Oesterreichische Nationalbank

Financial Stability Report

3

Publisher and editor:

Oesterreichische Nationalbank

Otto-Wagner-Platz 3, A 1090 Vienna

Editor in chief:

Wolfdietrich Grau, Secretariat of the Governing Board and Public Relations

Coordination of content:

Walter Waschiczek, Economic Analysis Division

Contributions:

Markus Arpa, Michael Boss, Luise Breinlinger, Werner Dirschmid, Ulrike Ditlbacher, Helmut Elsinger (Universität Wien), Friedrich Fritzer, Evgenia Glogova, Georg Hubmer, Harvir Kalirai, Alfred Lehar (Universität Wien), Thomas Reininger, Franz Schardax, Martin Scheicher, Martin Summer, Maria Teresa Valderrama, Walter Waschiczek

Edited by:

Alexander Dallinger, Economic Analysis Division

Otto-Wagner-Platz 3, A 1090 Vienna

Translated by:

Dagmar Dichtl, Ingrid Haussteiner, Irene Mühldorf,

Ingeborg Schuch, Susanne Steinacher, Foreign Research Division

Design:

Peter Buchegger, Secretariat of the Governing Board and Public Relations

Layout and typesetting:

Hannes Jelinek, Printing Office

Printing and production:

Oesterreichische Nationalbank, Printing Office

Published and produced at:

Otto-Wagner-Platz 3, A 1090 Vienna

Paper:

Salzer Demeter, 100% woodpulp paper,

bleached without chlorine, acid-free, without optical whiteners

Inquiries:

Oesterreichische Nationalbank

Secretariat of the Governing Board and Public Relations

Otto-Wagner-Platz 3, A 1090 Vienna

Postal address: P.O. Box 61, A 1011 Vienna

Telephone: (+43-1) 404 20, ext. 6666

Fax: (+43-1) 404 20, ext. 6696

Orders:

Oesterreichische Nationalbank

Documentation Management and Communications Services

Otto-Wagner-Platz 3, A 1090 Vienna

Postal address: P.O. Box 61, A 1011 Vienna

Telephone: (+43-1) 404 20, ext. 2345

Fax: (+43-1) 404 20, ext. 2398

Internet:

http://www.oenb.at

DVR 0031577

Vienna 2002

Contents

Editoral close: May 10, 2002

Executive Summary

The global economic slowdown has not continued into 2002. The U.S. economy in particular gathered steam in the first quarter of 2002, driven primarily by the expansion of private consumption and the surge in public spending. Nevertheless, these two demand components are no guarantee for a sustained upswing. In the light of weak investment spending and the financial imbalances evident in the U.S.A. – a low savings ratio combined with a high current account deficit – economic forecasts are shrouded in uncertainty. The euro area's rebound has been more subdued so far. With confidence indicators gaining since early 2002, it is likely that the euro area economy has also already bottomed out. Yet, economic growth is expected to pick up speed only in the second half of 2002.

No definitive trend has as yet manifested itself on the global equity markets since the beginning of this year. The sound fundamentals for the U.S.A. are being marred by growing concern about the sustainability of the economic recovery. Besides, the collapse of the energy company Enron in particular has put the spotlight on corporate governance weaknesses and the transparency of corporate balance sheets. The stock of highly leveraged companies took a beating in the wake of Enron's bankruptcy.

Central and Eastern European countries (CEECs), especially those seeking to accede to the European Union, remained largely unscathed by the Argentine crisis in 2001. The yield spreads of the CEECs' euro-denominated government bonds widened only temporarily.

The risks of the banking sectors in central Europe have increased only in Poland. The operating results that have become available so far for the first half of 2001 indicate that most countries are likely to even best the robust 2000 performance. Poland, by contrast, seems to have fared worse in 2001. Risk costs are feared to increase further amid the cyclical weakness.

With Austrian banks increasingly engaged in cross-border activities and with financial services becoming more and more complex, it is necessary to extend bank examinations and cooperate more closely with international supervisory bodies. Austria's new integrated supervisory regime took effect on April 1, 2002. A single supervisory body, the Financial Market Authority (FMA), performs banking, securities, insurance and pension fund supervision. The FMA is autonomous – it operates independently and is not bound by any instructions – and is organized as an institution under public law with a separate legal personality. The restructuring was aimed at establishing a high-quality, effective and at the same time cost-efficient supervisory regime. Given the Oesterreichische Nationalbank's far-reaching operational integration in banking and financial market supervision, the Austrian central bank can fulfill its manifold macroprudential tasks also within the Eurosystem and can thus contribute to safeguarding financial stability.

With the Austrian financial market becoming progressively integrated into the global financial infrastructure, its stability is ever more linked to international developments. Households have invested a substantial share of their financial assets abroad. Marked increases in the second half of the 1990s notwithstanding, direct and indirect investment (via mutual funds) in listed stocks in Austria still trails the euro area average, which is why the impact of tumbling stock prices in 2000 and 2001 on domestic households' financial wealth

remained relatively subdued. Therefore, no significant wealth effects seem to have emanated from global stock market developments.

Overall, however, the Austrian economy, slowed down considerably when the global economy slackened. In turn, dampened corporate earnings and more sluggish real income growth lessened credit demand in 2001; there was no evidence of an extreme deterioration in the credit standing of Austrian consumers and businesses, though.

Within this framework, Austria's banking system sustained its sound performance in the second half of 2001. Earnings remained stable in spite of the economic slowdown; the major banks, on balance, even managed to boost their income, which was largely ascribable to their subsidiaries in Central and Eastern Europe (CEE). Moreover, the by international standards still relatively great weight of bank lending had a stabilizing effect amid volatile financial markets. The cyclical downturn, however, drove up loan loss provisions for 2001.

The large Austrian banks continue to record highly dynamic activities in the CEECs. Despite the economic slowdown, the framework conditions for their CEE operations have not deteriorated perceptibly since the fall of 2001, as growth rates in most CEECs receded less sharply than in the euro area. In terms of their share in the group's business volume, Austrian banks' subsidiaries made a disproportionately high contribution to operating income. At the same time, banks succeeded in containing risk provisioning to date, as their market position allows Austrian subsidiaries to focus on prime borrowers. Foreseeable shifts from wholesale to retail lending and stiffer competition, which could cause Austrian banks' subsidiaries to start financing lower-rated companies, might in the long run align the risk situation to that prevailing in Western Europe. The growth potential of the CEE markets is, however, likely to remain high for the foreseeable future.

While taking the edge off competition among banks, the consolidation drive of recent years has apparently not restricted access to bank loans. There are at present no signs that banks would curb the supply of credit to an extent exceeding that attributable to the cyclical dip in credit demand. The structure of the Austrian financial system does not seem to be conducive to the emergence of a shortage of credit. Given the traditionally close relationship between enterprises and their banks, businesses are granted loans even when economic conditions become less favorable.

The effects of a diminishing credit supply, moreover, depend on whether businesses revert to other types of financing. In Austria, the substitution of bank loans with bond issues, while still in its infancy, has picked up some speed recently. Equity financing, however, was hit by the dampened market sentiment last year.

With banks still dominating the Austrian financial sector, the ability of the Austrian banking system to absorb risks is crucial for its stability. Austrian credit institutions' sound capital adequacy ratios – even though banks mostly rely on internal sources of finance to expand into CEE – are bound to cushion the impact of any potential problems.

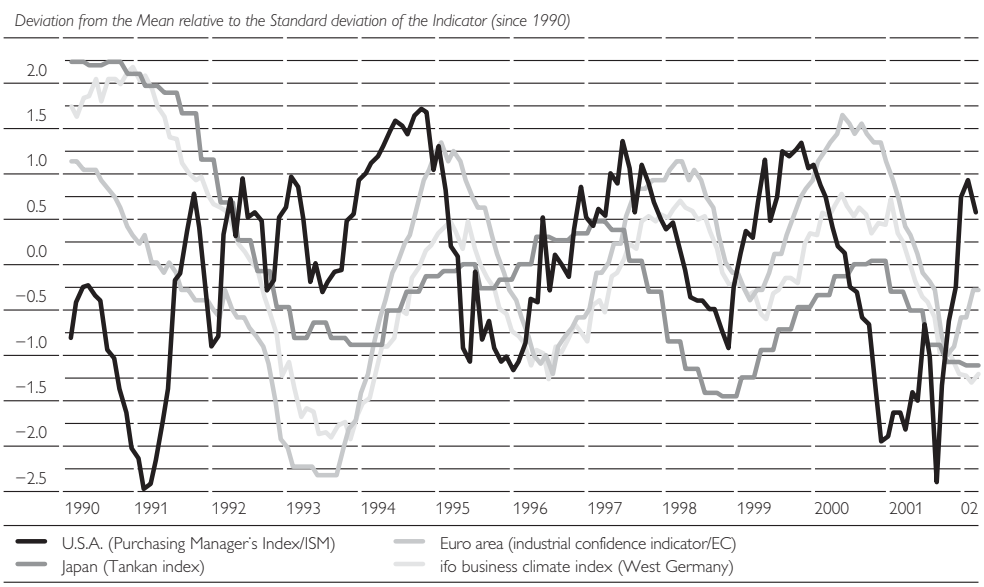
REPORTS

International Economic Developments

The synchronous global cyclical downturn in 2001, which was led by the U.S.A. and was largely caused by overinvestments in the high technology sector as well as a surge in oil prices, bottomed out at the turn of 2001. Growing prices on risk capital markets in the fourth quarter of 2001 and, later on, improving economic indicators and rising input prices (e.g. in semiconductor technology) were the first signs of an economic revival. By now, an increasing number of "hard facts," including the rise in industrial output in the U.S.A. since January 2002, have corroborated the assumption that the U.S.A. are leading the global economy back to growth. Although growth rates are highly divergent across the world in the first half of the year, they should converge as the year progresses so that most areas should see at least moderately positive output growth, more or less without inflationary pressures, by the end of 2002.

Figure 1

Business Climate-Indicators in the G-3



Source: Datastream, OeNB.

The rapid emergence from the global economic trough was largely made possible by the strong response of monetary and fiscal policies in the U.S.A. and, to a lesser degree, in the euro area, as well as by a moderation of oil prices in the fourth quarter of 2001 and most of the first quarter of 2002.

The sustainability and strength of the global economic recovery, however, remain subject to uncertainty, in particular because of financial imbalances in the U.S.A. (low saving rate and large current account deficit) and Japan (fragile banking sector and high budget deficit) and the future development of oil prices.

Rapid Turnaround of the U.S. Economy

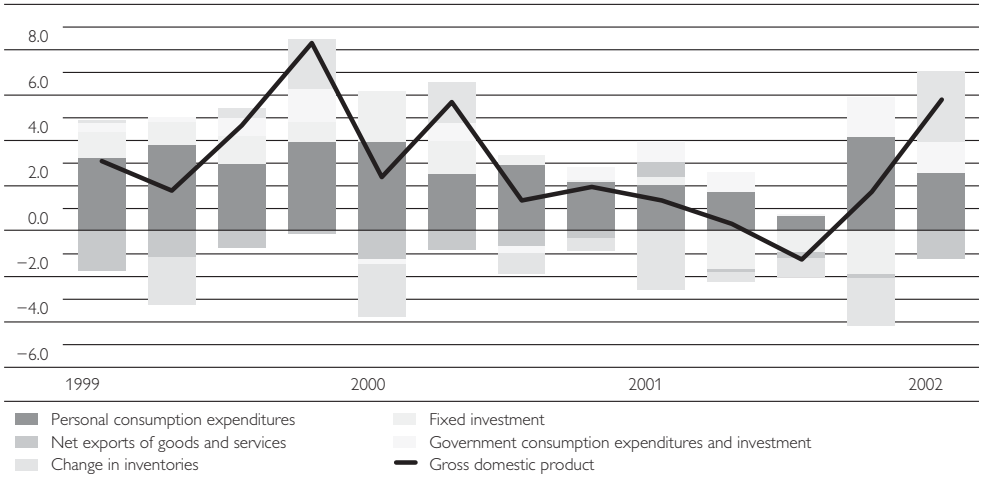
The economic trend reversal in the U.S.A. at the end of 2001 turned out to be more marked than first expected. Real GDP expanded at an annualized quarterly growth rate of (preliminary) 5.8% in the first quarter of 2002, after 1.7% in the fourth quarter of 2001. The annual growth rate of real GDP came to 1.2% in 2001.

Figure 2

Growth of Real GDP Components in the U.S.A.

Contribution to Seasonally Adjusted GDP Growth

Change on previous quarter in percentage points



Source: Bureau of Economic Analysis.

The terrorist attacks of September 11, 2001, had an immediate negative impact on the U.S. economy, triggering a short-term slump in private consumption, a noticeable decline in industrial and consumer confidence, layoffs of staff and the postponement of business investments. In the fourth quarter of 2001, private consumption rebounded powerfully, also on account of numerous special offers for consumer durables. In addition, the U.S. economy was fueled by greatly increased government expenditures in the wake of the terrorist attacks. Private investment, however, continued to go down in the U.S.A., and inventories were further reduced.

In the first quarter of 2002, U.S. economic activity gained considerable momentum, as – in addition to continued solid personal consumption and rising government expenditures – destocking clearly decelerated, which, in turn, boosted industrial output. Although the vigorous economic growth should abate somewhat after the first quarter, most forecasters expect the economic revival to continue throughout 2002.

But we cannot speak of a sustainable economic upswing in the U.S.A. before private investment again registers positive growth rates and unless private consumer demand retains its robust pace. As corporate investment has so far remained rather weak, the danger of a considerable deceleration of the pace of expansion still remains. High private debt and the widening current account deficit represent a latent risk for the U.S. economy and for U.S. capital markets, in particular in case of a confidence shock of U.S. consumers or a reestimation of the yields to be expected by (foreign) investors from investments in the U.S.A.

The Federal Reserve System considerably cut interest rates in response to last year's recession. Most recently, the target federal funds rate was lowered to 1.75% in December 2001.

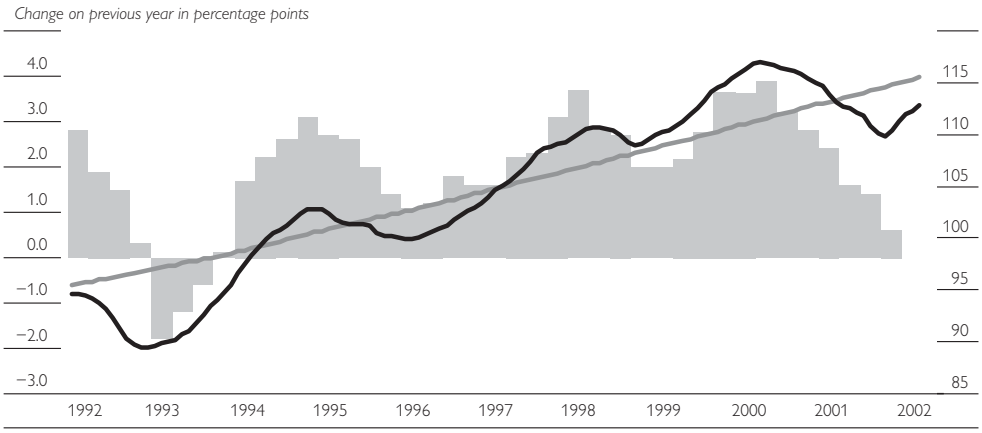
Restrained Recovery in the Euro Area

As in previous quarters, real GDP developments in the euro area were characterized by weak domestic demand in the fourth quarter of 2001, which was only partially offset by a positive contribution of net exports to output growth. In the fourth quarter of 2001, real GDP retreated 0.2% against the previous quarter. 2001 economic growth amounted to 1.5%.

The continuous contraction of economic growth between the middle of 2000 and the end of 2001 was largely attributable to global factors, such as the oil price hikes in 1999 and 2000, overinvestments in the high technology sector, marked price losses in "growth" stocks and the economic downturn in the U.S.A. In addition, developments rooted in Europe or individual countries weighed down the euro area economy and caused rather great differences in the growth rates of individual euro area countries in 2001, ranging from 0.6% in Germany and 2% in France to 6.6% in Ireland.

Figure 3

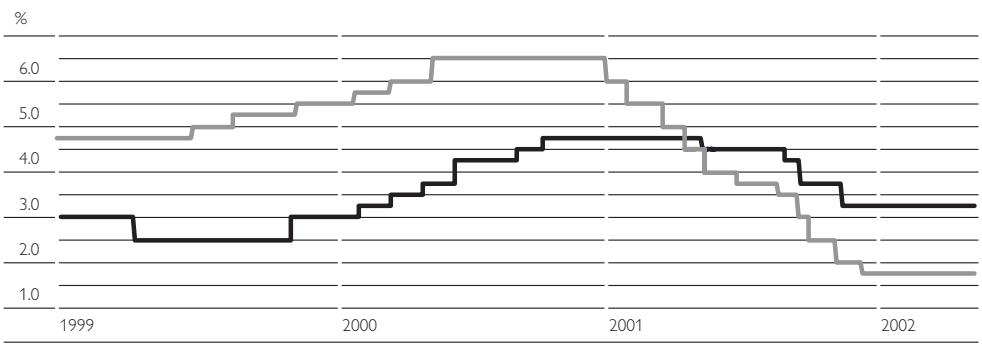
OECD Leading Indicator for the Euroarea



Source: OECD, Datastream.

Figure 4

Key Interest Rates: Euro Area and U.S.A.



Source: Datastream.

The expectation of a slow economic revival in the euro area in the first half of 2002 has been corroborated by improving confidence indicators, especially in industry, since the beginning of the year. Most recent forecasts of real GDP growth in the euro area thus predict restrained growth rates in the first half of 2002 and a more robust pace of expansion in the second half of 2002.

Sluggish economic activity and reduced price effects from crude oil and meat prices caused euro area inflation to further ease in the fourth quarter of 2001. Despite a temporary rise to 2.7% in January 2002, mainly because of special factors, both the Eurosystem and most forecasters assume the trend of sinking inflation rates to continue in 2002. In the light of these developments, the Governing Council of the ECB again cut the key interest rate by 50 basis points to 3.25% in November 2001.

Difficult Economic Situation in Japan Continues

As of the second quarter of 2001, the Japanese economy registered negative real GDP growth rates quarter on quarter, as domestic demand was weak. Uncertain employment prospects, in particular, dented personal consumption expenditure. In addition, subdued international demand dampened Japanese exports. Overall, real GDP contracted 0.5% in 2001. In the first quarter of 2002, the Bank of Japan's Tankan sentiment barometer did not yet show any improvements, but there were first indications that the global economic warming might jumpstart Japanese exports. The most problematic factors are the protracted deflation, the high budget deficit, a surging government debt ratio and the large number of nonperforming loans, which are a strain on the banking sector and impair its function as intermediary. These factors as well as the imminent restructuring of the private and public sectors and rising unemployment are likely to continue to contain domestic demand, thus perpetuating weak growth for the time being.

Emerging Market Economies Detached Themselves from the Argentine Crisis

The economic development in the emerging market economies was determined by the business cycle in industrialized countries. Only large and relatively closed economies, such as China, India or Russia, managed to detach themselves from the global economic downtrend. In the fourth quarter of 2001, the "tiger countries" were still hit by retreating high-technology investments, and in Latin America, the Argentine crisis aggravated increasingly. At the beginning of 2002, however, the outlook brightened for Southeast Asia as export demand revived and consumer and business confidence improved.

Argentina, in contrast, had to announce its insolvency at the turn of 2001, and, as a consequence, severed the peso's peg to the U.S. dollar. By the beginning of May 2002, the Argentine peso had depreciated from a ratio of 1:1 to about 1:3 USD/ARS. Although the other Latin American countries could not escape the global economic downtrend, they remained largely unscathed from spillover effects from Argentina.

That Argentina's insolvency has so far had hardly any substantial contagious effects on other emerging markets is most likely linked to the fact that financial markets had anticipated such a development, which was subsequently reflected in the prices of Argentine debt securities. Furthermore, financial market par-

ticipants seem to differentiate rather clearly between the situation in Argentina and in other emerging market economies. But since Argentina's prospects are still rather uncertain, it is too early to completely exclude any spillover effects of this crisis on other emerging markets.

The EU Economy also Influences Central and Eastern Europe

In 2001, the overall economic development in Central and Eastern Europe was determined by the growth deceleration in the European Union and, in the case of Russia, by the decline in oil prices. Only those countries which were hit by the global economic downturn amid a strong rebounding of domestic demand could record an acceleration of growth against 2000 (Croatia, Slovak Republic, Czech Republic). In Croatia and the Slovak Republic, the combination of vigorous domestic demand and low export growth caused the current account deficit to widen considerably, in Slovakia even to surge to a very high level. In both countries, however, the current account deficit was largely offset by net inward direct investments. Croatia thus even registered a rise in official gross reserves, measured by monthly imports of goods and services. In Slovakia, reserves slightly declined and recorded the lowest figure from among the countries under review, as in 2000.

The overall 2002 development of this region will be determined by how quickly and to what extent the economy of the European Union (EU) and thus export growth revives. In the case of the Slovak economy, a dampening of domestic demand growth will probably be needed in addition to further extensive direct investment inflows. Both factors, however, will be substantially influenced by political developments, in particular the parliamentary elections to be held in the fall of 2002. Exchange rate developments in Poland will essentially depend on the import propensity of the future upswing of domestic investment demand.

International Financial Markets

Guarded Revival of Financial Markets in the Fourth Quarter of 2001

The capital market trend of fleeing into "high quality," which has been evident since the second quarter of 2000, strengthened directly after the terrorist attacks of September 11, 2001. Prices on risk capital markets declined sharply, with low-rated stocks and corporate bonds plummeting in particular. Risk-free securities, on the other hand, especially Western government bonds, registered substantial price gains.

Figure 5

DJ Euro STOXX – Standard & Poor's 500 – Tokyo SE Price Index

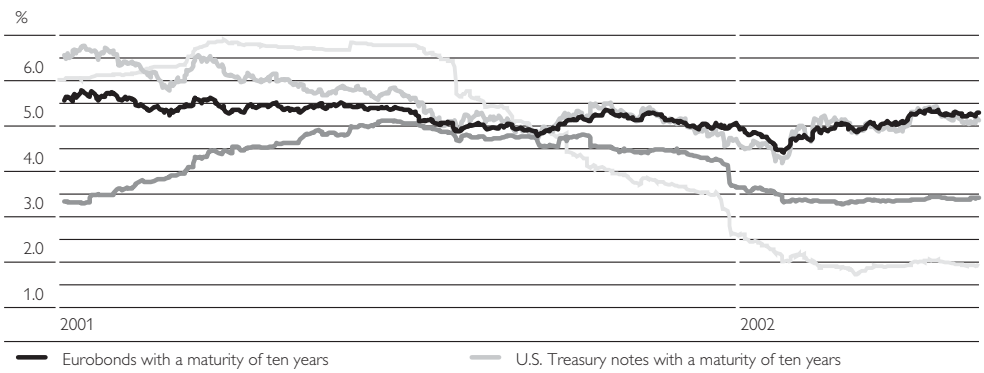
January 1, 2001, to May 10, 2002

Source: Datastream, OeNB.

Figure 6

Interest Rates in the Euro Area and in the U.S.A.

January 1, 2001, to May 10, 2002



Source: Datastream.

This development, however, did not last very long. Already at the end of September 2001, volatility receded, and prices on risk capital markets bounced back in anticipation of an imminent global and largely inflation-free economic revival. Price/earnings (P/E) ratios surged temporarily, mainly in the U.S.A., as a consequence of these anticipative stock prices, which were as yet unsubstantiated by real-economy developments and plummeting corporate profits.

On government bond markets, an imminent economic recovery was expected as of November 2001, which quickly resulted in partly substantial price losses and yield gains and – together with key interest rate cuts – in much steeper yield curves.

Furthermore, spreads between corporate and government bonds also retreated in the course of the fourth quarter, as financial market evaluations generally turned more optimistic.

At the end of 2001, the general financial market outlook was much brighter than at the end of the third quarter of 2001.

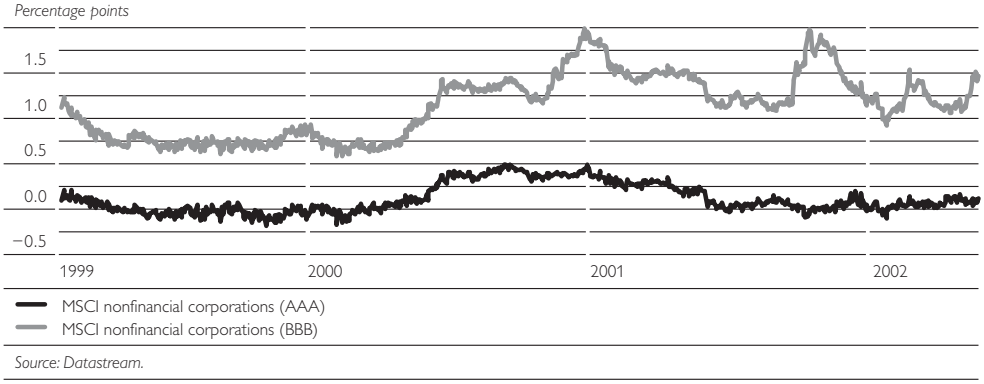
Open Questions on Corporate Governance Characterized the First Months of 2002

Financial markets were largely characterized by two developments in the first months of 2002: On the one hand, the economic outlook improved continuously, on the other, the corporate failure of the energy group Enron, in particular, posed questions on corporate governance and the transparency of corporate balance sheets.[1]) As of the end of January 2002, the latter dealt a considerable blow to the credibility of corporate financial information, which especially hit growth companies with a large share of outside capital, such as many high-technology corporations.

Consequently, corporate stocks from this segment and very low-rated corporate bonds suffered in part considerable price losses. By contrast, the brightening economic outlook and slightly improved profit expectations favored those stocks and corporate bonds which investors did not associate with doubtful accounting methods and excessive debt ratios. Under these circumstances the

Figure 7

Yield Spread Between Euro-Denominated Corporate Bonds and Benchmark German Government bonds

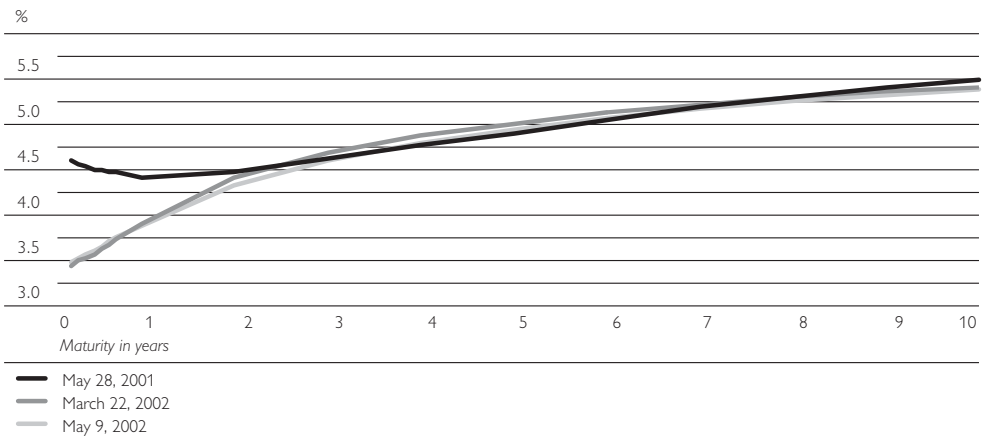


Source: Datastream.

1 *Enron initially caused this discussion, but there were numerous other cases, such as Swissair in Europe, which were used as examples in debates on corporate governance.*

Figure 8

Zero-Coupon Yield Curve of the Euro



Source: Datastream.

DJ Euro STOXX index and the U.S. index Standard & Poor's (S&P) 500 largely moved sidewards in the first four months of 2002, whereas the Japanese TOPIX index slightly gained in value.

The yield curve in the euro area and especially in the U.S.A. turned even steeper on account of a slight rise in long-term government bond interest rates during the first quarter of 2002, probably most of all due to the expected economic upswing and less to an anticipated increase of inflation. At the beginning of the second quarter, long-term interest rates eased somewhat, especially in the U.S.A.

In Japan, short-term interest rates lingered at zero, yields of government bonds with a maturity of ten years remained rather constantly around 1.4%, despite a downgrading by Moody's for domestic government bonds.

Bond and stock markets in the emerging economies largely showed a positive development in the fourth quarter of 2001 and the first months of 2002, despite the aggravated crisis in Argentina, and some government issuers from these regions returned to the international capital market with new issues. This was mostly made possible by a greater willingness of investors to incur risk and a rapid reflux of capital into these areas. High-risk debtors, however, continue to be in a precarious situation, as was illustrated at the beginning of May 2002 in Brazil, where domestic political problems caused bond spreads to widen again and private Brazilian issuers to delay planned issues.

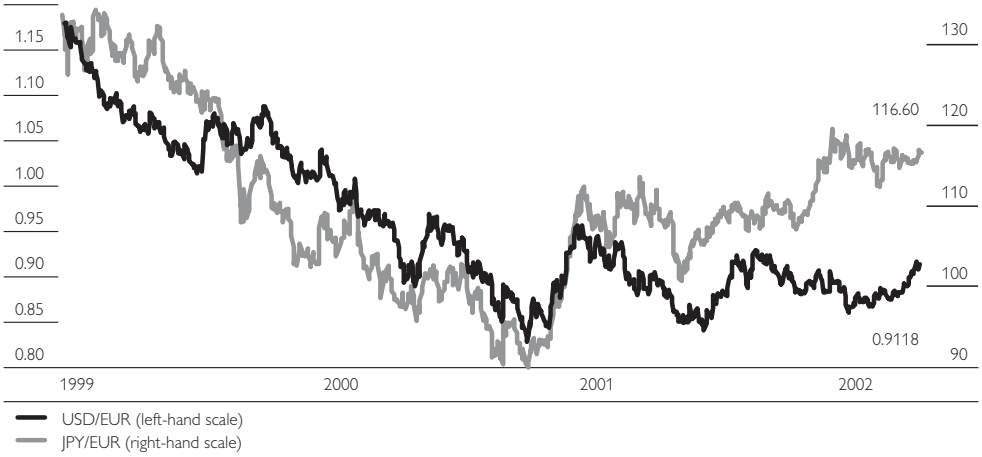
Little Volatility of the Euro Exchange Rate against the U.S. Dollar

The euro exchange rate against the U.S. dollar revolved around 0.90 USD/EUR in the fourth quarter of 2001, dipped slightly below that level in the first quarter of 2002 and returned to around 0.90 USD/EUR at the end of April/beginning of May. The low volatility of the exchange rate during the entire period was remarkable. It may have been caused by the fact that, from the point of view of financial markets, the events of September 11, 2001, represented a largely symmetrical shock. On the other hand, capital flows into the U.S.A. seem to have declined in the reporting period, which is probably less ascribable to relative

Figure 9

Development of the Euro Exchange Rate

January 1, 2001, to May 10, 2002



Source: Datastream.

growth prospects than to the relative yield expectations of euro area investments against U.S. portfolio and direct investments.

The euro exchange rate against the Japanese yen climbed by up to 10% to 120 JPY/EUR in the second half of the fourth quarter of 2001 and fluctuated around 115 JPY/EUR afterwards. The weakness of the Japanese yen in the fourth quarter 2001 was mainly due to the negative economic outlook in Japan, declining stock prices and their effect on the fragile Japanese banking sector.

Within Europe, the euro exchange rate remained mostly stable during the reporting period. Against the pound sterling, the euro hovered around 0.61 GBP/EUR. Directly after the terrorist attacks, the Swiss franc profited from "safe haven" inflows. Later on, the euro exchange rate against the Swiss franc remained relatively stable between 1.48 and 1.46 SFR/EUR. As of the end of April 2002, the Swiss franc appreciated again, causing the Swiss National Bank at the beginning of May 2002 to lower its three-month LIBOR target range by 0.5 percentage point to between 0.75% and 1.75%. After this decision, the euro exchange rate fluctuated around 1.4550 SFR/EUR.

