A Meta-Analysis of Business Cycle Correlations between the Euro Area, CEECs and SEECs – What Do We Know?

Jarko Fidrmuc[1]
Iikka Korhonen[2]

We review the literature on business cycle correlation between the euro area, eight new EU Member States (the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia), and two Southeastern European candidate countries (Bulgaria and Romania) which are expected to join the EU in 2007. Our meta-analysis suggests that several new Member States have already achieved a comparably high degree of synchronization with the euro area business cycle. We also find that estimation methodologies can have a significant effect on correlation coefficients. Finally, we show that Bulgaria and Romania also display a lower but still positive correlation of business cycles with Europe, although these countries have been increasingly disregarded in most recent publications.

1 Introduction

In the following discussion, we take stock of the growing literature on business cycle correlation between the euro area and Central and Eastern European countries (CEECs), i.e. the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia, as well as selected Southeastern European countries (SEECs), i.e. Bulgaria and Romania. Thus, the analyzed set of countries includes eight new Member States (NMS), which joined the EU in May 2004, and two candidate countries in Southeastern Europe (Bulgaria and Romania), which are expected to follow in 2007.[3] After accession to the EU, these countries are supposed to prepare for euro adoption. Therefore, business cycle correlation has gained increased attention recently as the NMS have started to prepare for full participation in monetary union.

The optimum currency area (OCA) theory suggests business cycle synchronization to be an important criterion for participation in a monetary union. The business cycle correlation criterion is generally applied to questions related to euro adoption and exchange rate regimes of the NMS, but it also is considered for other countries with extensive trade and economic relations with the EU. A variety of methodologies has been applied in recent business cycle studies of the CEECs.

The economic analyses applied to the CEECs inherently suffer from significant data problems. Generally speaking, reliable time series are available only from the beginning of the 1990s, and data comparisons of several sources often reveal significant differences. Moreover, frequent data revisions make replications of analyses difficult. As a result, the robustness of results for any particular study should always be questioned.

Of course, such data problems are fairly common in the natural and social sciences. Thus, meta-analyses of existing studies offer a potentially fruitful way to gain more robust results (Lipsey and Wilson, 2000). Meta-analysis typically summarizes published results on a particular topic. In addition to a more precise aggregate view, meta-analysis permits analysis of factors that may influence the results e.g. for data definition and the time period. More recently, meta-analysis

[1] *Oesterreichische Nationalbank (OeNB), Foreign Research Division, jarko.fidrmuc@oenb.at, and Comenius University Bratislava, Faculty of Mathematics, Physics and Informatics, Department of Applied Mathematics and Statistics, Slovakia.*
[2] *Institute for Economies in Transition, Bank of Finland, iikka.korhonen@bof.fi.**We are grateful to Jukka Pirttilä, Doris Ritzberger-Grünwald, Maria Antoinette Silgoner, Anna Czogała, Zsolt Darvas and Julius Horvath for their comments on an earlier draft of the paper and to Irene Mühldorf for language advice. The views expressed in this paper are those of the authors and do not necessarily represent the views of the Oesterreichische Nationalbank or the Bank of Finland.*
[3] *The remaining NMS (Cyprus and Malta) and candidate countries (Croatia) are not included here because the majority of the reviewed analyses does not refer to them.*

has become a popular research tool in economics (e.g. Stanley, 2001; De Grauwe and Storti, 2004; Rose, 2004). Meta-analysis extends the analysis beyond standard literature surveys.

Applying meta-analysis to the increasing body of OCA literature on the euro area and CEECs, we show that results of individual studies differ quite significantly, which in itself may have economic policy implications. In any case, taken together, some general elements emerge. First, the business cycle correlations of Hungary, Poland and Slovenia are highest, irrespective of the indicator used. These countries show business cycle correlation with the euro area comparable with those of the core participants in European Economic and Monetary Union (EMU). Indeed, several of the smaller euro area countries have lower business cycle correlation than these CEECs.

Second, although some NMS (e.g. the Czech Republic) show low synchronization of business cycles with the euro area, they are nevertheless synchronized with the overall euro area business cycle to the same extent as the EU peripheral countries Greece, Ireland and Portugal. Third, business cycles in the Baltic countries (except Estonia) and some Balkan countries generally display the lowest correlation with the euro area. Recognizing this, we define a relative ranking of business cycle similarity between the new EU countries and the euro area. Fourth, we find that the estimation methodology can have a significant effect on the correlation coefficients. For example, using supply and demand shocks to determine the correlation of business cycles results in significantly lower correlations.

Finally, we look at the position of Bulgaria and Romania, which started the transition process and accession negotiations with the EU jointly with the NMS. However, Bulgaria and Romania faced much more severe structural problems than other countries on their path to the EU. Furthermore, the implementation of economic reforms was also more difficult for a large variety of reasons. Nevertheless, these countries received a new impetus to implement economic reforms after the recent enlargement of the EU. As a result, these countries are likely to join the EU in 2007.

The paper is structured as follows: The next section reviews the OCA theory from the point of view of the NMS. Based on this evidence, section 3 presents a meta-analysis of nearly 30 publications with nearly 350 point estimates of business cycle correlation between the CEECs and the euro area. The last section concludes. The achieved degree of business cycle coordination implies that some new EU member countries would probably not have asymmetric business cycles with the euro area – or at least no more so than some small member countries. Of course, the new EU members must ensure that their economic policies are sustainable and in line with the requirements of monetary union.

2 The Business Cycle and the Optimum Currency Area Theory

The OCA theory originates with Mundell (1961), who proposed that a country would find it more advantageous to peg the external value of its currency when the business cycles of two countries are highly correlated.[4] In practice, such correlation is never perfect, but the problem of asymmetric shocks is alleviated as long as factors of production are free to move between countries and regions. Fiscal policy and flexible labor markets may also replace traditional adjustment channels. With the breakdown of the Bretton Woods system, OCA analysis became a regular tool for assessing the desirability of a fixed exchange rate for a particular country. OCA analysis quickly revealed that labor movement between countries or regions in Europe was extremely low, which in itself was sufficient reason to abandon fixed exchange rate regimes (see McKinnon, 2002).

A revival in the empirical testing of OCA theory preceded the introduction of EMU. These empirical studies typically assess the correlations between the business cycles of Germany[5] and other potential members of a monetary union. The influential contribution of Bayoumi and Eichengreen (1993) recovers the underlying supply and demand shocks in the prospective members of monetary union using a technique developed by Blanchard and Quah (1989). Their basic assumption is that an economy can be hit by either demand or supply shocks. Such shocks are identified with the help of the restriction that the long-term impact of demand shocks on output is zero and the assumption that only supply shocks have a permanent effect on output. In addition, Bayoumi and Eichengreen designate an "overidentifying" restriction, which says that the accumulated effects of supply and demand shocks on prices are negative and positive, respectively. As this condition is not imposed on the model, its fulfillment can be used to check the consistency of the results.

Bayoumi and Eichengreen's approach can be justified within a neo-Keynesian model of aggregate supply and demand curves (McKinnon, 2000). The framework is based on sticky wages, which make the adjustment process to a new equilibrium gradual when the economy is hit by demand or supply shocks. The neo-Keynesian model distinguishes between short- and long-run equilibria for the economy. Thus, economic policy can reduce the adjustment costs, for example, through the selection of an appropriate exchange rate regime (i.e. floating exchange rate, fixed exchange rate or participation in a monetary union).

