world growth. For instance, the annual percent change of growth in 2005 for emerging countries regions as Developing Asia, Central and Eastern Europe and Latin America was 9.0%, 5.4% and 4.3%, well above the advanced economies data for 2005 (2.6%) and higher or similar to world growth (4.9%); see IMF (2006).

Concerning the proactive debt management, the evolution of public debt and forex debt is closely related to the development of local debt markets in local currency, mainly because of the increasing importance that fiscal authorities have recently attached to reduce vulnerability of public finances in a sustainable manner. This encouraged more proactive debt policies in order to manage public debt in this direction. The impulse by fiscal authorities was driven by lessons from the past concerning excessive exchange rate exposure that gave rise to balance sheet mismatches.

Finally, it is important to stress that both factors –benign conditions and proactive policies – are closely linked, since the discretionary change of debt composition by the authorities is facilitated by the favourable financial conditions and the expected behaviour of the exchange rate, which increased the relative demand of local debt and the ability of the authorities to place it in the market.

Nonetheless, the conjunction of both factors has brought a paradox which is worth mentioning. In a context of currency appreciation, authorities attempting to maximise debt reduction focused in short term would have an incentives to maintain or increase the share of forex debt as this would decrease public debt on GDP, getting involved in some sort of "virtuous circles". On the contrary, a reduction of forex debt as such experienced due to active debt management will tend to mitigate debt reduction driven by exchange rate appreciation. But, contingent on a financial turbulence, this "paradox of the local debt bias" is expected to be solved: in such a case, the exchange rate is expected to sharply appreciate and if there has been previously a reduction in the proportion of forex debt on total debt then the country would be able to absorb better the impact of the negative scenario. The comparison between this short term costs of debt reduction and the long-term (contingent) benefits is one of the by-products of our analysis.[7]

In order to assess the effective vulnerability reduction in the debt composition and the precise contribution of proactive debt management we develop in this paper a quantitative approach to analyse the issue. As a first step, in Section 2, the contribution of the exchange rate to the shifts in debt structure is disentangled from other autonomous or genuine composition effects in the structure of debt. These second effects can be roughly attributed to the debt management strategies of the authorities. In Section 3, the theoretical framework of debt dynamics analysis is developed to perform in Section 4 a counterfactual exercise based on calculating public debt dynamics under the previous debt structure. In this way we can assess the change in vulnerability from the difference in p.p. of GDP between the actual debt and the debt resulting from this counterfactual exercise. Then, the scenario of economic and financial turbulence of the previous crises for the period 2006–2008 is replicated in order to perform a stress test analysis on debt sustainability. As a robustness test, alternative criteria to design the stress are used, too. This type analysis accounts for the expected deterioration of debt structure due to the exchange rate depreciation and other factors and is useful in order to check whether vulnerability – contingent on a stress test – has effectively been reduced after proactive debt management. As mentioned above –and the counterfactual may show-, proactive debt management may mitigate vulnerability reduction in good

[7] This paper is focused on the sustainability-vulnerability assessment concerning the exchange rate linked debt. Other topics on debt composition such as the long term versus short term debt or the nominal versus indexed debt are omitted, even though there is an intense debate on them. See, for instance, Alfaro and Kanczuk (2006).

times but it is expected to engineer more favourable debt dynamics under financial turbulence. Thus, the compounded effect of the counterfactual and the stress test exercises will provide the net impact of the development of proactive policies in the sustainability-vulnerability framework. Finally, Section 5 sums up and concludes.

2. Public Debt Composition: Disentangling Price and Composition Effects

This section is focused on setting a framework for the analysis of the shifts in forex debt (the sum of external and domestic exchange rate indexed debt) on total public debt. The share of forex debt, α is defined as

$$\alpha_t = \frac{e_t D_t^*}{(D_t + e_t D_t^*)} \tag{1}$$

where e_t is the nominal exchange rate in the period *t*, D_t* is the amount of outstanding forex debt, either external debt and exchange rate linked domestic debt, denominated in dollars in *t*; and D_t is the outstanding domestic debt denominated in local currency in period *t* [8].

Within this framework, it is rather straightforward to evaluate the importance of the effect of the exchange rate and the effect due to the composition of debt on total variation of composition. The total variation of the ratios of forex debt on total debt between the final (t=1) and the initial (t=0) periods of reference, that is, (α_1- α_0), can be decomposed in these two effects, as follows,

$$\alpha_1 - \alpha_0 = EE + CE + \varepsilon \tag{2}$$

where the first part of the right hand side of (2) is the Exchange rate Effect (EE onwards) and CE is the composition effect. The residual term ε in the expression will be allocated between both effects as explained below.

The exchange rate effect *EE,* is the variation in the proportion of external debt and indexed to a foreign currency domestic debt due to variations in the exchange rate, obtained by keeping the amount of debt unaltered. Analytically:

$$EE = \frac{e_1 D_0^*}{D_0 + e_1 D_0^*} - \alpha_0 , \tag{3}$$

where the first element in the right hand side of EE will be denoted as α_1^E.

[8] See Calvo *et al.* (2002) for a pioneering paper that analyses fiscal sustainability incorporating the currency composition of debt.

The Composition Effect is the variation of α due to the changes of the relative volumes of the different types of debt, had the exchange rate not changed:

$$CE = \frac{e_0 D_1^*}{D_1 + e_0 D_1^*} - \alpha_0 \tag{4}$$

where, analogously to (3), the first element in the right hand side of (4) will be denoted as α_1^C.

In this last type of effect, the impact of proactive management policies arises, although other factors such as the relative demand and supply of debt instruments may be prominent.

The allocation of the residual change to each factor is made according to the scheme in chart 5. Notice that, the whole variation in the forex debt share (that is, α_1- α_0), is the area defined by coordinates e_1D_1* minus e_0D_0* (the area shadowed with vertical lines). The EE as stated in previous notation would be the area comprised by α_1^E- α_0 and the CE would be α_1^C- α_0 (the light grey and dark grey shaded area, respectively). The remaining area should be equally distributed between EE and CE, in order to accurately represent the difference between the vectors α_1 and α_0.

The factorial decomposition of, EE and CE are represented in chart 6 for the six countries in terms of the percentage points which each factor has contributed to the reduction in the share of foreign currency debt, considering that *t=1* is 2005 and *t=0* is the year of the corresponding debt crisis for each country. We use as reference for this exercise the public debt net of reserves (quasi-gross public debt), but for the case of Russia, where such magnitude is negative.

In spite of the strong exchange rate appreciation, the composition effect (CE) dominates in all countries but Indonesia, where it contributes to the increase in the share of forex debt. CE is largest in Brazil, in absolute terms (34%of the 40% reduction in the forex debt share is due to CE), but in relative terms it is even more important in Turkey (26% of the 28% reduction is CE); that is, more than 90% of the reduction is due to the composition effect). For the average of the five countries where the share of foreign currency debt is reduced, 85% of the reduction can be attributed to the pure composition effect.

3. The Framework of Analysis: Debt Dynamics

Public debt sustainability analysis (DSA) – is an increasingly widespread tool to assess the vulnerability position of public finances. During the last years there has been an increasing attention paid to this approach in policy analysis, most notably in IMF country assessments. A growing amount of papers also handle DSA analysis – sometimes from a stochastic approach – see, for example, Celasun *et al.* (2006), Hostland and Karan (2006) or Garcia and Rigobon (2004). The main advantage of this methodology for our objectives, apart from its simplicity, is that it can provide an explicit measure of vulnerability which can be traced throughout time and suits well the stress test analysis.

Debt sustainability analysis focuses on the debt dynamics equations which are determined –in a simplified framework – by a rather limited number of variables. Furthermore, forecasts for most of these variables are readily available in the market. These forecasts allow determining a base scenario of the future evolution of debt. The framework is also useful to see how debt would respond to a situation of stress by changing the forecasts by estimates of the variables under negative shocks. These stress tests compound alternative scenarios, which gives an idea of the resilience of debt and therefore of the vulnerability of the public finance position.

The starting point is the debt dynamics equation expressed as:

$$D_t = -PB_t + \frac{(1+r_t)}{(1+g_t)}(1-\alpha_t)D_{t-1} + \frac{(1+r_t^*)(1+\Delta e_t)}{(1+g_t)}\alpha_t D_{t-1}, \tag{5}$$

where PB_t is the primary balance and D_t is the stock of public debt at the end of time t, both expressed as a ratio of GDP. The share of debt denominated in foreign exchange is α_t , as we already know, while $(1-\alpha_t)$ is the share of local currency debt; r^*_t and r_t are their corresponding real interest rates. Foreign denominated external debt can be in foreign currency – mostly external debt – or debt indexed to the exchange rate – mostly domestic debt. Finally, Δe_t is the variation in the nominal exchange rate – where a positive Δe_t means an exchange rate depreciation – and g_t is the real rate of growth.

After some algebra, the dynamics of public debt can be expressed as

$$\Delta D_t = -PB_t + \frac{(r_t - g_t)}{(1+g_t)}(1-\alpha_t)D_{t-1} + \frac{(r_t^* + \Delta e_t + r_t^*\Delta e_t)}{(1+g_t)}\alpha_t D_{t-1}, \tag{6}$$

where, for simplicity, we have dropped the contingent liabilities. This equation is the basis for the sustainability exercises performed in the DSA. Given the current level and composition of debt, for given forecasts of the primary balance, the growth rate, the nominal exchange rate and the real interest rates (domestic and foreign) it is possible to project debt trajectories. Increases in the ratio of debt to GDP derived from these exercises provide a measure of vulnerability, and a decrease in the ratio suggests a reduction in vulnerability.

Expression (6) can be transformed in a more convenient way by separating the effect of the exchange rate from the rest:

$$\Delta D_t = -PB_t + \frac{((1-\alpha_t)r_t + \alpha_t r_t^*)}{(1+g_t)}D_{t-1} - \frac{g_t}{(1+g_t)}(1-\alpha_t)D_{t-1} + \frac{\Delta e_t + r_t^*\Delta e_t}{(1+g_t)}\alpha_t D_{t-1}. \tag{7}$$

For practical purposes, it is important to note that the real interest rates by instrument or currency are not usually available, so that we have to find a way to measure the approximate real cost of local and forex debt. There exists data on interest payments on public debt. IP_t which can be defined as

$$IP_t = ((1-\alpha_t)r_t + \alpha_t(1+\Delta e_t)r_t^*)D_{t-1} = \rho_t D_{t-1}, \tag{8}$$

where, for convenience, ρ_t denotes the average cost of debt at time *t*. ρ_t can be calculated in every country through the data of IP_t from this expression.,

$$\rho_t = \frac{IP_t}{D_{t-1}} \tag{9}$$

For completeness and further convenience, also note that the implicit local debt real rate can be solved out from the definition of ρ_t

$$r_t = \frac{\rho_t - \alpha_t(1+\Delta e_t)r_t^*}{(1-\alpha_t)}. \tag{10}$$

so that if we are able to proxy the real foreign cost of debt –through the spread, as it turns out – an approximation to the respective real interest rate by currency. Substituting ρ_t in (7) yields the basic equation for the empirical approach

$$\Delta D_t = -PB_t + \left[\rho_t - (1-\alpha_t)g_t + \Delta e_t \alpha_t\right]\frac{D_{t-1}}{(1+g_t)} \tag{11}$$

4. Empirics. Debt Evolutions, Debt Structure and Vulnerability Reductions

These expressions provide us with an adequate framework to analyse what has been going on in the considered countries. It is convenient to start with an illustrative example of how the different factors impinge on the evolution of debt and then move to a more detailed analysis of the impact of the shifts in debt structure on vulnerability.

4.1 Contributions to Debt Reduction

Computing the partial derivatives in expression (5) allows to determine the contribution of each factor to the de variation of D_t (ΔD_t) on an annual basis. To focus on the issues we are more interested in, we consider the decomposition of the annual variation of D_t in terms of PB (in this case there is a one-to-one relationship.$_t$, and the annual variation of the share of forex debt on total public debt, α_t, the exchange rate, e_t and the average cost of debt minus the growth of GDP (ρ_t-g_t).

Chart 7 illustrates the case of Brazil. The substantial magnitude of the primary balance is a powerful debt reduction driver throughout the period. But the interesting results regard the interaction between the exchange rate and the share of forex debt α_t From 2001 to 2002 the currency depreciated, and there was an important positive contribution to debt of 9 p.p of GDP.Thereafter, the appreciation of the exchange rate induced a negative contribution to public debt in terms of GDP has been negative. The accumulative decrease from 2002 to 2005 was of 4% in terms GDP. In parallel, α_t increased in the first, turbulent period; due to the contemporaneous exchange rate depreciation this added up 3 p.p to the debt-to-GDP ratio (the black area in the figure). Both factors together amounted to 12 percentage points of GDP to the increase in debt in 2002. However in the following years of currency appreciation and reduction in forex debt interacted in a different way: the contribution of the dwindling share of forex debt is positive because it mitigates the effect of the exchange rate appreciation on debt reduction. Finally, the last factor, given by the difference of the average real cost of debt and the real rate of growth (ρ_t-g_t) is also changing in sign. It might come as a surprise that this term has a positive contribution in the last years, when the *nominal* cost of debt has decreased and the growth rate has been robust. However, it should be noted that ρ_t is expressed in real terms and it embeds inflation. The large reduction in inflation in the last years turns out to be counterproductive for debt dynamics.

4.2 A Counterfactual Exercise: Debt Reductions without Proactive Management Policies

The Brazilian example highlights that the interaction between exchange rate appreciations and reductions in the forex share can play against debt reduction. This is the '*paradox of the local debt bias'* pointed out in the introduction. But we also noted in section 2, that the changes in debt structure (see chart 6), are in part mechanically driven by the evolution of the exchange rate. Indeed, we showed there that a substantial part of the reduction in forex debt was not due to the exchange rate evolutions but to pure composition effects, where the proactive debt management policies of the authorities has had an central role.

Now, within the debt dynamics framework we can give a quantitative assessment of the (negative) impact of proactive debt management in the reduction of debt. The question is straightforward: Which would be the level of debt today netting out the net composition effect, that is, without proactive debt management?

Obtaining the computations of α_1^E as stated in (3) on a yearly basis, we can determine counterfactual debt paths, for the public debt ratio. This exercise is carried out for the six considered countries and is represented in chart 8. The black thick line represents the actual public debt trajectory; netting out the pure composition effect delivers the path represented by the thin dotted line. The graph is completed with the opposite exercise – continuous thin line. In this case, we consider the pure composition effect but assuming that the impact brought about by the exchange rate evolutions disappears, that is the current debt level had the real exchange rate been kept constant.

Table 2 summarizes the outcomes of the counterfactual exercise for the six countries. In the case of Brazil, the actual path displays debt falling from 74% to 68% of GDP, but this fall is much wider to around 60% in 2005 when we net out the pure composition effect. The reason is that the dwindling forex debt does not fully capitalise the impact of the real exchange rate appreciation. To sum up, for Brazil, the implicit loss, in terms of percentage points of debt-to-GDP – derived from the proactive debt management of the government, nowadays the level of debt would be a sizable 8 pp of GDP. This can be taken as a measure of the opportunity costs of substituting local debt in local currency for forex debt. On the contrary, if the nominal exchange rate would have remained in the levels of 2002, the quasi-gross public debt would have been in 2005 of around 79% of GDP.

In Turkey, these proactive policies have also been quite pronounced. There, netting the change in composition due to the debt management of the government the public debt would be in 2005 10 pp of GDP lower. In the rest of the countries where the reduction in the share of forex debt on total public debt has been relatively small or has not taken place (Colombia, Indonesia, Russian Federation and Uruguay), the difference between the actual path of public debt and the public debt under constant composition of the year of crisis is also small (this difference represents less than 1 pp of the GDP of each country).

Brazil or Turkey represent a clear example were the "opportunity costs" of diminishing the total amount of forex debt on total public debt are more evident, due both to the intense exchange rate appreciations and to the efforts by the fiscal authorities to recompose debt in favour of local and local currency denominated debt.

Some important caveats are in order, though, which gives a more nuanced view of these opportunity costs of moving out of forex debt. Most important is that this is a partial exercise. We are assuming that nothing else changes, but this is an extremely strong assumption. As mentioned above, the fiscal authorities could have not developed so swiftly the local debt markets under more stringent financial conditions. More importantly, the very same evolution of the exchange rate is not alien to the evolution of debt composition: the reduction in external debt, process deepened by very active policies in Brazil shapes the expectation of agents and it has probably contributed to put higher pressure on the exchange rate and to foster a higher accumulation of reserves (and thus a bigger reduction of quasi-gross debt)

From the second type of exercise, where the exchange rate is kept unaltered, some interesting conclusions also follow. As expected, the numbers show that debt dynamics would have been much less favourable under exchange rates of the year of crises for the six countries – except for Indonesia and Russia, where nominal exchange rate has appreciated with respect to their years of crises. The more damaged country in case of maintaining the same nominal exchange rate would have been Uruguay, that would have increased its debt in 18 pp of GDP.

All in all, under the perspective taken in this section, it might seem that having performed proactive policies in order to reduce the share of forex debt on total GDP has entailed costs in terms of limited debt reduction,. Nevertheless, this short-term cost must be measured up with the prospective benefits derived from a less forex dependent debt structure in the case of financial turbulence.

4.3 Stress Test: The Resilience in Debt Vulnerability

The standard DSA framework based on stress testing consists of designing a situation of turbulence (or stress) comparable with the last crises to check whether vulnerability has effectively been reduced and contrast it with a base scenario.

Therefore, the first step is to define the base scenario. With forecasts from the respective IMF's Article IV reports, LatinFocus and Consensus Forecast on a three year horizon (2006, 2007 and 2008) the raw data to project the debt paths are obtained.[9] This methodology is useful in order to improve homogeneity of the analysis and in order to check out the different outcomes with those provided by IMF. Second, the stress scenario is designed so as to replicate the most recent financial turmoil that these countries have suffered –coinciding as seen above with the previous peak in debt. The data underlying the base and the stress scenarios are displayed in table 3. The changes therein are applied to all variables in the debt dynamics equation (5)[10]

The results for the six countries appear in chart 9 and table 4. Let us take again Brazil as illustrative case. The thick dotted line represents the base scenario, whereas the orange dotted line stands for debt dynamics under the stress scenario. In both debt evolutions it is employed the path of α under debt composition of 2005. As expected under the base scenario –conveying the continuation of favourable conditions – quasi-gross debt gently decreases towards 60% of GDP, while under the stress scenario debt increases and then stabilises above 70%.

[9] The two last data sources are needed for exchange rates forecast, the rest of forecast are mostly based on the respective Article IV of IMF for each country.

[10] In those punctual cases where there is no data availability for the period of crisis the negative shock was obtained by adding to the data in the base scenario one standard deviation of the available data

What would have been the impact of the turmoil if the debt structure been kept unaltered relative to the year of the crisis? A first – but inadequate – approximation is given by the shadowed line. It represents the impact of the stress test with the debt structure net of the pure composition effect (but letting the exchange rate effect operating) *and the current level of debt*. Notice that the evolution is much more explosive that under the current debt structure (plus the stress scenario-orange line). Had the debt management not been proactive[11], the increase would have been much larger (to over 95%) – shadowed line – and set the debt in an explosive path. The gap between both lines (more than 20 p.p of GDP in a 3-year horizon) is indicative of the importance of a less forex-exposed debt structure in order to reduce vulnerability and reinforce the sustainability of debt.

Why is the shadowed line misguiding? We have seen in the counterfactual exercise, that netting out pure composition effects would have resulted in a lower debt ratio in the case of Brazil because of the sustained real exchange rate appreciation.. Thus, the effective lower reduction in debt due to the proactive debt management policies has to be compared with the prospective gains in the case of a financial crisis. More precisely, the dash dotted line represents the debt dynamics assuming no pure composition effect – as in the shadowed line – *plus* the level of debt resulting from the counterfactual exercise. This, in our view, is the right gauge to measure vulnerability reduction due to proactive debt management. In practical terms, this amounts to take the end-point of the thin dotted line as reference and project if forward under the stress scenario.

The so-extended thin dotted line has a similar path compared with the dash dotted line, but it starts from a lower level. As a consequence, the difference in the ratio of debt is very small in the first year, and then widens up to around 10 p.p. of GDP. This figure can be taken as the net gain from the debt management policy by Brazil. In other words the "short-term cost" of implementing proactive policies in order to decrease the share of forex debt on total debt, is more than compensated by "long-term gains" of implementing them.

For the other five countries the forecasts under the base scenario are as follows. Colombia, Turkey and Uruguay decrease its debt towards 40%, 45% and 60% of GDP, respectively (thick dotted line). Despite the evolution of its currency and the composition of its debt, Indonesia also reduces its debt to 25% of GDP. Finally, the forecast for Russia is especially favourable, as the forecast for the gross debt decreases sharply to –25% of GDP – that means that not only quasi-gross debt is negative, but also gross debt!

The stress scenario for rest of the countries can also be analysed in the same manner as Brazil, although the results are less clearcut. Recall that the more interesting conclusions arrive from the comparison of the evolution of debt under

[11] To be more precise the '2002 debt composition' lets the exchange rate effect impact on the structure but nets out the pure composition effect.

the debt composition of the year of crisis (thin dotted line) and under the debt composition of 2005 (orange line). The comparison only favours the case of debt recomposition in Russia –where the debt level is not currently a problem and Uruguay, to a lesser extent than in Brazil (gap 5 pp of GDP, see table 4). Nevertheless, in some countries as Colombia, the benefit of the performed proactive policies until 2005 gives rise to an scant average decrease of debt of 1 pp of GDP accumulated in the forecasted period, and in the case of Turkey the accumulated differences after three years are negative (–1 p.p. GDP) although they are previously positive. In the case of Indonesia the gap is negligible, throughout the forecast scenario.

Here underscoring the caveats is even more relevant because the direct inference from these results is that, with the exception of Brazil, the debt recomposition effort, do not seem to pay off in terms of vulnerability reduction under stress. Again, the caveats are based on the impact of these debt trajectories on expectations. It is difficult to assume that the reaction of the markets would be the same comparing the mild deterioration implied by the orange line with the sharp increase in debt under a less favourable debt structure. As a consequence, the evolution of the financial variables is reasonably expected to be worse in the second case. This endogeneity implies that the computation of net gains is rather a floor than a mid-point estimate.

In order to check the robustness of the stress test, the exercise is repeated considering two alternative assumptions for the design of the stress scenarios. First, following the methodology employed in most IMF's Article IV, 2 standard deviations on the sample series are added to the corresponding data of the base scenario–this is denoted as 2SD in the table[12]; second, a scenario is built on the average stress scenario (average stress, for short) for each variable of the six countries based on the historical criterion of previous subsection.

Table 4 shows the outcomes corresponding to these two new criteria. The results in general are quite robust under the three different alternatives, both in terms of size of the shock and direction to the two new stress scenarios designed. Two are the main exceptions: Indonesia and Turkey. In the case of Indonesia the exercise is not robust under the assumption of two standard deviations, as public debt on GDP is lower under the stress scenario than under the base scenario. In the case of Turkey, under these two new assumptions, the gap between the stress under the debt structure of the year of crisis – that is, the counterfactual – and the stress under the debt structure of 2005 becomes negative, implying less resilience to a negative shock. For the other simulations results are almost equivalent, and even in some cases, such as the results of the scenario based on averages for Colombia

[12] It is added to each variable from 2006 to 2008 (both inclusive) two standard deviations of the sample of each variable from the year of the crisis to 2005.

gives rise to a lower debt under current composition than under previous composition.

5. Conclusions

In this paper we have evaluated the impact of the shift of public debt away from foreign currency on the vulnerability of a group of selected emerging countries which, not so long ago, underwent deep financial turbulences.

We have first underscored that, the ratio of public debt to GDP and, even more dramatically, the share of forex debt have been reduced in emerging markets in a context of favourable financial conditions. The exchange rate appreciations in this context have helped to reduce both ratios. However, the proactive debt management strategies of the authorities – aimed at reducing the vulnerability of the debt composition – has been the dominant factor in quantitative terms in most countries. Clearly, a favourable external environment and exchange rate evolutions have facilitated this process, since expected exchange rate appreciation favours issuing debt in domestic currency. The development of local debt markets has both benefited from and facilitated this proactive debt management.

The changes in the structure of debt are expected to have important implications for the reduction of financial vulnerability in public finances. However, our approach to this issue has first uncovered a paradox related to the recent bias towards local debt. By reducing forex debt through proactive policies governments have not taken full advantage of the real exchange appreciation enjoyed by their economies after the crises. Otherwise, the debt ratios in the analysed countries would have been lower than they currently are, and the difference is sizable in certain cases.

This short term "opportunity cost" of shifting towards local debt has to be taken into account in order to assess the *net* benefits of the proactive debt management policies. The stress tests suggests that even after controlling these short-term costs there is a reduction in vulnerability derived from the proactive shift towards local debt-measured by the difference in the ratio of debt to GDP in a situation of stress – in most cases, although the magnitude is some of them is small.

One important caveat reinforces these results. A central assumption of the exercise is taken into account: the evolution of the variables which drive the debt to GDP ratio is independent of the ratio or structure of debt. However, the behaviour of the financial variables is very much influenced by perceptions on debt vulnerability. This applies both in the counterfactual and in the stress tests. More precisely, with a higher share of forex debt the exchange rate appreciations would have presumably been lower in the recent years and the deterioration of the financial variables in the stress would have been higher. Finally, the probability of a turbulence is expected to increase under a debt structure very sensitive to financial volatility. These caveats taken together imply that the estimated reduction in vulnerability is a minimum bound, and therefore the effective vulnerability reduction is higher.

All in all, the move to local debt has been shown to be positive from the point of view of the vulnerability reduction. This can be considered an important breakthrough of emerging markets in order to improve their resilience in the face of eventual financial shocks and also to reduce their occurrence.

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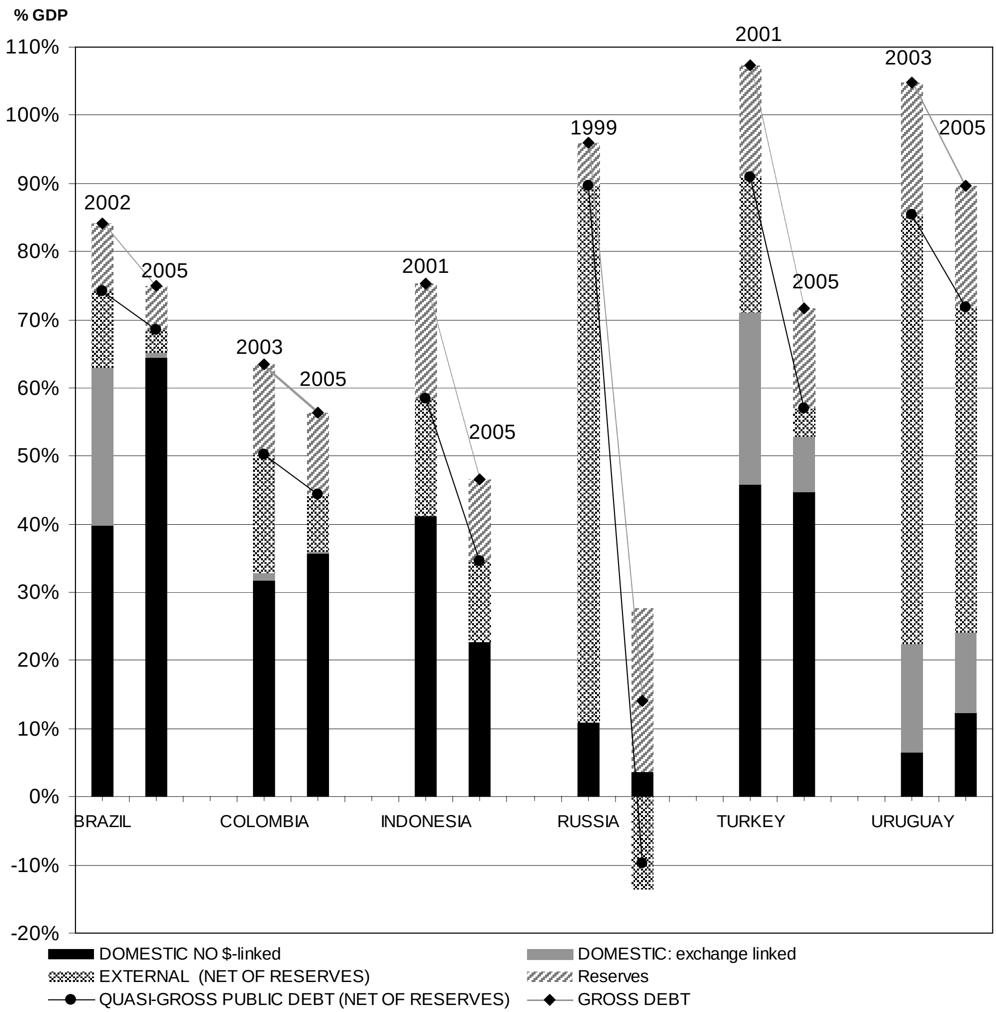
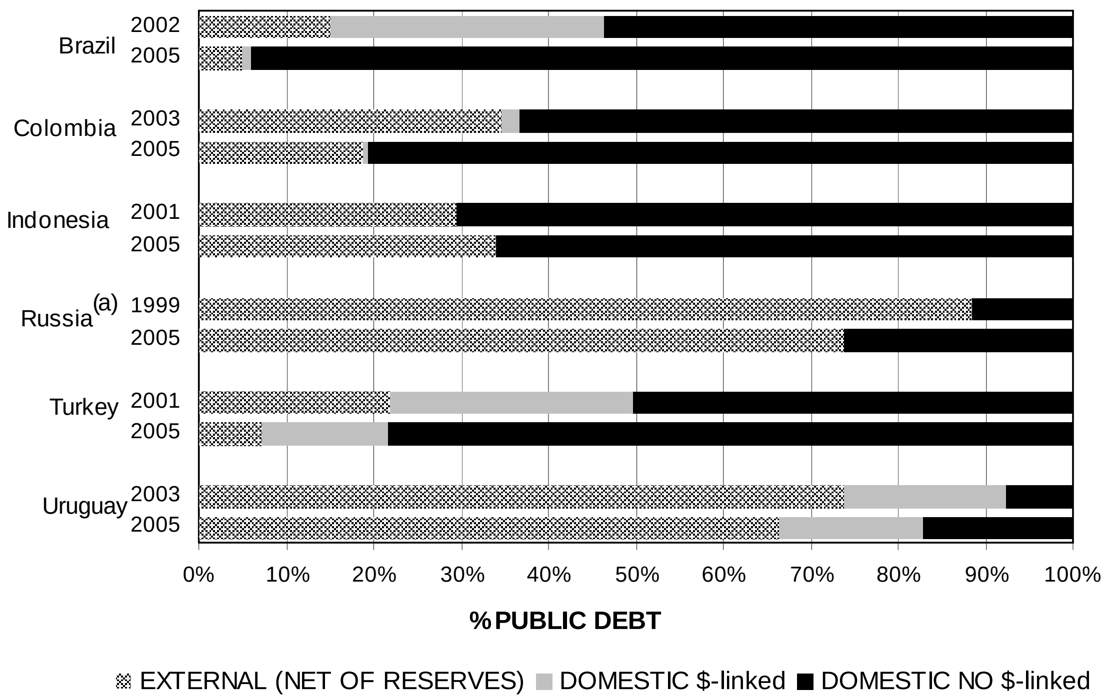
Chart 1: Gross and Quasi-Gross Public Sector Debt for Six Selected Countries



Source: National statistics and authors' calculations.

Chart 2: Public Debt Composition (Quasi-Gross Public Debt) in Six Selected Countries

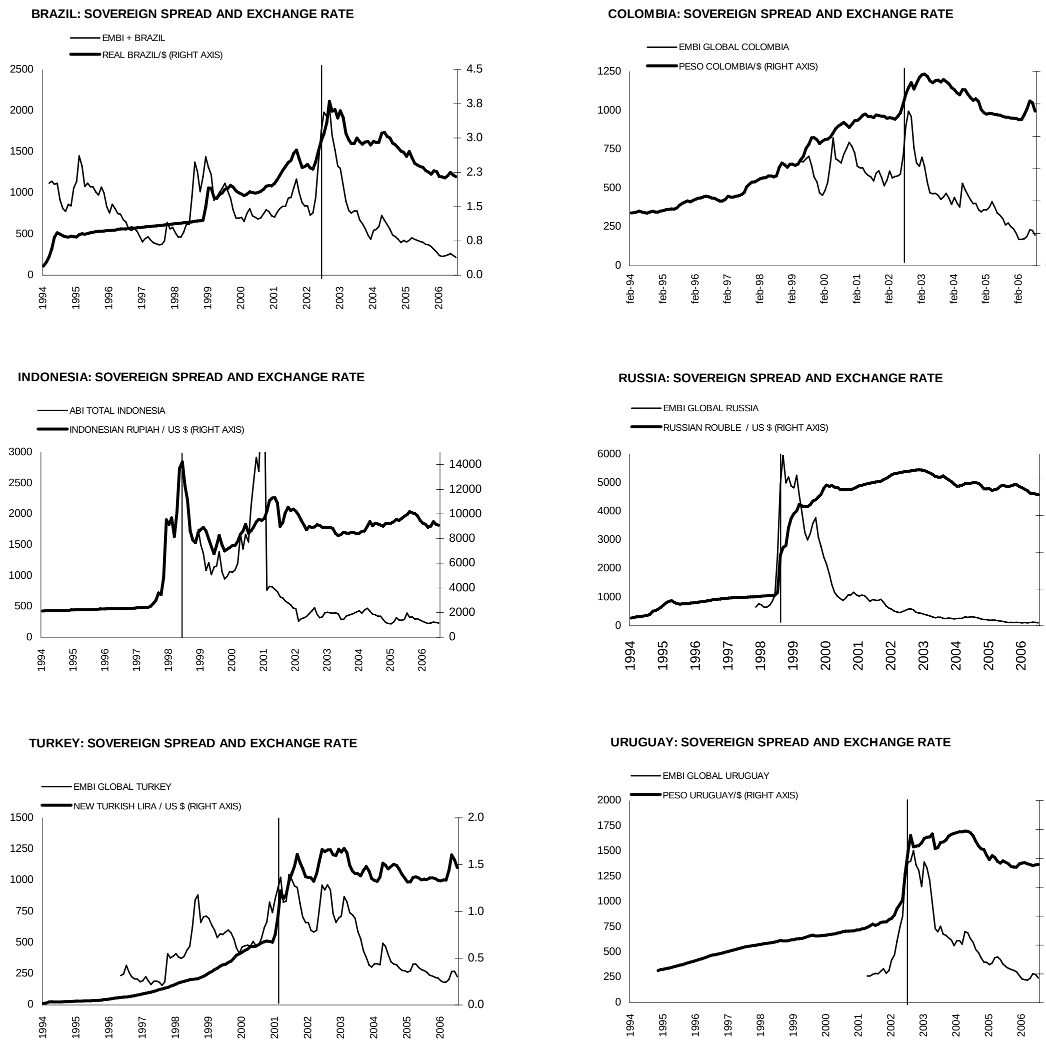
% of public debt-



(a) Reserves not excluded.

Source: National statistics and authors' calculations.

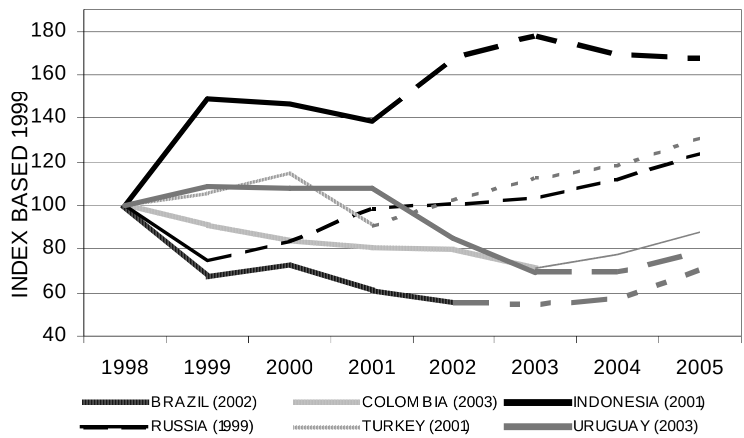
Chart 3: Identification of Sovereign Crisis Episodes in Selected Countries



(Together with Sovereign Spreads and Nominal Exchange Rates)

Source: Datastream.

Chart 4: Real Exchange Rates for Six Selected Countries (a)



(a) Year of major outstanding debt in barckets and dotted line from this year.

Source: Economist Intelligence Unit (EIU).

Chart 5: Public Debt Decomposition

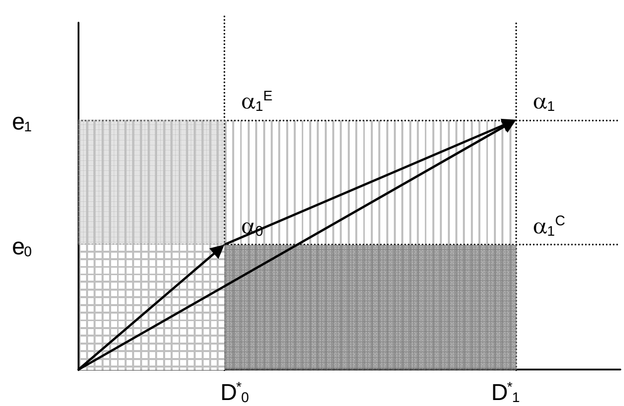
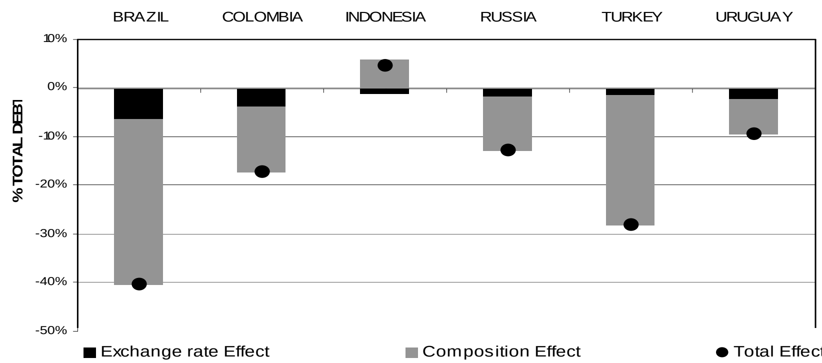
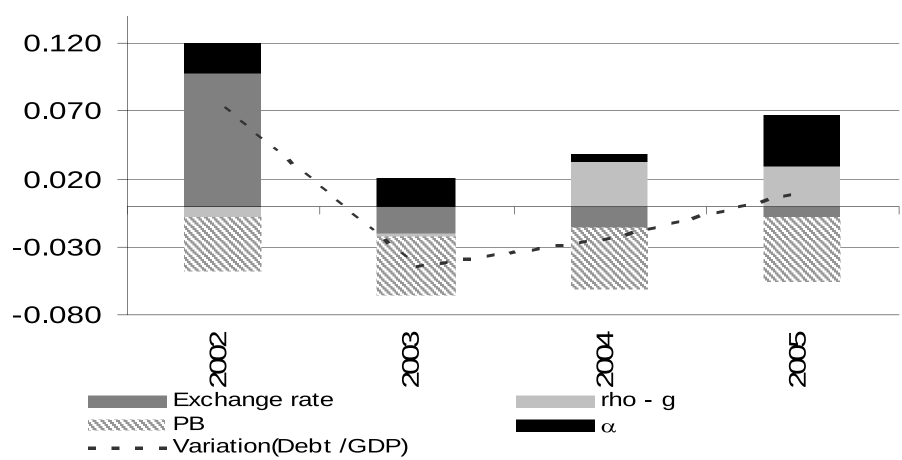


Chart 6: EE and CE (Quasi-Gross Public Debt) in Six Selected Countries



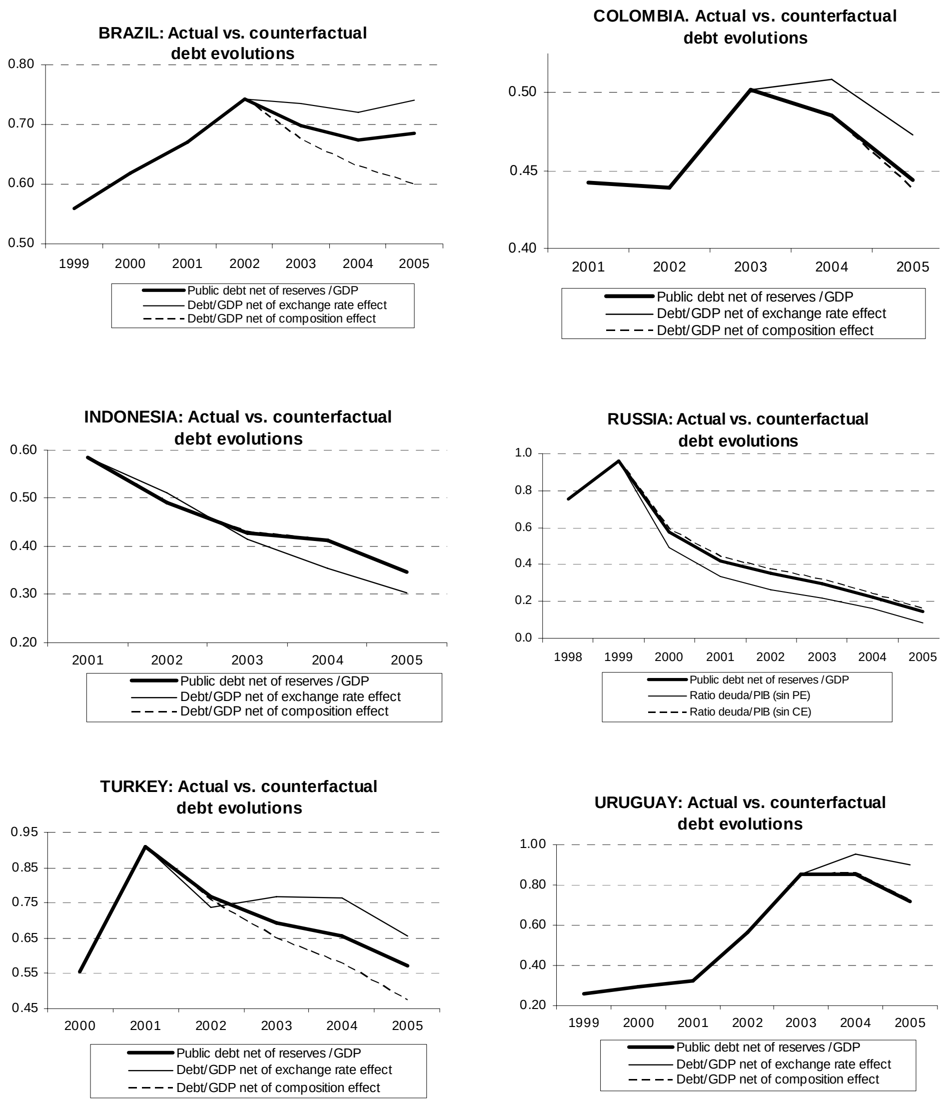
Source: National Statistics and authors' calculations.

Chart 7: Brazil: Annual Variation of Public Debt on GDP Disaggregated in Terms of Contributions



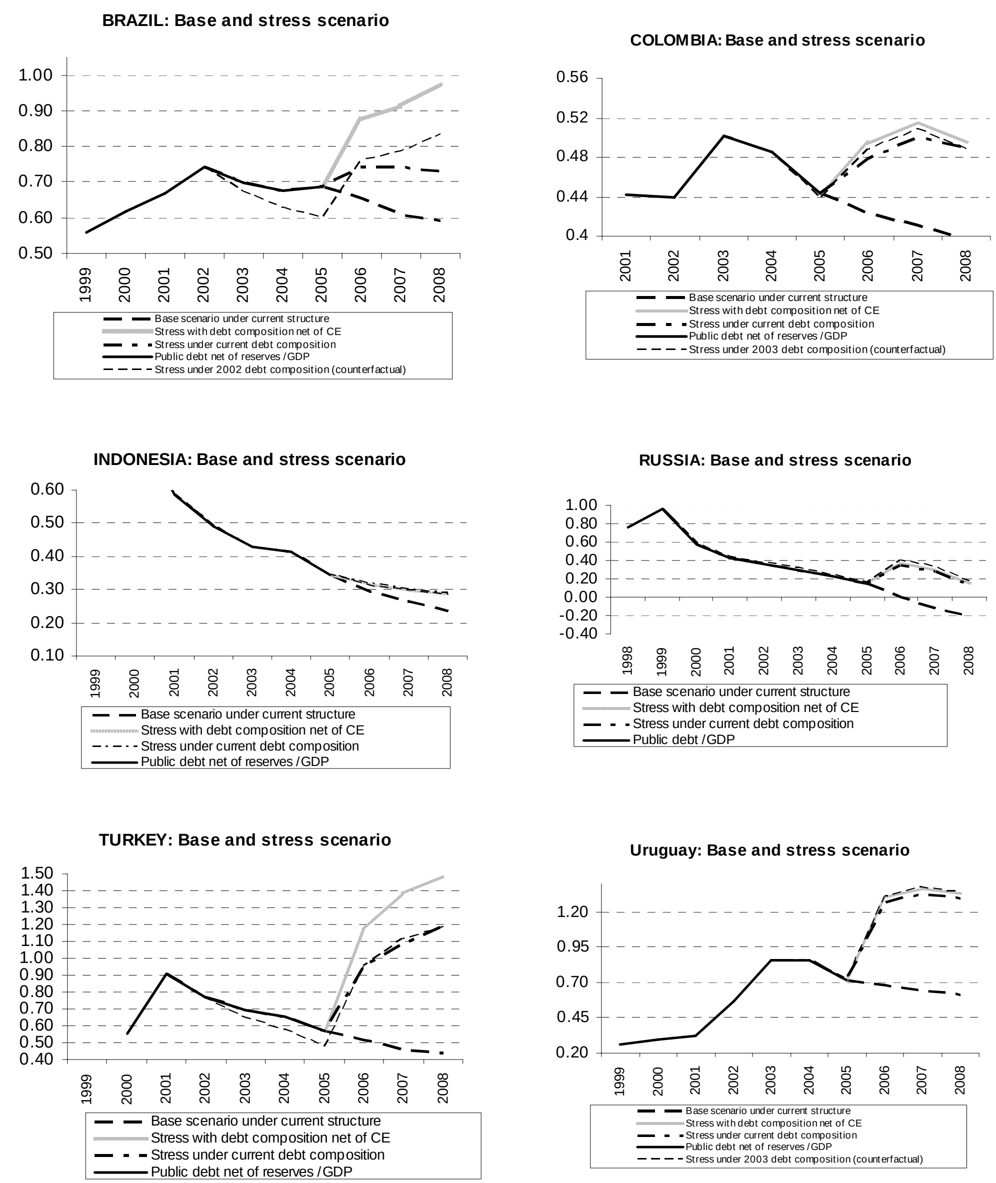
Source: Authors' calculations.

Chart 8: Actual vs. Counterfactual in Six Selected Countries



Source: Authors' calculations

Chart 9: Base and Stress Scenario in Six Selected Countries



Source: Authors' calculations

Table 1: Database Construction

Country	Year of the Debt crisis	Availability of data	Description	Source	Web link
Brazil	2002	1999	General Government Gross Debt [(a)]	Banco Central do Brasil	http://www.bcb.gov.br
			Public Sector Domestic Debt [(b)]	Ministerio de Fazenda	http://www.stn.fazenda.gov.br/estatistica/est_divida.asp
Colombia	2003	2001	Public Sector Debt [(a)]	Banco de la República	http://www.banrep.gov.co/economia/deuda/BoletinDePu18.pdf
			National Government Domestic Debt [(b)]	Ministerio de Hacienda	http://www.minhacienda.gov.co/
Indonesia	2001	2001	Central Government Gross Debt	Art.IV	
Russia	1999	1998	General Government Gross Debt	Art.IV	
Turkey	2001	1998	Public Sector Debt [(a)]	Turkish Treasury	http://www.treasury.gov.tr/
Uruguay	2003	1999	Public Sector Debt [(a)]	Banco Central de Uruguay	http://www.bcu.gub.uy/autoriza/pepmaf/deudapublica/dbspg2.xls

[(a)] Domestic and External

[(b)] Used to do the brakedown of the Domestic Public Debt

Table 2: Counterfactual Exercise Results for 2005

COUNTERFACTUAL (2005)	BRAZIL	COLOMBIA	INDONESIA	RUSSIA	TURKEY	URUGUAY
Public debt net of reserves /GDP	68.5%	44.4%	34.6%	14.5%	57.1%	71.9%
Debt/GDP net of exchange rate effect	74.0%	47.3%	30.4%	54.6%	65.7%	90.3%
Debt/GDP net of composition effect	60.0%	43.8%	34.4%	14.7%	47.3%	72.3%
Points of Debt/GDP due to composition effect	5.5	2.9	-4.2	40.1	8.6	18.4
Points of Debt/GDP due to exchange rate effect	-8.5	-0.5	-0.2	0.2	-9.7	0.5

Source: Authors' calculations.

Table 3: Base Scenario and the Stress Scenario for the Simulation of Debt Dynamics

BRAZIL

BASE SCENARIO	dic-05	dic-06	dic-07	dic-08
Variation Exchange rate (real/dollar)	-12.2%	-4.3%	3.6%	0.0%
Real GDP growth	2.3%	3.5%	4.0%	3.5%
GDP deflator	7.2%	4.0%	4.2%	4.4%
Nominal domestic interest rate (i)	13.5%	14.3%	12.9%	12.4%
Nominal external interest rate (i*)	7.5%	7.5%	7.5%	7.5%
Primary Balance / GDP	4.8%	4.3%	4.3%	4.2%
Recognition of implicit or contingent liabilities /GDP	-0.5%	3.0%	3.0%	0.0%

STRESS SCENARIO	dic-05	dic-06	dic-07	dic-08
Variation Exchange rate (real/dollar)	-12.2%	50.3%	7.9%	18.5%
Real GDP growth	2.3%	-0.8%	-0.3%	3.3%
GDP deflator	7.2%	7.5%	7.7%	7.9%
Nominal domestic interest rate (i)	13.5%	14.9%	15.5%	12.3%
Nominal external interest rate (i*)	7.5%	11.6%	11.6%	11.6%
Primary Balance / GDP	4.8%	0.0%	3.2%	3.5%
Recognition of implicit or contingent liabilities / GDP	-0.5%	3.0%	3.0%	0.0%

COLOMBIA

BASE SCENARIO	dic-05	dic-06	dic-07	dic-08
Variation Exchange rate (peso/dollar)	-5.4%	6.5%	3.4%	0.0%
Real GDP growth	5.2%	5.2%	4.5%	4.0%
GDP deflator	5.5%	4.7%	4.1%	3.5%
Nominal domestic interest rate (i)	8.6%	12.2%	11.6%	10.2%
Nominal external interest rate (i*)	6.8%	6.8%	6.8%	6.8%
Primary Balance / GDP	3.5%	3.1%	2.4%	2.2%
Recognition of implicit or contingent liabilities /GDP	0.3%	0.0%	0.0%	0.0%

STRESS SCENARIO	dic-05	dic-06	dic-07	dic-08
Variation Exchange rate (peso/dollar)	-5.4%	24.0%	-2.6%	-13.3%
Real GDP growth	5.2%	2.3%	-2.4%	4.7%
GDP deflator	5.5%	5.3%	7.4%	6.4%
Nominal domestic interest rate (i)	8.6%	13.1%	12.7%	11.2%
Nominal external interest rate (i*)	6.8%	8.8%	8.8%	8.8%
Primary Balance / GDP	3.5%	0.9%	0.9%	-0.3%
Recognition of implicit or contingent liabilities / GDP	0.0%	0.0%	0.0%	0.0%

INDONESIA

BASE SCENARIO	dic-05	dic-06	dic-07	dic-08
Variation Exchange rate (rupee/dollar)	6.0%	0.0%	0.0%	0.0%
Real GDP growth	5.6%	5.2%	6.0%	6.5%
GDP deflator	13.7%	13.2%	6.5%	6.5%
Nominal domestic interest rate (i)	6.1%	5.7%	5.5%	5.7%
Nominal external interest rate (i*)	7.4%	7.4%	7.4%	7.4%
Primary Balance / GDP	2.2%	1.2%	1.3%	1.1%
Recognition of implicit or contingent liabilities /GDP	0.3%	0.0%	0.0%	0.0%

STRESS SCENARIO	dic-05	dic-06	dic-07	dic-08
Variation Exchange rate (rupee/dollar)	6.0%	15.6%	-3.1%	2.2%
Real GDP growth	5.6%	4.5%	4.9%	5.7%
GDP deflator	13.7%	16.7%	6.0%	4.4%
Nominal domestic interest rate (i)	6.1%	-3.1%	3.4%	5.6%
Nominal external interest rate (i*)	7.4%	25.8%	16.6%	7.4%
Primary Balance / GDP	2.2%	0.4%	0.5%	0.3%
Recognition of implicit or contingent liabilities / GDP	0.0%	0.0%	0.0%	0.0%

RUSIA

BASE SCENARIO	dic-05	dic-06	dic-07	dic-08
Variation Exchange rate (ruble/dollar)	-1.8%	0.0%	0.0%	0.0%
Real GDP growth	6.4%	6.5%	6.5%	6.1%
GDP deflator	19.6%	15.6%	8.9%	6.2%
Nominal domestic interest rate (i)	7.7%	10.8%	9.2%	17.4%
Nominal external interest rate (i*)	5.6%	5.6%	5.6%	5.6%
Primary Balance / GDP	9.2%	10.0%	8.7%	7.8%
Recognition of implicit or contingent liabilities /GDP	-0.5%	3.0%	3.0%	0.0%

STRESS SCENARIO	dic-05	dic-06	dic-07	dic-08
Variation Exchange rate (ruble/dollar)	-1.8%	153.3%	14.4%	3.7%
Real GDP growth	6.4%	-0.3%	11.4%	15.0%
GDP deflator	19.6%	32.5%	27.8%	25.1%
Nominal domestic interest rate (i)	7.7%	38.8%	19.9%	22.8%
Nominal external interest rate (i*)	5.6%	23.5%	13.9%	7.6%
Primary Balance / GDP	9.2%	-3.6%	2.9%	7.5%
Recognition of implicit or contingent liabilities / GDP	0.0%	0.0%	0.0%	0.0%

TURKEY

BASE SCENARIO	dic-05	dic-06	dic-07	dic-08
Variation Exchange rate (lira/dollar)	0.7%	0.0%	0.0%	0.0%
Real GDP growth	7.4%	5.0%	5.0%	5.0%
GDP deflator	5.4%	7.0%	5.0%	5.0%
Nominal domestic interest rate (i)	24.6%	22.9%	22.2%	22.4%
Nominal external interest rate (i*)	6.6%	6.6%	6.6%	6.6%
Primary Balance / GDP	6.5%	6.5%	6.5%	6.5%
Recognition of implicit or contingent liabilities /GDP	-0.5%	3.0%	3.0%	0.0%

STRESS SCENARIO	dic-05	dic-06	dic-07	dic-08
Variation Exchange rate (lira/dollar)	0.7%	116.4%	13.1%	-14.6%
Real GDP growth	7.4%	-7.4%	8.0%	5.9%
GDP deflator	5.4%	26.8%	42.2%	56.8%
Nominal domestic interest rate (i)	24.6%	90.1%	112.4%	122.9%
Nominal external interest rate (i*)	6.6%	9.5%	9.5%	9.5%
Primary Balance / GDP	6.5%	5.5%	5.5%	5.5%
Recognition of implicit or contingent liabilities / GDP	-0.5%	3.0%	3.0%	0.0%

URUGUAY

BASE SCENARIO	dic-05	dic-06	dic-07	dic-08
Variation Exchange rate (peso/dollar)	-10.2%	2.7%	2.8%	0.0%
Real GDP growth	6.6%	4.6%	4.2%	2.8%
GDP deflator	1.7%	5.1%	3.8%	4.0%
Nominal domestic interest rate (i)	-6.9%	6.5%	6.3%	8.6%
Nominal external interest rate (i*)	7.4%	7.4%	7.4%	7.4%
Primary Balance / GDP	3.9%	3.7%	4.0%	4.0%
Recognition of implicit or contingent liabilities /GDP	0.0%	0.0%	0.0%	0.0%

STRESS SCENARIO	dic-05	dic-06	dic-07	dic-08
Variation Exchange rate (peso/dollar)	-10.2%	84.2%	7.8%	-9.9%
Real GDP growth	6.6%	-1.1%	0.2%	1.2%
GDP deflator	1.7%	15.0%	14.8%	3.8%
Nominal domestic interest rate (i)	-6.9%	9.9%	9.5%	19.8%
Nominal external interest rate (i*)	7.4%	15.0%	15.0%	15.0%
Primary Balance / GDP	3.9%	0.1%	2.7%	3.8%
Recognition of implicit or contingent liabilities / GDP	0.0%	0.0%	0.0%	0.0%

Source: IMF and authors' calculations.