Appreciation of Financial Assets of Central and Eastern Europe

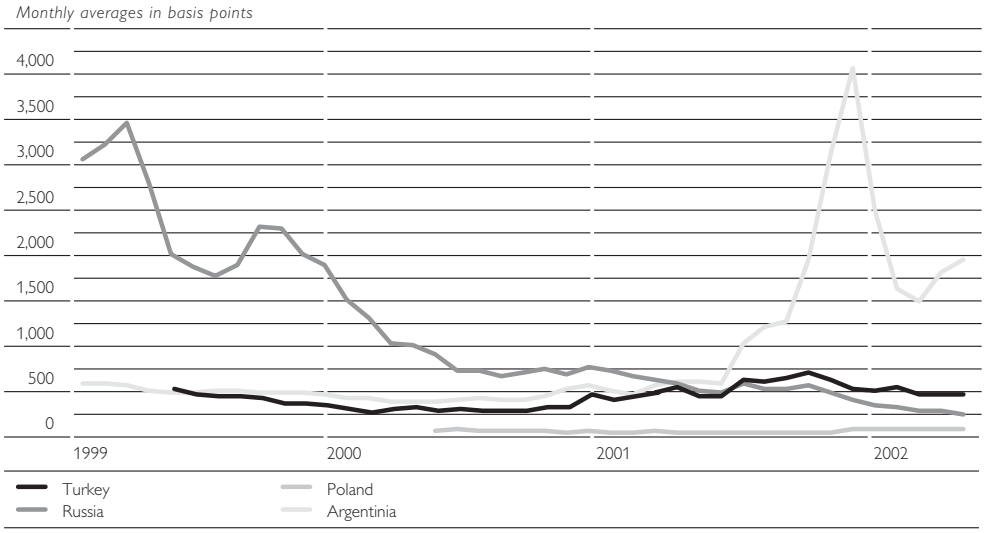
Argentine Crisis Causes no Lasting Widening of Euro-Denominated Bond Spreads

The international market valuation of euro-denominated bonds in Central and Eastern European countries should reflect the estimated ability of these sovereign debtors to meet payment obligations.

But this valuation is also determined by the developments in other economies. With a view to analyzing to what extent a differentiated evaluation of sovereign risks in Central and Eastern Europe is being made already, figure 10 shows bond spreads of euro-denominated government bonds issued by Argentina, Turkey and various Central and Eastern European countries. Obviously, the drastic widening of Argentine spreads as of July 2001 caused a widening of spreads or the breaking of a narrowing spread trend in Russia, Rumania, Croatia and the Slovak Republic only temporarily, i.e. between July and

Figure 10a

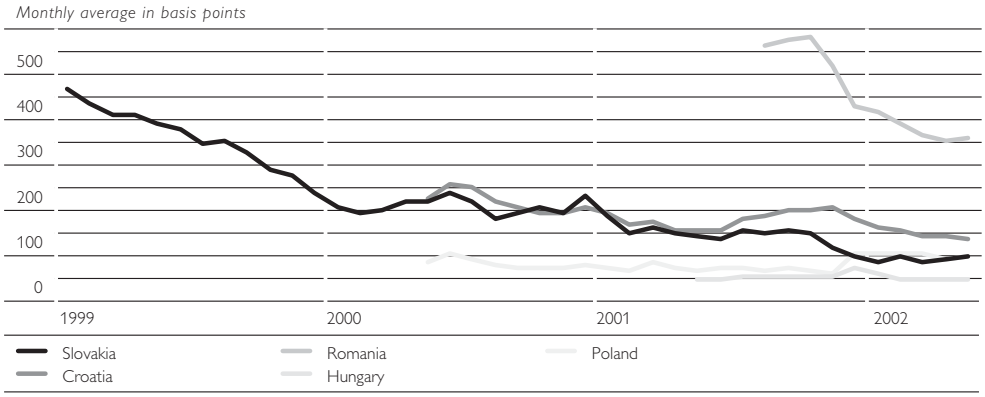
Yield Spread of Euro-Denominated Government Bonds



Source: Bloomberg, JP Morgan, OeNB.

Figure 10b

Yield Spread of Euro-Denominated Government Bonds



Source: Bloomberg, JP Morgan, OeNB.

October 2001. In these countries, government bond spreads were considerably or, in the case of Croatia, slightly lower in April 2002 than before the rise in Argentine spreads in July 2001. In particular EU accession countries as well as Russia could thus avoid lasting contagious effects of the Argentine crisis. By contrast, bond spreads of euro-denominated Brazilian government bonds for instance clearly remained above the level of June 2001 until May 2002 (the cut-off date for this report).

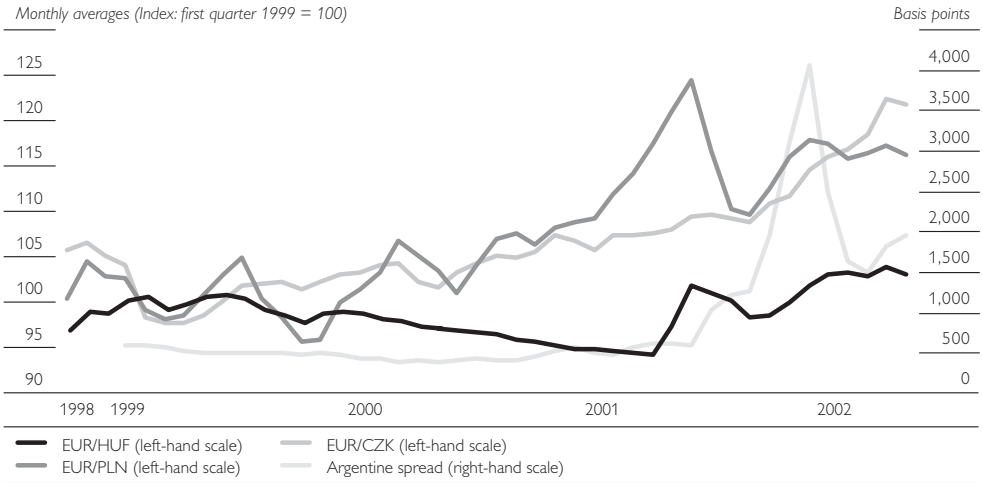
Despite Argentine Crisis Mostly Both Real and Nominal Currency Appreciations

The fundamental reevaluation of Argentine debt securities on the international financial market in July 2001 lead spreads of euro-denominated Argentinean bonds to dramatically double to about 1,050 basis points (see figure 11, right-hand scale). Whereas this widening of spreads did not noticeably influence

Polish and Hungarian spreads, this marked reevaluation seems to have had a direct impact on the assessment of Central and Eastern European currencies. As a consequence, the currencies of Russia, Poland and – to a somewhat lesser degree – Hungary, which had initially shown a very strong nominal appreciation against the euro, depreciated substantially between July and September/Octo-

Figure 11a

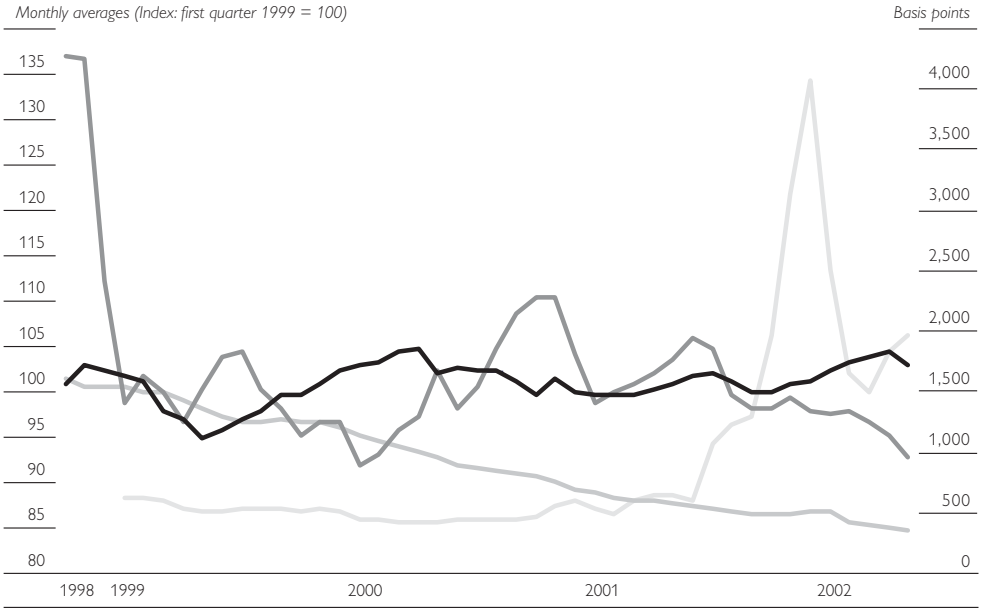
Euro Exchange Rate of Central and Eastern European Currencies and Bond Spread of Euro-Denominated Argentine Government Bonds



Source: Bloomberg, Datastream, JP Morgan, OeNB.

Figure 11b

Euro Exchange Rate of Central and Eastern European Currencies and Bond Spread of Euro-Denominated Argentine Bonds



Source: Bloomberg, Datastream, JP Morgan, OeNB.

ber 2001. The currencies of the Slovak and Czech Republics depreciated slightly as well, and only the tendency of the Slovenian currency remained completely untouched (see figure 11).

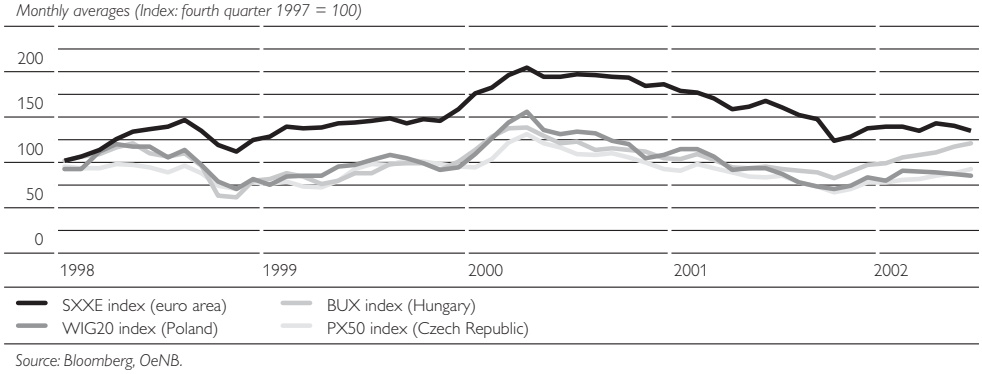
In the course of the fourth quarter of 2001, however, a more differentiated risk evaluation obviously gained ground on the market, as another doubling of the spreads of Argentine euro-denominated bonds did not lead to a further (strong) weakening of Central and Eastern European currencies. But in April 2002 the exchange rates for the Hungarian forint, the Czech koruna and the Slovak koruna were already much higher than before July 2001. The nominal appreciation of the Slovak koruna between October 2001 and April 2002 seems to be in line with fundamentals to a limited extent as the current account deficit was financed by net inward direct investments. But to a certain extent, a spill-over effect from the Czech koruna might also have had an impact here. As of October 2001, the Polish zloty also experienced a trend reversal toward a nominal appreciation, without reaching the, by comparison, extremely high previous level. A decline in interest differential and burgeoning domestic demand growth, however, might lead to another depreciation of the zloty. Only in the case of the Russian rouble the nominal currency depreciation as of July 2001 continued in a moderate way until May 2002.

Global Developments Dominate Stock Markets

The long-term stock market developments of the Czech Republic, Hungary and Poland are only to a very small degree fundamentally determined by national factors, as is illustrated by figure 12. Stock indices move in parallel with the DJ Euro STOXX index (SXXE), but typically with much greater proportional differences between successive lows and highs. These more extensive relative fluctuations are probably due to the basically higher risk rating attributed to these markets by international equity funds. In a longer-term perspective, between their lows in October 1998 on account of the Russian crisis and April 2002, the Czech and Polish indices registered about the same upwards movement as the DJ Euro STOXX, while the Hungarian index surged even more strongly. But as the Russia-based slump was much more extensive in Central European stock indices than in the DJ Euro STOXX, the index highs of before the Russian crisis have not even been reached by the Hungarian BUX.

Figure 12

Stock Indices in the Euro Area and in the Accession



Source: Bloomberg, OeNB.

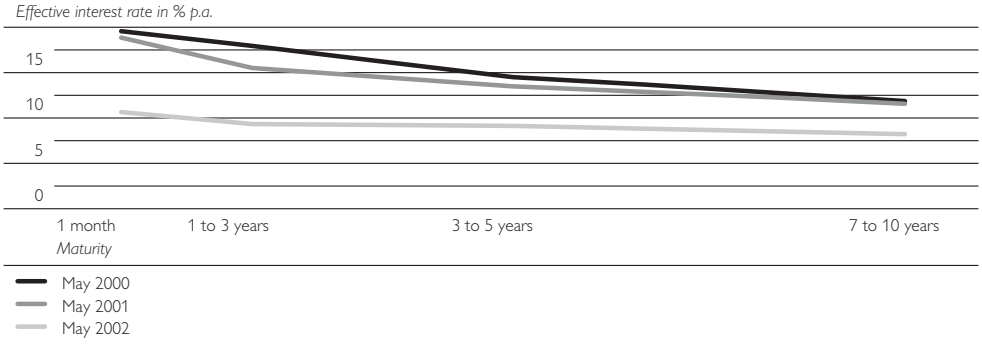
Polish Interest Rates and Long-Term Yields Both Far Exceed Inflation

Both Poland and Hungary have depicted inverted yield curves since the creation of a multi-year debt security market in the first half of the 1990s, whereas the Czech Republic has shown a rising yield pattern already for a number of years (see figure 13). The inverted curve pattern reflects an expected long-term disinflation process. This is corroborated by the fact that the inflation decline in Poland in the past twelve months was accompanied by reduced inversion, i.e. less steepness of the inverted curve.

Since the beginning of 2000, Poland has shown highly positive differentials between both interest rates and short- and long-term yields on the one hand and inflation on the other hand. In Hungary, inflation did not dip below the yield level until the second half of 2001 and to a much lesser degree. This striking contrast can, first of all, be explained by different monetary policies, which are also reflected in one-month money market interest rates. Secondly, structural inflation expectations might still be somewhat higher in Poland than in Hungary. At the beginning of 2002, however, the difference between long-term

Figure 13a

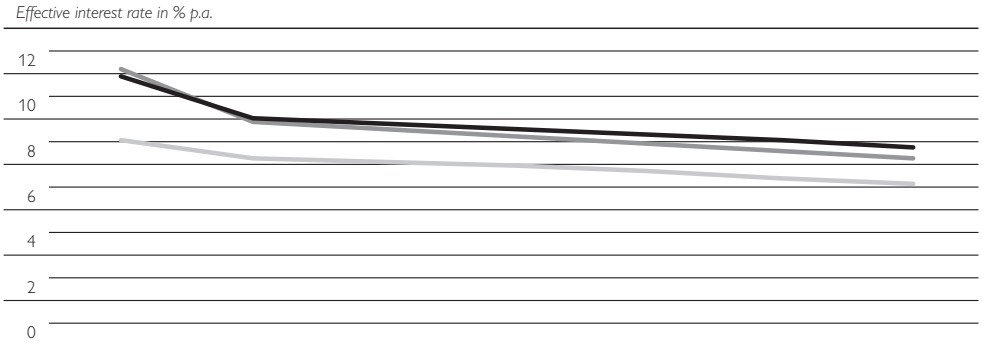
Yield Curve in Poland



Source: Bloomberg, OeNB.

Figure 13b

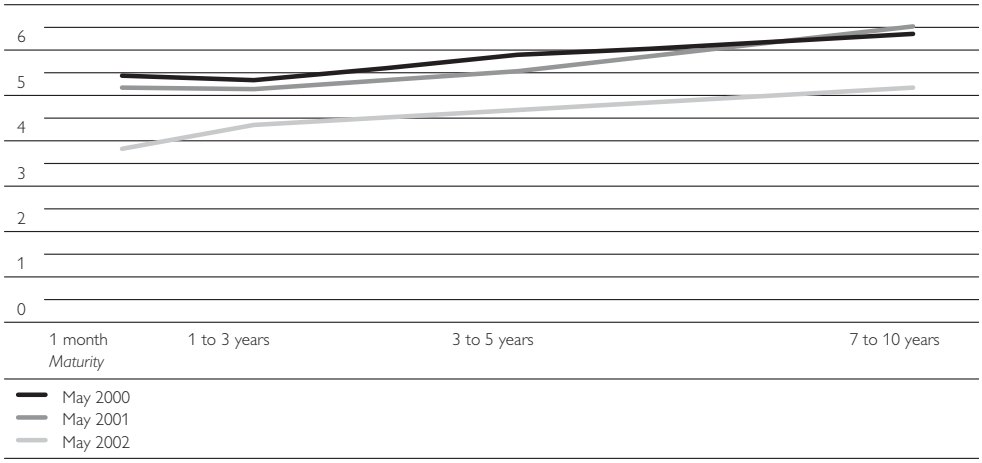
Yield Curve in Hungary



Source: Bloomberg, OeNB.

Figure 13c

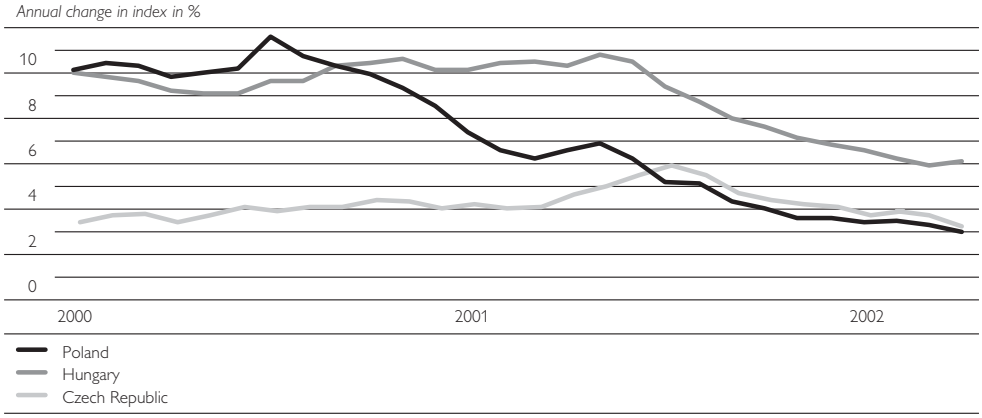
Yield Curve in the Czech Republic



Source: Bloomberg, OeNB.

Figure 13d

Inflation in Poland, Hungary and the Czech Republic



Source: Bloomberg, OeNB.

yields and current year-on-year inflation might also have increased in Hungary on the basis of long-term inflation expectations, with the most recent disinflation success being interpreted in part also as the result of the positive supply shock of an oil price decline, and with further disinflation prospects being considered more subdued now. Even if divergent patterns in inflation expectation serve as an explanation, it is still questionable whether they may sufficiently account for the substantial differences in the gap between short-term yields and inflation, in particular. As third and last determinant we refer to the potentially divergent expectations of future exchange rate changes. Prices of zloty-denominated government bonds, for instance, might include expectations of much higher short- and long-term currency depreciations than bonds denominated in Hungarian forint and especially in Czech koruna.

Banking in Central Europe Ever More Profitable

Growth Slows Down in the First Half of 2001

In the first half of 2001, the development of total banking sector assets in Central Europe varied considerably across countries, but real growth was mostly below the full-year figures for 2000. From January to June 2001, annualized real growth of banking assets ranged from 9.5% in Slovenia to almost –4% in the Slovak Republic. Compared to 2000, real asset growth in the banking sector accelerated in the Czech Republic, while slowing down in Poland, Hungary, the Slovak Republic and Croatia, and remaining practically unchanged in Slovenia.

In Slovenia, Croatia and Hungary, loans to businesses and households grew faster than total assets; in Poland and the Czech and Slovak Republics, by contrast, these balance sheet items grew at a slower pace, with Slovakia even reporting a decline in the absolute level (as in 2000). Given the strength of the Polish zloty and the substantial positive interest rate differential, the bulk of new loans were denominated in foreign currencies, driving the share of foreign currency loans in all commercial bank claims on nonfinancial institutions up to 24% by the end of June 2001. In the Czech Republic, where in 1999 and 2000, in the course of cleansing their loan portfolios, banks had also registered a decline in the volume of loans outstanding to the private sector, this position was observed to rise in the first half of 2001, indicating the end of this weeding-out process.

Further Increase of Profitability in the Central European Banking Sector

With the exception of Poland, return on equity (ROE) went up year on year in all countries under review in the first half of 2001.

In the case of Hungary, however, growth was influenced by one-time factors (provisions released following the sale of equity interests and legal adjustments), which accounted for around 60% of the rise in profit before tax. Even so, the (nominal) increase in operating income compared with the first half of 2000 was 29%.

Table 1

Return on Equity

	1997	1998	1999	2000	First half	
					2000	2001
	%					
Croatia	..	–16.1	4.8	10.7	13.5	16.2
Poland	37.7	9.2	12.9	14.6	16.8	15.4
Slovakia	..	–13.4	–36.5	25.2	1.3	21.3
Slovenia	10.3	11.3	7.8	11.3	12.2	12.5
Czech Republic	– 5.3	– 5.2	– 4.3	12.0	6.6	15.1
Hungary	11.9	7.5	4.0	10.9	15.2	21.2

Source: National central banks, OeNB.

After operating income had been on the decline for two years, banks in the Czech Republic recorded an increase in the first half of 2001. With operating expenses augmenting only moderately, the Czech banking sector appears to have sustainably improved its operating performance. Preliminary results for the year 2001 are already available for Slovakia, indicating a further pronounced rise of the annual banking sector surplus. This rise in net profits is mainly attrib-

utable to the release of provisions, but operating income went up as well. In Poland, by contrast, given the slow growth in operating revenues and the simultaneous rise in loan loss provisions, ROE went down slightly during the first six months of the reporting year compared to the first half of 2000, although the contribution of some less sustainable income components (such as foreign exchange gains) increased somewhat. The decline in the absolute level of operating expenses, however, indicates that the cost discipline of Polish banks is comparably high.

The net interest rate spreads recorded in most of the countries under review in the first half of 2001 largely corresponded to those for the entire year 2000; only in Poland, this indicator went down markedly. The considerable decline in net interest income as a percentage of average total assets in Poland can be ascribed to a combination of narrowing interest rate margins, a rise in the importance of foreign currency loans (on which fees are higher but margins lower) and a deterioriation of banks' loan portfolios.

Table 2

Net Interest Rate Spread

Net Interest Income as a Percentage of Average Total Assets

	1997	1998	1999	2000	First half	
					2000	2001
	%					
Croatia	..	..	..	..	..	3.78
Poland	4.77	4.62	4.04	4.28	4.40	3.38
Slovakia	..	..	6.70	6.40	..	..
Slovenia	4.18	3.84	3.53	3.86	4.05	3.64
Czech Republic	1.81	2.97	2.50	2.21	2.05	2.04
Hungary	3.83	4.32	3.99	3.94	4.07	4.01

Source: National central banks, OeNB.

Compared with the first half of 2000, operational efficiency (measured in terms of the cost/income ratio) improved in all countries under review but Slovenia.[1]) In Hungary, this ratio deteriorated vis-à-vis 2000 as special factors had caused an upward distortion of operating expenses in 2000.

Table 3

Cost/Income Ratio

	1997	1998	1999	2000	First half	
					2000	2001
Croatia	..	..	..	..	..	58.9
Poland	55.6	63.0	65.2	63.2	62.5	61.3
Slovakia	..	62.0	78.6	67.7	..	64.2
Slovenia	61.4	63.3	65.2	58.9	59.5	63.7
Czech Republic	48.6	49.2	56.6	65.7	64.3	59.2
Hungary	53.0	59.6	87.0	57.9	73.7	66.7

Source: National central banks, OeNB.

Owing to seasonal factors, there are certain restrictions to interpreting the development of loan loss provisions in the first half of 2001. Compared to the reference period of 2000, risk costs in Poland, however, appear to have risen even further.

1 No reference values are available for Croatia and the Slovak Republic.

Table 4

Risk Provisions as a Percentage of Operating Income

	1997	1998	1999	2000	First half	
					2000	2001
	%					
Croatia	..	..	..	..	..	0.1
Poland	4.4	9.9	14.3	16.3	11.2	14.0
Slovakia	..	38.4	103.3	–17.1	..	–46.1
Slovenia	19.8	15.4	19.7	21.9	18.7	13.7
Czech Republic	34.0	14.6	0.1	–46.7	–108.3	9.7
Hungary	1.4	8.1	1.1	0.2	1.8	– 6.2

Source: National central banks, OeNB.

With the exception of Croatia, which posts the highest capital adequacy ratio of the countries under review, capital adequacy ratios remained unchanged or went up in the first half of 2001.

Table 5

Banks' Capital as a Percentage of Risk-Weighted Assets

	1997	1998	1999	2000	First half	
					2000	2001
	%					
Croatia	..	..	..	21.3	..	18.8
Poland	12.4	11.7	13.2	13.0	12.4	14.4
Slovakia		3.1	5.3	12.5	11.7	..
Slovenia	..	..	..	13.5	13.6	13.5
Czech Republic	9.5	12.1	13.6	14.9	16.7	15.2
Hungary	16.7	16.5	15.0	15.2	14.0	15.1

Source: National central banks.

Profitability Improves in All Countries, but Economic Conditions Deteriorate in Poland

The development of operating profit over the first half of 2001 suggests that results for the year 2001 might even surpass those of the previous year, which was the most successful business year to date in the countries under review. The improvement of profitability both in 2000 and 2001 in Slovakia and in the Czech Republic, in particular, reflects the rising profitability of some large credit institutions majority-owned by Austrian banks. The fact that operating income improved in the Czech Republic from January to June 2001 compared with the first half of 2000 after having been in decline for two years may imply that banking has become a more profitable business in the Czech Republic. The banking sectors in Hungary and Slovenia appear to maintain their comparably stable situation. By contrast, risks for the Polish banking sector are likely to keep going up. The weak cyclical situation and the high level of real interest rates indicate that risk costs will continue to rise. In addition, the growing importance of foreign currency loans makes the real sector more vulnerable to exchange rate fluctuations. However, as Polish banks have achieved comparably good operating results (despite the difficult macroeconomic situation) and continue to apply strict cost control measures, the Polish banking sector's resistance to macroeconomic risk factors can be deemed to be relatively high.

Framework Conditions

Relatively Swift Recovery from the Uncertainty Triggered by the Events of September 11, 2001

All in all, Austria's credit institutions mastered the difficult year 2001 successfully, having weathered the episode of uncertainty in the aftermath of September 11, 2001, and the concomitant economic slowdown. Banks' exposures to the industries hardest hit, such as tourism (especially airlines) and insurance, did not pose any threat to stability.

The events of last September further hurt the performance of mutual funds, pension funds and insurances, which was already adversely affected by the stock market's weakness of recent years. The developments of the first few months of 2002 compensated for this falloff, however, as the assets managed by Austrian mutual funds expanded by 6% to EUR 92.6 billion.

The operating performance of the major Austrian banks largely improved in 2001, with subsidiaries in Central and Eastern European countries (CEECs) contributing significantly to boosted interest income. Deteriorating credit quality and increasing insolvencies, however, caused banks to step up their provisions for loan losses in 2001.

The consolidation drive in the Austrian banking sector did not let up. Bank Austria AG's integration into Bayerische Hypo- und Vereinsbank AG (HVB) is almost complete; Creditanstalt is scheduled to be fully integrated into Bank Austria AG by mid-2002. Banks in the multi-tier sectors are increasingly keen on strengthening their sectoral infrastructures. Within the savings bank sector, a loss sharing agreement with mutual guarantees – complementing the existing deposit insurance scheme – and centralized liquidity management took effect in January 2002. With a view to streamlining structures, Erste Bank der oesterreichischen Sparkassen AG (Erste Bank) – the lead bank of the sector – transferred branches in the provinces to the respective regional savings bank in exchange for a corresponding stake in the latter. In this context, Erste Bank gained a majority stake in Tiroler Sparkasse at the end of 2001. The Volksbank credit cooperatives transferred their Österreichische Volksbanken-AG (ÖVAG) shares to a newly set up Volksbanken Holding, which now holds a 55% stake in ÖVAG.

The introduction of euro banknotes and coins, an undertaking requiring meticulous planning and sophisticated cash logistics, went smoothly. Austria, in addition, frontloaded EUR 500 million to neighboring CEECs via existing commercial banking channels.

Comprehensive Reform of Financial Market Supervision

Several EU countries and European forums are currently contemplating measures to overhaul financial market supervision and to further improve cooperation between central banks and supervisory authorities. Austria launched a new Financial Market Authority (FMA) on April 1, 2002.[1]) The reform of Austria's financial market oversight was aimed at producing a high-quality, effective and, at the same time, cost-efficient supervisory framework. In addition, the new

1 *See also: Würz, M. (2001). Reform of Financial Market Supervision in Austria – The New Financial Market Supervision Act (Finanzmarktaufsichtsgesetz – FMAG), OeNB Financial Stability Report 2 of December.*

supervisory regime accounts for changes in the regulatory framework, such as the Basel Committee's Core Principles for Effective Banking Supervision and the New Basel Capital Accord, also known as Basel II, currently in the making. Moreover, with Austrian banks increasingly engaged in cross-border activities and with the complexity of financial services ever on the rise, it is imperative to step up supervision, extend examinations and cooperate more closely with international supervisory bodies.

Integrated Financial Market Supervision

- *Austria's new integrated supervisory regime took effect on April 1, 2002.*
- *The Financial Market Authority (FMA) is organized as an autonomous institution under public law with a separate legal personality which performs banking, insurance, pension fund and securities supervision ("single regulator").*
- *The FMA has the power to impose administrative penalties and to enforce its supervisory rulings.*
- *The costs of the new supervisory regime are borne largely by the institutions subject to supervision; the central government contributes EUR 3.5 million p.a. to the FMA budget.*
- *To foster cooperation and the exchange of views and to provide advice on supervisory matters, a Financial Market Committee was set up at the Federal Ministry of Finance, serving as a platform for the institutions (FMA, OeNB and Ministry of Finance) jointly responsible for financial stability.*
- *The new legislation safeguards the OeNB's solid operational involvement in banking supervision. It is mandatory for the FMA to commission the OeNB with on-site examinations of credit institutions' market and credit risk. In the case of other types of on-site examinations of banks (e.g. money laundering audits), requesting the OeNB's participation is optional. FMA staff is entitled to participate in on-site examinations performed by the OeNB. According to various provisions of the Austrian Banking Act (e.g. paragraph 26 et seq.), the OeNB is required to draw up expert opinions. The framework under which banks have to report data to the OeNB and the latter processes these data has been left in place. The exchange of information between the OeNB and the FMA has been ensured through a clause that explicitly requires them to provide mutual administrative assistance.*
- *The OeNB has been invested with payment systems oversight and, in fulfilling this mandate, is not bound by instructions.*

The overhaul of financial market supervision in Austria and the OeNB's far-reaching operational involvement in supervisory tasks ensure that the OeNB may effectively contribute to maintaining financial stability also in the Eurosystem.

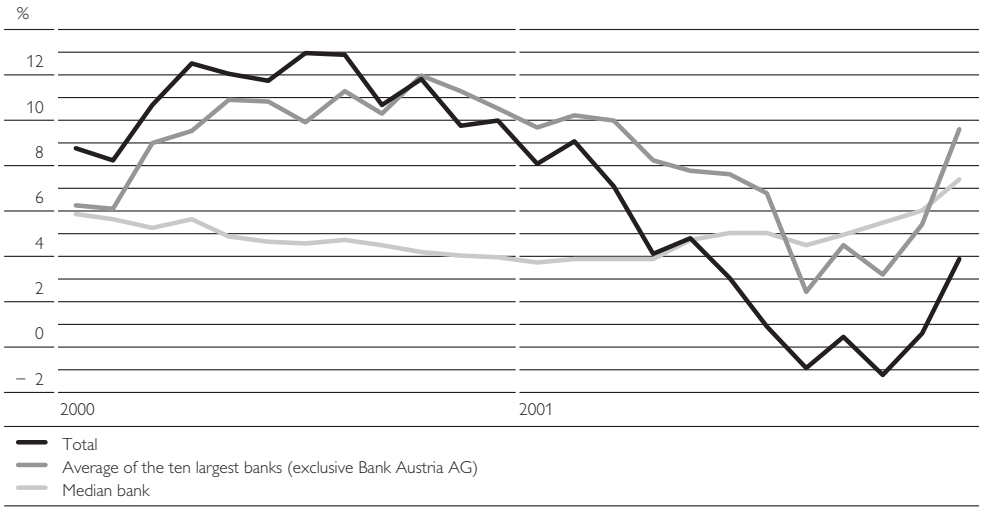
Banks

Total Asset Growth Increases in the Second Half of 2001

Since the second half of 2000 the annual growth of total assets of all Austrian credit institutions declined steadily. This trend was ascribable primarily to the restructuring measures accompanying the merger of Bank Austria AG and HVB.[1]) In the months that followed, a change in the development of Austrian credit institutions' total assets was observable, and in the last quarter of 2001 its growth rate increased to 3.9% p.a. The total assets recorded by all Austrian banks amounted to EUR 581 billion at end-December 2001 (unconsolidated, as reported in the monthly returns). When the consolidated balance sheets of the five largest Austrian banks are considered, which include foreign subsidiaries and participations, total assets, based on the 2001 annual accounts, stood at some EUR 650 billion.