All new EU members are required to participate in monetary union.[6] They have flexibility, however, in determining when they enter the exchange rate mechanism (ERM II), as fulfillment of the Maastricht convergence criteria is required ahead of the introduction of the euro. A key issue here is the timing

[4] *However, risk insurance mechanisms within a monetary union could potentially reverse the results. Demanyk and Volosovych (2004) conclude that those countries facing most asymmetric business cycles may gain most from risk sharing. This idea goes back to Kalemli-Ozcan et al. (2001) and originally to Mundell (1973). See also MacKinnon (2002) for a more general discussion of risk-sharing implications for OCA theory.*

[5] *However, Germany was increasingly viewed as a less suitable proxy for the euro area, which was caused by Germany's worse growth performance since the second half of the 1990s. Therefore, the recent analyses predominantly use euro area data.*

[6] *Newcomers have no option to opt out of monetary union.*

of membership in monetary union and the optimal interim exchange rate arrangement. If the business cycle of the NMS is correlated to a significant degree with that of the euro area, the cost of giving up monetary independence may be quite reasonable for the new member.

In this section, we survey the literature related to testing the OCA criteria in the NMS and accession countries (Bulgaria and Romania). Using a variety of methods, most studies find that the business cycles in a few of the NMS are already as synchronized with those of the euro area as are some of the euro area's peripheral members' cycles. However, these papers also often express uncertainty as to the robustness of their results.

Table 1

Surveyed Studies

Authors	Countries	Method	Frequency	Reference country
Boone, Maurel (1998)	CZ, HU, PL, SI	HP filter (UR and IP)	monthly	Germany
Frenkel (1999)	CE5, BG, EE, LV	supply and demand shocks	quarterly	Germany
Horvath (2000)	CE5, B3	supply and demand shocks	quarterly	Germany
Korhonen (2001, 2003)	CE5, B3, RO	VAR (correlation of IRF)	monthly	euro area
Fidrmuc, Korhonen (2001, 2003)	CE10	supply and demand shocks	quarterly	euro area
Fidrmuc (2001, 2004)	CE10	correlation (GDP and IP)	quarterly	Germany
IMF (2000)	CE10	correlation (GDP and inflation)	annually	Germany
Borowski (2001)	PL	correlation of IP growth rates	monthly	Germany
Frenkel, Nickel (2002)	CE5, BG, EE, LV	supply and demand shocks	quarterly	euro area
Babetski et al. (2002, 2004)	CE5, EE, LV, RO	supply and demand shocks (Kalman filter)	quarterly	EU
Buiter, Grafe (2002)	CZ, EE, HU, PL, SI	correlation of inventory changes	annually	Germany
Boreiko (2002)	CE10	HP filter (IP)	monthly	Germany
Csajbók, Csermely (2002)	CE4	supply and demand shocks	quarterly	euro area
Luikmel, Randveer (2003)	EE	HP filter (GDP)	quarterly	euro area
Süppel (2003)	CE5, B3	supply and demand shocks	quarterly	EU
Horniková (2003)	CZ	SVAR (IP, inflation, money)	monthly	euro area
Backé et al. (2003)	CE10	HP filter (inflation)	monthly	euro area
Horvath, Ratfai (2004)	CE5, B3	supply and demand shocks	quarterly	Germany
Fidrmuc, Korhonen (2004)	CE10	supply and demand shocks	quarterly	euro area
Backé et al. (2004)	CE5, B3	supply and demand shocks	quarterly	euro area
Babetski (2004)	CE5, EE, LV, RO	supply and demand shocks (Kalman filter)	quarterly	EU
Hagara, Fidrmuc (2004)	CE5, B3, BG	supply and demand shocks	quarterly	euro area
Ramos, Suriñach (2004)	CE5, B3	supply, demand, monetary shocks	quarterly	euro area
Artis et al. (2004)	CE5, B3	BP filter (IP)	monthly	euro area
Demanyk, Volosovych (2004)	CE5, B3	correlation of GDP growth rates	quarterly	EU-25
Barrell, Holland (2004)	CZ, HU, PL	macromodel	quarterly	Germany
Darvas, Szapáry (2004)	CE5, B3	HP and BP filter (GDP)	quarterly	euro area

Source: Authors' compilations.
Notes: CE4 = Czech Republic, Hungary, Poland and Slovakia; CE5 = CE4 plus Slovenia; B3 = Estonia, Latvia and Lithuania; BG = Bulgaria; CZ = Czech Republic; EE = Estonia; HU = Hungary; LV = Latvia; LT = Lithuania; PL = Poland; RO = Romania; SI = Slovenia; CE10 = all countries. UR = unemployment rate; IP = industrial production; HP = Hodrick-Prescott filter; BP = Band-Pass filter; VAR = vector autoregression model; IRF = impulse response function; SVAR = structural vector autoregression model.

Table 1 lists papers that assess the correlation of CEECs' business cycles with the euro area business cycle (or some proxy thereof). In this format, it is immediately apparent that this topic has been approached from several angles. A few contributions utilize a structural VAR (vector autoregressive) approach, while most papers take the much simpler approach of merely looking at the cyclical variation around an estimated trend (usually the trend of industrial production). Availability of data places some obvious limits on testing options.

A frequent criticism of meta-analysis in summarizing results on any given topic is that all papers are given equal weights in determining the outcome. However, it would be hard to rank the studies on quality. Some papers were published in refereed journals (which probably assures a certain level of qual-

ity), but since this subfield is so new, many papers we mention are still in the midst of the refereeing process. Several studies, including the most influential ones, do not specify the number of observations (which could be useful in weighting the results). Following the convention of other meta-analyses in the field (Égert and Halpern, 2004), therefore, we weight all estimates equally.

In summarizing study results, we identify three major strands of the literature on business cycle coordination between the euro area and the CEECs. The first strand of papers looks at a simple correlation of an indicator of aggregated output. Those belonging to the second strand use a statistical approach geared to the properties of CEECs' business cycle indicators. Business cycle coordination is analyzed mainly from the perspective of the international transmission of business cycles, and various filters (including the Hodrick-Prescott filter and the Band-Pass filter) or time series models are used. In the third strand, structural VARs are used to recover underlying shocks with properties derived from economic theory. While the first approach prevailed in early analysis (and in papers using business cycle synchronization in further analysis), the latter two directions dominate the current discussion.

2.1 Early Analysis

Analysis of simple correlations prevailed in the first stage of research on the issue. For example, the IMF (2000) notes a relatively high degree of business cycle synchronization between Germany and the CEECs. Similarly, Buiter and Grafe (2002) suggest correlations of inventory changes as a more appropriate indicator of business cycle correlation than aggregate GDP.

The majority of papers with sophisticated statistical tests start with a short look at the properties of the raw data. We suggest in Fidrmuc and Korhonen (2003) that this picture may be misleading. There are generally high correlations among several country groups; in particular, EU countries correlate strongly with the U.S.A. One possible interpretation, in contradiction to previous results (see Artis and Zhang, 1997), is that there is no independent European cycle. As a result, the increased degree of business cycle synchronization within the EU (and possibly between the euro area and the NMS) is consistent with globalization rather than Europeanization. This result is confirmed for various statistical filters (see Artis, 2003a). By contrast, structural VARs reveal greater differences between Europe and the U.S.A. in underlying shocks (Fidrmuc and Korhonen, 2003).