Table 4: Comparison of Stress Scenarios

		SCENARIO	dic-05	dic-06	dic-07	dic-08
BRAZIL		Base scenario under current structure (blue)	0.69	0.65	0.61	0.59
	Replica	Stress scenario under current structure (orange)	0.69	0.74	0.74	0.73
		Stress scenario under counterfactual (green)	0.60	0.76	0.79	0.83
		Gap (counterfactual and stress) (1)	**-0.09**	**0.02**	**0.04**	**0.10**
	2 SD	Stress scenario under current structure (orange)	0.69	0.73	0.69	0.68
		Stress scenario under counterfactual (green)	0.60	0.76	0.74	0.73
		Gap (counterfactual and stress) (1)	**-0.09**	**0.04**	**0.04**	**0.05**
	Aggregated stress	Stress scenario under current structure (orange)	0.69	0.81	0.84	0.83
		Stress scenario under counterfactual (green)	0.60	0.89	0.95	0.93
		Gap (counterfactual and stress) (1)	**-0.09**	**0.08**	**0.11**	**0.10**
COLOMBIA		Base scenario under current structure (blue)	0.44	0.42	0.41	0.40
	Replica	Stress scenario under current structure (orange)	0.44	0.48	0.50	0.49
		Stress scenario under counterfactual (green)	0.44	0.49	0.51	0.49
		Gap (counterfactual and stress) (1)	**-0.01**	**0.01**	**0.01**	**0.00**
	2 SD	Stress scenario under current structure (orange)	0.44	0.48	0.50	0.53
		Stress scenario under counterfactual (green)	0.44	0.50	0.52	0.55
		Gap (counterfactual and stress) (1)	**-0.01**	**0.01**	**0.02**	**0.02**
	Aggregated stress	Stress scenario under current structure (orange)	0.44	0.55	0.54	0.51
		Stress scenario under counterfactual (green)	0.44	0.59	0.59	0.56
		Gap (counterfactual and stress) (1)	**-0.01**	**0.04**	**0.05**	**0.05**
INDONESIA		Base scenario under current structure (blue)	0.35	0.29	0.26	0.24
	Replica	Stress scenario under current structure (orange)	0.35	0.32	0.30	0.29
		Stress scenario under counterfactual (green)	0.34	0.31	0.30	0.28
		Gap (counterfactual and stress) (1)	**0.00**	**0.00**	**0.00**	**0.00**
	2 SD	Stress scenario under current structure (orange)	0.35	0.29	0.23	0.19
		Stress scenario under counterfactual (green)	0.34	0.28	0.23	0.19
		Gap (counterfactual and stress) (1)	**0.00**	**0.00**	**0.00**	**0.00**
	Aggregated stress	Stress scenario under current structure (orange)	0.35	0.43	0.37	0.29
		Stress scenario under counterfactual (green)	0.34	0.41	0.35	0.28
		Gap (counterfactual and stress) (1)	**0.00**	**-0.02**	**-0.02**	**-0.02**
RUSSIA		Base scenario under current structure (blue)	0.15	-0.01	-0.12	-0.20
	Replica	Stress scenario under current structure (orange)	0.15	0.35	0.28	0.13
		Stress scenario under counterfactual (green)	0.16	0.41	0.33	0.18
		Gap (counterfactual and stress) (1)	**0.02**	**0.06**	**0.05**	**0.04**
	2 SD	Stress scenario under current structure (orange)	0.15	0.18	0.09	-0.01
		Stress scenario under counterfactual (green)	0.16	0.21	0.11	0.00
		Gap (counterfactual and stress) (1)	**0.02**	**0.03**	**0.02**	**0.01**
	Aggregated stress	Stress scenario under current structure (orange)	0.15	0.25	0.18	0.06
		Stress scenario under counterfactual (green)	0.16	0.29	0.22	0.09
		Gap (counterfactual and stress) (1)	**0.02**	**0.04**	**0.03**	**0.03**
TURKEY		Base scenario under current structure (blue)	0.57	0.52	0.46	0.44
	Replica	Stress scenario under current structure (orange)	0.57	0.96	1.09	1.20
		Stress scenario under counterfactual (green)	0.47	0.95	1.11	1.18
		Gap (counterfactual and stress) (1)	**-0.10**	**0.00**	**0.03**	**-0.01**
	2 SD	Stress scenario under current structure (orange)	0.57	0.82	1.18	1.77
		Stress scenario under counterfactual (green)	0.47	0.69	0.99	1.47
		Gap (counterfactual and stress) (1)	**-0.10**	**-0.13**	**-0.19**	**-0.30**
	Aggregated stress	Stress scenario under current structure (orange)	0.57	0.72	0.69	0.12
		Stress scenario under counterfactual (green)	0.47	0.68	0.66	0.11
		Gap (counterfactual and stress) (1)	**-0.10**	**-0.04**	**-0.03**	**-0.01**
URUGUAY		Base scenario under current structure (blue)	0.72	0.68	0.65	0.62
	Replica	Stress scenario under current structure (orange)	0.72	1.27	1.33	1.30
		Stress scenario under counterfactual (green)	0.72	1.31	1.37	1.34
		Gap (counterfactual and stress) (1)	**0.00**	**0.04**	**0.05**	**0.04**
	2 SD	Stress scenario under current structure (orange)	0.72	0.93	1.01	1.09
		Stress scenario under counterfactual (green)	0.72	0.95	1.03	1.11
		Gap (counterfactual and stress) (1)	**0.00**	**0.02**	**0.02**	**0.03**
	Aggregated stress	Stress scenario under current structure (orange)	0.72	1.18	1.14	0.98
		Stress scenario under counterfactual (green)	0.72	1.21	1.18	1.01
		Gap (counterfactual and stress) (1)	**0.00**	**0.03**	**0.04**	**0.03**

(1) Represents the difference between the stress under 2002 debt composition (counterfactual) and the stress under current debt composition.
Source: own calculations

Source: Authors' calculations.

Privatisation, Consolidation and the Increased Role of Foreign Banks

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Introduction

This paper discusses three major structural changes – privatisation, consolidation and an increased role of foreign banks – that have been taking place in banking systems of emerging market economies, focusing on the period since 2000. It assesses, on the basis of standard indicators, how far the banking systems studied have increased intermediation efficiency as a result of these changes. In this regard the paper looks at both the productive efficiency of the banking industry itself and some aspects of allocative efficiency, focusing on changes in the composition of lending to different sectors of the economy. The issues of dynamic efficiency – the impact of changes in banking systems on economic growth and financial stability – are not discussed. The paper also identifies some challenges that the evolving banking structure might create for market discipline and supervisory oversight.

When these issues were last discussed by deputy governors at the Bank for International Settlements (BIS) in December 2000, many emerging market economies were still recovering from financial crises of the second half of the 1990s (Hawkins and Mihaljek, 2001). Deregulation of financial services at the national level and opening-up to international competition were just beginning. Although privatisation was well advanced in Central Europe and Latin America, many state-owned banks in these regions as well as Asia had yet to be privatised. The global financial industry was in the midst of an unprecedented boom in the use of information technology. Changes in corporate behaviour such as the growing use of debt markets and increased emphasis on shareholder value were also beginning to spread worldwide.

[1] The author thanks David Archer, Sylwester Kozak, Philip Turner and Bill White for valuable comments, and Marc Klau for help with the data. The views expressed are those of the author and do not necessarily represent those of the BIS or member central banks. An earlier version of this paper was published in BIS Papers No 28, August 2006 (www.bis.org).

Changes in the structure of the banking industry that have taken place over the past five years are important but perhaps less spectacular than what was expected in December 2000. Trends in privatisation, consolidation and the increased role of foreign-owned banks have continued, but the banking systems in many countries – particularly large Asian economies – have yet to be integrated fully with the global financial system. Improvements in the efficiency of intermediation have been more uniform, suggesting that benefits to industry and consumers from greater competitive pressure in banking have been widespread. But questions continue to be raised about the effectiveness of banking systems in Asian countries with high saving rates in steering funds towards the most productive uses from the global economy perspective (Bernanke, 2005, Clarida, 2005). Banks in many Asian and Central European economies have shifted lending from the public sector and corporations towards households and smaller firms, but in some Latin American countries the share of bank credit to the government has actually increased.

The paper is organised as follows. Section 1 reviews broad changes in the structure of banking systems in emerging market countries since 2000, focusing on trends in privatisation and bank consolidation. Section 2 looks at the effects of these changes on the composition of bank lending and on bank efficiency. Section 3 concludes with a discussion of some policy challenges facing central banks and supervisory authorities in this new environment.

1. Structural Changes in the Banking Sector since 2000

1.1 Structure of the Banking System

Two main elements of the structure of banking systems that are considered in this section are the degree of government versus private domestic or foreign ownership of banks, and trends in consolidation in the banking industry. There is a large literature on benefits and costs associated with privatisation and foreign ownership of banks in emerging market economies.[2] In general, studies suggest that productive, allocative and dynamic efficiency tend to be lower in banking systems dominated by state owned banks, while privatisation and an increased role of foreign banks helps to improve at least some aspects of efficiency. There has been less research on bank consolidation in emerging market economies, partly because the relevant problem in many banking systems is excess fragmentation rather than excess concentration (see below). Research on industrial countries suggests that concentration in banking plays a more complex role than would be suggested for traditional industries such as manufacturing and trade.

Commercial banks retain a dominant role in providing credit in emerging market economies (see Mohanty et al., 2006). Outside Latin America and a few

[2] See, for example, the review article by Barth et al. (2004).

Asian economies, non-bank financial institutions supply negligible amounts of aggregate credit.[3] Within the banking sector, commercial banks provide on average 90% of total credit. This share has actually increased over the past five years, in particular in Latin America, but also in some crisis-hit countries in Asia, where many fringe financial intermediaries have collapsed. Deposit-taking institutions other than commercial banks play a more important role only in Korea, Malaysia and Thailand, where they supply roughly a quarter of total credit.

Changes in the ownership structure of banks have been more significant. As indicated in chart 1, the share of state-owned commercial banks in total bank credit has declined or remained stable in all emerging market regions since 1999.[4] Except in China, India and Indonesia, state-owned banks are no longer major providers of credit to the economy. The declining role of state-owned banks has been particularly pronounced in Central Europe, where bank privatisations have essentially been completed.

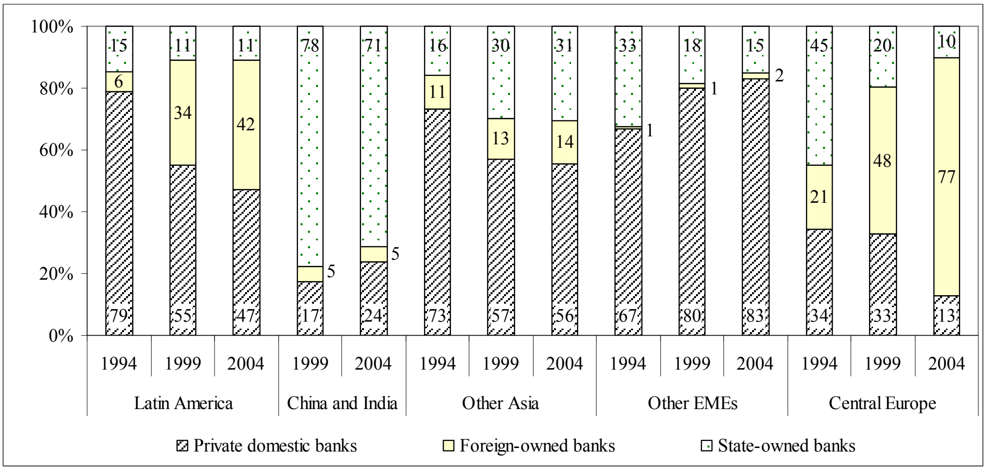
There have also been major shifts in the relative importance of domestic and foreign private banks. Continuing a trend that was observed five years ago, since 1999 the share of private domestic banks has declined in Latin America and Central Europe (to 60% and 13% of total bank credit, respectively) while that of foreign-owned banks has increased significantly. But in some Asian countries (Indonesia, Malaysia and Thailand) and other emerging market economies (Israel, Saudi Arabia and Turkey), there has been no further penetration of foreign-owned banks since 1999.

In terms of total assets, the share of foreign ownership ranges from nil in Saudi Arabia to 96% in the Czech Republic. The share is higher in Central Europe and Latin America, and lower in Asia, Israel, Saudi Arabia and Turkey; it also tends to be higher in smaller economies than in larger ones. Upper middle income countries (eg Chile, Hungary, Mexico, Malaysia and Poland) tend to have a higher proportion of foreign ownership of bank assets. Interestingly, foreign banks own about the same percentage of bank assets in many high-income economies (e.g. Israel and Korea) as in lower-income economies (e.g. India and Indonesia). Overall, these comparisons do not reveal a simple relationship between country characteristics and degree of foreign ownership of banking assets.

[3] Unless otherwise indicated, the country groupings used in this paper are as follows: Latin America (Chile, Colombia, Mexico and Venezuela); other Asia (Indonesia, Korea, Malaysia and Thailand); Central Europe (Czech Republic, Hungary and Poland); and other emerging market economies (Israel, Saudi Arabia and Turkey).

[4] The small increase in the share of state-owned banks in total credit in other Asian countries in 2004 is due entirely to Indonesia, where the majority of commercial banks that failed during the 1999 crisis were nationalised and subsequently gradually privatised.

Chart 1: Commercial Banks by Type of Ownership (Share in Total Bank Credit, in %)



Source: National data (BIS questionnaire).

Table 1 provides some preliminary evidence on the extent of bank consolidation. Since 1999, the number of commercial banks has increased only in China, Saudi Arabia and Colombia, while in other economies mergers, acquisitions and liquidations have resulted in a decrease in the number of banks ranging from 10 to 30%. Chart A1 in the Appendix reveals another common pattern: after an initial increase – for instance, in Hong Kong SAR, Indonesia, the Czech Republic and Poland during the first half of the 1990s – the number of commercial banks has subsequently retrenched. The number of bank branches has also decreased in most countries over the past five years; large expansions in branch networks have taken place only in Chile, Colombia and Malaysia. As indicated in the second column of table 1, bank consolidation had already started in the mid-1990s, but at that time the branch network was still growing in most countries, in particular in Asia and Latin America. With few exceptions, this has also resulted in a decrease in the number of bank employees per branch (chart 2). Given that economies in the sample differ widely in terms of market size and level of financial development, it is hard to generalise about the future direction of change in banking density.

Table 1: Number of Commercial Banks and Branches[1]

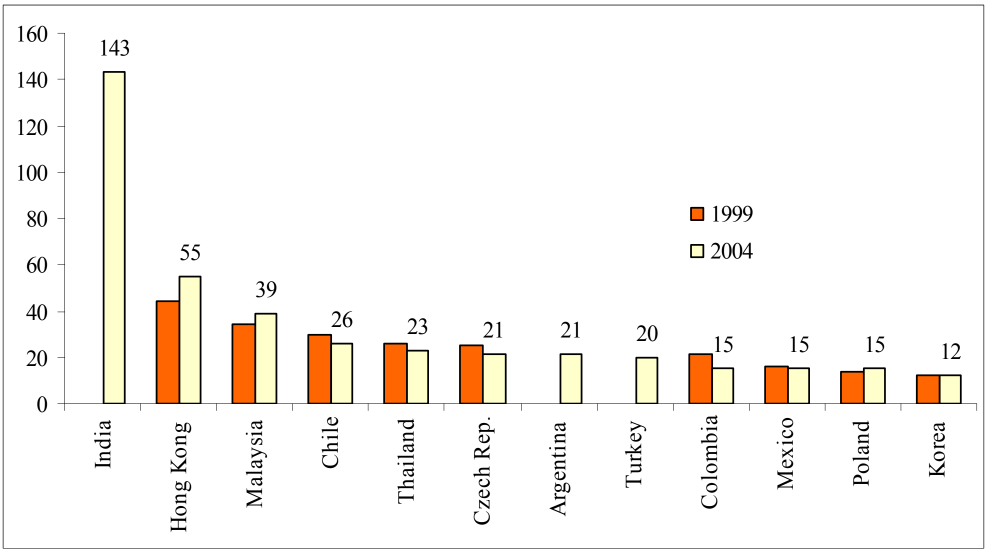
1990–94			1994–99			1999–2004		
Country	**Banks**	**Branches**	**Country**	**Banks**	**Branches**	**Country**	**Banks**	**Branches**
Czech Rep	511	–41	Thailand	17	35	China	92	…
Hong Kong SAR	132	…	Mexico	13	60	Saudi Arabia	20	2
Indonesia	43	22	Singapore	8	35	Colombia	13	20
Colombia	19	…	Venezuela	8	18	Chile	–10	10
Saudi Arabia	0	18	Hungary	–2	…	Thailand	–12	2
Thailand	–3	…	Poland	–6	–16	India	–13	4
Singapore	–6	12	Malaysia	–8	47	Hungary	–15	–3
Chile	–8	23	Israel	–13	–2	Venezuela	–17	2
Turkey	–8	–7	Korea	–17	44	Czech Rep	–17	–11
Venezuela	–10	24	Saudi Arabia	–17	–2	Korea	–19	–5
Malaysia	…	29	Chile	–19	15	Singapore	–19	–38
			Turkey	–19	14	Argentina	–20	–12
			Colombia	–23	–3	Indonesia	–21	–5
			Czech Rep	–24	…	Mexico	–21	–3
			Hong Kong SAR	–25	2	Israel	–23	–10
			Indonesia	–33	3	Turkey	–23	–11
						Hong Kong SAR	–27	–17
						Malaysia	–29	11
						Poland	–30	–16

Note: [1]Change in the number of commercial banks/bank branches during the period, in %.

Source: National data (BIS questionnaire).

In sum, banking systems in emerging market economies have generally continued to evolve towards more private and foreign-owned structures, with fewer commercial banks and often smaller numbers of bank branches. As discussed below, in some countries these trends have been the result of post-crisis weeding-out of weak financial institutions, and mergers encouraged by the authorities under financial sector "master plans" (e.g. in Indonesia, Malaysia and Thailand). Elsewhere, these developments have been mostly market-driven (e.g. Central Europe, Mexico). However, the pace of structural change has slowed compared with the second half of the 1990s. Three main reasons come to mind: first, banking crises have been less widespread – Argentina's and Turkey's crises being the only major ones after 2001. Second, the transition towards market-based systems had been largely completed in Central Europe by the early 2000s. And third, in the favourable macroeconomic and financial environment that has prevailed over the past five years there has been less urgency to reform banking systems.

Chart 2: Employees per Commercial Bank Branch



Source: National data (BIS questionnaire).

1.2 Privatisation

Since 2000 there have been 51 partial or full privatisations in the 19 emerging market countries studied in this paper (table 2). The major privatisations took place in Indonesia, Korea, Thailand and Central Europe. In Indonesia, 15 banks accounting for 70% of total banking sector assets were sold in initial public offerings by the bank restructuring agency between 2000 and 2004. The Korean authorities privatised four banks nationalised during the 1997/98 crisis, representing 18% of total banking sector assets at the time of privatisation (see Kim et al., 2006). In Thailand, the authorities reduced their shareholdings in three out of five major domestic banks taken over by the Financial Institutions Development Fund during the 1997 crisis. The government still retains large holdings in three major domestic banks – including Krung Thai Bank, one of the largest in the country – and is waiting for favourable market conditions to sell these stakes.

Privatisations have largely been completed in the Czech Republic and Hungary, but have yet to run their course in Poland. In the Czech Republic, the government sold holdings in two major banks (accounting for 38% of total banking sector assets in 2001) to strategic foreign investors in 2000–2001. In Hungary, three smaller banks with a combined market share of 7% were sold in 2003. In both countries, government ownership is now restricted to special purpose institutions which provide support to exporters, small firms and municipalities (Czech Republic), or were set up to develop the mortgage bond market (Hungary). In Poland, the government sold 30% of shares in the country's largest retail bank, PKO BP, at the Warsaw Stock Exchange in late 2004. However, the government still retains a majority stake in the bank.

Elsewhere, progress in privatisation has been mixed. The authorities in China are focusing on four large state-owned banks, which control 60% of the market. The goal is to diversify their ownership rather than privatise the banks. Since 2003, three state-owned banks have become joint stock companies in preparation for partial privatisation. The authorities have exposed their non-performing loans and allowed foreign strategic investors to buy shares. The Bank of Construction has been listed on the Hong Kong Stock Exchange, while the Industrial Bank and the Bank of China could be listed in 2006. As with the large state-owned banks, one goal of reform with respect to other joint stock banks with part local government, part private ownership is to expand foreign ownership and participation in management. Presently, 17 joint stock banks have 22 foreign strategic investors and a large number of foreign professionals work in these banks (see Shiyu et al., 2006). Another important area for China is cooperative banks. As 60% of the population lives from agriculture, China has over 30,000 credit cooperatives. The government has invested large sums of money in restructuring with a view to ensuring that cooperative banks become profitable, commercially oriented and founded on mixed ownership.

In India, no state-owned commercial bank has been privatised since 2000, nor are there any plans for divesting government shareholdings. India's 28 public sector banks account for 80% of total commercial bank credit and by law the government's shareholding in these banks cannot fall below 51%. There is a new roadmap for opening up the banking sector which envisages a greater role for foreign banks after 2009, by which time the consolidation process of domestic banks is expected to be completed.

Russia privatised one state-owned bank in the period under review, in June 2005. The government's strategy for the banking sector does not set out any significant steps to reduce the dominance of state-owned banks (Lohmus and Teo (2005)). Russia's largest bank, Sberbank, accounts for 28% of total banking sector assets, 42% of total deposits and 30% of credit to the economy. The gradual decline in Sberbank's dominance – its share in total household deposits declined from 75% in 2000 to 60% in 2004 – has been offset by the expansion of other state-controlled banks.

Table 2: Commercial Bank Privatisations, 2002–2005

Country	**Number and main characteristics of privatised banks**		**Guarantees extended**		**Residual state ownership**
Colombia	0	But privatisations initiated for 2 banks intervened in late 1990s	Yes	In the past; depositors, employees' pensions	3 banks acquired during the crisis in the late 1990s
Mexico	2	smaller banks intervened in 1999 auctioned off in 2000 and 2001	Yes	Assets not adequately valued; hidden liabilities	None; minority holdings in previous privatisations
Venezuela	0	Privatisations were carried out from 1992 to 1998			2 state-owned banks; no privatisation plans 1 failed bank taken into state ownership in 2000
China	14	joint stock commercial banks sold shares to foreign investors. No plans to initiate widespread privatisation, but shares of 2 state banks to be sold in public offerings	Yes	Implicit guarantees to depositors	Majority state holding of shares in all major banks; plans to reduce shareholdings in the long run
India	0				28 public sector banks; government shareholding cannot fall below 51%
Singapore	0				Less than ⅓ shareholding in former development bank
Indonesia	15	banks, accounting for 70% of total assets, sold in IPOs	Yes	Guarantees to depositors; gradually reduced	Minority ownership in a number of banks; to be sold
Korea	4	banks nationalised during the 1997/98 crisis sold through private placement, tender and auction	Yes	Deposits; bad loans; contingent liabilities (subject to limit; none in some cases)	Plan to sell 32% in one major bank; privatise holding company with 4 state bank subsidiaries
Thailand	3	large banks out of 5 taken over during the 1997/98 crisis sold through public offering to strategic partners	Yes	Limited compensation for NPL losses	Holdings (incl. majority) in 3 major banks, waiting for market opportunity to sell

Table 2 continued: Commercial Bank Privatisations, 2000–2005

Country	Number and main characteristics of privatised banks		Guarantees extended		Residual state ownership
Czech Republic	2	major banks (38% of total assets) sold in 2000–01 through tender to strategic foreign investors	Yes	Impaired assets guaranteed or transferred to a special purpose entity	2 special purpose banks (state support of exporters, small firms, municipalities)
Hungary	3	banks (7% of total assets) sold through public offerings, tender or auction	Yes	Impaired assets; contingent liabilities	Residual shares in several banks (mostly small); full share in mortgage bank
Poland	5	banks with majority or minority state ownership were partially privatised to domestic and foreign investors	No	Employment guarantee schemes (2–3 years) as part of privatisations	1 fully owned state bank; 1 major and 3 smaller banks with majority share; 8 banks with minority share
Russia	1	bank set up in 1993 to implement priority investment projects			State ownership in banking sector remains dominant
Turkey	0	Initiated restructuring ahead of privatisation of 2 major banks			12 banks taken over during the 2001 crisis; 11 since sold, merged or liquidated
Israel	2	One small bank privatised; one major bank (16% of total assets) currently being privatised	No		Plans to privatise major state-owned bank (30% of total assets)
Saudi Arabia	0	Partial privatisations in 1980s and 1990s of banks rescued during the 1960s crisis			Shareholdings of 10–80% in 4 out of 11 domestic banks; held largely by 3 government funds as passive investors

Note: There were no privatisations in Chile, Hong Kong SAR or the Philippines.

Source: Central bank answers to BIS questionnaire.

The Turkish authorities have initiated restructuring of two state banks which they plan to privatise in 2006. The only privatisations in the four Latin American countries for which data are available are those of two smaller banks in Mexico, which were acquired during rescues in 1999.

As in the 1990s, the primary motive for privatisations over the past five years has been to sell the stakes held by the government to investors with the skills and experience necessary to complete the restructuring of banks and transform them into viable business-oriented organisations. More specifically, governments of emerging market economies have generally wanted to strengthen banks' capital and overall stability, increase their profitability and competitiveness, broaden the range of products and services offered and increase the overall efficiency of financial intermediation. Considering the huge fiscal costs of banking crises in the 1990s, many governments also wanted to limit the size of any potential future intervention in the banking system.

Regarding privatisation methods, in the late 1990s impaired assets of many banks nationalised during the crisis in Asia were disposed of by asset management companies, while in Central Europe and Latin America state-owned banks were often sold to strategic foreign investors. By contrast, from 2000 to 2004 several different methods were used, including the sale of shares through initial and subsequent public offerings; sale of shares through tender or auction; and, in some cases, sale of shares through private placement, often to strategic investors. These changes in privatisation methods have reflected normalisation of the banking industry after the crises and, in central and eastern Europe, the completion of the systemic transformation towards a market-based economy in the late 1990s.

So far, there have been no comprehensive analyses of net costs of bank rescues and privatisations for taxpayers.[5] Cost-benefit considerations seem to be largely absent when banks are rescued during systemic crises. Limited evidence from individual bank cases suggests that, even under the best of circumstances – a rescue quickly followed by successful privatisation – the net costs are very large, which perhaps explains why governments prefer not to know exactly how much money taxpayers lose when the state restructures and recapitalises distressed banks before selling them to new owners.[6] Several central banks observed in this context that recapitalisation rarely solved banks' problems, but many governments nonetheless saw it as necessary because banks could not have otherwise found strategic partners.

With the exception of Israel and Poland, governments extended guarantees to depositors in privatised banks and to purchasers of state-owned banks, covering various impaired assets and contingent liabilities. In many countries, limits on guaranteed deposits were reduced over time and guarantees for contingent liabilities were subject to a ceiling.

As already indicated, the public sector still has a major residual role in many emerging market banking systems, in particular in large economies such as China, India and Russia. Expectations expressed in Hawkins and Mihaljek (2001) that this

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5 On aggregate costs of banking crises see eg Honohan and Klingebiel (2001) and Sherif (2004).

6 One well documented case is the rescue of Hungary's Postabank in 2000. The rescue cost the state around HUF 150 billion (about EUR 580 million), and the bank was sold for HUF 100 billion at end-2003, implying a net loss of 33%. Another exception to the lack of transparency about costs and benefits of bank rescues is the Czech Republic – Barta and Singer (2006) calculate costs of both bank crises and delays in privatisation.

role would diminish relatively quickly have proved to be overly optimistic. Outside of Central Europe, Mexico, Hong Kong and Singapore, policymakers in many countries apparently still see a useful role for state-owned commercial banks, not just in serving customers in remote areas or certain types of customers (farmers, small firms), but more generally, as necessary for socio-economic development. In view of the strong conclusions reached in the empirical literature on the inefficiency of using state ownership of banks as a social and development tool, why such perceptions are still held remains an open question. As discussed below, one reason might be that the remaining state-owned commercial banks have been subjected to greater market discipline and have become less inefficient than in the past.

1.3 Consolidation

In the late 1990s, the banking systems of many emerging market economies were highly fragmented in terms of the number and size of institutions, ownership patterns, profitability and competitiveness, use of modern technology, and other structural features. Very often, three or four large commercial banks coexisted with a large number of smaller urban and rural banks, many of them family-owned (especially in Asia) or under the influence of the public sector (as in Latin America and Central Europe). In general, few commercial banks, even larger ones, were listed on a stock exchange. Profitability varied widely, with some banks earning high gross returns but operating very inefficiently, and others competing fiercely for a narrow segment of the market. Likewise, while some banks used advanced technology and financial innovation, many were still struggling with basic operations such as credit risk assessment and liquidity management.

In this environment, bank mergers were considered to be a potentially important vehicle for improving the structure and efficiency of the banking industry. They were expected to derive both cost reductions (from economies of scale, improved organisational efficiency, lower cost of funding, greater risk diversification, and economising on capital) and revenue gains (by exploiting economies of scope, making large deals possible, etc). In many crisis-hit countries, mergers and acquisitions were seen as an exit strategy for weak banks; while in others, officials wanted domestic banks to be large enough to compete with foreign entrants.

The drive towards consolidation has continued. The number of mergers and acquisitions has declined since 2000, but only slightly. As shown in table 3, from 2000 to 2004 there were 99 M&A deals between domestic institutions and 45 deals between domestic and foreign-owned institutions. The corresponding figures for 1995–1999 were 108 and 31 deals, respectively. In addition, domestic banks from Hungary, Malaysia and Singapore acquired a total of 11 banks abroad from 2000 to 2004; while subsidiaries of foreign-owned banks in Colombia, Hungary, the Philippines and Turkey were involved in a total of eight mergers and acquisitions in these host and other countries. Moreover, the total value of assets of institutions merged since 2000 now exceeds USD 270 billion, compared with USD 170 billion in the second half of the 1990s. One should note that the figures on the value of mergers do not include data for several countries with significant M&A activities, such as the Czech Republic, Hong Kong SAR, Poland, Russia and Turkey.

The largest numbers of deals were completed in Hong Kong, Korea, Malaysia, Poland and Russia. By far the biggest deals involved Mexican banks, followed by Thai, Korean and Philippine banks. Mergers and acquisitions in Poland and Russia have involved mostly smaller banks. In Central Europe, merger activity was strong in both periods. During the 1990s, however, this activity was mostly domestic; while since 2000, many mergers and acquisitions have also involved domestic and foreign banks, reflecting merger activity among parent banks from the European Union. Despite numerous mergers and acquisitions, the number of commercial banks in Indonesia and Central Europe remains large (see Appendix chart A1).

Mergers in Latin America, Central Europe and Hong Kong seem to have been by and large market-driven. This is evident from central bank responses to the BIS questionnaire. The central bank, the supervisory authorities and the competition authorities in these countries generally have a neutral stance vis-à-vis mergers and acquisitions in the banking sector, which are considered to be private business deals. The authorities fulfil their respective duties if financial institutions apply for registration of such deals by considering, among others, standard industrial organisation criteria to assess the impact on competition and concentration in the banking industry. However, the authorities take a neutral stance towards the broader impact of such deals on financial market development and the economy – market forces are presumed to work, and the satisfaction of standard prudential and competition criteria is regarded as sufficient to assure favourable effects on the market and fiscal development.

Table 3: Mergers and Acquisitions (M&As) in Commercial Banking Sectors

Type of M&A	1995–1999			2000–2004		
	Country	Number of M&As	Value (USD m)[1]	Country	Number of M&As	Value (USD m)[1]
M&As between domestic institutions	Colombia	6	20	Colombia	7	10
	Chile	2	480	Chile	2	530
	Mexico	6	64,600	Mexico	1	18,600
	Singapore	2	1,700	China	1	…
	Indonesia	1	…	Hong Kong SAR	14	…
	Korea	10	13,500	Singapore	2	8,000
	Malaysia	2	20	Korea	5	23,480
	Philippines	2	6,900	Malaysia	15	40
	Thailand	1	47,700	Philippines	9	16,400
	Czech Rep	4	…	Thailand	2	28,000
	Hungary	5	3,000	Czech Rep	1	…
	Poland	9	…	Poland	11	…
	Russia	58	…	Russia	29	…
				Turkey	9	…
Total		*108*	*137,920*		*99*	*95,060*
M&As between domestic and foreign-owned institutions	Colombia	2	20	Colombia	1	10
	Chile	2	380	Chile	4	690
	Mexico	2	17,300	Mexico	4	152,000
	Korea	1	860	Korea	2	3,930
	Thailand	4	10,000	Philippines	3	300
	Czech Rep	5	…	Czech Rep	2	…
	Hungary	2	4,700	Hungary	2	12,200
	Poland	13	…	Poland	19	…
				Turkey	8	…
Total		*31*	*33,260*		*45*	*169,130*
Cross-border M&As by domestic institutions[2]	Chile	1	10	Singapore	6	3,400
	Singapore	6	1,200	Malaysia	1	2,980
				Hungary	4	…
Total		*7*	*1,210*		*11*	*6,380*
Cross-border M&As by foreign-owned institutions[3]	Colombia	1	0	Colombia	3	30
	Hungary	4	920	Philippines	1	1,040
	Poland	1	…	Hungary	3	5,790
				Turkey	1	…
Total		*6*	*920*		*8*	*6,860*
All M&A activities		***152***	***173,310***		***163***	***277,430***

Note: [1] Value of assets of merged institutions, rounded up to the nearest USD 10 million.
[2] Acquisition by domestic institutions of banks in other countries.
[3] Acquisition by foreign-owned institutions in host country of banks in host and other countries.

Source: Central banks (BIS questionnaire).

By contrast, in many Asian countries (including Indonesia, Malaysia, the Philippines and Thailand), mergers and acquisitions have been more or less actively promoted by the authorities. The Thai approach is illustrative in this respect (see Watanagase, 2006). Since January 2004, the Bank of Thailand has, together with the finance ministry, started to implement the Financial Sector Master Plan, a medium-term development plan for Thailand's financial sector. The purpose of this plan is to develop a "competitive, efficient, stable, and balanced financial system, capable of servicing both sophisticated and unsophisticated users". One of the key policies under the plan is a new licensing regime, which foresees only two types of deposit-taking institutions – commercial banks and retail banks – in lieu of the current four. In line with this new regime, existing financial institutions have to apply for a change in their licensing status. For instance, finance companies or real estate (credit foncier) companies may merge with one another to become commercial banks; if they do not wish to merge, they can submit an application to become retail banks on their own. In Indonesia, where bank mergers have also been actively encouraged, there has been little dynamism in M&A activity so far, partly because owners of small banks have been reluctant to give up ownership without special incentives (see Goeltom, 2006).

Singapore has pursued a different, facilitative approach. Recognising that increasing globalisation of financial markets and cross-border competition offered Singapore the opportunity to become an Asian financial hub, the authorities launched a phased opening-up of the domestic financial market in 1999. The policy involved encouraging the local banks to engage in mergers and takeovers in a bid to realise economies of scale, as well as to strengthen their capability to invest in technology and management systems and to attract talent. However, the authorities did not seek to influence the outcome of mergers and takeovers, letting the new configuration be determined by market forces.

How effective the different approaches to consolidation will in the end prove to be remains to be seen. So far, there have been no unintended consequences of either the neutral or the more active stance vis-à-vis bank consolidation. A key reason might be that issues of excessive concentration have not yet arisen in emerging market banking industries.[7] By and large, central banks and other authorities have not yet seen an increase in market concentration resulting from domestic bank mergers sufficient to raise concerns about market competition. However, concerns have emerged about increased regional concentration of banks' activities in some countries. Moreover, as will be discussed in Section 3, cross-border mergers among large institutions that own subsidiaries in emerging market

[7] One concentration issue that has arisen in a number of countries is provision of non-bank financial services by commercial banks. In Israel, for instance, commercial banks have typically been advisers to and providers of mutual funds, putting them into conflict of interest situations. In 2005, the authorities required the banks to divest such non-banking activities (see Sokoler, 2006). In many central and eastern European countries, commercial banks own leasing companies, which provide increasing amounts of credit to consumers.

countries with an already large presence of foreign-owned banks could bring such issues to the fore of the policy agenda in the near future.

2. Impact on Financial Intermediation

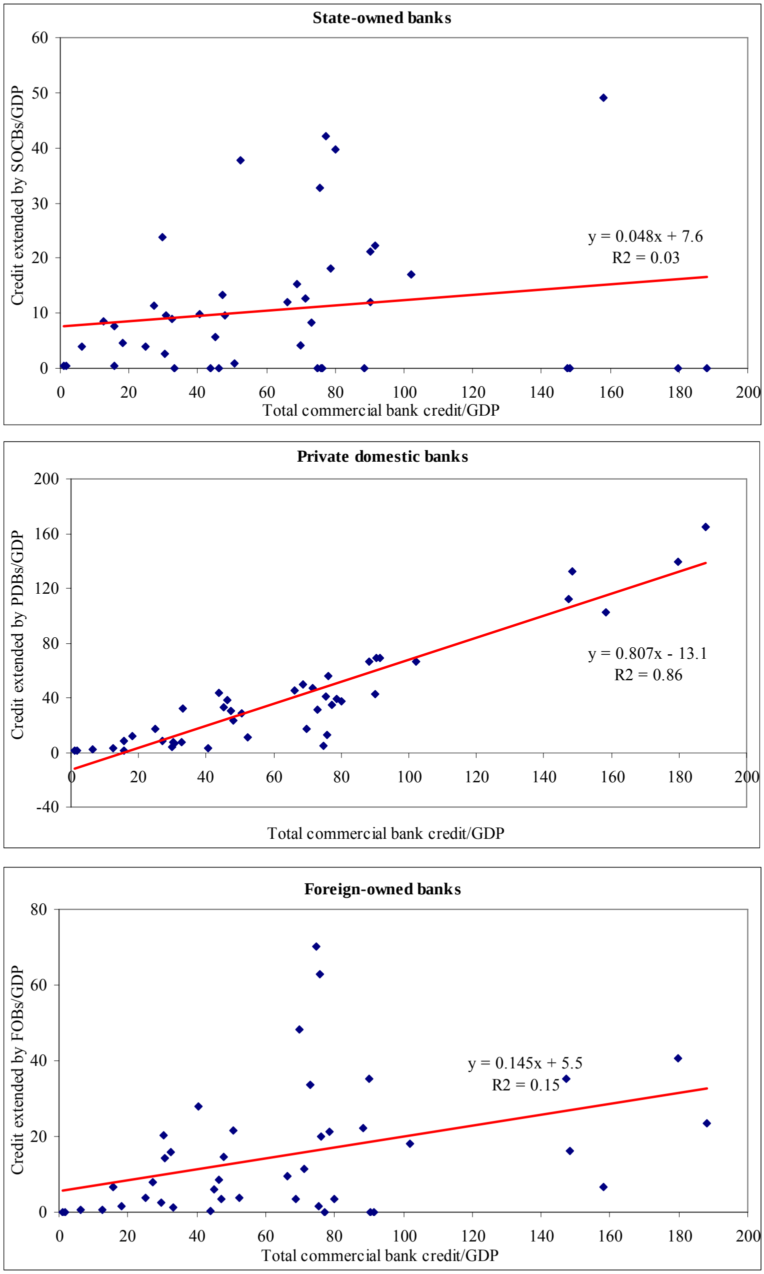
In late 2000, the impact of structural changes in the banking industry on financial intermediation could not yet be discerned. Growth of bank credit to the private sector was weak in most countries and falling sharply in those that had experienced a banking crisis in the late 1990s. Newly established domestic and foreign-owned banks were in many cases in the midst of restructuring and were reluctant to extend credit to customers other than large corporations or the government. Intermediation margins were very wide, and lending to households and small and medium-sized enterprises (SMEs) was largely absent. In many emerging market countries policymakers complained about "cherry-picking" by foreign-owned banks, and some even lamented the diminishing role of state-owned banks, which were seen as key providers of credit to small firms and households. They also referred to evidence that lending by state-owned commercial banks was less procyclical than lending by private domestic and foreign-owned banks.

Since late 2000 there has been a sea change in the bank lending landscape, so much so that policymakers in many emerging market countries have started to worry about – and in several cases seek to limit – too rapid growth of bank credit to the private sector, and in particular to households. The factors explaining the resurgence of private sector credit are discussed for instance in Mohanty et al. (2006). This section will focus on the evolving composition of private sector credit and bank performance by different types of banks (state-owned, private domestic, foreign-owned), rather than on the performance and impact of banking systems as a whole.

2.1 Impact on Bank Lending

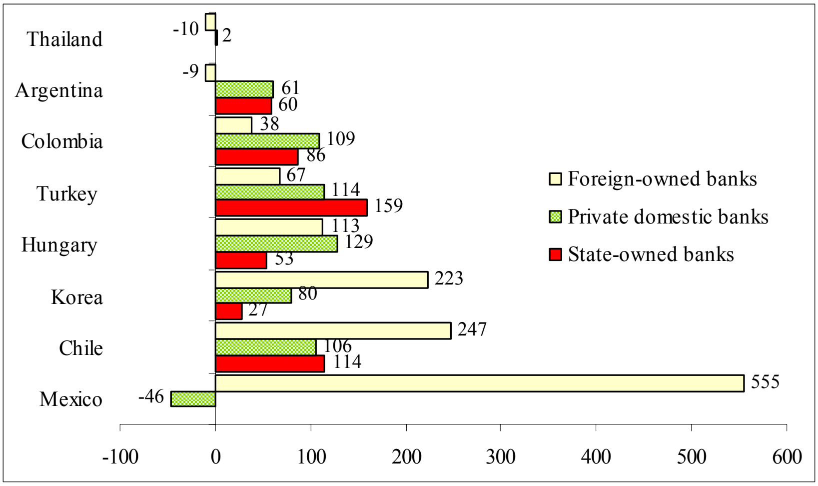
Chart 3 assesses how far banks with different ownership structures have participated in the process of financial deepening observed over the past 10 years. Points in this graph match total commercial bank credit as a percentage of GDP in 1994, 1999 and 2004, with the corresponding shares of state-owned, domestic and foreign-owned bank lending (as a percentage of GDP) for 14 emerging market economies for which data were available. Over the past 10 years, private domestic banks have participated in total credit expansion to a considerably greater extent than either foreign- or state-owned banks: for every 10 percentage point increase in the credit to GDP ratio, credit extended by private domestic banks has expanded on average by 8% of GDP, while the share of foreign-owned banks has increased by about 1½% of GDP, and that of state-owned banks by less than half a percentage point.

Chart 3: Credit Growth and Bank Ownership (as a Percentage of GDP)



Source: National data (BIS questionnaire).

Chart 4: Cumulative Growth of Bank Credit, 2000–2004 (%, in Real Terms)



Sources: IMF; national data (BIS questionnaire).

Over the past five years, however, foreign-owned banks have expanded lending more rapidly than private domestic banks in several countries, including Chile, Korea and Mexico (chart 4). In Brazil, by contrast, the share of foreign-owned banks stabilised at about 20% of total loans and their role in the domestic banking system has not grown, as private domestic banks seemed more capable of profiting from the growing domestic market. Private domestic banks also led the credit expansion in this period in Argentina, Colombia and Hungary. The contrast in lending by different types of banks is particularly stark in the case of Mexico, where foreign-owned banks expanded credit fivefold, while credit by private domestic banks contracted by almost 50% from 2000 to 2004. Turkey is one of the few examples of state-owned banks dominating credit expansion in recent years.[8]

Further insights can be obtained from the data on the composition of bank lending (table 4 and chart 5). Focusing first on credit to the government, it is interesting that, on average, both state- and foreign-owned banks increased their lending to the government relative to lending to other sectors between 1999 and 2004, in particular in Argentina, Colombia and Turkey (state-owned banks) and Argentina, Colombia, Hungary, Korea, Mexico and Thailand (foreign-owned banks). While fiscal dominance seems a plausible explanation for the increased lending by state-owned banks (especially in Argentina and Turkey, which experienced crises in 2001), why foreign-owned banks would increase lending to

[8] Other examples would include China and India, for which the same breakdown of credit expansion is not available.

the government in countries such as Colombia, Korea, Mexico and Thailand is puzzling.

The share of loans to the corporate sector declined in all three types of banks in almost all countries between 1999 and 2004, with the largest average declines occurring for state- and foreign-owned banks. The exceptions are few: Chile, Israel, Mexico (private domestic banks) and Turkey (foreign-owned banks). Much of this decline is healthy, reflecting deleveraging by large firms and diversification of their sources of finance (to corporate bonds, equity and, in some cases, borrowing from banks abroad). Data for countries in Central Europe indicate, for instance, a strong increase in lending to SMEs in recent years, which in several countries rivals lending to households in terms of the pace of credit expansion. Some of the decline in corporate lending also reflects post-crisis risk aversion and balance sheet repair on the part of banks.

The most significant change in the composition of bank lending in the last five years has been a shift towards lending to households. Foreign-owned banks in particular have offset the large decline in the share of corporate loans (by 17 percentage points) with a rise in the share of household loans in total loans. Even state-owned banks increased lending to households between 1999 and 2004 (with the exception of Argentina and Colombia). The increase in the share of loans to households has been most pronounced in Hungary, Korea and Turkey.

Comparing the composition of loans across banks, household loans accounted for roughly one quarter of total lending for all three types of banks in 2004 (table 4). The big differences are in lending to corporations and the government. Private domestic banks lend mostly to the corporate sector (60% on average) and relatively little to the government (with the exception of Argentina, 15% on average).

For state-owned banks, government and corporate loan portfolios are on average of the same size. Foreign-owned banks also lend primarily to the corporate sector, but unlike private domestic banks, the government accounts for over a quarter of their loan book; moreover, with the exception of Chile, Hungary and Turkey, this share has increased significantly since 1999.

These differences in the composition of loans probably reflect the different business strategies, risk attitudes and histories of state-owned, private domestic and foreign-owned banks. Today's state-owned banks for the most part inherited a large portfolio of loans to the public sector and corporations, including in several countries not just large corporations but also SMEs, which are supported by various government credit schemes (Mihaljek, 2004). Initially, they did not lend much to households, except in some cases under subsidised housing schemes. But over time, as competitive pressures have increased and state-owned banks have become more business- and profit-oriented, they have increasingly turned to the household sector, in many countries providing both consumer and housing loans.

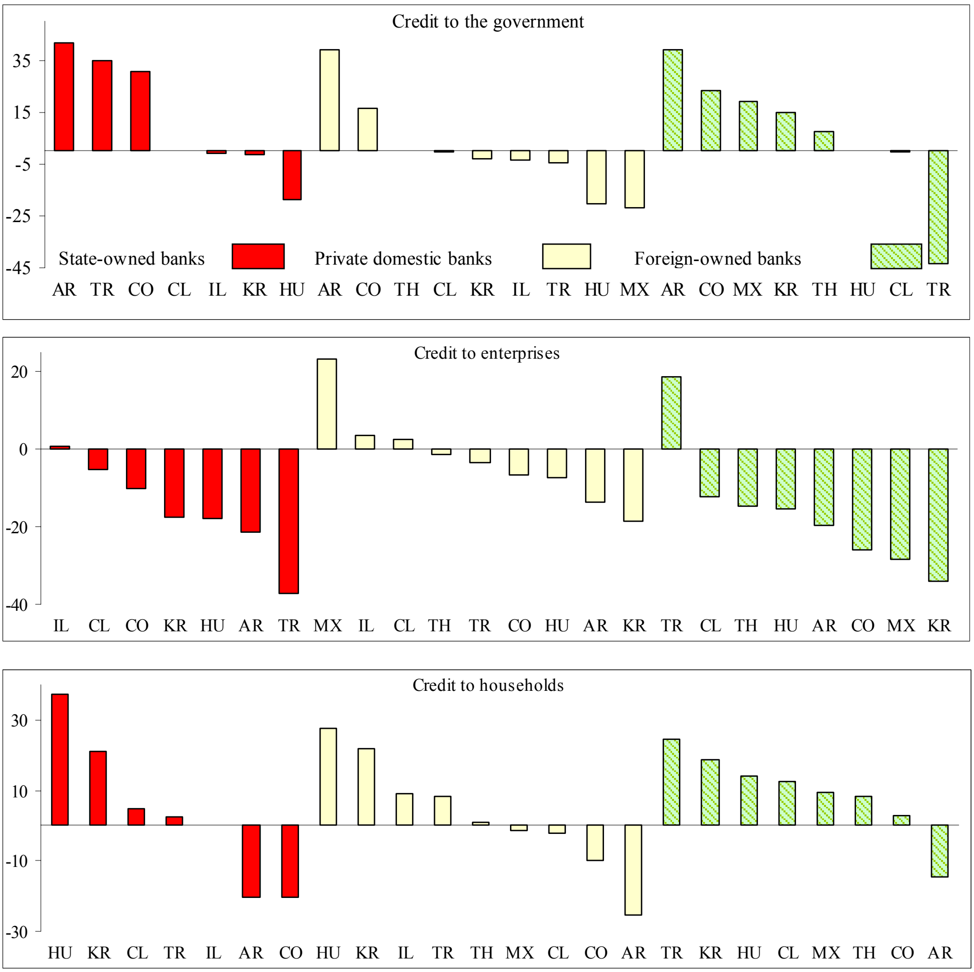
Korea and Hungary are clear examples in this respect. Nonetheless, state-owned banks still lend disproportionately to the government.

Table 4: Composition of Lending[1]

	Government[2]		**Corporate**		**Household**	
	1999	**2004**	**1999**	**2004**	**1999**	**2004**
State-owned banks						
Korea	6.3	4.9	76.1	58.6	15.6	36.5
Argentina	35.8	77.4	31.0	9.7	33.2	12.8
Chile	0.1	0.4	53.2	47.9	46.7	51.7
Colombia	20.0	50.6	44.5	34.3	35.5	15.1
Hungary	49.4	30.4	48.4	30.4	2.2	39.3
Turkey	30.3	65.2	64.9	27.7	4.8	7.1
Israel	34.7	33.9	52.1	52.7	13.1	13.4
Average	*25.2*	*37.5*	*52.9*	*37.3*	*21.6*	*25.1*
Private domestic banks						
Korea	8.4	5.2	61.1	42.7	30.5	52.2
Thailand	4.5	4.9	68.1	66.9	27.4	28.2
Argentina	25.6	64.8	32.2	18.4	42.2	16.8
Chile	1.0	0.6	64.0	66.6	35.0	32.8
Colombia	14.4	30.7	62.2	55.6	23.4	13.7
Mexico	45.4	23.6	33.0	56.2	21.6	20.2
Hungary	39.2	18.8	36.9	29.7	23.9	51.4
Turkey	27.2	22.6	64.2	60.6	8.5	16.9
Israel	10.8	7.2	89.2	92.8	9.0	18.2
Average	*21.0*	*21.7*	*56.2*	*55.9*	*23.9*	*24.8*
Foreign-owned banks						
Korea	8.1	23.1	75.2	41.2	16.8	35.7
Thailand	5.6	13.0	89.7	75.0	4.7	13.0
Argentina	26.2	60.1	45.5	25.9	28.3	13.9
Chile	1.6	1.4	86.0	73.6	12.4	24.9
Colombia	9.5	32.6	73.7	47.6	16.8	19.8
Mexico	36.3	55.2	51.1	22.7	12.7	22.0
Hungary	14.2	14.6	80.5	65.1	6.4	20.3
Turkey	59.2	15.8	38.4	57.2	2.4	27.0
Average	*20.1*	*27.0*	*67.5*	*51.0*	*12.6*	*22.1*

Note: [1] As a percentage of total credit, excluding interbank credit.
[2] Net claims on the government for most countries.

Chart 5: Change in the Composition of Lending between 1999 and 2004 (Percentage Points of Total Bank Lending)



Source: National data (BIS questionnaire).

From a governance point of view, one might argue that the lack of independence of state-owned banks from their owners is similar to connected lending practices in the private sector, with similar risks to profitability and soundness, and in principle would have to be sanctioned as such by independent supervisory authorities.

Private domestic banks, on the other hand, emerged from the crises and restructuring of the late 1990s holding portfolios that consisted mainly of corporate loans (about 60%) and roughly equal proportions of claims on the government and the household sector. As macroeconomic conditions improved, they shifted their business towards households to a greater extent and more quickly than did state-owned banks. The fall in corporate lending shares also reflects an overextension of corporate lending in the past. As a result, both supply side (a pullback of banks from corporate lending) and demand side factors (weak corporate borrowing) have been at play.

Russia's experience is particularly interesting in this regard. A few years ago foreign-owned banks accounted for only 5% of total bank loans in Russia (including cross-border loans); in 2005, the figure had risen to 40%. The main customers of foreign banks have become big Russian exporters, which used to be serviced by large domestic banks in the past. These domestic banks have reoriented their lending towards SMEs, which used to be serviced by medium-sized banks in the past. These banks, in turn, have reoriented lending towards households, which used to be served by small banks. As a result of this domino effect, many small banks are being taken over or closed.

Foreign-owned banks that entered emerging markets by buying local state-owned banks also inherited a large portfolio of loans to the government and the corporate sector. Like private domestic banks, these foreign-owned banks initially focused on the corporate sector (see Pruski and Zochowsk, 2006). Other foreign banks, which entered emerging markets either as greenfield operations or by buying local mid-sized state-owned banks, were from the start more oriented towards households. As the financial position of large firms strengthened over time and many of them started to issue bonds and equity, foreign-owned banks that serviced them also started to turn to the household sector in search of higher margins. And as competition in consumer and housing credit markets has intensified, foreign-owned banks in some countries – in particular in Central Europe – have turned to the next underserved segment of the market: SMEs. More recently, larger corporations in countries such as Hungary and Mexico have again begun to borrow from domestic banks, partly because the banks are offering them new types of loans at lower interest rates, including foreign currency loans. The development cycle of different loan products has thus turned full circle in some countries and a new cycle has begun.