Figure 14

Asset Growth in the Austrian Banking Sector



Source: OeNB.

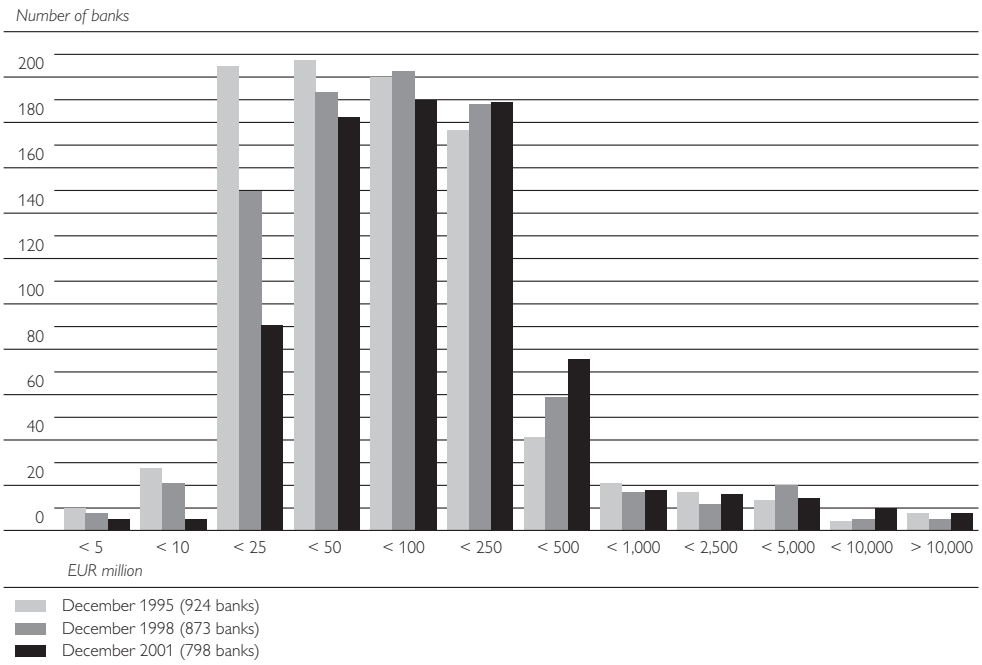
Figure 14 highlights two developments. On the one hand, as of mid-2000, the contraction of Austrian credit institutions' total assets (excluding special purpose banks) can not be attributed exclusively to Bank Austria AG's restructuring measures, since total asset growth posted by the ten largest Austrian banks – even when Bank Austria AG is factored out – fell from 12% in the last quarter of 2000 to just slightly over 2% by end-September 2001. The decline in total asset growth may therefore be partly ascribable to the economic slowdown. Total asset growth of an "average" Austrian credit institution, a so-called

1 *During the restructuring, part of the business volume of Bank Austria AG was transferred to HVB, which reduced Bank Austria AG's total assets substantially in 2001. Since Bank Austria AG, by far the largest bank in Austria, accounts for 25% of credit institutions' total assets, this decline had a marked impact on Austrian credit institutions' total assets.*

median bank,[1]) likewise reflected a, albeit modest, contraction from as early as the beginning of 2000 to the end of the first quarter of 2001. On the other hand, total asset growth of the ten largest banks excluding Bank Austria AG[2]) indicates a trend reversal already at the end of the third quarter of 2001. In the second half of 2001, total asset growth mounted from just over 2% to almost 10%. In the same vein, total asset growth calculated for the median bank climbed from close to 4% in the second quarter to 7.5% by the end of 2001. The median bank showed less pronounced total asset growth compared to the major banks, just as the preceding slowdown had been more subdued, too. Thus, the economic environment seems to impact the "average" Austrian bank to a lesser degree than the large banks.

Figure 15

Distribution of Austrian Banks by Total Assets



Source: OeNB.

1 *The term median bank refers to the credit institution for which it is true that 50% of all credit institutions show a given higher indicator (e.g. total asset growth, total assets, cost/income ratio); special purpose banks are not considered. Since the median bank differs depending on the indicator and varies over time, the median bank does not denote a specific credit institution. Rather, the median bank is a notional credit institution which represents a "typical" or "average" Austrian bank for a given indicator or ratio. Using the concept of a median bank instead of the average value ensures that the result is not distorted by outliers. For instance, the total assets calculated for the median bank are about EUR 80 million as at end-2001, while the average of the Austrian credit institutions' total assets stands at EUR 708 million. When we compare these values with the distribution of banks by total assets shown in figure 15, it is evident that the median bank provides a much more accurate picture of the total assets of a "typical" Austrian bank than the average, because the latter gives disproportionately more weight to the few major banks which record very large total assets.*

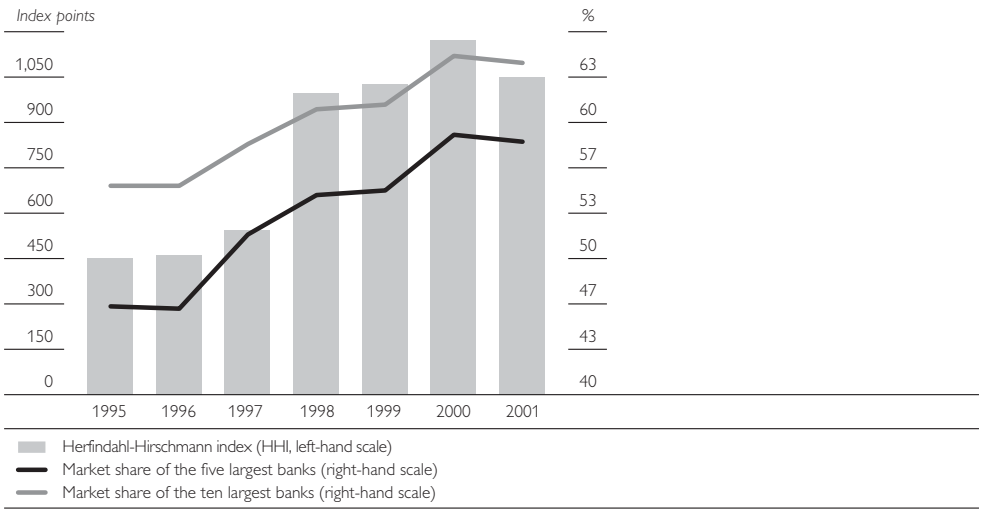
2 *This trend reversal is also observable for Bank Austria AG whose total asset growth started to increase again as of the fourth quarter of 2001. This would imply that the restructuring measures have been completed.*

The increase in total asset growth was mainly driven by stepped-up interbank business, which in the fourth quarter of 2001 expanded by 9.3% on the asset side and by 2.1% on the liabilities side year on year. At the same time, liabilities to nonbanks advanced by 6.1%, while claims on nonbanks edged up by a mere 2.9%. The differing asset-side and liabilities-side interbank growth rates are probably ascribable to the fact that nonbank deposits were plowed increasingly into foreign banks, especially to refinance Eastern European subsidiaries.

As at December 31, 2001, less than 10% of Austria's 798 credit institutions (excluding special purpose banks) registered total assets exceeding EUR 500 million, and only 4 large banks posted total assets of more than EUR 30 billion. Since the late 1990s the Austrian banking system has been subject to an accelerating concentration process given the mergers among smaller banks – especially Raiffeisen credit cooperatives. As a result, the number of credit institutions has decreased by some 13% since 1995. As is evident from figure 15, there has not been a gradual shift from one category to the next higher category of banks in recent years, which points to ongoing concentration. From 1995 to 2001, the number of banks whose total assets amounted to up to EUR 100 million decreased by nearly 30%, whereas the number of banks with total assets of between EUR 100 million and EUR 500 million rose by just slightly more than 20%. At the same time, the total assets of the median bank increased from EUR 52 million to EUR 80 million.

Figure 16

Change in the Concentration of Austrian Banks



Source: OeNB.

Concentration has also been underway among major banks, whose merger activities are of much greater systemic relevance. Figure 16 portrays the concentration path since 1995 via the Herfindahl-Hirschmann index (HHI)[1]) and by spelling out the shares of the five and ten largest banks, respectively, in banks' total assets (excluding special purpose banks). The pronounced rise of the HHI

1 *The HHI is calculated by summing the squared market shares in percent of total assets and (theoretically) yields values ranging from 0 (perfect competition) to 10,000 (monopoly).*

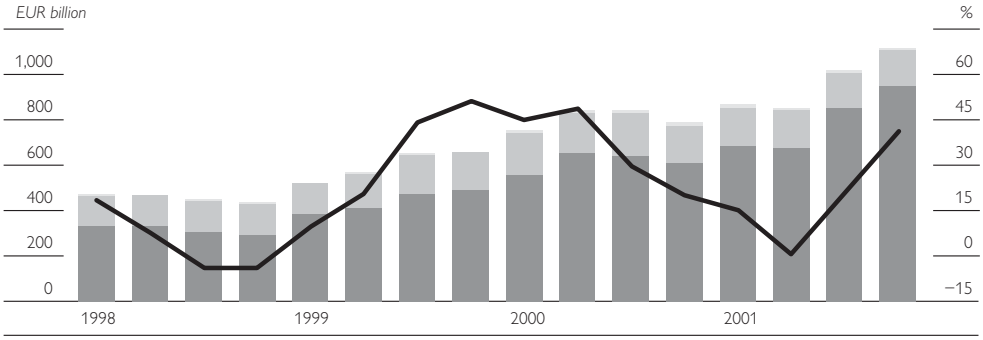
from 1995 to 2000 is attributable primarily to large-scale mergers (1998: Bank Austria AG/Creditanstalt AG; 2000: Bank für Arbeit und Wirtschaft AG (BAWAG)/Österreichische Postsparkasse AG (P.S.K.)). The 2001 drop in the HHI is traceable to Bank Austria AG's restructuring mentioned above.

Derivative Business on the Rise as the Volume of the Securities Portfolio Diminishes

After trading in derivatives (options, futures, swaps, etc.) had posted progressive annual growth rates in 1999, it slowed subsequently and almost came to a halt by the end of the second quarter of 2001. Figure 17 shows that this trend reversed in the second half of the year. By the end of the fourth quarter of 2001, the volume of derivatives traded amounted to more than EUR 1,100 billion (+41% year on year). Since December 2000, derivative transactions as a percentage of total assets jumped by 49 percentage points to 190%.

Figure 17

Derivatives



Source: OeNB.

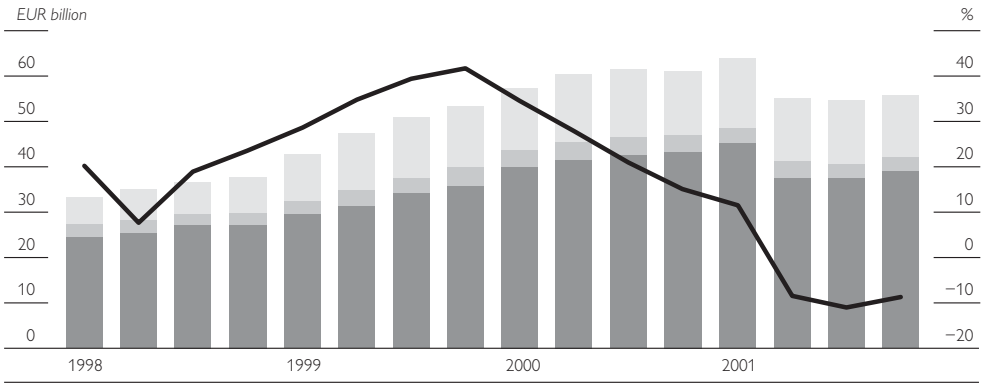
The increase derives almost exclusively from interest rate contracts, whose volume reached nearly EUR 950 billion in the fourth quarter of 2001. The bulk of interest rate contracts is made up of interest rate swaps, i.e. the exchange of fixed rate and floating rate interest payments, with floating rates linked to a money market rate, such as the EURIBOR.[1]) Since the establishment of monetary union, interest rate contracts have grown at a considerable pace, which seems to be largely due to the uniform yield curve that emerged on the swap market following the introduction of the euro.[2]) Banks use interest rate swaps, very much like government bonds, for instance to fine-tune cash flows in active/passive portfolio management and to control interest rate risk. According to figure 18, the share of debt securities in the entire securities portfolio

1 *The volume presented in figure 17 refers to the notional amount used to calculate the interest payments; the counterparties exchange only the difference of the fixed rate and floating rate interest payment. The notional amount as such is not exchanged, which is why the actual amounts transferred are much lower than the volume shown here. In addition, the trading volume is no indication of the risk inherent in the underlying transactions.*

2 *By contrast, the government bond market to this date has not been fully integrated given the differences in liquidity and credit risks as well as in the provisions on taxation.*

Figure 18

Securities Portfolio



Source: OeNB.

decreased perceptibly in the second quarter of 2001. In line with the global trend, Austrian credit institutions also seem to increasingly favor interest rate swaps over government bonds in performing active/passive management and in controlling interest rate risk.

Exchange rate and gold contracts account for the second largest share in the volume of derivatives traded. Their volume even edged up slightly in the first half of 2000, mainly owing to hedging transactions linked to foreign currency loans. Since the third quarter of 2000 their volume contracted by 18% from EUR 192 billion to EUR 152 billion. The diminished exchange rate risk (following the introduction of the euro) apparently did impact the trading volume of exchange rate derivatives, albeit with a time lag.

The volume of the securities portfolio of the Austrian credit institutions (see figure 18) expanded until the end of 1999, registering increasing annual growth rates. Growth subsequently slowed and turned negative in the third quarter of 2001. The volume of mutual funds rose steadily until early 2000, recording annual growth rates of up to 100%. From then onward growth rates continued to decline, and as of the second quarter of 2001, the volume of mutual funds even diminished year on year, closing the year 2001 at EUR 14 billion. The decrease in the volume of the entire securities portfolio is ascribable to the reduction in debt securities from EUR 45 billion to EUR 38 billion in the second quarter of 2001.[1])

Interest rate-sensitive instruments account for a significant share both in the derivatives traded (swaps) and in the securities portfolio (debt securities). In the light of the reporting requirements in place, it is not possible to provide a definitive assessment of interest rate risk, in particular regarding swaps. As of December 31, 2002, all Austrian credit institutions must provide quarterly reports on interest rate risk at the level of the individual institution, i.e. in an unconsolidated form. These reports are to outline the risk profile of a bank

1 *This marked decrease in the volume of debt securities is traceable to one single large bank and is likely to be connected to internal restructuring measures.*

in the area of interest rates, detailing a breakdown by the initial period of fixation, product category and currency. The statistics will shed light on an institution's interest rate risk and will support the supervisory review process with regard to assessing interest rate risk in the banking book as called for by Basel II. Among the banks which were subject to reporting as of end-2001, 13 institutions decided not to make use of the transitional period and to start compiling these statistics already as of December 31, 2001. The reported statistics have already been subjected to a rough analysis focusing in particular on financial stability, but given the small number of reporting institutions, a caveat applies to the preliminary findings, which do not point to a heightened risk potential for the system as a whole.

Continued Strong Presence of Austrian Banks in Central and Eastern European Countries

To date, the large Austrian commercial banks have established subsidiaries in 12 CEECs. In 2001, the focus of their activities was shifting increasingly to countries in the east of Europe, such as Bosnia and Herzegovina or Serbia, where Austrian credit institutions are at the vanguard of foreign banks entering the market. The Austrian commercial banks established in the CEECs posted total assets of around EUR 59 billion[1]) at the end of 2001, no less than roughly 10% of all Austrian banking assets. Having continually expanded their operations, they now form a network of 38 banks with 2,611 banking offices and with some 51,700 employees – approximately two thirds of the employment count of the domestic banking sector. The large Austrian banks Bank Austria AG, Erste Bank and Raiffeisen Zentralbank Österreich AG (RZB) even employ considerably more staff abroad than at home.

Table 6 lists key ratios for the subsidiaries of Austrian banks in Croatia, Slovakia, Slovenia, the Czech Republic and Hungary.[2]) Their combined assets jumped to EUR 40.2 billion in the course of 2001 from EUR 24.0 billion at the end of 2000.

Austrian banks have a particularly high profile in the Czech Republic, Slovakia, Hungary and Croatia. At the end of 2001, the Slovakia-based banks topped the list with a share of roughly 40% of the local market (Slovenská Sporiteľňa being the largest, and Tatra Banka the third largest Slovak bank). Next in line are the banks based in the Czech Republic with a market share of 25% (Česká Spořitelna being the second largest, and HVB Czech Republic a.s. the fourth largest bank of the country), followed by Croatia (18%) and Hungary (17%).

The CEEC-based banks plan to boost their market shares in the various countries by taking over further banks, developing key accounts in the retail market and expanding their branch networks. In this respect, they stand to benefit from continued strong catching-up demand for financial services, which should remain a key driver of growth in the years ahead. Another pillar of

1 *Inclusive of the 34% share of Bank Austria AG in BPH PBK, Poland, which is managed by the Bank Austria-Creditanstalt group.*

2 *Exclusive of Poland for data protection reasons; following the merger of the two Polish subsidiaries of Bank Austria AG and HVB, only one bank continues to be majority-owned by an Austrian bank.*

Table 6

Eastern European Commercial Banks

Majority-Owned by Austrian Banks[1])

Country	Total assets	Operating profit	Risk costs	Market share	ROE	Staff	Banking offices
	EUR million			*%*		*Number*	
Croatia							
December 2000	1.715	57	– 25	13	20	1.108	58
December 2001	3.885	90	– 8	18	38	2.108	81
Poland							
December 2000	7.664	155	– 71	7	15	9.839	414
December 2001[2])	×	×	×	×	×	×	×
Slovakia							
December 2000	2.789	79	– 13	16	28	2.365	98
December 2001	8.507	115	1	40	21	8.851	566
Slovenia							
December 2000	706	14	0	5	17	380	12
December 2001	944	13	– 5	5	3	413	15
Czech Republic							
December 2000	15.256	170	– 100	21	3	17.303	749
December 2001	21.159	272	– 87	25	11	15.486	756
Hungary							
December 2000	3.484	59	– 11	18	26	2.813	134
December 2001	5.742	98	– 16	15	17	3.455	160
Total (exclusive Poland)							
December 2000	23.951	379	– 148	×	×	23.969	1.051
December 2001	**40.237**	**588**	**– 114**	**x**	**x**	**30.313**	**1.578**

Source: OeNB.

[1]) Rounded national totals; data for December 2001 reflect the merger with subsidiaries of HVB.

[2]) Not available for this reporting date for data protection reasons.

growth is the substantial progress made in enhancing banking structures and preparing the ground for EU accession. The other side of the coin of the strong presence of Austria's large banks in the CEECs is, of course, an increasing dependency on the financial stability and soundness of the banking systems in these countries amid cyclical downturns. When the parent company of a group uses its capital to finance acquisitions and takeover activity is strong, the capital buffer declines continuously. Accordingly, the large Austrian banks have increased their capital (at RZB a EUR 363 million capital increase, mostly earmarked to fund the bank's eastward expansion, has already been approved) or are planning to do so (Erste Bank) in order to finance their activities in Eastern Europe.

The subsidiaries are a key source of group income: in 2001 they contributed substantially to the operating profit achieved by the Austrian banking groups. In the case of Bank Austria AG, for instance, the Central and Eastern European (CEE) subsidiaries generated 25% of the group's operating profit for 2001 while accounting for just around 8% of the assets of the group. The medium-term target of Bank Austria AG is for its subsidiaries to deliver 50% of the group's operating profit. The highest profit contribution (63%) was generated by the CEE subsidiaries of RZB, representing 24% of the group's total assets. Erste Bank owes its favorable assessment by rating agencies and the good performance of its stock at the Wiener Börse, among other things, to the success of its oper-

ations in Eastern Europe and the swift integration of both Česká Spořitelna and Slovenská Sporiteľňa into the group network. The return on equity (ROE) of the subsidiaries, reaching up to 46% at individual banks, also attests to their high profit potential. Risk costs likewise developed favorably in 2001, with the exception of Poland.

Bank Profitability Roughly Unchanged in 2001

The performance of the Austrian banking industry was stronger in 2001 than the initial quarterly statements and the events of September 11, 2001, first implied. By and large, profits were as high as in 2000, notably because of the favorable developments in the final quarter. The profitability assessment based on unconsolidated quarterly report data can be refined with (preliminary) group analyses.[1]) These results are, however, not fully comparable with the previous year's data because three large banks switched to IAS reporting in 2001. Moreover, the results reflect a number of one-off effects stemming from changes in the group structure of the large banks.

Judging from unconsolidated data, the operating profit of all Austrian banks taken together has remained fairly constant over the past five years (except for a low in 1999) when measured as a percentage of total assets. At the end of 2001, this ratio stood at 0.8% (unconsolidated; 0.84% on a consolidated basis[2])) for all banks, while the smaller banks achieved a better result at 0.92%.

Year on year, the (unconsolidated) operating profit of all banks rose by 1.3% to EUR 4.58 billion in 2001. This compares with a rise by 4.6% on a consolidated basis, reflecting a 14% increase in consolidated operating income and a 19% expansion of consolidated operating expenses. Here, the big banking groups provided the key impetus, improving their operating profit by up to 16%. By contrast, the operating profit of the smaller banks deteriorated by 4.7%, thus falling short of expectations, but nonetheless exceeding the year-earlier figure because risk costs were lower in 2001.

Both the unconsolidated and the consolidated analysis show net interest income to have risen in 2001, specifically by 5.2% on an unconsolidated basis. After having consistently deteriorated from 1.9% to 1.2% from 1993 to 1999 and subsequent stabilized in 2000, net interest income (in % of total assets) climbed to 1.24% in 2001 for the banking industry as a whole, or to as much as 1.66% when the large banks are factored out. The slight rebounding can probably be ascribed to an easing of refinancing conditions given lower money market rates and to an improvement in retail margins. The additional income generated by the subsidiaries abroad boosted the consolidated result.

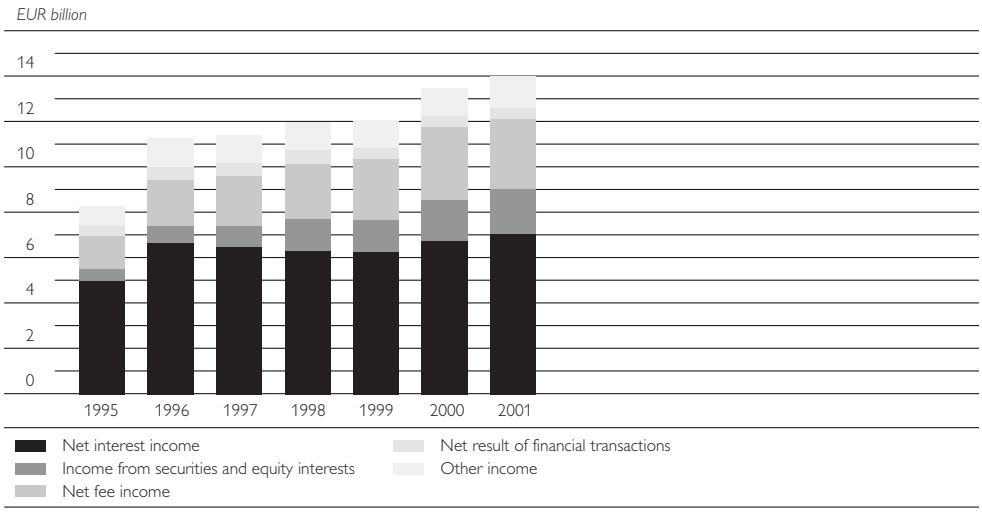
As is evident from the structure of operating profit since 1995 (see figure 19), net interest income has been accounting for an increasingly lower share of operating income. Its end-2001 share of 50.4% is in fact a slight improvement on the 2000 result, on account of the weak performance of

1 *The OeNB is scheduled to receive the final results for the fourth quarter and the full year following the audit of the banks' financial statements.*

2 *Consolidated data were calculated for Bank Austria AG, Erste Bank, BAWAG/P.S.K. group, RZB and ÖVAG from the preliminary consolidated group results of these banks for 2001. Therefore, consolidated data are supplied only for the banking sector as a whole and for the major banks.*

Figure 19

Breakdown of Operating Income



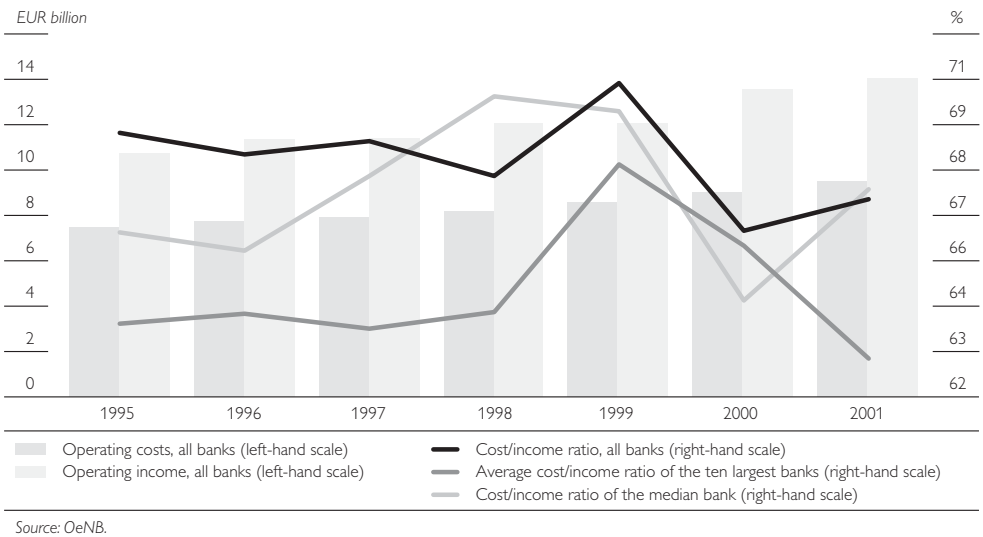
Quelle: OeNB.

noninterest, fee-generating business. Fee-based income (on a net basis) contracted by 4.4% in 2001, reflecting the sharp drop in fee income from securities transactions. Overall, interest income activities have, however, consistently lost in importance over the past years. Fee-based income and income from financial transactions tend to be more volatile as they are linked to capital market performance. When the stock market is weak, the – by international standards – comparative strong reliance of Austrian banks on interest income activities thus stabilizes earnings.

The gains in operating income (+3.9%) registered in 2001 were slightly lower than the increase in operating expenses, as both staff costs (+4.5%) and administrative expenses (+7.5%) rose substantially. As a result, the

Figure 20

Cost/Income Ratio



Source: OeNB.

cost/income ratio deteriorated by 0.8 percentage point year on year to 67.4% at the end of 2001. The cost/income ratio has not exhibited a uniform trend since 1995 (see figure 20). What is striking is that the ten largest banks tend to score a better ratio than the median bank and than all banks taken together.[1]) The cost/income ratio of the ten largest banks has improved consistently since 1999 and measured 63% at the end of 2001 whereas that of the median bank deteriorated in the past year.

As the distribution of banks by the cost/income ratio shows, most banks are in the range of 60% to 80%. However, the number of banks in the 50 to 60 percentage band was visibly lower year on year at the end of 2001, while the number of banks in the range of 70% to 80% was markedly higher. The number of banks whose expenses cancel out more than 80% of their income also rose in 2001.

The expected requirement for additional loan loss provisioning in 2001 exceeded the corresponding expectations in 2000 by 14%. Holdings of securities and equity interests generated income through appreciation, causing risk costs to shrink overall. As a percentage of the profit for the year or of total assets, the risk costs of the Austrian banking sector have in fact declined consistently over the past five years. Broken down by sectors, (unconsolidated) risk costs have been going down in all sectors but the savings bank sector. The consolidated assessment reveals an increase of risk costs in the group balance sheets but a decrease in the balance sheets of the smaller banks, which adds up to a slight reduction in the bottom line.

Loan Growth Decelerated Visibly,
Demand for Foreign Currency Loans Stabilized

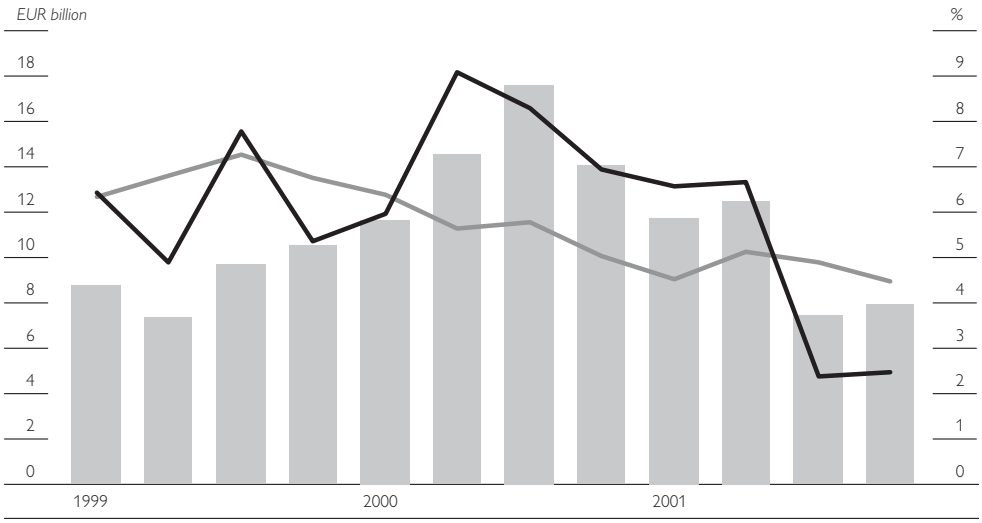
At a total end-2001 credit volume of EUR 233 billion, lending continues to be a major business area of Austrian banks. Demand for loans has, however, been decreasing markedly since the end of 2000 even though interest rates declined. As is evident from figure 21, annual loan growth decelerated further, from EUR 12 billion to an annual low of EUR 7.9 billion in the third quarter of 2001. The ten largest banks were clearly hit much harder than the median bank, whose loan growth rates contracted only slightly in recent years. In the second half of 2001, loan growth dropped from 5.1% to 4.5% at the median bank, but from 6.3% to 2.5% at the ten largest banks.

A breakdown by economic sectors reveals that loan growth declined above all as corporate sector demand softened amid the economic slowdown. While in the first two quarters of 2001 nonfinancial corporations accounted for roughly two thirds of loan growth, their share dropped to 43% by the fourth quarter, falling from EUR 8.5 billion to EUR 3.5 billion. Over the same period, growth of loans to households contracted merely from EUR 4.5 billion to EUR 3.6 billion; this translates into a growth contribution of loans to households of 44%, which is even somewhat better than that of loans to the corporate sector. The slight rebounding of loan growth in the fourth quarter of 2001 can be traced to domestic financial intermediaries (excluding banks), mostly insurance compa-

1 *The calculation of the cost/income ratio is based on the data of the quarterly report; it does therefore not reflect consolidated group returns for the major banks.*

Figure 21

Loan Growth



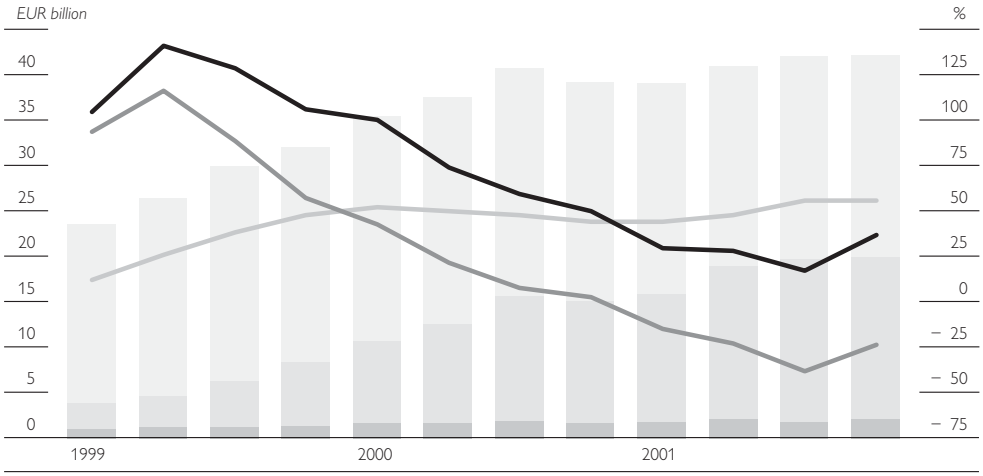
Source: OeNB.

nies, whose funding needs increased in the wake of the terrorist attacks of September 11, 2001.