Some authors use simple correlations of business cycles for further analysis. Fidrmuc (2001) and Maurel (2002) rely on the endogeneity hypothesis of OCA criteria laid down in Frankel and Rose (1998). Fidrmuc shows that the convergence of business cycles relates to intraindustry trade, but finds no significant relation between business cycles and bilateral trade intensity. Furthermore, the business cycle (defined as detrended industrial production) strongly correlates with the German cycle in Hungary, Slovenia and, to a lesser extent, Poland. Moreover, due to the high degree of intraindustry trade, it is possible to identify a significant potential for increasing the correlation between business cycles in the EU and the NMS (Hungary, Slovenia, Poland, the Czech Republic and Slovakia). Maurel (2002) also finds evidence that intraindustry trade increases the symmetry of business cycles, which is important for those who

take the view that higher per capita GDP in the NMS is associated with greater intraindustry trade.

Boreiko (2002) takes the correlation of business cycles as one of several indicators for fuzzy cluster analysis (the other indicators describe the fulfillment of the individual Maastricht criteria). He compares the simple correlation of growth rates for industrial production and for the Hodrick-Prescott trend. Both methods produce comparable results, although the latter yields slightly higher values (preferred estimates).

2.2 Statistical Approach

Another group of studies uses different measures of correlation between business cycles in the euro area (or EU) and the CEECs. Boone and Maurel (1998) calculate correlation coefficients between the cyclical components of industrial production and unemployment rates for selected CEECs (the Baltic states are excluded) against Germany and the EU. The cyclical component of the business cycle indicators is derived with the help of a Hodrick-Prescott filter. They generally find a relatively high degree of business cycle correlation for the CEECs with Germany (and higher than that of either Portugal or Greece). This implies relatively low costs for giving up monetary sovereignty and entering a monetary union with Germany.

Boone and Maurel (1999) abandon the methodology used in their earlier work to assess the similarity between business cycles in selected CEECs (the Czech Republic, Hungary, Poland and Slovakia) against Germany and the EU. They fit a time series model for the unemployment rate in an accession country using EU (German) unemployment shocks derived in a separate regression. Under this framework, they ask: What share of the variation in the unemployment rate can be attributed to German or EU-wide shocks? Afterward they look at correlations in the propagation of the shock. Boone and Maurel find that the share of variation explained by the German shocks is fairly high for all analyzed countries, and highest for Hungary and Slovakia. The countries with the highest correlations of responses to a German shock are Poland[7] and Slovakia. Boone and Maurel conclude that the business cycles in these countries are sufficiently close to the German cycle that participation in monetary union would bring net benefits.

Barrell and Holland (2004) compare residuals of estimated employment in a large-scale macroeconomic model of the world economy (including the Czech Republic, Hungary and Poland). A positive correlation is interpreted as coordination of economic activities between countries. From 1993 to 2002, only Hungary has a high degree of correlation with Germany; the Czech Republic and Poland are negatively correlated.

Korhonen (2003) examines monthly indicators of industrial production in the euro area and nine CEECs. The issue of correlation is assessed with the help of separate VARs for the first difference of euro area production and production in each of the analyzed countries. The correlation of impulse responses to a euro area shock is taken as evidence of symmetry of the business cycles. Korhonen observes that some CEECs (especially Hungary) exhibit a high correlation with

[7] *This result may reflect the high degree of trade intensity between Germany and Poland.*

the euro area business cycle. Moreover, correlation seems to be at least as high as in the smaller EMU members, Portugal and Greece.

Artis et al. (2004) and Darvas and Szapáry (2004) describe the CEECs' business cycles. These papers prefer the Band-Pass filter to structural VARs for robustness reasons. Artis et al. (2004) focus on identifying individual business cycles. They find that Hungarian and Polish business cycles are generally the most similar to the euro area cycle. Darvas and Szapáry (2004) differ from most other contributions insofar as they investigate the behavior of several expenditure and sectoral components of GDP. They find that GDP, industrial production and exports in Hungary, Poland and Slovenia have achieved a reasonably high degree of correlation with the euro area. However, private consumption and services are not correlated even in these three countries. In other new EU member countries, the level of correlation is clearly lower. Darvas and Szapáry also assess whether the correlation of CEECs with the euro area has increased over time. Again, the results are somewhat inconclusive. The correlation of the GDP cycle increased in approximately half of the countries while decreasing in the other half.

A few studies attempt to test whether the correlation of business cycles has changed over time. Babetski et al. (2002 and 2004) use a Kalman filter to estimate time-varying correlation coefficients for supply and demand shocks in the CEECs vis-à-vis shocks in the EU and Germany. They find that the correlation of demand shocks increased during the 1990s, whereas the correlation of the supply shocks did not increase to the same degree. Korhonen (2003) estimates the correlation of impulse response functions from two-variable VARs for two separate subperiods (1992–95 and 1996–2000) and finds that the correlation of business cycles increased clearly in the second half of the 1990s in the Czech Republic, Hungary and Slovenia. These results suggest that the growing integration of the CEECs with the EU has increased business cycle correlation and may continue to do so in the future. Artis et al. (2004) look at the overall correlation as well as the moving correlation of business cycles computed as deviations from Band-Pass cycles, where the moving window of approximately three years gives lower weights to observations more distant from time t.

2.3 Structural VAR

Frenkel et al. (1999), Frenkel and Nickel (2002), Fidrmuc and Korhonen (2003 and 2004), Süppel (2003), Backé et al. (2004), and Fidrmuc and Hagara (2004) use an approach similar to that of Bayoumi and Eichengreen to recover quarterly supply and demand shocks for various countries, including most CEECs.

Frenkel et al. (1999) find that the correlation between shocks in the euro area and in the nonparticipating EU Member States is as high as it is for the remaining EFTA countries. The correlation of shocks is quite different between the euro area (proxied by Germany and France) and the CEECs. Unfortunately, there are difficulties in interpreting the results. Perhaps the most serious caveat relates to the data used for estimation. Frenkel et al. use quarterly data from the first quarter of 1992 to the second quarter of 1998. The time period is obviously short (an unavoidable problem with such studies), but more importantly, the first two or three years in the sample belong to the period of transformational recession for some CEECs, i.e. output losses relate to the change in the eco-

nomic system. This can make the interpretation of economic shocks problematic. Frenkel and Nickel (2002) use a longer sample, although for a smaller set of comparative countries.

Csajbók and Csermely (2002) estimate supply and demand shocks for a fairly long period (1992 to 2000). Furthermore, the comparative EU benchmark is derived from the principal component analysis. This may possibly cause deviations between their results and those of other studies. The Czech Republic notably displays the highest correlation of both demand and supply shocks, while the previous studies show zero or even negative correlation of both types of shocks.

More recently, Ramos and Suriñach (2004) introduce monetary shocks as a complement to structural VAR models.[8] The authors suggest two possible ways to include monetary shocks – real interest rates, following Artis (2003b), or the real effective exchange rate, in line with Clarida and Gali (1994) – to the structural VAR model of the previous variables (growth and inflation). For data reasons, the second model could be estimated only for four NMS (the Czech Republic, Hungary, Poland and Slovakia). Surprisingly, the monetary shocks implied by Artis' decomposition are very similar in the CEECs and the euro area. Correlation coefficients (computing for three two-year windows) reach up to 0.78 in the case of Hungary (2001–02). But the Czech Republic and Poland also display high positive correlations (above 0.5 in both cases) in the floating period (1998–2000). Actually, no CEECs show negative correlations between 1998 and 2002. This counterintuitive result is contradicted by the alternative decomposition for the four Visegrad countries, which implies a very low or even negative correlation of monetary shocks with the euro area between 1998 and 2002.