2.2 Impact on Bank Efficiency

In the wake of the emerging market banking crises of the 1990s, a growing number of studies have found evidence that foreign bank entry tends to benefit the host country.[9] It has been argued in particular that foreign bank entry may stimulate competition in the banking industry, leading to higher efficiency for domestic banks, and result in improvements in the quality and accessibility of financial services for host country firms and individuals. Data provided by central banks

[9] See e.g. Claessens et al. (2001) and Demirgüç-Kunt and Huizinga (2001).

confirm that structural changes in emerging market banking systems have generally led to an improvement in standard prudential and efficiency indicators over the past five years. However, it has not been possible to assess improvements in the quality and accessibility of financial services.

The average share of non-performing loans (NPLs) in total loans declined significantly for all types of banks between 1999 and 2004 (table 5). The largest improvements were on average achieved by state-owned banks. Israel is the only country where there was an increase in the share of NPLs for all three bank categories. Other exceptions are Hungary and Venezuela for state-owned banks and Turkey for private domestic banks. The improvement in NPL ratios has been fairly uniform across countries and regions.

One should note that much of this improvement probably reflects the business cycle and is not necessarily the result of different behaviour of representative bank categories. In addition, many banks, in particular state-owned ones and those that were sold to foreign strategic investors, unloaded a significant portion of their NPL portfolios to asset management companies and other vehicles for resolution of bank distress. This is partly confirmed by central bank answers to the questionnaire on guarantees offered to buyers of privatised banks (see table 2 above). Nevertheless, there seems to have been some structural improvement in NPLs, as the 2004 NPL ratios shown in table 5 are generally below those observed during the previous cyclical upturn in the mid-1990s (cf. Hawkins and Mihaljek, 2001).

Provisioning against loan losses has also risen significantly (chart 6). Banks in most countries had set aside provisions for at least two thirds of NPLs at end-2004; in Chile, Korea, Mexico and Saudi Arabia cover exceeded 100% of NPLs. Cover seems relatively low only in Central Europe, India, Malaysia and Venezuela, and these provisioning ratios are in many cases considerably higher than prior to the crisis in the mid-1990s (in the case of Turkey, prior to 2001).

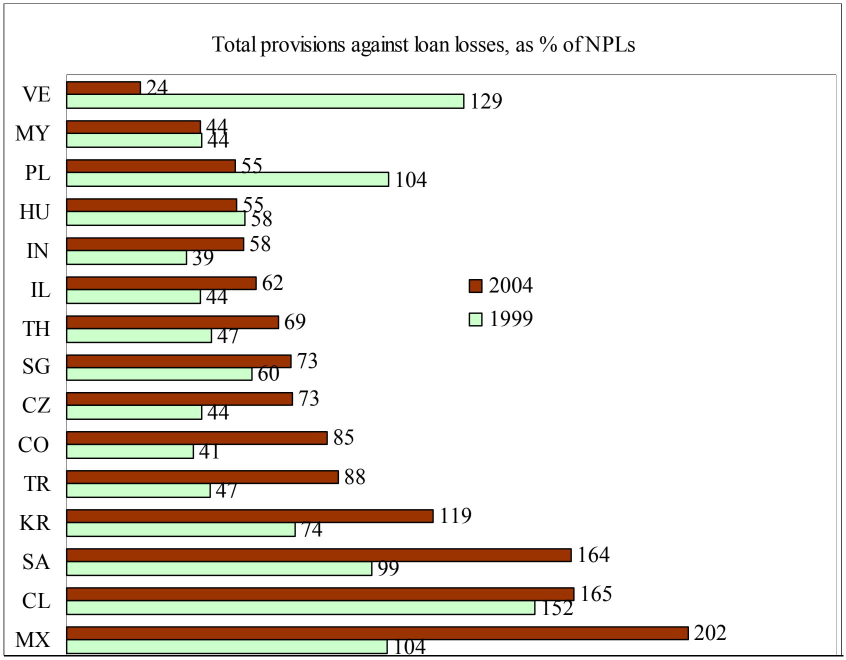
Table 5: Non-Performing Loans[1]

	State-owned banks		Private domestic banks		Foreign-owned banks		All commercial banks	
	1999	**2004**	**1999**	**2004**	**1999**	**2004**	**1999**	**2004**
Argentina	23.4	13.7	13.6	12.5	12.0	7.1	16.5	11.1
Chile	1.4	0.8	1.7	1.1	1.8	1.5	1.7	1.2
Colombia	22.8	3.5	7.1	3.8	7.3	2.1	10.0	3.4
Mexico	…	…	10.8	1.2	2.2	2.2	9.2	2.1
Venezuela	24.0	29.5	6.2	1.6	5.1	0.7	6.1	1.7
China[2]	22.4	15.6	12.0	4.9	…	…	…	…
India	16.0	8.1	10.3	5.9	7.2	4.9	14.6	7.4
Korea	15.0	1.9	8.7	2.0	20.6	1.6	11.4	1.9
Thailand	55.3	9.6	21.6	12.8	7.5	2.6	31.2	10.9
Hungary	4.3	17.6	4.4	2.0	3.7	2.9	3.9	3.5
Turkey	11.3	11.4	3.8	5.1	2.4	3.3	6.1	6.4
Israel	4.9	6.5	0.6	3.5	…	…	1.7	4.2
Average	*18.3*	*10.7*	*8.4*	*4.7*	*7.0*	*2.9*	*10.2*	*4.9*

Note: [1] *As a percentage of total loans.*
[2] *Based on five-tier classification. Data for private domestic banks are for joint stock commercial banks.*

Source: Central banks (BIS questionnaire), IMF.

Chart 6: Total Provisions against Loan Losses (as a Percentage of NPLs)



Sources: Central banks, IMF.

Capital adequacy has generally improved for state-owned banks, and has stayed relatively high for private domestic and foreign-owned banks (table 6). With risk-adjusted capital/asset ratios (capital adequacy ratios) of around 32%–37%, state owned banks in the Czech Republic, Hungary, Thailand and Turkey are probably overcapitalised while those in China, with an adjusted CAR of below 7% in 2004, are clearly undercapitalised. In Korea and the Czech Republic, foreign-owned banks have reduced capital adequacy ratios that were perhaps unsustainably high for a competitive banking environment to more normal levels. In most other countries, including India and Turkey, private banks have either increased or maintained relatively high levels of capital adequacy. Again, these levels compare favourably with capital adequacy ratios from pre-banking crisis periods.

Structural changes have also had a visible impact on bank profitability, as measured by returns on assets and equity. State-owned banks in particular have significantly improved both their return on assets (Appendix table A1) and their return on equity (Appendix table A2) since 1999, as well as with respect to the mid-1990s. Improvements in these indicators were also pronounced for private domestic banks in Colombia, the Czech Republic, Hungary, Korea, Saudi Arabia and Thailand. For instance, in 2004 the return on equity of private domestic banks in Colombia, Hungary and Venezuela exceeded 30% and the return on assets exceeded 3%, with banks in Saudi Arabia realising slightly lower but still fairly high returns. The improvement since 1999 has been less pronounced for foreign-owned banks, whose profitability was already somewhat higher in 1999 than that of private domestic banks. In Argentina, profitability of foreign-owned banks declined drastically after the 2001 crisis.

Table 6: Capital Adequacy[1]

	State-owned banks		**Private domestic banks**		**Foreign-owned banks**		**All commercial banks**	
	1999	**2004**	**1999**	**2004**	**1999**	**2004**	**1999**	**2004**
Argentina	16.5	9.1	31.5	16.3	16.3	11.9	19.7	12.3
Chile	13.3	10.1	11.4	12.0	15.4	16.7	13.5	13.6
Colombia[2]	9.1	8.3	11.7	11.1	12.0	11.1	11.2	10.7
Mexico	…	…	16.4	17.8	14.6	13.2	16.0	14.1
Venezuela	15.2	10.9	12.8	12.6	13.6	12.6	13.3	12.5
China[3]	5.4	6.8	…	7.6	…	…	…	…
India	11.3	13.2	11.9	11.2	10.8	15.0	11.3	12.9
Korea	9.3	12.5	11.6	11.3	21.9	13.1	12.0	11.8
Thailand	24.4	31.9	16.3	13.7	13.8	12.1	15.0	13.2
Czech Rep.	…	31.6	11.5	14.0	18.6	12.1	13.6	12.6
Hungary	24.4	31.9	16.3	13.7	13.8	12.1	15.0	13.2
Poland	8.8	16.3	12.6	15.1	15.0	15.4	12.4	15.6
Turkey	11.7	36.8	17.2	22.3	22.5	26.9	7.0	26.2
Israel	9.6	10.8	9.3	10.7	…	…	9.4	10.8
Average	13.3	13.7	14.7	13.5	15.7	14.4	13.0	13.8

Note: [1] Risk-weighted capital adequacy ratios, in %.
[2] Total capital over total assets.
[3] Data refer to end-2001 and June 2004, respectively. Data on private domestic banks are for joint stock commercial banks.

Source: Central banks (BIS questionnaire); OECD.

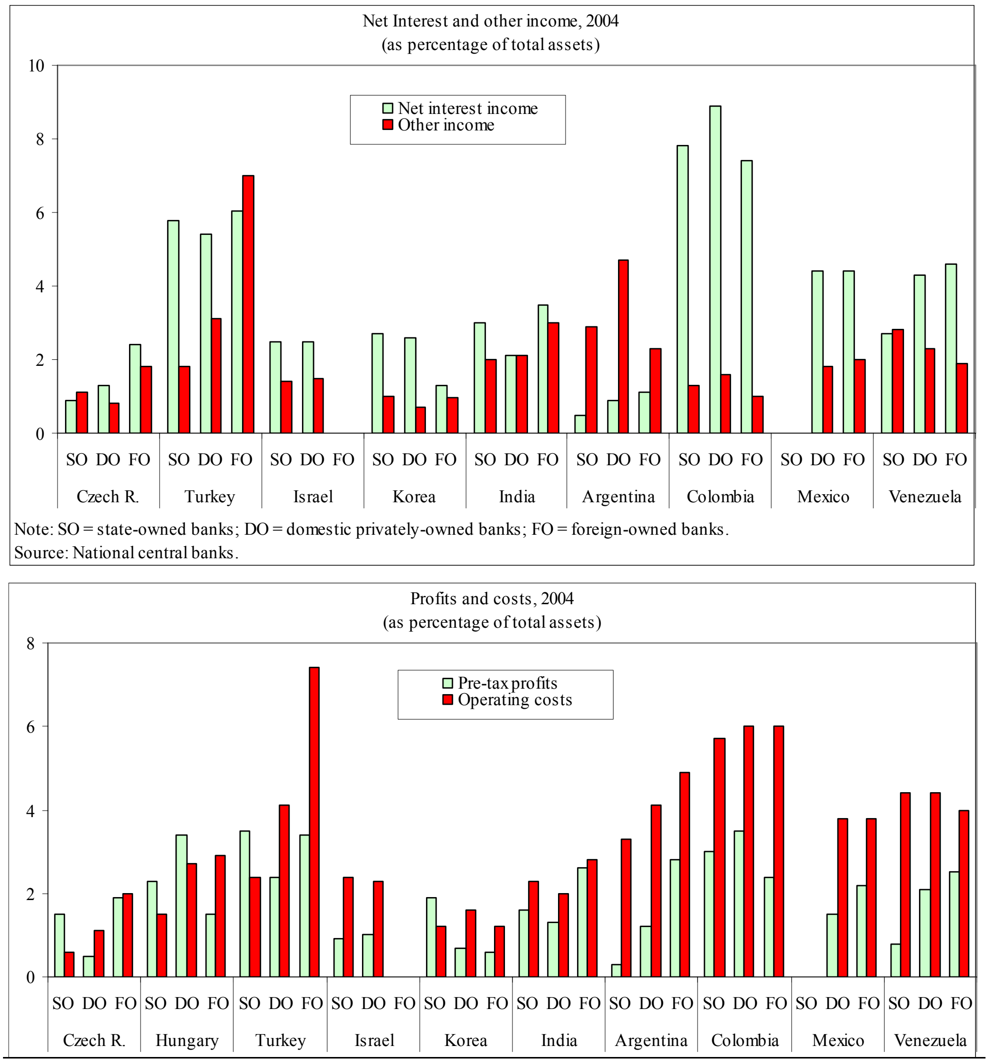
Changes in net interest income and other income have been less pronounced. State-owned and private domestic banks generally increased net interest income relative to total assets between 1999 and 2004 (Appendix chart A2). But for foreign-owned banks net interest income ratios were either constant or declined in most countries, reflecting the narrowing of interest rate margins brought about by greater competition. In Hungary, Turkey, Colombia and Venezuela, net interest income ratios for most banks exceeded 4% in 2004, suggesting that intermediation margins were still quite high. In Hungary, Turkey and Venezuela, high interest margins in addition partly reflected relatively high real interest rates in an environment of rapid disinflation.

Chart 7 compares sources of income (upper panel) and profits and costs (lower panel) for different categories of banks in 2004. With the exception of Argentina, net interest income is still the main income source for most banks, regardless of ownership structure. But the share of non-interest income is generally higher for foreign-owned banks than for state-owned or private domestic banks, reflecting the broader range of products offered by foreign banks. For all three types of banks there has been a widespread increase in this share since 1999 (Appendix chart A2), suggesting an expanding scope of financial intermediation as banks have introduced new fee-based products and services.

Increased competition in the banking industry has also been reflected in generally lower interest rate margins. As shown in chart 8, with the exception of Hong Kong SAR and Turkey, the spread between representative bank lending rates and customer deposit rates declined from an average of 6.1 percentage points in 1999 to 4.1 percentage points in 2004. The narrowing of interest margins has been particularly pronounced for state-owned banks, suggesting that large rents were extracted in the past from their dominant position in many countries. There has also been a substantial narrowing of interest rate margins for foreign banks, with private domestic banks making on average less progress.

Pre-tax profits have risen in most countries and operating costs have generally declined since 1999 (Appendix chart A3), as well as with respect to the mid-1990s. For both profits and costs, the magnitude of these improvements has been similar across different types of banks. The absence of clear "winners" suggests that increased competition has provided state, private domestic and foreign-owned banks with roughly equal incentives to improve performance. What differences remain probably reflect different starting positions. As shown in the lower panel of graph 7, foreign-owned banks tend to have slightly higher pre-tax profits (2.2% of total assets on average, compared with 1.8% for private domestic and state-owned banks), but they also have higher costs (3.9% of total assets, compared with 3.2% for domestic banks and 2.6% for state-owned banks). It is not entirely clear what factors have contributed to these differences. One reason might be that, compared with foreign banks, state banks often own real estate in attractive locations (or rent it at low cost from city authorities), and can offer their staff higher state benefits in exchange for somewhat lower salaries.

Chart 7: Income, Profits and Costs 2004



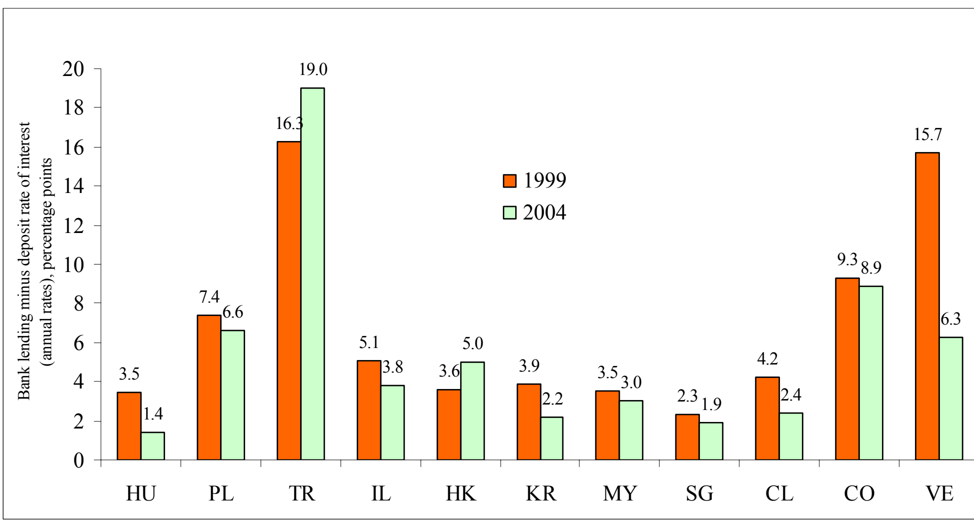
Note: SO: state-owned banks, DO: domestic privately-owned banks, FO = foreign-owned banks.

Source: National central banks.

In sum, several indicators point to a positive impact overall of structural change on bank lending and efficiency. The structure of lending has become more diversified, with less credit going to the government and large enterprises and more to households and – at least in Central Europe – smaller enterprises. Banks in emerging market countries have by and large also become financially stronger and operationally more efficient. Greater foreign bank participation has helped improve bank governance.

Yet differences between state-owned and other banks still remain. Compared with foreign-owned banks, for instance, state-owned banks have generally been slower in diversifying their lending and reducing non-performing loans; but have been recapitalised to a greater extent (perhaps excessively so in some countries), and have done more to improve return on equity/assets and narrow interest rate margins, albeit often from worse starting positions.[10] Positive effects of competition on bank performance have also been visible in the case of private domestic banks. This is perhaps the most significant development, considering that in many countries these banks had to cope with restructuring at their own shareholders' expense, whereas the state-owned banks were typically restructured at taxpayers' expense and subsequently sold to foreign-owned banks, in most cases below the cost of restructuring.

Chart 8: Interest Rate Margins



Source: National data (BIS questionnaire).

3. Challenges for Market Discipline and Supervision

The changing structure of the emerging economies' banking systems has many implications for financial stability and in particular the supervisory regime. This

[10] One common complaint about foreign banks in Latin America is that their managers have very short time horizons and tend to act procyclically (see Betancourt et al., 2006). By contrast, publicly owned banks tend to have longer time horizons.

section addresses two specific issues that arise in this context: first, supervision of foreign-owned banks; and second, the impact of delisting of large domestic banks from local stock exchanges after takeovers by foreign-owned banks.

The presence of foreign banks has generally led domestic supervisory authorities to upgrade the quality and increase the size of their staff in order to supervise the more sophisticated activities and new products being introduced by these banks. In addition, supervisory authorities in banking systems dominated by foreign-owned banks have had to cooperate with home country supervisory authorities to a greater extent. In virtually all countries in the sample, domestic supervisory authorities have established formal channels of communication with the authorities in charge of financial supervision in parent banks' home countries. In most cases, the framework for cooperation is set out in bilateral memoranda of understanding. Areas of cooperation typically cover: exchange of information on operations of foreign-owned banks in host and home countries; exchange of information on management of foreign-owned banks; and joint consultations and visits to foreign owned banks. Cooperation is generally judged to be smooth, and the main obstacle in establishing closer working relationships with foreign supervisory authorities is usually seen to be the different legal treatment of confidential data and information in various jurisdictions.

Yet some central banks have expressed more general scepticism about overly legalistic modes of communication among supervisors. In practice, the consolidated (home) supervisor has tended to dominate the host country supervisor even in the case of subsidiaries. Moreover, comments provided in the BIS questionnaire suggest that some host country authorities were not always fully informed about the situation of parent banks in home countries. One special challenge is governance: foreign-owned banks are managed from their headquarters from a global perspective, which means that different transactions are booked in different banking hubs around the world. As a result, some subsidiaries end up with a greater concentration of certain risks than would otherwise be the case. As reporting lines for different operations often bypass local managers, central banks in host countries might not always be informed in time about issues such as liquidity problems of local subsidiaries. Different accounting standards also create problems, in part because they affect the type of business activities that foreign banks carry out in host countries.

Several central banks noted that foreign bank affiliates are often of marginal importance from the parent perspective, but might well be systemically important for the host country. One issue that arises in this context is what would happen if a foreign-owned subsidiary that was systemically important locally ran into problems. One central bank acknowledged that it did not know what parent banks would do in such a case. There were cases where a parent company had helped its subsidiary immediately, without asking host country authorities for any assistance.

But there were also some cases of a parent abandoning its subsidiary.[11] The response would seem to depend on financial health of the parent – if the parent was in weak shape, it might care less about reputation costs and abandon its subsidiary. Another central bank attached less probability to foreign parents abandoning their subsidiaries than to foreign owners more generally not acting in the interests of local shareholders.

A related issue in this context is the possible conversion of systemically important subsidiaries of foreign-owned banks into branches. This development has been facilitated in the European Union by the adoption of the single EU banking passport. But the issue is more general, as the centralisation of the decision making process in global financial institutions has led to a system in which subsidiaries operate more or less like branches anyway.[12] The issue in this case is less whether such systemically important branches (or quasi-branches) might be abandoned in a period of distress – legally, branches cannot be "abandoned" because claims on the bank stay with the parent – and more how the central bank and supervisory authorities in the host country might deal with the loss of liquidity in the domestic banking system and disruptions to the payment system if the parent institution decides to close a branch that is small for the parent, but systemically important for the host country.

Developments in the global banking industry are important for market discipline and supervision in emerging market host countries for yet another reason: mergers between parent institutions in industrial countries might result in a significant increase in concentration in host countries. For instance, the merger between Unicredito and HVB has implications for competition in the Polish banking market, as these two parents own the second and third largest banks in Poland. As noted above, bank consolidation in most emerging economies has not yet been associated with any marked rise in concentration, as most mergers have involved smaller banks. But mergers between large domestic institutions that reflect merger activity outside the borders of the host country might be harder to resist. What could supervisory authorities do in such circumstances if they cannot challenge such domestic mergers on legal grounds?

The delisting of foreign-owned subsidiaries from local stock exchanges raises a different set of concerns. Among countries in the sample, such delisting has occurred in the Czech Republic, Hong Kong SAR, Korea, Mexico and Poland. In the Czech Republic, it involved one institution with a 12% share in market

[11] One well known case is that of Riječka banka, Croatia's third largest bank, in which a currency trader caused losses of nearly USD 100 million, or three quarters of the bank's capital, in 2002. Germany's Bayerische Landesbank decided to sell its 59% share in the bank for a symbolic price of USD 1 to the Croatian government when the losses were discovered. The government subsequently sold the bank to Austria's Erste Bank for EUR 55 million plus a capital increase.

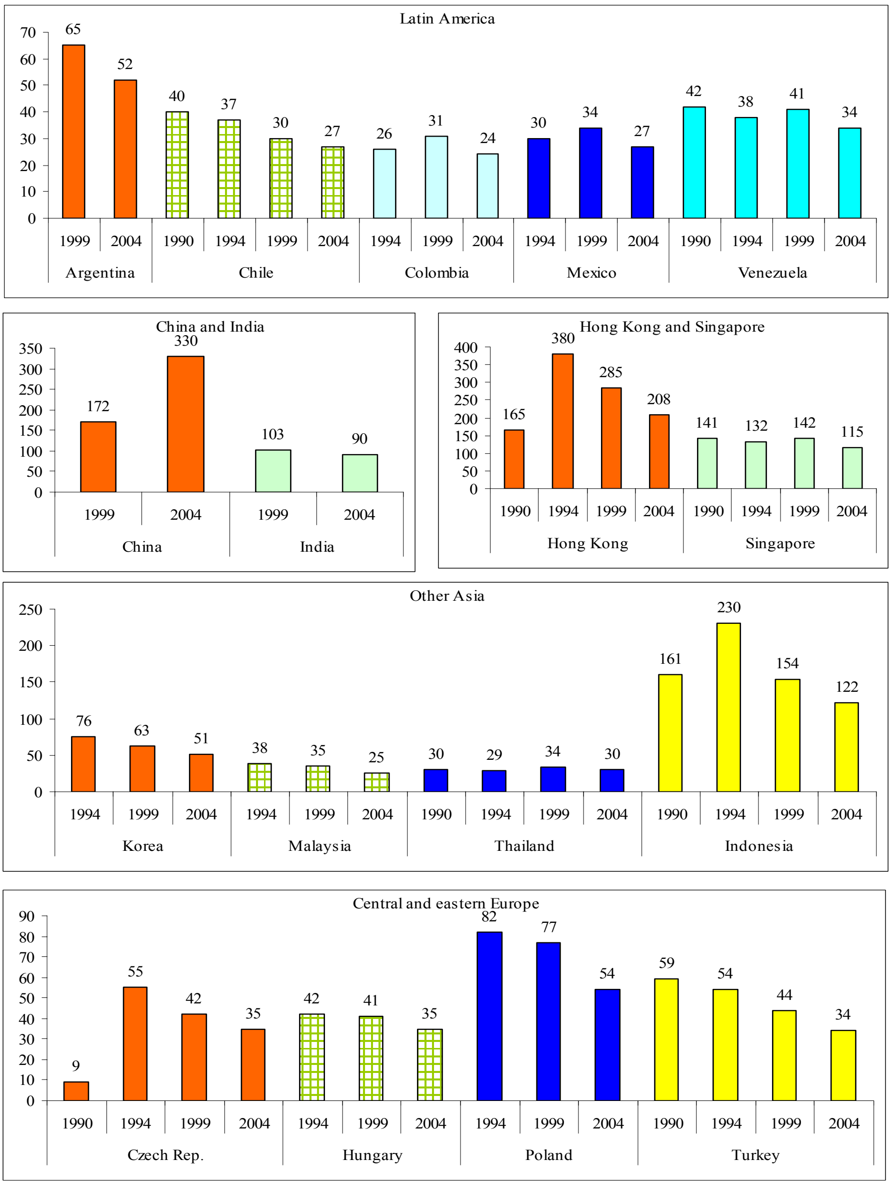
[12] See CGFS (2004, 2005) and Domanski (2005).

capitalisation; in Hong Kong, one very small bank; in Korea, two institutions with a 0.8% share in total market capitalisation each; and in Poland, three institutions with a combined share in stock market capitalisation of 5%.

Delisting has been by far the biggest issue in Mexico (see Sidaoui, 2006). From 2000 to 2005, five of the largest institutions in Mexico, representing 77% of total bank assets, were acquired by foreign-owned banks (foreign-owned banks now account for 82% of the country's total bank assets). All of these five institutions were subsequently delisted from the Mexican stock exchange, leading to a significant loss of market prices and scrutiny by independent analysts. Moreover, as these banks represented 15% of total stock market capitalisation at the time of acquisition (11% at the time of delisting), their delisting affected the development of the Mexican capital market more generally. Even though supervisors required subsidiaries to report as if they were listed, that information did not benefit the local market. In addition, the disclosure of timely and meaningful information about developments in institutions accounting for close to 80% of Mexico's banking sector was impaired, making it necessary to significantly improve information flows from parent banks to markets, and from home supervisors to host authorities. The delistings also raise broader questions about financial and corporate development in emerging market economies and possible policy responses.

Appendix

Chart A1: Number of Commercial Banks



Source: National data (BIS questionnaire).

Table A1: Return on Assets[1]

	State-owned banks		Private domestic banks		Foreign-owned banks		All commercial banks	
	1999	**2004**	**1999**	**2004**	**1999**	**2004**	**1999**	**2004**
Argentina	–0.1	0.3	1.4	1.1	–0.1	–3.0	0.2	–0.5
Chile	0.7	0.5	0.5	1.5	0.8	1.3	0.7	1.2
Colombia	–14.5	3.0	–0.2	3.5	–1.4	2.4	–3.7	3.2
Mexico	…	…	1.8	1.0	0.7	1.1	1.5	1.1
Venezuela	0.7	1.5	2.6	4.2	3.5	4.9	2.9	4.2
China	0.1	0.3	…	…	…	…	…	…
India	0.4	1.1	0.7	1.0	0.9	1.6	0.5	1.1
Korea	–3.7	1.9	–0.0	0.7	–1.0	0.6	–1.2	0.8
Thailand	…	…	–6.0	1.2	–0.2	2.3	–5.2	1.4
Czech Rep	…	0.9	–1.0	0.4	0.7	1.4	–0.3	1.3
Hungary	0.6	2.5	1.5	3.7	0.1	1.7	0.5	2.4
Poland	1.1	1.8	2.0	0.5	1.2	1.4	1.4	2.0
Turkey	1.1	2.5	4.3	1.6	5.4	2.3	–0.7	2.1
Israel	0.5	0.6	0.6	0.7	…	…	0.6	0.7
Saudi Arabia	...	…	1.7	2.7	…	…	1.7	2.7
Average[2]	*–1.3*	*1.5*	*0.7*	*1.7*	*1.0*	*0.9*	*–0.1*	*1.9*

Note: [1] *In percent.*
[2] *Excluding Argentina.*

Source: Central banks (BIS questionnaire); IMF.

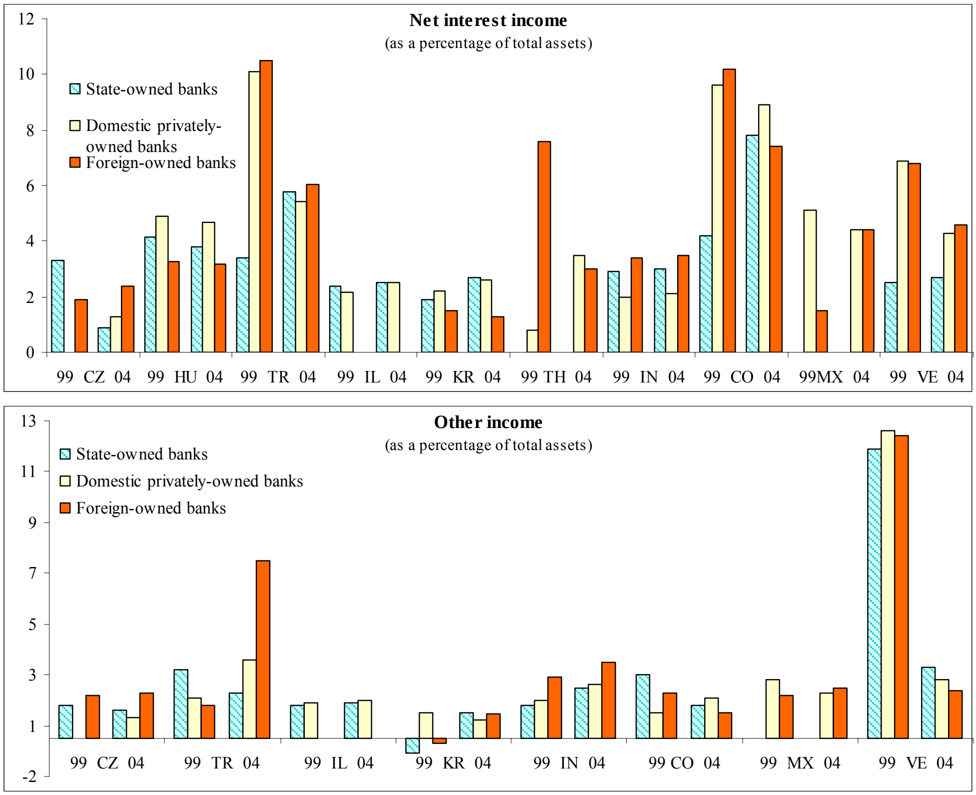
Table A2: Return on Equity[1]

	State-owned banks		Private domestic banks		Foreign-owned banks		All commercial banks	
	1999	2004	1999	2004	1999	2004	1999	2004
Argentina	–1.3	3.6	6.9	8.4	–0.8	–30.3	1.9	–4.9
Chile	12.9	12.1	9.6	21.0	8.6	14.0	9.4	16.7
Colombia	–159.0	36.3	–1.5	31.1	–11.9	21.3	–32.5	29.9
Mexico	…	…	17.6	11.9	10.5	12.4	16.3	12.3
Venezuela	4.3	13.7	20.2	32.7	26.0	38.7	21.7	34.0
India	8.5	20.9	12.5	16.3	9.9	15.4	9.2	19.3
Singapore	…	…	10.5	13.5	…	…	10.5	13.5
Korea	–60.1	29.6	–0.5	15.0	–7.8	11.2	–17.5	16.5
Czech Rep	…	14.9	–16.8	9.6	9.8	25.1	–4.3	23.4
Hungary	4.0	19.1	27.2	41.2	1.2	22.7	6.3	28.5
Poland	18.7	27.3	19.5	8.5	13.7	16.9	16.3	18.3
Turkey	27.6	26.6	33.2	10.3	44.9	–61.9	–14.0	14.0
Israel	10.5	11.4	11.8	11.6	…	…	11.3	13.2
Saudi Arabia	…	…	15.8	26.2	…	…	15.8	26.2
*Average*2	*–14.7*	*21.2*	*12.2*	*19.1*	*10.5*	*11.6*	*3.7*	*20.4*

Note: [1] *In percent.*
[2] *Excluding Argentina.*

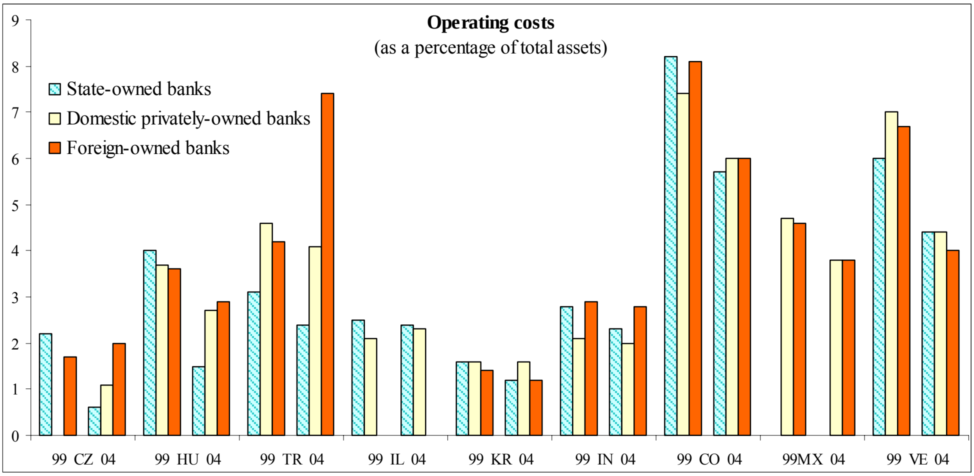
Source: Central banks (BIS questionnaire).

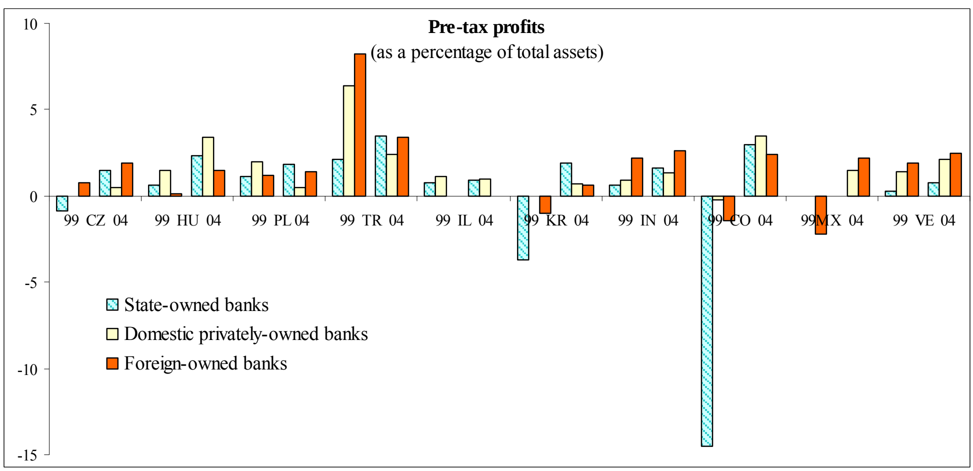
Chart A2: Income Sources, 1999 and 2004



Source: Central banks (BIS questionnaire).

Chart A3: Operating Costs and Pre-Tax Profits





Source: Central banks (BIS questionnaire).

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Private-Sector Credit in Central and Eastern Europe: New (Over)Shooting Stars? [1]

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1. Introduction[2]

The emerging literature on credit growth in transition economies has documented that lending to the private sector has recently grown dynamically in a number of transition economies.[3] This can be attributed to a number of factors, including macroeconomic stabilization, comprehensive reforms and privatization in the financial sector, the introduction of market institutions and legal reforms. However,

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[3] See e.g. Cottarelli, Dell'Ariccia and Vladkova-Hollar (2003), Schadler (2005), Backé and Zumer (2005), Duenwald, Gueorguiev and Schaechter (2005), Pazarbaşýoğlu et al. (2005), Coricelli, Mucci and Revoltella (2006) and Hilbers, Otker-Robe and Pazarbaşıoğlu (2006).

given the size of the recent boom in bank lending in Central and Eastern Europe (CEE) some commentators have questioned whether the growth rates recorded in these countries can be viewed as sustainable in the medium to long run.

In order to answer this question, this paper investigates the determinants of domestic credit to the private sector as a percentage of GDP in 11 CEE countries[4] as well as the equilibrium level of private credit-to-GDP ratio. We have tested our empirical specifications for a variety of panels composed of (1) transition economies, (2) developed small and large OECD countries and (3) emerging market economies from Asia and the Americas.

The use of these panels provides some interesting perspectives. First, in-sample panels give useful insights regarding the major determinants of credit-to-GDP levels in CEE. Second, as financial depth in most transition economies remains comparatively low, it might well be that private credit-to-GDP ratios have still remained below their equilibrium levels for most of the last decade. This would give rise to a bias in the econometric estimates, as credit-to-GDP ratios tend to converge toward their equilibrium levels.[5] To overcome this problem, we could use estimates obtained from panels composed of small open OECD and emerging market economies from Asia and the Americas to obtain the equilibrium credit-to-GDP ratios for 11 CEE countries.

The paper is structured as follows. Section 2 reviews some stylized facts regarding credit growth in the transition economies. Section 3 briefly overviews the relevant literature, sketches the issue of initial undershooting and overshooting of the credit-to-GDP ratio, and examines their consequences for econometric testing. Section 4 presents the economic specification used for the estimations and describes the dataset and the estimation techniques. Section 5 then presents and discusses the estimation results. Finally, Section 6 draws some concluding remarks.

2. Some Stylized Facts

To place credit developments in transition economies into context, it is useful to recall that financial systems in these countries are bank-based – about 85% of financial sector assets are bank assets – and that capital markets (in particular corporate bond and stock market segments) are generally not very developed. This implies that bank credit is the main source of external financing in these countries, although also foreign direct investment (FDI) has been important in some countries. Banking sectors in transition economies in CEE have undergone a comprehensive transformation in the past one-and-a-half decades, including wide-

[4] Countries included are Bulgaria, Croatia, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia.

[5] An analogous line of reasoning is applied in the literature on equilibrium exchange rates of CEE countries (Maeso-Fernandez, Osbath and Schnatz, 2005).

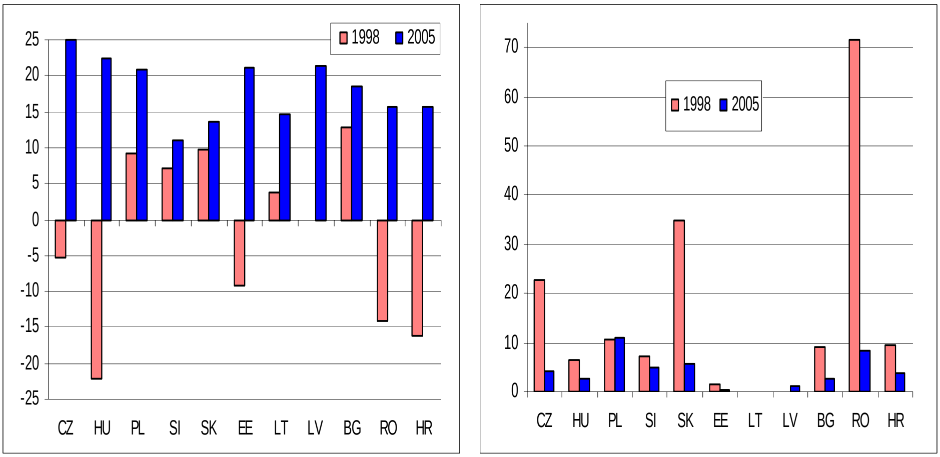
ranging reforms of regulatory frameworks and supervisory arrangements, bank consolidation schemes and – in almost all countries – sweeping privatization, mainly to foreign strategic owners (mostly financial institutions based in "old" EU Member States). Consequently, the governance of banks has greatly improved, and the performance and health of banking sectors have advanced substantially, as standard prudential indicators show.[6]

In 2005, the banking systems' capital adequacy ratio in the eleven countries ranged from 10.6% (Slovenia) to 20.3% (Romania), with an unweighted average of about 13%, well above the statutory minimum of 8% prescribed by the Basle rules. Profitability has risen considerably, as return on equity data show, and is now above the EU average (about 13%) in most countries covered in this study (see chart 1). Asset quality has improved, as non-performing loan ratios have fallen (see chart 1). Reserves and provisions now cover a considerable part of substandard assets in most of the countries under review her, as coverage ratios ranged from 60% to 100% in 2005 in most cases, with an unweighted average of about 85%.[7]

[6] On recent assessments of banking sector performance and strength in CEE countries see e.g. ECB (2005a, 2005b and 2006), EBRD (2005), IMF (2005a, 2005b and 2006), IMF Financial System Stability Assessments (http://www.imf.org/external/NP/fsap/fsap.asp).

[7] Romania (15%) and Hungary (44%) are outliers in this respect. It should be noted, however, that a low coverage ratio is not necessarily problematic, as it can be to some extent a reflection of the classification and the composition of non-performing assets. Moreover, a high capitalization may provide alternative cushion, if the coverage ratio of reserves and provisions is low.

Chart 1: Return on Equity (Left-hand Side, %) and Non-Performing Loans (Right-Hand Side, %)



Source: National central banks.

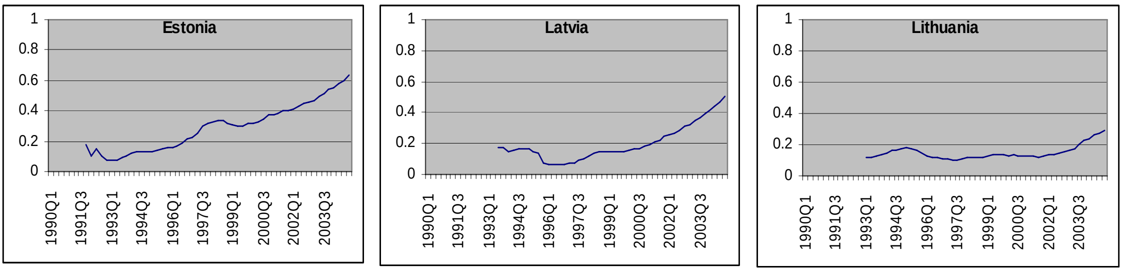
Note: Return on equity: Slovakia: value 2000 (instead of 1998); Romania: value 1999 (instead of 1998); Latvia: value 2004 (instead of 2005).Non-performing loans: Latvia: value 2004 (instead of 2005); no data available for Lithuania.

Chart 2 gives an overview of the development of credit to the private sector in percent of GDP[8] from the early 1990s to 2004. Several observations can be made on the basis of chart 1. Some countries, namely Estonia, Latvia, Lithuania, Poland, Romania and Slovenia, started transition with low credit-to-GDP ratios of around 20%. Estonia and Latvia then recorded a marked increase in the ratio, and the credit-to-GDP ratio also rose steadily in Slovenia from the early 1990s to 2004 although the overall increase was less pronounced than in the two aforementioned Baltic countries. Credit growth has picked up only recently in Lithuania and Romania, and for Poland, only a moderate increase can be observed during the second half of the period studied.

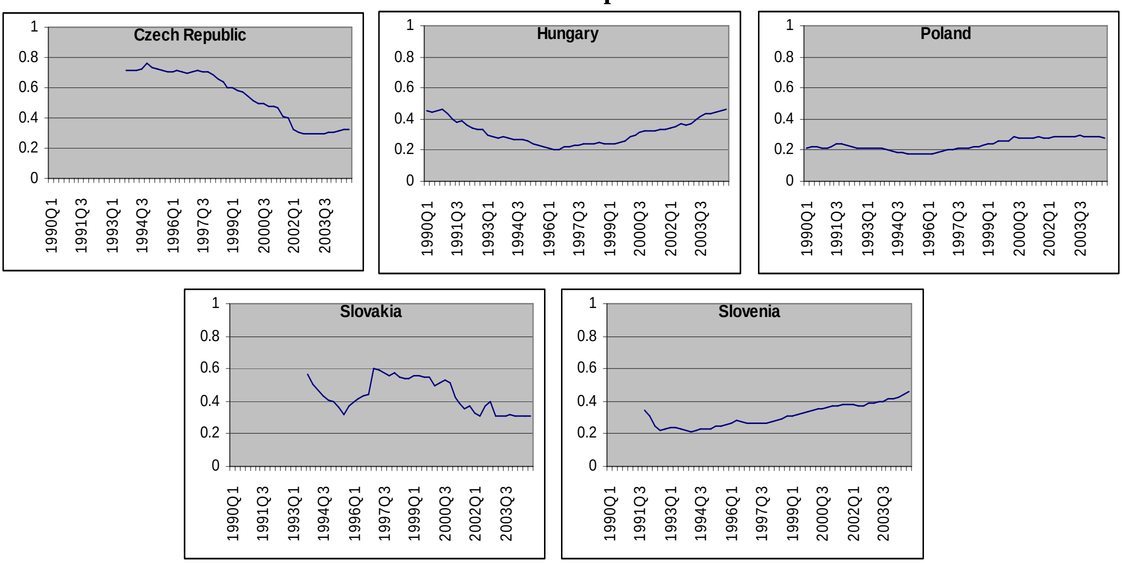
[8] The private sector is defined here as the nongovernment non-bank sector, i.e. households, nonfinancial corporations and nonbank financial institutions. Wherever disaggregated data are available, public nonfinancial corporations are separated from private nonfinancial corporations and are added to the public sector.

Chart 2: Bank Credit to the Private Sector as a Percentage of GDP, 1990 to 2004

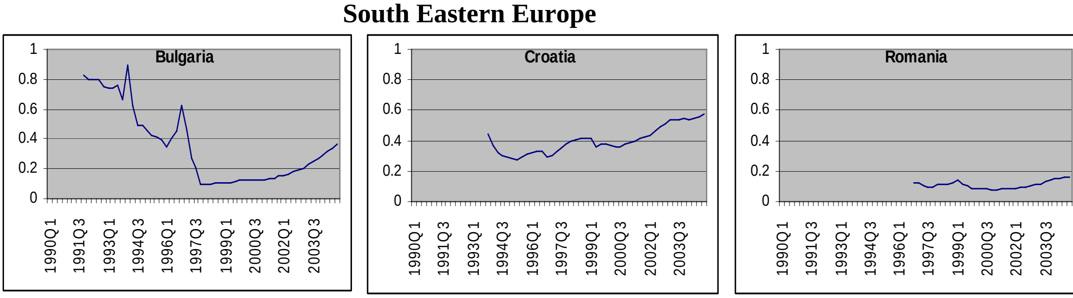
Baltic Countries



Central and Eastern Europe – 5



South Eastern Europe



Source: Authors' calculations based on data drawn from the IFS/IMF. For exact data definitions, see the data appendix.

By contrast, the second group of countries, notably Croatia and Hungary, started transition with higher credit-to-GDP ratios than the Baltic countries. After dropping considerably to close to 20%, the ratio started to increase, reaching pretransition levels in Hungary and growing to levels well exceeding 40% in Croatia by 2004.

The third group of countries, comprising Bulgaria, the Czech Republic and Slovakia, had the highest credit-to-GDP ratio at the beginning of the period (between 60% and 80%). For Bulgaria, this ratio came down to 10% in 1997, while expanding to close to 40% by 2004.[9] The Czech Republic and Slovakia also recorded a substantial contraction (to nearly 30% for both countries), while the ratios seem to have stabilized during the last couple of years.

The differences in initial credit-to-GDP levels can be traced largely to different approaches with respect to the financing of (credit to) enterprises under central planning across countries as well as strongly diverging inflation (price level adjustment) patterns across countries at the initial stage of transition. In turn, major temporary contractions in credit-to-GDP ratios during the transition process have mainly been due to banking consolidation measures, by which nonperforming assets were removed from banks' balance sheets.[10] Such nonperforming assets (mostly loans) had either been inherited from the previous era of central planning or were built up in the early transition years, when banking systems were still immature, flawed by inadequate regulation, connected lending and simple lack of experience.

[9] Note that the peculiar and rather fuzzy pattern of the credit-to-GDP ratio in Bulgaria shown in chart 1 is not due to data problems but, to a considerable extent, driven by exchange rate movements. The ratio rose sharply in 1994, 1996 and 1997 because of the depreciation of the domestic currency vis-à-vis the U.S. dollar, considering that a significant share of credit was denominated in foreign currency (mainly U.S. dollars). Correction of the credit ratio occurred in the post-crisis period because of the appreciation of the domestic currency and because of the write-off of nonperforming loans.

[10] Note that the displayed series include credit to private nonfinancial corporations in Croatia and Romania and in the three Baltic states, while they include credit both to private and public nonfinancial enterprises in the other countries (see data appendix on this issue). Hence, the high initial values observed for Bulgaria, the Czech Republic and to a lesser extent for Hungary and Slovakia might be also due to a large initial credit stock to state-owned firms. However, credit to public firms declined and reached low levels, as privatization and bank rehabilitation proceeded.

3. The Equilibrium Level of Private Credit

3.1 Literature Overview

Several theoretical and empirical studies have dealt with credit growth, financial deepening and lending booms. One body of literature on credit growth reviews the determinants of credit demand and credit supply. In the models on credit demand, real GDP, prices and interest rates are commonly the explanatory variables, although there is no "standard" model which would be widely used. On the supply side, a variety of credit channel models consider how changes in the financial positions of banks (bank lending channel) and borrowers (balance sheet channel) affect the availability of credit in an economy (see Hall, 2001, for a succinct overview). However, modeling and estimation techniques in this area are complicated due to difficulties with separating demand side effects from supply side effects (see e.g. Rajan 1994).

There are strong empirical indications of a positive interaction between finance and growth, usually with elasticity higher than one in the long run. This implies that credit to GDP levels rise as per-capita GDP increases, a process which is denoted as financial deepening (see Terrones and Mendoza, 2004 for a concise overview). In addition, empirical studies have examined the direction of causality; with most results suggesting that it is financial deepening which spurs economic development (see e.g. Beck, Levine and Loayza, 2000, and Rajan and Zingales, 2001 for an overview). While the results of this literature are appealing, it goes without saying that establishing genuine causality is intricate, while nonlinearities in the relationship between financial development and growth as well as country heterogeneity add to the problems of empirical analysis in this area (see discussion in Favara, 2003).

On lending booms, leading theories highlight several triggers, in particular (i) real business cycles caused by technological or terms-of-trade shocks (with highly pro-cyclical output-elasticity of credit demand), (ii) financial liberalization of an initially repressed financial system, (iii) capital inflows triggered by external factors, and (iv) wealth shocks originating e.g. from comprehensive structural reforms (see Gourinchas, Valdes and Landerretche (2001) for a survey). In addition, less-than fully credible policies (in particular exchange-rate based stabilizations) can also play a role in spurring credit booms, by setting off an unsustainable consumption boom (see Calvo and Vegh, 1999 for a review). Moreover, the financial acceleration literature, including the more recent literature on credit cycles, gives some theoretical insights in the mechanisms that drive or amplify credit expansions, that turns out to be non-sustainable and thus ultimately require a correction (Terrones and Mendoza, 2004). From the empirical literature on the topic one cannot conclude that lending booms typically lead to financial crises. As Gourinchas, Valdes and Landerretche (2001) point out, while the conditional probability of a lending boom occurring before a financial crisis may be quite high, this does not tell much about the converse, i.e. the conditional probability that a financial crisis will follow a lending boom.[11]

3.2 Initial Under- and Overshooting in Transition Economies

The question of whether or not credit growth in transition economies is excessive is closely related to the issue of what the equilibrium level of the stock of bank credit to the private sector as a share of GDP in those countries is. In this study, we define the equilibrium level of private credit as the level of private credit, which would be justified by economic fundamentals. Deviations from the equilibrium level occur if changes in the private credit-to-GDP ratio cannot be explained by changes in economic fundamentals. Hence, our notion of equilibrium is very close to the one used for instance in the literature on equilibrium exchange rates (Behavioral Equilibrium Exchange Rate – BEER) and in other fields of the economic profession.[12]

Chart 3 demonstrates when moving from point A through B to C that the level of private credit increases as a function of the underlying fundamentals. The depicted trajectory of the increase in the credit-to-GDP ratio (credit growth) can be thought of as an equilibrium phenomenon insofar as it is in line with economic fundamentals.

Nevertheless, we may also think of a situation when the observed credit-to-GDP ratio is out of tune with economic fundamentals. Point A' depicts the situation when the initial credit-to-GDP ratio is higher than what the level of economic development would justify (initial overshooting). By contrast, point A'' shows a credit-to-GDP ratio which is lower than what the level of economic development of the given country would predict (initial undershooting). In those cases, credit

[11] The financial accelerator literature, including the more recent literature on credit cycles, gives some theoretical insights in the mechanisms that drive or amplify credit expansions, which later on turn out to be non-sustainable and thus ultimately require a correction. Overshooting, to give just one example, may occur if bank managers follow overly loose credit policies in order to boost current bank earnings at the expense of future earnings to enhance their own reputation in the market. Moreover, as information externalities make banks' credit policies interdependent, banks coordinate to tighten credit policy in the event of an adverse shock to borrowers (Rajan, 1994).

[12] Note that our definition of equilibrium is not suitable for analyzing the connection between credit growth and external sustainability, financial stability aspects of credit growth or the optimal currency (foreign currency vs. domestic currency) or sectoral (households vs. corporate sector) composition of the credit-to-GDP ratio.

growth should differ from the equilibrium rate of growth, and this would secure the return to the equilibrium level of the credit-to-GDP ratio.[13]

Initial undershooting may be important for transition economies, most of which started economic transformation with lower levels of credit to GDP than other countries at the same level of development would have in other parts of the world. This is a heritage of central planning because of the underdevelopment of the financial sector under the communist regime. Hence, once economic transformation from central planning to market is completed, higher credit growth in the transition economies may partly reflect the correction from this initial undershooting to the equilibrium level of the credit-to-GDP ratio. This is shown in chart 3, where the move from A'' to B can be decomposed into (a) equilibrium credit growth, given by A'' to B'', and (b) the adjustment from initial undershooting to equilibrium (from B'' to B). However, in cases of high credit growth rates, the increase in credit to GDP may be even higher than the equilibrium change and the correction from initial undershooting would justify. The move from A'' to B' on chart 2 indicates such an overshooting where the excessive increase in credit to GDP is given by the distance between B and B'.