Demand for foreign currency loans stabilized from mid-2000 compared with previous years. While the share of foreign currency loans in total loan growth (including loans to financial intermediaries other than banks and to

Figure 22

Foreign Currency Loans



Source: OeNB.

the public sector) was more than 100% in 1999 owing to a decline in euro-denominated loans, this share dropped to 17% by the third quarter of 2001 (see figure 22). Notably the annual growth of loans in Swiss francs and their share in overall loan growth decelerated from 1999 onward and turned negative at the beginning of 2001. Over the same period loans in Japanese yen soared, causing their contribution to overall loan growth to increase to 56% in the third quarter of 2001, from 44% in the corresponding quarter of 2000. In the fourth quarter demand for yen loans stabilized, while the decline of loan growth in Swiss francs dropped from –37% to –25%. In the bottom line, the share of foreign currency loans in total loan growth rebounded to 37%.

Reflecting increased demand for loans in Japanese yen, the share of the latter in total foreign currency loans outstanding at the end of the final quarter of 2001 increased from 34% to 41% year on year, which corresponds to an outstanding volume of EUR 17.8 billion. Over the same period the share of lending in Swiss francs contracted from 61% to 52%. Notwithstanding the recent negative growth rates, Swiss francs continue to account for the bulk of foreign currency loans outstanding, namely EUR 22 billion.

At a rate of nearly 18%, the share of foreign currency loans in total loans outstanding continues to be high in an international comparison. While demand for foreign currency loans appears to have stabilized in 2001, these loans must be monitored closely with a view to the stability of the Austrian banking sector. After all, the share of yen loans, which entail a higher exchange rate risk than loans in Swiss francs, in total loan growth has increased year on year. Even though the exchange rate and interest rate risk inherent in foreign currency loans must be met by the borrower, such loans have nonetheless indirect implications for the risk positions of banks. At any rate, banks take a stern line on adequate collateralization and pay heightened attention to monitoring loan accounts.

Credit Risk Rose Slightly, but Risk-Bearing Capacity is Satisfactory

For virtually all Austrian banks credit risk is the most critical source of risk they are faced with. The current credit risk can be assessed on the basis of the data banks report under the prevailing capital adequacy directive as defined by the Basel Accord of 1988. In calculating the regulatory capital requirement, loans must be weighted according to the credit standing of the borrower; hence the share of risk-weighted assets in total assets may serve as an indicator of credit quality.

This ratio was considerably smaller at 45% for the ten largest banks at the end of 2001, compared with 58% for the median bank. This implies that, on average, the large banks tend to grant fewer higher-risk loans than the "average" Austrian bank. To some extent this may be due to the fact that the large banks tend to grant comparatively more loans to the public sector, i.e. to prime borrowers, than the "average" Austrian bank.

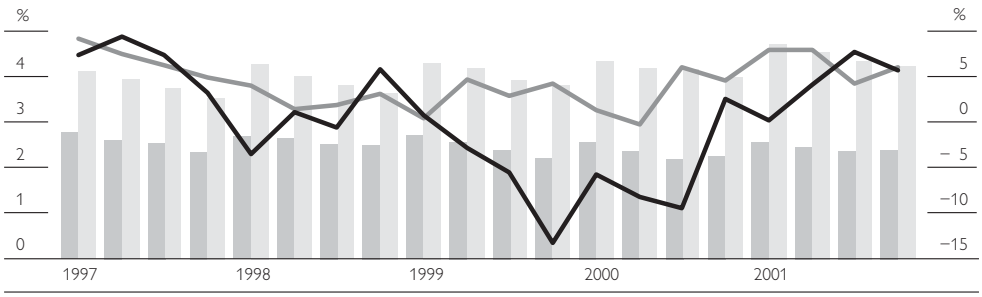
Another important indicator for assessing credit risk within the current Basel framework is the ratio of loan loss provisions to total claims, i.e. the level of risk provisions that banks report in their monthly returns in respect of loans that are likely to be irrecoverable. Regarding interbank loans, banks reported a very low level of loan loss provisions in the past two years, on average below

0.1% of interbank claims. As loans to nonbanks account for a considerably larger share of the credit risk of Austrian banks, the requirement for loan loss provisions is much higher in this segment. In the past few years total loan loss provisions in respect of claims on nonbanks were at a relatively low level (between 3% and 3.75%). The figure for the fourth quarter of 2001 was 3.16%, which is a slight increase (0.15%) year on year.

Figure 23 plots the loan loss provisions in respect of loans to nonbanks taken by the systemically important banks against such provisions taken by the "average" Austrian bank. In recent years, the loan loss provision rate of the ten largest banks was consistently 1 to 2 percentage points below that of the median bank. The ten largest banks closed the year 2001 with a loan loss provision rate of 2.4%, and the median bank at 4.2%. In both cases this corresponds to an increase by more than 5% on the previous year, though.

Figure 23

Loan Loss Provisions Relative to Claims on Nonbanks

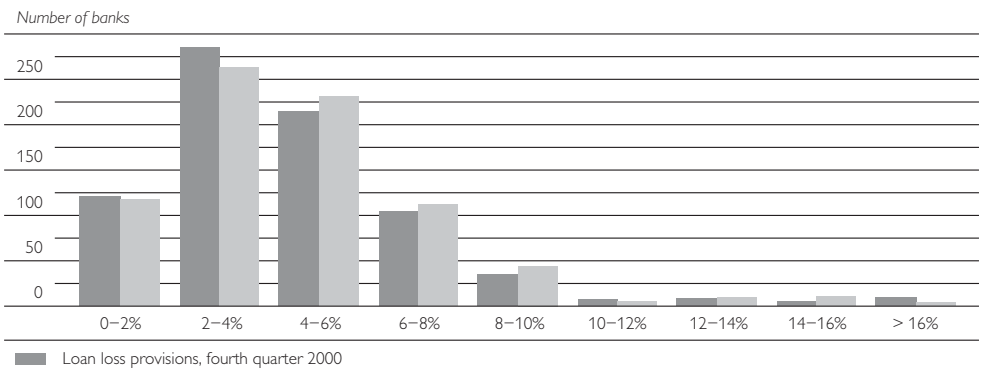


Source: OeNB.

Figure 24, which shows the distribution of Austrian banks in accordance with their loan loss provision rate, confirms the slight annual deterioration that loan portfolios have undergone. The distribution has generally shifted to the right; in other words, a larger number of banks were taking higher loan loss

Figure 24

Distribution of Loan Loss Provisions relative to Claim on Nonbanks



Source: OeNB.

provisions. In 2001, 25 banks (or about 4% of the banking industry) moved from the category of banks with a loan loss provision ratio of up to 4%, while roughly the same number shifted to the category of banks with a ratio between 4% and 10%. The number of banks that reported loan loss provisions above 10% in the final quarter of 2001 has remained constant at 29 (3.6% of credit institutions) year on year; in other words, the deterioration of credit quality is not that dramatic. The number of banks with loan loss provisions of 16% or more even shrank from 10 to 5 banks over the same period.

To round off the evaluation of the risk-bearing capacity of the Austrian banks, their capital ratio must be critically assessed along with credit quality and credit risk. The average year-end ratio of capital allocated against credit risk[1]) across the banking sector has hovered between 13% and 14% since 1998. This is safely above the minimum ratio required under the Banking Act (8%), which was not missed by a single bank in the final quarter of 2001.

Within the individual sectors, capital ratios have been developing along relatively constant lines since 1998: At the end of 2001, the savings banks reported the highest capital ratio at 15.7% apart from special purpose banks (25.2%), while the state mortgage banks (10.9%) and the building and loan associations (9.7%) fell clearly short of the 13.8% capital ratio of the banking sector as a whole. The joint stock banks (12.1%), the Raiffeisen credit cooperatives (12.8%) and the Volksbank credit cooperatives (12.9%) are roughly halfway between the extremes.

A comparison of the ten largest banks with the median bank (see figure 25) shows that the systemically important banks have considerably improved their ratios from the fourth quarter of 2000. At the end of 2001, the capital ratio of these banks averaged 13.1%, 1 percentage point above the median value. The capital ratio of the large banks has, however, been a lot more volatile than that of the median bank; while the latter has held steady between 12% and 12.5% since 1998, the former shrank markedly between 1999 and mid-2000, evidently reflecting, among other things, the increased capital needs for funding the expansion into the CEECs. In the first three quarters of 2000, the ratio was even below that of the median bank. From the fourth quarter of 2000 it rebounded visibly[2]) by up to 14% a year, thus trailing the corresponding annual figure (13.2%) by a mere 0.1 percentage point. The dispersion of the capital ratio was also satisfactory at the end of 2001: The 95% quantile[3]) of the capital ratio was 8.7% in the fourth quarter of 2001, and almost 80% of all banks had a capital ratio of above 10%.

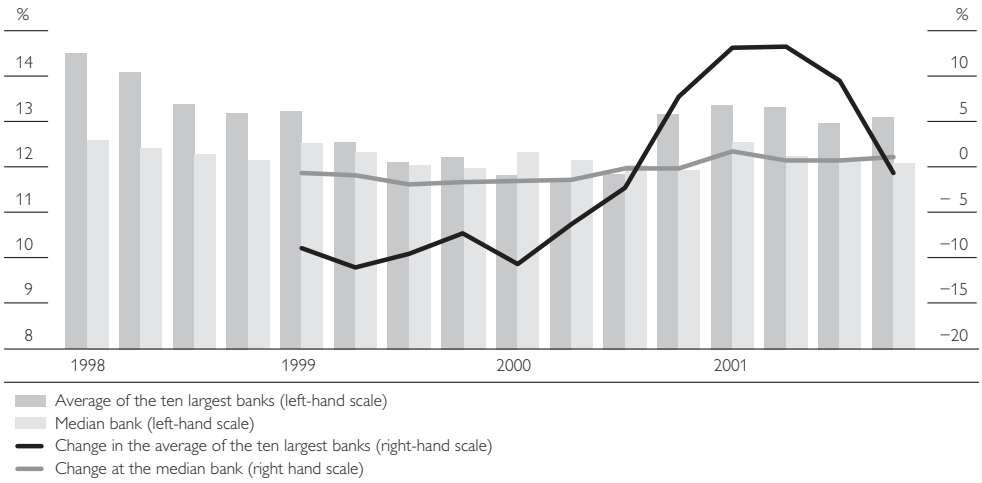
1 *In this context the capital ratio refers to the capital eligible as credit risk cover under the Austrian Banking Act, i.e. core capital (tier 1) plus supplementary capital (tier 2) minus deduction items as a percentage of the assessment base. The capital ratios published in the weekly financial statement of the OeNB and its Financial Stability Report 2/2001 also include tier 3 capital and are therefore higher. Since the latter is subordinated capital that may only be allocated against market risks, it was not included here so as to produce a conservative capital adequacy assessment.*

2 *The high annual growth rates until the third quarter of 2001 can be traced above all to the increase in the average capital ratio of the top ten banks from 11.9% to 13.2% from the third to the fourth quarter of 2000. This rise in turn results basically from the issuance of large volumes of subordinated capital by one of the large banks, which caused the amount of eligible capital – principally tier 2 capital – to increase by 80%.*

3 *The 95% quantile indicates the capital ratio that is exceeded by 95% of all banks.*

Figure 25

Credit Risk-Based Capital Adequacy Ratio



Source: OeNB.

Judging from the data available at the cut-off date for this report, the risk-bearing capacity of the Austrian banks is satisfactory. While higher provisions have been allocated against loans to nonbanks in an annual comparison, this may be mostly due to the economic slowdown. On average, loan loss provisions were some 5% higher at the end of 2001 than a year earlier, but the share of banks with a loan loss provision ratio of over 10% has remained constant year on year. Moreover, banks continue to maintain solid capital ratios, which are on average safely above the statutory minimum 8%.

From a stability perspective it is worth mentioning that the systemically important banks clearly outperform the "average" Austrian bank in terms of all credit quality or credit risk indicators available: Over the past years risk-weighted assets as a percentage of total assets, loan loss provisions as a percentage of claims on nonbanks as well as problem loans as a percentage of total claims[1]) were consistently lower in the average of the ten largest banks than the respective median values. The data available for the fourth quarter of 2001 attest to a continuation of this trend. At the same time, the large banks reported above-average capital ratios since the final quarter of 2000, implying a good risk-bearing capacity for the systemically important banks.

1 *For a detailed description of credit quality as evidenced in the prudential reports for the period 1996 to 2000, refer to issue 2 of the OeNB's Financial Stability Report (2001). The corresponding figures for 2001 were not yet available at the cut-off date for this report.*

Other Financial Intermediaries

Mutual Funds

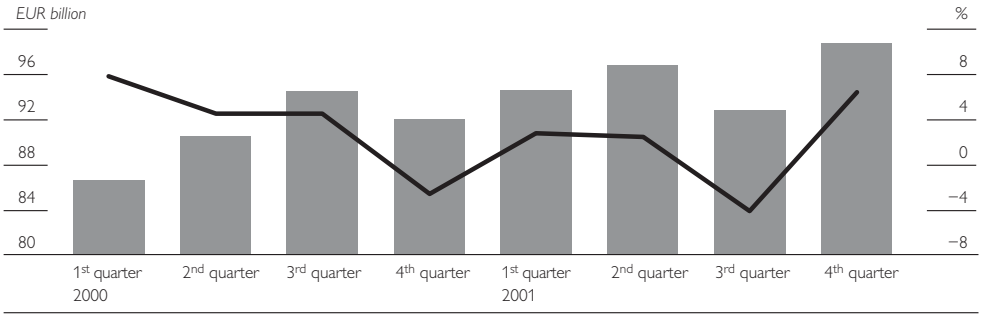
The portfolio[1]) return of Austrian mutual funds in 2001 reflects the situation on the stock market and the events in the U.S.A. Following constant growth in the first two quarters, a setback occurred after the terrorist attacks of September 11. These interim losses did not fully feed through to the bottom line, however. By the end of 2001, Austrian asset management firms had expanded their investment portfolio to EUR 86.8 billion, which corresponds to an annual return of 4.6% and is in fact twice as high as the European average (EU total excluding Austria: 2.3%). The amount of capital newly invested in mutual funds in 2001 grew by 7.6%, causing assets under management to rise to EUR 98.7 billion. While falling short of the impressive growth rates of previous years, this rate came close to the growth rate of savings deposits, which amounted to 7.8% in 2001.

Regarding the investment pattern of Austrian mutual funds, the bulk of assets – over 60% – continued to be invested in fixed-income securities. Investment in mutual fund shares mounted from 9% in 1999 to a share of some 18% by end-2001. The share of stocks and other equity continued to hover around 20%, unchanged from 2000. Thanks to the rather conservative portfolio mix with a fixed-income bias, Austrian mutual funds reported only small price losses at EUR 9 million in the wake of the global adverse stock market developments and the terrorist attacks in the U.S.A. Measured against assets under management at December 2000, this implies an overall performance of close to –0.01%. In 2001, only 74 or 17% of all 441 equity funds performed positively, while as many as 89% of all fixed-income funds gained in value compared with a year earlier.

As a result of their high fixed-income bias, the mutual funds operated by Austrian investment companies do not follow the European trend,[2]) which is increasingly dominated by equity funds. Across Europe, the share of equity

Figure 26

Changes in Assets Managed by Mutual Funds in Austria



Source: OeNB.

1 *Managed portfolio 2001 equals managed portfolio 2000, plus capital newly invested, minus dividends, plus/minus price gains/losses.*

2 *See Fédération Européenne des Fonds et Sociétés d'Investissement (FEFSI). The State of European Investment Funds Industry, 2001.*

funds rose from 25% in 1995 to 40% at the end of 2001. Apart from the favorable stock market developments in this period, the growing appeal of alternatives to traditional savings products may have been driving this trend.

Given the surge in mutual fund assets, investment companies have come to bear more strongly on systemic stability, and new challenges stand to arise from the reform of employee termination benefits. Stability depends, among other things, on balanced asset allocation, which will sustain the funds also in times of crisis. The institutionalization of investment in securities markets through professional asset managers is becoming more and more important not least for reasons of efficiency and stability. While professional money management has its merits, the growing concentration of funds that it entails evidently creates new risks that need to be controlled effectively for prudential reasons.

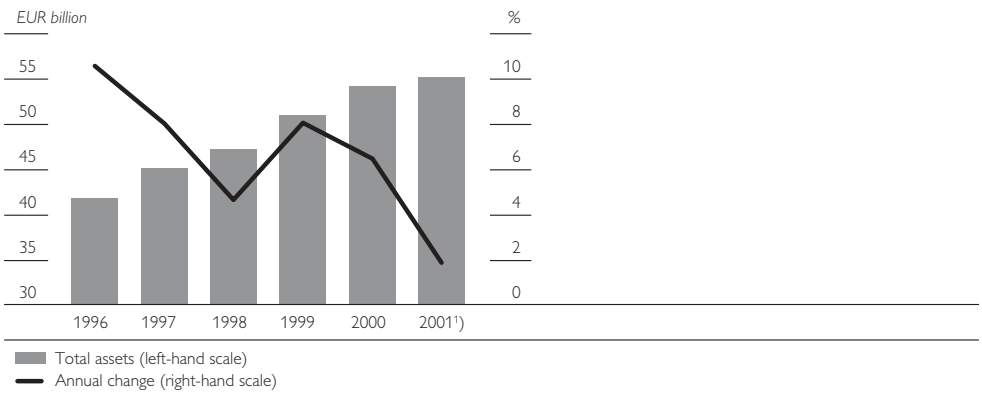
Insurance Companies

Judging from preliminary data, the performance of Austrian insurers was positive in 2001, despite the stock market downturn and the terrorist attacks in the U.S.A. In continuation of the trend established in previous years, the insurance premium volume increased further. Since 1990, insurance density[1]) has in fact grown at a faster rate than the population, reflecting above all the continued boom of private retirement provision. The data that the Association of Austrian Insurance Companies has made available so far indicate that the premium volume expanded by 6.6% in 2001. Most of the premium growth of 2001 is attributable to life insurance plans, and the remainder to health, damage and accident insurance plans.

The development of the investment portfolios of insurance companies was mixed. While the growth rate of holdings of domestic debt securities and lending to the public sector decreased within a range of 1.8% and 24%, that of domestic equity interests and foreign assets contracted slightly in the third quarter of 2001 in the aftermath of the September 11 events; these setbacks could, however, be offset until the end of the year.

Figure 27

Asset Growth at Insurance Companies



Source: OeNB.
¹) Preliminary data excluding reinsurance.

1 *Premiums per capita.*

The growth in total assets observed in previous years is likely to have continued in 2001, albeit at a markedly lower rate than before. This will also affect bonus payments, i.e. profit share payments which are granted beyond the guaranteed rate of return.[1]) Bonuses, which used to amount to between 6% and 7% of profit in recent years are likely to have dropped to between 5% and 5.5% in 2001. This implies that longer-term weaknesses in capital markets may affect the performance of insurance providers despite the stringent statutory investment regulations. While the private sector insurance market generates comparatively little added value (1.5% in real terms), it is a key player from a stability perspective given the huge sums that are handled by insurers. The negative repercussions of the September 11 events on the insurance industry are a case in point. The Association of Insurance Companies estimates the damage to the Austrian insurance industry to have totaled EUR 7.2 million at most. Thus the impact on Austrian insurance companies was rather moderate, thanks to the European focus of their international business. In this respect their activities in Central and Eastern Europe, which the leading insurance companies hope to expand further, are gaining in importance.

Pension Funds

In the light of the reform of pension systems and the growing significance of occupational pension provision, pension funds are playing an increasingly important role in the domestic financial markets. This is evidenced by the surge in assets managed by Austrian pension funds from EUR 1 billion in 1993 to some EUR 8 billion in 2001. The late 1990s stand out with annual growth rates of between 46% and 52%. Accordingly, the ranks of active and retired pension plan members swelled, jumping from 54,020 in 1993 to 318,000 by the end of 2001. The number of Austrian pension funds rose to 19 in 2001 and comprises 12 in-house pension funds and 7 multi-employer plans.

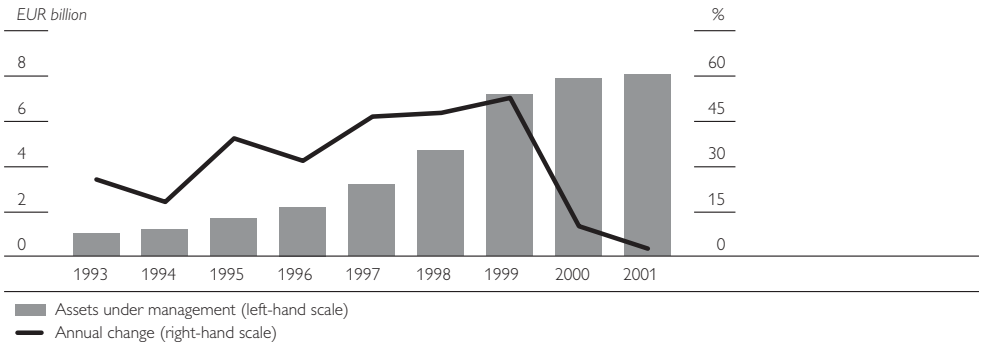
Overall, pension plan assets grew by just EUR 201 million in 2001 or a moderate 2.6% year on year, compared with about 10% in 2000. Affecting not only the performance of mutual funds and insurance companies, the adverse developments on stock markets took their toll on pension funds as well. The 7 multi-employer pension funds, for instance, reported a negative investment return of 1.5% on average. Since, unlike life insurance companies, pension funds do not offer a guaranteed rate of return, such conditions may lead to pension cuts under defined-contribution plans if the effective return on the capital is below the rate of return assumed in the actuarial valuation. To avoid this, legislators have foreseen the creation of a fluctuation reserve[2]) to compensate any shortfalls. However, should investment returns be weak over a succession of years, even the fluctuation reserve could be depleted, so that pensions would have to be cut after all. Pension funds are therefore called upon to adjust their investment strategies in line with capital market requirements.

1 *Insurance companies provide a guaranteed annual rate of return on accumulated premium payments. This rate is fixed at the time the contract is concluded and applies throughout the life of the contract. Currently the maximum guaranteed interest rate on premium payments is 3.25% p.a., according to a decision of the Austrian insurance regulator effective from July 1, 2000.*

2 *The fluctuation reserve consists of any returns on investment that exceed the budgeted returns and the actuarial gains.*

Figure 28

Change in Assets Managed by Pension Funds



Source: OeNB.

In the year under review, pension funds invested primarily in domestic assets. The lion's share, namely 89%, was invested in mutual fund shares, perpetuating the asset allocation pattern of recent years. Looking ahead, the transposition of the UCITS directive[1]) endorsed in December 2001 by the Ecofin Council will widen the range of investment possibilities for pension funds. Whilst maintaining the existing high level of investor protection, UCITS will be allowed to invest in money market instruments and units of UCITS authorized according to this directive. Moreover, UCITS have been permitted to invest in deposits with credit institutions that are repayable on demand or have the right to be withdrawn, and maturing in no more than 12 months, financial derivative instruments dealt in on a regulated market and OTC derivatives as well as index-tracking funds.[2])

1 *Directive 2001/108/EC of the European Parliament and of the Council of 21 January 2002 amending Council Directive 85/611/EEC on the coordination of laws, regulations and administrative provisions relating to undertakings for collective investment in transferable securities (UCITS), with regard to investments of UCITS.*

2 *Index-tracking funds are funds that mimic stock market or bond market indices.*

Households

Higher Market Volatility Changes the Structure of Financial Asset Accumulation

In 2001, economic growth weakened markedly in Austria in the wake of international economic developments. Against this background, household real income growth decelerated in 2001, and real final consumption expenditure declined. Although the cyclical slowdown is likely to bottom out in the first half of 2002, income forecasts remain subdued for 2002, which is in part attributable to the worsened employment conditions. Households have also reduced their saving rate accordingly.

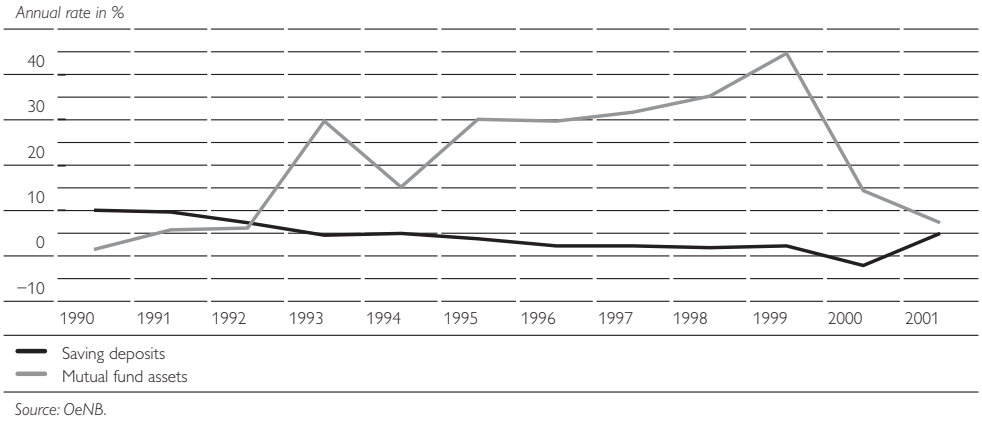
Given the growth setback, the accumulation of financial assets by households and their debt behavior was surrounded by greater uncertainty. Since the beginning of 2002, Austrian growth prospects have been improving and will cause the income expectations of households to brighten. Nonetheless, stagnating employment and higher unemployment are likely to continue to depress considerably household consumption and savings for the time being.

The share of marketable – notably foreign – financial instruments in household financial assets has been going up in the past few years, with investment in financial markets largely taking the form of mutual funds shares. At present, about 12% of private financial assets are managed by mutual funds. 58% of Austrian mutual fund assets are invested in foreign securities (EUR 57.3 billion at the end of 2001). Austrian investors have therefore also been hit by the price slumps on key international stock exchanges since 2000. Although Austrian mutual funds proved to be relatively resistant to the international price collapse, their performance was still substantially weaker than the year before. Compared to previous years, yields from insurance and pension fund investments also went down sharply, which might feed through to the financial position of households.

Faced with price losses and higher volatilities on stock markets, households showed renewed interest in savings deposits in 2001. The decline in the relative importance of deposits in the second half of the 1990s thus seems to have been reversed in 2001, at least for the time being. In 2001, the private sector[1]) raised

Figure 29

Growth of Savings Deposits and Mutual Fund Assets



Source: OeNB.

1 *In money and banking statistics, savings deposits of households and nonfinancial corporations are reported as one figure. It may be assumed that the majority of deposits is held by households.*

its savings deposits by EUR 5.6 billion or 4.7% after a decline of EUR 2.6 billion or 2.2% in 2000. Preliminary data on the stocks of financial assets confirm that households showed an increased preference for liquidity in 2001. In part, the euro cash changeover favored deposit growth, as substantial cash holdings were paid into sight and savings accounts in the wake of the currency conversion. Insecure market perspectives, however, also played an important role in driving up deposits.

Although the financial wealth of households has been influenced by market developments in recent years, the adverse price developments of 2001 are not likely to have had severe impacts on the overall economic financial position, as, on the whole, households have adequate financial assets – as reported in the previous two editions of the Financial Stability Report of the Oesterreichische Nationalbank (OeNB). A deterioration might have occurred with savings schemes that are used as repayment vehicles for foreign currency loans and more generally with funds that serve as collateral.

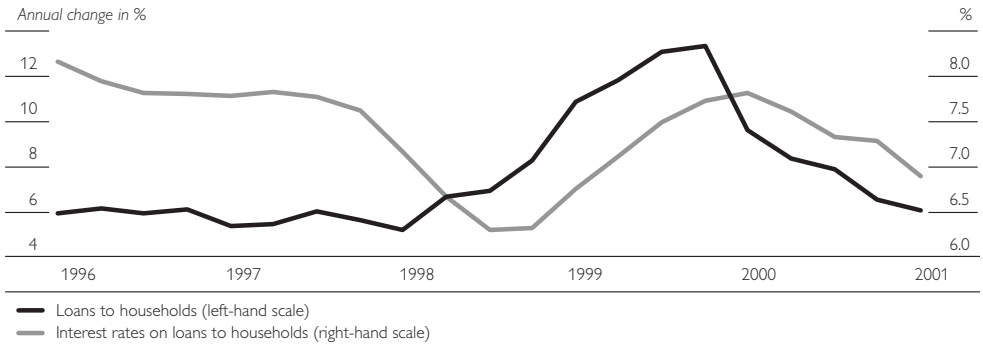
Household real property assets should not have suffered any fundamental negative wealth effects, either. No data are yet available for 2001, but the real estate price index, serving as an indicator of real wealth effects, has for years been following a positive trend characterized by slight volatilities. It may thus be presumed that no substantial real wealth losses did occur in 2001 that might have sustainably impaired the overall financial wealth of households.

Economic Slowdown Depresses Loan Demand

Subdued consumer confidence in the wake of the economic downtrend noticeably dampened the loan demand of households in the fourth quarter of 2001. Short- and medium-term consumer loans, in particular, posted reductions.[1]) By contrast, long-term bank financing of household consumption picked up 13.2%, although durable consumption declined in real terms in 2001. With interest rates being low, households obviously debt-financed a larger proportion of their long-term purchases. Alternatively, this may imply that debt maturities were extended or that short-term financing instruments, such as overdraft

Figure 30

Loans to Households – Growth and Interest Rates



Source: OeNB.

1 *Consumer loans with a maturity of up to one year diminished 2.3% in the last quarter of 2001 year on year, whereas loans with a maturity of one to five years dropped 3.6%.*

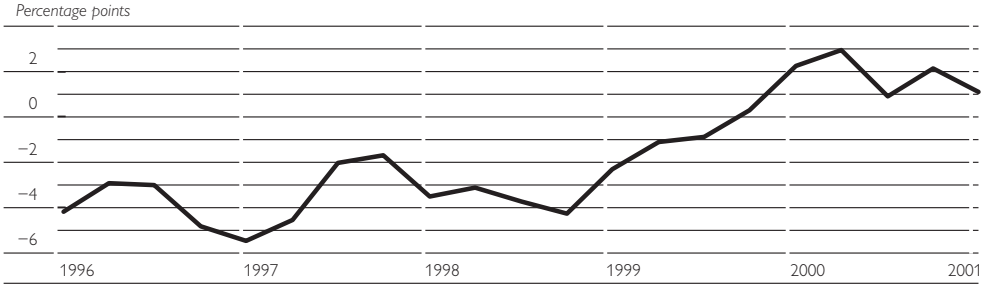
facilities on current accounts, were transformed into long-term loans. The development of private bankruptcies also supports this view. While private bankruptcies went down 1.4% in the first quarter of 2002 year on year, bankruptcy petitions that were dismissed as a "no asset case" jumped by one third.

Growth of housing loans, which constitute a major part of the financial liabilities of households, went down as well. Given the considerable weight of housing loans in household budgets, economic downtrends are able to quickly feed through to the liquidity of borrowers in this context.

Since the end of 2000 households have been significantly less inclined to take out major loans (in excess of EUR 350,000). Since then such loans have been growing more slowly than overall loans to households. The subdued income expectations are likely to contain demand for major loans. As in the case of long-term home financing, the currently low interest rate level might have risk-reducing effects.

Figure 31

Growth Difference Between Total Loans and Major Loans to Households



Source: OeNB.