2.4 Related Literature

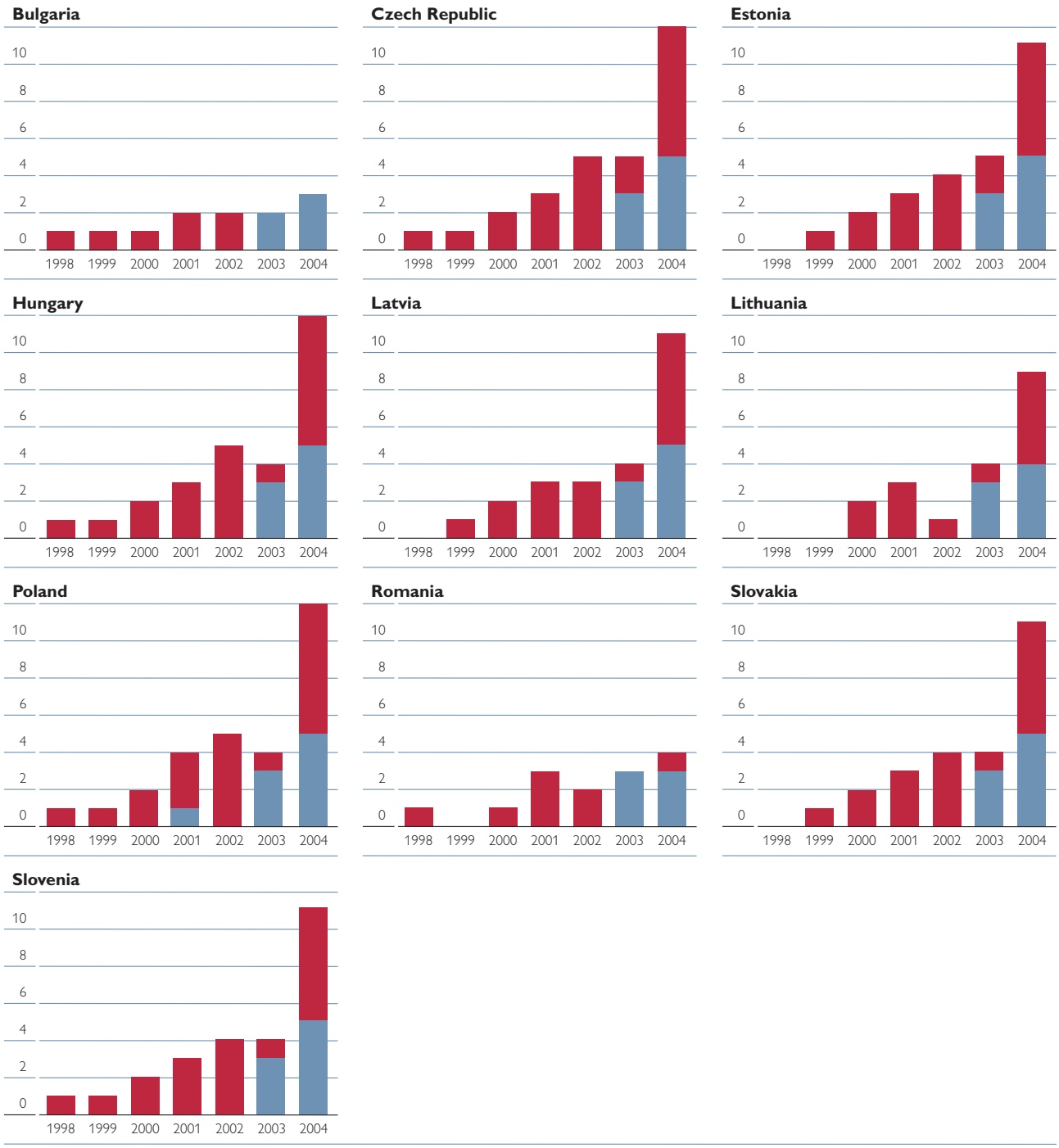
A related strand of literature looks at the convergence of the level of economic activity and prices between the CEECs and the EU. Although business cycle correlation is probably more important in formulating monetary policy, long-term convergence (or a lack thereof) can also impact the functioning of a monetary union. The level of GDP in the CEECs during the period of centrally planned systems grew slowly in relation to Western Europe. Thus, the divergence between Western and Eastern Europe grew in the 1970s and 1980s, and this increasing welfare gap between market and centrally planned economies in Europe was a major reason for the introduction of early reforms in some CEECs.

Estrin and Urga (1997) find only limited evidence of convergence in the former Soviet Union and within various groups of Central European command economies. More surprisingly, Fidrmuc et al. (1999) conclude that the Czech Republic and Slovakia did not converge between 1950 and 1990 or within a subsample from 1970 to 1990. In contrast, Kočenda (2001) and Kutan and Yigit (2004) find increasing convergence between the CEECs and the EU.

[8] *Also Borghijs and Kuijs (2004) estimate three-variable structural VARs for the Czech Republic, Hungary, Poland, Slovakia and Slovenia, although they are not concerned with the correlation of shocks vis-à-vis the euro area. In the estimated VARs, they use monthly data for industrial production, inflation and the real exchange rate against the euro. They then derive supply, real demand and money shocks from these estimations and conclude that nominal exchange rates have been fairly useless shock buffers in the five CEECs, and, in fact, have amplified the effects of money shocks.*

Chart 1

Number of Publications on Euro Area/CEECs Business Cycle Correlation



Source: Authors' compilations.

3 Results of the Meta-Analysis

3.1 A Hot New Field?

We are presently aware of 27 independent studies[9] that altogether provide nearly 400 estimations of business cycle correlation between the euro area (or some proxy) and the individual CEECs. To our knowledge, the earliest two papers on the topic were published in 1998, and publishing on the topic took off in 2002 (see chart 1). The number of working papers basically exploded as soon as the details of EU enlargement were announced. Refereed journals published the first contributions in 2003. 12 studies were published in the first half of 2004, reflecting a conference (EABCN meeting in Vienna) and the dedication of an entire issue of the *Journal of Comparative Economics* to the topic. Unfortunately, nearly all these studies concentrate on the new EU member countries and overlook Bulgaria and Romania.

In general, academic institutions in the EU-15 countries (i.e. the EU members before May 2004) initially dominated the discussion. Contributions from Eurosystem central banks and the CEECs have also begun to increase recently. A somewhat surprising feature of the discussion to date is the near absence of interaction between academia and central banks, and between researchers located in the CEECs and in the EU-15.

A decisive feature of the literature is its relatively broad cross-country focus. We found only three papers that focused on a single country. The majority of the studies include all ten CEECs (although Bulgaria and Romania are increasingly omitted in recent contributions). Correspondingly, the average number of countries covered is relatively high (7.5). Many studies also estimate business cycle correlations for a number of EU-15 countries, which are then used as benchmarks for the NMS.