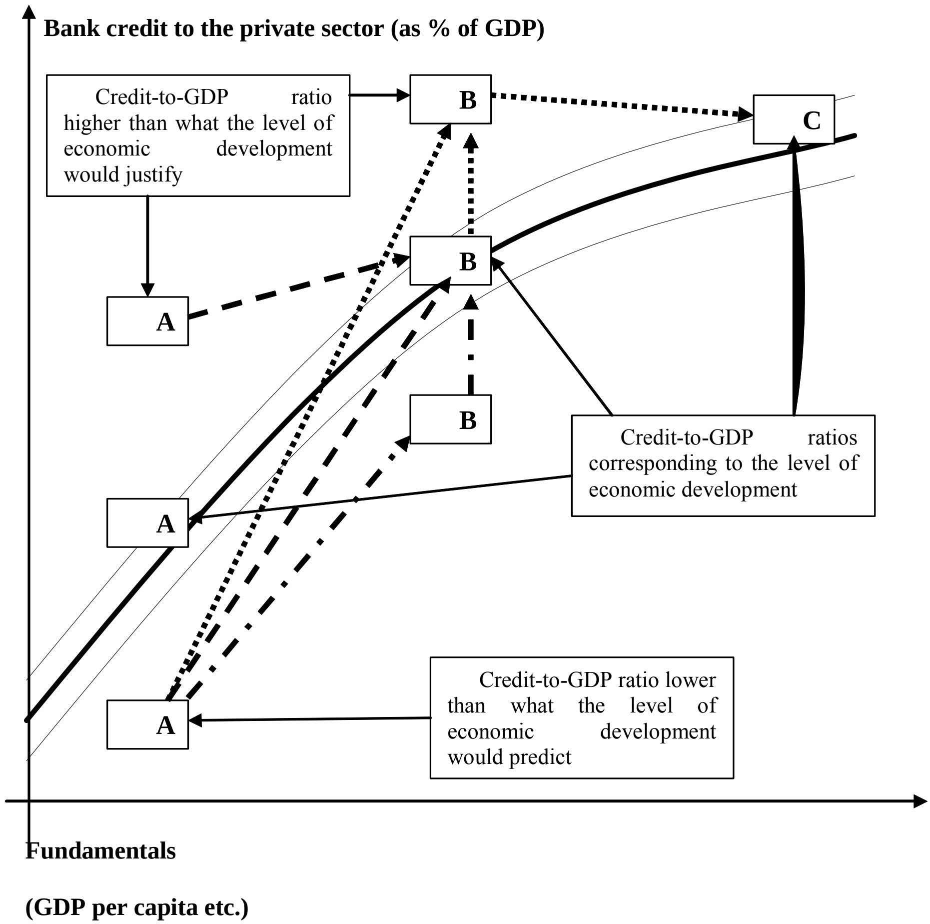
3.3 The Consequences of an Initial Under- or Overshooting

If there is initial under- or overshooting at the beginning of the transition process and if the adjustment toward equilibrium occurs gradually, implying persistent initial under- or overshooting, the use of panels including only transition economies may lead to severely biased constant terms and coefficient estimates, as put forward in the context of equilibrium exchange rates by Maeso-Fernandez, Osbath and Schnatz (2005). When regressing the observed credit-to-GDP ratio moving from A'' to B (instead of the equilibrium change from A to B) on a set of fundamentals, the slope coefficient would suffer from an obvious upward bias. By the same token, the constant term will be lower than it would be in the absence of an initial undershooting.

This is the reason why one would be well advised to use panels including countries which do not exhibit an initial under- or overshooting in the credit-to-GDP ratio or to use out-of-sample panels for the analysis of the equilibrium level of the credit-to-GDP ratio of transition economies.

[13] In both cases, credit growth is expressed in terms of GDP. For example, credit growth ([C(t)-C(t-1)]/C(t-1) is higher for countries with lower credit-to-GDP levels than for countries with higher credit-to-GDP levels if both countries have similar credit-to-GDP flows. Hence, it is more appropriate to relate changes in credit to the GDP to avoid this distortion (Arpa, Reininger and Walko, 2005), like we do in this study.

Chart 3: The Evolution of the Credit-to-GDP Ratio



3.4 Empirical Literature on Transition Economies

Cottarelli, Dell'Ariccia and Vladkova-Hollar (2005) were the first to estimate a model of the long-term relationship between the private sector credit/GDP ratio and a set of variables (see table 1) for a panel of non-transition economies. Subsequently, they produce out-of-sample estimates for private sector credit/GDP ratios of 15 CEE countries. As actual private sector credit-to-GDP levels were considerably lower in 2002 than the authors' estimates of the expected long-term credit/GDP ratios they conclude that private-sector bank credit levels in that year were not inconsistent with the structural characteristics of the economies under examination.

We are aware of two other recent studies, which also investigate the equilibrium level of private credit and the possible "excessiveness" of credit growth in transition economies. Boissay, Calvo-Gonzalez and Kozluk (2006) first estimate time series models including GDP-per-capita and real interest rates for a number of established market economies for periods with stable credit-to-GDP ratios. They then compare the average of the credit growth rates for transition economies obtained using the error correction specifications estimated for the developed countries with the observed credit growth in the transition economies. They also estimate time series models for transition economies, which include the real interest rate, a quadratic trend and a dummy aimed at capturing changes in credit growth after 2001. Their results indicate excessive credit growth in the three Baltic States and in Bulgaria and to a lesser extent also in Hungary and Croatia. At the same time, credit growth in Romania and Slovenia seems to be non-excessive.[14]

The study by Kiss, Nagy and Vonnák (2006) estimates a dynamic panel (Pooled Mean Group Estimator) model including GDP-per-capita, real interest rate and inflation of 11 euro area countries (excluding Luxembourg) to generate out-of-sample estimates for private sector credit-to-GDP ratios of the three Baltic countries and of the CEE-5 (Czech Republic, Hungary, Poland, Slovakia and Slovenia). They find that only Estonia and Latvia may have come close recently to equilibrium while the other countries have credit-to-GDP ratios below the estimated equilibrium levels. Besides being above the estimated equilibrium credit level, they define two other criteria which may indicate a credit boom: (a) if the observed credit growth exceeds the one implied by the long-run equilibrium relationship and (b) if the observed growth rate is higher than the speed of adjustment to equilibrium in the error-correction model. Overall, they find that the risk of a credit boom is high in both Estonia and Latvia according to these criteria, whereas Hungary, Lithuania and Slovenia might be in the danger zone because the observed growth rates are higher than the one derived from the long-run equilibrium relationship. In addition, they argue that possible credit booms are

[14] Two observations come to mind with regard to this paper. First, the quadratic trend may capture missing variables from their model (which indeed only contains real interest rates) and explosive trends due to credit boom or to adjustment from initial undershooting of credit levels. It is in fact surprising to see that a sizeable number of countries have excessive credit growth given that the quadratic trend has a very good fit thus leaving very little unexplained variation in the credit series. Second, the authors use Euribor for their only macroeconomic variable, the real interest rate. This may be problematic because some foreign currency denominated loans are linked to other currencies than the euro for instance in Hungary but also because Euribor neglects the country risk and default risk at the micro level.

mainly due to credit expansion to households and not to the nonfinancial corporate sector.[15]

We contribute to this literature by expanding the list of countries (11 transition, OECD and emerging market economies), the list of explanatory variables, by constructing carefully several possible benchmark country groups which share common characteristics with the transition economies (emerging markets, small emerging markets, small and open OECD countries) and by performing extensive sensitivity analysis of the estimation results.

4. Economic and Econometric Specifications

4.1 The Empirical Model

Most studies investigating credit growth employ a simple set of explanatory variables (see table 1), which usually includes GDP per capita or real GDP, some kind of (real or nominal) interest rate and the inflation rate (Calza et al., 2001, 2003: Brzoza-Brzezina, 2005; Boissay, Calvo-Gonzalez and Kozluk, 2006 and Kiss, Nagy and Vonnák, 2006). Hofmann (2001) extends this list by housing prices, a very important variable, because a rise in housing prices is usually accompanied by an increase in credit to the private sector.

Cottarelli et al. (2005) use indicators capturing factors driving the private credit to GDP ratio. These variables describe the degree of financial liberalization, the quality and implementation of accounting standards, entry restrictions to the banking sector and the origin of the legal system. Finally, they use a measure of public debt aimed at analyzing possible crowding-out (or crowding-in) effects.

The economic specification which we estimate for the private credit-to-GDP ratio relies on explanatory variables used in previous studies but also extends on them. We consider the following variables:

[15] It may be noted that the two additional criteria used by the authors have some drawbacks. First, the observed growth rates may be in excess of the one derived from the long-run equilibrium relationship because of the adjustment from initial undershooting. Second, the speed of adjustment to equilibrium differs if the actual observations are below or above the estimated equilibrium.

Table 1: Overview of Papers Analyzing the Determinants of Credit Growth

Author(s)	Dependent variable	Explanatory variables
Calza et al. (2001)	Real loans	GDP per capita in PPS, short- and long-term real interest rates
Calza et al. (2003)	Real loans	Real GDP growth, nominal lending rate, inflation rate
Brzoza-Brzezina (2005)	Real loans	Real GDP growth, real interest rate
Hofmann (2001)	Real loans	Real GDP, real interest rate, housing prices
Cottarelli et al. (2005)	Credit to the private sector (%GDP)	GDP per capita in PPS, inflation rate, financial liberalisation index, accounting standards, entry restrictions to the banking sector, German origin of the legal system, public debt
Boissay et al. (2006)	Credit to the private sector (%GDP)	GDP per capita, real interest rate (Euribor), quadratic trend
Kiss et al. (2006)	Credit to the private sector (%GDP)	GDP per capita, real interest rate, inflation rate

Note: GDP per capita in PPS (purchasing power standards) is obtained by converting GDP per capita figures using the nominal exchange rate given by the domestic and foreign price levels (P/P).*

GDP per capita in terms of purchasing power standards (PPS) ($CAPITA$). An increase in per capita GDP is expected to result in an increase in credit to the private sector. Alternatively, we also use real GDP ($gdpr$) and industrial production (ip) to check for the robustness of the GDP per capita variable and to see to what extent these variables, which are used interchangeably in the literature, are substitutes.

Bank credit to the public sector (including central and local government and public enterprises) in percent of GDP (C^G). As this variable captures possible crowding-out effects, any increase (decrease) in bank credit to the government sector is thought to give rise to a decrease (increase) in bank credit to the private sector. It should be noted that bank credit to the government measures crowding out better than public debt as employed in Cottarelli et al. (2005) because public debt also includes loans taken out abroad and because public entities may well finance themselves on security markets. Moreover, public debt is subject to valuation and stock-flow adjustments.

Short-term and long-term nominal lending interest rates (i). Lower interest rates should promote credit to the private sector, implying a negative sign for this variable. Calza et al. (2001) use both short-term and long-term interest rates, arguing that whether short-term or long-term interest rates play a more important role depends on the respective share of loans with fixed interest rates and variable interest rates. Because the nominal lending interest rates used in the paper show a high correlation with short-term interest rates (three-month treasury bills and money market rates), short-term interest rates are used as a robustness check rather than as an additional variable.

Inflation (p). High inflation is thought to be associated with a drop in bank credit to the private sector. Inflation is measured both in terms of the producer price index (PPI) and the consumer price index (CPI).

Housing prices ($p^{housing}$). There are a number of reasons why changes in housing prices might lead to changes in credit demand. First, increases in housing prices result in a rise in the total amount which has to be spent to purchase a given residential or commercial property. This is subsequently reflected in an increase in demand for credit through which the higher purchasing price can be fully or partly financed. This means that an increase in housing prices may generate more credit to the private sector. Second, rising housing prices may generate a rise in credit demand of homeowners as higher housing prices increase lifetime wealth according to Modigliani's lifecycle theory, which in turn leads to consumption smoothing by means of more borrowing. By contrast, higher housing prices are usually connected to higher rents, which decrease borrowing of renters (Hofmann, 2001). Third, credit demand may be affected by housing prices because Tobin's *q* theory is also applicable to the housing market. For example, a higher-than-unity *q* implies market value above replacement cost, and this promotes construction production, which is reflected in higher demand for loans. Changes in commercial and residential property prices also have an influence on credit supply. According to the broad lending channel, net wealth, serving as collateral for credit, determine the capacity of firms and household to borrow externally. Put differently, higher housing prices resulting in rising net wealth increase the amount of credit provided by banks. Overall, both credit supply and demand bear a positive relationship to housing prices from a theoretical viewpoint.

However, a fundamental problem arising here is whether price increases in the real estate market are driven by fundamental factors or whether they reflect a bubble. If price developments in the real estate market mirror changes in fundamentals, such as the quality of housing or adjustments to the underlying fundamentals, the ensuing rise in the stock of credit can be viewed as an equilibrium phenomenon. In contrast, in the event that high credit growth is due to the development of a housing price bubble due to speculation, the accompanying credit growth is a disequilibrium phenomenon from the point of view of long-term credit stock.

The degree of liberalization of the financial sector, in particular that of the banking sector. A higher degree of financial liberalization makes it easier for banks to fund credit supply. Because the financial liberalization indices (*finlib*) used in Abiad and Mody (2005) and Cottarelli et al. (2005) only partially match our country and time coverage, we use in addition the spread between lending and deposit rates to capture financial liberalization. A decrease in the spread can be an indication of financial liberalization in particular if it reflects more intensive competition among banks and also between banks and other financial intermediaries. It should be noted that the spread variables could also capture other factors than financial liberalization. With this caveat and limitation in mind, spread variables still are the most appropriate variables to capture financial liberalization that are available for all the countries in the different panels covered in this study.[16]

Public and private credit registries (*reg*). The existence of credit registries diminishes problems related to asymmetric information and the probability of credit fraud. This in turn leads to an increase in the supply of bank credit, all things being equal.[17],[18]

Our baseline specification includes per capita GDP, bank credit to the public sector, nominal lending rates, inflation rates and financial liberalization based on the spread:[19]

$$C^P = f(\overset{+}{CAPITA}, \overset{-}{C^G}, \overset{-}{i^{lending}}, \overset{-}{p^{PPI}}, \overset{-}{spread}) \tag{1}$$

[16] Note e.g. that the recent decline in the absolute level of spreads may be partly due to record low global interest rates.

[17] In contrast to Cottarelli et al. (2005), for econometric reasons, we do not include a variable that captures the tradition of legal systems of countries, which can affect financial development. The mean group estimator (MGE) estimation methods in section 5 do not allow the use of dummy variables that take a value of zero throughout the entire period.

[18] We are aware of the fact that the registry variable may not capture how credit contracts are enforced in courts. However, even though an easier seizure of collateral by banks may spark credit to households and small firms, such growth will probably be reflected in a one-off spike in growth rates.

[19] For some of the variables, it is notoriously difficult to separate whether they influence the demand for or the supply of credit. For instance, GDP per capita and the interest rate variables could affect both credit demand and supply. These problems were tackled in the literature on the credit channel by the use of bank- and firm-level data (for an overview, see e.g. Kierzenkowski, 2004). However, given that we are interested in aggregated macroeconomic variables, these identification issues are beyond the scope of this paper. Another important issue is that our approach is based on the assumption that credit markets are in continuous equilibrium. However, this is not necessarily the case as shown for instance in Hurlin and Kierzenkowski (2003) and Kierzenkowski (2005) for the case of Poland. Nevertheless, we leave this unexplored avenue for future research because of the complexity of the issue.

where C^P is bank credit to the private sector expressed as a share of GDP. In addition, it is worthwhile checking whether the robustness of the variables included in equation (1) is affected by the use of alternative measures often used in the literature (e.g. replacing GDP per capita by real GDP growth and real industrial production, or long-term lending rates by short-term lending rates, and the PPI by the CPI). These alternative variables are subsequently introduced one by one in the baseline specification, which yields six additional equations.

$$C^P = f(\overset{+}{ip}, \overset{-}{C^G}, \overset{-}{i^{lending}}, \overset{-}{p^{PPI}}, \overset{-}{spread}) \tag{2}$$

$$C^P = f(\overset{+}{gdpr}, \overset{-}{C^G}, \overset{-}{i^{lending}}, \overset{-}{p^{PPI}}, \overset{-}{spread}) \tag{3}$$

$$C^P = f(\overset{+}{CAPITA}, \overset{-}{C^G}, \overset{-}{i^{short-term}}, \overset{-}{p^{PPI}}, \overset{-}{spread}) \tag{4}$$

$$C^P = f(\overset{+}{CAPITA}, \overset{-}{C^G}, \overset{-}{i^{lending}}, \overset{-}{p^{CPI}}, \overset{-}{spread}) \tag{5}$$

$$C^P = f(\overset{+}{CAPITA}, \overset{-}{C^G}, \overset{-}{i^{lending}}, \overset{-}{p^{PPI}}, \overset{+}{finlib}) \tag{6}$$

The sensitivity check to the alternative specification is then followed by the use of the registry variable and by the inclusion of housing prices:

$$C^P = f(\overset{+}{CAPITA}, \overset{-}{C^G}, \overset{-}{i^{lending}}, \overset{-}{p^{PPI}}, \overset{-}{spread}, \overset{+}{reg}) \tag{7}$$

$$C^P = f(\overset{+}{CAPITA}, \overset{-}{C^G}, \overset{-}{i^{lending}}, \overset{-}{p^{PPI}}, \overset{-}{spread}, \overset{+}{p^{housing}}) \tag{8}$$

4.2 Estimation Methods

The first step is to check whether our series are stationary in levels. Four panel unit root tests are applied: the Levin, Lin and Chu (2002), the Breitung (2000), the Hadri (2000) and the Im-Pesaran-Shin (2003) tests. The first three tests assume common unit roots across panel members while the Im-Pesaran-Shin test allows for cross-country heterogeneity. A further difference is that the Hadri test tests the null of no unit root against the alternative of a unit root whereas the remaining tests take the null of a unit root against the alternative of no unit root.

If the series turn out to be nonstationary in levels but stationary in first differences, the coefficients of the long-term relationships for the relationships shown in equations (1) to (9) are derived using three alternative estimation techniques: a.) fixed-effect ordinary least squares (FE_OLS); b.) panel dynamic OLS estimates (DOLS) and c.) the mean group estimator (MGE) proposed by Pesaran, Shin and Smith (1999).

The panel dynamic OLS, which is the mean group of individual DOLS estimates, accounts for the endogeneity of the regressors and serial correlation in the residuals in the simple OLS setting by incorporating leads and lags of the regressors in first differences. The panel DOLS can be written for panel member i as follows:

$$Y_{i,t} = \alpha_i + \sum_{h=1}^{n} \beta_{i,h} X_{i,t} + \sum_{h=1}^{n} \sum_{j=-k_{i,1}}^{k_{i,2}} \gamma_{i,j} \Delta X_{i,t-j} + \varepsilon_{i,t} \tag{9}$$

where $k_{i,1}$ and $k_{i,2}$ denote respectively leads and lags and the cointegrating vector β' contains the long-term coefficients of the explanatory variables (with $h = 1,...,n$) for each panel member i.

The mean group estimator (MGE) is based on the error correction form of the ARDL model, which is given for panel member i as shown in equation (10) where the dependent variable in first differences is regressed on the lagged values of the dependent and independent variables in levels and first differences:

$$\Delta Y_{i,t} = \alpha_i + \rho_i (Y_{i,t-1} + \sum_{h=1}^{n} \delta_{i,h} X_{i,t-1}) + \sum_{j=1}^{l_1} \eta_{i,j} \Delta Y_{i,t-j} + \sum_{h=1}^{n} \sum_{j=0}^{l_2} \gamma_{i,j} \Delta X_{i,t-j} + \varepsilon_{i,t} \tag{10}$$

where $l1$ and $l2$ are the maximum lags. The long-term coefficients (β') are obtained by normalizing vector δ' on ρ.

Finally, we use the error correction term (ρ) obtained from the error-correction specification of the mean group estimator as tests for cointegration. A negative and statistically significant error correction term is taken as evidence for the presence of cointegration.

5. Results

5.1 Estimation Results

The estimations are carried out for quarterly data, covering 43 countries, which are grouped in 3 main panels: (a) developed OECD countries, (b) emerging markets from Asia and the Americas,[20] and (c) transition economies from CEE. The OECD panel is further split into 2 subpanels: (a) small OECD countries (excluding transition economies that have joined the OECD),[21] and (b) large OECD

[20] Argentina (AR), Brazil (BR), Chile (CL), India (IN), Indonesia (ID), Israel (IL), Mexico (MX), Peru (PE), Philippines (PH), South Africa (ZA), South Korea (KR), Thailand (TH). Although South Korea and Mexico are OECD countries, they can be viewed as catching-up emerging market economies for most of the period investigated in this paper.

[21] Austria (AT), Australia (AU), Belgium (BE), Canada (CA), Denmark (DK), Finland (FI), Greece (GR), Ireland (IE), the Netherlands (NL), New Zealand (NZ), Norway (NO), Portugal (PT), Spain (ES) and Sweden (SE).

countries[22]. The CEE panel consists of 11 transition economies and is also subdivided into 3 presumably more homogeneous groups: (a) the Baltic 3 (B-3): Estonia (EE), Latvia (LV) and Lithuania (LT), (b) the CEE-5: the Czech Republic (CZ), Hungary (HU), Poland (PL), Slovakia (SK) and Slovenia (SI), and (c) the Southeastern Europe 3 (SEE-3): Bulgaria (BG), Croatia (HR) and Romania (RO). The sample begins between 1975 and 1980 for the OECD countries, between 1980 and 1993 for the emerging market economies, and between 1990 and 1996 for the transition economies; it ends in 2004.[23]

Panel unit root tests are employed for level data and for first-differenced data. While the test results show that most of the series are I(1) processes, in a few cases, the tests yield conflicting results for level data. However, since the tests do not indicate unambiguously in any case that the series are stationary in level, we conclude that they are I(1).[24]

When analyzing possible long-term relationships between the private credit-to-GDP ratio on the one hand and the explanatory variables on the other, one has to make sure that the variables are cointegrated. As explained earlier, the error correction terms (ρ) issued from the estimated error correction form of the MGE are used for this purpose. The variables are connected via a cointegrating vector in the event that the error correction term is statistically significant and has a negative sign. According to results shown in table 2 below, most of the error correction terms fulfill this double criterion. A notable exception is the panel composed of the three Baltic states, as there seems to be only one cointegration relationship out of the eight tested equations.

Table 2: Error Correction Terms (ρ) from the Mean Group Estimator Estimations, Equation 1 to Equation 7

	Large OECD	**Small OECD**	**Emerging**	**CEE-11**	**CEE-5**	**B-3**	**SEE-3**
E 1	–0.094***	–0.063***	–0.132***	–0.281***	–0.225***	–0.103	–0.551***
E 2	–0.088***	–0.052***	–0.135***	–0.174***	–0.188***	–0.052	–0.273***
E 3	–0.092***	–0.055***	–0.202***	–0.188***	–0.183***	–0.135**	–0.248***
E 4	–0.097***	–0.069***	–0.189***	–0.226***	–0.136***	–0.049	–0.553***
E 5	–0.097***	–0.057***	–0.215***	–0.198***	–0.207***	–0.066	–0.315***
E 6	–0.160***	–0.049**	–0.211***	–0.233***	–0.269***	–0.120	–0.285**
E 7	–0.980***	–0.003**	–0.134***	–0.227***	–0.231***	–0.033	–0.414**

*Note: *, ** and *** indicate statistical significance at the 10%, 5% and 1% significance levels, respectively.*

[22] Germany (DE), France (FR), Italy (IT), Japan (JP), United Kingdom (UK) and the United States (US).

[23] The dataset is unbalanced, as the length of the individual data series depends largely on data availability. All data are transformed into logs. See appendix A for a detailed description of the source and the time span for variables.

[24] These results are not reported here but are available from the authors upon request.

We can now turn to the coefficient estimates obtained using equation (1), which are displayed in table 3.[25] GDP per capita enters the long-run relationship with the expected positive sign for the OECD and the emerging markets panels. This result is particularly robust for small OECD and emerging market economies, with the size of the coefficient usually lying somewhere between 0.4 and 1.0 for most of the alternative specifications. However, less robustness is found for the transition countries. This holds especially true for the CEE-5, for which GDP per capita turns out to be insignificant both in the baseline and in alternative specifications. Although cointegration could not be firmly established for the Baltic countries, it is worth mentioning that GDP per capita is usually statistically significant for this group as well as for the SEE-3. The fact that the coefficients' size largely exceeds unity reflects the upward bias due to quick adjustment toward equilibrium. The results furthermore indicate that the bias is substantially larger for the Baltic countries than for the SEE-3.

With regard to credit to the public sector, the estimations provide us with some interesting insights, as an increase (decrease) in credit to the public sector is found to cause a decline (rise) in private credit. This result is very robust for emerging market economies and for the CEE-5, as the coefficient estimates are almost always negative and statistically significant across different specifications. This lends support to the crowding-out/crowding-in hypothesis in these countries. Some empirical support for this hypothesis can be also established for the advanced OECD and for emerging market economies. By contrast, the estimated coefficients are either not significant or have a positive sign for the Baltic countries and for the SEE-3. This finding might mirror in particular the very low public indebtedness of the three Baltic countries.

Let us now take a closer look at the nominal interest rate and at the inflation rate. In accordance with the results shown in table 3 and in the appendix, there is reasonably robust empirical support for nominal lending rates being negatively linked to private credit in the CEE-5 as well as in emerging markets and small OECD countries. In contrast, the finding for the Baltic states and the SEE-3 is that interest rates mostly have a positive sign, if they turn out to be statistically significant. Note that these results are not really affected by the use of lending rates or short-term interest rates.

For emerging economies from Asia and the Americas, particularly strong negative relationships are detected between the rate of inflation and private credit. Although less stable across different specifications and estimation methods, this negative relationship between inflation and credit is also supported by the data for

[25] The estimations carried out for equations (1) to (7) are not reported here because they do not differ quantitatively from the results of the baseline equations. Nevertheless, they are available from the authors upon request.

the CEE-5 and for small OECD economies. By contrast, no systematic pattern could be revealed for the Baltic and Southeastern European countries.

Table 3: Estimation Results – Baseline Specification

$$Vector = X\beta'$$

$$X = (CAPITA, C^{G}, i^{lending}, p^{PPI}, spread)\ ;\ \beta' = [1, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5]$$

expected signs: [1,+,–,–,–,–]

	β_1	β_2	β_3	β_4	β_5
Large OECD					
FE_OLS	0.422***	–0.198***	–0.028	–0.394*	–0.050***
DOLS	0.391***	–0.034***	0.120***	0.241	0.171***
MGE	0.040	0.118	–0.016	–2.611**	0.207*
Small OECD					
FE_OLS	0.480***	–0.170***	–0.068***	–0.178	–0.037***
DOLS	0.540***	–0.065***	–0.082	0.678***	–0.143***
MGE	0.643***	0.057	–0.171	–1.272	0.281
Emerging					
FE_OLS	0.492***	–0.120***	0.136***	–0.263***	0.069**
DOLS	0.715***	–0.064***	0.187***	–0.436***	–0.001
MGE	0.583***	–0.386***	0.454	–0.492***	–1.172
CEE11					
FE_OLS	1.648***	0.053**	0.297***	–0.046	–0.640***
DOLS	0.981***	–0.169***	0.125	–0.105	–0.382***
MGE	2.043	–0.114	–0.027***	–0.263	–0.907**
CEE5					
FE_OLS	0.169	–0.276***	–0.031	–1.179***	–0.407***
DOLS	0.375***	–0.308***	–0.046	1.062***	–0.109*
MGE	–1.076	–0.222***	–0.057***	1.501	–0.985**
B3					
FE_OLS	2.554***	0.024	0.369***	0.396*	–0.458***
DOLS	2.227***	–0.121	0.083**	–1.676***	–0.481***
MGE	4.045	0.313	–0.124***	–2.852	–1.466
SEE					
FE_OLS	2.049***	0.455***	0.218***	–0.102**	–0.366***
DOLS	0.745***	0.013	–0.298	–0.479	–0.737***
MGE	1.654***	0.264	0.120	–0.616**	0.217

*Note: *, ** and *** indicate statistical significance at the 10%, 5% and 1% significance levels, respectively.*

An increase in financial liberalization, measured by (a decline in) spread, has the expected positive impact on private credit in small OECD economies and in the CEE–5, and also to some extent in the other transition economies. By contrast, the results for the financial liberalization index are less robust. Although the financial liberalization index is positively associated with private credit in OECD and emerging economies, it has an unexpected negative sign for all transition economies. An explanation for this may be the delay with which financial liberalization measured by this index is transmitted to private credit, whereas the spread variable captures the effective result of financial liberalization. The same mismatch between OECD and transition economies can be seen for private and public credit registries. While changes in credit registries produce the expected effect on private credit in OECD countries, the estimation results show the opposite happening in the transition economies.

Table 4: Estimation Results – Equation 8, Housing Prices

$$Vector = X\beta'$$

$$X = (CAPITA, C^{G}, i^{lending}, p^{PPI}, spread, p^{housing})\ ;\ \ \beta' = [1, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6]$$

expected signs: [1,+,–,–,–,–,+]

	ρ	β_1	β_2	β_3	β_4	β_5	β_6
Small OECD countries							
FE_OLS		0.611***	–0.166***	–0.098***	–0.125	–0.010	–0.062**
DOLS		0.286***	–0.064	–0.043	0.086	–0.081	0.399***
MGE	–0.207***	0.033	0.203***	–0.277**	–0.548	–0.080	0.587***
Large OECD countries							
FE_OLS		0.078*	–0.209***	–0.022	–0.855***	0.007	0.290***
DOLS		0.395***	–0.079***	–0.041*	–0.345	–0.040	–0.161**
MGE	–0.181***	–0.360	–0.049	–0.097*	–2.397***	0.139	0.544**
OECD countries with high growth rates in housing prices							
FE_OLS		0.111*	–0.160***	–0.066**	–0.787***	–0.025	0.336***
DOLS		0.334***	–0.171***	–0.043**	–0.412	0.022	0.040*
MGE	–0.176***	–0.838	–0.146***	–0.235**	–2.404**	0.432*	0.745**
CEE–4							
FE_OLS		0.316	–0.429***	0.032	–0.603***	–0.096	0.541***
DOLS		0.010***	–0.042***	0.050	–0.563**	0.002	–0.018
MGE	–0.125***	–0.651	–0.136***	–0.599***	0.080	–0.359	0.561**

*Note: ρ is the error correction term. *, ** and *** indicate statistical significance at the 10%, 5% and 1% significance levels, respectively.*

Because data on housing prices are available only for developed OECD countries and for four transition economies (the Czech Republic, Estonia, Hungary and Lithuania), the estimations are performed only for large and small OECD and transition economies. In addition, we constructed a panel including countries exhibiting large and persistent increases in housing prices over the late 1990s, possibly indicating the build-up of a real estate bubble (Canada, Spain, France, the U.K. and the U.S.A.). The results are not particularly robust for the small and large OECD economies, as the coefficient on housing prices changes sign across different estimation methods. For transition economies, even though the results are somewhat more encouraging, as the coefficient is always positively signed if it is found to be statistically significant, the estimated equations seem to be rather fragile in general.

Now, if we look at the group of countries with large increases in housing prices, it turns out that housing prices are positively correlated in a robust fashion with private credit, and that the other coefficient estimates are also in line with our earlier findings. However, the fact that the inclusion of housing prices yields robust results only if large increases have taken place on the property markets might suggest that housing prices mostly matter for private credit in the event of possible housing market bubbles.

5.2 Deviations from the Estimated Equilibrium Levels

We can now proceed with the comparison of the fitted values from the panel estimations for the transition economies to the observed values for the transition economies. This exercise makes it possible to see how far away the observed private credit-to-GDP ratio is from the estimated long-term value. As both the estimated long-run coefficients and the constant terms might be biased because of the possibility of a large initial undershooting followed by a steady adjustment toward equilibrium in transition economies, partly confirmed in table 3, we are cautious about the use of in-sample panel estimates, i.e. about using the coefficient estimates obtained for the transition panels. But more importantly, it is the lack of robustness of the coefficient estimates for the transition economies that prevents us from relying on the in-sample panel estimations. As tables 3 and 4 and in the appendix show, there is no single equation for transition economies, in which all coefficients are statistically significant and have the expected sign.[26]

One may argue that emerging market economies provide with a natural benchmark for CEE economies. However, the fact that some of the coefficient estimates for the emerging market economies are not significant or, importantly, have the wrong sign disqualifies the emerging markets as a benchmark. Small emerging market economies could also constitute a meaningful benchmark, given that these countries are broadly comparably to CEE countries both sizewise and in terms of per-capita GDP levels. Therefore, we have experimented with a smaller panel including only small emerging markets (Chile, Israel, Peru and South Africa) in order to adjust for possible size effects. Yet the coefficient estimates (not reported here) do not improve as the coefficients on credit to the government, the interest rate and the spread variable are either insignificant or have the wrong sign.

[26] Note that the analogy with the literature on equilibrium exchange rates in transition economies ends here, given that it is possible to establish robust relationships between the real exchange rate and its most important fundamentals, such as for instance productivity (see e.g. Égert, Halpern and MacDonald, 2006).

As a result, we are left with the OECD panels. The baseline specification estimated by means of fixed effect OLS for small open OECD economies[27] appears to be best suited, as this is the only equation where all coefficients bear the right sign and all but one are statistically significant (highlighted in table 3).[28][29]

When engaging in an out-of-sample exercise, i.e. using the coefficient estimates obtained for the small open OECD panel to derive the fitted value for transition economies, the underlying assumption is that in the long run there is parameter homogeneity between the small developed OECD panel and the transition countries. One might reasonably assume that in the long run (after adjustment toward equilibrium is completed) the behavior of transition economies will be similar to the present behavior of small OECD countries. Even though this homogeneity is fulfilled between the two samples, the estimated long-run values of the private credit-to-GDP ratio and the underlying deviation from equilibrium should be interpreted from a long-run perspective.

Given that no country-specific constant terms are available for the transition economies, the next intricate issue is how constant terms should be applied to derive the fitted values.[30] Our safest bet is to use the largest and the smallest constant terms (as well as the median constant term) obtained on the basis of the small OECD panel, which gives us the whole spectrum of possible estimated values for private credit.[31]

[27] Small OECD countries appear to be a reasonably useful benchmark, at least with respect to longer-term equilibrium levels. It should be noted that CEE countries have undergone a substantial convergence to small OECD countries in structural and institutional terms. As a consequence, four of these countries - the Czech Republic, Hungary, Poland and Slovakia - joined the OECD in the second half of the 1990s. Likewise, the EBRD transition indicators (see EBRD 2005), the standard reference point for gauging progress structural and institutional change in CEE countries, show that the countries under review in this study, in particular the Central European and Baltic countries but also Croatia had made substantial progress towards fully-fledged market economies already in the second half of the 1990s, while gradually advancing further in more recent years.

[28] Note that we also carried out estimations for a panel composed of catching-up EU countries (Greece, Portugal and Spain). However, the results (not reported here) appear to be not very robust.

[29] Given that this relationship may have undergone some changes over time, we carried out estimations for the following sub-periods: 1980-2004; 1985-2004 and 1990-2004. The coefficients do not change much both in terms of size and significance with the exception of the spread variable which becomes insignificant for 1985-2004 and for 1990-2004. Therefore, the estimation obtained for the whole period seems reasonably stable and thus suitable for proceeding further with it in the analysis.

[30] Note that Cottarelli et al. (2005), the only paper which derives the equilibrium level of private credit for transition economies, does not address the issue of the constant terms.

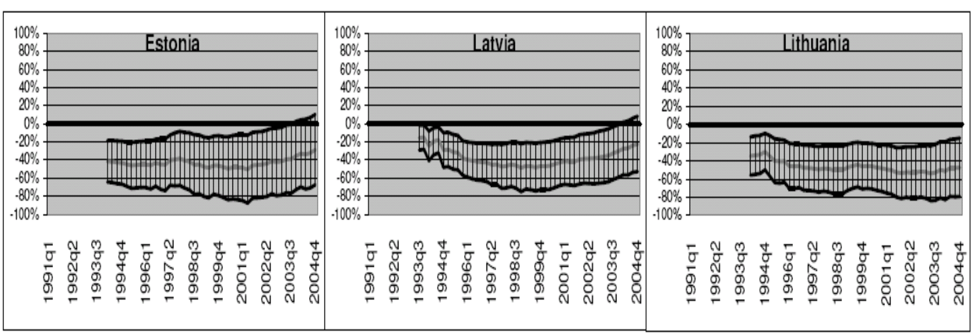
[31] Another reason for selecting the baseline specification is that the variables included are all expressed in levels, which ensures that the constant terms derived on this basis have a

The derived range of deviation is plotted on chart 4. The error margin is rather large. Consequently, if one considers midpoints, Croatia is now the only country which might have reached equilibrium by 2004. When looking at whole ranges, other countries, namely Bulgaria, Estonia, Hungary, Latvia and Slovenia, might have already reached equilibrium as well, while the mass of the estimated deviation is still located mostly on the undershooting side in 2004. At the same time, the upper edges of the estimated band come close to equilibrium for Hungary, Bulgaria, Poland and Slovenia. Moreover, it turns out that the initial overshooting might not have been that large for the Czech Republic and Slovakia, after all. Finally, it is interesting to see that the initial undershooting remains relatively stable for Lithuania and Romania, and also perhaps for Poland throughout the period.

One explanation for the initial undershooting observed for the countries under study is the low share of credit to households in total domestic credit. Chart 5 hereafter shows the importance of credit to households was substantially lower in transition economies than in the euro area in 1999. Nevertheless, a relative increase in credit to households can be observed over the last 7 years or so, in particular in countries where an adjustment towards equilibrium is shown on chart 4.

Chart 4: Deviations from Long-Run Equilibrium Credit-to-GDP, 1990 to 2004

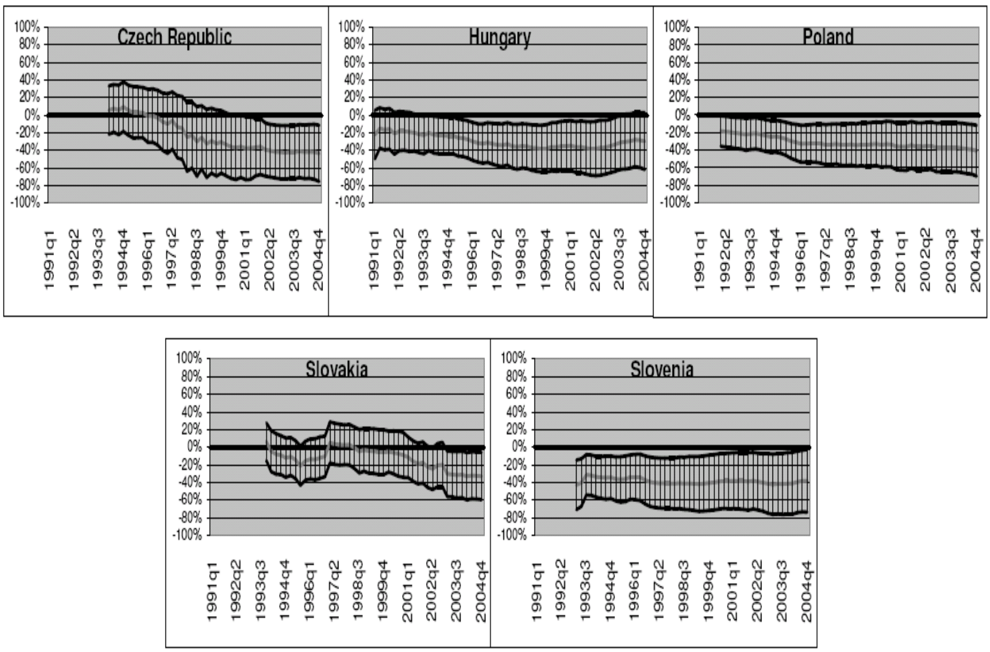
Baltic Countries



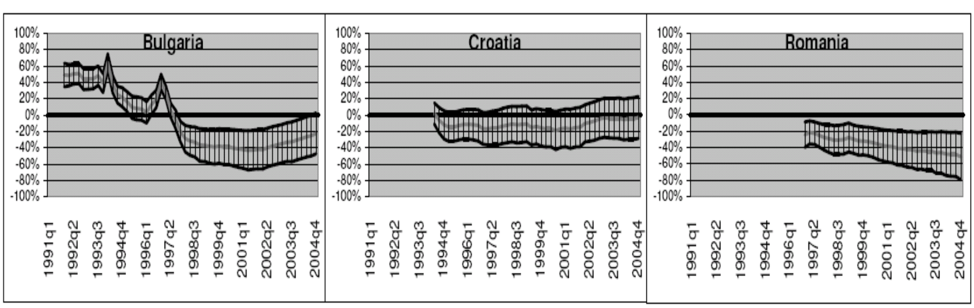
cross-sectional meaning. For instance, the constants would not have any cross-sectional meaning if indices with a base year were used (such as for industrial production or housing prices).

Chart 4 continued: Deviations from Long-Run Equilibrium Credit-to-GDP, 1990 to 2004

Central and Eastern Europe – 5

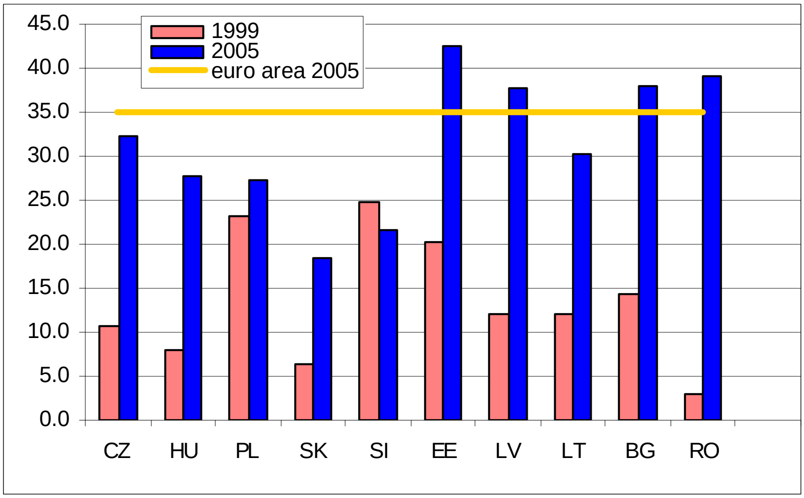


South Eastern Europe



Note: Negative values indicate that the observed private credit to GDP ratio is lower than what a particular country's GDP per capita would predict ("undervaluation"). Conversely, positive figures show an "overvaluation" of the private credit to GDP ratio.

Chart 5: Share of Credit to Households in Total Domestic Credit



Source: National central banks.

6. Conclusion

In this paper, we have analyzed the equilibrium level of private credit to GDP in 11 transition economies from CEE on the basis of a number of dynamic panels containing quarterly data for transition economies, developed OECD economies and emerging markets, and relying on a framework including both factors that capture the demand for and the supply of private credit.

Credit to the public sector (crowding out/crowding in), nominal interest rates, the inflation rate and the spread between lending and deposit rates aimed at capturing financial liberalization and competition in the banking sector turn out to be the major determinants of credit growth in the CEE-5, while GDP per capita is the only variable that enters the estimated equations in a robust manner for the Baltic and Southeastern European countries. Furthermore, we find the estimated coefficients for transition economies are much higher than those obtained for OECD and emerging market economies, which testifies to the bias caused by the initial undershooting of private credit to GDP in most countries. Another interesting result is that house prices are found to lead to an increase in private credit only in countries with high house price inflation. This finding disqualifies the house price variable from being included in the long-run equation to be used for the derivation of the equilibrium level of private credit.

We have emphasized that relying on in-sample panel estimates of the equilibrium level of private credit for transition economies is problematic not only because of the possible bias which shows up in the estimated coefficients due to the initial undershooting, but also because the equations estimated for transition economies are not sufficiently stable. To overcome these problems, we used small open OECD countries as a benchmark to derive the equilibrium level of private credit for transition economies as our intention to use the emerging markets panel as the benchmark was thwarted by the lack of robustness of the empirical results. Another reason for using the small OECD panel as a benchmark is the following. Transition economies are expected to converge in behavior to this panel in the longer run. Hence, such a panel provides us with coefficient estimates that can be used to infer equilibrium credit-to-GDP ratios which apply in the long run for transition economies.

We can draw some general conclusions with regard to undershooting and overshooting for transition economies, even though the application of the out-of-sample small open OECD panel to transition economies yields a wide corridor of deviations from the equilibrium. Considering the midpoint of the estimated interval, Croatia is the only country which might have reached the equilibrium by 2004. When looking at whole ranges, the upper edges of the estimated band reached equilibrium in Bulgaria, Estonia, Hungary, Latvia and Slovenia, although the mass of the estimated deviation was still located mostly on the undershooting side in 2004. Moreover, it turns out that the initial overshooting might not have been that large for the Czech Republic and Slovakia, after all. Finally, it is interesting to see that the initial undershooting remains relatively stable for Lithuania, Poland and Romania throughout the period. Overall, our results suggest that the CEE countries cannot be generally regarded as (over)shooting stars in terms of their credit-to-GDP ratios despite robust credit growth observed in most of the countries. However, Croatia seems to outcompete the other countries in the pursuit of the title of an (over)shooting star, albeit Bulgaria, Estonia, Hungary, Latvia and Slovenia are still trying hard to fight back.

The prospects for the future are that credit growth will very likely remain rapid in CEE or to accelerate further in those countries where it is still comparatively moderate, given that the underlying factors which support private sector credit dynamics will remain at work for some time to come. As experience shows, the rapid pace of credit expansion and its persistence in a number of countries does by itself pose the risk of a deterioration of asset quality. Moreover, it exposes lenders and borrowers to risks because of an increase in unhedged foreign currency lending. Furthermore, the rapid adjustment process toward equilibrium levels may trigger demand booms, causing current account deficits to move above levels that can be sustained over a longer period of time. However, we leave it to future research to determine empirically the optimal speed of adjustment toward equilibrium that does not jeopardize macroeconomic and financial stability.

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Data Appendix

Data Sources and Definitions

Quarterly data for bank credit to the private sector, credit to the government sector, short-term and long-term interest rate series, the consumer and producer price indices (CPI and PPI), real and nominal GDP, and industrial production are obtained from the International Financial Statistics of the IMF accessed via the database of the Austrian Institute for Economic Research (WIFO).[32] For some emerging markets, industrial production data is not available from this source, and hence are obtained from national data sources. Inflation is computed as a year-on-year rate (p_t / p_{t-4}). Lending rates are based on bank lending rates, and wherever not available, long-term government bond yields are used instead. Three-month treasury bill rates, and wherever not available, money market rates, are employed for short-term interest rates. The spread is calculated using lending (or, wherever not available, long-term government bond yields) and deposit rates.

GDP per capita expressed in PPS against the euro and the U.S. dollar is drawn from the AMECO database of the European Commission and the World Economic Indicators of the World Bank, respectively. The data start in 1975 for OECD countries and the emerging markets and in the 1990s for transition economies. The data are linearly interpolated from annual to quarterly frequencies.

The financial liberalization index (from 0 to 20) reported in Abiad and Mody (2003) and used in Cottarelli et al. (2005) is used for OECD and emerging market economies. This financial liberalization index is obtained from the aggregation of six subindices covering: (1) credit controls, (2) interest rate controls, (3) entry barriers to the banking sector, (4) banking sector regulations, (5) banking sector privatization, and (6) capital account transactions. The data cover the period from 1975 to 1996 and are available for all emerging countries and for nine OECD economies, namely the large OECD countries plus Canada, Australia and New Zealand. For the transition economies, the average of the liberalization index of the banking sector and that of the financial sector provided by the EBRD from 1990 to 2004 are used (rescaled from the range 1 to 4+ to the range 0 to 20, which corresponds to the scaling used in Abiad and Mody, 2005). The data are linearly interpolated from annual to quarterly frequencies. Data for the existence of public and private credit registries are taken from Djankov et al. (2005), who provide data for 1999 and 2003. The series we use can take three values: 0 in the absence of both public and private registries; 1 if either public or private credit registries are in operation and 2 if both exist. This variable basically captures whether a change

[32] IFS codes: Bank credit to the private sector: lines 22d (claims on private sector) and 22g (claims on nonbank financial institutions); credit to the public sector: lines 22a (claims on central government), 22b (claims on local government) and 22c (public nonfinancial enterprises). Note that data disaggregation for 22c (public nonfinancial enterprises) and 22d (claims on private sector) is available for Estonia, Latvia, Lithuania, Croatia and Romania, furthermore for Australia, Japan, Norway, Brazil, Chile, Indonesia, Mexico, Philippines and Thailand. For the remaining countries, the IFS database provides only series combining claims on private sector, public nonfinancial enterprises and nonbank financial institutions (claims on other resident sectors (22d),).

Interest rates: lines 60b, 60c, 60l, 60p and 61; CPI and PPI: lines 64 and 63; nominal GDP: lines 99b and 99b.c; real GDP: lines 99bvp and 99bvr; industrial production in industry: lines 66, 66..c and 66ey (in manufacturing).

between 1999 and 2003 alters the supply of credit during this period. GDP per capita, the financial liberalization index and the registry variable are transformed to a quarterly frequency by means of linear interpolation.

Housing prices are not available for emerging countries and for Italy. For transition economies, data could be obtained only for the Czech Republic, Estonia, Hungary and Lithuania. Quarterly data for the OECD economies are obtained from the Macroeconomic Database of the Bank for International Settlements (BIS) and Datastream. The source of the data is the respective central banks for the Czech Republic, France, Hungary and Lithuania and the national statistical office for Estonia.

The Span of the Data

Starting dates (the series end in 2004:Q4 unless indicated otherwise)
Private credit (the same applies to public credit unless indicated otherwise in parentheses):
OECD: 1975:Q1 to 2004:Q4.
Emerging markets: 1975:Q1 to 2004:Q4 except for AR: 1982:Q3 (1983:Q3); BR: 1988:Q3 (1989:Q3); ID: 1980:Q3; PE: 1984:Q1 (1985:Q1).
T*ransition economies*: HU, PL: 1990:Q4; BG, EE, SI: 1991:Q4; LT: 1993:Q1; LV: 1993:Q3; CZ, SK: 1993:Q4; HR: 1993:Q4 (1994:Q2); EE: 1991; RO: 1996:Q4.
Spread:
OECD: 1975:Q1 except for DE: 1977:Q3; NO: 1979:Q1; IE: 1979:Q3; FI, NL: 1981:Q1; NZ: 1981:Q4; ES: 1982:Q1; IT: 1982:Q3.
Emerging markets: ID, KR, PH: 1975:Q1; CL, TH: 1977:Q1; ZA: 1977:Q4; IN, MX: 1978:Q1; IL: 1983:Q1; PE: 1988:Q1; AR: 1993:Q2; BR: 1997:Q1.
Transition economies: HU, PL: 1990:Q1; BG: 1991:Q1; SI: 1991:Q4; HR: 1992:Q1; CZ, LT, SK: 1993:Q1; EE: 1993:Q2; LV: 1993:Q3; RO: 1995:Q4.
PPI (in parentheses **CPI** and **industrial production** (IP) if time span different):
OECD: 1975:Q1 except for PPI in NO, NZ: 1977:Q1; BE: 1980:Q1; IT: 1981:Q1.
Emerging markets: 1975:Q1 except for AR: 1987:Q1 (1994:Q1; not available); BR: 1992:Q1 (1992:Q1, 1991:Q1); CL: 1976:Q1 (1976:Q1, 1975:Q1); ID: IP:1976:Q1; IL: IP not available; KR IP: 1980:Q1; PE: 1980:Q1 (1980:Q1, 1979:Q1); PH: 1993:Q1 (1975:Q1, 1981:Q1).
Transition economies: BG: 1991:Q1; CZ: 1993:Q1; HR: 1993:Q1; EE: 1993:Q1 (1992:Q1, 1993:Q1); HU: 1990:Q1; LV: 1994: Q1 (1992:Q1, 1993:Q1); LT: 1993:Q1; PL: 1991:Q1; RO: 1992:Q1; SK: 1991:Q1 (1993:Q1, 1990:Q1); SI: 1992:Q1.
Real GDP:
OECD: 1975:Q1 except for BE: 1980:Q1; DK, PT: 1977:Q1; NZ: 1982: Q2.
Emerging markets: IN, IL, KR: 1975:Q1; CL, MX: 1980:Q1; PE: 1979:Q1; PH: 1981:Q1; BR: 1990:Q1; AR, ID, TH: 1993:Q1.

Transition economies: SI: 1992:Q1; HR, EE, LV, LT, RO, SK: 1993:Q1; CZ: 1994:Q1, HU, PL: 1995:Q1; data for IN and RO are linearly interpolated from annual to quarterly frequency.

All series stop in 2004:Q4.

GDP per capita in PPS:

Data based on the euro for *transition economies*: CZ, PL, RO: 1990; BG, HU, SI: 1991; LV, LT: 1992; EE, SK: 1993; HR: 1995.

Data based on the U.S. dollar for *transition economies*: HR, HU, PL, RO: 1990; BG, EE, LV, LT, SK, SI: 1991; CZ: 1992.

Housing prices:

OECD: The starting date of the series is as follows: DK, DE, NL, UK, US: 1975:Q1; JP: 1977:Q1; ZA: 1980:Q1; FR: 1980:Q4; CA: 1981:Q1; FI: 1983:Q1; SE: 1986:Q1; AU: 1986:Q2; ES: 1987:Q1, AT: 1987:Q2; PT: 1988:Q1; NZ: 1989:Q4; IE: 1990:Q1; BE, NO: 1991:Q4; GR: 1994:Q1. The series stop in 2004:Q4.

Transition economies: CZ: 1999:Q1 to 2004:Q4; EE: 1994:Q2 to 2004:Q4; HU: 1991:Q1 to 2004:Q4; LT: 2000:Q1 to 2004:Q4.

Booms and Busts Episodes and the Choice of Adjustment Strategy

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Abstract

Numerous industrialised and emerging market countries have experienced boom-bust episodes in asset prices in the past 20 years. This study looks at stylised facts and conducts statistical analysis for such episodes, distinguishing between countries that pursued an external adjustment strategy (and experienced a real effective exchange rate depreciation during busts) and those that relied on an internal adjustment process (and experienced no depreciation).

The study finds that different adjustment experiences are correlated with the degree of macroeconomic imbalances and balance sheet problems. Internal adjustment seems more prevalent when financial vulnerabilities, excess demand and competitiveness loss remain relatively contained in the boom. In the bust, internal adjusters experience more protracted but less deep downturns than external adjusters as imbalances unwind more slowly.

Some Central and Eastern European EU Member States have started showing signs of a boom. Against this background the experience of other countries may serve as an "early warning" and may raise awareness of related policy challenges.

Key words: Booms and busts, financial crisis, external and internal adjustment, competitiveness
JEL codes: E32, E63, E65

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1. Introduction

What have been the experiences with boom-bust episodes that have affected numerous industrialised and emerging market countries over the past 20 years? How has this experience been influenced by the exchange rate adjustment strategy?

These are the first questions that this study tries to answer by deriving stylised facts on a number of boom-bust episodes. Many of these episodes have already been studied extensively on a country basis or from a regional perspective. But this study takes a more comprehensive, global view and looks at experiences and patterns across different country groups including industrialised countries, emerging markets and a number of Central and Eastern European EU Member States.

Moreover, the study analyses different adjustment strategies in the face of busts. It differentiates between those countries that experienced a (CPI-based) real effective exchange rate depreciation/devaluation during the bust, which we call "external adjusters", and those that did not experience a devaluation, which we call "internal adjusters".

The study looks at the interaction of real and financial sector variables in boom-bust episodes where asset price cycles and their impact on private balance sheets constitute an important driving force. Volatility can be reinforced (or moderated) through domestic macroeconomic factors, competitiveness developments and the international financial environment. We first derive stylised facts for different country groups by examining a number of relevant flow and stock variables. In addition, we conduct statistical analyses as regards the incidence and patterns of boom and bust episodes and their impact on the exchange rate strategy.

The study finds that boom bust patterns are rather similar across industrialised and emerging countries. The former countries are perhaps less vulnerable but not immune to systemic risk with reversing international capital flows and busts turning into financial crises. Most importantly, we find that countries' different (exchange rate) adjustment experiences are correlated with the extent of macroeconomic imbalances and balance sheet deterioration.

- External adjusters tend to experience more pronounced booms with more overheating of demand, increases in prices and credit, loss of competitiveness and deterioration of (private, public and external) balance sheets than reported for internal adjusters.
- In busts, external adjusters tend to experience deep downturns and rapid recoveries as imbalances are initially more severe but, subsequently, also unwind more quickly. Internal adjusters tend to face less deep but more protracted downturns (and even deflation) as imbalances unwind more slowly and adjustment via the trade and credit channels takes more time.