The capability of households to service their debts is increasingly being influenced by exchange rate developments, too, as foreign currency debt keeps climbing. The growth of foreign currency borrowing should be closely observed; after all foreign currency personal loans have lately accounted for almost 25% of all loans extended to households. As households are less well placed to hedge against exchange rate risks than businesses, the former tend to incur higher risks when taking out foreign currency loans.

The financial market position of households remained virtually unaffected by the overall economic cooling in 2001. Although the reduced saving rate led to a slower accumulation of real and financial wealth, the stock of household financial assets continues to be high. The negative price developments might in part have affected the adequacy of assets as collateral. Stagnating income and bad employment prospects dampened loan demand and thus debt growth. But, at the same time, the servicing of existing debt became more difficult.

Nonfinancial Corporations

In the corporate sector, the international economic downturn in the past year largely translated into a drop in exports. The decline in export growth and the uncertain development of demand and earnings caused many corporations to delay investment projects. According to the WIFO investment survey, corporate propensity to invest has been deteriorating substantially since the middle of 2001. This is also reflected in loan demand, the growth of which has been decelerating significantly since the second half of 2001.

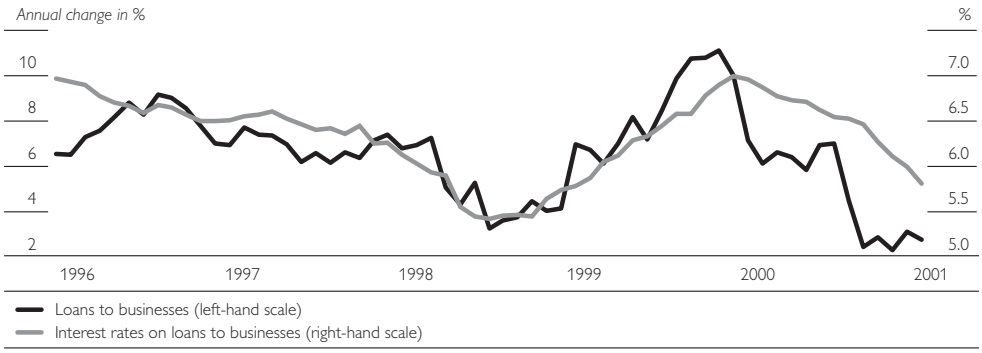
Higher investment demand is only to be expected after a revival of exports. Business surveys had revealed a marked clouding of the business climate in manufacturing in the fourth quarter of 2001, but in the first quarter of 2002 industrial corporations assessed the economic situation much more favorably, and the majority of respondents expect an output rise for 2002. In 2001, corporate loans only picked up 2.7% year on year, after a growth rate of 7.1% in 2000 (compare figure 32).

Businesses especially reduced loans with short- and medium-term maturities in 2001, whereas long-term loans maintained a high momentum at a growth of over 10%. As was observed with households, the extension of maturities might in part have been influenced by the unfavorable economic situation. Short-term liabilities might have been extended over longer periods to improve liquidity and avoid financial difficulties. Low interest rates and the flat yield curve until the first half of 2001 might also have contributed to the stronger demand for long-term loans.

The decline in short-term debt might also be attributable to a lower demand for operating credit as a consequence of reduced corporate turnover. Cash flow developments in key economic areas indicate higher liquidity requirements. In the wake of the economic downturn, the manufacturing cash flow ratio thus receded from 9.8% in 2000 to 9.6% in 2001.

Figure 32

Loans to Businesses – Growth and Interest Rates



Source: OeNB.

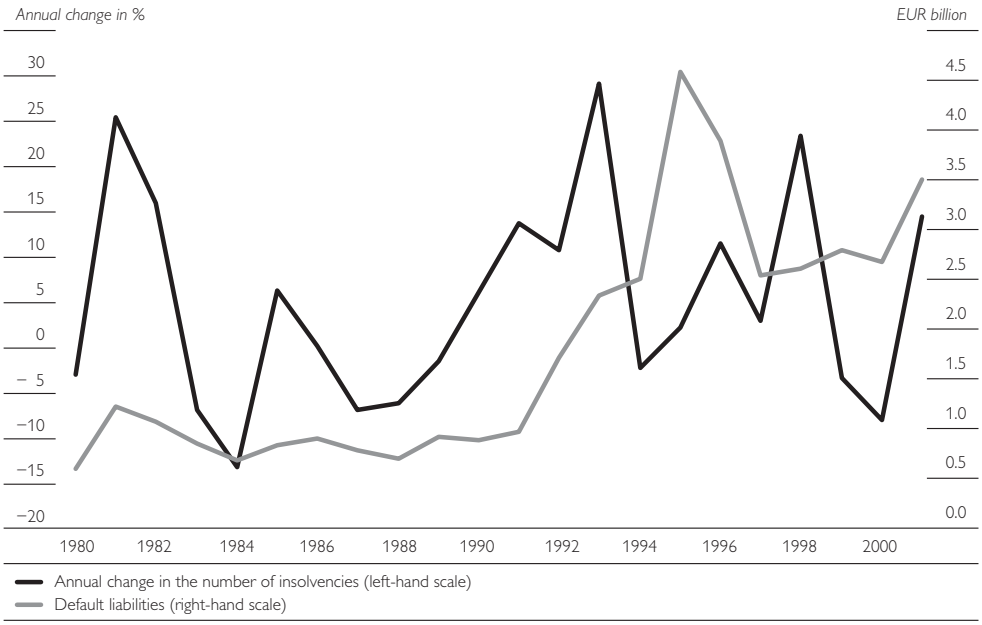
By contrast, interest rate developments eased the financing burden on corporations. Interest rates for corporate loans have been trending downward since the beginning of 2001 and have now reached end-1999 levels.

In parallel with the economic slowdown, corporate bankruptcies augmented in Austria. According to the Kreditschutzverband von 1870, total insolvencies picked up 14.5% in 2001. Bankruptcy growth continued in the first quarter of

2002 at 8.7% year on year. Default liabilities, however, fell behind 18% year on year, as no major businesses went bankrupt as at the beginning of last year – a development which might have pushed up default liabilities. From the perspective of the liabilities affected, the commercial failures in 2001 were less extensive and posed less threat to creditors of being dragged into bankruptcy as well.

Figure 33

Insolvencies and Default Liabilities



Source: Kreditschutzverband von 1870.

Smaller investment projects and the concurrent slower loan growth illustrate the pessimistic corporate sales expectations. Weaker loan demand and lower interest rates should help to keep a lid on corporate default probabilities. But, as the economy cools down, the likelihood of corporate insolvencies grows, which, in turn, leads to more prudent lending and worse credit ratings.

The Financial Accelerator in Austria

The financial accelerator theory states that weak balance sheets amplify adverse shocks to the economy by curtailing corporate investment. This implies two kinds of asymmetries: On the one hand, there are asymmetries over time, since balance sheets tend to be weaker during a downturn and financial constraints that are not binding during a boom may become binding during a downturn. The second asymmetry stems from the fact that companies that face significant agency costs of borrowing in credit markets, such as small, young or highly indebted firms, have weaker balance sheets. Thus, banks may ration credit to such financially constrained firms (either by cutting the loan supply or by increasing loan costs) more readily than credit to firms that are not financially constrained.

The importance financial factors have for investment and asymmetries in Austria has been analyzed by a number of papers[1]) drawing on balance sheet and income statement data that the OeNB collects in the course of its refinancing activities. The main results show that financial factors, along with the user cost of capital, are more important determinants of investment than the growth of sales. This finding implies that the worsening of economic conditions or changes in interest rates will be amplified by the so-called bank lending channel.

The studies also analyzed the asymmetry of the financial accelerator effect across groups of firms with different degrees of access to the financial market. Financial factors were found to be more important for small firms (because their capacity to collateralize their debt is limited) than for young firms, which tend to depend more on sales growth.

Moreover, the papers have confirmed the crucial importance of relationship banking, as banks can overcome informational asymmetries through a long-term relationship. Firms that have narrow and exclusive relationships with one bank are less prone to be financially constrained than firms that borrow from multiple sources. This is particularly true for small firms that have a house bank, but not necessarily for young firms; apparently an exclusive relationship must be validated over time.

The fact that investment by firms that have a house bank is less sensitive to balance sheet variables suggests that the prevalence of relationship banking in Austria offsets the effect of a reduction in the supply of loans following economic downturns or a tightening of monetary policy. However, as the data samples analyzed are biased toward solvent firms, these results must be interpreted with caution.

1 *See Valderrama, M. T. (2001). Credit channel and investment behavior in Austria: a micro-econometric approach. ECB Working Paper No. 108; Valderrama, M. T. (2001). Balance Sheet and Bank Lending Channels: Some Evidence from Austrian Firms. In: OeNB Focus on Austria 3+4; and Wesche, K. (2000). Is there a Credit Channel in Austria? The Impact of Monetary Policy on Firms' Investment Decisions, OENB Working Paper No. 41.*

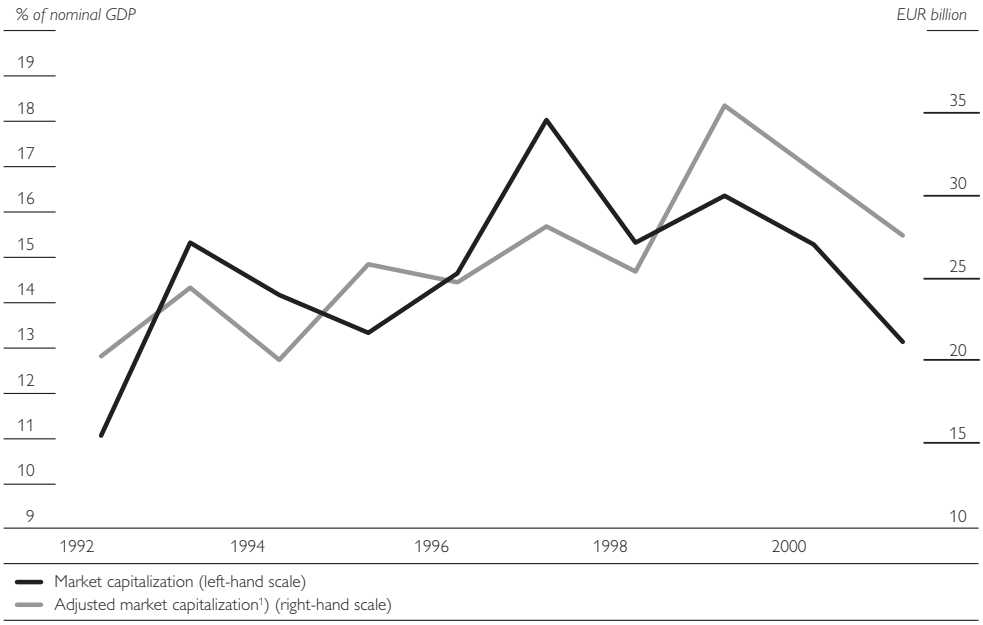
Stock Market

The Economic Significance of the Wiener Börse

In comparison to other European countries, raising money on the stock exchange plays a minor role in Austria. As illustrated by figure 34, the market capitalization of the Wiener Börse came to 13.1% in relation to GDP, thus being significantly lower than in almost all other European countries.[1]) The decline in market capitalization, observed in the past few years, continued in the first quarter of 2002. At the end of March 2002, the combined value of WBI-listed stocks (Wiener Börse index, contains all stocks listed in the official market) ran to EUR 27.7 billion, a year-on-year decline despite positive price developments. This is, in particular, ascribable to the fact that the listings of five businesses have so far been cancelled in 2002, while no new listings have been added. The price-adjusted market capitalization[2]) of the Wiener Börse has been trending downward since 1999.

Figure 34

Market Capitalization of the Wiener Börse



Source: Wiener Börse.
1) Market capitalization adjusted for annual price gains/losses.

Recently, the opinion has been gaining ground that the positive correlation between financial market structure (e.g. market- versus bank-based systems) and economic growth is less pronounced than that between the financial market structure and the industrial structure of an economy.[3]) For instance, the capital

1 *According to the World Federation of Exchanges, market capitalization in relation to GDP amounted to 72.1% in Germany and to 198.3% in the United Kingdom in 1999.*

2 *Price gains achieved after the issuance of shares may not be used for investments by the issuing corporations. Therefore, market capitalization adjusted for price gains/losses is a better indicator than nominal market capitalization.*

3 *The first paper to determine empirical evidence for such a correlation was: Carlin, W. and Mayer, C. (1999). How Do Financial Systems Affect Economic Performance? Mimeo, July 14.*

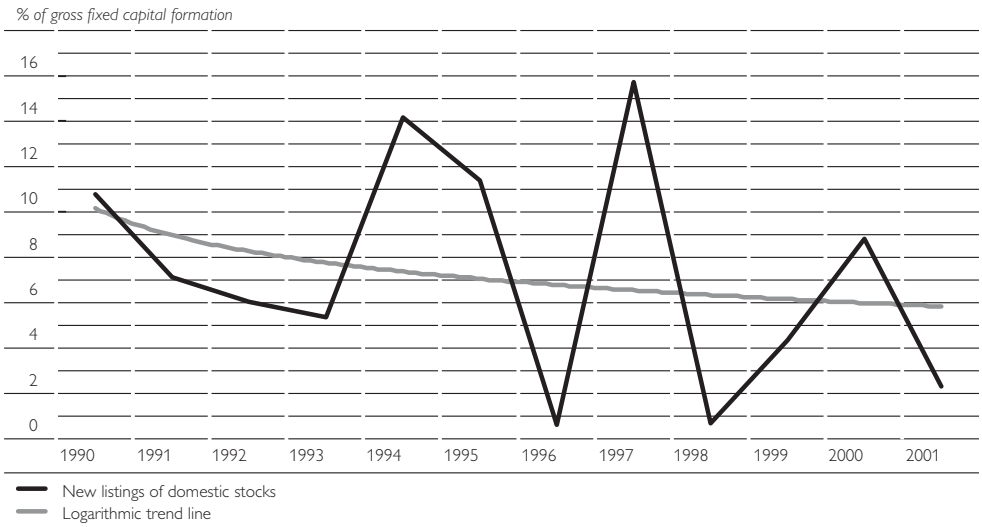
raised on the stock exchange is often plowed into long-term investment projects that will only yield positive returns after a start-up phase. New listings of shares are an indicator of the economic significance of a stock exchange, as these are also frequently used to finance innovations.

In order to measure the economic significance of exchange-financed innovations, we put them in relation to nominal gross investment in plant and equipment. As can be seen from figure 35, the volume of new issues floated at the Wiener Börse was subject to strong fluctuations in the past decade. Since 1990, however, we diagnose a slight downward trend. As a percentage of gross investment in plant and equipment, new issues in 2001 only came to 2.3%, thus lagging far behind the average of 7.3% in the period from 1990 to 2001.

Considering the downward trend of new listings at the Wiener Börse, the importance of the Austrian stock market for "innovative types of investments" seems to have gone down increasingly. This tendency, however, must be seen in the light of the growing impact of venture capital financing for businesses in the past few years. But Austria is nonetheless dominated by traditional industrial sectors with less pronounced research and development activities than are common in surging high-tech corporations, as for instance in the computer industry.

Figure 35

New Listings of Domestic Stocks at the Wiener Börse



Source: Wiener Börse.

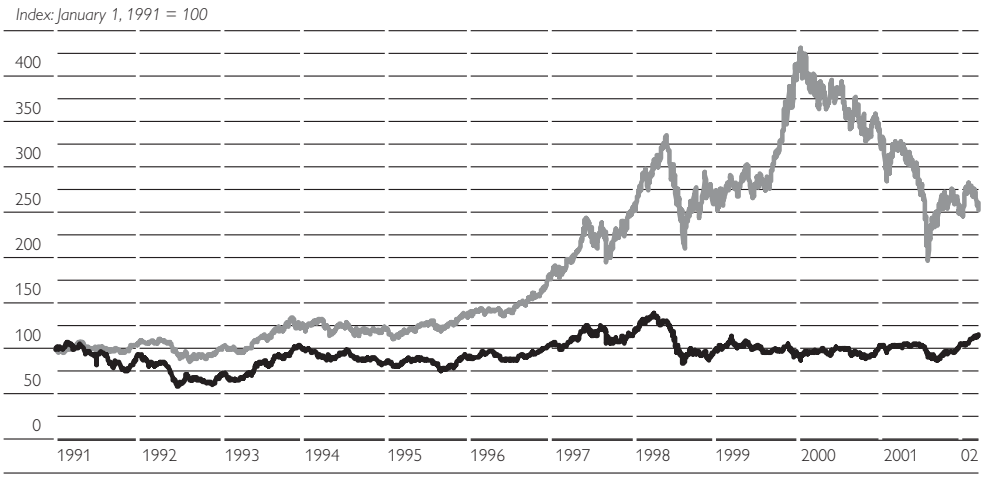
Positive Price Developments on the Vienna Stock Market

Since the beginning of 2002, the Vienna stock market has been trending upwards, with the Austrian Traded Index (ATX) up about 18% at the beginning of May 2002. Hence, ATX price developments did not evolve in sync with other European stock markets.[1]) The German stock index DAX and other European stock markets, by contrast, recorded price losses until the middle of February.

1 *Seen over a longer period of time, the Wiener Börse has been relatively independent of price developments in foreign stock markets as well. This is clearly reflected by the lower correlation of the ATX with stock indices abroad. Since the beginning of 2000, the correlation is even negative, i.e. price developments have evolved against the international trend.*

Figure 36

ATX and DAX



Source: Datastream.

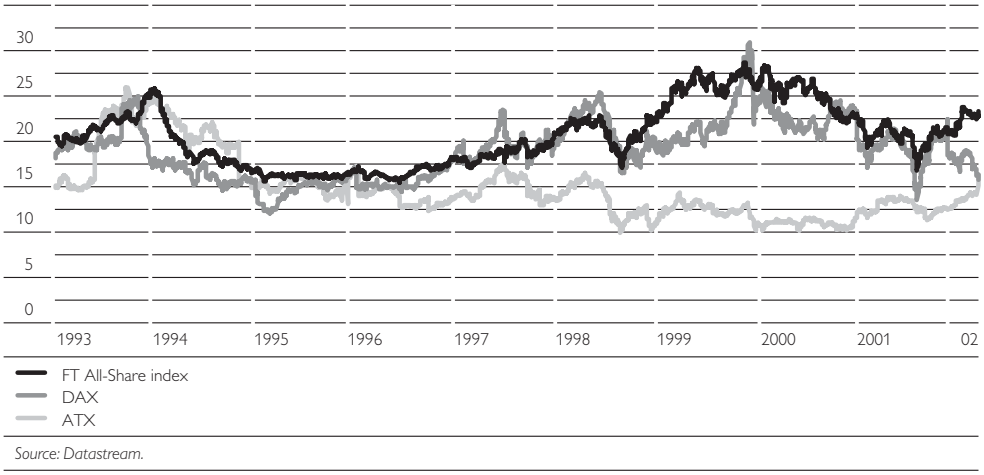
Austria has largely been spared the heightened stock market uncertainty caused by the bankruptcy of the U.S. energy corporate group Enron.[1]) Thus, Vienna only counted one eighth as many days with absolute price fluctuations exceeding 2% as Frankfurt between the beginning of 2002 and the first week in April.

The positive price performance of the Vienna stock market has largely also been carried by the sectoral setup of the ATX. In the first quarter "cyclical" stocks, such as VA Tech, Mayr-Melnhof or Vienna Airport, registered the

Figure 37

Price/Earnings Ratio

ATX, DAX and FT All-Share Index



Source: Datastream.

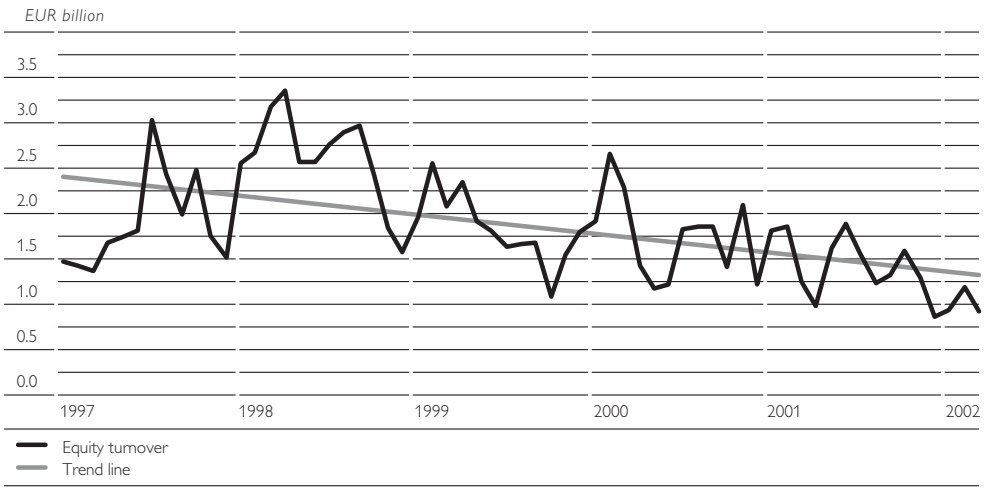
1 *The bankruptcy of the U.S. energy group Enron in December 2001, which, as a consequence, also dragged down the CPA firm Arthur Andersen LLP, triggered a European discussion on reporting and auditing systems. This was also mirrored in a higher implied DAX volatility.*

highest price gains[1]). In times of greater market uncertainty of investors, cyclical securities tend to be a lot less sensitive than growth stocks, such as telecommunication businesses, which – measured by the DJ Euro STOXX – had the largest impact on the decline of European stock indices.[2]) Also with regard to technology stocks, the Vienna stock market moved against the international trend. The securities that are combined in the growth index ViDX (Vienna Dynamic Index) picked up a little over 4% between January and the beginning of May 2002.

The positive ATX price performance has also caused the price/earnings ratio (P/E ratio) to rise since the beginning of 2002. At the beginning of May 2002, the ATX P/E ratio exceeded the mark of 16, thus leaving behind the 10 to 15 range that has been monitored since the fall of 1998. But in comparison to other European stock indices, there still remains room for further upward movement. In the first week of May 2002, the P/E ratio of the FT All-Share index, for instance, came to about 23. The current price performance could, therefore, not be interpreted as an "overestimation" of the Vienna stock market.

Figure 38

Equity Turnover at the Wiener Börse



Source: Wiener Börse.

Market liquidity on Wiener Börse, however, remains low. Equity turnover even retreated further in the first three months of 2002, only reaching 44% year on year and 63% of the average turnover of 2001.

1 *Farrell, J. L. (1983), Guide to Portfolio Management, McGraw-Hill, New York, differentiates stock-listed corporations, among others, into cyclical sectors and growth sectors. The stock development in cyclical sectors frequently shows a strong correlation to the business cycle. The performance of growth sectors, by contrast, is more dependent on the – not always fundamentally justified – expectations of financial players.*

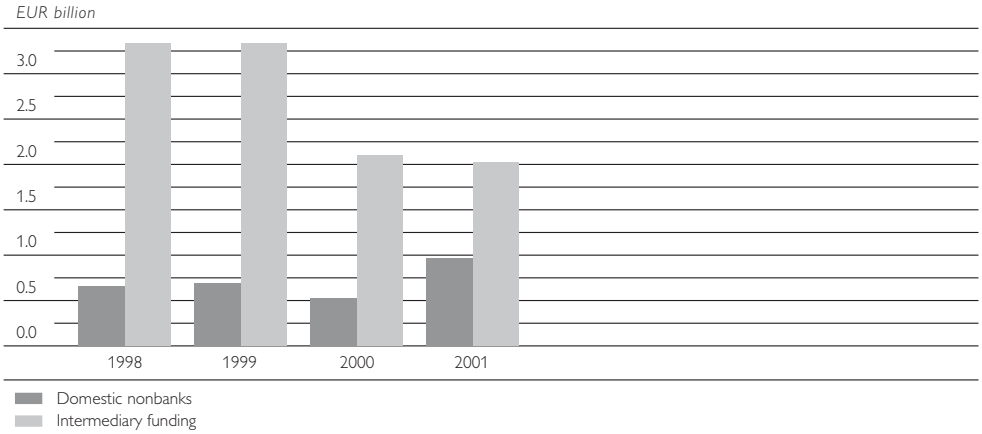
2 *From among the sectors of the DJ Euro STOXX, telecommunication stocks have registered the greatest price losses at 46% since the beginning of 2002. NEMAX, the Frankfurt index for growth and technology stocks, has been plummeting about 22% since the beginning of 2002. Receding sales figures for mobile phones and personal computers worsened the investment climate for technology stocks.*

Bond Market

The Austrian bond market continued to thrive in 2001. According to the OeNB issuance statistics, which do not contain foreign issues of Austrian issuers, gross issues came to about EUR 29.6 billion in 2001. With a (gross) issuing volume of about EUR 14.8 billion or 50% of overall issues, the central government was the top player on the domestic bond market, followed by banks with about EUR 13.8 billion or 47%. Corporations increasingly financed themselves by the issuance of bonds in 2001. At about EUR 960 million, other domestic nonbanks[1]) issued about 3% of overall gross issues, that is almost twice as much as in 2000.

Figure 39

Gross Issues by Domestic Nonbanks and Intermediary Funding by the Central Government



Source: OeNB, Federal Debt Committee.

It may be postulated that the tendency of Austrian businesses to directly tap the capital market will further intensify, not only on the domestic, but also on the European capital market, which is integrating rapidly. According to the financial accounts, more than 70% of Austrian corporate bonds were held abroad in 2000. We also have to take into consideration that the central government has been financing third parties since 1998 by issuing bonds and relending them under unchanged conditions to public-owned entities. At the end of 2001, such intermediary funding programs reached a new peak at EUR 9.6 billion. Against 2000, this means an absolute increase of about EUR 2 billion. Thus, the actual share of nonfinancial corporations in the overall volume outstanding of Austrian issuers is substantially higher.

1 Other domestic nonbanks include issues by the electricity sector, the industry and other domestic issuers.

Special Topics

Macroeconomic Stress Testing: Preliminary Evidence for Austria

Harvir Kalirai,
Martin Scheicher

1 Introduction

Financial stability is gaining importance among monetary and financial authorities as the process of globalization continues. In the last few decades, there has been a decrease in the impediments to trade and capital flows and an increase in information flows, financial innovation, deregulation and advances in technology, which has all contributed to the formation of closer links among global financial markets. While this has aided the efficiency and overall functioning of the global economy, there is a downside risk arising from this interdependence of markets. Namely, financial crises have a greater potential to spread beyond national borders and have a magnified impact on the global economy. With increased risks of contagion, central banks must be more vigilant to potential vulnerabilities that may threaten financial stability on a national and global level.

Episodes such as the near failure of Long-Term Capital Management (LTCM), the Asian crisis, the Scandinavian banking crisis and Argentina's recent debt default highlight the urgency for action on the part of policymakers to maintain and ensure financial stability. The Asian crisis showed how trade and financial linkages can propagate a financial disturbance internationally. A currency crisis which started in Thailand spread rapidly to other emerging Asian economies including Indonesia, Malaysia and South Korea. The crises in the Asian countries exposed the weakness of their banking systems and prompted the International Monetary Fund (IMF) to step in with various bailout packages to prevent a total economic collapse in these countries. The Scandinavian banking crisis in the first half of the 1990s coincided with the bursting of the property price bubble. Property prices had escalated to exuberant levels; as real estate was used as collateral to finance ever-increasing loans, the sharp fall in property prices led to significant losses for banks that had large exposures to the sector. The Scandinavian banking crisis is estimated to have cost 5% to 7% of GDP.

Central banks have a vital role in ensuring financial stability and minimizing fragility in the financial system. In a number of countries, central banks take part in supervisory activities. More generally, a key responsibility of monetary authorities is the lender-of-last-resort role. In this context, the question arises as to how vulnerabilities in the financial systems can be detected. Observing potential signs of heightened risks present in the financial system is important for central banks as they rely on such insights to be able to take both preventive measures and adequate action in crisis management. A key method supporting policymakers in the task of conserving financial stability is macro stress testing, because it performs quantitative analyses of financial fragility.

The purpose of this paper is to perform macro stress tests for the Austrian banking system. Our focus is on the impact of credit risk. This risk category has recently been the topic of considerable analysis for a number of reasons. First, credit risk is still the preeminent risk category for banks in the euro area. Second, the changing regulatory framework and the development of new products have generally strengthened the focus on modeling default risky assets. In particular, the ongoing Basel II process and the rapid development of credit derivatives have motivated researchers to undertake quantitative work on credit risk. By means of a scenario analysis, we estimate the impact of an increase in risk

provisions on the risk-bearing capacity of Austrian banks. Our scenarios are based on changes in key macroeconomic variables. We compare the outcome of a number of scenarios to total capital available to Austrian banks. Here, we observe that a number of variables, including industrial production and real or nominal short-term rates, have a statistically significant impact on changes in loan loss provisions. As regards the economic impact of our scenarios, generally, the evidence is limited due to the fact that we test the impact of changes in single variables as opposed to changes in a scenario that covers a group of variables. In order to conduct multi-factor analysis, a comprehensive macroeconomic model would be needed, which is beyond the scope of this paper.

The rest of this paper is organized as follows: In section 2, we present a brief overview of stress testing, section 3 gives some details about credit risk in the Austrian financial system. Section 4 describes the methodology and the empirical results. Section 5 summarizes and concludes.

2 Methodology of Stress Tests

The basis for stress testing comes from the methods that banks use to manage the market risk of their trading books. Here, the primary tool is the daily analysis of the value at risk (VaR). Stress testing is a key tool that complements VaR analysis. The difference is that stress testing measures the risk arising from abnormal market events whereas VaR analysis focuses on the risk arising from low probability events in normal markets. VaR analysis assigns a single quantitative value to the maximum potential loss that can result for a portfolio within a specific confidence interval and over a specific holding period. For example, a financial institution may have a 90-day VaR of USD 100 million on its equity portfolio within a confidence band of 95%. That is, there is a 95% probability that the maximum possible loss on the portfolio over the next 90 days will be USD 100 million (this is the value that is at risk). The remaining 5%, which are captured in the tails of the loss distribution function, are not taken in account in the VaR analysis. These 5% represent the probability of incurring losses greater than USD 100 million. Such potential extreme losses can be estimated via stress tests.

Some assumptions of VaR analysis are not easily supportable, which lends further backing to stress testing (see Oesterreichische Nationalbank, 1999; or Krenn, 2001, for more details). First, VaR analysis assumes that markets remain constant over a given time horizon when in reality breaks in markets do occur. Such periods of market breaks are often characterized by an increase in financial fragility, and stress tests can be used to assess the potential losses arising from such breaks. Second, VaR analysis usually assumes that changes in the financial time series (the risk factors) are normally distributed when they are in fact characterized by fat tail distributions. This assumption can lead to a fatal flaw since the likelihood of extreme events is understated when using a normally-distributed loss function as opposed to a fat-tail distribution. (CGFS, 2001; 2001)

Stress tests measure risks in abnormal market conditions but they do not assign any probabilities to the likelihood of such losses occurring. As discussed, they are used to quantify the risks associated with the tails of the distribution of losses ignored by VaR analysis. History has repeatedly shown that abnormal

market events do occur and often have a substantial impact on financial markets. As such, there is a large cost associated with ignoring such abnormal events during risk assessment exercises.

Examples of abnormal events include the oil shock of the 1970s, the October 1987 stock market crash, the Exchange Rate Mechanism (ERM) crisis in 1992, the "tequila crisis" in 1994 when the Mexican peso collapsed, the 1997 Asian crisis and the 1998 Russian crisis. It is often not difficult to explain why and how these events arose, after the fact. However, regulators need to be aware of possible risks to the financial system prior to the occurrence of such abnormal events. There is increasing demand by authoritative bodies on financial institutions to put in place mechanisms or tools that can aid in the full assessment of risks present in the financial system. The focus is thus shifting towards including stress tests along with VaR analysis.

Central bankers, unlike corporate risk managers, are interested in conducting aggregate stress tests in order to evaluate the vulnerability of the financial system to potential risks. Their focus is not on a single financial institution or portfolio but rather on the entire financial system and its stability. Analysis of financial stability extends stress tests from the level of a single bank to modeling the entire banking system. These aggregate stress tests are used to measure the risk-bearing capacity of the financial sector for a specific stress scenario. Aggregate stress tests differ from portfolio stress tests because they have different objectives. Portfolio stress tests are used by risk managers or traders to determine whether the amount of risk inherent in a portfolio is justified by the expected returns. Hence, the main goal in portfolio stress testing is to determine how much risk is acceptable for a given level of expected return. Conversely, aggregate stress testing is used to measure structural vulnerabilities and the risk situation in the entire financial system. Such vulnerabilities are important to regulators as they may lead to massive turmoil in financial markets. Thus, aggregate stress tests must be able to assess the impact of potentially adverse events on the entire financial system and provide policymakers with the option to take counteractive measures before a full-blown crisis develops.