Table 2

Metastatistics

	CZ	HU	PL	SK	SI	EE	LV	LT	BG	RO
Observations	43	42	43	39	39	38	36	32	17	13
Mean	0.167	0.381	0.267	0.04	0.256	0.141	0.108	−0.059	0.075	0.077
Median	0.152	0.35	0.29	0.01	0.31	0.135	0.095	−0.135	0.03	0.02
Maximum	0.84	0.93	0.88	0.9	0.98	0.98	0.96	0.92	0.48	0.86
Minimum	−0.39	−0.4	−0.69	−0.618	−0.46	−0.57	−0.49	−0.66	−0.593	−0.193
Standard deviation	0.283	0.304	0.352	0.332	0.367	0.343	0.324	0.419	0.269	0.295
Skewness	0.322	−0.199	−0.832	0.639	−0.239	0.217	0.299	0.785	−0.595	1.621
Kurtosis	2.648	2.876	3.783	3.329	2.37	2.777	3.176	2.842	3.343	4.894
Jarque-Bera	0.965	0.304	6.060**	2.834	1.015	0.376	0.584	3.323	1.088	7.634**
t-statistic	3.873***	8.130***	4.971***	0.756	4.358***	2.535**	2.002*	−0.792	1.152	0.945

Source: Authors' calculations.
*Note: *, ** and *** denote significance at the 10%, 5% and 1% level.*

3.2 Metastatistics

The largest number of correlation estimates[10] (43) is reported for the Czech Republic and Hungary, but a sufficient number of estimates has been reported for all Central European countries and the Baltic states (see table 2 and chart 1). By contrast, only few available estimates are reported for Bulgaria (13) and

[9] *Several papers have been published in working-paper and journal versions. Table 1 includes both the most influential working-paper version and the possible journal version. Unless the journal version is clearly updated in a comparison to the previous working paper, we only use the journal version for further meta-analysis.*

[10] *Note that several publications report more than one correlation estimate.*

Romania (17), respectively. It should be noted that we are able to compare estimates across studies directly. Whatever the methodology, all studies arrive at a single statistic, i.e. the correlation coefficient.

On average, the highest average estimates of business cycle correlation with the euro area are reported for Hungary, followed by Poland and Slovenia. The studies report on average a negative correlation of the business cycle only for Lithuania. For nearly all countries, the mean is slightly higher than median, which may imply that some outliers are influential. The skewness statistic, which is positive on average for all ten CEECs, also indicates that the distribution of reported results is asymmetric with a long right tail. Furthermore, the kurtosis statistic shows that the distribution of reported results is flat relative to the normal distribution. Nevertheless, the null of normal distribution of the results can be rejected only for Poland and Romania.[11] In summary, there is no obvious consensus regarding the extent of business cycle correlation.

Somewhat surprisingly, the variance of reported results is quite similar between countries. Countries with relatively low average correlation (Bulgaria, the Czech Republic and Romania) also have relatively low standard deviations of reported results. A *t*-test rejects that the mean of reported results equals zero only for half of the CEECs (the Czech Republic, Estonia, Hungary, Poland and Slovenia).

Similar *t*-tests of equal means (reported in table 3) between the CEECs reveal further insights. The results for Hungary clearly differ from other results (with the possible exception of Poland), reinforcing the view that Hungary's business cycle has the highest correlation with the euro area cycle of any new EU member country. On the other hand, the business cycle correlations in Slovenia are not statistically different from Polish correlations (and the average correlations in both countries are almost the same). The Czech Republic, Estonia and Latvia appear to form a group with reasonably similar correlation patterns. Finally, Slovakia and Lithuania are quite different from the other countries (and from each other). Slovakia's correlation is positive, but small, while Lithuania, as already mentioned, is the only country in the sample with a negative average correlation.

Table 3

Test of Correlation Equality between the CEECs

	CZ	HU	PL	SK	SI	EE	LV
HU	0.0008***						
PL	0.0247**	0.1286					
SK	0.0415**	0.0000***	0.0005***				
SI	0.0577*	0.0955*	0.4023	0.0020***			
EE	0.3638	0.0008***	0.0184**	0.1031	0.0413**		
LV	0.2925	0.0004***	0.0113**	0.1339	0.0278**	0.4308	
LT	0.0107**	0.0000***	0.0002***	0.1929	0.0006***	0.0280**	0.0370**

Source: Authors' calculations.
*Note: We report p-values of t-tests of equal means. *, **, and *** denote significance at the 10%, 5% and 1% level.*

[11] *We cannot reject the normality of the reported results if we pool the data for all countries.*

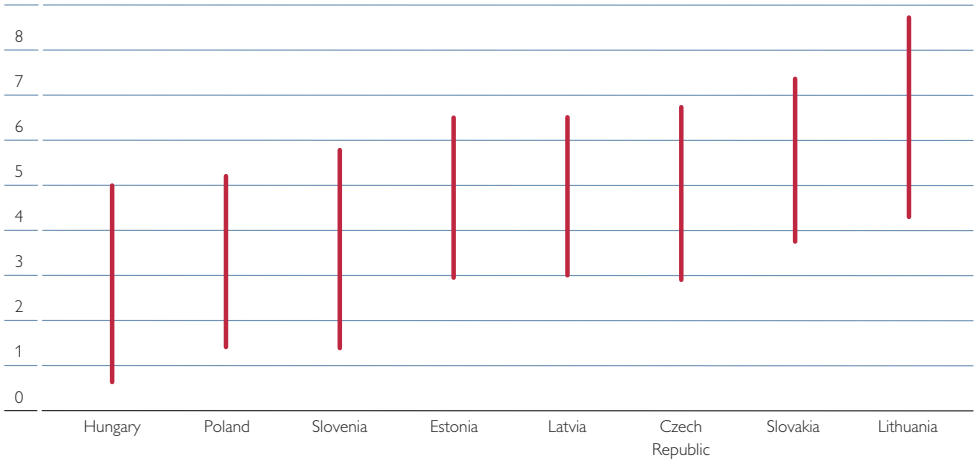
3.3 Who Are the Forerunners?

As the estimation methods often differ considerably from one study to another, we assess the relative ranking of business cycle correlation in the CEECs next to shed additional light on the robustness of the estimated correlations.

As the geographical focus of papers reviewed here varies quite a bit from one to the other, we first concentrate on studies that include all new EU member countries from the CEECs (i.e. the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia and Slovenia). Our database contains a total of 50 estimates of business cycle synchronization (several papers report multiple estimates). Of these, 32 estimate correlations for all eight new EU members from the CEECs.

Chart 2

Average and Standard Deviation of Rankings



Source: Authors' calculations.

Chart 2 shows the average ranking of various countries in the studies as well as the standard deviation of the rankings. Hungary has the lowest ranking in the studies (i.e. the highest correlation), followed by Poland and Slovenia. The average rankings for Estonia, Latvia and the Czech Republic are almost identical, while Slovakia and especially Lithuania trail behind the other countries. Thus, we obtain a rough order among the new EU member countries when it comes to the correlation of business cycles (the standard deviations of rankings are fairly large).