What is the current situation of the Central and Eastern European EU Member States? The analysis of these countries suggests that there are a few new CEE

Member States that appear to be in the early stages of a boom while there are some others that appear to be further along. But clear and definite conclusions can not be drawn as yet, not least due to serious data problems. The experiences of boom-bust scenarios in other countries may nevertheless serve as an "early warning" and may raise awareness of related policy challenges.[2]

The study has a number of shortcomings. The choice to discuss stylised facts for a large number of diverse countries comes at the expense of a more detailed analysis for the individual countries or regions. Furthermore, we do not analyse whether countries "chose" a certain adjustment strategy or whether markets "forced" them to do so (or a mixture of the two).[3] We are mainly interested in detecting patterns of cross-country experiences with booms and busts as depending on the different exchange rate adjustment experience. Moreover, we focus on the interaction of various transmission channels and different country groups but not on institutional and micro-structural issues.

The study is organized as follows. The next section discusses conceptual issues, including the discussion of exchange rate adjustment experiences, the relevant sectoral variables and transmission channels and the methodology for identifying boom-bust cycles. Section three discusses experiences across different country groups. Section 3.1 reports the experience of ten industrialised countries with boom-bust phases in the 1980s-1990s. Section 3.2 turns to a small sample of emerging Asian market countries before section 3.3 examines the recent experiences of Portugal and the Netherlands. Section 4 takes stock of the situation in CEE EU Member States and looks at boom probabilities for these countries. Section 5 concludes.

2. Conceptual Issues

2.1 Transmission Channels

Boom-bust episodes are empirical phenomena. There is not just one and only one theoretical framework that defines them and explains their emergence and evolution. There are different theoretical approaches and measurement tools. Nevertheless, there is a considerable literature that looks at boom bust episodes primarily as a result of asset price "cycles" that propagate into the real economy via

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[2] In addition, with respect to the CEE EU Member States it would be interesting to look at boom episodes that did not end in a bust period. Including such episodes and comparing them in a systematic way with the current situation in the CEE EU Member States is, however, beyond the scope of this paper.

[3] The "choice" of adjustment strategy is to some extent "endogenous" to the extent of prevailing imbalances as larger imbalances ceteris paribus make internal adjustment more difficult/costly.

the credit transmission channel (Bernanke, Gertler and Gilchrist, 1999; Bordo and Jeanne, 2002; Borio, 2005).[4] This channel also forms our conceptual basis for identifying boom-bust episodes. However, there are also three other propagation mechanisms or transmission channels which play a role in the evolution of booms and busts and which warrant a brief discussion: ii) the trade channel, iii) the international financial channel, and iv) the fiscal channel.

As regards the first channel, the financial accelerator literature explains the emergence of boom-bust phenomena in the real and financial economy via asset supply rigidities and the *credit transmission channel*. When asset prices rise, the collateral value of the assets increases which, in turn, stokes credit supply and demand. This in conjunction with wealth effects provokes further real demand, output and asset price rises. Asset supply increases and growth of debt cause this process to reverse at some point (putting pressure on prices and net worth), and the opposite, mutually reinforcing dynamics fuel the downturn of asset prices and the real economy.

The second channel worth referring to in this context is the *trade channel*. In a period of strong growth, a country may lose competitiveness via rising unit labour costs. This initially further boosts domestic demand and imports but it undermines the tradable goods sector and export growth. Over time the weakening effect from exports and the trade-competing sector start to dominate, employment is falling, so that growth weakens. In the downturn and especially if a devaluation of the exchange rate takes place, relative price adjustments result in the revival of import-competing industries which together with rising exports helps the economy to emerge from the downturn. If the exchange rate is not devalued, the full adjustment has to come through a reversal of unit labour costs and relative prices between tradables/non-tradables before the revival of exports and import-competing industries can set in.

The third channel is the *international financial channel*. Capital inflows in the boom/high growth period keep the exchange rate appreciated and imports cheap. Sudden stops of inflows and net capital outflows can exacerbate (if not trigger) the asset price bust and downturn of the real economy by choking domestic demand, increasing pressure on the exchange rate and on the banking system (see Calvo, Izquierdo and Mejia, 2004; Calvo, Izquierdo and Talvi, 2003 or Eichengreen and Choudhry, 2005).

Much attention has been drawn to international capital flows exacerbating booms. They can give rise to significant short term and foreign-currency denominated debt, coupled with insufficient reserves. If then the boom turns to

[4] A somewhat different approach where frictions from adjustment costs to investment and monopolistic competition in the non-trade goods sector can generate boom bust phenomena in dynamics general equilibrium modelling is applied by Fagan and Gaspar (2005).

bust, a reversal of capital flows may make the exchange rate untenable which, in turn, exacerbates the effect of asset price declines on collateral value and non-performing loans and may even push the economy from "bust" into a "full-fledged" crisis. By contrast, the opposite case of countries experiencing capital inflows and pressure on their exchange rate to appreciate during bust phases has received much less attention. We will see below that this has been the experience of a number of countries whose currencies are considered safe havens including Switzerland and Japan. In these instances, relative prices in the tradable-non-tradable goods sectors in the bust have to adjust internally even more strongly.

The role of public finances (or the *fiscal channel*) is little discussed in the boom-bust literature. Jaeger and Schuknecht (2004) point to revenue windfalls during booms that derive from asset-based taxes and from indirect tax revenue that is boosted by wealth effects on domestic demand. These windfalls can be very significant. They can create incentives of pro-cyclical policies in the boom if such windfalls are not recognized as such and spent. Fiscal policies can also be (forced to become) pro-cyclical in the downturn if the fiscal position at the beginning of the bust is weak and adjustment is needed to prevent destabilizing deficit increases. Jaeger and Schuknecht find significant evidence for such pro-cyclical policies in a study of industrialised country boom-bust episodes since the 1970s.

Fiscal policies can also exacerbate boom-bust experiences via indirect effects through other channels. The financing needs arising from large fiscal deficits can increase vulnerability via the international financial channel if such deficits raise the current account deficit and hence the vulnerability to "sudden stops". Fiscal policies can worsen imbalances via the competitiveness/trade and domestic financial channels if public wage and employment increases put pressure on unit labour costs and if these, in turn, stoke credit and asset price booms.

The previous references to interlinkages between the sectoral channels, already point to the fact that vulnerabilities and risks need to be assessed from an inter-sectoral perspective. Or in other words, we need to look at *systemic risks* and not just at sectoral ones. The literature has started to acknowledge the importance of analysing intersectoral linkages, especially via balance sheet vulnerability (Allen, Rosenberg, Keller, Setser and Roubini (2002). Boom-bust phenomena that in some cases culminate in financial/BOP crises are intellectually interesting because of these very complexities. Moreover, they are economically relevant because of the significant adjustment needs and the large output and fiscal costs that can arise in protracted busts or deep crises (Watson, 2005; Honohan and Klingebiel, 2003; Bordo and Jeanne, 2002; Calvo et al.).

2.2 Identification of Booms and Busts

But when is there a boom and bust? There is by now a considerable literature that develops methodologies of identifying such phenomena. These include Bordo and

Jeanne (2002), Jaeger and Schuknecht (2004), or Detken and Smets (2004) for defining boom and bust episodes in industrialized countries. For emerging markets we proxy bust with financial crises as listed by Honahon and Klingebiel (2003) which include overt systemic financial crises and cases of financial distress where the net worth of the banking system is negative.

In this study, we look at (i) boom-bust episodes in industrialised countries since the mid 1980s as identified in Jaeger and Schuknecht, 2004 and defined as phases of major and persistent upswings or downturns in asset price indices as derived by Borio, Kennedy and Prowse (1994), [5] (ii) a number of Asian emerging market financial crises in the 1990s (as identified by Caprio and Klingebiel, 2003), where anecdotal evidence suggests that crises were preceded by asset price booms and (iii) the situation of the CEE EU Member States, where in some cases strong growth is also coupled with anecdotal evidence of very significant asset price increases.

2.3 Internal versus External Adjustment

When countries need to adjust in an environment turning from boom to bust as discussed above, they can either adjust through the exchange rate or the domestic price level or a combination of both. In this study we refer to *external adjusters* as those countries that allowed the nominal exchange rate to depreciate and (due to inflation differentials with trading partners being smaller than the devaluation) also experienced a depreciation of the real effective exchange rate. *Internal adjusters* are those countries that did not allow a depreciation or that experienced an appreciation of their real exchange rate through the depreciation of their trading partners. These countries had to correct real wage or tradable/non tradable sector imbalances via domestic price adjustments while external adjusters primarily (though not necessarily exclusively) addressed imbalances through the exchange rate change.

[5] Jaeger and Schuknecht (2004) construct boom and bust phases in real asset prices by following a dating method initially proposed by Harding and Pagan (2002), based on the so-called triangular methodology. This technique identifies the peaks and troughs of the asset price series (their turning points) whereby asset price indicators include stocks and real estate depending on their weight in the asset composition of an economy. They then calculate the duration of the period from trough to peak (the upswing) and from peak to trough (the downturn) and the amplitude of the asset price changes over these periods. By multiplying duration and amplitude, they arrive at a ranking of asset price upswings and downturns of which the largest quintile is referred to as boom-bust episodes. This enables them to separate booms and busts in asset prices from more normal asset price movements. The approach does not entail that a boom or a bust phase needs to be followed by another similar phase. The only exception in this list is Portugal where no comparable asset price indicator is available.

We measure exchange rate developments via the real effective exchange rate that adjusts nominal exchange rate changes for CPI differentials for the weighted average of trading partners. This is a more appropriate measure than unit labour cost-based measures which already include wage-based internal adjustment.

2.4 Country and Variable Choice and "Road Map" for Discussion

Table 1 presents the countries we examine, the periods of booms and busts and the respective adjustment experience of each country. We apply a so-called case study approach. For all countries the first year of the bust (or the first year of financial crisis) are set as t1. Previous years cover the boom period and are counted backward. Following years cover the bust and financial crisis/post crisis period respectively. We normally look at 12 year windows from t-6 to t5 (unless t1 is so recent that data until t5 is not yet available). We also conduct Wilcoxon/Mann-Whitney tests to see whether differences in the means and variances of external and internal adjusters are "significant".

In order to derive stylised facts for the case studies we look at a number of stock and flow variables that are most representative of the economic sectors and transmission channels discussed above. As shown in table 2, these include (i) output and demand related variables, (ii) credit and asset price variables and private sector debt (domestic financial channel), (iii) real effective exchange rate, unit labour costs and export/GDP (trade/competitiveness channel), (iv) the current account and external financing patterns and external debt (international financial channel) and (v) public deficits and debt (fiscal channel). As will be seen, this matrix of variables can in reality not be discussed fully homogenously as there are significant data gaps. But it provides a road map linking the conceptual framework with stylised facts discussed below.

As we put particular emphasis on exchange rate developments and the adjustment strategy, we will first distinguish external and internal adjusters according to their real effective exchange rate developments. The subsequent discussion starts from the presumption of a certain sequencing in boom-bust episodes that also suggests a certain order of the sectoral discussion. Initially domestic financial and real variables seem to interact and produce a boom. We start with the discussion of real sector variables before proceeding to asset prices and domestic financial developments.[6]

[6] The reverse order is also conceivable (see e.g. Jonung, Schuknecht and Tujula, 2005) given that this is something of a "chicken and egg problem". However, the more "conventional" ordering approach chosen in this study appeared to be a bit more reader-friendly.

Table 1: Sample Countries and Relevant Dates/Episodes

Country	Boom	Bust
I. Industrialised countries, mid 1980s – early 1990s		
"External adjusters"		
Australia	1984-89	1990-95
Canada	1985-89	1990-95
Finland	1986-89	1990-93
Italy		1991-97
Spain	1985-90	1991-95
Sweden	1986-89	1990-93
United Kingdom	1983-89	1990-94
"Internal adjusters"		
France	1986-90	1991-96
Japan	1979-90	1991-02
Switzerland	1983-89	1990-96
II. Asian emerging economies, late 1990s	Bust= start of Asian Crisis	
Hong Kong ("internal adjuster")	1997	
"External adjusters"		
Korea	1997	
Thailand	1997	
Malaysia	1997	
III. Industrialised countries, late 1990s – today ("internal adjusters")	Boom	
Netherlands	1993-2000	
Portugal	1996-2000	
IV. Central and Eastern European EU Member States	Observation period	
Bulgaria	All 1999-2006	
Czech Republic		
Estonia		
Hungary		
Latvia		
Lithuania		
Poland		
Romania		
Slovakia		

Table 2: Key Variables to Analyse Transmission Channels

	Real (demand and supply)	**Domestic financial**	**Trade/external competitivenes s**	**International financial**	**Fiscal**
Flow variables	Δ output/ consumption/ investment	Δ credit Δ asset prices	Δ real effective exchange rate/ unit labour costs/ exports/current account	External financing via FDI, portfolio and other inv.	Deficit
Stock variables	Cumulative changes	Household & corporate debt	Cumulative changes	Cumulative changes	Public debt

The trade and competitiveness channel tends to contribute to ending the boom and is therefore discussed next. The international financial channel can already exacerbate the boom but since its greatest relevance is for emerging markets (e.g. sudden stops) it is discussed fourth. Although public finances can exacerbate or moderate boom-bust episodes, the government often picks up the tap (as losses are socialized) and, hence, this channel is discussed last.

3. Analysing Past Boom-Bust Episodes in Industrialised and Emerging Economies

3.1 Boom-Bust Episodes in Industrialized Countries in the 1980s and 1990s

This section will look at case studies and stylised facts for 10 industrialised country which experienced (asset price) boom-bust episodes in the late 1980s and 1990s.[7] As we are particularly interested in the external environment and exchange rate policies, we will present stylised facts for 1) the seven countries that experienced a depreciation of their real effective exchange rate in the bust. They include the UK, Sweden, Finland, Australia, Canada, Italy and Spain. These external adjusters are mostly countries that had relatively fixed exchange rates in the boom but floated/devalued their currencies early in the bust. 2) The three countries that experienced an appreciation in the real effective exchange rate (CPI-based) in the bust. This group includes Japan, Switzerland and France (called internal adjusters). Two of the internal adjusters had floating currencies throughout the boom and bust

[7] For earlier studies, applying a stylised facts approach on these phenomena see also Jaeger and Schuknecht (2004), Jonung, Schuknecht and Tujula (2005), and IMF (2000).

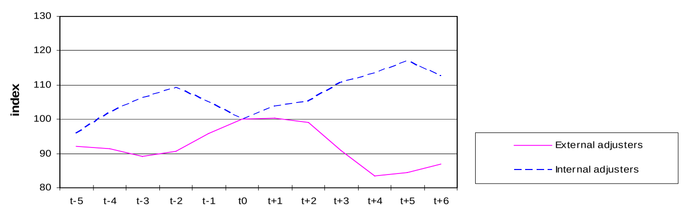
(Japan and Switzerland). France maintained its peg to the German Mark (while widening the band) so that it experienced a relative appreciation as its main trading partners devalued.

To prepare the discussion of stylised facts across economic sectors from the angle proposed above, we look at *exchange rate developments* in the sample countries. Chart A1 shows that over the boom period, the ten countries experienced a (CPI-based) real effective exchange rate appreciation (REER) by roughly 10% on average. This appreciation was more pronounced in the group of external adjusters, especially towards the end of the boom. Most interesting is the pattern during the bust: external adjusters show a strong depreciation in the REER as of the second/third year of the bust (when most sample countries actively devalued or floated their currencies). A continued, gradual appreciation was experienced by the internal adjusters.

As regards the *real economic environment***,** Chart A2 shows the relatively strong growth performance in the boom of the late 1980s (t-5 to t0): three to four percent real growth. In the bust (t1-t6), growth not only fell rapidly but significant divergences across the two countries groups emerged. Amongst external adjusters growth fell very rapidly. Growth on average was negative by t2. This was followed by a sharp rebound in t3-t4. Internal adjusters experienced a more gradual slowdown to near zero growth in t2 and t3. But the subsequent recovery was also much more gradual: average growth only recovered to 1-2% by the end of the observation period. In more concrete terms, it reflects the experience of six years of very low growth in France and Switzerland and the very persistent weak growth performance of Japan.

Chart 1: Boom-Bust Episodes in Industrialized Countries in the 1980s and 1990s

Chart A1: Real effective exchange rate in 1980s-90s boom-bust episodes



Note: External adjusters are Australia, Canada, Finland, Ireland, Spain, Sweden and United Kingdom. Internal adjusters are France, Japan and Switzerland.

Chart A2: Real economic growth in 1980s-90s boom-bust episodes

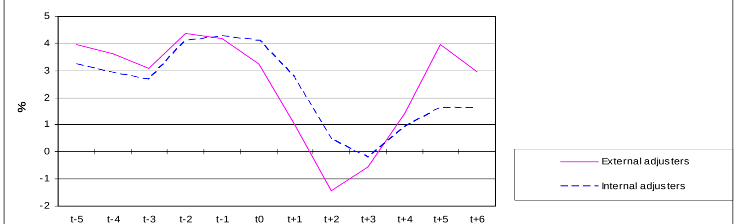
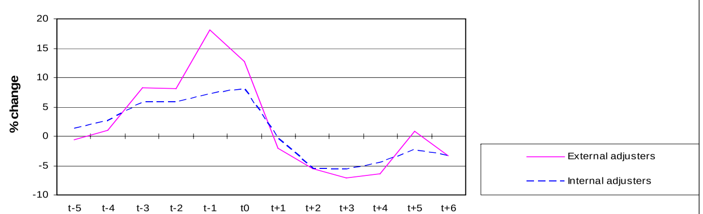


Chart A3: Real estate prices in 1980s-90s boom-bust episodes



Note: Real estate prices are adjusted for inflation and average growth.

Chart A4: Domestic credit growth in 1980s-90s boom-bust episodes

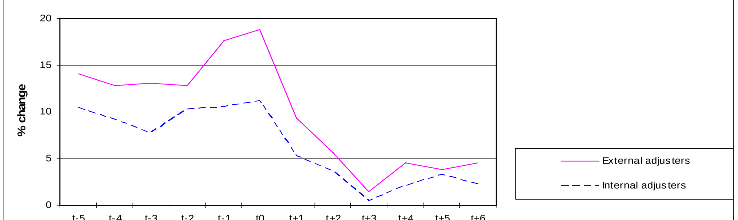


Chart A5: Inflation in 1980s-90s boom-bust episodes

Chart A6: Real short-term interest rates in 1980s-90s boom-bust episodes

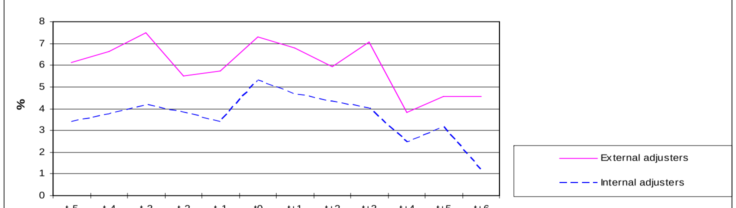


Chart A7: Unit labour costs in 1980s-90s boom-bust episodes

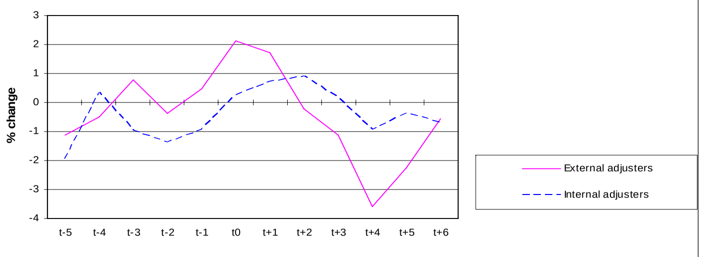


Chart A8: Export growth (volumes) in 1980s-90s boom-bust episodes

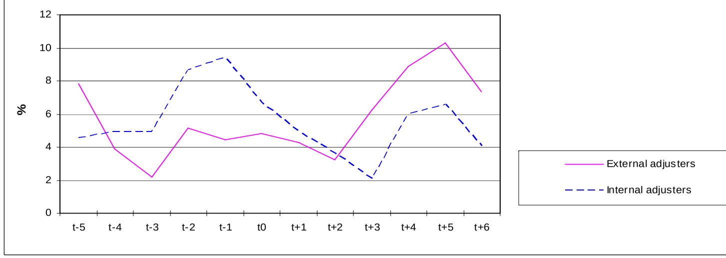


Chart A9: Export in 1980s-90s boom-bust episodes

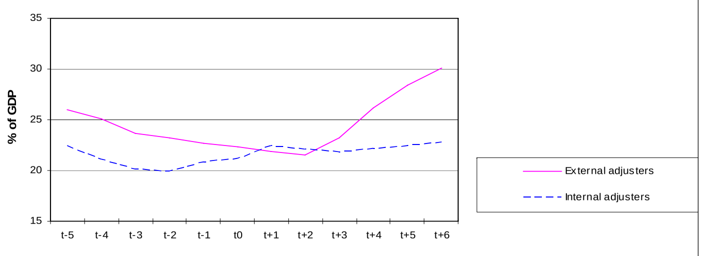


Chart A10: Current account balance in 1980s-90s boom-bust episodes

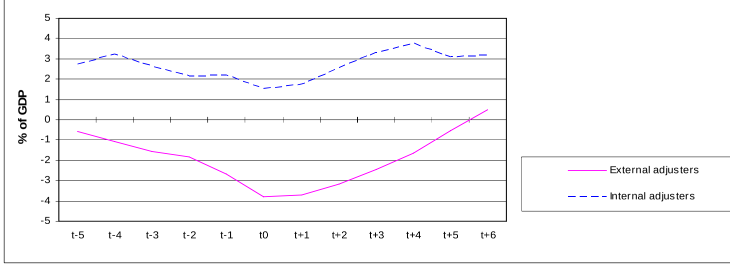


Chart A11: Fiscal balance in 1980s-90s boom-bust episodes

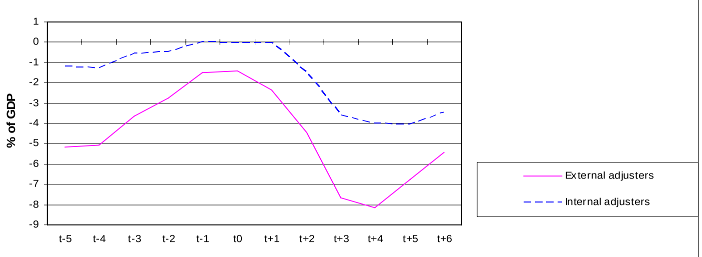
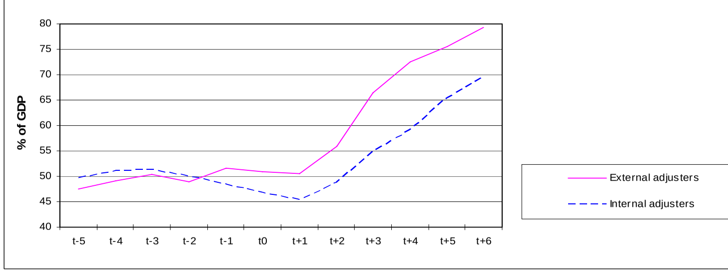


Chart A12: Public debt in 1980s-90s boom-bust episodes



Turning to demand composition, all countries experienced a strong consumption and investment boom where average growth rates exceeded output growth (hence contributing to growing external imbalances). In the bust, the picture reversed with the result that cumulative positive departures from trend consumption and investment were balanced out or even overshot in the other direction in the bust.[8] Consumption and investment declines were even steeper in the group of external adjusters, in line with the picture for r eal output growth.

Turning to the *domestic financial environment*, Chart A3 illustrates the significant real estate price cycle that was experienced over the boom and bust phase across all countries. Note that price increases during the boom were somewhat more extreme for external as compared to internal adjusters. The real estate price cycle coincided with a distinct credit cycle where credit growth accelerated gradually until the end of the boom phase and decelerated sharply thereafter (Chart A4). The credit cycle was also more pronounced for the external adjusters.

The credit and real estate boom led to a considerable build up of private sector debt in the boom that was (at least partly) reversed in the bust. However, good quality data for that period is only available for very few countries. Household and corporate debt ratios increased on average by 50% during the boom. This increase was largest in Japan (from 140% of GDP in 1980 to about 210% of GDP in 1991). On the whole, this picture is consistent with the view that the asset price cycle in conjunction with the credit channel contributed to the emergence and evolution of boom-bust phases.

Inflation developments are also interesting and point to important problems in the policy mix for external adjusters (Chart A5). On the whole, inflation picked up rather gradually over the boom before declining in the downturn. But as regards the two country groups, external adjusters on average experienced significantly higher inflation than internal adjusters in the boom. While inflation differentials were relatively moderate on a year-to-year basis (inflation peaked in t1 at 7% for the average of external adjusters versus 4% for internal adjusters) the differential accumulated over the years is nevertheless very significant. In the bust, external adjusters experienced continued inflation pressures partly as a result of significant exchange rate devaluations.

The different inflation performance in conjunction with the credit channel could be an explanation for the hammock-shaped pattern of protracted low growth experienced by internal adjusters during the bust that contrasts with the V-shaped pattern experienced by external adjusters. The high inflation rate of the external adjusters facilitated a rapid price adjustment in real estate markets without much of

[8] Jaeger and Schuknecht (2004) found that the average cumulative deviation from trend in booms and busts amounted to about 10% for consumption and about one quarter for investment.

a nominal price fall (given that real estate prices tend to be nominally sticky). Low inflation countries, by contrast, experienced a much more protracted housing market adjustment. The adverse effects of drawn-out house price adjustments via collateral effects on credit markets were, therefore, probably less pronounced but more persistent than in high inflation countries.

Interest rate policies at the time of the boom reflect the fact that external adjusters' monetary policies were geared at exchange rate targeting where high capital inflows kept interest rates less counter-cyclical than the strong demand (and asset price) boom might have otherwise suggested. Initially, interest rates also stayed high during the bust, first to defend the exchange rate and subsequently to fight inflationary pressures (Chart A6). Internal adjusters pursued somewhat more counter-cyclical policies and real interest rates rose more strongly in the boom while coming down gradually in the bust.

Turning to *competitiveness and the trade channel***,** we find a strong divergence in competitiveness and trade developments over time and across country groups. We start with unit labour costs (ULC) which followed a very similar pattern as real and financial variables did before with ULC growth increasing over the boom before declining significantly in the bust (Chart A7). The internal adjusters experienced a much more gradual trend of unit labour cost increases and decreases. External adjusters, however, first experienced significant ULC increase before experiencing a rather sharp reversal.

Real effective exchange rates and unit labour costs together are probably largely responsible for the emerging pattern of trade developments and, hence, the role of the trade channel. External adjusters experienced much weaker export growth than internal adjusters over the boom period (Chart A8). In the bust this relation reversed. Export volume growth increased strongly in the context of depreciation/devaluation while it remained more muted in countries pursuing internal adjustment. As a result export/GDP ratios were roughly flat over the boom and bust cycle for internal adjusters (Chart A9). For external adjusters, this ratio first declined in the boom before rising again in the bust. This supports the claim that competitiveness changes and the trade channel were much less relevant in the case of internal adjusters. This may be the second (and perhaps even more important) reason why the growth profile during the bust is that of protracted low growth (hammock) for internal adjusters than that of deep downturn followed by a rapid recovery (V shaped) for external adjusters.

Pulling the information from the real and external side together, we should find—and indeed this is confirmed in Chart A10—that the current account balance (the counterpart to domestic savings and investment balance) deteriorates for the average of all countries in the boom before improving in the bust. This pattern is more distinct for external adjusters in the boom and bust due to stronger domestic demand growth in excess of output growth and competitiveness loss, slower export growth in the boom and a more distinct reversal of these trends in the bust. As regards the level of the current account balance, external adjusters on average report a deficit over the full cycle which increases strongly over the boom. Internal adjusters show a very modest deterioration in the current account in the boom and a moderate improvement in the bust and overall levels remain positive throughout the cycle.

The *international financial channel* at first seems less relevant for this sample of countries where the volatility of capital flows is normally assumed to play a lesser role. Nevertheless given significant current account deficits in one group, the pattern of "other investment flows" (bank lending etc) for this group is worth looking at. The literature has identified exposure to short term foreign capital as a main vulnerability that could lead to abrupt adjustment needs in periods of confidence loss ("sudden stops"). External adjusters experienced strong inflows in the boom (up to 3% of GDP per annum) and strong outflows over the first three years of the bust (also up to almost 3% of GDP). In this particular instance it is also worthwhile looking at individual countries in this group. The clearest sign of emerging market type "sudden stop" phenomena is visible for Finland and in particular Sweden. In the latter case, inflows of other investment amounted to 12.2% of GDP in 1990 before reversing to -2.7% in 1991 and staying negative until 1993. In these cases, anecdotal evidence also points to strong exposure to foreign-currency denominated debt in the private sector but firm data is hard to come by. Overall, this information suggests that the international financial channel may have played a significant role in the choice of adjustment strategy and the abruptness of adjustment (strong fall in growth) in at least some of these countries.

What role did *fiscal policies play*? First, fiscal variables reflect the revenue impact of the boom bust cycle where revenue windfalls from capital gains related taxes boost fiscal accounts in the boom before reversing in the downturn. Consequently, the fiscal balance improves over the boom before deteriorating strongly over the bust (Chart A11). Again there is a difference in magnitude and levels in parallel with current account developments: internal adjusters experience better fiscal balances and a slower deterioration of fiscal accounts than external adjusters. The data also replicates the findings of Jaeger and Schuknecht (2004) who argue that political economy dynamics induce insufficient consolidation in the boom (the windfall is spent) and result in significant average deficits over the boom-bust cycles. In some (but not all) cases deficits reached magnitudes that required pro-cyclical consolidation to avoid macroeconomic destabilization.

The pattern of deficits and growth over boom bust cycles determine public debt developments: debt goes down modestly in the boom before rising rapidly in the bust (Chart A12). Another way of interpreting this result is that the benefits of the boom are largely "privatized" while the costs are "socialized". In some cases, this socialization was rather direct through bank and balance sheet support, e.g., in the cases of Sweden and Finland (Jonung and Stymne, 1997; Eschenbach and

Schuknecht, 2004). In these countries, debt increased by 30 and 50% of GDP respectively.

While the Chart illustrates well the sustainability risks from boom-bust episodes for external adjusters, it perhaps underemphasizes this risk for internal adjusters. Internal adjusters' debt dynamics look healthier at first but they also become very adverse over time and continue to remain adverse for longer as the adjustment period is more prolonged. Japan is the most extreme case in point.

Some simple *statistical tests* support the evidence as regards differences in the means and patterns over boom-bust episodes across the two country groups for most of the variables discussed above. Table 3 shows the results for Wilcoxon/Mann-Whitney tests for differences in the means of the two country groups ("populations") and tests of equal Variance (F-tests) for differences in the volatility of the series. Real effective exchange rates, credit, inflation, export shares and fiscal and external balances are found to differ significantly between internal and external adjusters. As regards real GDP and export growth, differences in means and volatility are not confirmed. This suggests that the main difference between the two groups is not the level and extremeness of the business and trade cycle per se while the more accentuated downturns and upswings in the groups of external adjusters is not picked up well with this test. The equal variance test finds a significant difference in the amplitude of swings for the export share and the current account balance and perhaps even more importantly, for unit labour costs and (not quite statistically significant) real estate prices.

Table 3: Wilcoxon Signed Ranks Test for Selected Indicators, Boom-Bust Episodes in Industrialised Countries in the 1980s and 1990s

	Median (Wilcoxon/Mann-Whitney)	**Eq.Variance (F-test)**
	P-value	
REER	**0.00*** **	0.87
Real GDP growth	0.62	0.40
Real estate prices	0.84	0.14
Domestic credit growth	**0.09***	0.22
Inflation	**0.00*** **	0.77
ULC	0.89	**0.06***
Export growth (volumes)	0.98	0.61
Export (% of GDP)	**0.002*** **	**0.002*** **
Current account balance, % of GDP	**0.00*** **	**0.03** **
Fiscal balance, % of GDP	**0.003*** **	0.29
Public debt, % of GDP	0.26	0.16
Interest rate	**0.00*** **	0.77

*Note: ***/**/* denotes significance at 1%, 5% and 10% significance levels. Each series has 12 observations.*

In summary, these stylised facts and statisticcal tests confirm the hypotheses expressed above: the domestic financial, trade and fiscal channels seem to contribute to the evolution of boom-bust episodes. Countries on average depicted the expected pattern of economic and financial developments. However, external adjusters were prone to experience more pronounced upswings with stronger asset price and credit growth, more competitiveness loss and unfavourable trade developments, external vulnerability due to cumulative external imbalances, and less favourable fiscal positions. In the bust, external adjusters experienced more pronounced troughs as competitiveness loss and balance sheet problems depressed demand. But once the currency was floated/devalued, growth also recovered more swiftly and forcefully, as exports rose and imports were being replaced by domestic output. The group of internal adjusters experienced fewer and smaller macroeconomic imbalances at the end of the boom and economic and financial developments were less volatile. However, internal adjustment implied a more prolonged real and financial downturn.

While the findings clearly illustrate the intersectoral linkages that are at work, it is also important to point to systemic risks that can arise from their interplay. In Sweden, Finland and Japan, busts turned into financial crisis and both groups of countries were affected. Sweden and Finland also faced emerging market-type reversals of capital flows. They adjusted their exchange rate policy as part of the crisis resolution strategy. This strategy reinforced immediate adjustment needs in the real and financial sectors but also facilitated the emergence from the bust. Internal adjustment, pursued by Japan, did not prevent crisis but its emergence was delayed and its impact was felt in a more protracted manner.

3.2 Emerging Markets: Some Experiences in South-East Asia in the Late 1990s

When looking at boom-bust episodes from a global perspective, emerging markets are the second country group that is most interesting to analyse. In some cases, countries experienced not just one but several (more and less severe) booms and busts over recent decades. In many cases, countries started with fixed exchange rates in the boom which proved unsustainable when "good" times came to an end. In a number of countries, financial/balance of payment crises occurred at the turn from "good" to "bad" times.

Given that we have insufficient data on booms and busts in asset prices (beyond largely anecdotal references) but rather good data on incidences of financial crisis (Honahon and Klingebiel, 2000; Caprio and Klingebiel, 2002), we use this as criterion for selecting our sample countries and for determining the turning points from boom to bust under our case study approach. We focus on only a few "Asian crises" in the past decade, namely Korea, Malaysia and Thailand (Asian 3). These countries floated/devalued their currencies and could hence be considered external adjusters. In addition, we examine the experience of Hong Kong, the only emerging economy of the region which should be considered an internal adjuster as it retained its currency board. These countries' experiences can be seen as particularly relevant from a European perspective as the level of development, policy and development strategies show some similarities with that of the CEE EU Member States.

We follow the same "procedure" as in section 3.1 when going through the different transmission channels and indicator variables. The first bust/crisis year of 1997 is considered as t1. Since all sample countries experienced booms and busts/crises at the same time, we can refer to "real" years and we report data for the period 1991 to 2002 (which corresponds to the twelve year period of t-5 to t6 in the previous section). However, even though data for these countries are better than for many other non-industrialised countries, the analysis is hampered by scarce data availability on certain key indicators. There is virtually no data on real estate prices and booms which from anecdotal evidence have played a significant role in several Asian countries. We have no comprehensive data on private sector indebtedness and even indicators of cost competitiveness are scarce and often not fully reliable. Hence the picture is sketchier than in the previous section.

Starting with *exchange rate developments* (i.e. the CPI-based REER), the pattern of developments in our sample of Asian financial crises economies is similar to that of industrialised country boom bust episodes (Chart B1). The REER appreciated slightly in the boom preceding the bust/crisis. The bust/crisis starting in 1997 led to a drastic devaluation for the Asian 3. Thereafter, the REER appreciated again and some of the competitiveness gain was eroded. Hong Kong made the opposite experience with the real effective exchange rate initially appreciating. Thereafter, appreciation in its major trading partners led to some correction, but on the whole the REER remained much higher than before 1997.

When looking at the *real sector*, we find confirmation of a strong economic upswing in the years before the bust/crisis (Chart B2). In particular, economic expansion of the Asian 3 was very fast, averaging 5-10% annual real growth between 1991 and 1996. Hong Kong's economic growth was somewhat lower at around 5% per annum. The bust/crisis led to a dramatic fall in growth especially in the Asian 3, and mostly in the first and second bust/crisis year before recovering. After a somewhat more moderate fall, growth remained more volatile and on average somewhat lower in Hong Kong.

When looking at *domestic financial conditions*, the Asian 3 experienced a pre-bust/crisis credit boom that is more extreme though, as a pattern, very reminiscent of the experiences in some industrialised countries (Chart B3). Evidence also points to deteriorating credit quality and growing non-performing loans in the pre-bust/crisis phase which contributed to later problems. Hong Kong also experienced strong credit growth but the magnitudes were more in line with industrialised country booms. In Hong Kong, real estate prices more than tripled in real terms between 1990 and 1997 (Chan, Peng and Fan, 2005).

In the downturn, the difference between adjustment strategies becomes fully apparent. Credit growth slowed strongly but remained positive in the Asian 3 while it became strongly negative in Hong Kong. This is consistent with a strongly contractionary effect thorough the credit channel as a real estate price decline of 40% within two years and of almost 60% within 6 years depressed collateral values dramatically. In this regard, Hong Kong's experience is much more extreme than that of the industrialised country internal adjusters of the early 1990s.

The significant difference between the Asian countries and external and internal adjusters amongst industrialised countries is also confirmed when looking at inflation developments (Chart B4). Hong Kong's inflation during the boom remained much lower and became negative in the aftermath of the bust/crisis. The "brutal" internal adjustment process is reflected in negative price increases persisting for four years. The Asian 3 experienced a small blip in inflation after their devaluations but subsequently inflation came down to very low levels.

Arguably, the *competitiveness and trade channel* played a significant role in explaining this picture but there are some complications we need to make reference to. The Asian 3's export performance mirrors that of external adjusters amongst industrialised countries albeit growth rates were on average much higher (Chart B5). Export growth came down in particular towards the end of the boom before it recovered after the devaluation. The adjustment of relative prices and regained competitiveness of the import-competing sector helped the post-crisis recovery. Hong Kong's export growth initially declined in tandem with the Asian 3 until 1996. However, it was much lower in the subsequent three years before internal adjustment could bear fruit.[9]

Real and trade developments are also reflected in current account data (Chart B6). The Asian 3 depicted again the pattern that was already typical for the external adjusters in the West—at least up to the devaluation: current account deficits were significant and growing (to -5% of GDP in 1995/1996). During and after the bust/crisis, the current account took a turn which was much more dramatic than in our earlier sample countries. The current account balance in the Asian 3 countries peaked at a surplus of over 10% of GDP before coming down to 5% of GDP by 2002. Hong Kong's experience was more consistent with that of the internal adjusters of the previous section. The external position was on average much more favourable in the boom with only two years of significant current account deficits. The recovery of the external balance was much slower than for the Asian 3.

In these (by global standards relatively small) economies the *international financial channel* and volatility in capital flows has been argued to be much more

[9] Hong Kong's export growth reflects to a very significant extent re-exports which were positively affected by the export boom in those countries that had devalued. Hence the domestic export picture is probably less favourable.

important than in industrialised countries when it comes to explaining booms and busts. Indeed, the Asian 3 experienced a huge swing in capital flows between boom and bust. Chart B7 shows that capital inflows of about 5% of GDP of portfolio and other investment broadly financed the current account deficit until 1996. In 1997, capital flows became negative while the current account remained near a deficit of 5%. As of 1998, the Asian 3 had reversed their current account position and were able to finance continued capital outflows. The situation of Hong Kong by contrast is unclear as no reasonable data is available for post-1996.

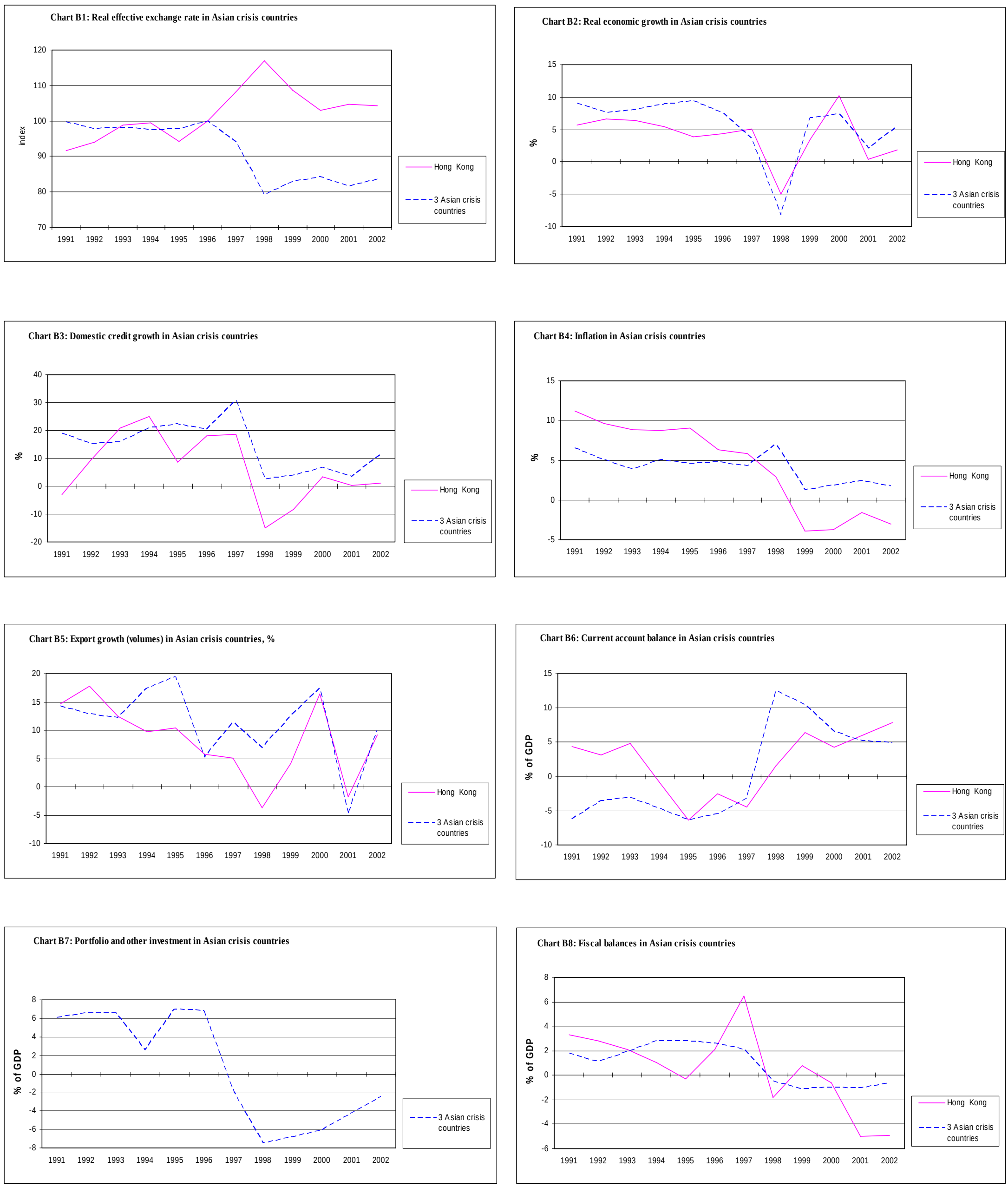
Finally, we take a quick look at *public finance* developments (Chart B8). Fiscal balances again show the same pattern as for industrialised country boom-bust episodes. But the starting point was much better for the Asian 3 (which experienced average surpluses in the boom). Fiscal balances deteriorated in all countries during the bust/crisis before they started recovering. Hong Kong's fiscal position in the boom on average was not better than for the Asian 3 but significant net assets of the government also helped prevent financial difficulties in the public sector.

In summary, the Asian (emerging market) booms and bust/crisis episodes in many ways show similar patterns as industrialised countries although data availability at times hampers the analysis.[10] The same transmission channels seem to be at work even though in particular the international financial channel is likely to be much more important for emerging economies than for advanced countries. Reversal of capital flows can easily tip countries from a "simple" bust into a full-fledged crisis when there are significant external liabilities—even when public debt is small. This again points to systemic risks that the interplay of the various transmission channels creates. External adjustment facilitated the emergence from bust/crisis.

The only country in South-East Asia that did not adjust its currency in the context of the Asian crisis was Hong Kong. Its internal adjustment strategy led to a somewhat more extreme adjustment experience as that of the internal adjusters in industrialised countries. At the end of the boom, external and fiscal positions were very favourable so that a full-fledged crisis could be avoided. The internal adjustment strategy implied deep relative price adjustment that manifested itself in several years of strong consumer and asset price deflation and low and volatile growth. However, this promoted balance sheet adjustment and the re-establishment of competitiveness.

[10] This finding is also confirmed when conducting the earlier Wilcoxon/Mann-Whitney and variance tests on extended groups where Hong Kong is added to the group of internal adjusters and Korea, Malaysia and Thailand to the external adjusters.

Chart 2: Experiences in South-East Asia in the Late 1990s



3.3 Two Case Studies from Recent Years: the Netherlands and Portugal

From the perspective of the euro area and with a view to identify challenges for the CEE EU Member States, two more recent country experiences are worthwhile discussing in more detail: the Netherlands and Portugal. In both countries, one could see 2000 as the last year of an asset-price boom in conjunction with a period of rapid economic expansion and 2001 as the beginning of a period of low growth and other economic and financial developments that are akin to the busts of the early 1990s.[11]

Following the same approach as in the previous section (and assuming the same transmission channels and hypotheses), we look at stylised facts in these two countries and, when useful, compare them with euro area developments. Starting with exchange rate developments, both countries adopted the euro at the beginning of 1999. This means by definition that they chose the internal adjustment strategy for any eventual adjustment need. The data on real effective exchange rate developments illustrates that the two countries experienced similar REER developments over the boom as the internal adjusters in the previous section (Chart C1). Until 2000, the Netherlands and (to a lesser extent) Portugal experienced a depreciation of their CPI-based REER. Between 2000 and 2004 and with the end of the boom, the REER appreciated by 10% in both countries (which was somewhat more than for the euro area average).

Starting with the *real economy*, the boom bust pattern is clearly visible in real economic growth figures as reported in Chart C2. The two countries experienced a strong boom between about 1995 and 2000: average growth reached nearly 4% of GDP per annum. Since then growth first slowed down and briefly reached negative territory. Similar to the 1980s/90s episodes, this pattern reflects a consumption and, even more importantly, investment boom in the two countries in the late 1990s which reversed in 2001.

When looking at the *domestic financial environment*, the earlier period was accompanied by a very strong stock and real estate price cum credit boom in the Netherlands. The inflation-adjusted stock market index, for example, increased five-fold between the early 1990s and 2000. It is not clear whether Portugal experienced a significant real estate price boom. Anecdotal evidence points to such an experience while the evidence from indicators is more mixed which may also reflect measurement problems. However, the stock market boomed strongly in the

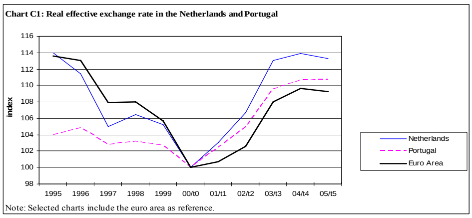
[11] While in the case of the Netherlands, this is based on the Jaeger/Schuknecht methodology; in the case of Portugal asset price indicators were not available. The identification hence follows from the parallel experience of the stock market decline that started in 2000 in all industrialized countries and patterns of economic and financial developments discussed below.

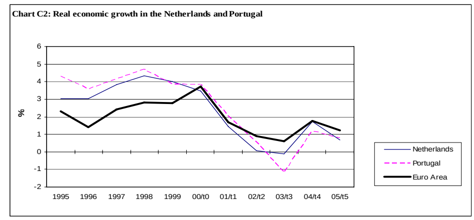
late 1990s. Until 2001 loans in Portugal grew considerably more rapidly than in the Netherlands, although this can be partly explained by catching-up processes (Chart C3). The stock market boom came to an end in both countries in 2000 and indices fell by about 50% within two years while the Netherlands real estate boom also faded out. In parallel, loan developments show a strong deceleration as of 2001.

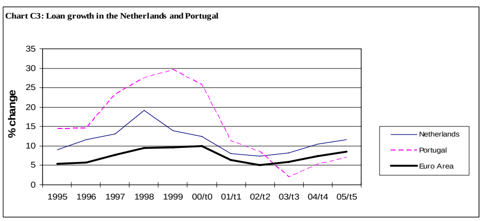
The credit boom resulted in a dramatic deterioration of private sector balance sheets between 1995 and the early 2000s (for which there is good data available for euro area countries since 1995). This is illustrated in Chart C4. Dutch and Portuguese household and corporate debt increased very strongly over the 1995-2004 period to levels that are amongst the highest in industrialised countries and far above the euro area average.

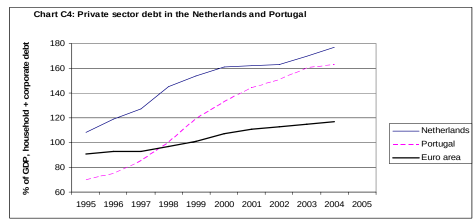
Price developments in the two countries also exhibit a broadly similar pattern as previous boom-bust episodes (Chart C5). Inflation picked up especially towards the end of the boom when it markedly exceeded the euro area average. Subsequently, inflation came down to levels relatively close to the euro area average of about 2%. *Despite these differences as compared to the euro area, inflation developments in* the Netherlands and Portugal have still been more comparable to the experience of internal adjusters in the late 1980s and early 1990s.

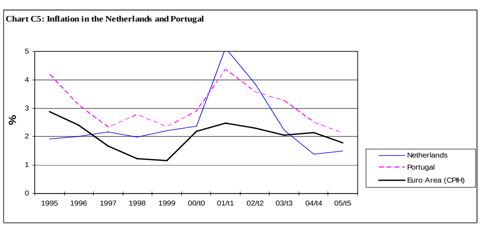
Chart 3: Two Case Studies from Recent Years: the Netherlands and Portugal

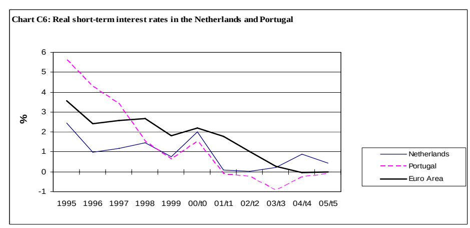


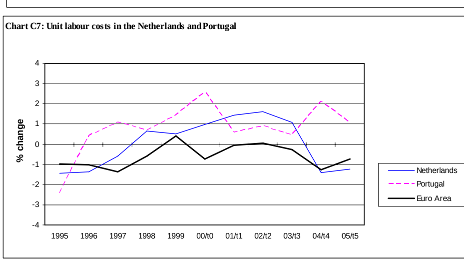


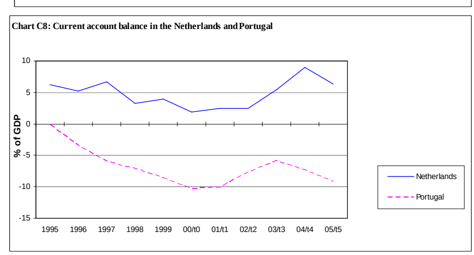


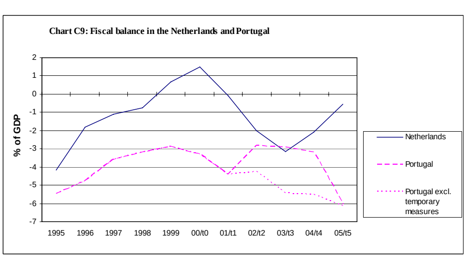


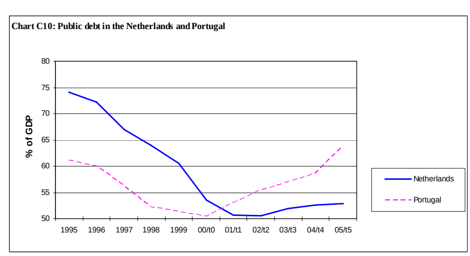












The impact of monetary policy during the boom period was mildly expansionary in the Netherlands, where real short-term interest rates tended to fall until 1999, and strongly expansionary in Portugal, with a fall in real short-term interest rates by nearly five percentage points between 1995 and 1999 (Chart C6). This should be seen in the context of Portugal's nominal convergence process to the euro area. During the initial years of the bust, real short-term interest rates continued to fall in both Portugal and the Netherlands, thus playing a supportive role in the early phase of the internal adjustment process. Only from 2002 respectively 2003 onwards the trend decline reversed, in line with the decline in inflation. Overall, however, real interest rates remained rather low in the Netherlands and Portugal.

Turning to *competitiveness and the trade channel*, unit labour costs grew rapidly during the boom (Chart C7). The depreciation of the REER may have compensated to some extent for the adverse effects until 2000, but thereafter it worked in the same direction. The reversal of the earlier competitiveness loss relative to the euro area started in 2004 in the Netherlands while unit labour cost growth remains high in Portugal. In light of these figures it comes as no surprise that both countries' export performance also suffered in the course of the boom before it started to pick up again in 2004.

Current account developments of the two countries show a marked deterioration (Chart C8). But the Netherlands started from a significant surplus and the deterioration was less severe. As a result the current account remained in surplus at the height of the boom. This is very much in line with the pattern for internal adjusters displayed in earlier boom bust episodes. Portugal reported a strong deterioration from balance in 1995 to a deficit of more than 10% of GDP in 2000. This partly reversed until 2003 before deteriorating again thereafter. While the initial deterioration was roughly equally due to an increase in consumption and investment, developments in recent years feature a strong decline in investment that was partly "eaten up" by a further decline in savings and an increase in consumption.

As regards *international financial vulnerability*, the magnitude of external imbalances for Portugal is reflected in rather dramatic capital flows. In fact, Portugal financed most of its current account imbalance via "other (foreign) investment" which reflects mainly Spanish banks financing the Portuguese credit and demand boom.

In both countries, *fiscal balances* improved during the boom but this improvement was much stronger in the Netherlands than in Portugal (Chart C9). Portuguese public finances in fact already started to deteriorate in 2000. Revenue windfalls had largely been transformed into rising public spending in this country so that the fiscal deterioration in the bust started from an unfavourable level. By contrast, the bust-related worsening of the Dutch fiscal position started from a relatively favourable level.

Strategies also differed significantly in the downturn. Portugal undertook mostly one-off measures that stabilized headline deficits while masking a continuous further deterioration of the underlying balance. Chart C9, therefore, represents deficits both including and excluding temporary measures. The elimination of one-off measures brought the deficit to about 6% of GDP in 2005. The Netherlands took drastic adjustment measures of about 4% of GDP and the deficit breached the 3% threshold in 2003 before improving again in the two subsequent years.

Public debt developments reflect deficit trends (C10). The Netherlands used the good times for significant debt reduction and the recent increase has not brought the debt ratio above the 60% threshold again. Portuguese debt declined much less in the boom and then started rising rapidly again.

In summary, both Portugal and the Netherlands experienced an asset price, credit and real economy boom followed by a marked and sustained slowdown. Inflation in the boom was above the euro area average but differences remained rather contained and real interest rates were low both during the boom period and the subsequent downturn. However, private sector balance sheets and cost competitiveness declined in both countries during the boom and by 2005 had not yet improved (in particular in Portugal) so as to expect a rapid recovery via the trade and credit channel. There are also major differences between the two countries: the Netherlands was in a relatively favourable fiscal and external position at the end of the boom and determined action prevented major fiscal deterioration in the bust. The Portuguese "party" of the 1990s left it with very significant imbalances where it appears that most of them have yet to be tackled.