A leading role in the development of aggregate stress tests has been performed by the IMF, in cooperation with the World Bank. These institutions started the Financial Stability Assessment Program (FSAP) in May 1999. The aim of this program is to "increase the effectiveness of efforts to promote the soundness of financial systems in member countries." In the FSAP's pilot project, which covered 12 countries, tests were conducted on various types of risks, including interest rate risk, credit risk, exchange rate risk and equity market risk (Blaschke et al., 2001). By identifying weaknesses in a country's financial sector and suggesting remedial policies, the FSAP should, over time, contribute to reducing the incidence of crises.

There are two main approaches to conducting stress tests on an aggregate level, each with its own limitations and difficulties. One approach is to use the individual stress tests conducted by financial institutions' risk management teams and simply add up the results to obtain an aggregate stress test result. The second approach is for a regulatory or supervisory body to first aggregate portfolio and balance sheet data from individual financial institutions and then to conduct stress tests on this aggregated data.

The first approach requires consistent stress testing methodologies to be applied by all financial institutions. It may, however, not be cost-effective for firms to make operational changes to ensure similar risk management modeling techniques. Furthermore, with this approach, the same stress test scenario must be applied across all institutions. Developing a common risk scenario can be problematic as different institutions have different portfolio compositions with different exposures to risk. One bank, for example, may have higher exposure to Latin America since it engages in lending in these foreign currencies. Another bank may have a strong focus on domestic issues or on the housing market via relatively large mortgage loans. Non-customized stress tests may not provide the relevant information needed at the portfolio manager and trader level, although it may be more useful to a regulatory authority. In its survey of stress testing practices in financial institutions, the Bank for International Settlements (BIS; see CGFS, 2001) reported the presence of such asymmetry in risks. Risk managers surveyed stated that they are focusing on stress testing in some situations where there is the possibility of mismeasuring risk when using VaR analysis. These situations can arise when there is the lack of good historical data, in cases of market illiquidity or with estimating non-linear exposures related to options trading. The advantage of this aggregation approach is that the central coordinator will use the results of stress tests that have already been run, thus easing the burden on the central coordinator. The BIS survey refers to this approach as "low burden, low accuracy."

The second approach to conducting aggregate stress tests requires the coordinator or regulatory body to obtain the relevant raw data from the individual financial institutions. These institutions must follow the same reporting and accounting guidelines in order for the data to allow comparison and aggregation. The stress test scenario to be applied to the aggregated data will be relevant from the broader perspective of studying fragility in the overall financial system, as opposed to testing the robustness of a single institution. Our paper is exclusively concerned with this second approach.

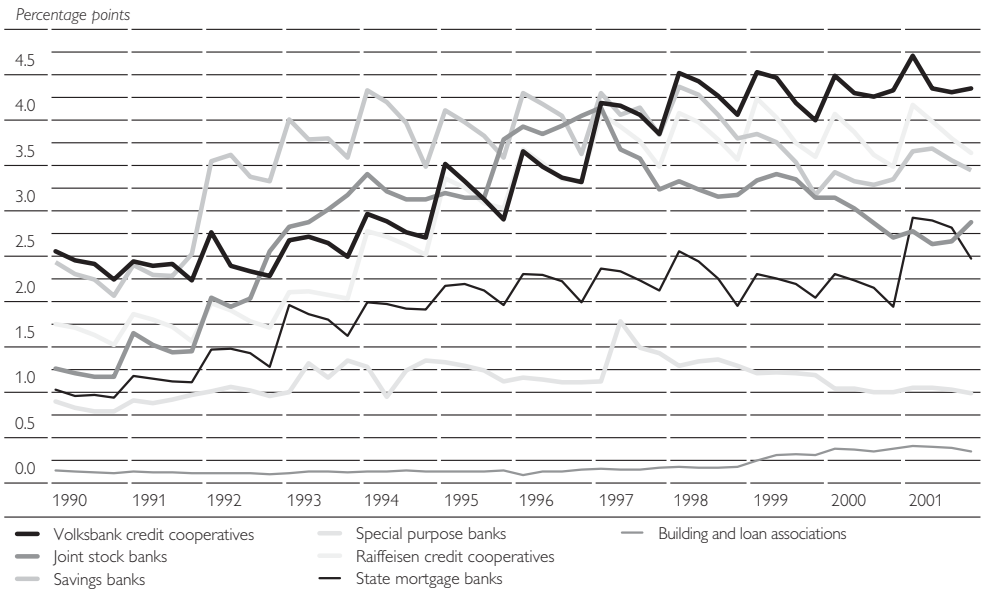
3 Credit Risk in the Austrian Financial System

Despite a number of structural changes, the most important part of Austrian credit institutions' operations is still the lending business. A significant source of risk is therefore the development of credit exposure, i.e. the risk that a borrower or a contracting party may default on its obligations. The continuing importance of the default risk is evidenced by a comparison of capital requirements. For covering the market risk arising from the trading book, i.e. the equity, interest rate and foreign exchange risks, the monthly banking statistics data show a sum of EUR 1 billion. In contrast, the solvency requirement amounts to EUR 22 billion. Hence, a deterioration of the loan books can be considered as a primary source of potential fragility in the Austrian financial system.

The calculation of credit exposure, which provides the basis for the statements made in this study, is currently based on the 1988 Basel Accord, as the new Basel II standards have yet to be finalized and implemented (see BCBS, 2001). These profound changes in capital adequacy regulations will lead to credit exposure being calculated on an entirely new basis. The aim is to reduce

Figure 1

Loan Loss Provisions



Source: OeNB.

the difference between economic and regulatory capital and to recognize risks more effectively. The current debate focuses on issues of implementation including, in particular, the potential impact of procyclical movements in regulatory capital requirements (see ECB, 2001).

An analysis of lending by economic sectors shows that 56% of loans were granted to businesses. More than one quarter of banks' claims are on households. The share of loans made to the government has been declining for quite some time and now stands at 12%. Less than 10% of banks' claims are on domestic nonbank financial intermediaries, mostly insurance companies.

A key indicator in measuring credit quality is the level of loan loss provisions (see figure 1). Loan loss provisions (LLP) are documented by banks in their monthly reports to the supervisors. Loss provisions are set up in respect of loans where the bank doubts the borrower's ability to meet his financial obligations. The level of LLP relative to claims on nonbanks has been low for some years and, in December 2001, remained flat at 3.1% (0.2 percentage point higher than in December 2000). At that date, the Volksbanken sector (4.4%), the Raiffeisen sector (3.6%), and the savings banks sector (3.5%) were above the average, while the building and loan associations sector reported below-average loss provisions (0.4%). Overall, the data on loan loss provisions show that the quality of the domestic credit institutions' loan portfolios is good. At the time the study was compiled, the data in hand did not point to any major rise in bad loan charge-offs. For the empirical study in the next section, we take the LLP as a share of total loans as the dependent variable.

A more detailed analysis of the quality of the Austrian banks' loan portfolios can be carried out on the basis of the prudential report, which includes observations on the overall situation of credit institutions by the bank auditors

required under the Austrian Banking Act (BWG).[1]) On the whole, domestic banks' nonaccrual and nonearning assets (measured as a percentage of loans) remained at a low level during the past years. At year-end 2000, the global mean value of nonaccrual and nonearning assets was 1.15%. A breakdown of loans by risk categories shows that the volume of problem loans (nonperforming and irrecoverable) as a proportion of total credit volume has declined over recent years. In the year 2000, some 2.2% of loans were classified as nonperforming. As collateral is not considered in this context, forecasts about the recovery rate cannot be made. These data thus represent conservative assessments of credit quality.

4 Macro Stress Tests for Austria

Our empirical section consists of three steps: Estimations to find significant factors, scenario analysis and considerations of risk-bearing capacity. Given the importance of credit risk underlined in the previous section, our focus is only on this risk category. In order to measure credit risk, the literature offers a broad variety of models (see Saunders, 1999; or Nandi, 1998, for details). Our definition of credit risk is concentrated on the impact of defaults and hence on loan losses arising from the inability of a debtor to repay a loan. Therefore, we neglect losses in the market value of loan books arising from the downgrading of debtors. The basis for our approach is the hypothesis that the development of loan losses is linked to the macroeconomic environment. Hence, we model the systematic component of credit risk by means of its relation to the state of the business cycle, inflation or external factors and neglect the idiosyncratic, i.e. firm-specific component of credit risk. Among the models discussed in the literature, the Credit Portfolio View concept is closely related to ours as it specifies a relation between the conditional transition matrix and macroeconomic variables (see Crouhy et al., 2000, for an overview).

The starting point for our analysis is the method which the IMF proposes to assess credit risk (Blaschke et al., 2001). The impact of external shocks on unexpected credit losses can be modeled using a linear regression. Nonperforming loan (NPL) ratios are regressed against various macroeconomic variables, such as the nominal interest rate, inflation rate, real GDP growth and percentage change in the terms of trade. The regression coefficients capture the sensitivity of loan quality to specific macroeconomic factors.

As pointed out also by the IMF, in the field of stress testing, data limitations pose significant constraints on the construction of models. This is also the case currently with the Austrian banking data. However, changes in data collection and monitoring have already started in the process of Basel II, and in the future there will be a greater set of readily available data for the purposes of assessing financial system stability.

1 *The following performance categories are used in the prudential reports: without default risk, watch list loans (loans that might be at risk in the future), nonperforming (defaults are expected to occur), irrecoverable (default has already occurred), nonaccrual and nonearning assets (payment of outstanding principal or interest accruals is not expected at present/in the near future).*

4.1 Estimation of Factor Regressions

Our first step is to model the relation between a measure of credit risk and macroeconomic factors. For this purpose, we estimate Ordinary Least Squares (OLS) regressions on a comprehensive data set (see Arpa et al., 2000, for a related study in the context of macroprudential analysis). We analyze changes in LLP, as data on NPLs are only available on an annual basis. This does not detract from the analysis since changes in LLP are expected to have a high correlation with changes in NPLs. That is, banks are expected to adjust their LLP over time to the degree and variation in NPLs. Besides credit risk, the LLP are also affected by other measures which banks conduct to manage their balance sheets.

A key assumption in our procedure is that the time series of our variables do not contain unit roots. The evidence for the stationarity of the yearly differences of the LLP is slightly ambiguous. The Augmented Dickey Fuller test shows nonstationarity whereas the Philips Peron procedure indicates stationarity.[1]) The test procedures for unit roots may be problematic due to the small sample. For our estimations, we proceed by assuming stationarity. Hence, our hypothesized model is as follows:

$$\Delta LLP_t = \alpha_0 + \alpha_1 x_{1t} + ... + \alpha_i x_{it} + u_t$$

with:

LLP	total loan loss provisions / total loans
x_{it}	change in factor i at date t
u_t	residual with $u_t \sim N(0, \sigma^2)$

Our sample consists of quarterly data from 1990 to 2001. For presentation purposes, we divide the macroeconomic variables which enter the above equation into the following six categories: cyclical indicators, price stability indicators, household indicators, corporate indicators, financial market indicators and external variables. Our categorization contains some ambiguity; for example, industrial production could also be included among corporate indicators, but we choose this categorization purely for the purpose of summarizing the set of variables. All variables except interest rates, inflation rate and unemployment rates and the yield curve are real and log differenced.[2]) For the variables mentioned, we use absolute differences. A caveat in our study is the small size of our sample, i.e. we do not observe a complete economic cycle. This is a common problem in the area of default risk modeling. In the following, we outline our set of factors in more detail. The descriptive statistics of the variables are given in table 1. A summary of the variables together with the hypothesized sign is provided in table 2.

1. Cyclical indicators

This category includes variables that relate to the general economic activity. The assumption is that loan quality is sensitive to the economic cycle. A deterioration in economic activity leads to falling incomes, rising payment difficulties and more business failures and hence default risk rises, causing a decline in the qual-

1 *Results of the unit root tests are omitted for reasons of space but are available from the authors.*

2 *Austrian industrial production growth is calculated as [IP/IP(–4)]–1 and not using log differences.*

Table 1

Descriptive Statistics of Variables

	Mean	Standard Deviation	Maximum	Minimum	Skewness	Kurtosis
GDP	2.43	1.39	5.03	– 0.06	–0.02	1.99
Industrial production	3.80	4.36	10.63	– 5.45	–0.25	2.03
Output gap	0.02	0.99	1.91	– 2.56	–0.62	3.59
Inflation	0.01	0.73	1.70	– 1.37	0.43	2.60
M1	4.19	5.79	16.17	– 6.07	0.20	2.27
Consumption	2.50	1.45	5.13	– 1.16	–0.31	2.69
Unemployment	0.09	0.51	1.03	– 0.90	–0.13	2.46
Employee compensation	4.22	2.21	8.74	0.44	0.51	2.64
New car registrations	0.47	9.60	22.30	–28.21	–0.64	4.63
Investment	2.60	4.50	11.82	– 5.70	0.29	2.28
Total gross fixed capital formation (GFCF)	2.77	3.49	9.81	– 5.71	–0.11	2.68
GFCF, construction, nonresidential	2.41	8.42	19.56	–22.31	–0.33	4.03
GFCF, construction, residential	1.85	7.70	17.83	–13.32	0.03	2.32
GFCF, machinery and equipment	3.23	7.56	17.96	–14.47	–0.08	2.46
Real productivity	2.01	1.07	4.13	0.07	0.10	1.96
Ifo business-climate index	– 1.19	8.91	16.73	–17.12	0.17	1.99
Bankruptcies	9.97	21.14	63.62	–38.99	0.22	3.17
Nominal 3-month interest rate	– 0.25	1.23	2.25	– 3.03	–0.26	2.74
Nominal 10-year bond yield	– 0.16	0.96	1.72	– 1.72	0.70	2.41
Real 3-month interest rate	– 0.27	1.06	1.42	– 2.77	–0.47	2.29
Real 10-year bond yield	– 0.18	0.93	2.37	– 1.77	0.71	3.11
ATX	– 1.31	18.06	39.58	–33.92	0.30	2.41
DJIA	12.65	9.94	33.78	– 8.33	0.07	2.24
DAX	9.83	19.21	46.55	–32.69	–0.10	2.26
Euro STOXX	13.96	17.32	41.79	–31.74	–0.58	2.82
Yield Curve	0.09	1.08	2.54	– 1.80	0.48	2.44
Exports	5.83	4.90	16.81	– 4.88	–0.12	2.72
ATS/USD exchange rate	1.34	10.40	18.85	–19.01	–0.40	2.16
ATS/GBP exchange rate	0.18	9.22	23.29	–17.19	0.29	2.95
ATS/ITL exchange rate	– 2.54	7.90	15.63	–22.73	–0.76	4.15
ATS/CHF exchange rate	1.00	3.48	8.89	– 7.36	–0.37	2.89
ATS/JPY exchange rate	2.32	13.93	30.21	–25.93	0.07	2.31
Oil price (North Sea)	3.34	29.91	87.13	–52.32	0.69	3.54
Oil price (Arab Light)	3.44	32.91	95.95	–59.42	0.64	3.67
Oil price (Brent Crude, 1 mth fwd)	3.64	28.18	82.80	–47.94	0.67	3.42
Change in LLP as ratio of total loans	0.15	0.24	0.63	– 0.28	0.29	2.36

Source: OeNB, Datastream.

ity of the banking books. As cyclical variables we include GDP, the output gap and industrial production.

GDP is the primary measure of the state of the economy. GDP growth and the output gap[1]) are expected to be related negatively with loan loss provisions. During periods of economic downturn, borrowers are less likely to be able to repay all of their debts, thus the probability of loan defaults and of loan losses by banks is expected to increase. Industrial production growth often leads the GDP growth cycle. As such, increased industrial production growth is expected to reduce loan losses since the economy is in a growth phase.

1 *The output gap is defined as actual GDP minus potential GDP. A positive output gap indicates that the economy is operating above its potential level.*

2. Price stability indicators

A measure of price stability is the index for consumer price inflation. Higher inflation may indicate that an economy is operating above its potential growth level and may be overheating. Higher inflation assists borrowers in repaying their debt since the real value of the debt repaid at some point in the future is less than loan. Conversely, falling inflation often signals that the economy is cooling down. Falling inflation also pushes real interest rates higher. This is likely to be followed by increased loan defaults given that the real cost of borrowing has increased. Money growth is included as an indicator due to its potential linkages to inflation.

3. Household indicators

Variables in this category relate to the situation of the household sector, which accounted for more than 25% of total loans in 2001. Consumption expenditure, unemployment, employee compensation and new car registrations are some variables that provide a gauge of the development of household incomes.

Generally, when households have higher disposable income, overall economic conditions are favorable and loan losses are low. Thus, consumption expenditure and new car registrations are expected to have a negative correlation with loan defaults. Unemployment is another variable that provides a measure of the state of households. Higher unemployment may indicate that households have greater difficulty repaying their debts. Higher total compensation for employees, which includes wages and salaries, implies higher disposable income which in turn suggests that employees are less likely to default on their debts. Employee compensation is thus expected to be inversely related to loan losses.

4. Corporate indicators

Corporate indicators assess the financial outlook of firms. The corporate sector is important given that it had a 56% share of total loans at the end of 2001. The primary variable examined here is investment expenditure, specifically gross fixed capital formation, wich is further broken down into residential construction, nonresidential construction, and machinery and equipment expenditures. Confidence indicators such as the frequently observed Ifo index of German business climate are also examined. Real productivity per employee and the growth rate of bankruptcies are other factors that are examined.

Corporations increase investment expenditures when the economic outlook is favorable. Thus, investment expenditures (including fixed investments, construction investment and investment in machinery and equipment) are expected to be negatively correlated with loan defaults. Corporate bankruptcies are expected to have a positive correlation with loan losses. Productivity gains enable companies to increase profit margins and such gains largely occur during economic upswings. Confidence indicators, which track the economic cycle and tend to lead real macroeconomic data such as industrial production and GDP growth, are likely to be negatively related to loan defaults. Increasing industrial confidence leads to stronger economic activity and a period where loan defaults decline as borrowers are in better financial positions.

5. Financial market indicators

Financial market variables examined in this study consist of nominal and real interest rates (3-month and10-year rates), the yield curve, and stock market indices (ATX, DAX, Dow Jones Industrial Average, Euro STOXX).

Interest rates are a central variable as they represent the direct costs of borrowing. Thus, the higher the interest rate, the greater the cost of borrowing and the greater the possibility of loan default as firms and households are less able to service their debt. The steepness of the yield curve, which is measured as the 10-year bond yield minus the 3-month interest rate, provides an indication of the impact of monetary policy and the economic cycle. For example, a relatively steep yield curve may suggest that the economy is growing at a very high rate and future interest rate hikes are expected in order to contain the buildup of inflationary pressures. In this case, the yield curve is expected to be negatively related to loan losses. However, the higher interest rates expected when the yield curve is steep suggest that the cost of borrowing is expected to rise and as discussed above, this is likely to be related to greater loan losses. Higher short interest rates eventually flatten the yield curve and possibly even result in an inverted yield curve where long rates are below short rates. This situation is often characteristic of a recession. Thus, given the dynamic nature of the yield curve, its relationship to potential loan losses is ambiguous.

Stock market indices tend to follow or lead the cyclical trends of the macroeconomy. Most stock markets of the large industrialized nations are linked to some extent and movements in the U.S. stock market in particular often have spillover effects across global markets. Rising stock markets deliver higher returns to investors and thus lower the probability of loan defaults. This linkage is captured on the level of an individual firm in the benchmark model of Merton (1974).

6. External indicators

This category refers to nondomestic factors that can impact Austria's domestic financial system. These forces primarily relate to international trade links. Exchange rates (cross rates of the Austrian Schilling against the U.S. dollar, Swiss franc, Japanese yen, British pound sterling and Italian lira), exports and oil prices are examined.

A fall in exports can adversely impact a small open economy and in turn result in greater loan defaults. For example, an export-oriented firm that suffers losses may not be able to repay all of its debts as it faces a negative cash flow. With regard to nominal exchange rates, a depreciation of the domestic currency means that the borrowers must repay less than they borrowed initially. The net real position of the borrower has, in fact, improved. Also, a lower domestic currency is positive for a country's export sector. Hence, it is expected that a depreciation in the nominal exchange rate leads to lower loan defaults and losses. This situation is reversed if the borrowers are primarily borrowing in foreign funds, in which case they stand to benefit from an appreciation of their domestic currency. Generally, the relationship between the exchange rate and loan losses is ambiguous. The one exception to this ambiguity is for loans denominated in foreign currency. In this category, the Swiss franc and Japanese yen have the largest share and it could be expected that depreciations of the

domestic currency lead to increased loan losses as the repayment amounts rise. Sharp increases in oil prices can lead to a negative demand shock to the economy causing household and business energy costs to rise. Thus, an increase in oil prices is likely to be associated with a deterioration of the economic climate and, thus, greater loan losses.

For all the above explanatory variables and the LLP, table 1 summarizes the statistical properties. We observe that the mean change in LLP relative to total loans is 0.15% with a standard deviation of 0.24. The largest changes were an increase of LLPs by plus 0.24% and a fall by minus 0.63%.

4.2 Results for Bivariate Regressions

Table 2

Summary of Variables and Bivariate Regression Results[1])

Factor X_i	Expected sign	Regress ΔLLP against $\Delta LLP(-1)$, Dummy, $X_i(-1)$		
		Coefficient	T-Statistic	R^2
1. Cyclical				
GDP	−	−0.0047	−0.346	0.860
Industrial production	−	−0.0128	−3.518[2])	0.875
Output gap	−	0.0352	1.692	0.870
2. Price Stability				
Inflation	−	0.0047	0.239	0.860
Money growth	−	−0.0078	−3.341[2])	0.889
3. Household				
Consumption expenditure	−	−0.0073	−0.747	0.862
Unemployment rate	+	0.0250	0.678	0.861
Employee compensation	−	0.0152	1.834	0.875
New car registrations	−	0.0006	0.472	0.860
4. Corporate				
Investment expenditures	−	−0.0022	−0.978	0.861
Total gross fixed capital formation (GFCF)	−	0.0006	0.123	0.860
GFCF, construction, non-residential	−	0.0000	0.001	0.860
GFCF, construction, residential	−	0.0031	0.599	0.862
GFCF, machinery & equipment	−	−0.0017	−1.246	0.862
Productivity per employee	−	−0.0078	−0.694	0.861
Industrial/business confidence	−	−0.0048	−3.694[2])	0.886
Bankruptcies	+	0.0008	1.017	0.863
5. Financial markets				
Nominal short interest rate	+	0.0372	2.728[2])	0.884
Nominal long interest rate	+	−0.0132	−0.654	0.861
Realshort interest rate	+	0.0414	2.177[2])	0.885
Real long-term interest rate	+	−0.0210	−0.705	0.863
ATX	−	−0.0016	−2.747[2])	0.874
DJIA	−	−0.0017	−1.176	0.865
DAX	−	−0.0012	−2.844[2])	0.868
Euro STOXX	−	−0.0013	−3.085[2])	0.866
Yield curve	+/−	−0.0429	−3.760[2])	0.892
6. External				
Exports	−	−0.0061	−2.452[2])	0.870
ATS/USD exchange rate	+/−	0.0004	0.191	0.860
ATS/GBP exchange rate	+/−	−0.0020	−1.654	0.864
ATS/LIT exchange rate	+/−	0.0001	0.098	0.860
ATS/CHF exchange rate	+/−	−0.0051	−0.969	0.865
ATS/JPY exchange rate	+/−	−0.0005	−0.503	0.860
Oil price (North Sea)	+	−0.0006	−1.050	0.865
Oil price (Arab Light)	+	−0.0007	−1.281	0.867
Oil price (Brent Crude, 1 mth fwd)	+	−0.0006	−1.019	0.864

Source: OeNB, Datastream.

[1]) Where LLP = loan loss provisions / total loans(t) - loan loss provisions/total loans(t−4); and Dummy = 1 for the period 1995:1−1995:4 and 0 otherwise.

[2]) The variable is significant at a confidence level of 90%.

Bivariate regressions are estimated using a single macroeconomic risk factor. The models estimated include a lagged dependent variable, a dummy variable (to account for the change in risk provision definitions for the period first quarter 1995 to fourth quarter 1995) and a single macroeconomic risk factor. This systematic methodology will enable the selection of regressors to be used in a comprehensive data set. These are presented in table 2. For the purpose of comparisons, we also include the expected sign for the independent variable.

The results indicate that in each category, with the exception of the household sector, there is at least one macroeconomic variable that enters significantly (and with the correct hypothesized directional impact) into the regression. The cyclical variable with the highest predictive power is industrial production, while GDP does not enter significantly. Among measures of price stability, money growth is significant. The Ifo business-climate index is the only significant corporate sector variable. Although the Ifo index measures business confidence for Germany, it has been shown to have predictive properties for euro area growth. Significant financial market variables consist of the nominal and real short rates, the ATX, DAX and Euro STOXX indices, and the yield curve. Finally, for external factors, only exports are significant with all the bilateral exchange rates having insignificant predictive power.

In order to analyze the robustness of the specification, the models are estimated using a lag of 1 and a lag of 4 quarters for the risk factors. There was no improvement in the number of macroeconomic variables that were significant in the regressions, nor was there an improvement in the degree of significance of the variables when using a lag of 4. Based on an examination of the significance of the regressors (while also analyzing the significance of the dummy variable), the following variables (with 1 lag) are selected from each category (see table 3 for the complete estimation results):

- Cyclical variable: *industrial production*
- Price stability variable: *money (M1)*
- Household variable: *none*
- Corporate variable: *Ifo business-climate index*
- Financial market variable: *real and nominal short-term interest rate, ATX index, DAX index, Euro STOXX index*
- External sector variable: *exports*

Among financial market variables, the real and nominal short-term interest rates and the stock market indices are not highly correlated. Thus, they both affect loan losses differently. The yield curve is not included although it is significant. The linkage from the yield curve to credit risk is somewhat ambiguous. The yield curve can impact the economy and financial sector through various channels, which makes it difficult to interpret the regression results. Among other financial market variables, notably, the nominal and real 10-year interest rates do not have the correct sign. There is no household sector variable included, but the household sector closely follows the overall macroeconomic cycle and is thus captured by the cyclical variables. Hence, the cyclical variations in household income are already represented by industrial production and the Ifo index. Regarding the fit of the regressions, we note that the R^2 values are higher than 80%, indicating a satisfying performance of our simple model.

Table 3

Complete estimation results for significant factors

		Macro factor X_i								
		Industrial production	Exports	Real 3-month interest rate	Money (M1)	Ifo business-climate index	Nominal 3-month interest rate	ATX	DAX	Euro STOXX
Constant	Coeff	0.0767	0.0529	0.0103	0.0508	0.0076	0.0040	0.0059	0.0234	0.0200
	t-stat	2.5817	2.3791	0.4988	2.2699	0.3944	0.2890	0.3046	1.1916	1.0322
	p-Val	0.0137	0.0223	0.6207	0.0288	0.6955	0.7741	0.7623	0.2406	0.3097
$\Delta LLP(-1)$	Coeff	0.0767	0.8525	1.0083	0.8698	0.8603	1.0251	0.9234	0.9048	0.8269
	t-stat	2.5817	10.0473	18.4219	19.9062	13.1096	16.6921	14.8373	14.1985	13.4172
	p-Val	0.0137	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Dummy	Coeff	0.0713	0.0352	0.0225	0.0562	0.0723	0.0620	0.0305	0.0232	0.0307
	t-stat	1.9937	1.1963	0.6700	1.8240	3.5529	2.2312	0.8240	0.6198	0.8671
	p-Val	0.0532	0.2388	0.5068	0.0758	0.0010	0.0315	0.4149	0.5390	0.3924
$X_i(-1)$	Coeff	−0.0128	− 0.0061	0.0414	− 0.0078	− 0.0048	0.0372	− 0.0016	− 0.0012	− 0.0013
	t-stat	−3.5179	− 2.4518	2.1768	− 3.3412	− 3.6936	2.7280	− 2.7471	− 2.8436	− 3.0845
	p-Val	0.0011	0.0188	0.0356	0.0018	0.0007	0.0095	0.0091	0.0071	0.0042
R^2		0.8753	0.8698	0.8847	0.8888	0.8862	0.8836	0.8740	0.8679	0.8660
DW Statistic		1.4931	1.4254	1.7424	1.8394	1.7626	1.9068	1.6239	1.6432	1.8634

Source: OeNB, Datastream.

When we analyze the time series of the residuals, the Durbin Watson tests show no signs of residual autocorrelation at lag 1.

4.3 Scenario Analysis

Following the estimations of the bivariate model we now turn to measuring the impact of various adverse macroeconomic events. Here, the method for choosing a scenario is a key step. For our methodology, we started by comparing historical and hypothetical shocks. The selection of the magnitude of the shocks to the macroeconomic variables was therefore based on the comparison of two events: the historical[1]) extreme values experienced in the time series of the variables and, as a hypothetical event, a 3-standard deviation change in the variable. The choice between the two approaches is driven by the aim of constructing plausible scenarios. Hence, we choose to define the adverse events by the historical extremes of the respective exogenous variables. Given that they actually happened, these historical scenarios are plausible enough to receive appropriate consideration by central bankers and supervisory authorities.

This choice of historical scenarios ensures homogeneity and therefore comparability of the tests. The following sensitivity tests were therefore conducted:

- Fall in industrial production by 10.4% (which occurred in the second quarter of 1975);
- Fall in M1 by 13.8% (which occurred in the third quarter of 1981);
- Fall in business confidence by 17.1% (which occurred in the fourth quarter of 1992);
- Rise in real short-term interest rate by 1.42 percentage points (which occurred in the first quarter of 1990);
- Rise in nominal short-term interest rate by 4.25 percentage points (which occurred in the second quarter of 1980);

1 *This is based on the availability of data for each variable.*

– Fall in the ATX, DAX and Euro STOXX indices by 33.9%, 32.7% and 31.7%, respectively (which occurred in the third quarter of 1992 for the ATX index and in the third quarter of 2001 for both the DAX and Euro STOXX indices);
– Fall in exports by 4.9% (which occurred in the second quarter of 1993).

Table 4

Single Factor Stress Tests

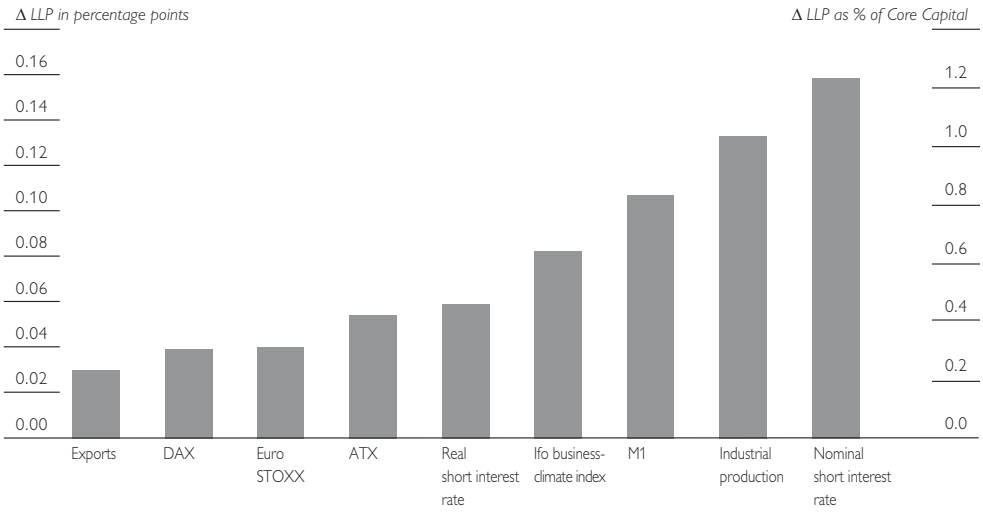
Factor X_i	Expected sign	Coefficient	Largest historical move	Change in LLP given historical move
Industrial production	−	−0.0128	−10.4000	+0.1331
Money growth	−	−0.0078	−13.8000	+0.1070
Industrial/business confidence	−	−0.0048	−17.1200	+0.0825
Nominal short interest rate	+	+0.0372	+ 4.2500	+0.1580
Real short-term interest rate	+	+0.0414	+ 1.4200	+0.0588
ATX	−	−0.0016	−33.9200	+0.0545
DAX	−	−0.0012	−32.6900	+0.0396
Euro STOXX	−	−0.0013	−31.7400	+0.0407
Exports	−	−0.0061	− 4.8800	+0.0297

Source: OeNB, Datastream.