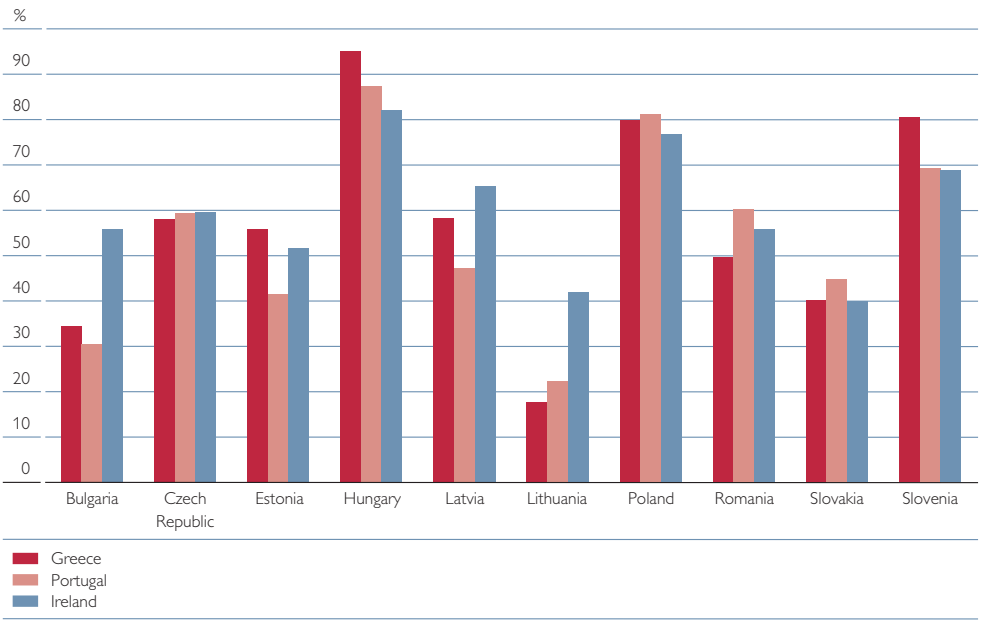
Looking at Pearson rank correlations among the 35 papers under scrutiny here reveals that rankings change from paper to paper, sometimes quite drastically. The average of all 595 rank correlations (given by (35*35–35)/2) is 0.23. Calculating averages of rank correlations for all individual papers, it turns out that four papers have a negative average correlation with the other papers: Korhonen (2003) with a rank correlation of –0.10, Horvath and Ratfai (2004) –0.26, Horvath (2000) –0.31 and IMF (2000) –0.16. Approximately ten papers have average rank correlations of between 0.4 and 0.5, and the rest lie between 0.0 and 0.4. Most papers are approximately in agreement with each other as to the relative ranking of the new EU member countries.

3.4 Are the New Member States More Closely Correlated with the Euro Area than the Current Euro Periphery?

In addition to the previous analyses, we consider how the CEECs perform in comparison with some current members on the periphery of the euro area. Most studies include at least some current euro area countries in their data samples, and many reviewed here also include some peripheral countries (e.g. Greece, Ireland or Portugal) in their data sample. It is natural to compare the estimated correlations in the CEECs with correlations of small peripheral euro area members. Comparison with the correlation of the new Member States' business cycles with the euro area cycle helps us to gauge how far the new Member States have advanced in business cycle correlation. If business cycle correlation in an NMS is higher than in, say, Ireland and Portugal, one could be more confident that the new EU country has progressed far enough in fulfilling this OCA criterion. Correspondingly, chart 3 shows the share of studies in which CEECs had higher business cycle correlations with the euro area than Greece, Ireland or Portugal.

Chart 3

Share of Observations where the CEECs' Business Cycle Correlation is Higher than in Benchmark Countries



Source: Authors' calculations.

Most new member countries do quite well in this regard. Results are more or less in line with the relative rankings surveyed earlier. Hungary has a higher business cycle correlation than three peripheral euro area members in nearly all cases, and Poland and Slovenia are only slightly behind. Even Latvia, which generally ranks quite low among the new member countries, has a higher correlation than the three peripheral euro area countries in approximately half of the cases. These results would imply that even though the degree of correlation in the new member countries is far from perfect, there is no significant difference in this respect to Greece, Ireland and Portugal. However, Lithuania, Bulgaria, and Slovakia show a lower degree of business cycle synchronization

than Greece and Portugal. Nevertheless, also these countries are largely comparable to Ireland.

3.5 Metaregression Analysis

The metastatistics presented in section 3.2 show that, on average, the available estimates of business cycle correlation provide a fairly consistent ranking of the CEECs. However, the presented metastatistics also reveal a relatively high degree of variance among studies. It is generally argued that a substantial part of this variance can be attributed to the specifics of presented studies (especially data definition and selected time periods).

Metaregression analysis provides an appropriate tool to adjust for these effects. A metaregression relates our summary statistics to a set of characteristics of reviewed studies. However, the correlation coefficient has some undesirable properties that may be important for regression results, e.g. the correlation coefficient is defined between –1 and 1. Therefore, Lipsey and Willson (2001) recommend Fisher's transformation, which removes this restriction.[12] The metaregression may thus be stated as

$$\frac{1}{2}\log\left(\frac{1+\rho_{ij}}{1-\rho_{ij}}\right) = \tilde{\rho}_i + \sum_{k=1}^{K}\beta_{ijk}D_{ijk} + \varepsilon_{ij}, \qquad (1)$$

where parameters ρ_{ij} represent correlation estimates reported by the source j for country i, D_{ij} represent K characteristics of reported summary statistics (some characteristics, e.g. sample periods, may be different between countries also according to the same source), and ε is the error term with standard statistical properties.

This specification assumes that the characteristics of the reviewed studies have the same effects for all reported countries (i.e. no country-specific bias in the individual studies). We are mainly interested in the country effect, $\tilde{\rho}_i$. After the transformation back to the standard correlation, we obtain the estimate of degree of business cycle synchronization with the euro area.

We start by replication of average country estimates without covering additional characteristics,[13] which basically replicates the computation of metastatistics above (we use Fisher's transformation of the correlation coefficient here). This confirms the significance of business cycle correlation with the euro area in the Czech Republic, Estonia, Hungary, Poland and Slovenia (see table 4), although the size effects are again different. Next, we add several sets of indicators that characterize reviewed estimates of business correlation reported in table 4. Quarterly data (QUARTER) lead to a lower reported correlation of business cycles between the countries than monthly or annual data, while the use of industrial production has no significant effects. The number of observations (OBS) has a negative, but insignificant, effect.[14] The application of time series models (TSERIES), statistical filters (HP) and structural vector autoregressions (SVAR) has negative effects comparable to simple correlation coeffi-

[12] *For a correlation index sufficiently distant from the limit values, Fisher's transformation is approximately equal to the original values. However, the index converges to* ∞ *and* $-\infty$ *as the correlation approaches 1 and –1, respectively.*

[13] *This approach reflects the fact that some explanatory variables may be correlated. We try to reflect this feature of our data set in the final specification as well.*

[14] *We get the same results if we take the lengths of time period in months.*

Table 4

Metaregressions of Euro Area / CEEC Business Cycle Correlations

	Basic estimation	Data frequency	Method of estimation	Applied variables	Publication features	All variables	Preferred estimation
CZ	0.192	0.645	0.511	0.289	0.208	0.379	0.435
	(3.749)	(4.712)	(5.856)	(4.482)	(4.075)	(3.385)	(6.405)
HU	0.473	0.924	0.792	0.571	0.489	0.655	0.716
	(6.892)	(6.520)	(8.774)	(8.020)	(6.547)	(5.663)	(8.552)
PL	0.307	0.751	0.619	0.398	0.323	0.482	0.544
	(4.599)	(5.525)	(7.079)	(5.306)	(4.472)	(4.223)	(7.241)
SK	0.064	0.529	0.394	0.169	0.085	0.252	0.318
	(0.963)	(3.729)	(4.255)	(2.255)	(1.256)	(2.201)	(4.369)
SI	0.331	0.782	0.643	0.423	0.349	0.505	0.568
	(3.920)	(4.886)	(6.123)	(5.686)	(4.099)	(4.050)	(6.734)
EE	0.194	0.643	0.503	0.290	0.221	0.357	0.432
	(2.367)	(4.130)	(4.543)	(3.546)	(2.643)	(2.824)	(5.015)
LV	0.145	0.602	0.471	0.245	0.174	0.319	0.397
	(1.948)	(4.038)	(4.792)	(3.355)	(2.301)	(2.689)	(5.483)
LT	−0.030	0.410	0.280	0.051	0.013	0.142	0.213
	(−0.307)	(2.621)	(2.420)	(0.548)	(0.136)	(1.134)	(2.241)
BG	0.077	0.521	0.385	0.153	0.086	0.216	0.274
	(1.095)	(3.671)	(4.371)	(1.563)	(1.091)	(1.585)	(2.811)
RO	0.113	0.505	0.351	0.088	0.144	0.196	0.236
	(1.046)	(3.143)	(2.747)	(0.793)	(1.341)	(1.443)	(2.367)
MONTH		0.031				−0.254	
		(0.136)				−(0.871)	
QUARTER		−0.416				0.047	
		(−3.297)				(0.383)	
OBS		−0.004				0.002	
		(−1.685)				(0.647)	
TSERIES			−0.307			−0.248	−0.204
			(−2.891)			−(2.401)	(−2.207)
SVAR			−0.461			−0.094	
			(−5.988)			−(0.859)	
HP			−0.208			−0.223	−0.254
			(−2.306)			−(1.795)	(−2.820)
Q				0.057		0.147	
				(0.744)		(1.738)	
SUPPLY				−0.236		−0.284	−0.378
				(−4.569)		−(2.870)	(−6.472)
DEMAND				−0.269		−0.352	−0.424
				(−4.581)		−(3.289)	(−6.466)
CPI				0.525		0.600	0.463
				(2.779)		(3.285)	(2.881)
YEAR					−0.035	−0.032	−0.035
					(−2.027)	−(2.132)	(−2.706)
JP					−0.062	−0.083	
					(−1.312)	−(1.508)	
Observations	341	341	341	341	341	341	341
Adjusted R^2	0.072	0.18	0.223	0.254	0.095	0.302	0.294