4. The Central and Eastern European EU Member States

Finally, we look at the recent experiences and economic situation of the eight Central and Eastern European (CEE) EU Member States. [12] The CEE countries can be broadly grouped into two separate sub-groups, first the three Baltic countries Estonia, Latvia and Lithuania plus Bulgaria (CEE4) and second, the Czech Republic, Hungary, Poland, Romania and Slovakia (CEE5). [13]

[12] Two other new EU Member States, Cyprus and Malta are not covered in this paper given that asset price and financial market developments as well as real economic growth in these two countries have been rather subdued in recent years compared to the CEE countries. This makes a stocktaking exercise in view of possible boom and bust experiences due to the interaction of real and financial sector variables less meaningful.

[13] Slovenia has not been included in either of these two groups. With regard to asset price and economic growth development it would fit into the CEE5 group of countries, but it follows an internal adjustment strategy. In fact Slovenia has joined the euro area on 1 January 2007.

For the purposes of this paper there are two key differences between these groups. The CEE4 are a group of (very) small open economies that decided early on in the transformation process to (largely) forego active monetary and exchange rate policy and established currency boards instead. They can thus be considered as internal adjusters. The CEE5 countries are small- to medium-size open economies which, despite significant country-specific differences in their monetary and exchange-rate policy, tend to make more active use of monetary and exchange-rate policy instruments than the CEE4. However, ERM II membership and ultimately euro adoption implies for these countries that they will also have to ultimately move to an internal adjustment strategy (Backé et al. 2004, Schadler et al. 2005) although the timing of this transition process will be again country-specific.

In line with the analytical framework used for the other country groups, we start our stock-taking exercise of the variables underlying the different transmission channels by first looking at *real effective exchange rate* developments in the CEE4 and the CEE5. Chart D1 shows a trend appreciation of the REER in both country groups. This is not surprising, given that these countries currently experience a real convergence process towards the euro area (and EU) average. However, the rate of appreciation was stronger over the last few years in the CEE5 countries, whereas the appreciation trend flattened in the CEE4.

Chart 4: The Central and Eastern European EU Member States

Chart D1: Real effective exchange rate in the New member states, CPI deflated (2000=100)

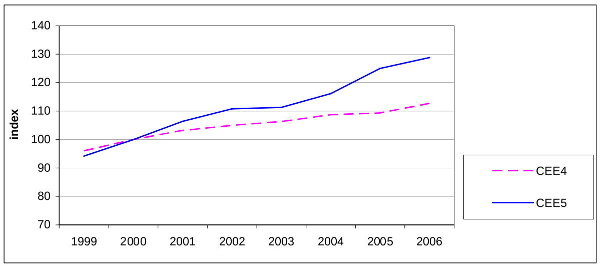


Chart D2: Real Economic growth in the New Member States

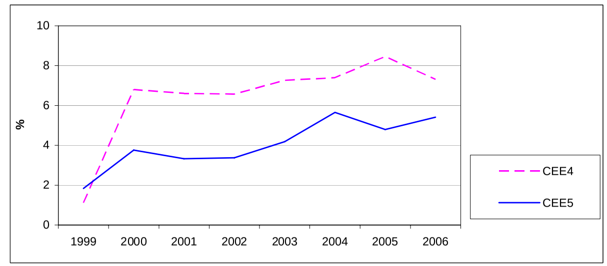
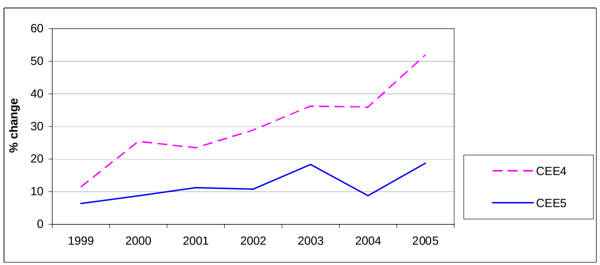
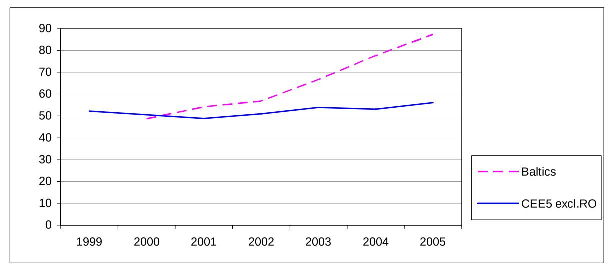


Chart D3: Domestic credit growth in the New Member States



Note: BG 2005 data missing

Chart D4: Private sector debt (% of GDP) in the New Member States



Note: BG data missing, CZ data in 2005 missing, RO available (2001-2003), LV available (2002-2004)

Chart D5: Share of foreign currency loans in total loans to private sector, %

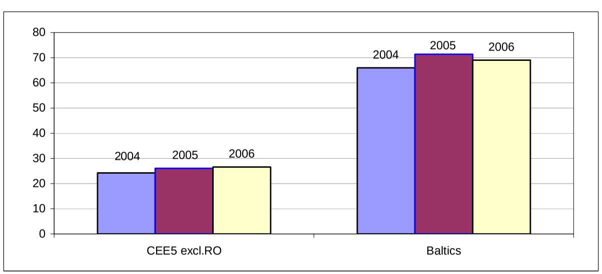


Chart D6: Inflation in the New Member States

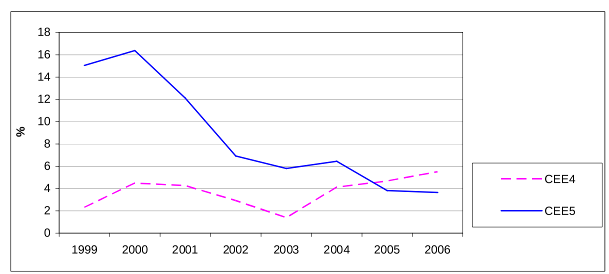


Chart D7: Unit labour costs in the New Member States

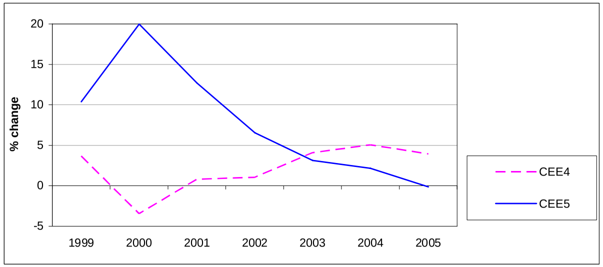


Chart D8: Export growth (volumes) in the New Member States, %

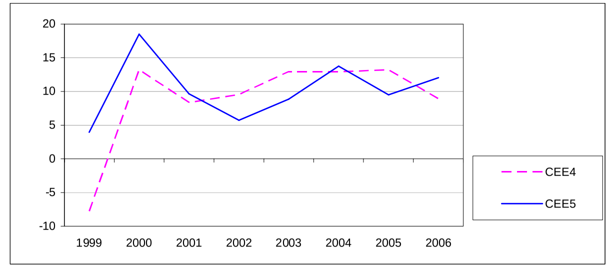


Chart D9: Current account balance in the New Member States

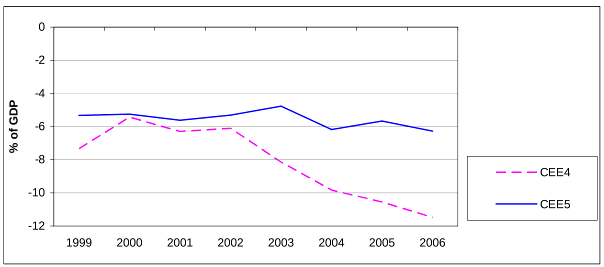


Chart D10: Portfolio and other investment in the New Member States

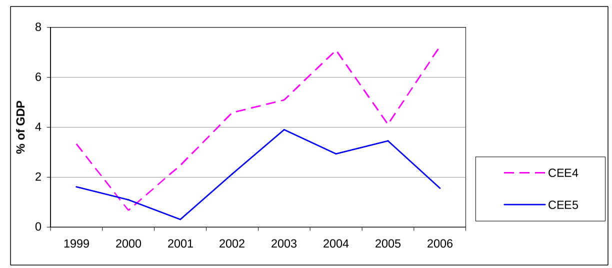


Chart D11: Fiscal balance in the New Member States

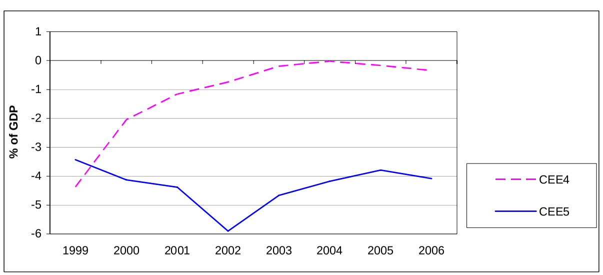
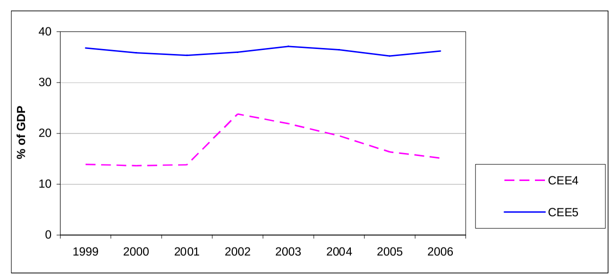


Chart D12: Public debt in the New Member States



Note: BG has data only as of 2002, therefore the jump in the series

Real *economic growth* in the CEE5 countries was in recent years far below the growth rates of the CEE4. In fact, it was rather similar to growth rates experienced by industrialised countries during boom periods (Chart D2).[14]By contrast, the rate of economic expansion in the CEE4 countries is also very rapid. In fact, out of the country groups discussed in this paper only the Asian emerging economies experienced similarly strong rates of economic expansion during their boom period until 1995. This similarity can also be observed for consumption and investment developments.

Analyses of the *domestic financial environment* in the CEE countries are unfortunately plagued with severe data problems.[15]However, the CEE countries have seen very buoyant credit growth in recent years. This applies in particular to the CEE4 (over 50% in 2005) but also to some CEE5 countries (see Chart D3).[16]As a result, private sector debt-to-GDP ratios are beginning to increase, especially in the Baltic countries. Although debt is still relatively low compared to the euro area average (see Chart D4 and Chart C4 for the euro area average) there are indications that the net financial position of non-financial corporations in the CEE countries is less advantageous than in the euro area (due to a less favourable asset position). Moreover, stock markets in the CEE countries have mostly experienced very fast growth in the recent past and – although the data situation in this area is particularly weak – there is patchy evidence of strong house price increases in many CEE countries.

The very dynamic growth of credit in recent years is likely to have been influenced by the strong trend decline in real short-term interest rates observed in the CEE in general and particularly in the CEE4. In fact, real short-term interest rates in the CEE4 have recently fallen to levels below those seen in the groups of external and internal adjusters in the late 1980s. Furthermore, the share of foreign currency loans in per cent of total loans has reached very high levels, in particular in the Baltic countries where long-established currency boards and the associated perception of low currency risks make foreign currency loans with a lower interest rate particularly attractive (see Chart D5)[17]. However, despite the at times considerable exchange rate volatility in the CEE5 countries foreign currency loans also play a sizeable role in this group. This applies not only to euro-denominated loans but also to loans denominated Japanese Yen and Swiss Francs.

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[14] On growth prospects in the new central European EU Member States see e.g. Arratibel et al. (2007), European Commission (2004) or Wagner and Hlouskova (2002).

[15] For a detailed overview of credit developments in the CEE countries see Backé and Zumer (2005) or European Central Bank (2006a).

[16] Cottarelli et al. (2003) do not see the recent evolution of bank credit in Central and Eastern Europe and the Balkans as troublesome. However, the results of their empirical work are based on developments only up to 2003.

[17] Comparable recent data for Bulgaria and Romania is not available.

Price developments in the CEE4 and the CEE5 since 1999 are characterised by a strong disinflation period in the CEE5 (strongly influenced by initially very high inflation in Romania) and relatively benign inflation between 1999 and 2003 in the CEE4 (see Chart D6). During the last three years, however, inflation in the CEE4 has picked up to levels above 5%, well above the CEE5 and euro area average.

Turning to the *trade and international competitiveness channel*, unit labour cost increases in the CEE5 have experienced a trend decline for a number of years largely due to very high gains in productivity (see Chart D7). However, although productivity increases in the CEE4 countries were also quite significant, ULC increase quite strongly in these countries since 2000. This is largely due to increasing wage growth in recent years, which in turn is related to emerging labour market bottlenecks in a very high growth environment..

Export growth was buoyant in both groups of CEE Member States since 2000 although the CEE4 recently experienced a slight decline in export volume growth (see Chart D8). Turning to the current account, however, both country groups show persistent deficits during the entire observation period (see Chart D9). Moreover, current account imbalances in the CEE4 countries worsened considerably since 2002, reaching almost 12% of GDP in 2006. Given that the CE8 are catching-up economies, current account deficits are not surprising, also in view of the large investment needs of rapidly transforming economies. However, whereas the gap in investment growth between the CEE4 and the CEE5 averages has recently closed, the current account gap has widened significantly, suggesting that at least part of the CEE4's external imbalance originates from consumption rather than investment. In fact, these are the highest, persistent external imbalances experienced by any of the sample countries in this study.

Looking at the main sources of *international finance*[18] used to cover the external imbalances in the CEE countries, some similarities between the sub-groups emerge. FDI inflows are significant in the entire region, although they tended to decrease somewhat in the recent past. This can largely be explained by the trend decline in privatisations in these countries. By contrast, portfolio and other investment increased until 2003 in both country groups. Since then inflows into the CEE5 remained more or less constant respectively decreased in 2006. By contrast, this relatively volatile forms of international capital inflows reached almost 8% of GDP in the CEE4 in 2004 and again in 2006 (see Chart D10).

Finally, turning to *fiscal developments* since 1999, public accounts in the CEE4 recovered steadily from the aftermath of the Russian crisis and remained at or close to balance since 2003 (see Chart D11).[19]However, despite very strong growth in recent years the CEE4 do not record fiscal surpluses. By contrast, fiscal balances in

18 On international capital flows and the new Member States see e.g. Begg et al. (2003).

19 For a useful overview of fiscal developments in most CEE countries see the ECB's Convergence Reports in 2006 (ECB 2006b and ECB 2006c).

the CEE5 countries gradually deteriorated until 2002 and only the last few years saw some moderate improvement. As a result, public debt in the CEE5 remained close to 40%, still well below the EU average but well above the public debt ratio afforded by most emerging markets (Afonso, Nickel and Rother, 2005) (see Chart D12).

Summing up, the CEE countries are currently experiencing a period of strong credit and asset price growth in conjunction with rapid economic expansion. On the basis of the stylised facts discussion above the emerging "boom" in these countries appears more pronounced and advanced in the CEE4 while the CEE5 countries seem to be at an earlier stage.

Looking at the other sample groups discussed in this paper, the external adjusters tended to experience more pronounced booms with more significant losses of external competitiveness and more pronounced external imbalances. By contrast, the internal adjusters among the CEE group of countries, i.e. the CEE4, appear to be closer to a boom than the external adjusters, i.e. the CEE5. Great caution is needed, however, when interpreting this finding. First, although the probability estimates above suggest that a boom in the CEE countries – if not already in place – is very likely to happen, the current situation does not allow a clear prediction of what such a possible boom will look like and how it will end. In the run up to the peak of the boom it can not be excluded for example, that the financial and economic expansion in the CEE5 countries will gain further momentum and catch up with the current situation in the CEE4. In addition – and even more importantly – boom periods do not need to turn into a bust but may as well lead to a more benign 'soft landing'.

5. Conclusions and Policy Implications

This study has derived stylised facts and some preliminary statistical analysis on a number of boom – bust episodes. It has looked at different country groups (industrialised countries, emerging markets and the new CEE EU Member States) and at different adjustment strategies in the face of busts (external adjustment with real effective exchange rate devaluation versus internal adjustment without such devaluation).

The findings support the claim that real and financial variables interact in boom-bust episodes where asset price cycles and their impact on private balance sheets constitute an important driving force. The study also finds that boom bust patterns are rather similar across industrialised and emerging countries. The former group is perhaps less vulnerable but not immune to systemic risk with reversing capital flows and busts turning into financial crises.

Most importantly, countries' different (exchange rate) adjustment experiences are correlated with the extent of macroeconomic imbalances and the degree of balance sheet vulnerability. Together with relatively loose fiscal policies, this stoked asset price and consumer price inflation and domestic demand. At the same time it reinforced competitiveness losses in the boom which – when fortunes reversed – exacerbated the bust and the resulting adjustment needs. In those cases where the external adjustment was chosen and the exchange rate was devalued, this shift in policy first reinforced balance sheet problems in the private sector but then precipitated a rapid recovery. From this we conclude:

- External adjusters tend to experience more pronounced booms with more overheating of demand, increases in prices and credit, loss of competitiveness and deterioration of (private sector, external and public) balance sheets than reported for internal adjusters.
- In busts, external adjusters tend to experience deep downturns and rapid recoveries as imbalances are initially more severe but, subsequently, also unwind more quickly. Internal adjusters tend to face less deep but more protracted downturns (and even deflation) as imbalances unwind more slowly and adjustment via the trade and credit channels takes more time.

What policy messages arise from these experiences? The study seems to confirm many "orthodox" messages about sectoral and systemic risks:

- The more dramatic demand and financial excesses, competitiveness loss, and fiscal and external imbalances in the course of the boom the more likely it seems that a country would be found in the group of external adjusters in the bust.
- Internal adjustment appears to be more prevalent when external and fiscal imbalances are small, and when credit growth, inflation and competitiveness loss is contained during the boom
- Monetary policies and wage developments should not contribute to disequilibria in prices, demand or balance sheets. Fiscal policies should not stoke the boom. Low public debt would leave room for "socializing" part of the losses in the bust if needed. Fiscal policies have been more prudent on average in the group of internal adjusters but a number of country experiences have shown that sound headline figures in the boom are no panacea.

Stylised facts for the CEE EU Member States suggest that a few of them appear to be in the early stages of a boom while there are some others that appear to be further along. Although clear and definite conclusions can not be drawn for the CEE EU Member States, not least due to the serious data problems for these countries that complicate inter alia a detailed examination of asset price developments and balance-sheet vulnerabilities, the experiences of boom-bust scenarios in other countries may serve as an "early warning" and may raise awareness of related policy challenges in the CEE countries. On the whole, they also confirm that the Maastricht convergence criteria provide much important information to assess the sustainability of economic developments in EU Member States that aim at adopting the euro. However, balance sheet vulnerability in the private sector may be an additional factor to monitor. Whereas it is not part of the formal convergence assessment as specified in the EU Treaty, the country experiences reviewed in this paper show that such imbalances may affect the indicators observed directly in the convergence process – although with a considerable lag and in a non-linear manner – and may provide early warnings on emerging boom – bust cycles.

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Annex Table: Data and Sources

Real effective exchange rate (REER): IMF/WEO database, Global Insight/World Market Monitor database and ECB.

Real economy/demand channel

Real economic growth: OECD/OEO database and IMF/WEO database.

Real private consumption: OECD/OEO database and IMF/WEO database.

Real private investment: OECD/OEO and IMF/WEO database, European Commission/AMECO database and Eurostat.

Total employment: OECD/OEO database and IMF/WEO database and European Commission/AMECO database.

Domestic financial/credit channel

Asset price/real estate price indices: BIS, Hong Kong Monetary Authority

Credit: IMF/IFS database.

Loans: ECB.

Private debt: ECB

Real short-term interest: OECD/OEO.

Inflation: OECD/OEO database and IMF/WEO database.

Trade/competitiveness channel

Real unit labour costs: OECD/OEO database and IMF/WEO database, and Eurostat.

Export volumes: IMF/WEO database.

Import volumes: IMF/WEO database.

Exports: IMF/WEO database.

Imports: IMF/WEO database.

International financial channel

Current account balance: OECD/OEO database and IMF/WEO database.

Foreign Direct Investment: IMF/WEO database.

Portfolio: IMF/WEO database.

Other investment: IMF/WEO database.

Fiscal channel

Fiscal balance (adjusted for one-off UMTS receipts): OECD/OEO database and IMF/WEO database.

Public debt: OECD/OEO database and IMF/WEO database and European Commission/AMECO database.

Equilibrium Exchange Rates in Oil-Dependent Countries[1]

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Suomen Pankki

Abstract

We assess the determinants of equilibrium real exchange rates in a sample of oil-dependent countries. Our basic data cover OPEC countries from 1975 to 2005. We also include three oil-producing Commonwealth of Independent States (CIS) countries in our robustness analysis. Utilising several estimation techniques, including pooled mean group and mean group estimators, we find that the price of oil has a clear, statistically significant effect on real exchange rates in our group of oil-producing countries. Higher oil price lead to appreciation of the real exchange rate. Elasticity of the real exchange rate with respect to the oil price is typically between 0.4 and 0.5, but may be larger depending on the specification. Real per capita GDP, on the other hand, does not appear to have a clear effect on real exchange rate. This latter result contrasts starkly with the consensus view of real exchange rates determinants, emphasising the unique position of oil-dependent countries.

Key words: equilibrium exchange rate, pooled mean group estimator, resource dependency
JEL codes: F31, F41, P24, Q43

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1. Introduction

We focus in this paper on how the real price of oil affects the equilibrium exchange rate of oil-dependent countries. As oil and related products essentially constitute practically the sole source of export revenue for most of the countries examined here, oil prices can be inferred to affect terms of trade and the real exchange rate. In addition, the real price of oil has been quite volatile during recent decades, so we should expect to see large macroeconomic effects from oil price changes in these countries.

We consider a dozen countries that depend heavily on exports of oil, natural gas and oil products. We augment a core sample of nine OPEC members with three Commonwealth of Independent States (CIS) countries in our robustness analysis. The empirical analysis uses a sample extending from 1975 to 2005 for the OPEC states and 1993 to 2005 for the CIS countries.

In the empirical analysis we do not rely on any one theory of exchange rate determination, but instead adopt BEER (Behavioural Equilibrium Exchange Rate) approach, where usually a number of plausible variables are introduced as determinants of real exchange rate. In our application relationship of these variables with the real exchange rate is assessed e.g. with the help of panel co-integration methods. Our preferred method is the pooled mean group (PMG) estimator proposed by Pesaran et al. (1996), but we also employ a mean group estimator and ordinary fixed effects.

In our estimation framework the real oil price has a direct effect on the equilibrium exchange rate, and, more importantly, that oil price is the only variable with a consistent and statistically significant effect on real exchange rate in oil-producing countries. While coefficient estimates differ from one estimation methodology to another, estimates tend to cluster around 0.5 (the coefficient may be larger in some specifications). In other words, a 10% increase in the real price of oil leads to appreciation of about 5% in the equilibrium exchange rate of a typical oil-producing country.

The study is structured as follows. In the next section, we provide a short literature survey on the topic. We then assess the time series properties of our data. Section 4 provides our main econometric analysis and section 5 concludes.

2. Literature Survey

The real exchange rate *(RER)* is generally defined as the nominal exchange rate adjusted for price level differences between countries. Formally, the real exchange rate (in period t) is denoted as RER_t, the nominal exchange rate E_t (in units of home currency per one unit of foreign currency), the domestic price level P_t, and the price level in a foreign country P_t*. Thus, *RER* may be expressed as

$$RER_t = E_t \frac{P_t^*}{P_t}. \tag{1}$$

Under our definition, an increase in real exchange rate index means depreciation. We first compare the bilateral real exchange rate of sample oil-dependent countries against the U.S. dollar. We also consider the real effective exchange rate (*REER*) calculated as a weighted average of individual bilateral real exchange rates. The weights here represent the shares of different countries in the home country's foreign trade. *REER* is defined here so that upward movement means appreciation.

A number of studies discuss the determinants of equilibrium exchange rates in developing or emerging market countries (e.g. Baffes et al., 1999; Edwards, 1989, 1994; Montiel, 1999). Montiel (1999) argues that the long-run equilibrium real exchange rate emerges from macroeconomic equilibrium in an economy where policy and exogenous variables are sustainable in the long run. He suggests a number of variables that might be associated with the long-run equilibrium real exchange rate, including variables relating to the Balassa-Samuelson effect.

The Balassa-Samuelson theorem presupposes that purchasing power parity (PPP) applies to the market for traded goods and that the ratio of prices of traded and non-traded goods may develop differently for different countries. Specifically, productivity growth in poorer countries is higher in the traded-goods sector than in the non-traded goods sector, as the potential for productivity growth in the traded-goods sector of poorer countries is higher than in more affluent countries. *Ceteris paribus* poorer countries tend to grow faster than richer ones. The theorem further assumes that productivity in the non-traded sector rises more slowly, but wages are the same in both sectors. In such case, the real exchange rate appreciates in the country with higher growth even if the PPP holds for the traded sector. Here, we proxy the productivity differential with the per capita GDP differential.

Other variables may also influence a country's equilibrium exchange rate. Lane and Milesi-Ferretti (2002) find, as predicted by theory that countries with lower international net asset positions tend to have weaker currencies. A decrease in the net foreign asset position (say, from an increase in foreign debt) increases that country's debt servicing costs. To obtain foreign currency to cover the new costs, the country must export more. To achieve this, its real exchange rate must depreciate.

A number of papers consider equilibrium exchange rates in commodity-dependent countries. Chen and Rogoff (2003) focus on three OECD countries that rely heavily on commodity exports: Australia, Canada and New Zealand. They find U.S. dollar prices for their commodity exports have a strong effect on real exchange rates, especially in Australia and New Zealand. The result is weaker for Canada, perhaps because of its somewhat more diversified export structure. Cashin et al. (2004) examine 58 commodity-exporting countries and find that real commodity prices have an effect on real exchange rates in about a third of them. The approach in the Cashin study can be distinguished from ours in two important respects. First, they study each country separately, while we pool country data in a panel. Second, they exclude countries that predominantly export oil.

Koranchelian (2005) and Zalduendo (2006) look at the effects of oil price on the real exchange rate in an oil-dependent country (Algeria and Venezuela, respectively). Koranchelian (2005) finds that both Balassa-Samuelson effect and real oil price affect the equilibrium real exchange rate of Algeria. She calculates the Algerian currency's deviation from an estimated equilibrium exchange rate value. Similarly, Zalduendo (2006) finds within a vector error correction model that oil prices and productivity have an effect on the real equilibrium exchange rate in Venezuela. Long-run elasticity of real effective exchange rate with respect to the real oil price is somewhat over one. However, the trend depreciation of the real exchange rate has been determined also by the steadily deteriorating productivity differential (relative per capita GDP against the main trading partners). The initial estimations are done with official exchange rate data. Estimates with parallel market exchange rates produce qualitatively similar results, but, for example, the long-run elasticity of real effective exchange rate with respect the oil price is now approximately 0.5. As we show below, this is quite close to our results for the larger country sample.

Kalcheva and Oomes (2007) assess whether Russia suffers from Dutch disease, and find within a co-integration framework that the elasticity of real exchange rate with respect to the oil price is very close to 0.5, irrespective of the exact specification.

Finally, Issa et al. (2006) study how energy prices affect the Canadian dollar. Before 1993, they find higher energy prices led to depreciating currency. After 1993, however, energy prices had the opposite effect, i.e. higher prices led to appreciation of the Canadian dollar. The 1993 breakpoint corresponds to Canada's shift from net importer to net exporter of energy products. The value of its energy exports has grown ever since.

Overall, the literature indicates that commodity prices have an effect on the real exchange rates of commodity-exporting countries. This result holds even for developed countries such as Australia and New Zealand. Our literature survey also suggests that the effects of oil prices on exchange rate have been studied relatively little. We aim to contribute to this part of the literature.

3. Data

Our data are drawn from the World Bank's World Development Indicators database. We use three series for real exchange rate: real exchange rate calculated against the U.S. dollar (rerusdcpi and rerusddef) and the real effective exchange rate (reer). Rerusdcpi is calculated from the nominal exchange rate series and consumer price index in the U.S.A. and the country in question. For rerusddef, GDP deflators are used. While the real effective exchange rate is better suited to empirical work, it is not available for all countries here. Also, using the three different real exchange rate series serves as a robustness check. All the real exchange rate series are in natural logarithms. Real oil price is the price of one barrel of Brent oil expressed in U.S. dollars, deflated by the U.S. consumer price index. Also oil is in natural logarithm form.

In accordance with the literature reviewed in the previous section, the control variable for real exchange rate is per capita GDP (measured as the log-difference between the country's per capita GDP in PPP-based constant 2000 U.S. dollars and per capita GDP in the U.S.A.). Both theory and previous empirical work lead us to expect higher per capita GDP relative to the U.S.A. to be associated with a stronger currency.[2]

For our main panel, we use annual data from nine countries,[3] spanning the years 1975 to 2005. We have fairly balanced data for all these countries, although per capita GDP series for Kuwait are not available for 1990-1994.

By definition, equilibrium exchange rates are long-term phenomena; actual exchange rates may fluctuate around their equilibrium values for a long period. Given the nature of the time series and our focus on the long-term relationships between variables, it is important to select the most appropriate econometric techniques.

To do this, we first try to establish whether or not our time series are stationary. This has bearing on the methods chosen for the actual econometric work. Table 1 reports results from five different panel unit root tests with three different null hypotheses. The first is the LLC test where the null hypothesis is the unit root (with the assumption that the cross-sectional units share a common unit root process). The second group includes several tests (IPS, ADF-FCHI, PP-FCHI) with null of unit root assume that the cross-sectional units have individual unit root process. The last test is the Hadri test (Hadri, 2000), where the Z-stat has a null hypothesis of no unit root (but assumes a common unit root process for all cross-sectional units).

There are only two cases out of four where all tests point to the same conclusion as to whether a time series is stationary. For the real exchange rate based on GDP deflator and the real effective exchange rate, results of the first four tests are consistent with Hadri's Z-stat and do not reject the null of non-stationarity. For the CPI-deflated real exchange rate series, the first four tests reject the null hypothesis of non-stationarity, contradicting Hadri's test. Given our rather short sample (31

[2] We initially included net foreign asset position as a control variable in this study. However, it was statistically insignificant in practically all specifications and/or had a sign not predicted by theory. Therefore, we have omitted net foreign asset position in these estimations.

[3] Algeria, Ecuador, Gabon, Indonesia, Iran, Kuwait, Nigeria, Saudi Arabia and Venezuela.

years), it is not particularly surprising that some real exchange rates are found to be non-stationary. In empirical research, testing for the existence of purchasing power parity, usually several decades worth of data are necessary to confirm that the real exchange rate of a country is stationary. Hadri's Z-stat rejects the null of stationarity in every case, while two of the other tests reject the null of non-stationarity for GDP.

Therefore, one of our real exchange series (rerusdcpi) is perhaps stationary, and the same applies to GDP.

Finally, we perform unit root tests for the real price of oil. It appears to be non-stationary. As a result, we choose to utilise several estimation methods to account for the possibility that our variables may be stationary or non-stationary.

Table 1: Panel Unit Root Tests, Sample of 9 OPEC Countries (1975–2005)

	Levin, Lin & Chiu (LLC)	Im, Pesaran & Shin (IPS)	Augmented Dickey-Fuller - Fisher Chi-square (ADF-FCHI)	Phillips-Perron – Fisher Chi-square (PP-FCHI)	Hadri's Z-stat
rerusdcpi	–5.521***	–2.901***	51.892***	26.712*	6.614***
rerusddef	–0.428	0.532	10.647	11.930	9.923***
reer	–0.689	0.494	9.510	7.511	5.039***
GDP	–2.727***	–1.310*	23.486	14.745	6.429***
	Augmented Dickey-Fuller	Phillips-Perron	Kwiatkowski-Phillips-Schmidt-Shin	Ng-Perron	
oil	–1.443	–1.474	0.397	–4.108	

*Note: ***, ** and * signify that the null hypothesis is rejected at the 1%, 5% or 10% confidence level, respectively. All tests include a constant.*

Source: Authors' calculations (as all tables in this paper).

4. Estimation

As we are not completely sure whether our variables are stationary or non-stationary, we estimate the relationship between real exchange rate and the other variables with several methods. Utilising multiple methods also provides a robustness check. We start with simple panel estimation methods and then proceed to Pooled Mean Group (PMG) estimator.

To control for country-specific factors, we first estimate a fixed effects model. The results for *rerusdcpi* are presented in table 2 and for *rerusddef* in table 3. Real exchange rate appreciation with a GDP deflator is only a fraction of CPI-based appreciation. GDP deflators typically give greater weight to traded items than the CPI as they include goods used by non-household sectors of the economy (e.g. investment goods). Results for *reer* (real effective exchange rate) appear in table 4. For *rerusdcpi* and *rerusddef,* an upward movement means depreciation, i.e. a negative coefficient of *realoil* means that higher oil price leads to real exchange rate appreciation. For *reer*, upward movement means appreciation.

All three tables indicate that a higher oil price always causes appreciation and the effect is significant in all specifications. Elasticity of the real exchange rate with respect to oil varies from one specification to another. As *rersuddef* and *reer* are broader measures of the real exchange rate, we attach greater importance to the results where they are used. When cross-section specific trends are included in the specifications, the coefficient of *realoil* is generally between 0.4 and 0.5.

The results for per capita GDP depend on whether we include fixed effects and cross-section specific trends. The reason for this is that there is a clear downward trend in per capita GDP in eight of the nine countries in our sample during the 1975-2005 period.[4] This is also seen in cross-section specific trends, which are nearly always statistically significant. The coefficient of the *GDP* variable also changes from the fixed effects analysis when trends are included in the specification, because we already control to a great extent for per capita GDP movements in our country-specific trend variables.

Further robustness checks using a different data set are reported in Appendix 1. Using a shorter data sample (with three countries added) seems to produce only spurious results.[5]

[4] Indonesia is the sole exception to this rule.

[5] Due to data limitations, we only run the pooled least squares (i.e. no MG or PMG estimations) with the shorter sample.

Table 2: Pooled Least Squares Estimates with CPI-based Real Exchange Rate against the USD as Dependent Variable, Sample of 9 OPEC Countries (1975–2005)

	1 Fixed effects	2 Cross-section specific trends	3 Cross-section specific trends and fixed effects
GDP	–0.270**	0.320***	0.333**
oil	–0.404***	–0.190***	–0.115*
AL	FE	trend 0.033***	FE and trend 0.055***
EC	FE	trend 0.037***	FE and trend 0.028***
GA	FE	trend 0.029***	FE and trend 0.043***
IND	FE	trend 0.045***	FE and trend 0.044***
IR	FE	trend 0.021***	FE and trend 0.041***
KUW	FE	trend 0.012**	FE and trend 0.021**
NIG	FE	trend 0.057***	FE and trend 0.052***
SA	FE	trend 0.019***	FE and trend 0.046***
VE	FE	trend 0.025***	FE and trend 0.019**
R^2	0.24	0.45	0.54
N	273	273	273

*Note: ***, ** and * signify that the coefficient is different from zero at the 1%, 5% or 10% confidence level, respectively.*

Table 3: Pooled Least Squares Estimates with GDP-deflator-based Real Exchange Rate against the USD as Dependent Variable, Sample of 9 OPEC Countries (1975–2005)

	1	2	3
	Fixed effects	Cross-section specific trends	Cross-section specific trends and fixed effects
GDP	–0.330	0.618***	0.442***
oil	–0.800***	–0.480***	–0.391***
AL	FE	trend 0.051***	FE and trend 0.023***
EC	FE	trend 0.028**	FE and trend 0.291***
GA	FE	trend 0.046***	FE and trend 0.022***
IND	FE	trend 0.074***	FE and trend 0.012
IR	FE	trend 0.043***	FE and trend 0.022***
KUW	FE	trend 0.016	FE and trend 0.016*
NIG	FE	trend 0.106***	FE and trend 0.049***
SA	FE	trend 0.023**	FE and trend 0.023**
VE	FE	trend 0.046***	FE and trend 0.018**
R^2	0.44	0.25	0.92
N	273	273	273

*Note: ***, ** and * signify that the coefficient is different from zero at the 1%, 5% or 10% confidence level, respectively.*

Table 4: Pooled Least Squares Estimates with Real Effective Exchange Rate as Dependent Variable, Sample of 7 OPEC Countries (1975–2005)

	1 Fixed effects	2 Cross-section specific trends	3 Cross-section specific trends and fixed effects
GDP	–1.795***	0.647***	–1.486***
oil	0.751***	0.296***	0.466***
AL	FE	trend –0.031***	FE and trend –0.048***
EC	FE	trend –0.011	FE and trend –0.001
GA	FE	trend –0.034***	FE and trend –0.030***
IR	FE	trend –0.021**	FE and trend –0.036***
NIG	FE	trend 0.030***	FE and trend –0.037***
SA	FE	trend –0.067***	FE and trend –0.036***
VE	FE	trend –0.061***	FE and trend 0.001
R^2	0.59	0.15	0.72
N	186	186	186

*Note: ***, ** and * signify that the coefficient is different from zero at the 1%, 5% or 10% confidence level, respectively.*

Next, we estimate the long-term relationship between the variables with the Pooled Mean Group estimator. First proposed by Pesaran et al. (1996), the PMG estimator has the advantage that only long-run coefficients are constrained to be the same across cross-sections (in our case, countries), while short-run responses can be different.[6] For purposes of robustness check, we also utilise a mean group (MG) estimator.

Table 5 gives results of the PMG and MG estimations. In columns 1 and 3, we include both intercept and trend, while in columns 2 and 4 we utilise only intercept. In our PMG estimations, elasticity of the real exchange rate with respect to the oil price is between 0.4 and 0.5. Quite remarkably, we can see that for our sample of OPEC countries, the Balassa-Samuelson effect has no statistical support. The Hausmann test implies that we can pool data from the different cross-sections

[6] In fact, one can also choose to restrict only some long-run coefficients to be the same, and allow others to differ across cross-sections. We will not follow this approach in this paper.

together. In table 6, we use a different dependent variable, i.e. the real effective exchange rate. When both constant and trend are included in the specification, long-run elasticity of the real effective exchange rate with respect to the real price of oil is almost exactly 0.4. It rises above one when only a constant is included.

Therefore, real oil price always has a positive effect on real exchange rate, i.e. a higher oil price leads to real exchange rate appreciation. This result is very robust for different specifications. Moreover, the elasticity of real exchange rate is almost always in the interval between 0.4 and 0.5.[7] Previous literature found that real commodity prices influence real exchange rates in commodity-exporting countries. We confirm this result for our group of oil-exporting countries.

Table 5: PMG and MG Estimation with GDP Deflator Based Real Ex-Change Rate against the USD as Dependent Variable, Sample of 9 OPEC Countries (1975–2005)

	1 PMG	2 PMG	3 MG	4 MG
GDP	0.025	–0.006	0.540	–1.529
oil	–0.422***	–0.529***	–0.479***	–0.744***
error correction term	–0.424***	–0.302***		
control variables	intercept, trend	intercept	intercept, trend	intercept
Joint Hausmann test (p-value)	0.81 (0.67)	1.55 (0.46)		

*Note: ***, ** and * signify that the coefficient is different from zero at the 1%, 5% or 10% confidence level, respectively.*

[7] The exception is the specification where the reer equation is estimated without a trend. In this case, the Hausmann test rejects pooling anyway.

Table 6: PMG Estimation with Real Effective Exchange Rate as Dependent Variable, Sample of 9 OPEC Countries (1975–2005)

	1 PMG	2 PMG	3 MG	4 MG
GDP	–2.283***	–1.585*	0.797	–3.856
oil	0.371***	1.346***	0.853*	1.096**
error correction term	–0.367**	–0.128		
Control variables	intercept, trend	intercept	intercept, trend	intercept
Joint Hausmann test (p-value)	3.11 (0.21)	8.39 (0.02)		

5. Concluding Remarks

We confirmed that real oil price has a statistically significant positive effect on the real exchange rate of oil-producing countries using several estimation methodologies and variable definitions. On the other hand, we found little evidence for the Balassa-Samuelson effect in our sample of oil-producing countries. Taken together, these results imply that the oil price may drive many macroeconomic variables in oil-dependent economies. Thus, ignoring this effect may lead to erroneous conclusions.

While exact estimates of long-run elasticity of the real exchange rate with respect to the real price of oil seem to depend on the specification, most of our estimates cluster close to 0.5. This result is independent from the choice of real exchange rate variable. Moreover, the estimated coefficients are statistically significant. Interestingly, Zalduendo (2006) estimates similar results for Venezuela and Kalcheva and Oomes (2007) for Russia. It seems that our nine OPEC countries are sufficiently homogenous that we may employ panel data methodology. When we try to expand the data sample to the CIS countries, however, we lose data along the time dimension, rendering the results very unstable. Kalcheva and Oomes avoid this problem by using monthly data.

Our results have obvious policy relevance. When the oil price increases, the equilibrium real exchange rate of oil-producing countries appreciates. Unless authorities let the nominal exchange rate appreciate in response, inflation will tend to accelerate. In such a situation, authorities can not maintain a weaker level of exchange rate and keep inflation down for any extended period of time.

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Appendix 1

Robustness Tests

In this appendix, we report results from the robustness tests involving (in addition to our main sample of nine OPEC countries) three countries from the Commonwealth of Independent States (CIS), i.e. Azerbaijan, Kazakhstan and Russia. Since the latter three countries were once part of the Soviet Union, i.e. a centrally planned economy, there are no comparable data for pre-1992 period. Moreover, as data from 1992 is spotty at best for these countries, we start our sample from 1993. Given the brevity of these time series, our robustness tests must be treated with caution.

Our results are presented in tables A.1 and A.2. As to the specifications with cross-section specific trends, the results show little qualitative change from the longer sample. For the fixed effects, however, oil now has a positive sign contrary to our main results. Taken together, we consider the results for the shorter sample to be spurious. Even though we are able to expand the dataset by adding more cross-sections, it does not make up for the loss of periods.

Table A1: Pooled Least Squares Estimates with CPI-based Real Ex-Change Rate against the USD as Dependent Variable, Sample of 9 OPEC and 3 CIS Countries (1993–2005)

	1 Fixed effects	2 Cross-section specific trends	3 Cross-section specific trends and fixed effects
GDP	0.107	0.136	1.025***
oil	0.174**	–0.004	–0.030
AL	FE	trend 0.028***	FE and trend 0.042*
AZ	FE	trend 0.012	FE and trend –0.064**
EC	FE	trend 0.019**	FE and trend 0.020
GA	FE	trend 0.023***	FE and trend 0.057**
IND	FE	trend 0.028***	FE and trend 0.057**
IR	FE	trend 0.028***	FE and trend 0.011
KUW	FE	trend 0.008**	FE and trend 0.017
KZ	FE	trend 0.010	FE and trend –0.049*
NIG	FE	trend 0.027*	FE and trend 0.072***
SA	FE	trend 0.017***	FE and trend 0.046*
RU	FE	trend 0.005	FE and trend –0.042*
VE	FE	trend 0.010	FE and trend 0.016
R^2	0.30	0.34	0.44
N	151	151	151

*Note: ***, ** and * signify that the coefficient is different from zero at the 1%, 5% or 10% confidence level, respectively.*

Table A2: Pooled Least Squares Estimates with GDP Deflator-based Real Exchange Rate against the USD as Dependent Variable, Sample of 9 OPEC and 3 CIS Countries (1993–2005)

	1 Fixed effects	2 Cross-section specific trends	3 Fixed effects and cross-section specific trends
Gdp	–0.421	0.247*	0.883**
oil	0.066	–0.185	–0.280**
AL	FE	trend 0.026**	FE and trend 0.013
AZ	FE	trend 0.016	FE and trend –0.104***
EC	FE	trend 0.044***	FE and trend 0.282***
GA	FE	trend 0.022**	FE and trend 0.047*
IND	FE	trend 0.030**	FE and trend 0.037
IR	FE	trend 0.030***	FE and trend 0.004
KUW	FE	trend 0.010*	FE and trend 0.007
KZ	FE	trend 0.015	FE and trend –0.051*
NIG	FE	trend 0.041**	FE and trend 0.083***
SA	FE	trend 0.011*	FE and trend 0.018
RU	FE	trend 0.010	FE and trend –0.019
VE	FE	trend 0.017*	FE and trend 0.011
R^2	0.14	0.21	0.64
N	152	152	152

*Note: ***, ** and * signify that the coefficient is different from zero at the 1%, 5% or 10% confidence level, respectively.*

Common Volatility Trends in the Central and Eastern European Currencies and the Euro[1]

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Abstract

How much convergence has been achieved between Central and Eastern European (CEE) economies and the euro area? Complementing the literature on business cycle correlations, we explore this question by comparing long-run volatility trends in the CEE currencies and the euro. We find that these trends are closely correlated, pointing to convergence in the economic and financial structures of these economies. Nonetheless, the degree of commonality remains weaker than what had been found for major European currencies before the introduction of the euro. Although spillovers of volatility across regional markets generally have diminished over time, the Hungarian forint remains a significant source of volatility shocks in the region.

1. Introduction

The role of the exchange rate in adjustment to shocks lies at the heart of the optimum currency area theory (Mundell, 1961). Under a flexible exchange rate regime, the exchange rate can help buffer the economy from external shocks. In a currency union, where the nominal exchange rate between two currencies

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disappears, adjustment would have to take place through relative prices (Obstfeld, 2002). A limited degree of volatility in the bilateral exchange rate would thus imply that the two economies have achieved a sufficient degree of convergence in their economic and financial structures and face similar shocks, so that a common monetary policy is likely to be sustainable.[3]

How much convergence has been achieved between Central and Eastern European (CEE) countries and the euro area is the question that is coming to the front of policy discussions as these new members of the European Union (EU) ponder the appropriate timing of euro adoption.[4] The literature on the convergence of the CEE countries has largely focused on the analysis of business cycle correlations. And this analysis suggests that the CEE economies have achieved a considerable degree of integration with the euro area (Fidrmuc and Korhonen, 2006; Eickmeier and Breitung, 2006), albeit less so than what had been achieved among the core members of the euro area prior to the introduction of the euro.

To our knowledge, the only study that did examine exchange rate volatility in the CEE currencies from the perspective of convergence is Horváth (2005), which modeled the determinants of simple statistical measures of bilateral exchange rate volatility using panel data. The conclusion that emerged from this analysis – that volatility in the CEE currencies was at the same levels in the 1990s as in the euro area countries before they had adopted the euro – is seemingly at odds with the conclusions of the convergence literature based on business cycle correlations. One possible reason for the difference is the measurement of exchange rate volatility.

The literature on exchange rate volatility in major currencies often has used conditional variance measures of volatility, which take into account the volatility clustering typical of financial series, and has focused on the analysis of long-run trends in exchange rate volatility, thereby disregarding nonfundamental fluctuations (Harvey et al., 1994; Klaassen, 1999; Black and McMillan, 2004). The latter study, in particular, identified a strong long-run volatility trend in major European currencies (the Deutsche mark, French franc, Italian lira, and the British pound sterling) from 1974 to 1998, confirming a significant degree of convergence achieved among these economies prior to the introduction of the euro. That study provides a useful benchmark for the analysis of common trends in exchange rate volatility of the CEE currencies and the euro – the topic of this paper.

A finding of a common long-run volatility trend in the CEE currencies and the euro would suggest similarity in the underlying economic and financial structures

[3] This is the main rationale for including the exchange rate convergence criterion among the Maastricht criteria for adopting the euro. As outlined in the Treaty on European Union, fulfilling the exchange rate convergence criterion requires participation in ERM II and maintaining exchange rate stability against the euro.

[4] The CEE countries comprise the Czech Republic, Hungary, Poland, the Slovak Republic, and Slovenia.

and the shocks faced by these economies. In line with the existing literature on the business cycle convergence of the CEE economies, we would expect the degree of commonality in the volatility trends of the CEE currencies and the euro to be weaker than what has been found for the original EU members prior to the introduction of the euro. The focus on exchange rate volatility in the CEE region seems particularly appropriate in light of the identified differences between *de jure* and *de facto* exchange rate regimes (Frömmel and Schobert, 2006). In addition, the analysis of volatility patterns in the CEE currencies can provide insights into the dynamics of the CEE currency markets, including the propagation of volatility shocks across these markets, also known as volatility contagion (Dungey et al., 2005).

Following the literature on exchange rate volatility in industrial countries, we use a twofold research approach:

- First, we identify the stylized facts concerning exchange rate volatility in the CEE currencies. We decompose exchange rate volatility into a long-run trend and a transitory component using the Component-GARCH model developed by Engle and Lee (1993). The decomposition, originally proposed by Beveridge and Nelson (1981) for the analysis of business cycles, has been found useful in the analysis of exchange rate volatility (Black and McMillan, 2004; Byrne and Davis, 2005). The two components of volatility are typically interpreted as driven by different factors: the long-run trend of volatility as reflecting shocks to economic fundamentals, and transitory volatility as driven by market sentiment and short-term position-taking. In line with the existing models of exchange rate volatility in emerging market currencies (for example, Guimarães and Karacadag, 2004), we include an asymmetric term in the model to test for differences in volatility associated with exchange rate depreciations and appreciations, which we expect to be significant for the CEE countries.
- Next, we examine principal components and pairwise correlations between currencies for evidence of common volatility trends. To check for robustness of the results based on principal component analysis, we test for the presence of volatility spillovers across currency markets. Volatility spillovers have also been known as "meteor showers," after the original paper by Engle, Ito, and Lin (1990), which found evidence of volatility spillovers in well-integrated currency markets for major currencies.[5] Evidence of significant long-run volatility spillovers between the CEE currencies and the euro would be consistent with increasing convergence, while a finding of short-run volatility spillovers across CEE currency markets would imply a certain likelihood of "bandwagon" effects and contagion in a financial crisis.

We find that the volatility patterns in CEE currency markets are broadly similar to those observed in other mature and emerging market currency markets (Byrne and

[5] See also Melvin and Melvin (2003).

Davis, 2005; Guimarães and Karacadag, 2004; Black and McMillan, 2004). The long-run volatility component outweighs the transitory component, suggesting that exchange rate volatility is mainly driven by shocks to economic fundamentals rather than shifts in market sentiment. The degree of persistence in the exchange rate volatility of the CEE currencies is fairly high, often exceeding that in mature currencies, but has been declining over time. There is evidence of asymmetric effects in the volatility of the CEE currencies: depreciations are often associated with higher volatility than appreciations.

The principal component and correlation analyses confirm on-going economic and financial convergence of the CEE countries and the euro area: a common long-run volatility trend in the CEE currencies is found to be correlated with the long-run volatility trend in the euro for the period from January 1997 to June 2005. However, the degree of commonality is less than what Black and McMillan (2004) found for major industrial countries in Europe before the introduction of the euro. Among the CEE currencies, volatility in the Slovak koruna has become most closely related to that in the euro in recent years, while volatility in the Polish zloty has shown the weakest relation. Tests for volatility spillovers show that long-run volatility in both the Slovak koruna and the Czech koruna has been affected by volatility in the euro in recent years, while long-run volatility spillovers from the euro to the Polish zloty and other CEE currencies have been insignificant.

Short-run volatility spillovers across CEE currency markets generally have declined over time, possibly reflecting increased country differentiation on the part of investors. Only the Hungarian forint remained an important source of short-run volatility in regional currency markets throughout the past decade. This finding is consistent with the conclusion of Kóbor and Székely's (2004) study using a Markov-switching model that correlations in the volatility of the CEE currencies were generally insignificant from 2001 to 2003, except for high-volatility periods. In contrast to spillovers into volatility, spillovers of volatility into means remain prevalent, which points to some degree of predictability in returns possibly owing to limited liquidity in the CEE currency markets.

The rest of the paper is organized as follows: Section 2 describes the methodological approach used in the study, focusing on the description of the Component-GARCH model and Wald tests for volatility spillovers. The section also describes the data set. Section 3 discusses the findings of the study: the relative importance of the long-run and transitory components of volatility, common trends in these components, and volatility spillovers. Section 4 concludes.

2. Methodology and Data

2.1 Volatility Decomposition and Common Trends

Our analysis of exchange rate volatility is cast within the generalized autoregressive conditional heteroskedasticity (GARCH) class of models introduced by Engle (1982) and Bollerslev (1986). These models have been designed to capture the volatility clustering observed in financial time series, including exchange rates. GARCH models focus on the conditional variance of the underlying series by identifying and measuring the degree of autocorrelation in second moments.

We use a specification known as Component-GARCH (CGARCH), which decomposes volatility into two components – a stochastic long-run trend and short-run deviations from that trend. The model is described by the following set of equations:

$$x_t = a_0 + a_1 x_{t-1} + \varepsilon_t + b_1 \varepsilon_{t-1}, \qquad \varepsilon_t \mid I_{t-1} \sim N(0, h_t^2), \tag{1}$$

$$h_t^2 = q_t + \alpha_1(\varepsilon_{t-1}^2 - q_{t-1}) + \gamma(\varepsilon_{t-1}^2 - q_{t-1})D_{t-1} + \beta_1(h_{t-1}^2 - q_{t-1}), \tag{2}$$

$$q_t = \omega + \rho q_{t-1} + \varphi(\varepsilon_{t-1}^2 - h_{t-1}^2), \tag{3}$$

where $D_t = 1$ for $\varepsilon_t < 0$, $D_t = 0$ otherwise. Equation (1) is the mean equation, where x_t is the log-difference and hence the continuously compounded rate of return of daily exchange rates. The term ε_t reflects any unexpected appreciation or depreciation, which is assumed to be uncorrelated and conditionally normally distributed, given I_{t-1}, the information set available at time t-1. The mean equation also includes AR(1) and MA(1) terms.[6]

Our main interest lies in the conditional variance in equations (2) and (3). By analogy with the GARCH(1,1) setup, this equation models the conditional variance (h_t^2) as a linear function of a time-dependent intercept, the lag in the squared realized residual (the so-called ARCH term), an asymmetric term that augments the ARCH term whenever a lagged residual is negative, and the lagged conditional variance (labeled the GARCH term). The ARCH, GARCH, and asymmetric terms are all specified as deviations from the long-run trend of conditional variance.

The model allows for asymmetric effects on volatility of currency appreciation and depreciation. In line with the literature (Engle and Lee, 1993; and Byrne and

[6] We determine the appropriate lag structure of the mean equation for each currency based on the Schwarz Information Criterion (BIC) and other regression diagnostics. We have tested for higher-order AR, MA, and ARMA effects in each currency model, but the best fit resulted universally from an AR(1), MA(1), or AR(0) structure.

Davis, 2005; for example), we include an asymmetric term in the model – through a dummy variable (D_t) that takes the value “1” for negative realized residuals.

The distinctive feature of the CGARCH setup is equation (3), which explicitly models the time-varying long-run component of conditional variance. This component consists of a time-invariant permanent level (ω), an AR term (with coefficient ρ), and the so-called forecast error (with coefficient φ), which is the difference between the lag in the squared realized residual and the forecast from the model (based on information available at time t-2). The long-run component is allowed to vary over time in response to the forecast error, but, as equation (3) shows, it converges to the time-invariant unconditional level, provided $|\rho| < 1$. Given that the long-run component is fully accounted for by q_t, the short-run component of conditional variance is described by the right-hand side of a rearranged version of equation (2):

$$h_t^2 - q_t = \alpha_1(\varepsilon_{t-1}^2 - q_{t-1}) + \gamma(\varepsilon_{t-1}^2 - q_{t-1})D_{t-1} + \beta_1(h_{t-1}^2 - q_{t-1}). \quad (4)$$

The (unconditional) expectation of each of the three terms in the short-run component is equal to zero, implying that transitory volatility will converge to zero over time and aggregate volatility converges to its long-run trend. The condition for these volatility dynamics to hold is that the short-run component of volatility converge faster than the long-run component: $(\alpha_1+\beta_1) < \rho$. The sum of the coefficients α_1 and β_1 is also referred to as the half-life of (positive) shocks and is used as a measure of volatility persistence.