Table 4 documents the stress test results assuming the historical extreme move in the individual macro factors. One of the strongest impacts on LLP came about from an increase in the nominal short-term interest rate. Interest rates capture the borrowing cost of capital and are expected to have a significant impact on the quality of a bank's loan portfolio. Higher interest rates lead to a greater debt servicing burden and, in turn, higher expected loan losses. The impact of a fall in industrial production, M1, business confidence and the ATX stock index amounted to an increase in the LLP ratio of 0.13, 0.11, 0.08 and 0.06 percentage points, respectively. Exports have the smallest

Figure 2

Changes in Loan Loss Provisions Ratio in Response to Changes in Single Factors[1])



Source: OeNB, Datastream.
[1]) The left-hand scale shows the change of the LLP in response to the maximum historical change in the single factors as defined in the text. The right-hand scale measures the responses as a share of core capital.

impact, about one-fifth of the impact from the nominal short rate. The household factors do not have any measurable impact since the coefficients from the bivariate regressions were not significant. The same holds for GDP, investment expenditures, productivity, bankruptcies, exchange rates and oil prices.

The maximal impact on LLP resulting from the sensitivity tests listed above ranges from 0.03 to 0.16 percentage points. The average change in LLP is 0.15 percentage points with a standard deviation of 0.24. These single-factor shocks do not imply a change in LLP that is significantly greater than its mean change.

In practice these single-factor shocks are not likely to occur in isolation without being combined to some degree with changes in other macroeconomic variables as well. For conducting plausible multi-factor stress tests, a comprehensive macroeconometric model would be needed. Such a model would allow for the definition of adverse events for the entire Austrian economy. This is beyond the scope of our preliminary work on stress testing and therefore left for future research. Hence, we continue with the bivariate setup. Figure 2 provides a summary of the sensitivity stress tests conducted. This figure summarizes the results presented in table 4, as discussed above.

4.4 Analysis of Risk-Bearing Capacity

The third step is to compare the risks shown by the scenario analysis to risk-bearing capacity. A key mechanism to limit the repercussions of problems arising at a bank is the capital adequacy requirement. The bank's capital is the reserve that buffers the impact of potential losses. Such losses may be incurred as a result of borrowers' defaults or, in securities trading, due to adverse market movements. The most important measure of the risk-bearing capacity of Austrian banks is the capital adequacy ratio, i.e. the ratio of capital to the bank's risk weighted assets. According to the Austrian Banking Act, there are three types of capital: tier 1 capital (core capital), tier 2 capital (supplementary capital) and tier 3 capital (special subordinated capital) to cover market risk.

Table 5

The Impact of the Stress Tests on Core Capital

Factor X_i Tested	Change in LLP ratio	Change in LLP	Change in LLP
	percentage points	*EUR million*	*as % of core capital*
Exports	+0.0297	+ 88.7466	+0.3295
DAX	+0.0396	+118.4045	+0.4397
Euro STOXX	+0.0407	+121.4879	+0.4511
ATX	+0.0545	+162.9412	+0.6050
Real short interest rate	+0.0588	+175.7011	+0.6524
Ifo business-climate index	+0.0825	+246.4670	+0.9152
M1	+0.1070	+319.6586	+1.1870
Industrial production	+0.1331	+397.7375	+1.4769
Nominal short interest rate	+0.1580	+472.1931	+1.7534

Source: OeNB, Datastream.

At the end of 2001, tier 1 capital totaled around EUR 27 billion. In terms of actual currency, LLP for the fourth quarter of 2001 totaled EUR 9.26 billion. That is, LLP were approximately 34.3% of core capital. The maximal change in the LLP ratio resulting from the stress tests is calculated in terms of core capital in order to provide a less abstract understanding of the impact of the various

stress tests. These results are presented in table 5. The largest impact comes from a change in the nominal short rate. The hypothetical size in terms of core capital of this scenario is 1.8% or EUR 472 million. With regard to the other tests, the amount is 1.5% for industrial production, 0.9% for business confidence and 0.6% the ATX stock index. The size ranges from a maximum of 1.8% to a low of 0.3%, which is for exports.

Thus, we find that despite the simple model, some statistically significant effects can be observed. A judgment on the economic significance of these quantities is a complex task for a number of reasons. First, the size of our sample is quite small and, in particular, we can not observe a complete business cycle. Second, our use of a linear model to measure the impact of large shocks is restrictive because in reality, the events may have a nonlinear impact. Third, we use a bivariate framework, whereas in reality, shocks may not take place in isolation. Finally, LLP are a proxy for the measurement of credit risk and, thus, an error-in-variables problem may be present.

5 Summary

The purpose of this paper has been to perform a preliminary stress test for the Austrian banking system. Our focus was on the interdependence of credit risk and the state of the economy, as measured by macroeconomic variables. We used a simple linear regression approach to describe the relation between loan loss provisions and potential explanatory factors. Among these, a rise in the short rate, a fall in business confidence, a decline in the stock market and a decline in industrial production have effects on the LLP. Based on the regressions we then studied the hypothetical impact of historical "worst cases" in key macroeconomic variables. These changes in LLP were then compared to the risk-bearing capacity of the Austrian banking sector as it is captured by its capitalization. We find that, in our tentative simulation exercise, the greatest effect amounts to 1.8% of core capital.

For future research, two extensions seem important. As already mentioned, the first extension is to construct multi-factor scenarios. In order to realize this aim, a comprehensive macroeconomic model is required. Another key direction is to extend the linear specification. In particular, a more complex model for the relation of credit risk to the state of the economy would be a useful tool for the analysis of financial stability. Among the models discussed in the literature, one possibility is the CreditPortfolioView. It is built on a relation between the default rates and macroeconomic variables.

References

Arpa, M., Giulini, I., Ittner, A. and Pauer, P. (2000). The Influence of Macroeconomic Developments on Austrian Banks: Implications for Banking Supervision. In: BIS Papers, No. 1, 91–116.

BCBS – Basel Committee on Banking Supervision (2001). Overview of The New Basel Capital Accord. Bank for International Settlements.

Blaschke, W., Matthew, T. J., Majnoni, G. and Peria, S. M. (2001). Stress Testing of Financial Systems: An Overview of Issues, Methodologies, and FSAP Experiences, IMF Working Paper 01/88.

CGFS – Committee on the Global Financial System (2000). Stress Testing by Large Financial Institutions: Current Practice and Aggregation Issues. Bank for International Settlements.

CGFS – Committee on the Global Financial System (2001). A Survey of Stress Tests and Current Practice at Major Financial Institutions. Bank for International Settlements.

Crouhy, M., Galai, D. and Mark, R. (2000). A Comparative Analysis of Current Credit Risk Models. In: Journal of Banking & Finance, 24, 59–117.

ECB (2001). The new capital adequacy regime – the ECB perspective. In: ECB Monthly Bulletin, May, 60–75.

Krenn, G. (2001). Stress Testing by Austrian Banks. In: OeNB. Financial Market Stability Report, Vol. 1, June, 108–116.

Merton, R. (1974). On the Pricing of Corporate Debt: The Risk Structure of Interest Rates. In: Journal of Finance, 29, 449–470.

Nandi, S. (1998). Valuation Models for Default-Risky Securities: An Overview. In: Federal Reserve Board of Atlanta. Economic Review, Fourth Quarter, 22–35.

Oesterreichische Nationalbank (1999). Stress Testing. In: Guidelines on Market Risk, Vol. 5, September.

Saunders, A. (1999). Credit Risk Measurement: New Approaches to Value at Risk and Other Paradigms. Wiley.

A New Approach to Assessing the Risk of Interbank Loans

Helmut Elsinger,
Alfred Lehar,
Martin Summer[1])

Introduction

The use of complex and powerful risk management methods has been one of the key innovations in the banking sector over the past two decades. One of the factors driving this development is certainly that since the early 1970s banks have had to cope with a significantly more volatile and dynamic environment compared to the years following World War II. In the immediate post-war period, currency crises were largely insignificant, market interest rates fluctuated only negligibly, competition was limited by cartels and interest rate regulation, and competition by financial intermediaries outside the banking sector was insignificant. Once the Bretton Woods system had collapsed, the situation changed drastically, however. Exchange rate risks started to play a role, interest rate fluctuations reached previously unknown dimensions, the lifting of capital controls resulted in a considerable internationalization of the financial system, and competition by nonbanks increased strongly. New technologies and means of communications rendered barriers to competition, such as distance and national borders, obsolete. In addition, financial innovations abounded. Against this background, regulators started to exert more pressure on banks. As capital adequacy provisions were continuously extended and refined, regulators relied heavily on individual risk management models. In the public these regulatory measures were invariably justified by pointing out the need to attenuate *systemic risks* and strengthen *financial stability*. The question remains, however, whether improving risk management models and implementing capital adequacy guidelines at the level of *individual* banks automatically leads to more efficient risk control at the level of the banking *system*.

There are reasons to doubt this argument. One of them lies in the fact that risks may arise from complex interbank lending transactions in the course of liquidity management and derivatives trading, which cannot be captured at the level of the individual institution. It is difficult to assess e.g. the counterparty risk of a bank in an isolated manner, because this approach fails to disentangle the interdependencies of interbank liabilities. It could therefore go unnoticed that a single institution figures in a cascade of interbank liabilities in which risks are highly correlated. Another problem pointed out by Hellwig (1997) is that a complex network of interbank debtor/creditor relations may result in sophisticated maturity transformation, which, in turn, at the level of the individual institution, may mask interest rate exposures of the banking system. Since it is hardly possible to assess the risk of a banking system based on the evaluation of individual banks, a "system approach" is called for. While risk management methods may certainly be suitable for individual credit institutions, regulators, concerning themselves primarily with the stability of the whole banking system, have to get a clear idea of the risk borne by the banking system. This is important since a systemic banking crisis, i.e. a situation in which financial inter-

1 *Helmut Elsinger – University of Vienna; e-mail: helmut.elsinger@univie.ac.at.*
Alfred Lehar – University of Vienna; e-mail: alfred.lehar@univie.ac.at.
Martin Summer – Oesterreichische Nationalbank; e-mail: martin.summer@oenb.co.at (corresponding author).
The authors thank Ralf Dobringer, Gerhard Fiam, Bettina Kunz and Franz Partsch for their help and support in collecting the data. Andreas Worms, Christian Upper and the participants of the joint workshop of the Oesterreichische Nationalbank and the Deutsche Bundesbank provided valuable comments.

mediation collapses at a large scale, translates into substantial costs to the real economy.

In what way does systemic risk assessment differ from risk assessment at the level of individual institutions, and how can we put such a method into practice? A research project conducted by the Economic Studies Division of the Oesterreichische Nationalbank (OeNB) and the Center for Business Studies of the University of Vienna was aimed at finding answers to the following questions:[1]) How can we assess the risk of interbank loans at a system level, accounting explicitly for complex credit chains/interdependencies? How can we, to this effect, make optimal use of the data sources as they normally exist in central banks? The following sections briefly present the salient results of the said joint research project.

An Overview of the Model

The basic framework consists in a *network model* of the interbank market. Based on specific assumptions about the resolution of insolvencies, the model *endogenously* explains the possible payment flows among banks in different future states of the world (scenarios) for a given structure of interbank liabilities and for a given structure of other bank assets and liabilities. The states of the world are described by the impact interest rate changes, exchange rate and stock price fluctuations as well as credit defaults have on the banking business. The network model explicitly determines the possible interbank payments for each state of the world. Based on these results, we can calculate the expected default frequencies and the expected loss of interbank loans. The model is also capable of differentiating between insolvencies that are traceable to shocks resulting directly in the insolvency of a bank (fundamental insolvencies) and insolvencies that are triggered by the insolvency of another institution within the system (contagious defaults). This allows for an evaluation of the relative significance of fundamental insolvencies against insolvencies set off by chain reactions. We assess the risk of interbank loans on the basis of this analysis.

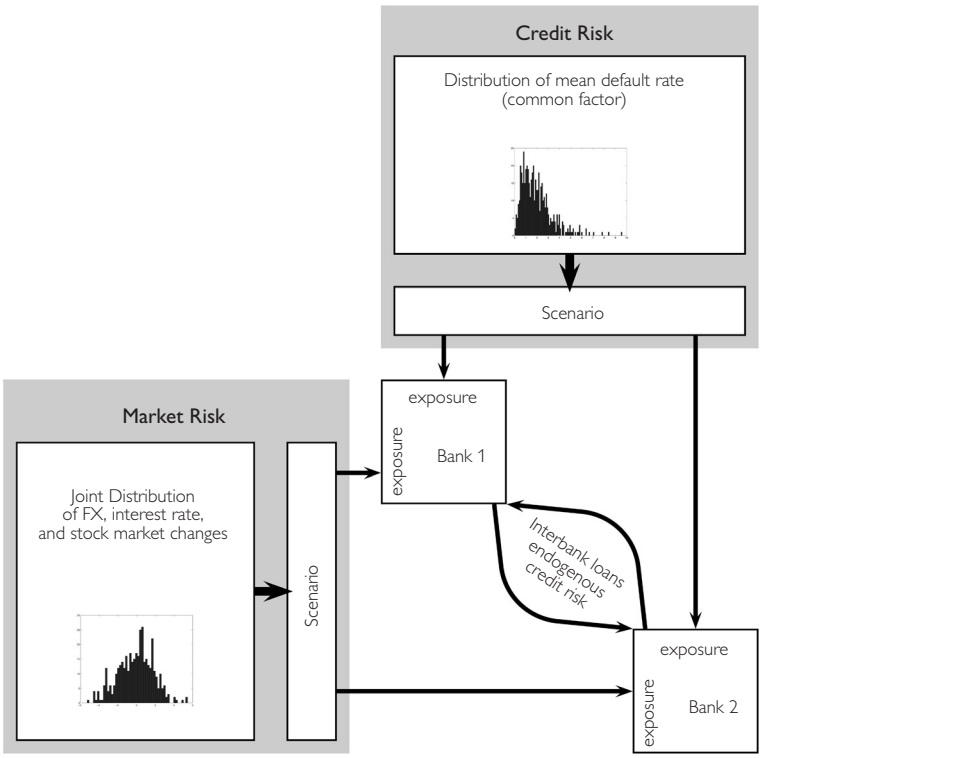
The main data sources are bank balance sheet data reported monthly to the OeNB and data of the Major Loans Register of the OeNB and a credit rating association, Kreditschutzverband of 1870. In addition, we use market data from Datastream. From the bank balance sheet data we estimate bilateral interbank positions and derive additional information about the claims and liabilities of individual institutions. The market data as well as Major Loans Register and Kreditschutzverband of 1870 data feed into the description of states of the world.

We use a cross-section of Austrian banks as at September 2001. According to the model calculation, the Austrian banking system is very stable and the likelihood of systemic banking crises is extremely low. In line with the September 2001 results, the median default probability of Austrian banks was below 1%. Only a very small percentage of all insolvencies of the model calculation are attributable to contagion. The frequency of contagious defaults is clearly correlated to the strength of negative developments in the fundamental risk factors.

For an overview of the basic structure of our model, see figure 1.

1 For first results of this project, see Elsinger, Lehar and Summer (2002).

Figure 1



The chart shows the basic structure of the model. Banks are exposed to shocks from market and credit risks. Interbank credit risk is endogenously explained by the network model.

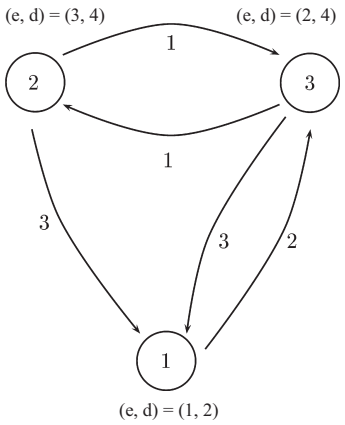
The Network Model

The network model we use to analyze the system of interbank loans was introduced to the literature by Eisenberg and Noe (2001), who present an abstract, static analysis of a clearing problem in their paper. We extended this model to include uncertainty. To illustrate the key concepts of this approach to modeling the interbank network, let us take a look at a highly simplified example. The banking system in this case consists of three banks whose interbank loans are known. Here, the structure of claims and liabilities may be shown as a matrix, which could look as follows:

$$L = \begin{pmatrix} 0 & 0 & 2 \\ 3 & 0 & 1 \\ 3 & 1 & 0 \end{pmatrix}$$

The rows of this matrix refer to the liabilities of bank 1, bank 2 and bank 3 vis-à-vis the other banks in the system. Bank 2, for instance, has liabilities of 3 against bank 1 and liabilities of 1 against bank 3. The columns of the matrix demonstrate which claims the individual banks have on the other banks within the system. Since banks do not incur liabilities against themselves, the diagonal shows only zeros. We may illustrate the total liabilities of each bank using a list or a vector $d = (2, 4, 4)$.

Figure 2



Let us assume that the net income of banks 1, 2, 3, which derives from their other activities, may be shown by the income flow $e = (1, 3, 2)$. We may now ask: Can the banks fulfill all their interbank liabilities? In this particular case the answer is yes. Given the income flows in this example, all three banks can meet their liabilities simultaneously. Figure 2 depicts the payments effected between the individual institutions.

Let us assume that exchange rate fluctuations, interest rate changes or credit defaults affect the positions on the assets and liabilities sides which do not fall into the interbank category in such a way that $e = (1, 3, 2)$ turns into $e = (1, 1, 1)$. If we ask now whether the banks can fulfill all their interbank liabilities, the answer is a clear no.

To better understand this, it is useful to alter the matrix L of interbank liabilities by normalizing the individual entries with the total liabilities, which produces the following matrix:

$$\begin{pmatrix} 0 & 0 & 1 \\ \frac{3}{4} & 0 & \frac{1}{4} \\ \frac{3}{4} & \frac{1}{4} & 0 \end{pmatrix}$$

If all banks met all their liabilities, the net value of all banks can be derived as follows:

$$\begin{pmatrix} 0 & \frac{3}{4} & \frac{3}{4} \\ 0 & 0 & \frac{1}{4} \\ 1 & \frac{1}{4} & 0 \end{pmatrix} \begin{pmatrix} 2 \\ 4 \\ 4 \end{pmatrix} + \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} - \begin{pmatrix} 2 \\ 4 \\ 4 \end{pmatrix} = \begin{pmatrix} 5 \\ -2 \\ 0 \end{pmatrix}$$

Note that it is necessary in the above calculation to transpose the normalized liabilities matrix in order to calculate each bank's income from interbank transactions. Assuming that all banks meet all their obligations, we arrive at a negative value for bank 2; in other words, this bank would be insolvent. Let us

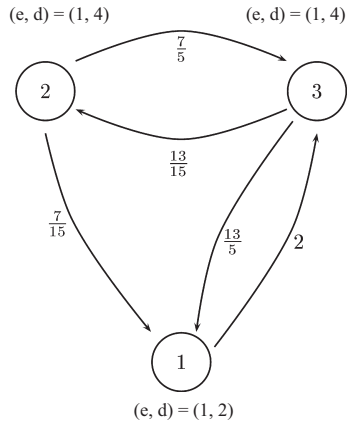
assume therefore that the debt owed to bank 1 and bank 2 is serviced proportionately, while these two banks meet all their obligations. We thus arrive at the following:

$$\begin{pmatrix} 0 & \frac{3}{4} & \frac{3}{4} \\ 0 & 0 & \frac{1}{4} \\ 1 & \frac{1}{4} & 0 \end{pmatrix} \begin{pmatrix} 2 \\ 2 \\ 4 \end{pmatrix} + \begin{pmatrix} 1 \\ 1 \\ 1 \end{pmatrix} - \begin{pmatrix} 2 \\ 2 \\ 4 \end{pmatrix} = \begin{pmatrix} \frac{7}{2} \\ -2 \\ -\frac{1}{2} \end{pmatrix}$$

The insolvency of bank 2 results in an interesting consequence. It reduces the interbank claims of bank 3 to such an extent that bank 3 fails to meet its obligations. Subsequently, bank 3 defaults as well. Triggering a *chain reaction,* the insolvency of bank 2 results in the insolvency of bank 3.

When we repeat the insolvency resolution rule of this example through proportionate debt servicing, we arrive at a payment vector which makes all claims consistent. In our case, this payment flow reads $p^* = (2.28, 15.52, 15)$. It is evident from this vector that bank 2 and bank 3 are insolvent. We can furthermore infer how big their defaults are. In addition, the method used for calculating this solution reveals that the insolvency of bank 2 triggers the insolvency of bank 3. Figure 3 demonstrates the consistent payment flows.

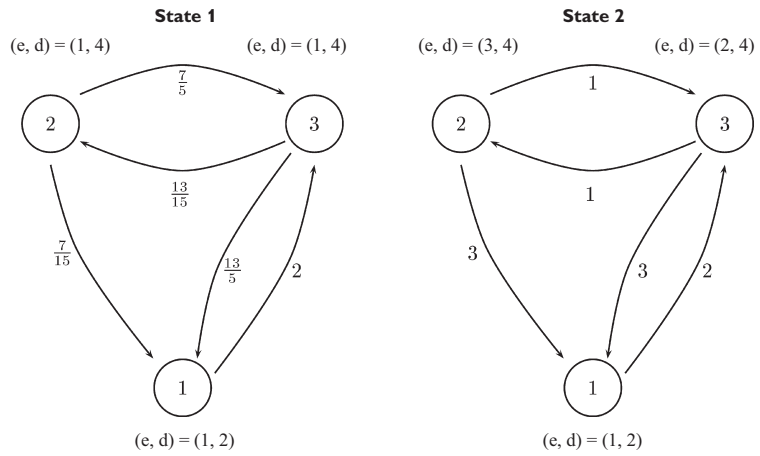
Figure 3



Eisenberg and Noe (2001) proved that this example may be generalized. It is in particular possible to show that vectors making reciprocal claims consistent, so-called clearing payment vectors, always exist. Moreover, these vectors are unique under very weak regularity assumptions about the network. The algorithm used in the example to calculate the vector converges after a finite number of steps, namely at the most after as many steps as there are banks in the system.

This outcome enables us to perform a *scenario analysis* since we know that there is a unique clearing vector for each state of the world. We collect the bank balance sheet data for a given oberservation date and then identify L and e. Subsequently, we define states of the world for a clearing date in the future, say, in one year's time. For each scenario, the network model determines the payment

Figure 4



flows and thus the default frequencies, the loss given default and the contagious insolvencies. Using the relative frequencies of the individual events across the various scenarios, we may then conduct probability estimations. Figure 4 illustrates this method for the above example.

Estimation of Bilateral Interbank Liabilities

The bank balance sheet data reported monthly to the OeNB show both the claims and the liabilities vis-à-vis other banks. This facilitates our analysis of the data; the information does not, however, provide much insight into the structure of *bilateral* claims and liabilities. According to the reporting requirements, banks must break down interbank claims and liabilities also by joint stock banks, savings banks, state mortgage banks, Raiffeisen credit cooperatives, building and loan associations, Volksbank credit cooperatives, special purpose banks, foreign banks and the OeNB. In sectors with one or two tiers of central institutions, i.e. the savings bank, Raiffeisen and Volksbank sectors, banks furthermore must indicate claims and liabilities positions vis-à-vis the central institution. Since the interbank liabilities of the bulk of Raiffeisen credit cooperatives, savings banks and Volksbank credit cooperatives are almost exclusively vis-à-vis the central institution, we can observe some 80% of the entries in matrix L directly from the data. To arrive at the remaining entries, we apply a specific estimation method.

To illustrate this method, let us take another look at our example. In the light of the available data, it is not possible to fill out the entire matrix L. From the data, we know the row and column totals for the individual sectoral subgroups. We also know that the diagonal must be zero. We derive individual entries based on what we know about the positions banks hold vis-à-vis the respective central institution. As many banks have only one interbank position, namely that against the central institution of their sector, it is clear from the sectoral row and column totals that the remaining row and column entries must be zero. In our example, we make the following observation for the matrix L:

	1	2	3	
1	0	x	x	2
2	x	0	x	4
3	x	x	0	4
	6	1	3	10

As is evident from this table, we know the column and row totals as well as the diagonal entries. We cannot as yet say anything about the other entries.

This problem of reconstructing data from tables is a frequent problem in applied mathematics and occurs in various contexts. The best known example from the field of economics is the calculation of the input-output table. In that case, the new table must be estimated based on the previous input-output table and current aggregated information.

The method we use to this end is called *entropy optimization*. This method attempts to distribute the mass of the row and column totals in such a way across the cells that the sum conditions are fulfilled and that as much consistency as possible is preserved with the a priori information about the unknown cell entries. For a more in-depth description of the formal details, see Elsinger, Lehar and Summer (2002). In this illustration, we only show the result this method generates for the matrix in our example.

$$L = \begin{pmatrix} 0 & 0.443637 & 1.55456 \\ 2.55452 & 0 & 1.445441 \\ 3.44548 & 0.556363 & 0 \end{pmatrix}$$

In contrast to the given example the data derived from the monthly bank balance sheet data are not consistent. This is not surprising since the accounting identities are not exact, as reporting institutions may interpret items differently, make mistakes, etc. To estimate the matrix, it is of course necessary to strictly adhere to these identities, since it must not make any difference in which order we add up the matrix entries. At present, we are testing various methods to cope with these discrepancies. For the calculation presented in this study, we introduced a fictitious bank into each sector to account for any discrepancies in the accounting identities.

The Creation of Scenarios

The scenarios we use are created by exposing various balance sheet items to risk factors. In each scenario banks face gains and losses derived from market and credit risks. While shocks which affect all non-interbank balance sheet items are exogenous, the interbank credit risk is modeled endogenously using the network model. Table 1 shows the balance sheet items and illustrates which risks the individual items are exposed to in our analysis.

We choose a standard risk management framework to model exogenous shocks. We use historical simulation to model scenario losses and gains that derive from market risks and a credit risk model to capture losses from loans to nonbanks. For historical simulations, past realizations of interest, foreign

Table 1

Risk of Balance Sheet Items

	Interest rate/ stock price risk	Credit risk	FX risk
Assets			
Short-term government bonds and receivables	yes[1])	no	yes[1])
Loans to other banks	yes[1])	endogenous in the network model	yes[1])
Loans to nonbanks	yes [1])	credit risk model	yes[1])
Bonds	yes[1])	no[2])	yes[1])
Equity	yes[1])	no	yes[1])
Other assets	no	no	no
Liabilities			
Liabilities to other banks	yes[1])	endogenous in the network model	yes[1])
Liabilities to nonbanks	yes[1])	no	yes[1])
Securitized liabilities	yes[1])	no	yes[1])
Other liabilities	no	no	no

[1]) *Historical simulation.*
[2]) *Primarily general government.*

exchange rates and stock prices are treated as an empirical distribution from which market scenarios are created. This method calls for a number of implicit considerations and the use of several approximations since not all the information can be read directly from the monthly return data. This applies, for instance, to estimations of changes in the term structure. For a more in-depth description, see Elsinger, Lehar and Summer (2002).

While we may use time series from Datastream for market risk data, this is not possible for modeling credit defaults. For this reason we attempt to capture loan losses via a standard credit risk model. In our analysis, we use CreditRisk+ (Credit Suisse, 1997). Since we are dealing with a system of credit portfolios and not just with the credit portfolio of a single bank, we have to adapt this model.

In simplified terms, the credit risk model works as follows: It considers that all banks are affected by both aggregate and idiosyncratic shocks to their credit portfolios. Input as to the average default frequency of each bank's individual credit portfolio and the standard deviation of this frequency need to be fed into the credit risk model. Based on these parameters, we may calculate a *distribution of default losses* for each bank. From this distribution we may in turn deduce the loan losses under each scenario.

We can, of course, only approximate these data. First, we decompose the balance sheet item "claims on nonbanks" in line with the Major Loans Register data into several exposures to industries. Second, we assign the remaining credit volume to a general item. Since we also know the number of large exposures in the individual industries, we have industry-specific information about the number and average volume of loans. On the basis of the credit rating data provided by the Kreditschutzverband of 1870, we may assign an estimated default frequency and its standard deviation to each loan recorded for the various industries. For the remainder of the credit volume which cannot be assigned on the basis of the Major Loans Register information, we deduce approximations from averages of the data available. In this way we can define the necessary parameters for the individual credit portfolios and calculate a distribution of default losses for each bank. The distribution then yields default loss scenarios.

For an in-depth description of the formal details, see Elsinger, Lehar and Summer (2002).

As a next step, scenarios may be generated by combining historical simulation and the credit risk model. Under each scenario the network model determines the impact of the shocks on the possible interbank payments.

Results for Austria

The results presented here derive from a model calculation for the observation date September 2001. We generated 10,000 scenarios for this calculation and attained the following outcome.

Default frequencies

Table 2 shows various quantiles of the probabilities of default resulting from the model calculation. For each of the 908 banks in our data set, the probability of default is calculated for the 10,000 simulation scenarios. After that the banks are sorted by their probability of default in an ascending order. From this we compute the measures shown in table 2. The last row refers, for instance, to the entire banking system. In the column "10% quantile" we see that the probability of default of the "best" 10% of banks comes to 0%. In other words, these banks do not default under any of the 10,000 scenarios. According to the column "Median," 50% of banks default in fewer than 0.73% of the scenarios. The right-most column "90% quantile" shows that the probability of default of only 10% of the banks is higher than 5.52%. Table 2 also indicates these measures for the individual sectors. All in all, it is evident that a predominant share of the banks is very sound.

Table 2

Probability of Default by Sectors

	10% quantile	median	90% quantile
	%		
Joint stock banks	0.00	0.06	2.39
Savings banks	0.00	0.19	2.34
State mortgage banks	0.00	0.17	0.61
Raiffeisen credit cooperatives	0.09	0.98	6.33
Volksbank credit cooperatives	0.12	0.48	7.16
Building and loan associations	1.21	3.35	7.18
Special purpose banks	0.00	0.00	0.61
Entire banking system	0.00	0.73	5.52

Source: OeNB, authors' calculations.

Severity of losses

When assessing credit risk, it is, of course, not only important to determine default frequencies, but also the severity of losses. The network model produces endogenous recovery rates. We calculate for each bank the share of debt it could still service in the case of default. We then average these shares for each bank and sort the results in ascending order. Let us again look at the last row, which refers to the entire banking system (see table 3). For 10% of the defaulting banks the recovery rate amounts to zero, while on average 50% of the banks would, in case of default, be only be able to meet less than 53.31% of their interbank obligations. Finally, the recovery rate of 10% of the banks exceeds 90.8%. Table 3 also shows the recovery rates per sector.

Table 3

Recovery Rates by Sectors

	10% quantile	median	90% quantile
	in %		
Joint stock banks	0.00	57.80	92.30
Savings banks	24.45	78.03	92.90
State mortgage banks	34.31	42.70	87.06
Raiffeisen credit cooperatives	0.00	51.42	90.35
Volksbank credit cooperatives	1.46	53.74	85.94
Building and loan associations	0.00	0.00	25.79
Special purpose banks	0.00	2.64	98.12
Entire banking system	0.00	53.31	90.80

Source: OeNB, authors' calculations.

Systemic stability

A regulator who needs to assess the risk of banks at the system level may learn several interesting details from the simulation results. Banks may default as a direct consequence of shocks (fundamental insolvencies), but also due to a chain reaction, i.e. because other banks defaulted in the first place. The algorithm we use to compute the clearing vector allows us to distinguish between these two types of insolvencies.

Fundamental insolvencies manifest themselves in the fact that the first iteration of the procedure produces a negative value for the bank. Banks for which the value turns negative only in further iterations default following the insolvency of other institutions in the system. The latter cases may be regarded as insolvencies caused by chain reactions (contagious insolvencies). Banking supervision which focuses on the individual institutions fails to detect such risks.