Source: Authors' calculations.
Note: t-statistics in parentheses.

cients of growth rates. It may be that simple growth rate correlations do not adequately reflect the underlying business cycle correlation. Synchronization of business cycles as measured by supply (SUPPLY) and demand shocks (DEMAND) goes in the same direction (again negative as implied by the coefficient on the SVAR dummy variable) by approximately the same amount, while the correlation of inflation (CPI) provides larger business cycle correlation than summary statistics based on GDP or industrial production (Q).

Furthermore, we look at the general properties of the publications in the field. First, we find a negative trend (YEAR, measured by demeaned year of publication), which indicates that there was some degree of overestimation of business cycle synchronization in the early analysis. The year of publication seems to work better than comparable indicators on the applied time period (starting and final year of the sample in surveyed publications). We can also see that journal publications (JP) are slightly more conservative, but this characteristic is not significant.

Finally, we include all characteristics in a single equation. This shows that characteristics describing the variables used have the most robust influence on results. By contrast, the variables pointing at publication properties are no longer significant. If we drop insignificant variables, we get our preferred metaregression, which involves a dummy for time series models, the application of statistical filters, supply and demand shocks, a dummy for inflation used as a variable measuring the business cycles, and the year of publication. In this specification (as in the majority of specifications), we find a positive and significant correlation of business cycles with the euro area for all CEECs, ranging between 0.210 for Lithuania and 0.615 for Hungary. We also estimate positive and significant correlations of business cycles in the euro area and in Bulgaria and Romania; however, it is lower than in nearly all NMS. Consequently, the differences between the CEECs appear even larger than in the original studies, but the ranking of CEECs confirms the results of the previous section.

4 Conclusions

In summary, empirical evidence seems to indicate that economic cycles in several CEECs are highly correlated with the euro area cycle. Judging from the spate of recent papers, interest in this topic is common. This seems to be especially true for Hungary, Poland and Slovenia. Although the Baltic countries were not always included in the aforementioned studies, there is evidence that Estonia has also achieved a certain degree of convergence with the euro area cycle. Indeed, correlation of business cycles in several CEECs apparently matches or exceeds the convergence of several of the smaller, peripheral monetary union participants. By contrast, there is a much smaller interest in the business cycle properties of the SEECs.

Our meta-analysis of the studies dealing with business cycle correlation confirmed relatively high correlations for many new EU member countries. In addition, we found that characteristics of individual studies have had a clear impact on the estimated correlations. For example, studies using quarterly data on average report lower correlations than those utilizing monthly data.

Furthermore, we show that several smaller current members of the euro area seem to have a lower business cycle correlation than the new Member States of the EU. However, we have to keep in mind that business cycle correlation is only one criterion for successful participation in a monetary union. Economic policies also need to be congruent with the demands of the monetary union. Finally, our results indicate that Bulgaria and Romania have also achieved a positive degree of business cycle synchronization with the euro area, although this level is lower than in the NMS.

References

Artis, M. 2003a. Is There a European Business Cycle? CESifo Working Paper 1053.

Artis, M. 2003b. Analysis of European and United Kingdom Business Cycles and Shocks. HM Treasury. Retrieved on November 30, 2004: www.hm-treasury.gov.uk.

Artis, M., M. Marcellino and T. Proietti. 2004. Characterizing the Business Cycles for Accession Countries. CEPR Discussion Paper 4457.

Artis, M. and W. Zhang. 1997. International Business Cycles and the ERM: Is There a European Business Cycle? In: International Journal of Finance and Economics 2. 1099–1158.

Babetski, J., L. Boone and M. Maurel 2002. Exchange Rate Regimes and Supply Shocks Asymmetry: The Case of the Accession Countries. CEPR Discussion Paper 3408.

Babetski, J., L. Boone and M. Maurel 2004. Exchange Rate Regimes and Shocks Asymmetry: The Case of the Accession Countries. In: Journal of Comparative Economics 32. 212–229.

Babebtski, J. 2004. EU Enlargement and Endogeneity of some OCA Criteria: Evidence from the CEECs. Working Paper 2. Prague: Česká národní banka.

Backé, P., J. Fidrmuc, T. Reininger and F. Schardax. 2003. Price Dynamics in Central and Eastern European EU Accession Countries. In: Emerging Markets Finance and Trade 39. 42–78.

Backé, P., C. Thimann, O. Arratibel, O. Calvo-Gonzalez, A. Mehl and C. Nerlich. 2004. The Acceding Countries' Strategies Towards ERM II and the Adoption of the Euro: An Analytical Review. Occasional Paper 10. Frankfurt: European Central Bank.

Barrell, R. and D. Holland. 2004. Modelling the Accession Countries: An Analysis of Symmetric and Asymmetric Structural Shocks and the Spillover Effects in Relation to the EU. CEPR-EABCN Conference on Business Cycle and Acceding Countries. Vienna.

Bayoumi, T. and B. Eichengreen. 1993. Shocking Aspects of European Monetary Integration. In: Torres, F. and F. Giavazzi (eds.). Growth and Adjustment in the European Monetary Union. Cambridge: Cambridge University Press. 193–230.

Blanchard, O. and D. Quah. 1989. The Dynamic Effects of Aggregate Demand and Supply Disturbances. In: American Economic Review 79. 655–673.

Boone, L. and M. Maurel. 1998. Economic Convergence of the CEECs with the EU. CEPR Discussion Paper 2018.

Boone, L. and M. Maurel. 1999. An Optimal Currency Area Perspective of the EU Enlargement to the CEECs. CEPR Discussion Paper 2119.

Boreiko, D. 2002. EMU and Accession Countries: Fuzzy Cluster Analysis of Membership. Working Paper 71. Vienna: Oesterreichische Nationalbank.

Borghijs, A. and L. Kuijs. 2004. Exchange Rates in Central Europe: A Blessing or a Curse? Working Paper 04/2. Washington D.C.: IMF.

Borowski, J., 2001. Podatność Polski na szoki asymetryczne a proces akcesji do Unii Gospodarczej i Walutowej. In: Bank i Kredyt 11–12. 10–21.