A number of restrictions need to be satisfied in this model to ensure that the conditional variance is nonnegative for out-of-sample forecasts: (i) $1 > \rho > (\alpha_1+\beta_1) > 0$, (ii) $\beta_1 > \varphi > 0$, and (iii) $\alpha_1, \omega > 0$. In addition to specifying the relative speed of convergence of the volatility components, restriction (i) rules out a random walk for the long-run component. In practice, a unit root is occasionally observed in the data. This finding does not invalidate estimation results, but calls for caution when using parameter estimates for forecasting purposes to avoid obtaining negative estimates of variance. Restrictions (ii) and (iii) impose strict positivity on all regression parameters, except for the asymmetric term.

Engle and Lee (1993) show that the CGARCH setup is essentially a GARCH(2,2) model. Such a more general model is less restrictive than a GARCH(1,1) specification, and in the case of over-specification, reduces to the simpler GARCH(1,1) setup. Conditions for this are as follows: (i) $\rho = \varphi = 0$, or (ii) $\alpha_1 = \beta_1 = 0$. If both ρ and φ are equal to zero, as in (i), the CGARCH model will reduce to the standard GARCH(1,1) setup with a constant long-run volatility trend and only short-run dynamics around this trend. If (ii) holds, with both α_1 and β_1 equal to zero, the resulting specification will differ from the standard GARCH model in that it takes into account only the long-run component of volatility, allowing it to vary over time.

We implement the CGARCH model in a univariate manner, that is, for individual currencies. An alternative, multivariate GARCH (MGARCH) approach would have the advantage that it can explicitly account for cross-currency spillovers in the volatility equation, but at the cost of not being robust to the ordering of series or requiring restrictions inconsistent with the purposes of our study.[7] We estimate the model using the quasi-maximum likelihood method and compute Bollerslev-Wooldridge robust standard errors. The robust errors tend to be larger than non-robust errors and present an appropriately more rigorous basis for hypothesis testing (Bollerslev and Wooldridge, 1992).

In the next step, we use principal component analysis to identify common trends in the long-run and short-run volatility components for the CEE currencies and the euro. We also examine pairwise correlations as a cross-check and a guide for interpreting the results of the principal component analysis.

2.2 Volatility Spillovers

As a robustness check of the results concerning common trends in volatility, we also test for cross-currency volatility spillovers. The presence of meteor showers or volatility spillovers across currency markets (Engle, Ito, and Lin, 1990) would be consistent with rising financial and economic integration and would imply a greater likelihood of bandwagon effects and contagion across these markets. To identify volatility spillover effects, we include the lagged variance series of another currency in the variance equation for the trend or transitory component of volatility. For spillover effects into the long-run component of conditional variance, we adjust equation (3) by including the lagged conditional variance:

$$q_t = \omega + \rho q_{t-1} + \varphi(\varepsilon_{t-1}^2 - h_{t-1}^2) + \delta_{k,j} h_{k,t-1}^2. \tag{5}$$

[7] In its most general and flexible specification, the so-called VEC model of Bollerslev, Engle and Wooldridge (1988), working with six series would require the estimation of so many parameters, even without the CGARCH enhancement, that the significance of the parameter estimates would be severely reduced. The problem of a lack of degrees of freedom can be overcome in more restricted multivariate specifications, such as the BEKK model proposed by Engle and Kroner (1995). However, the resulting specification is unlikely to be robust to the ordering of the series, and the number of parameters to be estimated still remains large. Severely restricted specifications, such as the constant conditional correlation model by Bollerslev (1990), sufficiently restrict the number of parameters, but the assumption of constant correlations would be hard to defend in our study. Allowing correlations to change over time, as in the dynamic conditional correlation models by Engle (2002) and Tse and Tsui (2002), imposes identical dynamics on all conditional correlations, which is also inappropriate in the context of our study. For more details, see the survey paper by Bauwens, Laurent, and Rombouts (2003).

Likewise, causality in the transitory component of conditional variance is tested by modifying equation (2):

$$h_t^2 = q_t + (\alpha_1 + \gamma D_{t-1})\times(\varepsilon_{t-1}^2 - q_{t-1}) + \beta_1(h_{t-1}^2 - q_{t-1}) + \delta_{k,j}h_{k,t-1}^2, \quad (6)$$

where D_t is defined as before: $D_t = 1$ for $\varepsilon_t < 0$, $D_t = 0$ otherwise.
Besides testing for meteor showers, we test for spillovers of volatility into means, whereby higher volatility in one market might lead to a change in the level of the exchange rate in the same or another market. Evidence of such volatility-mean spillovers would imply existence of a time-varying risk premium and predictability in exchange rates, which would be inconsistent with the market efficiency hypothesis (Fama, 1970 and 1991). To test for causality in mean, we change the mean equation (1) by including the lagged conditional standard deviation of either the same or a different currency:

$$x_{j,t} = a_{j,0} + a_{j,1}x_{j,t-1} + \varepsilon_{j,t} + b_{j,1}\varepsilon_{j,t-1} + \delta_{k,j}h_{k,t-1}. \quad (7)$$

The setup with the conditional standard deviation included in the mean equation bears close resemblance to the ARCH-in-mean (ARCH-M) specification, often used to test for the presence of time-varying risk premia in financial markets. A significant coefficient would suggest that the level of volatility has an impact on the price of the currency in question, but, given that we use lagged variance series, such a finding would also imply return predictability.

In each case, we perform a Wald test for the significance of $\delta_{k,j}$. For the causality-in-mean setup, we can test for significant spillover effects from all of the six currencies to a given currency, because currencies may be affected by their own lagged volatility (as in the original ARCH-M specification). When we test for causality in variance, however, we can only include the lagged conditional variance of another currency, as the own lagged conditional variance is by definition already included in both parts of the variance equation of the CGARCH model.

2.3 Data

Our focus is on the CEE currencies and the euro. The currency series consist of daily closing prices for the Czech koruna (CZK), the Hungarian forint (HUF), the Polish zloty (PLN), the Slovenian tolar (SIT), the Slovak koruna (SKK), and the euro (EUR), all of which are quoted as U.S. dollar (USD) rates. The data source is WM/Reuters, as reported by Datastream. Prior to 1999, the EUR series is reconstructed through the DEM/USD rate, which is divided by 1.95583, the fixed DEM/EUR conversion rate. The exchange rate data are shown in chart 1.

The sampling period covers the time period during which CEE countries had an exchange rate regime flexible enough to render the analysis meaningful (Borghijs and Kuijs, 2004). For the Czech Republic, the sample period starts in February 1996, when the authorities replaced the exchange-rate peg with a band of ± 7.5%. The sample period for Hungary starts in March 1995, when the ± 2.25% exchange-rate band was introduced.[8] Poland introduced a crawling exchange-rate band in May 1995. In the Slovak Republic, the crawling band was widened to ± 7% in early 1997. There are two exceptions to this sample dating approach: the EUR has been flexible during the whole period in question, while the SIT has been significantly managed for most of the time. The series for these two currencies thus start in January 1993. All six series end in June 2005. The sample period common to all six currencies is from January 1997 to June 2005. We also compare estimates for the earlier part of the sample period (from January 1997 to June 2001) and the later part (from July 2001 to June 2005).

All data series display a unit root, as shown in table 1. Hence, we transform them into log-differences and obtain continuously compounded exchange-rate returns in percentage terms: $x_t = 100[\ln(S_t) - \ln(S_{t-1})]$, where S_t is the spot rate.

3. Volatility Dynamics in Central and Eastern European Currency Markets

3.1 Is Volatility in Central and Eastern European Currencies of Long-Run or Transitory Nature?

Using the CGARCH model described in section 2, we decompose exchange rate volatility into a long-run component and a transitory component (table 2 and chart 2). In the long-run component of volatility, we find a positive and highly significant constant (ω) for all currencies. The AR coefficient of permanent volatility (ρ) is large and highly significant for all currencies in all periods.[9] Its size exceeds that of the coefficients in the transitory component ($\alpha_1+\beta_1$) in all instances, implying the model is stable. The degree of volatility persistence found in the CEE currencies is higher than that in the euro, but broadly in line with what has been found for other industrial economies (Byrne and Davis, 2005; Black and McMillan, 2004). The coefficient of the forecast error (φ), which shows how shocks affect the permanent component of volatility, is positive in all regressions and generally significant. An interesting pattern is that, for most currencies, the AR coefficient of

[8] While the degree of flexibility is still limited in this regime, a widening of the band to ± 15% occurred only in 2001, which would have reduced our observation period so significantly that a comparison with the other countries would have been difficult.

[9] In several instances, we find that the coefficient of the autoregressive term in the trend equation is equal or very close to one. As discussed above, this suggests that the long-run component follows a random walk and that out-of-sample forecasting needs to be handled with care to ensure the non-negativity of variance estimates.

long-run volatility is smaller in the late period than in the early period, implying that over time long-run volatility tends to revert to its time-invariant level faster, possibly because in the later period the exchange rates were allowed to fluctuate more freely. The signs and relative magnitudes of coefficients confirm that the CGARCH model is well specified and is an appropriate framework for analyzing volatility patterns in the CEE currencies.

As expected, the combined coefficient for the short-run component of volatility ($\alpha_1+\beta_1$) is positive and smaller than that for the long-run component (ρ). In a few instances, we find a significant negative coefficient for the ARCH term (α_1), but even in these cases, the sum of the coefficients on the ARCH and GARCH terms (α_1, β_1) is still positive. In cases where both α_1 and β_1 are insignificant, a Wald test generally cannot reject the hypothesis that both coefficients are jointly equal to zero. Together with significant coefficients on the forecast error in the long-run component, this implies that in those instances (specifically, the HUF and the SKK in the early period) shocks to the exchange rate were mostly of a long-run nature. The opposite holds for the CZK and the PLN in the early period, where shocks to volatility appear largely transitory, as the coefficient on the forecast error in these cases is insignificant.

For most currencies, short-run volatility is hardly persistent. This is reflected in the relatively short half-life of these shocks – about one day. Notable exceptions are the CZK and the PLN in the early period and the HUF in the late period. Higher persistence of short-run shocks in these cases (half-life exceeding five days) reflects episodes of turbulence in currency markets. Short-run volatility persistence has declined for the CZK and the PLN since then – their half-life was less than one day in the later part of the sample.

We find significant negative asymmetric effects (γ) for several CEE currencies, particularly the HUF in the late period and the PLN in the early period. Since the exchange rates are defined as domestic currency per U.S. dollar, a negative coefficient implies higher volatility in cases of currency depreciation. This would suggest that long and short positions in these currencies were not evenly enough distributed so that the market as a whole had a unidirectional view on the currency. This finding is in line with the literature: Byrne and Davis (2005), for instance, find a similar effect of unexpected depreciations for the Japanese yen and the Canadian dollar, while Guimarães and Karacadag (2004) find significant asymmetric effects for the Mexican peso and the Turkish lira.[10]

For all currencies and periods, the short-run component of volatility is much smaller than the long-run component (chart 2 and table 3). This suggests that

[10] Like Byrne and Davis (2005), we find that the asymmetric effect is insignificant for the euro. Its inclusion weakens the overall fit and stability properties of the model, and hence we exclude the asymmetric effect from the baseline specification for the euro. Our results are robust to the inclusion of the asymmetric effect.

transitory shifts in financial market sentiment tend to be less important determinants of exchange rate volatility than shocks to the underlying fundamentals. A similar pattern has been observed in currencies of industrial countries (Black and McMillan, 2004; and Byrne and Davis, 2005). Yet, relative to its lower mean level, the transitory component is in all cases much more volatile than the long-run trend level of volatility, as one would expect. For several currencies – the CZK and the PLN in the early period, and the HUF in the late period – the standard deviation of the short-run component exceeds that of the long-run component, reflecting periods of temporary turbulence in these markets. When scaled by means, however, the standard deviations of the short-run component exceed those for the long-run component (third column in table 3). We now turn to the analysis of comovement in the long-run and short-run components of volatility.

3.2 Is There a Common Volatility Trend in Central and East European Currencies and the Euro?

Next, we explore the degree of similarity in the volatility trends of the CEE currencies and the euro. Principal component analysis of the long-run volatility components suggests a fairly high degree of comovement between the CEE currencies and the euro. In particular, for the recent period, the weights on the first component are similar in sign and absolute value for the CEE currencies and the euro, which can be interpreted as evidence of a common underlying trend in the CEE currencies and the euro (table 4 and chart 3).

The degree of similarity in the long-run volatility trends of the CEE currencies and the euro is somewhat less than what Black and McMillan (2004) found for major industrial countries prior to the introduction of the euro. In their paper, deviations between the weights on the principal components for different European currencies (the French franc, Deutsche mark, Italian lira, and British pound sterling) are smaller than what we find for the CEE currencies and the euro. However, a broad measure of commonality in volatility trends, the share of variation explained by the first principal component, is quite similar to that observed for mature European currencies (about 55%) (table 4). Country-specific findings from the principal component analysis are:

- In the early half of the sample, the common factor for the HUF, PLN, SIT, and the EUR almost entirely leaves out the SKK, which instead is the sole driver behind the second principal component, and the third component picks up a significant portion of volatility in the CZK. In the later half of the sample period, the weights on the first principal component are more evenly distributed among the CEE currencies, so all these currencies appear to share a common long-run volatility trend. Notably, the SKK is not an outlier anymore, and instead shares a common component with other regional currencies.

- The degree of commonality in the long-run trends of the PLN and other CEE currencies is weaker than in the long-run trends of these other CEE currencies. The PLN appears to react differently to shocks than other CEE currencies, consistent with the findings in Borghijs and Kuijs (2004), who show that the shock-absorbing role of the PLN differs from that of other regional currencies. The second component is strongly correlated with the PLN and HUF, suggesting close linkages in these currencies.
- Interestingly, both in the early and later period, a significant portion of volatility in the CZK can be explained by factors other than those influencing the other CEE currencies. This finding might reflect the role of the CZK as a funding currency for investments in other CEE currencies and the high liquidity of the Czech koruna market, the development of which has been facilitated by a relatively more rapid liberalization of capital controls in the Czech Republic than in other countries in the region.

Pairwise correlations for the long-run volatility component broadly confirm the findings of the principal component analysis (table 5). Bilateral correlations of the SKK and the CZK with the EUR increase in the second half of the sample, while those of the PLN, the HUF, and the SIT decline, so that on the whole the cross-country differences in the degree of correlation with the EUR are smaller in the later period. As expected, pairwise correlations between the long-run volatility of the CEE currencies and the euro appear weaker that those observed between currencies of major industrial countries in Europe. Black and McMillan (2004), for example, find a correlation between the French franc and the Deutsche mark of 0.90. By comparison, correlations between the CEE currencies and the euro hardly exceed 0.60 for the three major CEE currencies – the PLN, the CZK, and the HUF – although they are higher for smaller, and more managed, currencies such as the SIT and the SKK. Within the CEE region, we find strong correlations between the CZK, PLN, HUF, and SIT in the early period and between the PLN and the HUF, and the CZK and the SKK in the later period.

The principal component and correlation analyses for the short-run volatility component suggest that these components have less in common than the long-run components (tables 6–7). The dispersion and overall variability of weights for the short-run component are significantly higher than for the long-run component. This is not surprising, as the short-run component of volatility reflects transitory and unsystematic disturbances, and is in line with findings for major industrial countries reported by Black and McMillan (2004). Only the SKK and the EUR show a significant common trend in all periods, but even that relationship is not stable as reflected in the changing signs of the weights on the first principal component as well as the correlations from the early to the late period. In the early period, the HUF also shares a common factor with the EUR, and in the late period the same is true for the CZK. Despite the variability in the relationship of the short-run volatilities for individual currencies, as a group, they show that common factors increasingly drive transitory volatility. This is reflected in the higher proportion of variance accounted for by the first principal component in the late period compared to the early period (40% versus less than 30%, respectively) and the cumulative proportion of variance explained by the first three principal components (76% versus 66%, respectively).

3.3 How Significant Are Volatility Spillovers Between CEE Currency Markets and the Euro-Dollar Market?

The Wald tests for volatility spillovers confirm the findings of the principal component and correlation analyses. The tests show that long-run volatility spillovers from the EUR to the CZK and the SKK become significant in the second half of the sample (table 8) – these are the two currencies for which the principal component and correlation analyses show that the long-run volatility trends have become more similar to those in the euro over time. Likewise, spillovers from the EUR to other currencies (particularly, the PLN) are weaker in the later part of the sample, in line with the principal component and correlation analyses. Tests for volatility spillovers also show that volatility in the CEE currencies is increasingly driven by common shocks affecting the region as a whole. The transmission of these shocks within the region appears limited: the number of significant intraregional spillovers in both long-run and short-run volatility has declined over time (tables 8–9). While we find significant volatility spillovers between most CEE currencies in the early period, only the HUF remains an important source of volatility spillovers to the PLN and the SKK in the later period.

Intraregional spillovers of volatility into means have become more frequent over time, implying that the degree of integration of CEE currency markets has increased (table 10). These results also suggest a relatively high degree of predictability in returns on the CEE currencies, possibly reflecting limited efficiency and liquidity of these markets. Interestingly, although the PLN does not affect any other currencies in the early period, it has a significant impact on most of them in the late period, which could be indicative of the increased importance of the PLN in the region as the country has removed the remaining capital controls. The mean return on the CZK is found to respond strongly to volatility in the SKK in the later period, confirming strong links between these two currencies. The volatility in the EUR also has a significant effect on the mean returns of the CEE currencies in a few instances.

4. Conclusions

This paper complements the existing analyses of business cycle correlations between the CEE countries and the euro area with the analysis of common trends in exchange rate volatility of the respective currencies – another way to gauge the degree of convergence of the new EU member states to the EU core. The volatility dynamics of the CEE currencies and the euro are found to be similar, consistent with other evidence on growing economic and financial integration of the CEE region with the euro area (Fidrmuc and Korhonen, 2006). The degree of convergence implied by the commonality of the long-run volatility trends is smaller than what had been estimated to exist among mature European economies prior to the introduction of the euro (Black and McMillan, 2004), which is also in line with conclusions of other studies on the convergence of the CEE region with the euro area.

The degree of commonality in the long-run volatility trends of the CEE currencies and the euro varies across countries. Volatility in the Slovak koruna appears to be most closely related to that in the euro. The degree of similarity is less for the Czech koruna, the Hungarian forint, and the Slovenian tolar, while volatility in the Polish zloty is the one least correlated with the euro. The finding that the long-run volatility trend in the Polish zloty differs somewhat from that in other CEE currencies is consistent with Borghijs and Kuijs's (2004) conclusion that the exchange rate plays a more significant role as a shock absorber in Poland than in other CEE economies owing to a larger size and a smaller degree of openness of the Polish economy. The degree of commonality in the long-run volatility trend of the Slovak koruna and other CEE currencies and the euro has increased considerably in recent years, pointing to increasing integration of the Slovak economy. Lastly, volatility in the Czech koruna appears to be driven in part by idiosyncratic factors, different from those influencing other CEE currencies – a finding that might reflect the role of the Czech koruna as a funding currency for investments in other CEE currencies. These findings are broadly consistent with tests for long-run volatility spillovers.

All in all, the findings in this paper do not imply that the CEE countries should delay euro adoption. The endogeneity of the optimal currency area criteria suggests that euro adoption is likely to promote further trade, production, and financial integration between the CEE countries and the euro area and to encourage greater synchronization in their business cycles (Frankel and Rose, 1998). The main policy implication of the study is that the CEE countries need to compensate for a smaller degree of convergence by further improving the flexibility of their labor and product markets, which will facilitate adjustment to any asymmetric shocks their economies might face for some time following euro adoption.

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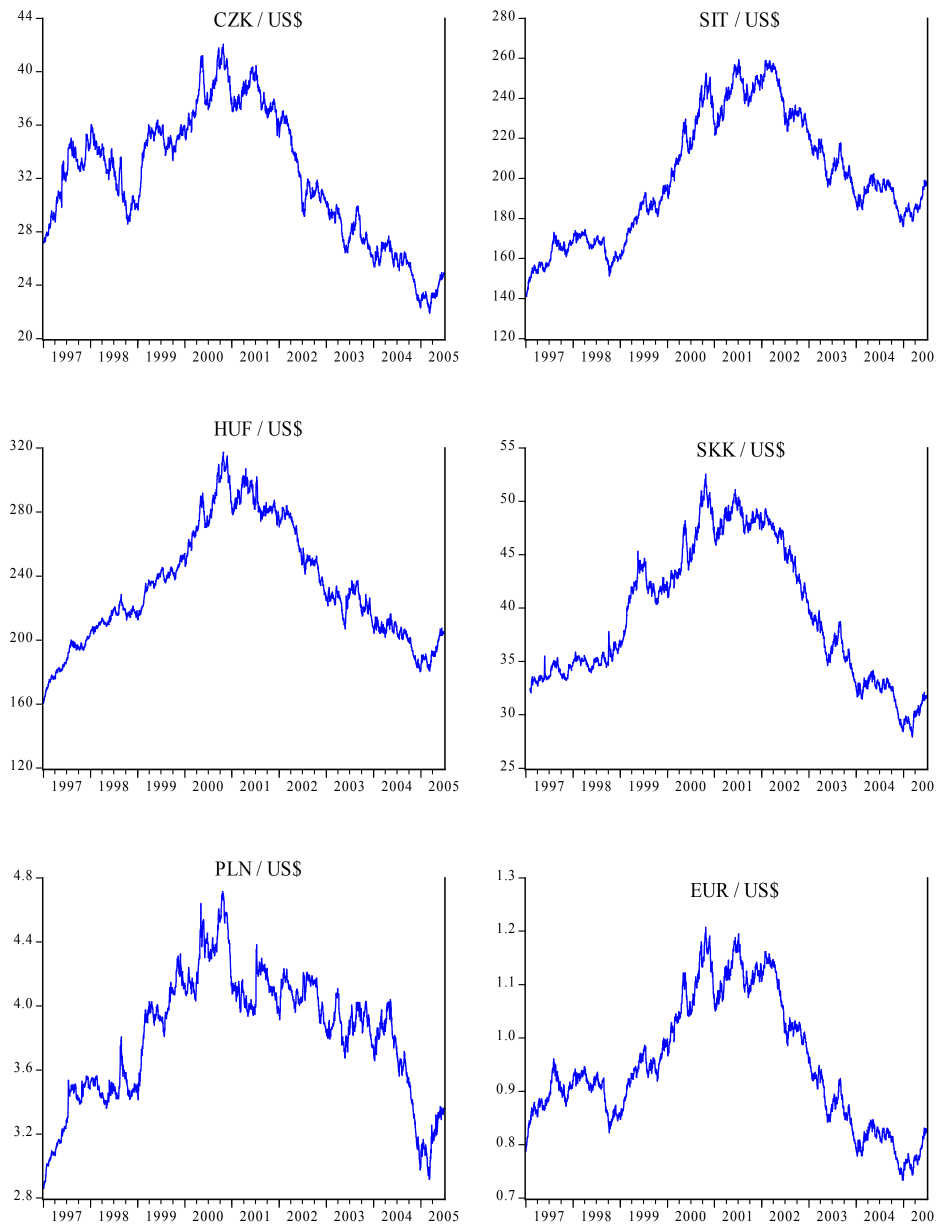
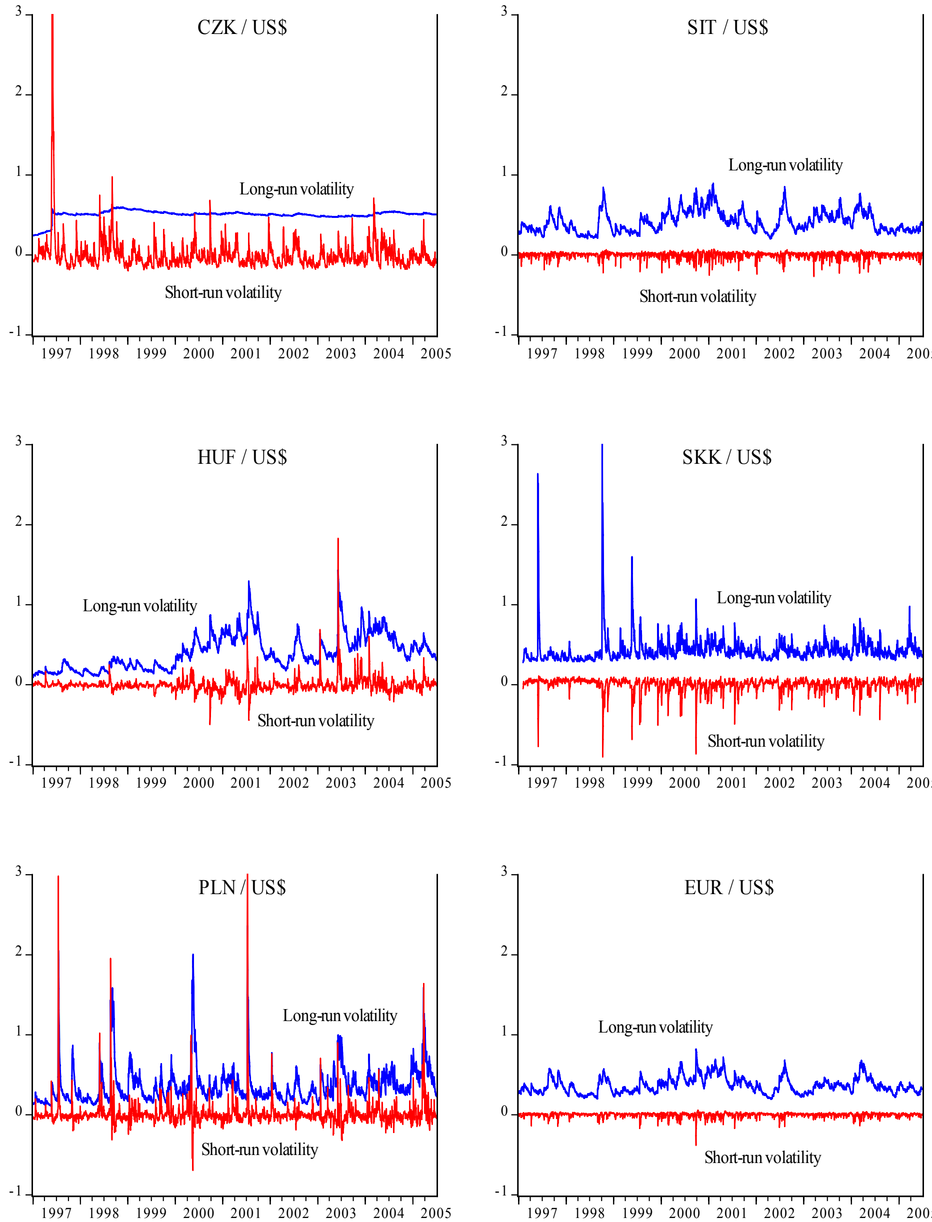
Chart 1: Daily Dollar Exchange Rates, January 1997–June 2005



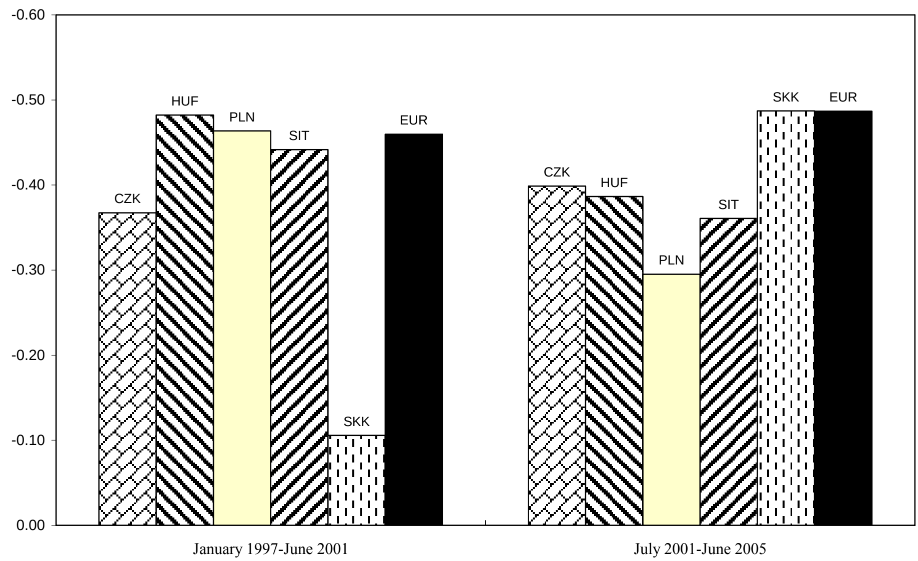
Source: Datastream.

Chart 2: Conditional Variance of Daily Dollar Exchange Rates



Source: Authors' estimates.

Chart 3: Weights on the First Principal Component



Source: Authors' estimates.

Table 1: Unit Root Tests

		CZK	HUF	PLN	SIT	SKK	EUR
Levels							
Test:	ADF	-0.96	-0.38	-0.90	-0.93	-1.25	-1.06
	PP	-1.02	-0.34	-0.81	-0.89	-1.25	-1.07
First Differences							
Test:	ADF	-49.92 ***	-52.94 ***	-47.92 ***	-58.29 ***	-45.73 ***	-56.88 ***
	PP	-49.89 ***	-52.90 ***	-47.78 ***	-58.31 ***	-45.73 ***	-56.88 ***

Note: For both the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests, the null hypothesis is for the existence of a unit root.

, **, and * indicate significance at the 10%, 5%, and 1% levels, respectively.*

Source: Authors' estimates.

Table 2: Asymmetric Component GARCH Estimates

The Full Period: January 1997-June 2005

		CZK	HUF	PLN	SIT	SKK	EUR
Trend Intercept	ω	0.558 ***	0.357 **	0.349 ***	0.427 ***	0.434 ***	0.371 ***
		(5.60)	(2.09)	(5.80)	(8.00)	(13.10)	(10.59)
Trend AR Term	ρ	0.998 ***	0.996 ***	0.968 ***	0.985 ***	0.830 ***	0.983 ***
		(1,101.3)	(383.9)	(78.55)	(151.5)	(5.00)	(127.3)
Forecast Error	φ	0.003 *	0.040 ***	0.098 ***	0.041 ***	0.076	0.037 **
		(1.84)	(5.38)	(4.32)	(4.67)	(0.36)	(3.25)
ARCH Term	α_1	0.080 **	0.077 **	0.164 ***	-0.063 ***	-0.005	-0.036 *
		(2.27)	(2.34)	(3.31)	(-2.60)	(-0.02)	(-1.85)
Asymm. Term	γ	0.014	-0.126 ***	-0.240 ***	0.018	-0.100 **	
		(0.34)	(-2.95)	(-3.91)	(0.68)	(-2.19)	
GARCH Term	β_1	0.790 ***	0.774 ***	0.636 ***	0.504	0.768 **	0.681 *
		(12.16)	(8.56)	(5.63)	(1.44)	(1.94)	(1.89)
	$\alpha_1+\beta_1$	0.87	0.85	0.80	0.44	0.76	0.64
Half-life (days) for	$\alpha_1+\beta_1$	5.0	4.3	3.1	0.8	2.6	1.6

The Early Period: January 1997-June 2001

		CZK	HUF	PLN	SIT	SKK	EUR
Trend Intercept	ω	0.882 *	-1.197	0.065	0.438 ***	0.475 ***	0.375 ***
		(1.71)	(-0.10)	(0.09)	(4.99)	(5.45)	(7.10)
Trend AR Term	ρ	0.999 ***	1.000 ***	1.000 ***	0.989 ***	0.692 ***	0.989 ***
		(1,167.3)	(258.2)	(867.2)	(146.3)	(5.76)	(167.9)
Forecast Error	φ	0.003	0.040 ***	0.006	0.040 ***	0.203 **	0.026 ***
		(1.39)	(4.88)	(1.50)	(3.64)	(2.14)	(3.37)
ARCH Term	α_1	0.151 **	0.081	0.253 ***	-0.056 *	-0.111	0.013
		(2.39)	(1.59)	(4.16)	(-1.91)	(-1.23)	(0.48)
Asymm. Term	γ	-0.064	-0.086	-0.180 ***	0.048	-0.099	
		(-1.32)	(-1.27)	(-2.82)	(1.37)	(-1.51)	
GARCH Term	β_1	0.740 ***	-0.192	0.657 ***	0.595	-0.349	-0.309
		(9.09)	(-0.47)	(8.84)	(1.07)	(-1.47)	(-0.23)
	$\alpha_1+\beta_1$	0.89	-0.11	0.91	0.54	-0.46	-0.30
Half-life (days) for	$\alpha_1+\beta_1$	6.0	0.3	7.4	1.1	0.9	0.6

Table 2 continued: Asymmetric Component GARCH Estimates

The Late Period: July 2001-June 2005

		CZK		HUF		PLN		SIT		SKK		EUR	
Trend Intercept	ω	0.450	***	0.474	***	0.379	***	0.405	***	0.409	***	0.347	***
		(13.84)		(7.68)		(7.33)		(10.98)		(10.03)		(10.23)	
Trend AR Term	ρ	0.875	***	0.965	***	0.946	***	0.944	***	0.955	***	0.965	***
		(8.00)		(52.99)		(48.13)		(27.08)		(30.64)		(44.69)	
Forecast Error	φ	0.064		0.036	**	0.090	***	0.060	*	0.060	*	0.043	**
		(1.15)		(2.00)		(3.84)		(1.72)		(1.68)		(2.22)	
ARCH Term	α_1	-0.024		0.137	**	-0.078		-0.127	***	-0.051		-0.092	***
		(-0.32)		(2.43)		(-1.30)		(-3.68)		(-0.94)		(-3.22)	
Asymm. Term	γ	-0.055		-0.264	***	0.001		0.037		-0.070	*		
		(-0.75)		(-4.51)		(0.01)		(1.07)		(-1.71)			
GARCH Term	β_1	0.252		0.737	***	0.130		0.694	***	0.751	***	0.566	*
		(0.36)		(10.34)		(0.23)		(2.67)		(3.54)		(1.85)	
	$\alpha_1 + \beta_1$	0.23		0.87		0.05		0.57		0.70		0.47	
Half-life (days) for	$\alpha_1 + \beta_1$	0.5		5.2		0.2		1.2		1.9		0.9	

Note: Bollerslev-Wooldridge robust t-statistics in parentheses.
, **, and * indicate significance at the 10%, 5%, and 1% levels, respectively.*

Source: Authors' estimates.

Table 3: Comparison of Long-Run and Short-Run Volatility Components

The Full Period: January 1997-June 2005

	St. Dev. of Long-Run Component / St. Dev. of Short-Run Component	Mean of Long-Run Component / Mean of Short-Run Component	(St. Dev. / Mean) of L-R Comp. / (St. Dev. / Mean) of S-R Comp.
CZK	0.18	70	0.0025
HUF	2.22	368	0.0060
PLN	1.27	19	0.0653
SIT	3.45	785	0.0044
SKK	2.07	159	0.0130
EUR	3.54	70,259	0.0001

The Early Period: January 1997-June 2001

	St. Dev. of Long-Run Component / St. Dev. of Short-Run Component	Mean of Long-Run Component / Mean of Short-Run Component	(St. Dev. / Mean) of L-R Comp. / (St. Dev. / Mean) of S-R Comp.
CZK	0.17	33	0.0051
HUF	7.06	155	0.0454
PLN	0.31	7	0.0445
SIT	5.53	208	0.0266
SKK	1.85	282	0.0066
EUR	10.11	6,041	0.0017

The Late Period: July 2001-June 2005

	St. Dev. of Long-Run Component / St. Dev. of Short-Run Component	Mean of Long-Run Component / Mean of Short-Run Component	(St. Dev. / Mean) of L-R Comp. / (St. Dev. / Mean) of S-R Comp.
CZK	2.15	6,217	0.0003
HUF	0.71	16	0.0460
PLN	4.17	1,673	0.0025
SIT	1.34	1,750	0.0008
SKK	1.55	606	0.0026
EUR	1.52	808	0.0019

Source: Authors' estimates.

Table 4: Principal Components of Long-Run Volatility

The Full Period: January 1997-June 2005

	Component 1	Component 2	Component 3	Component 4	Component 5	Component 6
Eigenvalues:	2.61	1.13	0.90	0.72	0.46	0.18
Variance Proportion	44%	19%	15%	12%	8%	3%
Cumulative Proportion	44%	62%	77%	89%	97%	100%
Eigenvectors:						
CZK	-0.17	-0.74	0.19	-0.63	-0.06	-0.04
HUF	-0.48	0.12	-0.31	-0.03	-0.81	-0.06
PLN	-0.27	-0.48	-0.65	0.42	0.32	-0.03
SIT	-0.53	0.30	0.09	-0.18	0.37	-0.67
SKK	-0.31	-0.27	0.66	0.61	-0.14	-0.03
EUR	-0.55	0.22	0.07	-0.16	0.28	0.74

The Early Period: January 1997-June 2001

	Component 1	Component 2	Component 3	Component 4	Component 5	Component 6
Eigenvalues:	3.66	0.97	0.95	0.24	0.12	0.06
Variance Proportion	61%	16%	16%	4%	2%	1%
Cumulative Proportion	61%	77%	93%	97%	99%	100%
Eigenvectors:						
CZK	-0.37	-0.08	-0.69	0.31	0.44	-0.32
HUF	-0.48	-0.07	0.15	-0.66	-0.11	-0.54
PLN	-0.46	-0.13	-0.39	-0.13	-0.51	0.59
SIT	-0.44	0.03	0.41	0.67	-0.36	-0.24
SKK	-0.11	0.99	-0.11	-0.06	-0.03	0.01
EUR	-0.46	0.01	0.42	-0.05	0.64	0.46

The Late Period: July 2001-June 2005

	Component 1	Component 2	Component 3	Component 4	Component 5	Component 6
Eigenvalues:	3.32	1.28	0.64	0.32	0.30	0.14
Variance Proportion	55%	21%	11%	5%	5%	2%
Cumulative Proportion	55%	77%	87%	93%	98%	100%
Eigenvectors:						
CZK	-0.40	-0.17	-0.75	0.23	0.45	0.00
HUF	-0.39	0.48	0.34	0.62	0.08	-0.34
PLN	-0.30	0.68	-0.02	-0.55	0.24	0.30
SIT	-0.36	-0.48	0.50	-0.31	0.50	-0.20
SKK	-0.49	-0.06	-0.20	-0.33	-0.61	-0.48
EUR	-0.49	-0.23	0.18	0.21	-0.33	0.72

Source: Authors' estimates.

Table 5: Correlations of Long-Run Volatility Component

The Full Period: January 1997-June 2005

	CZK	HUF	PLN	SIT	SKK	EUR
CZK	1	0.09	0.21	0.07	0.20	0.13
HUF		1	0.32	0.54	0.20	0.59
PLN			1	0.16	0.14	0.22
SIT				1	0.29	0.82
SKK					1	0.32
EUR						1

The Early Period: January 1997-June 2001

	CZK	HUF	PLN	SIT	SKK	EUR
CZK	1	0.51	0.84	0.36	0.13	0.37
HUF		1	0.78	0.74	0.11	0.85
PLN			1	0.59	0.10	0.60
SIT				1	0.15	0.86
SKK					1	0.14
EUR						1

The Late Period: July 2001-June 2005

	CZK	HUF	PLN	SIT	SKK	EUR
CZK	1	0.30	0.25	0.38	0.64	0.58
HUF		1	0.67	0.24	0.49	0.52
PLN			1	0.01	0.42	0.24
SIT				1	0.51	0.69
SKK					1	0.77
EUR						1

Source: Authors' estimates.

Table 6: Principal Components of Short-Run Volatility

The Full Period: January 1997-June 2005

	Component 1	Component 2	Component 3	Component 4	Component 5	Component 6
Eigenvalues:	1.90	1.34	0.96	0.74	0.70	0.36
Variance Proportion	32%	22%	16%	12%	12%	6%
Cumulative Proportion	32%	54%	70%	82%	94%	100%
Eigenvectors:						
CZK	-0.39	0.11	0.64	-0.52	-0.36	-0.16
HUF	0.09	0.69	0.11	-0.28	0.62	0.22
PLN	-0.03	0.68	-0.01	0.49	-0.54	0.07
SIT	0.35	-0.13	0.74	0.50	0.24	-0.13
SKK	0.60	0.18	-0.14	-0.28	-0.15	-0.70
EUR	0.60	-0.11	0.12	-0.29	-0.34	0.65

The Early Period: January 1997-June 2001

	Component 1	Component 2	Component 3	Component 4	Component 5	Component 6
Eigenvalues:	1.73	1.25	0.98	0.84	0.77	0.43
Variance Proportion	29%	21%	16%	14%	13%	7%
Cumulative Proportion	29%	50%	66%	80%	93%	100%
Eigenvectors:						
CZK	-0.26	0.37	0.64	-0.52	0.30	0.16
HUF	-0.46	0.01	-0.59	-0.40	0.35	-0.40
PLN	-0.10	0.67	-0.19	-0.13	-0.70	-0.07
SIT	-0.12	-0.64	0.16	-0.52	-0.53	-0.06
SKK	0.54	0.05	-0.39	-0.49	0.11	0.55
EUR	-0.63	-0.10	-0.18	0.21	-0.06	0.71

The Late Period: July 2001-June 2005

	Component 1	Component 2	Component 3	Component 4	Component 5	Component 6
Eigenvalues:	2.38	1.16	1.04	0.71	0.47	0.25
Variance Proportion	40%	19%	17%	12%	8%	4%
Cumulative Proportion	40%	59%	76%	88%	96%	100%
Eigenvectors:						
CZK	-0.48	-0.06	-0.36	-0.16	-0.78	0.00
HUF	0.10	-0.69	-0.45	0.55	0.08	0.09
PLN	-0.25	0.63	-0.13	0.72	0.02	0.01
SIT	-0.19	-0.31	0.81	0.35	-0.31	0.03
SKK	-0.57	-0.18	0.00	-0.05	0.38	-0.71
EUR	-0.57	-0.08	0.02	-0.15	0.38	0.70

Source: Authors' estimates.

Table 7: Correlations of Short-Run Volatility Component

The Full Period: January 1997-June 2005

	CZK	HUF	PLN	SIT	SKK	EUR
CZK	1	0.04	0.05	-0.07	-0.33	-0.23
HUF		1	0.28	0.01	0.19	-0.03
PLN			1	-0.06	0.07	-0.09
SIT				1	0.17	0.31
SKK					1	0.57
EUR						1

The Early Period: January 1997-June 2001

	CZK	HUF	PLN	SIT	SKK	EUR
CZK	1	0.07	0.13	-0.04	-0.19	0.07
HUF		1	0.07	0.04	-0.10	0.39
PLN			1	-0.20	-0.01	0.05
SIT				1	-0.06	0.11
SKK					1	-0.46
EUR						1

The Late Period: July 2001-June 2005

	CZK	HUF	PLN	SIT	SKK	EUR
CZK	1	0.00	0.21	0.00	0.54	0.54
HUF		1	-0.22	-0.05	-0.02	-0.11
PLN			1	-0.04	0.19	0.22
SIT				1	0.24	0.21
SKK					1	0.75
EUR						1

Source: Authors' estimates.

Table 8: Wald Tests for Causality in Long-Run Volatility Component

The Full Period: January 1997-June 2005

	Dependent variable:				
	CZK	HUF	PLN	SIT	SKK
Explanatory variables:					
CZK	---	12.93 ***	5.65 **	1.08	0.32
HUF	0.34	---	7.34 ***	2.82 *	3.38
PLN	0.12	3.13 *	---	3.15 *	2.08
SIT	3.41 *	0.48	1.98	---	3.96
SKK	0.10	0.22	0.07	0.01	---
EUR	0.06	1.32	0.93	1.68	2.34

The Early Period: January 1997-June 2001

	Dependent variable:				
	CZK	HUF	PLN	SIT	SKK
Explanatory variables:					
CZK	---	1.12	8.24 ***	0.05	0.15
HUF	0.38	---	6.72 ***	2.85 *	0.18
PLN	0.01	7.93 ***	---	4.89 **	2.68
SIT	0.00	2.15	0.05	---	1.03
SKK	0.08	0.00	0.23	0.01	---
EUR	0.00	2.39	2.83 *	4.59 **	1.22

The Late Period: July 2001-June 2005

	Dependent variable:				
	CZK	HUF	PLN	SIT	SKK
Explanatory variables:					
CZK	---	0.01	2.11	0.01	0.09
HUF	2.52	---	1.85	1.38	3.32 *
PLN	1.30	0.85	---	0.47	2.06
SIT	0.10	0.74	1.20	---	0.73
SKK	0.94	0.01	2.20	0.14	---
EUR	4.67 **	1.22	1.05	0.06	5.00 **

*Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.*

Source: Authors' estimates.

Table 9: Wald Tests for Causality in Short-Run Volatility Component

The Full Period: January 1997-June 2005

	Dependent variable:				
	CZK	HUF	PLN	SIT	SKK
Explanatory variables:					
CZK	---	0.01	2.18	49.51 ***	0.87
HUF	0.00	---	8.95 ***	28.06 ***	1.58
PLN	2.27	1.20	---	0.62	1.55
SIT	0.79	0.84	1.68	---	9.02 ***
SKK	0.32	0.69	7.52 ***	0.95	---
EUR	3.43	0.11	3.69 *	2.06	10.45 ***

The Early Period: January 1997-June 2001

	Dependent variable:				
	CZK	HUF	PLN	SIT	SKK
Explanatory variables:					
CZK	---	0.00	1.54	19.32 ***	0.13
HUF	7.48 ***	---	9.62 ***	34.54 ***	12.59 ***
PLN	0.46	6.79 ***	---	2.01	4.24 **
SIT	0.53	0.23	3.28 *	---	4.67 **
SKK	0.79	0.24	1.75	1.85	---
EUR	3.26 *	6.73 ***	4.13 **	49.48 ***	2.90 *

The Late Period: July 2001-June 2005

	Dependent variable:				
	CZK	HUF	PLN	SIT	SKK
Explanatory variables:					
CZK	---	0.09	1.42	0.50	2.76 *
HUF	1.57	---	4.10 **	0.72	4.39 **
PLN	0.86	0.09	---	0.74	2.28
SIT	3.59 *	2.27	0.74	---	2.19
SKK	2.70	0.58	2.62	2.26	---
EUR	4.78 **	1.88	0.85	144.02 ***	0.97

*Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.*

Source: Authors' estimates.

Table 10: Wald Tests for Causality in Mean

The Full Period: January 1997-June 2005

	Dependent variable:				
	CZK	HUF	PLN	SIT	SKK
Explanatory variables:					
CZK	0.45	55.75 ***	7.24 ***	0.37	0.03
HUF	0.51	7.44 ***	1.25	0.35	1.22
PLN	0.00	2.80 *	3.34 *	0.19	0.19
SIT	0.07	0.02	1.50	1.31	0.00
SKK	0.00	0.23	0.01	8.18 ***	5.55 **
EUR	0.01	2.84 *	2.26	1.01	0.26

The Early Period: January 1997-June 2001

	Dependent variable:				
	CZK	HUF	PLN	SIT	SKK
Explanatory variables:					
CZK	0.02	0.00	2.67	0.77	0.08
HUF	0.11	0.32	3.52 *	0.02	0.00
PLN	0.01	0.51	4.42 **	0.74	2.50
SIT	3.86 **	0.23	0.89	0.58	0.09
SKK	0.03	0.41	0.01	3.40 *	0.34
EUR	0.01	0.27	9.33 ***	3.03 *	0.49

The Late Period: July 2001-June 2005

	Dependent variable:				
	CZK	HUF	PLN	SIT	SKK
Explanatory variables:					
CZK	2.57	0.49	1.43	9.19 ***	0.98
HUF	0.18	0.25	1.01	4.11 **	0.04
PLN	5.89 **	6.66 ***	4.39 **	1.54	4.18 **
SIT	0.68	1.20	2.71	1.25	0.03
SKK	557.00 ***	3.61 *	2.47	12.70 ***	3.37 *
EUR	2.46	2.76 *	1.36	0.14	1.66

*Note: *, **, and *** indicate significance at the 10%, 5%, and 1% levels, respectively.*

Source: Authors' estimates.

Exchange Rate Volatility and Growth in Emerging Europe and East Asia[1]

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1. Introduction

After the 1997/98 Asian crisis a controversial discussion about the pros and cons of exchange rate stabilization has emerged. Proponents of flexible exchange rate have argued that fixed exchange rates encourage speculative capital inflows, moral hazard and overinvestment. The economic policy implication would be to pursue fully (more) flexible exchange rate regimes (Fischer 2001). In contrast proponents of fixed exchange rates have stressed the positive impact of exchange rate stability on the economic performance of the East Asian economies. For instance, McKinnon and Schnabl (2003, 2004a) emphasize the positive impact of low transaction costs for international and intra-regional trade and capital flows.

In the decade after the Asian crisis Emerging Europe and East Asia have taken different directions on the path towards more (less) exchange rate stability. Emerging Europe, i.e. the Central, Eastern and South-Eastern countries have further strengthened their institutional and economic linkages with the European Union. This has led to a wider use of the euro as an invoicing, vehicle, banking, pegging, intervention and reserve currency in the region and more exchange rate stability against the euro (ECB 2006, Kamps 2006). In contrast, in East Asia post-crisis exchange rate volatility against the U.S. dollar steadily declined up to the year 2005, but has increased since then. China and many other East Asian countries seem to follow (hesitantly) international policy recommendations in favour of more exchange rate flexibility.

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What will be the impact of the different exchange rate strategies on economic growth in the two regions? Up to the Asian crisis, an – for emerging market economies – exceptional degree of the international and intraregional exchange rate stability has been regarded as an important pillar of the East Asian miracle (World Bank, 1993, McKinnon 2005). Now Asia seems to move towards (more) exchange rate flexibility (against the U.S. dollar). In contrast, Emerging Europe has experienced high exchange rate volatility during most of the 1990s. Since exchange rates have started to stabilize in the late 1990s growth has accelerated.

Does this imply that ceteris paribus the long-run growth perspective will be better for Emerging Europe than for East Asia? Or do stable exchange rates against the euro encourage speculative capital inflows which in the long-run deteriorate Emerging Europe's growth performance? Previous research on the impact of exchange stability on growth has tended to find weak evidence in favour of a positive impact of exchange rate stability on growth. For the large country sample by Ghosh, Gulde and Wolf (2003) there is weak evidence that exchange rate stability affects growth in a positive or negative way. The panel estimations for more than 180 countries by Edwards and Levy-Yeyati (2003) find evidence that countries with more flexible exchange rates grow faster. Eichengreen and Leblang (2003) reveal a strong negative relationship between exchange rate stability and growth for 12 countries over 120 years. Yet, they conclude that the results of such estimations strongly depend on the time period and the sample.

While many previous studies have chosen very large samples to increase the robustness of the estimation process we approach the question from a different angle. We test the impact of the exchange rate volatility on growth for two groups of countries in the economic catch-up process which have widely dismantled capital controls. This allows us to control for the impact of (often rigid) capital controls which facilitate exchange rate stability but which are detrimental for the growth performance. The comparison of two groups of countries which have pursued different exchange rate strategies at different points of time are expected to yield enough heterogeneity in the cross-country panel to isolate a significant impact of exchange rate volatility on growth.

Building upon De Grauwe and Schnabl (2005) and Schnabl (2006), we perform GLS panel estimations for 17 countries in Emerging Europe and 9 East Asian countries. In addition we use 10 South American countries as a control group. The results provide evidence in favour of a robust negative relationship between exchange rate volatility and growth.

2. Regional Trends in Exchange Rate Volatility

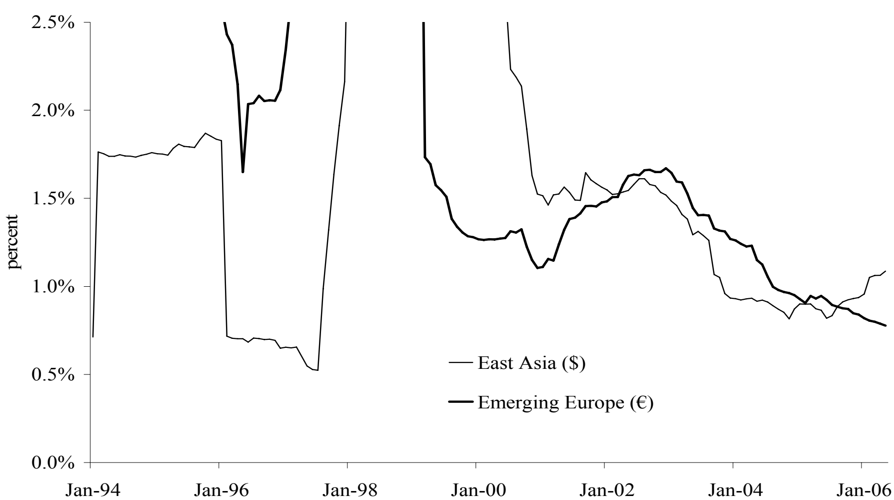
Since the late 1970s the East Asian emerging economies[3] kept their exchange rates tightly pegged to the U.S. dollar (McKinnon and Schnabl, 2004a). This common

[3] Hong Kong, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan and Thailand.

dollar peg not only maintained exchange rate stability against the U.S.A. as the most important trading partner, but also ensured an exceptional degree of intra-regional exchange rate stability. McKinnon (2005) argues that this "informal dollar standard" was the basis for a high degree of intra-regional partition of labour and export-oriented growth. Both factors are linked to the East Asia economic miracle (World Bank, 1993). China joined the East Asian dollar standard in 1994 when it pegged its exchange rate tightly to the U.S. dollar.

The intra-regional exchange rate stability in East Asia was high until the 1997/98 Asian crisis interrupted the fast economic catch-up. Post-crisis exchange rate stability against the U.S.A. re-approached the pre-crisis levels up to the year 2004 (McKinnon and Schnabl, 2004b). Since the year 2005 East Asian exchange rate volatility against the U.S. dollar has increased (chart 1). For instance, China and Malaysia have loosened their tight dollar pegs and have allowed for gradual appreciations of their currencies since then (Schnabl, 2006c). Korea has allowed for an unprecedented degree of exchange rate volatility against the U.S. dollar. This may reflect international policy recommendations in favour of more exchange rate flexibility in East Asia.

Chart 1: Exchange Rate Volatility in Emerging Europe (against the Euro) and in East Asia (against the Dollar)



Note: Volatility defined as two year rolling standard deviations of monthly percent changes against the respective anchor currency. Country groups as defined in table 1 are calculated as arithmetic averages. The German mark represents the euro before January 1999.

Source: IMF, International Financial Statistics (IFS).

Thus, while East Asia seems to move from exchange rate stability to (more) exchange rate flexibility, Emerging Europe is moving into the opposite direction. During most of the 1990s exchange rate volatility in the region has been high for two reasons. First, at the beginning of their transition process most of the countries in Central, Eastern and South-Eastern Europe experienced a high degree of macroeconomic instability and depreciations of their currencies. Second, various types of exchange rate pegs (hard pegs, downward crawling pegs, currency baskets) had different anchors. Some countries pegged their currencies to the German Mark (Estonia, Croatia) others to the U.S. dollar (Lithuania, Romania) or currency baskets (Latvia, Hungary, Czech Republic). The outcome was high intra-regional exchange rate instability which can be linked to weak intra-regional trade linkages.