Buiter, W. H. 2000. Optimal Currency Areas: Why Does the Exchange Rate Matter? CEPR Discussion Paper 2366.

Buiter, W. H. and C. Grafe. 2002. Anchor, Float or Abandon Ship: Exchange Rate Regimes for Accession Countries. CEPR Discussion Paper 3184.

Campos, N. F. and F. Coricelli. 2002. Growth in Transition: What We Know, What We Don't, and What We Should. In: Journal of Economic Literature XL. 793–836.

Clarida, R. and J. Gali. 1994. Sources of Real Exchange Rate Fluctuations: How Important Are Nominal Shocks. NBER Working Paper 4658.

Chamie, N., A. DeSerres and R. Lalonde. 1994. Optimum Currency Areas and Shock Asymmetry: A Comparison of Europe and the United States. Working Paper 1. Ottawa: Bank of Canada.

Csajbók, A. and Á. Csermely. 2002. Adopting the euro in Hungary: expected costs, benefits and timing. Occasional Paper 24. Budapest: Magyar Nemzeti Bank.

De Grauwe, P. and C. C. Storti. 2004. Effects of Monetary Policy: A Meta-Analysis. CESifo Working Paper 1224.

Darvas, Z. and G. Szapáry. 2004. Business Cycle Synchronization in the Enlarged EU: Comovements in the New and Old Members. Working Paper 1. Budapest: Magyar Nemzeti Bank.

Demanyk, Y. and V. Volosovych. 2004. Asymmetry of Output Shocks in the European Union: The Difference Between Acceding and Current Members. CEPR-EABCN Conference on Business Cycle and Acceding Countries. Vienna.

Égert, B. and L. Halpern. 2004. Equilibrium Exchange Rates in Central and Eastern Europe on the Eve of the Euro: New Insights from Meta-Analysis. Paper presented at the 10th Dubrovnik Economic Conference. Dubrovnik.

Estrin, S. and G. Urga. 1997. Convergence in Output in Transition Economies: Central and Eastern Europe. 1970–95. CEPR Discussion Paper 1616.

Fidrmuc, J. 2001. The Endogeneity of the Optimum Currency Area Criteria, Intraindustry Trade, and EMU Enlargement. Discussion Paper 106. Leuven: Centre for Transition Economics, Katholieke Universiteit.

Fidrmuc, J. 2004. The Endogeneity of the Optimum Currency Area Criteria, Intra-Industry Trade, and EMU Enlargement. In: Contemporary Economic Policy 22. 1–12.

Fidrmuc, J. and E. Hagara. 2004. Podobnosťt ponukových a dopytových sokov v EÚ a v pristupujúcich krajinách: implikácie pre Českú republiku a Slovensko. In: Politická Ekonomie 52. 171–182.

Fidrmuc, J., J. Fidrmuc and J. Horvath. 1999. Stability of Monetary Unions: Lessons from the Breakup of Czechoslovakia. In: Journal of Comparative Economics 27. 753–781.

Fidrmuc, J. and I. Korhonen. 2001. Similarity of Supply and Demand Shocks Between the Euro Area and the CEECs. BOFIT Discussion Paper 14. Helsinki: Institute for Economies in Transition, Bank of Finland.

Fidrmuc, J. and I. Korhonen. 2003. Similarity of Supply and Demand Shocks between the Euro Area and the CEECs. In: Economic Systems 27. 313–334.

Fidrmuc, J. and I. Korhonen. 2004. The Euro Goes East: Implications of the 2000–2002 Economic Slowdown for Synchronization of Business Cycles between the Euro Area and CEECs. In: Comparative Economic Studies 46. 45–62.

Frankel, J. A. and A. K. Rose. 1998. The Endogeneity of the Optimum Currency Area Criteria. In: Economic Journal 108. 1009–1025.

Frenkel, M. and C. Nickel. 2002. How Symmetric are the Shocks and the Shock Adjustment Dynamics between the Euro Area and Central and Eastern European Countries? Working Paper 222. Washington D.C.: IMF.

Frenkel, M., C. Nickel and G. Schmidt. 1999. Some Shocking Aspects of EMU Enlargement. Research Note 99–4. Frankfurt am Main: Deutsche Bank.

Horniková, M., 2003. Optimum Currency Areas and Shock Asymmetry: A Comparison of Europe and the Czech Republic. Master's Thesis. Budapest: Central European University.

Horvath, J., 2000. Supply and Demand Shocks in Europe: Large-4 EU Members, Visegrad-5 and Baltic-3 Countries. Mimeo. Budapest: Central European University.

Horvath, J. and A. Ratfai. 2004. Supply and demand shocks in accession countries to the European Monetary Union. In: Journal of Comparative Economics 32. 202–211.

IMF. 2000. Accession of Transition Economies to the European Union: Prospects and Pressures. World Economic Outlook – Prospects and Policy Issues, Chapter IV. Washington D.C.: IMF. 138–174.

Kalemli-Ozcan, S., B. E. Sørensen and O. Yosha. 2001. Economic Integration Industrial Specialization, and the Asymmetry of Macroeconomic Fluctuations. In: Journal of International Economics 55. 107–137.

Kočenda, E. 2001. Macroeconomic Convergence in Transition Economies. In: Journal of Comparative Economics 29. 1–23.

Korhonen, I. 2001. Some Empirical Tests on the Integration of Economic Activity Between the Euro Area and the Accession Countries: A Note. Discussion Paper 9/2001. Helsinki: Institute for Economies in Transition, Bank of Finland.

Korhonen, I. 2003. Some Empirical Tests on the Integration of Economic Activity Between the Euro Area and the Accession Countries: A Note. In: Economics of Transition 11. 1–20.

Kutan, A. M. and T. M. Yigit. 2004. Nominal and Real Stochastic Convergence of Transition Economies. In: Journal of Comparative Economics 32. 23–36.

Lipsey, M. W. and D. B. Wilson. 2001. Practical Meta Analysis. Applied Social Research Methods Series, Vol. 49. London: SAGE Publications.

Luikmel, P. and M. Randveer. 2003. The Synchronisation of the Estonian Business Cycle with Its Main Trading Partners. Mimeo. Tallinn: Eesti Pank.

Maurel, M. 2002. On the Way of EMU Enlargement Towards CEECs: What is the Appropriate Exchange Rate Regime? CEPR Discussion Paper 3409.

McKinnon, R. I. 2000. Mundell, the Euro and the World Dollar Standard. In: Journal of Policy Modeling 22. 311–324.

McKinnon, R. I., 2002. Optimum Currency Areas and the European Experience. In: Economics of Transition 10. 343–364.

Mundell, R. 1961. A Theory of Optimum Currency Area. In: American Economic Review 51. 657–665.

Mundell, R. 1973. Uncommon Arguments for Common Currencies. In: H. G. Johnson and A. K. Swoboda (eds.). The Economics of Common Currencies. London: Allen and Unwin. 114–132.

Ramos, R. and J. Suriñach. 2004. Shocking Aspects of European Enlargement. Mimeo. University of Barcelona.

Rose, A. 2004. A meta-analysis of the effect of common currencies on international trade. CEPR Discussion Paper 4341.

Stanley, T. D. 2001. Wheat from Chaff: Meta-Analysis as Quantitative Literature Review. In: Journal of Economic Perspectives 15. 131–150.

Süppel, R. 2003. Comparing Economic Dynamics in the EU and CEE Accession Countries. Working Paper 267. Frankfurt: European Central Bank.