Since the late 1990s exchange rate stability in Emerging Europe has increased steadily. The accession of the Central, Eastern und South-Eastern European countries to the European Union[4] required macroeconomic stabilization which led to a substantial decline in exchange rate volatility. Although some countries such as Poland and the Czech Republic moved to more exchange rate flexibility since the late 1990s intra-regional exchange rate stability increased as many countries re-pegged their currencies from the U.S. dollar to the euro (e.g. Lithuania, Bulgaria, Romania) or substituted currencies baskets by unilateral euro pegs (e.g. Latvia, Hungary).

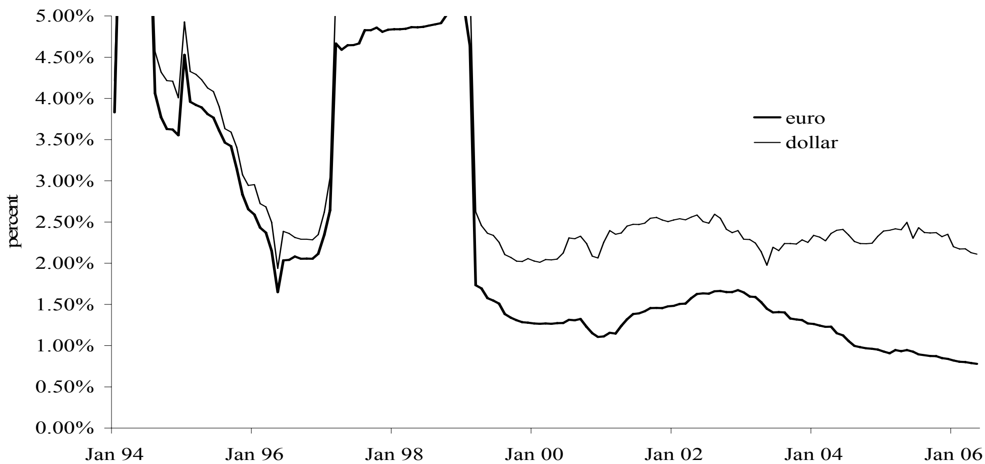
The redirection of the exchange rate targets towards the euro has both institutional and economic reasons. From an institutional perspective all countries (except the UK and Denmark) which join the European Union also have to join – sooner or later – the European Monetary Union (EMU). From an economic perspective the integration into the European goods and capital markets makes exchange rate stability against the euro beneficial as transaction costs decline. For this reason, also non-EU countries such as Albania, Croatia or the FYR Macedonia peg their currencies more or less tightly to the euro. Among the European countries, only Turkey maintains (partially) a dollar peg.

Chart 2 shows the different degrees of exchange rate volatility for Emerging Europe and East Asia both against the euro (before 1999 DM) and the U.S. dollar (unweighted averages). The upper panel depicts exchange rate volatility for Emerging Europe. During most of the 1990s exchange rate volatility was high both against the U.S. dollar and German mark. Since the late 1990s, exchange rate volatility against the euro is significantly lower than against the U.S. dollar and has steadily declined. In East Asia as shown in the lower panel exchange rate volatility against the U.S. dollar has been very low against the dollar compared to exchange

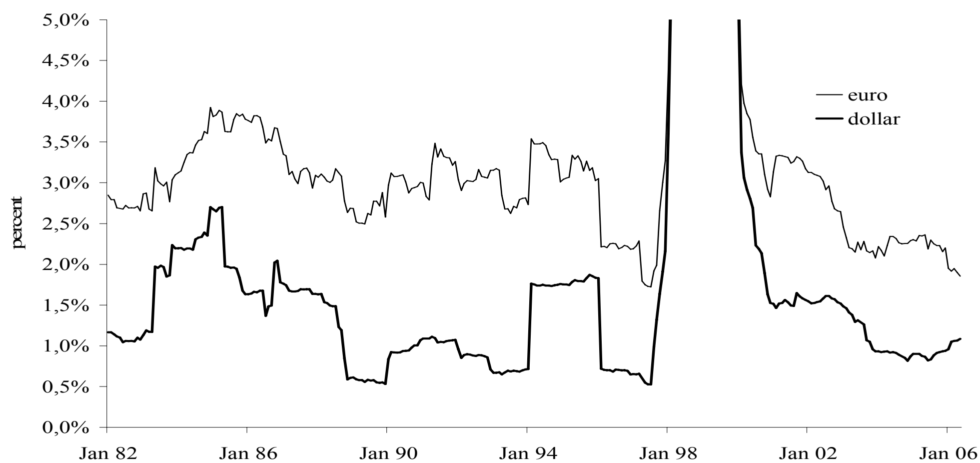
[4] Besides the countries which have already joined the European Union, Turkey, Croatia and the FYR Macedonia are candidate countries; Albania, Bosnia-Herzegovina, Serbia and Montenegro are potential candidate countries.

rate volatility against the euro (German mark before 1999) since the early 1980s except for the 1997/98 crisis period. Since the year 2005 exchange rate volatility has started to rise.

Chart 2: Exchange Rate Variability in Emerging Europe and East Asia



Emerging Europe



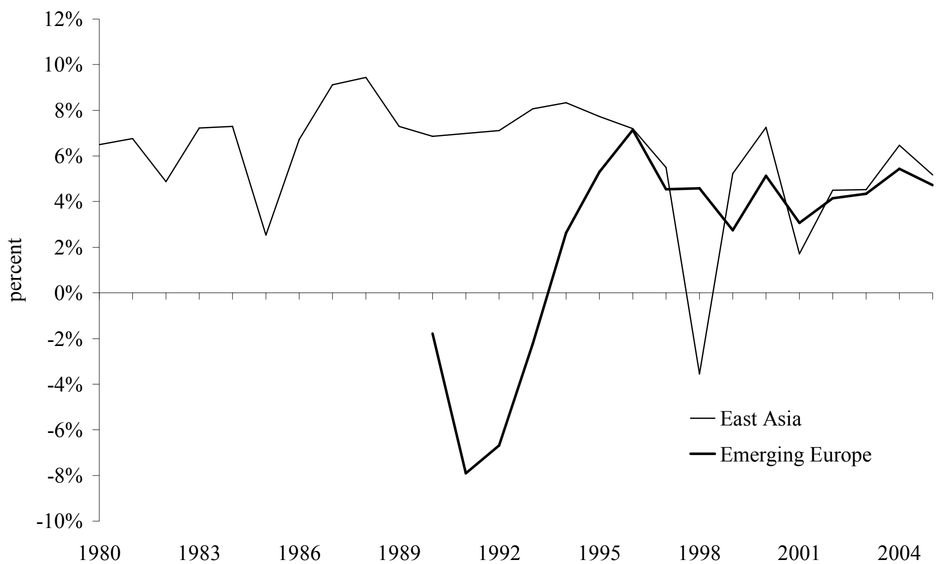
East Asia

Note: Volatility defined as two year rolling standard deviations of monthly percent changes. Country groups calculated as arithmetic averages. The country groups are defined in table 1. The German mark represents the euro before January 1999.

Source: IMF: IFS.

Chart 3 provides an overview over the growth performance of the two regions. Growth is defined as the arithmetic averages of the countries represented in the respective group as listed in table 1. We observe a very high level of growth of the East Asian countries up to the Asian crisis. After the crisis, the average growth in East Asia has pricked up again, but has declined compared to the pre-crisis period. In contrast, in Emerging Europe growth was low at the beginning of the transformation process and jumped to a high level during the second half the late 1990s. This may suggest a negative relationship between exchange rate volatility and growth.

Chart 3: GDP Growth in Emerging Europe and East Asia



Source: IMF. Arithmetic averages.

3. Theoretical Evidence

The increasing degree of exchange rate stability in Emerging Europe and the (still) high degree of exchange rate stability in East Asia pose the question of why countries stabilize exchange rates. The effects of the exchange rate volatility on growth can be seen as a comprehensive measure of the benefits and costs of exchange rate stabilization. The following section surveys the role of asymmetric shocks, international trade and international capital markets as the most important transmission channels from exchange rate volatility to growth.

3.1 Asymmetric Shocks

Flexible exchange rates have been regarded as an important tool to cope with asymmetric (real) shocks (Meade, 1951, Friedman, 1953). The reason is that under fixed exchange rate regimes real exchange rate adjustments have to be carried out through relative price and productivity changes which in a world of price and wage rigidities are slow and costly. The outcome is a lower growth performance.

Mundell's (1961) seminal paper on optimum currency areas (OCA) extended the argument to a monetary union. Interpreting monetary and exchange rate policies as Keynesian instruments of adjustment, Mundell (1961) argued that shock absorption within a heterogeneous group of countries is easier if monetary and exchange rate policies remain independent. In particular for countries with rigid labour markets and low international labour mobility, monetary autonomy was regarded as important. Today, Mundell's (1961) OCA framework remains the most important theoretical tool to analyse the pro and cons of EMU enlargement (see Fidrmuc and Korhonen 2006 for an overview).

In contrast, McKinnon (1963) emphasized the benefits of fixed exchange rate regimes for small open economies in the face of nominal shocks. Assuming that for small open economies the international price level is given and traded goods make up a high share of the domestically consumed goods, exchange rate stability ensures domestic price stability. The welfare effect of stable exchange rates originates in macroeconomic stability which provides a favourable environment for investment, consumption and growth. From this perspective, as acknowledged by Mundell (1973a, 1973b) in later works, monetary and exchange rate policies are regarded as a source of uncertainty and volatility in small open economies. Growth is stimulated when exchange rate fluctuations are smoothed.

3.2 International Trade

The welfare gains from the international partition of labour are widely acknowledged. The economic policy implication is to remove exchange rate volatility to foster trade and higher growth.

The impact of exchange rate volatility on trade among two or a group of countries has both a micro- and macroeconomic dimension. From a microeconomic perspective exchange rate volatility – for instance measured as day-to-day or week-to-week exchange rate fluctuations – is associated with higher transactions costs because uncertainty is high and hedging foreign exchange risk is costly. Indirectly, fixed exchange rates enhance international price transparency as consumers can compare prices in different countries more easily. If exchange rate volatility is eliminated, international arbitrage enhances efficiency, productivity and welfare. For instance, these microeconomic benefits of exchange rate stabilization have been a pivotal motivation of the European (monetary) integration process

(European Commission, 1990) which can be regarded as the most advanced and comprehensive approach to eliminate intra-regional exchange rate fluctuations.

The macroeconomic dimension arises from the fact that long-term exchange rate fluctuations – for instance measured as monthly or yearly changes of the exchange rate level – affect the competitiveness of domestic export and import competing industries. In specific in small open economies the growth performance is strongly influenced by long-term fluctuations of the exchange rate level. Even large, comparatively closed economies such as the euro area and Japan are sensitive to large exchange rate swings, in particular in the case of appreciation. McKinnon and Ohno (1997) show for Japan that since the early 1970s when the yen became flexible against the U.S. dollar growth has been strongly influenced by the appreciation of the Japanese currency.

McKinnon and Schnabl (2003) argue for the small open East Asian economies, that the fluctuations of the Japanese yen against the U.S. dollar strongly affected the growth performance of the East Asian tiger economies. They identify trade with Japan and competition in third markets (US) as crucial transmission channels. Before 1995 the appreciation of the Japanese yen against the U.S. dollar enhanced the competitiveness of the smaller East Asian economies who kept their exchange rates pegged to the U.S. dollar. Economic growth in the region accelerated. Then, the strong deprecation of the yen against the U.S. dollar from 1995 into 1997 slowed down growth in Japans small neighbouring countries, contributing to the 1997/98 Asian crisis.

Although the short-term and long-term exchange rate swings can strongly affect the growth performance of open economies through the trade channel the empirical evidence in favour of a systematic positive (or negative) effect of exchange rate stability on trade (and thereby growth) has remained mixed (IMF, 1984, European Commission, 1990). Bacchetta and van Wincoop (2000) find based on a general equilibrium framework that exchange rate stability is not necessarily associated with more trade. Gravity models have been used as frameworks to quantify the impact of exchange rate stability on trade and growth, in particular in the context of a monetary union. While the size of the coefficient by Frankel and Rose (2002) seems to exaggerate the trade effects of a monetary union, Micco, Stein and Ordoñez (2003) find that in its early years the European Monetary Union has increased trade by up to 16%.

3.3 Capital Markets

Capital markets have been playing an increasing role in the discussion about exchange rate stabilization and growth since the Asian crisis (Eichengreen and Hausmann, 1999, McKinnon and Schnabl, 2004a, De Grauwe and Schnabl, 2005a, Aghion et al. 2006). The impact of exchange rates on economic growth via capital markets has both a short-term (microeconomic) and a long-term (macroeconomic) dimension.

From a short-term perspective, fixed exchange rates can foster economic growth by a more efficient international allocation of capital when transaction costs for capital flows are removed (McKinnon, 1973). If international capital market segmentations are dismantled debtors in high yield emerging market economies benefit from a substantial decline in interest rates due to investment from low yield developed capital markets (Dornbusch, 2001). The authorities in the emerging market debtor countries have an incentive to encourage capital inflows by dismantling capital controls and by providing an efficient financial supervision.

From a more long-term perspective, fluctuations in the exchange rate level constitute a risk for growth in emerging markets economies as they affect the balance sheets of banks and enterprises of which foreign debt tends to be denominated in foreign currency (Eichengreen and Hausmann, 1999).[5] Sharp depreciations inflate the liabilities in terms of domestic currency thereby increasing the probability of default and crisis. In debtor countries with highly euroized (dollarized) financial sectors, the incentive to avoid sharp exchange rate fluctuations is even stronger (Aghion et. al., 2006, Chmelarova and Schnabl, 2006). Maintaining the exchange rate at a constant level, in particular preventing sharp depreciations, is equivalent to maintaining growth (McKinnon and Schnabl, 2004a).

3.4 Boom-and-Bust Cycles

Although as shown above, fixed exchange rates can support growth in small open economies by encouraging international capital inflows, speculative capital inflows into countries with shallow capital markets can contribute to excess volatility and crisis (Fratzscher and Bussiere, 2004).

During the 1970s and 1980s crisis in emerging market economies was associated with unsound macroeconomic policies, in particular in Latin American countries. The interdependence of volatile macroeconomic policies and crisis is reflected in the first generation of crisis models (e.g. Krugman, 1979). In contrast, the East Asian crisis economies provide an example for boom-and-bust cycles which are driven by "good governance" in macroeconomic policies including fixed exchange rate strategies. Before the 1997/98 crisis the East Asian emerging tiger economies attracted international capital flows (inter alia) for two reasons. First, the East Asian economies pursued favourable macroeconomic polices, i.e. low inflation and low government deficits. Second, the fixed exchange regimes helped

[5] The impact of exchange rate fluctuations in the case of asset dollarization is explored by McKinnon and Schnabl (2004b).

attracting international capital inflows as they provided implicit guarantees to reconvert investments at constant exchange rates against the U.S. dollar.

Both factors interact. To maintain fixed exchange rates in the long-term, a high degree of macroeconomic stability and flexibility is required. In particular labour markets have to adjust to asymmetric shocks. The resulting good macroeconomic performance attracts capital inflows. Interest rates decline. Investment, consumption and growth accelerate. As tax incomes rise due to the buoyant domestic activity, governments can keep deficits (more easily) low. In addition, capital inflows are accelerated if interest rates in the large capital markets are low. In the case of the East Asian emerging economies in the mid 1990s, capital inflows were further encouraged by historically low interest rates in Japan which boosted carry trade and the hunt for yield in Japan's small East Asian neighbouring countries (Schnabl und Starbatty, 1998).

The down side of "virtuous circles" of sound macroeconomic performance and capital inflows as observed in East Asia before the year 1997 is the threat of inflation. While in pre-crisis East Asia, consumer price inflation remained comparatively moderate, inflation rose above the level in the U.S.A. as buoyant capital inflows were translated through foreign exchange intervention into monetary expansion. Given that exchange rates were kept – by and large – constant the East Asian currencies appreciated in real terms. Current account deficits and financial account surpluses rose. The foreign currency denominated external debt and thereby the exposure of the banking sectors increased.[6] Inflation became most visible in the real estate and stock markets where prices rose fast thereby providing evidence of asset price bubbles and overheating.

In East Asia, the currency and financial crisis started with speculation against the dollar pegs which reflected rising concerns about the sustainability of the East Asian boom. The waves of speculation ended with the collapse of the dollar pegs of five East Asian crisis economies which rendered the banking sectors bankrupt. The outcome was severe recessions (chart 3) which were further enhanced by IMF austerity programs. The East Asian crisis was propagated to the other East Asian non-crisis economies which were affected through several transmission channels such as trade, capital flows and FDI. The outcome was most severe for Japan where the Asian crisis caused falling stock prices at the Tokyo stock exchange which finally cumulated in the Japanese financial crisis (Schnabl and Starbatty, 1998).

The lesson drawn from the currency attacks on the East Asian debtor economies was that the pre-1997 system of "soft" dollar pegs itself was at fault (Fischer, 2001). Before 1997, because of high risk premiums – which helped to sustain capital inflows when current account deficits increased – the interest rates in the

[6] Concerning the impact of the currency denomination of external debt and the probability of crises see Eichengreen and Hausmann (1999) and McKinnon and Schnabl (2004a).

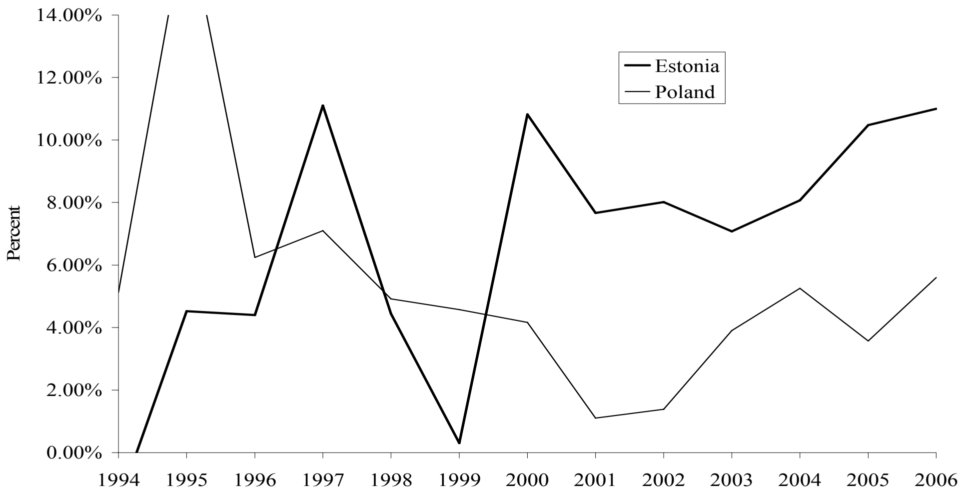
East Asian debtor economies were much higher than on U.S. dollar or yen assets. Domestic banks were tempted to accept low-interest U.S. dollar (or yen) deposits instead of relatively high-interest baht deposits. The temptation to risk foreign exchange exposure was all the greater because exchange rates were (softly) fixed.

The answer of if flexible exchange rates would reduce the risk of crisis is not straightforward and depends on the central bank's response to appreciation pressure. Let's assume a situation of strong capital inflows which are driven by both favourable macroeconomic conditions in the emerging market economy and low interest rates in the large industrialized countries. This would bring the currency of the emerging market economy under appreciation pressure. If the central bank allows for an appreciation and appreciation expectations become sustained additional speculative capital inflows will be encouraged.[7] Under such circumstances the likelihood increases that the central bank will intervene in foreign exchange markets against "excessive appreciation" and the capital inflows will be translated into a rising money supply. Compared to a fixed exchange rate regime the monetary expansion may be even larger because sustained appreciation expectations encourage additional capital inflows. The probability of overheating further rises.

Only if the central bank allows for "uncontrolled appreciation" of the domestic currency, the probability of crisis declines as the appreciation of the domestic currency deteriorates the economic outlook. The negative impact of appreciation on growth will be particularly strong in small open economies because the share of exports of GDP is high and domestic activity is comparatively small. From this perspective the price of a lower probability of crisis will be lower growth. For instance, chart 4 plots the growth rates of Estonia and Poland which can be seen as corner solutions in the choice of the exchange rate regime in Emerging Europe. Estonia has pursued a tight peg to euro (DM) since 1994. Poland has allowed for full exchange rate flexibility since 2001. Both countries have experienced very different levels of growth. Estonia has been growing significantly faster than Poland in average although Estonia was strongly hit by the 1998 Russian crisis.

[7] For countries in the economic catch-up process with inflation targeting frameworks the probability of appreciation is even higher due to the Balassa-Samuelson effect which implies a nominal appreciation if the inflation rate is kept close to the level of the reference economy (De Grauwe and Schnabl, 2005b).

Chart 4: Real Growth in Estonia and Poland



Source: IMF.

The upshot is that the policy choice of fully flexible exchange rates will be difficult to politically defend. This is even more the case when GDP per capita is low and if neighbouring countries with fixed exchange rate regimes experience high growth due to buoyant capital inflows. Discretionary foreign exchange intervention in times of appreciation becomes likely. This may imply that the central bank "jumps" between domestic targets of monetary policy making (for instance inflation targets) in times of a weak currency and exchange rate targets in times of a strong currency. During the economic catch-up – due to the Balassa-Samuelson effect – appreciation pressure is likely to be more frequent (De Grauwe and Schnabl, 2005b). The outcome would be more uncertainty with respect to monetary policy making which can be linked to higher risk premiums on interest rates and thereby lower growth (Schnabl, 2006b).

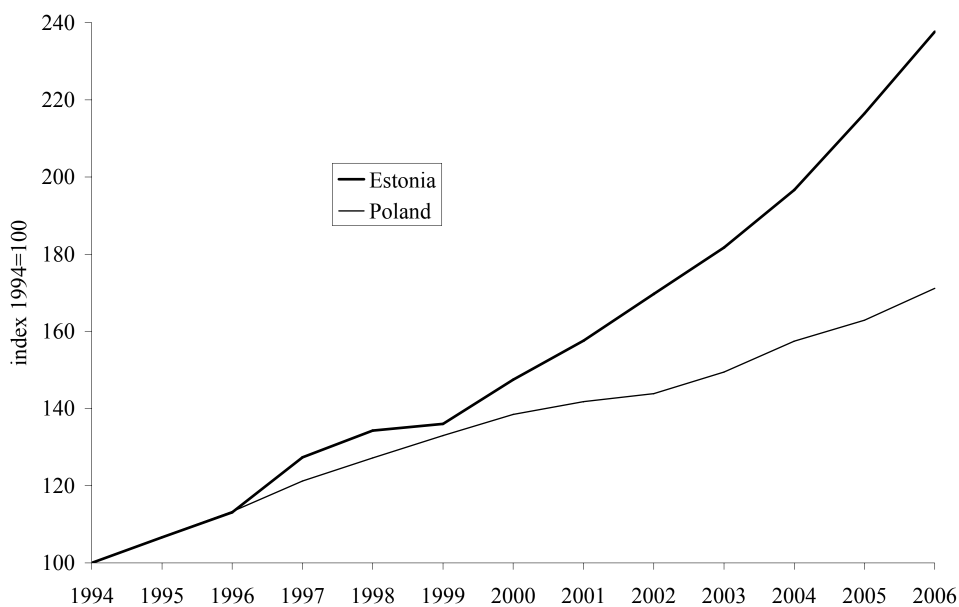
This leads to the long-term cost-benefit-analysis. Countries with fixed exchange rate regimes can better benefit from buoyant international capital inflows and high growth, but risk a higher probability of crisis.[8] Emerging market economies with fully flexible exchange rate regimes won't be able to fully reap the gains of international capital inflows, as appreciation pressure will slow down growth as soon as capital inflows allow for an acceleration of the economic catch-up process.

[8] This hypothesis implies that the respective countries' macroeconomic policies are flexible enough to maintain the peg. If this is not the case, as in Argentina, a flexible exchange rate regime may be the better policy choice.

"Intermediate regimes" which intervene occasionally against the "excessive appreciation" may even face a higher probability of crisis than countries with hard pegs if sustained appreciation expectations encourage additional speculative capital inflows. If capital inflows are curtailed by strict capital controls, domestic interest rates increase and growth will slow down as well.

The upshot is that in the absence of a first best solution, in the long-run credibly fixed exchange rate regimes are the (second) best solution despite a rising probability of overheating. Ranciere, Tornell and Westermann (2003) argue that there is a robust positive relationship between the speed of the economic catch-up and crisis, but that countries which provide favourable conditions for capital inflows – for instance by open capital accounts, macroeconomic stability and exchange rate stability – grow faster in the long-term. From this perspective currently Estonia has a higher probability of crisis than Poland. Yet in the long-run – despite possible crisis – Estonia would catch-up faster than Poland. This may be suggested by chart 5 which depicts the development of real output per capita since 1994 in both countries.

Chart 5: Real Output per Capita in Estonia and Poland



Source: IMF.

4. Empirical Investigation

Given the pro and cons about fixed exchange rates in emerging market economies the question about the impact of the exchange rate volatility on growth remains an empirical matter which is scrutinized here for Emerging Europe and East Asia. This investigation builds upon De Grauwe and Schnabl (2007) for the new EU member states and Schnabl (2006b) for the EMU periphery.

4.1 Sample, Observation Period, and Volatility Measures

To identify the effect of exchange rate volatility on growth, we specify an unbalanced cross-country panel model for 17 Emerging European countries and 9 East Asian countries. In addition we use 10 South American countries as a control group (table 1 provides an overview). First, we include 17 Central, Eastern and South-Eastern European countries which have already joined the European Union or are associated with the EU enlargement process as candidate or potential candidate countries. Serbia and Montenegro are excluded because of insufficient data. Most Central, Eastern and South-Eastern European countries have redirected their exchange rate policies towards the euro.

Second, we include nine East Asian countries, namely China, Hong Kong, Indonesia, Korea, Philippines, Malaysia, Singapore, Taiwan and Thailand. As outlined in section 2 up to very recently the East Asian countries have pegged their currencies commonly to the U.S. dollar (East Asian dollar standard) (McKinnon, 2005). The common dollar peg has been regarded as growth enhancing, but we are not aware of an investigation which provides econometric evidence.

The data sources are IMF International Financial Statistics, IMF World Economic Outlook and the national central banks. We use yearly data, as for some countries data are only available on a yearly basis. The volatility measures are calculated as yearly averages of monthly percent exchange rate changes. The sample period starts for Emerging Europe in 1994, because a substantial part of the sample consists of (former) transition economies. The pre-1994 data are for this reason unstable and very fragmented. The time period is up to the present (2005).

Table 1: Sub-Samples

	Countries	IFS County Code	Panel ID
Emerging Europe	Bulgaria	918	1
	Croatia	960	2
	Romania	968	3
	Turkey	186	4
	Albania	914	5
	Bosnia-Herzegovina	963	6
	FYR Macedonia	962	7
	Cyprus	423	8
	Czech Republic	935	9
	Hungary	944	10
	Latvia	941	11
	Lithuania	946	12
	Estonia	939	13
	Malta	181	14
	Poland	964	15
	Slovak Republic	936	16
	Slovenia	961	17
East Asia	China	924	18
	Hongkong	532	19
	Indonesia	536	20
	Korea	542	21
	Malaysia	548	22
	Philippines	566	23
	Singapore	576	24
	Taiwan	528	25
	Thailand	578	26
Latin America	Argentina	213	27
	Bolivia	218	28
	Brazil	223	29
	Chile	228	30
	Colombia	233	31
	Ecuador	248	32
	Paraguay	288	33
	Peru	293	34
	Uruguay	298	35
	Venezuela	299	36

Note: Serbia and Montenegro were removed due to insufficient data.

To test for the impact of the exchange rate volatility on economic growth, we use de facto volatility measures, because de jure volatility measures have proved to be flawed by "fear *of floating*" (Calvo and Reinhart, 2002, McKinnon and Schnabl, 2004a, De Grauwe and Schnabl, 2005a). Exchange rate volatility can be measured in four ways. First, oscillations around a constant level as measured by the standard deviation of percent exchange rate changes (σ) can be seen as a proxy for uncertainty and transactions costs for international trade and short-term capital flows.

Second, the arithmetic average of percent exchange rate changes (μ) can be seen as a measure for changes in the exchange rate level, i.e. for "beggar-thy-neighbour" depreciations (positive sign) or a sustained appreciation pressure (negative sign) for the respective economy. Both measures are summarized by the z-score ($z_t = \sqrt{\mu_t^2 + \sigma_t^2}$) as proposed by Ghosh, Gulde and Wolf (2003). Fourth, a sustained appreciation or depreciation path can be captured by the yearly relative exchange rate change (γ) comparing January with December. Appreciations exhibit a negative sign, depreciations a positive sign.

All four volatility measures are calculated against the euro and the U.S. dollar. We compute a minimum measure for exchange rate volatility which includes the smaller volatility either against the euro or the U.S. dollar. This matters in specific for the Emerging European countries which have tended to switch their exchange rate targets from the U.S. dollar to the euro. For the East Asian countries and the South American countries the volatility measures are only calculated against the U.S. dollar.

4.2 Model Specification and Estimation Procedure

We use a cross-country panel data model that explains economic growth by exchange rate volatility and a set of control variables[9]:

$$w_{it} = \gamma_i + v'_{it}\,\delta_i + \varepsilon_{it}\ , \qquad (1)$$

where w_{it} is the vector of yearly real growth rates from 1994 to 2005. The explanatory variable v_{it} consists of the indicators of exchange rate volatility (σ, μ, z, γ) and the control variables.

We use standard deviations of monthly exchange rate changes (σ) and January over December percent exchange rate changes (γ) as measures for exchange rate

[9] See Ghosh, Gulde, and Wolf (2003) and Edwards and Levy-Yeyati (2003) for a similar approach.

volatility. Alternatively, the z-score as a comprehensive measure of both is used.[10] As discussed in section 2 there are three main transmission channels from exchange rate stability to growth: interest rates, trade and macroeconomic stability. Exchange rate stability is expected to be linked with lower interest rates, more trade and lower inflation. We use short-term money market interest rates as a proxy for the interest rate channel. Yearly percent changes of exports in terms of U.S. dollar are used as a proxy for the trade channel. Yearly CPI inflation is used as a proxy for macroeconomic stability.

Capital inflows are included as a control variable for the following reason. If capital inflows are low, for instance due to capital controls, this has a positive impact on exchange rate stability, because the need for foreign exchange intervention to maintain the peg is less. Under tight capital controls interest rates increase, as domestic capital markets are disconnected from international capital markets where lower interest rates prevail. Our proxy for capital flows adds net short-term capital inflows, FDI and errors and omission which are regarded as unrecorded capital flows. A positive sign marks inflows, a negative sign marks outflows.

We include dummies for crisis in emerging markets such as for the 1997/98 Asian crisis, the 1998 Russian crisis and several crises in South America (1980–1983, 1994–1995, 1999–2002). We include dummies for inflation targeting regimes which are associated with exchange rate flexibility.

There are a large number of other macroeconomic variables which affect growth and therefore may be considered as control variables such as investment, consumption and government spending. Including these variables into the specification increases the fit of the model, but also decreases the degrees of freedom. In addition, in small open economies most macroeconomic variables are influenced by exchange rate volatility as they are strongly dependent on interest rates, trade and inflation. For this reason, we restrict the control variables to the variables described above.

4.3 Estimation Results

A generalized least square fixed effect model is used as estimation framework.[11] The fixed effect specification models the heterogeneity of the countries in the sample. We choose the General Least Squares model instead of a dynamic specification, as the concern about endogeneity is low. Fast growing countries can not be argued to adopt systematically either fixed or flexible exchange rate regimes. Macroeconomic stability can be argued to affect both the growth

[10] Yearly percent exchange rate changes are correlated with the means of monthly percent exchange rate changes.

[11] Random effect models lead to by and large the same results.

performance and the ability to maintain a fixed exchange rate regime but this source of a possible bias is assumed to be controlled by the inflation variable.

4.3.1 Emerging Europe

The estimation results for Emerging Europe with respect to exchange rate volatility against the euro provide evidence in favor of a negative correlation between exchange rate volatility and growth. The specification for the whole sample with all control variables suggests that exchange rate volatility against the euro has a clearly negative impact on growth (table 2). Both the coefficients for the standard deviations and the z-scores are negative and significant at the 1%-level. In the specification with the highest fit which includes all control variables the yearly change rate of the exchange rate has a positive sign suggesting a negative (positive) impact of appreciation (depreciation) on growth.

The proxies for the transmission channels have the expected signs and are mostly significant at the common levels. Higher interest rates are associated with lower growth at very significant levels. Export growth is positively linked to higher growth, also at very significant levels. Inflation is associated with lower growth, but at lower significance levels. Capital flows have the expected positive sign – inflows (outflows) are linked to higher (lower) growth – but remain insignificant. The dummy for inflation targeting has a negative sign and is significant in some

Table 2: GLS Estimation Results for the Emerging Europe 1994 – 2005 (Euro)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Standard	-0.553***		-0.102		-0.584***		-0.102*	
deviation	(0.160)		(0.064)		(0.160)		(0.063)	
Yearly change	0.009		-0.029***		-0.000		-0.029***	
	(0.009)		(0.008)		(0.009)		(0.007)	
Z-score		-0.426***		-0.242***		-0.537***		-0.252***
		(0.133)		(0.048)		(0.120)		(0.048)
Interest rate	-0.100***	-0.072***			-0.068***	-0.055***		
	(0.026)	(0.021)			(0.021)	(0.017)		
Export growth	0.056***	0.059***			0.055***	0.058***		
	(0.012)	(0.012)			(0.012)	(0.012)		
Inflation	-0.017	-0.025**			-0.014	-0.018*		
	(0.012)	(0.010)			(0.012)	(0.010)		
Inflation target	-0.017**	-0.016*	-0.013***	-0.010	-0.013	-0.013	-0.013	-0.011
	(0.008)	(0.009)	(0.010)	(0.010)	(0.008)	(0.008)	(0.009)	(0.010)
Crisis	-0.000	-0.001	-0.004	-0.003	-0.000	-0.001	-0.004	-0.004
	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.005)	(0.005)
Capital flows	0.018	0.014	0.008	0.059				
	(0.048)	(0.048)	(0.049)	(0.048)				
Constant	0.057***	0.054***	0.047***	0.043***	0.054***	0.053***	0.047***	0.048***
	(0.007)	(0.006)	(0.005)	(0.005)	(0.004)	(0.004)	(0.003)	(0.003)
Observations	178	178	194	194	184	184	200	481
Number of id	17	17	17	17	17	17	17	41
R^2 within	0.461	0.453	0.199	0.149	0.434	0.434	0.194	0.142
R^2 between	0.287	0.309	0.359	0.341	0.352	0.349	0.323	0.318
R^2 overall	0.315	0.327	0.223	0.174	0.345	0.343	0.216	0.164

*Note: *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level. Source: IMF, national central banks.*

specifications suggesting that countries with inflation targeting frameworks experience lower growth.[193]

Different specifications which exclude one or the other control variable show a stable negative relationship between the z-score and growth. Also the negative sign for the standard deviations is robust. In contrast, without controlling for interest rates, export growth and inflation the coefficient for the yearly exchange rate changes the sign suggesting that appreciation (depreciation) is associated with higher (lower) growth.

An alternative specification estimates the impact of exchange rate volatility on growth for the volatility measure which uses the lowest volatility either against the euro or the U.S. dollar (Min) (table 3). The minimum volatility measure can be regarded as a more precise proxy for exchange rate volatility in the region as some countries in the EMU periphery peg their exchange rates against the U.S. dollar or had pegged their exchange rates against the U.S. dollar in the early part of our sample period. Indeed, the fit of this specification is slightly better than for the previous model. The estimation results are very similar suggesting a robust negative relationship between exchange rate volatility and growth. Inflation targeting frameworks seem to have a negative impact on growth, but remain widely insignificant.

All in all, this suggests that Emerging Europe's move from high exchange rate volatility to increasing exchange rate stability (against the euro) has brought substantial benefits in terms of higher growth. The benefits arise from lower interest rates, more exports and a higher degree of macroeconomic stability. This confirms the role of interest rates, trade and macroeconomic stability as transmission channels. The anchor currency does not seem to matter for the impact of the exchange rate regime on growth as both exchange rate stabilization against the euro and against the U.S. dollar ensure low interest rates (if impediments to international capital flows are removed), exports and macroeconomic stability. Capital inflows seem to have a positive impact on growth.

[12] There are all kind of explanations why this could be the case for the underlying sample but this finding is not valid in general. One explanation is that inflation targeting frameworks are used as tools for disinflation which lead to negative growth effects in the short-term but would lead to higher long-term growth. Lower growth in countries with inflation targeting regimes would be also in line with findings that inflation targeting is associated with lower output volatility because a lower level of growth is linked to less output volatility.

Table 3: GLS Estimation Results for Emerging Europe 1994 – 2005 (Min)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Standard deviation	-0.559***		-0.102		-0.597***		-0.102*	
	(0.160)		(0.064)		(0.160)		(0.062)	
Yearly change	0.009		-0.028***		0.001		-0.028***	
	(0.010)		(0.008)		(0.009)		(0.007)	
Z-score		-0.398***		-0.239***		-0.512***		-0.249***
		(0.132)		(0.049)		(0.119)		(0.047)
Interest rate	-0.101***	-0.076***			-0.069***	-0.057***		
	(0.025)	(0.021)			(0.021)	(0.017)		
Export growth	0.055***	0.057***			0.054***	0.056***		
	(0.012)	(0.012)			(0.012)	(0.012)		
Inflation	-0.016	-0.025**			-0.013	-0.018*		
	(0.012)	(0.010)			(0.012)	(0.010)		
Inflation target	-0.016**	-0.016*	-0.013	-0.010	-0.013	-0.013	-0.013	-0.010
	(0.008)	(0.009)	(0.013)	(0.010)	(0.008)	(0.008)	(0.010)	(0.010)
Crisis	-0.001	-0.002	-0.004	-0.003	-0.001	-0.002	-0.004	-0.005
	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.005)	(0.005)
Capital flows	0.013	0.011	0.014	0.059				
	(0.048)	(0.048)	(0.049)	(0.049)				
Constant	0.057***	0.053***	0.046***	0.042***	0.053***	0.052***	0.047***	0.047***
	(0.007)	(0.006)	(0.005)	(0.005)	(0.004)	(0.004)	(0.003)	(0.003)
Observations	178	178	194	194	184	184	200	200
Number of id	17	17	17	17	17	17	17	17
R^2 within	0.463	0.448	0.196	0.147	0.436	0.428	0.194	0.139
R^2 between	0.288	0.311	0.372	0.342	0.355	0.359	0.333	0.325
R^2 overall	0.323	0.328	0.222	0.172	0.354	0.346	0.214	0.165

*Source: IMF, national central banks. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.*

4.3.2 East Asia

Before the Asian crisis East Asia has been regarded as a role model for the positive impact of (intra-regional) exchange rate stability on (export-led) growth. The observation period for East Asia is considerably longer than for Emerging Europe due to better data availability. The sample starts in 1980 when most countries in the sample had adopted export-oriented industrialization strategies. Exchange rate volatility is calculated against the U.S. dollar. Note that for the East Asian sample the explanatory value is substantially larger than for the Emerging Europe sample.

For the whole sample period the negative impact of exchange rate volatility on growth is strongly confirmed (table 4). The coefficients of exchange rate volatility measured in terms of standard deviations and z-scores are negative and highly significant suggesting a strong negative impact of exchange rate volatility on growth. Also the coefficient measuring appreciation (depreciation) of the East Asian currencies has the expected sign and is highly significant. Appreciation (depreciation) is strongly associated with less (more) growth. This may explain the strong inclination of the East Asian countries to stabilize exchange rates against the U.S. dollar (Dooley, Folkerts-Landau and Garber 2004, McKinnon and Schnabl, 2004a).

The results for the controls variables have mostly the expected signs. As for Emerging Europe, the specification with all control variables has the best fit. Exports have a strongly positive impact on growth. Macroeconomic instability is associated with lower growth. Yet in contrast to Emerging Europe the interest rate has not the expected sign and is insignificant. The dummy for the 1997/98 Asian crisis which controls for the negative impact of the volatility associated with the crisis is clearly negative and highly significant. This reflects the fact that the East Asian crisis was much more severe than the following instabilities in Emerging Europe during the year 1998.

In line with Emerging Europe the dummy for inflation targeting frameworks is mostly negative, associating inflation targeting with lower growth. Yet the coefficients remain widely insignificant. This may be due to two reasons. First, the impact of inflation targeting on growth is weak. Second, the East Asian countries have widely exhibited “fear of floating” even after they have adopted inflation targeting frameworks (Calvo and Reinhart, 2002, McKinnon and Schnabl, 2004b). Capital flows have a positive sign and are very significant reflecting the positive (negative) impact of capital inflows (outflows) on growth.

Table 4: GLS Estimation Results for East Asia 1980 – 2005 (Dollar)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Standard deviation	-0.486***		-0.658***		-0.627***		-0.654***	
	(0.122)		(0.104)		(0.116)		(0.106)	
Yearly change	0.074***		0.074***		0.071***		0.061***	
	(0.017)		(0.019)		(0.017)		(0.020)	
Z-score		-0.156		-0.400***		-0.323***		-0.425***
		(0.104)		(0.089)		(0.098)		(0.087)
Interest rate	0.039	-0.000			0.126*	0.099		
	(0.079)	(0.083)			(0.074)	(0.076)		
Export growth	0.139***	0.137***			0.154***	0.152***		
	(0.017)	(0.018)			(0.016)	(0.172)		
Inflation	-0.093*	-0.133**			-0.091*	-0.124**		
	(0.052)	(0.055)			(0.049)	(0.051)		
Inflation target	0.002	-0.009	-0.000	-0.007	0.003	-0.007	-0.007	-0.013*
	(0.008)	(0.008)	(0.007)	(0.007)	(0.008)	(0.008)	(0.008)	(0.008)
Crisis	-0.032***	-0.029***	-0.036***	-0.031***	-0.027***	-0.025***	-0.036***	-0.033***
	(0.009)	(0.010)	(0.010)	(0.011)	(0.008)	(0.008)	(0.009)	(0.009)
Capital flows	0.135***	0.147***	0.120***	0.122***				
	(0.035)	(0.037)	(0.039)	(0.041)				
Constant	0.049***	0.055***	0.067***	0.069***	0.044***	0.049***	0.070***	0.071***
	(0.006)	(0.007)	(0.003)	(0.003)	(0.006)	(0.006)	(0.003)	(0.003)
Observations	177	177	187	187	210	210	234	234
Number of id	8	8	8	8	9	9	9	9
R^2 within	0.598	0.548	0.390	0.327	0.534	0.487	0.284	0.242
R^2 between	0.420	0.482	0.029	0.085	0.313	0.526	0.069	0.128
R^2 overall	0.540	0.530	0.311	0.278	0.481	0.478	0.250	0.223

*Source: IMF, national central banks. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.*

4.4 Sensitivity Analysis

Both the Emerging European and the East Asian sample provide strong evidence that exchange rate volatility is detrimental for growth. The control variables confirm the important role of international trade and macroeconomic stability as transmission channels from exchange rate stability to growth. For the interest rate channel the evidence is mixed, as the Emerging European sample yields the expected result but not the East Asian sample.

We pool the Emerging Europe and East Asian sample to provide a comprehensive picture for the interdependence of exchange rate volatility and growth in emerging market economies. The pooled sample also allows for more heterogeneity within the sample. We restrict the pooled sample to the period from 1994 to 2005 as data are hardly available for Emerging Europe prior to the year 1994. The results are shown in table 5. There is strong evidence that exchange rate volatility affects growth negatively if exchange rate volatility is measured in terms of standard deviations and z-scores.

For the yearly exchange rate changes – as in the case of the Emerging European sample – the coefficient is as expected positive if interest rates, exports and inflation are included as control variables, but are insignificant. If these control variables are excluded the coefficients turn negative and become significant suggesting a positive impact of appreciation on growth. In the pooled sample the inflation targeting dummy remains negative, but is only significant at the common levels in some specifications. Capital inflows have a positive impact on growth at highly significant levels. Note that more information is drawn from the time dimension of the sample than from the cross-country dimension. All in all, the results for the single country groups are confirmed.

To pool the samples of East Asia and Emerging Europe for East Asia the period between 1980 and 1993 had to be dropped. To use the full sample period for the investigation we introduce ten South American countries as a control group (see table 1). This allows us to compare East Asia as a country group with comparatively low exchange rate volatility (against the U.S. dollar) with a country group with comparatively high exchange rate volatility (against the U.S. dollar). The results confirm the positive impact of exchange rate stability on growth while now more information is drawn from the cross-country dimension (table 6).

Table 5: GLS Estimation Results for Emerging Europe (Euro) and East Asia (Dollar) 1994 – 2005

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Standard deviation	-0.473***		-0.265***		-0.513***		-0.261***	
	(0.081)		(0.057)		(0.082)		(0.057)	
Yearly change	0.012		-0.009		0.003		-0.014**	
	(0.009)		(0.007)		(0.008)		(0.007)	
Z-score		-0.405***		-0.289***		-0.475***		-0.312***
		(0.075)		(0.044)		(0.071)		(0.043)
Interest rate	-0.082***	-0.047**			-0.062***	-0.046***		
	(0.024)	(0.019)			(0.020)	(0.018)		
Export growth	0.066***	0.075***			0.065***	0.069***		
	(0.011)	(0.011)			(0.011)	(0.010)		
Inflation	-0.031***	-0.039***			-0.027**	-0.031***		
	(0.011)	(0.010)			(0.010)	(0.009)		
Inflation target	-0.012*	-0.010*	-0.008	-0.008	-0.013**	-0.013**	-0.011	-0.010
	(0.006)	(0.006)	(0.007)	(0.007)	(0.006)	(0.006)	(0.007)	(0.007)
Crisis	-0.003	-0.004	-0.010**	-0.010**	-0.004	-0.005	-0.012***	-0.012***
	(0.004)	(0.004)	(0.005)	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)
Capital flows	0.123***	0.120***	0.122***	0.127***				
	(0.039)	(0.039)	(0.042)	(0.041)				
Constant	0.053***	0.049***	0.049***	0.049***	0.056***	0.055***	0.055***	0.055***
	(0.005)	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)
Observations	266	266	286	286	292	292	308	308
Number of id	24	24	25	25	26	26	26	26
R^2 within	0.478	0.468	0.227	0.226	0.424	0.422	0.193	0.188
R^2 between	0.143	0.151	0.082	0.070	0.309	0.314	0.252	0.234
R^2 overall	0.335	0.342	0.189	0.184	0.354	0.355	0.201	0.194

*Source: IMF, national central banks. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.*

Table 6: GLS Estimation Results for East Asia and Latin America 1980 – 2005 (Dollar)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Standard deviation	-0.080***		-0.054***		-0.097***		-0.064***	
	(0.021)		(0.018)		(0.021)		(0.019)	
Yearly change	0.003***		0.000		0.003***		0.000	
	(0.001)		(0.000)		(0.001)		(0.000)	
Z-score		-0.037**		-0.037***		-0.048***		-0.044***
		(0.017)		(0.008)		(0.017)		(0.008)
Interest rate	-0.001***	-0.000*			-0.002***	-0.000**		
	(0.000)	(0.000)			(0.000)	(0.000)		
Export growth	0.101***	0.098***			0.103***	0.099***		
	(0.001)	(0.013)			(0.013)	(0.013)		
Inflation	-0.002**	0.000			-0.002***	0.001		
	(0.001)	(0.001)			(0.001)	(0.001)		
Inflation target	-0.006	-0.004	-0.002	-0.002	-0.011*	-0.009	-0.007	-0.007
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)
Crisis	-0.028***	-0.027***	-0.030***	-0.031***	-0.031***	-0.031***	-0.032***	-0.033***
	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)	(0.005)
Capital flows	0.172***	0.182***	0.174***	0.174***				
	(0.030)	(0.031)	(0.031)	(0.031)				
Constant	0.041***	0.039***	0.049***	0.049***	0.044***	0.043***	0.054***	0.054***
	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)
Observations	385	385	423	423	418	418	470	470
Number of id	18	18	18	18	19	19	19	19
R^2 within	0.363	0.337	0.212	0.214	0.305	0.272	0.141	0.143
R^2 between	0.685	0.650	0.504	0.521	0.708	0.782	0.628	0.624
R^2 overall	0.396	0.366	0.243	0.247	0.357	0.324	0.195	0.199

All coefficients have the expected signs and are mostly highly significant. Exchange rate volatility is strongly associated with lower growth. Appreciations (depreciations) affect growth negatively (positively). All transmission channels have the expected signs and are highly significant. The dummies for inflation targeting and crisis exhibit negative signs. While for crisis the degree of significance is high, the level of significance is low for inflation targeting. Capital flows again turn out as an important driving force of growth in this pooled group of emerging market economies.

All in all, the negative impact of exchange rate volatility for economic growth seems to be robust suggesting that stable exchange rates are the better strategy for emerging market economies with underdeveloped capital markets. The role of international trade, interest rates and macroeconomic stability as transmission channels is confirmed. In addition there is a strong positive impact of capital inflows on economic growth. Note that both East Asia starting from the late 1970s and Emerging Europe starting from the mid 1990s have opened their capital accounts and have allowed for substantial international capital inflows.

In combination with fixed exchange rate regimes capital inflows contribute to lower interest rates and thereby higher investment and consumption. Yet, as outlined in section 3 also the probability of overheating and crisis is increasing. Although in our sample the East Asia has experienced such a crisis, this does not imply that flexible exchange rates are the better policy recommendation. In average the growth performance is higher and thereby the fixed exchange rate regimes should be maintained.

5. Conclusion

We have tested for the impact of exchange rate volatility on economic growth in Emerging Europe and East Asia. While East Asia had traditionally maintained a high degree of exchange rate stability it has moved towards (slightly) more exchange rate volatility (against the U.S. dollar). Emerging Europe (as a group) has continued to pursue increasingly exchange rate stability against the euro although some countries such as Poland and the Czech Republic have allowed their currencies to float substantially and have postponed EMU accession.

We have shown in the paper that there is no straightforward theoretical evidence in favour of or against exchange rate stability in emerging market economies. Neverthless, our empirical investigations suggest that emerging markets with fixed exchange rates grow faster in the long-term. The reason is that fixed exchange rates have a positive impact on international trade, interest rates and macroeconomic stability. As a pre-requisite capital controls have to be dismantled to allow for arbitrage in international goods and capital markets. Open capital accounts in combination with fixed exchange rate regimes also require macroeconomic stability which can be regarded as a further reason for higher growth.

Despite the strong evidence in favour of a positive impact of exchange rate stability on growth the relationship is not a linear one. Favourable conditions for international investment may encourage speculative capital inflows and overheating as experienced in the case of the Asian crisis. This does not imply, however, that countries should per se adopt flexible exchange rate regimes to reduce the likelihood of crisis because the price would be a considerable lower level of growth.

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List of “Workshops – Proceedings of OeNB Workshops”

For further details on the following publications see *www.oenb.at*

		published
No. 5	Macroeconomic Models and Forecasts for Austria *Vienna, 11 to 12 November 2004*	5/2005
No. 6	Capital Taxation after EU Enlargement *Vienna, 21 January 2005*	10/2005
No. 7	The European Integration Process: A Changing Environment for National Central Banks *Vienna, 21 October 2005*	3/2006
No. 8	Price Setting and Inflation Persistence in Austria *Vienna, 15 December 2005*	4/2006
No 9	New Regional Economics in Central European Economies: The Future of CENTROPE *Vienna, 30 to 31 March 2006*	6/2006
No. 10	Strategies for Employment and Growth in Austria *Vienna, 3 March 2006*	9/2006
No. 11	From Bretton Woods to the Euro – Austria on the Road to European Integration *Vienna, 29 November 2006*	7/2007
No. 12	Emerging Markets: Any Lessons for Southeastern Europe? *Vienna, 5 to 6 March 2007*	8/2007

Periodical Publications of the Oesterreichische Nationalbank

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Monetary Policy & the Economy *quarterly*

This quarterly publication, issued both in German and English, offers analyses of current cyclical developments, medium-term macroeconomic forecasts and studies on central banking and economic policy topics. It also summarizes the findings of macroeconomic workshops and conferences organized by the OeNB.

Statistiken – Daten & Analysen *quarterly*

This publication contains brief reports and analyses focusing on Austrian financial institutions, cross-border transactions and positions as well as financial flows. The contributions are in German, with executive summaries of the analyses in English. The statistical part covers tables and explanatory notes on a wide range of macroeconomic and financial indicators. The tables and additional information and data are also available on the OeNB's website in both German and English. This series also includes special issues on selected statistics topics published at irregular intervals.

econ.newsletter *quarterly*

The quarterly English-language newsletter is published only on the Internet and informs an international readership about selected findings, research topics and activities of the OeNB's Economic Analysis and Research Section. This publication addresses colleagues from other central banks or international institutions, economic policy researchers, decision makers and anyone with an interest in macroeconomics. Furthermore, the newsletter offers information on current publications, studies or working papers as well as events (conferences, lectures and workshops).
For further details see *www.oenb.at/econ.newsletter*

Financial Stability Report *semiannual*

Issued both in German and English, the *Financial Stability Report* contains first, a regular analysis of Austrian and international developments with an impact on financial stability and second, studies designed to provide in-depth insights into specific topics related to financial market stability.

Focus on European Economic Integration *semiannual*

The English-language publication *Focus on European Economic Integration* is the successor publication to Focus on Transition (published up to issue 2/2003). Reflecting a strategic regional research priority of the OeNB, this publication is a channel for communicating our ongoing research on Central and Eastern European countries (CEECs) as well as Southeastern European (SEE) countries ranging from economic country studies to studies on central banking issues and related topics. One of the purposes of publishing theoretical and empirical studies in the Focus on European Economic Integration, which are subject to an external refereeing process, is to stimulate comments and suggestions prior to possible publication in academic journals.

Workshops – Proceedings of OeNB Workshops *three to four issues a year*

The *Proceedings of OeNB Workshops* were introduced in 2004 and typically comprise papers presented at OeNB workshops at which national and international experts, including economists, researchers, politicians and journalists, discuss monetary and economic policy issues. Workshop proceedings are generally available in English only.

Working Papers *about ten papers a year*

The OeNB's *Working Paper* series is designed to disseminate, and provide a platform for discussing, findings of OeNB economists or outside contributors on topics which are of special interest to the OeNB. To ensure the high quality of their content, the contributions are subjected to an international refereeing process.

Economics Conference (Conference Proceedings) *annual*

The *Economics Conference* hosted by the OeNB represents an important international platform for exchanging views and information on monetary and economic policy as well as financial market issues. It convenes central bank representatives, economic policymakers, financial market players, academics and researchers. The conference proceedings comprise all papers presented at the conference, most of them in English.

Conference on European Economic Integration
(Conference Proceedings) *annual*

This series, published in English by a renowned international publishing house, reflects presentations made at the OeNB's annual conference on Central, Eastern and Southeastern European issues and the ongoing EU enlargement process (formerly East-West Conference).

For further details see *ceec.oenb.at*

Annual Report *annua*l

The *Annual Report* of the OeNB provides a broad review of Austrian monetary policy, economic conditions, new developments in the financial markets in general and in financial market supervision in particular as well as of the OeNB's changing responsibilities and its role as an international partner in cooperation and dialogue. It also contains the OeNB's financial statements.

Intellectual Capital Report *annual*

The *Intellectual Capital Report* has been published since 2003 as a review of the OeNB's intellectual capital and its use in the OeNB's business processes and services. The report provides an integrated view of the strategically important management of human, relational, structural and innovation capital; it clarifies the relationships between different types of capital and describes various determinants that influence the OeNB's intellectual capital. The findings of the report serve to assess the consistency of the OeNB's intellectual capital with its knowledge-based strategic orientation.