Table 4 presents the results of the simulation calculation. The value 0.075 in the row "11–20" and the column "1–10" shows e.g. that for between 11 and

Table 4

Fundamental and Contagious Insolvencies

Number of fundamental insolvencies	Contagious insolvencies				
	0	1–10	11–20	21–30	over 31
	%				
1–10	11.784	0.011	0.000	0.000	0.000
11–20	46.877	0.075	0.000	0.000	0.000
21–30	17.557	0.022	0.000	0.000	0.000
31–40	7.838	0.097	0.000	0.000	0.000
41–50	4.795	0.054	0.000	0.000	0.000
51–60	2.441	0.183	0.000	0.000	0.000
61–70	1.484	0.215	0.000	0.000	0.000
71–80	1.365	0.204	0.000	0.000	0.000
81–90	0.892	0.215	0.000	0.000	0.000
91–100	0.516	0.237	0.011	0.000	0.000
101–110	0.398	0.151	0.000	0.000	0.000
111–120	0.204	0.172	0.011	0.000	0.000
121–130	0.065	0.108	0.022	0.000	0.000
131–140	0.194	0.097	0.032	0.000	0.000
141–150	0.323	0.065	0.000	0.000	0.000
151–160	0.258	0.065	0.011	0.022	0.000
161–170	0.065	0.065	0.000	0.000	0.000
171–180	0.108	0.000	0.000	0.032	0.011
over 180	0.183	0.290	0.043	0.140	0.097
Total	97.345	2.322	0.129	0.194	0.108

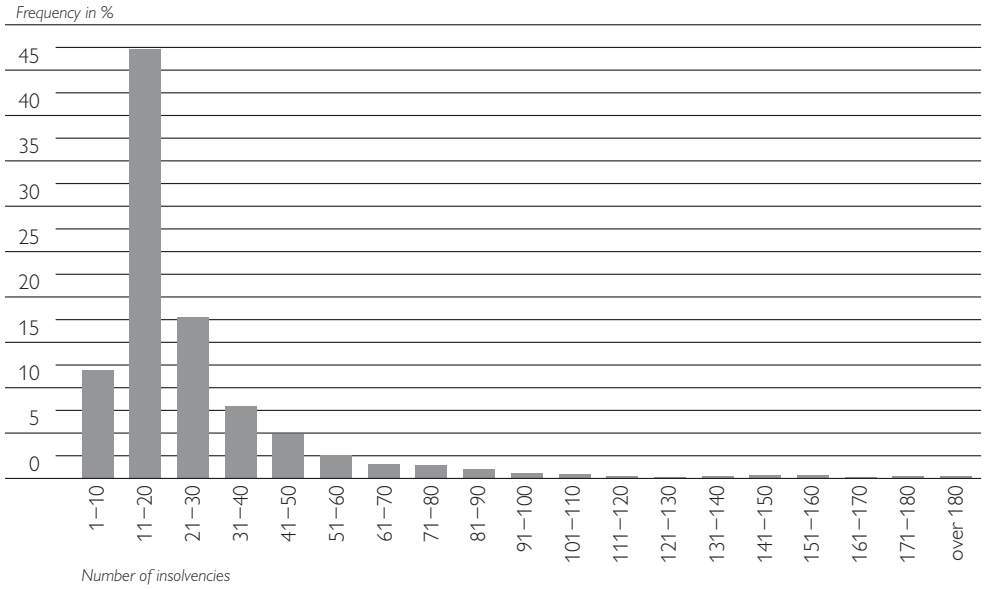
Source: OeNB, authors' calculations.

20 banks the probability to default because of a shock and in turn cause 1 to 10 banks to default is 0.075%. The last row of the table reveals that the bulk of all insolvencies, namely 97%, may be classified as fundamental, and only a small share, 3% to be precise, may be ascribed to contagion in the system.

The first column of table 4, giving the number of fundamental insolvencies, may also be shown in a histogram (see figure 5). When we look at the frequency of bank insolvencies under all scenarios, we see that a larger banking crisis is highly unlikely.

Figure 5

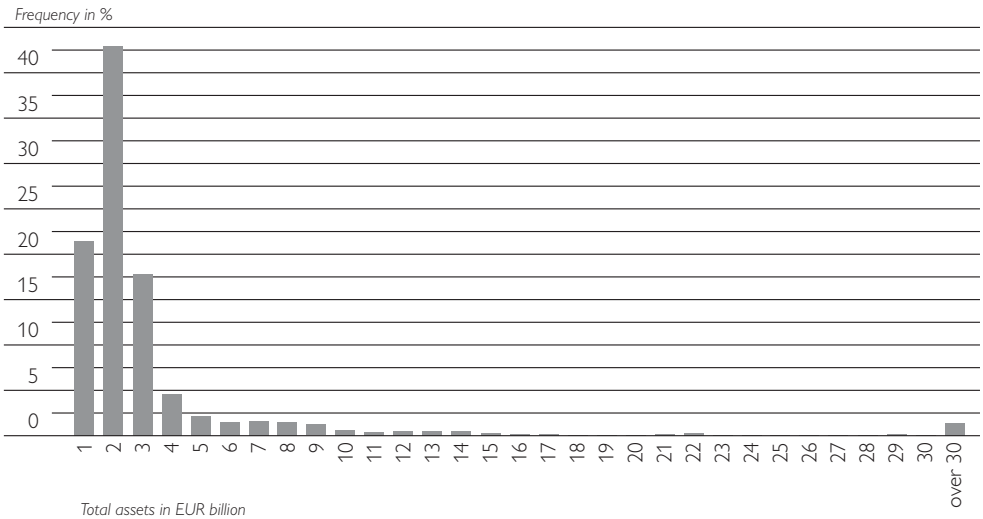
Fundamental Insolvencies



Source: OeNB, authors' calculations.

Figure 6

Bank Insolvencies by Total Assets



Source: OeNB, authors' calculations.

Figure 5 does, however, not indicate the size of the insolvent banks. It could be much more problematic for a banking system if only a few major banks become insolvent than if many smaller banks default. To analyze this question, we finally calculate the size of the balance sheets of all insolvent banks under each scenario. According to figure 6, the balance sheets of the insolvent banks are relatively small; smaller banks thus have a comparatively higher probability of default.

Concluding Remarks

We have presented a new approach to assessing the risk of interbank loans and applied it to a set of Austrian bank data. The approach is innovative in so far as risk is assessed at the system level instead of the level of individual institutions and that it demonstrates how the data sources usually available to central banks may be used to this effect. The advantages of such an approach are threefold.

First, assessment at the system level uncovers the exposure to aggregate risks which traditional banking supervision, focusing on the individual institutions, fails to detect and account for. The method allows for a distinction between risks emanating from fundamental shocks and risks resulting from the threat of chain reactions. Second, our approach may help redirect the debate about regulatory issues, which currently centers on the refinement of capital adequacy provisions, to the more fundamental question of risk allocation in the overall economy and specifically the question of which share of aggregate risk is actually borne by the banking system. Our model could further this discussion in particular because it lends itself to the analysis of many if-then scenarios. Last but not least the model is designed to draw as much as possible on existing data sources. Even though such data might not be perfect, we hope that our work shows that systemic risk assessment is feasible. As we go along, experience is likely to help us pinpoint the truly essential information for assessing the stability of the banking system.

We hope that these ideas will benefit regulators and central bankers by pointing out ways how to use existing data sources to analyze systemic risks. Furthermore, we hope our work will make a valuable contribution to the academic debate about a system approach to banking supervision.

References

Credit Suisse (1997). CreditRisk+: A Credit Risk Management Framework. Credit Suisse Financial Products.

Elsinger, H., Lehar, A. and Summer, M. (2002). The Risk of Interbank Credits: A New Approach to the Assessment of Systemic Risk. Working Paper (forthcoming).

Eisenberg, L. and Noe, T. (2001). Systemic Risk in Financial Systems. In: Management Science, 47, 236–249.

Hellwig, M. (1997). Systemische Risiken im Finanzsektor. In: Duwendag, D. (eds.), Finanzmärkte im Spannungsfeld von Globalisierung, Regulierung und Geldpolitik. Duncker & Humblot, Berlin.

Determinants of Initial Public Offerings: A European Time-Series Cross-Section Analysis

Luise Breinlinger,
Evgenia Glogova

1 Introduction

With the financial systems of continental European countries traditionally dominated by banks mainly for institutional reasons, debt financing has been playing a more prominent role than equity finance, causing the debt-to-equity ratios to be relatively high. The capital structure of a firm, in turn, influences its probability of default: higher leverage increases bankruptcy risk. Since a company tends to reduce its leverage when going public, as evidenced by a number of empirical studies for European countries (see, among others, Pagano et al., 1998), initial public offerings (IPOs) might be seen as reducing bankruptcy risk as they increase the equity ratio and reduce leverage. This reduction in bankruptcy risk, especially in combination with a potential systemic relevance of corporations going public, may have a positive effect on aggregate financial stability, given that banks benefit from lower credit risks and firms may gain more room for maneuver insofar as the money raised should theoretically enable them to optimize their business strategies under fewer restrictions than before. Most research carried out to date on IPO-related issues was devoted to the underpricing and underperformance of stocks issued. Relatively little – notably empirical – work, however, has been done to establish why and when companies go public, and what consequences public offerings typically have (a differentiation difficult to make). Given the considerable implications IPOs have for many internal and external company issues (the tendency to reduce leverage being only one, though the critical example for this work) this is particularly surprising. Moreover, many of the studies that have been undertaken were related to the U.S. market. Therefore, the mostly very different IPO cultures in Europe deserve further investigation.

A detailed discussion at the micro (individual firm) level was undertaken by Pagano et al. (1998), who investigated a comprehensive data set of Italian companies. The authors infer determinants of the decision to go public from corporate characteristics ("ex ante influences") as well as from the consequences public offerings have for investment and financial behavior. For independent companies (as opposed to carve-outs), they find the most important determinants of IPOs to be, first, company size (the larger the company, the higher the probability) and, second, the industry market-to-book ratio (which measures the stock market valuation of firms in a given industry for their shareholders). A typical Italian company launching an IPO is eight times as large and six times as old as a U.S. firm. With respect to consequences for investment and financial behavior, the authors' main conclusions about Italian IPOs are as follows: going public makes borrowing cheaper, and corporations use IPOs to rebalance their accounts after a period of high investment and growth rather than to finance subsequent investment and growth. In the United States, in contrast, companies usually undergo a considerable growth process after listing.

There are also relatively few papers which, even as an aside, undertake a macroeconomic analysis of factors that may prompt a company to going public, one example being the work by Loughran et al. (1994). This article reviews the timing of IPOs by analyzing data from 15 countries and modeling the number of issues in relation to inflation-adjusted stock price indexes as well as gross national product (GNP) growth rates. The results exhibit a positive relationship between IPO activity and stock price levels, but no correlation with business

cycle movements. Another study on cross-country data was carried out by Rydqvist and Högholm (1995). The authors use data from 11 European countries for the period 1980 to 1989 (in the case of Sweden, for the period 1970 to 1991), regressing the number of IPOs separately on, inter alia, GNP growth rates and relative changes in the stock price level. They find unlagged stock price returns to have significant explanatory power for IPOs. In contrast, GNP growth appears to demonstrate no significant explanatory power for IPO activity across the whole European sample. Mirroring the findings mentioned above, further results show that the average European firm going public is quite old (more than 40 years for the sample analyzed), and that IPOs are made mainly because the original stockholders wish to reallocate their portfolios and not because they have investment or growth intentions. Empirical results for Germany (Ljungqvist, 1995) suggest that high IPO frequencies are positively associated with both high stock index levels and good business conditions and tend to follow phases of extensive IPO underpricing. Rees (1997), concentrating on UK data, also examines the incentives for going public. The results again suggest that both the number and value of IPOs are significantly positively associated with the level of the stock market, the introduction of the Unlisted Securities Market in Great Britain, and, in the case of the number of IPOs, significantly positively associated with a business cycle indicator. No significant link is apparent between the number of IPOs and interest rates.

This paper intends to study the explanatory power of selected macroeconomic factors for IPOs. As the analysis is aimed at identifying IPO patterns in continental European economies, the sample area is limited to that region. We focus on a data set of annual observations of IPO volumes for six continental European countries over a period of 18 years (1980 to 1997). Due to the structural changes seen at European stock markets over the past few years, we decided not to extend our sample period beyond 1997. With investors continuing to rush into stocks despite inflated stock valuations and companies adapting their fund-raising behavior consequently, followed by scenarios of heavy price erosion, loss of investor confidence and finally (as one unavoidable consequence) readaption of IPO patterns, the past few years are likely to be viewed as a transition period. We think that analyses of the most recent, in a sense, consolidated period might deliver helpful indications for the next more stable state to come. Even though we are fully aware that any attempt at a final analysis will have to combine results from both micro- and macroeconomic considerations, we explicitly excluded microeconomic aspects in order to keep the problem formulation manageable. Concerning the composition of the data set no previous paper has, to our knowledge, used either a homogeneous cross-country data set or cross-country IPO volume data. We consider both criteria to be important and have therefore tried to incorporate them accordingly. After all, homogeneity is a precondition for pooling data across the countries included in the sample. And unlike IPO numbers, IPO volumes (being monetary data) can appropriately reflect the extent to which the primary market was actually tapped – information that cannot be simply deduced from the number of IPOs. This study applies panel data analysis, which can be expected to be an appropriate statistical approach given existing database features. Overall, we analyze the explanatory power of the following macroeconomic factors for national annual

IPO volumes: stock index returns, changes in savings deposits, gross domestic product (GDP) growth and interest rates.

The principal results obtained in this paper are: For stock index returns, all pooled procedures yield significantly positive parameter estimates, while individual country regressions working with untransformed IPO volumes tend not to generate significant parameter estimates. In contrast, logarithmic transformation of IPO volumes leads to persistently significant estimates for both pooled and individual country regressions. Across all specifications tested, neither savings deposit changes nor GDP growth are found to exhibit any significant influence on IPO volumes. Interest rates do not perceivably influence demand for raising equity through IPOs, either.

The rest of this paper is structured as follows: Section 2 describes the data set we use, specifies the models evaluated and sketches the applied methodology. Section 3 presents the empirical results, analyzes and interprets them, and section 4 concludes.

2 Data Set, Model Specifications and Applied Methodology

2.1 Data Set

The following table gives an overview of the variables used for our analyses:

Dependent Variable: Annual IPO Volumes (First Differences or ln)			
Explantory Variables	Data Sources	Calculation	Expected Sign
stock index return	IFS and MEI	annual growth rates (using yearly closing dates)	+
% change savings			–
% change GDP			+
interest rates		ten-year government bond yields	+

IPO data: The IPO data underlying the empirical analysis undertaken in this paper are national annual volume figures denominated in the respective local currency. National volumes are defined here as a product of the first listed price times the number of stocks included in the IPO, summed up across all IPOs per country and year. We obtained these data for six continental European states (Austria, Belgium, Denmark, Finland, France, and the Netherlands) over a time period of 18 years (1980 to 1997) from the main stock exchange in each of the above countries. The macroeconomic factors used as explanatory variables (stock index returns, changes in savings deposits, GDP growth and interest rates) as well as exchange rates were taken from the International Financial Statistics (IFS) and the Main Economic Indicators (MEI) databases. Stock index returns, changes in savings deposits and changes in GDP are calculated as annual growth rates by reference to yearly closing dates, with the U.S. dollar used as numeraire. As the annual evolution of the time series should not be distorted by DC/USD_{it} (exchange rate of the domestic currency of country i against the U.S. dollar for period t) exchange rate fluctuations, we calculate the average value of the DC/USD_{it} exchange rates over the whole observation period and apply the result (DC/USD_i) as a conversion factor (which is constant for each country and thus preserves the required continuity).

Stock index return: In the context of IPOs, stock index levels and stock index returns (unlike savings deposits) are among the most frequently analysed explanatory variables. The results obtained for stock index levels and stock index returns in previous studies seem to concur in that they all detect a significantly positive influence of stock index levels (see, for example, Loughran et al., 1994; Ljungqvist, 1995; and Rees, 1997) and stock index returns (see, for instance, Rydqvist and Högholm, 1995) on the number of IPOs. Rees (1997), who also includes monetary values, likewise finds these factors to have a significantly positive influence on the volume of IPOs. The approach of Pagano et al. (1998) differs from the above studies in that, among other things, they analyze the probability of IPOs at the micro level and use industry-specific indicators, including the relationship between industry market value to book value as an explanatory variable. They find this relationship to have a significantly positive effect on the probability of IPOs. Preliminary analyses carried out in the context of this paper, however, generated ambivalent results in that, unlike previous studies, they did not identify an unambiguously significant dependence of IPO volumes on stock index returns. Thus the question arose whether we were about to produce results partly contradicting previous papers or whether previous investigations had not taken into account certain functional and interactive aspects, the nonconsideration of which might cause unstable results. Following a closer examination, we defined the problem outline as follows: If one assumes that companies make the timing of their IPOs dependent on the level of the national stock index (in order to maximize the value they obtain for their stocks), then the actors' behavior exactly fits the empirically established significantly positive influence of stock index levels on IPO activity. From a demand-side perspective one might, alternatively, assume that stock market returns have a positive effect on IPO volumes on the grounds that higher profit potentials in the form of higher returns should induce increased buying interest. Closer examination reveals that successful efforts to optimally time an IPO with respect to the stock price are not compatible with a significantly positive homogeneous parameter across all stock price levels for stock index returns. This can most clearly be seen from the fact that price-maximizing behavior causes many IPOs to be launched during stock market highs, when stock price returns have decreased dramatically already or even turned negative. And even for those stock price levels which exhibit a positive influence of stock price returns on IPO volumes, this effect will be much weaker for low stock price levels than for high ones. Considering the need for problem segmentation, the question we want to address here is: are there stable indications that yearly IPO volumes depend on stock index returns for what we call consolidated periods, i.e. periods not characterized by extreme (positive or negative) market sentiments?

Changes in savings deposits: Percentage changes in savings deposits are included as an explanatory variable in order to identify possible flows of funds between savings deposits and investment in stocks (in this context, investment in IPOs), and to establish whether a reduction in one of the aggregates is accompanied by an increase in the other. Savings deposits themselves could be used as an indicator of monetary assets potentially available for alternative purposes (e.g., for investment in stocks). This idea addresses the nature of savings deposits as a reservoir that can be tapped for new investment. The higher these liquid

reserves, the more reasonable it will be to assume that some part will be made available for new uses, in this case for investment in stocks; in other words, savings deposits are an indicator of potential. But as untransformed savings deposits are not stationary, they have to be transformed accordingly – in this paper into percentage changes in savings deposits. To our knowledge, our analysis is the first to consider savings deposits as a possible explanatory variable for IPO volumes.

GDP growth: At first sight, previous investigations show no consistent results regarding the explanatory power of GDP and GNP growth for IPOs. On closer inspection, research results are divergent only when analyses of short-term GDP and GNP growth rates are compared with analyses of long-term GDP growth or absolute level figures. The research done by Loughran et al. (1994) and by Rydqvist and Högholm (1995) falls into the former category. Both articles analyze the influence of GNP growth rates on the number of IPOs, but do not find any significant influence. The paper of La Porta et al. (1997) falls into the latter category. Although the authors are more interested in the influence of economic conditions (as expressed in the respective legal systems) on the numbers of IPOs than in the influence of GDP per inhabitant, the findings in their cross-sectional study are interesting in this context. They show that the quality of law enforcement, which is highly correlated with the level of GDP per capita, has a strong positive effect on the number of IPOs. In addition, the authors identify a statistically significant influence of long-term GDP growth rates, i.e. average annual percentage growth of per capita GDP for the period 1970 to 1993, on IPOs. Complementary to these existing empirical results (suggesting a positive influence of both long-term GDP growth and GDP level on IPOs while not having identified any impact of short-term growth) we want to test the explanatory power of short-term GDP growth rates for IPO volumes for our sample. As we do not carry out a cross-sectional analysis with a sufficiently high number of cross-sectional units, we had to refrain from dealing with long-term GDP growth or with GDP levels as explanatory variables.

Interest rates: Interest rates used are ten-year government bond yields, the average of 12 monthly observations in order to give a representative indication of debt financing costs. As this information was not available for Finland, we considered the Finland Base Middle Rate instead. But on closer examination and when comparing the Finland Base Middle Rate with the Finland Interbank Fixing 3M Offered Rate as a sort of control measure, we found the latter lying up to 900 basis points above the former during the late 1980s and at the beginning of the 1990s before the two time series started converging from 1993 on. Therefore, the Finnish data available for interest rate analyses are – obviously partly due to the Finnish banking crisis – not appropriate. Thus, we eventually had to remove Finland from the data set for the interest rate analyses, although it might have been interesting to further investigate the years with extremely high divergences between the Finland Base Middle Rate and the Finland Interbank Fixing 3M Offered Rate, as the highest (out-of-sample period) Finnish IPO activity falls into this period.

2.2 Model Specifications

The models for which estimation results are presented in this paper are specified as follows:

$$IPO_{it} = \alpha + \beta_1 IPO_{it-1} + \beta_2 SR_{it-1} + \beta_3 SG_{it-1} + \beta_4 GDPG_{it} + u_{it} \qquad I$$

Where the variables are defined as stated below (for u_{it} see section 2.3):
$IPO_{it} = (\sum_{j=1}^{p} FLP_j * NB_j)$ (million) $*DC/USD_i$
j = index of IPOs for country i in period t
p = number of IPOs in country i for period t
FLP_j = first listed price of IPO j
NB_j = number of stocks of IPO j

$SR_{it} = \frac{SP_{it} - SP_{it-1}}{SP_{it-1}} * 100$
with: SP_{it} = overall stock price index of country i for period t

$SG_{it} = \frac{SD_{it} - SD_{it-1}}{SD_{it-1}} * 100$
with: SD_{it} = amount of savings deposits in country i for period t

$GDPG_{it} = \frac{GDP_{it} - GDP_{it-1}}{GDP_{it-1}} * 100$
with: GDP_{it} = gross domestic product of country i for period t (million)

We also test this model formulation by taking first differences, as the IPO series is not unambiguously stationary whereas first differences of IPOs are. Therefore, estimations are carried out for both alternatives.

$$ln\left(\frac{IPO_{it}}{GDP_{it}}\% * 100\right) = \alpha + \beta_1 ln\left(\frac{IPO_{it-1}}{GDP_{it-1}}\% * 100\right) + \beta_2 SR_{it-1} + \\ + \beta_3 SG_{it-1} + \beta_4 GDPG_{it} + u_{it} \qquad II$$

The idea behind the model II specification was, first, to put IPO volumes into proportion with GDP so that country-specific effects do not have to absorb differences in IPO volumes resulting from the varying sizes of the economies included in the sample. And second, we wanted to investigate our assumption that a nonlinear (specifically a logarithmic) relationship could possibly better model any dependence of IPO volumes on included independent variables than a linear one. Model II is tested with and without including the first lag of the dependent variable as an explaining variable. Zero observations on IPO volumes were approximated by replacing $ln\left(\frac{IPO_{it}}{GDP_{it}}\% * 100\right) = 0$ with 0.00001 and, alternatively (to make a sensitivity check), with 0.0000001 – an approximation which we consider to be economically negligible.

$$\Delta IPO_{it} = \alpha + \beta_1 GBY_{it} + u_{it} \qquad III$$

with: GBY_{it} = government bond yield for country i in period t per cent

As we had to exclude Finland from the sample set (see section 2.1), analyses for interest rates were carried out separately from the investigations under equations I and II in order to avoid unnecessary downsizing of our overall sample size.

2.3 Methodology

To estimate the model coefficients we used a panel data approach. In the following we briefly discuss the methodological aspects relevant for the investigations carried out in this paper. Equation (1) represents a basic model for panel data regressions which has to be specified and modified into different directions depending on the data set investigated and on the purpose of the respective analysis:

$$y_{it} = \alpha + x_{it}^T \beta + u_{it} \qquad i = 1, ..., N;\ t = 1, ..., T \qquad (1)$$

with i identifying cross-sectional units and t denoting time periods or time points. α should be a scalar, β a $K \times 1$ vector, x_{it} the it-th observation vector on K explanatory variables, and u_{it} the random error term (for the following see Baltagi, 2001; Hsiao, 1990). For economic research, panel data sets are very valuable and have several important advantages over conventional cross-sectional or time-series data sets: They provide a large number of data points, which helps to improve the efficiency of econometric estimates as degrees of freedom are increased and collinearities between explaining variables are reduced. Panel data also allow to study important economic issues that may be difficult or impossible to analyze exclusively on the basis of cross-sectional or time-series data sets (e.g., dynamic effects, precise estimates of dynamic coefficients, to better control for the effects of missing or unobserved variables).

One possibility to take account of heterogeneity across cross-sectional units and/or through time is to use variable-intercept models. The main assumption underlying variable-intercept models in general is that, conditional on the observed explanatory variables, the effects of all omitted (or excluded) variables are driven by three types of variables: individual-variant time-invariant, individual-invariant time-variant, and individual-variant time-variant variables.[1])

One-way error component models: The first generalization of a constant-intercept constant-slope model for panel data is to either introduce dummy variables to account for those omitted variables that are specific to individual cross-sectional units but stay constant over time, or to introduce dummy variables for the effects that are specific to each time period but are the same for all cross-sectional units at a given point in time – thereby forming a variable-intercept model with a one-way error component. The illustrations presented in the following are focused on individual-specific (in this context, country-specific) effects, though equally applicable to time-specific effects. The model therefore can be formulated as

$$\begin{bmatrix} y_1 \\ : \\ : \\ y_N \end{bmatrix} = \begin{bmatrix} e_T \\ 0 \\ : \\ 0 \end{bmatrix} \alpha_1^* + \begin{bmatrix} 0 \\ e_T \\ : \\ 0 \end{bmatrix} \alpha_2^* + ... + \begin{bmatrix} 0 \\ 0 \\ : \\ e_T \end{bmatrix} \alpha_N^* + \begin{bmatrix} X_1 \\ X_2 \\ : \\ X_N \end{bmatrix} \beta + \begin{bmatrix} v_1 \\ : \\ : \\ v_N \end{bmatrix}$$

1 *If the assumption that regression parameters take the same values for all cross-sectional units in all time periods, as it would be in the case of a single (constant) parameter pair (α, β), is not valid, the pooled least-squares estimates may lead to false inferences. Thus, in a first step, we had to test whether / which parameters characterizing the random outcome of variable y stay constant across all i and t. For a detailed description of the tests to be carried out on data poolability we refer to Hsiao (1990).*

$$\text{where } y_i = \begin{bmatrix} y_{i1} \\ y_{i2} \\ : \\ y_{iT} \end{bmatrix}; \quad X_i = \begin{bmatrix} x_{1i1} & x_{2i1} & ... & x_{Ki1} \\ x_{1i2} & x_{2i2} & ... & x_{Ki2} \\ : & : & ... & : \\ x_{1iT} & x_{2iT} & ... & x_{KiT} \end{bmatrix}; \; i = 1, ..., N. \quad (2)$$

Furthermore, $v_i^T = (v_{i1}, ..., v_{iT})$, $\mathrm{E}v_i = 0$, $\mathrm{E}v_i v_i^T = \sigma_v^2 I_T$, and $E\mathbf{v}_i v_j = 0$ if $i \neq j$. I_T should denote the T x T identity matrix and e_T is a vector of ones of dimension T. In addition, we have $\alpha_i^* = \alpha + \mu_i$, a 1 x 1 constant scalar. The error term v_{it} comprises the effects of omitted variables that are characteristic to both the individual units and time periods and can be represented by an IID random variable with mean zero and variance σ_v^2. Model (2) is also known as the analysis of covariance model. Given the above stated properties of $\mathbf{v}_{it}$, it is known that the ordinary-least-squares (OLS) estimator of (2) is the best linear unbiased estimator. The OLS estimators of α_i^* and β are:

$$\hat{\beta}_{CV} = \left[\sum_{i=1}^{N} \sum_{t=1}^{T} (x_{it} - \bar{x}_i)(x_{it} - \bar{x}_i)^T \right]^{-1} \left[\sum_{i=1}^{N} \sum_{t=1}^{T} (x_{it} - \bar{x}_i)(y_{it} - \bar{y}_i) \right] \quad (3)$$

$$\hat{\alpha}_i^* = \bar{y}_i - \beta^T \bar{\mathbf{x}}_i \quad i = 1, ..., N; T = 1, ..., T \quad (4)$$

where $\bar{y}_i = \frac{1}{T} \sum_{t=1}^{T} y_{it}$ and $\bar{x}_i = \frac{1}{T} \sum_{t=1}^{T} x_{it}$.

One can also obtain the least-squares dummy variables (LSDV) estimator from (2) via premultiplying the model by a T x T idempotent transformation matrix Q (in order to eliminate the α_i^* by using $Qe_T\alpha_i^* = 0$): $Qy_i = QX_i\beta + Qv_i$, with $Q = I_T - \frac{1}{T} e_T e_T^T$. Applying OLS to this latter equation leads to

$$\hat{\beta}_{CV} = \left[\sum_{i=1}^{N} X_i^T Q X_i \right]^{-1} \left[\sum_{i=1}^{N} X_i^T Q y_i \right]. \quad (5)$$

As (2) is also named analysis of covariance model, the LSDV estimator of β is sometimes called the covariance estimator – or the within-group estimator, as only the variation within each group is utilized in forming this estimator. The covariance (CV) estimator $\hat{\beta}_{CV}$ is unbiased and also consistent when either N or T or both tend to infinity. Whereas the estimator for the intercept (4), though being unbiased, is consistent only when T$\rightarrow \infty$.

Another possibility of generalization is to include the individual-specific effects as random variables, like v_{it}, assuming that the residual u_{it} can be described by $u_{it} = \mu_i + v_{it}$. Furthermore, $E\mu_i = Ev_{it} = 0$, $E\mu_i v_{it} = 0$, $E\mu_i x_{it}^T = Ev_{it}\, x_{it}^T = 0$, as well as

$$E\mu_i\mu_j = \begin{matrix} \sigma_\mu^2 & \text{if } i = j \\ 0 & \text{if } i \neq j \end{matrix} \quad \text{and} \quad Ev_{it}v_{js} = \begin{matrix} \sigma_v^2 & \text{if } i = j, t = s \\ 0 & \text{otherwise.} \end{matrix}$$

The variance of y_{it} conditional on x_{it} is consequently $\sigma_y^2 = \sigma_\mu^2 + \sigma_v^2$, with the variances σ_μ^2 and σ_v^2 called variance components – the latter also constituting the reason for this kind of model being known as variance-components (or error-components) model. The model specification can then be represented by

$$y_i = Z_i\delta + u_i \qquad i = 1, ..., N \tag{6}$$

where $Z_i = (e_T, X_i), \delta^T = (\alpha, \beta^T), u_i^T = (u_{i1}, ..., u_{iT})$, and $u_{it} = \mu_i + v_{it}$. As the residuals of (6) are correlated (u_{it} and u_{is} both contain μ_i), GLS has to be applied in order to obtain efficient estimates for $\delta^T = (\alpha, \beta^{\mathbf{T}})$. The normal equations for the GLS estimators are given by[1])

$$\left[\sum_{i=1}^{N} Z_i^T \Omega_i^{-1} Z_i\right] \hat{\delta}_{GLS} = \left[\sum_{i=1}^{N} Z_i^T \Omega_i^{-1} y_i\right] \tag{7}$$

Two-way error component models: The next broader generalization are two-way error component models

$$y_{it} = \alpha + x_{it}^T\beta + \mu_i + \lambda_t + v_{it} \qquad i = 1, ..., N; t = 1, ..., T \tag{8}$$

where α is a constant, μ_i an unobserved individual effect, λ_t an unobserved time effect, v_{it} an unobserved remainder, and u_{it} (as it will be used later) $= \mu_i + \lambda_t + v_{it}$. First we assume that μ_i and λ_t are unknown but fixed parameters such that $\sum_{i=1}^{N} \mu_i = 0$ and $\sum_{t=1}^{T} \lambda_t = 0$. The v_{it} are random such that $Ev_{it} = 0$ and $Ev_{it}v_{js} = \sigma_v^2$ if $i = j$ and $t = s, 0$ otherwise. Then, the best linear unbiased estimator of β will be

$$\hat{\beta} = (X^T Q_F X)^{-1} X^T Q_F y \tag{9}$$

where $Q_F = I_N \otimes I_T - I_N \otimes \bar{J}_T - \bar{J}_N \otimes I_T + \bar{J}_N \otimes \bar{J}_T$, with I_N (I_T) being an identity matrix of dimension N (T), with $J_T(J_N)$ as a matrix of ones of dimension T (N), and $\bar{J}_T(\bar{J}_N) = \frac{J_T}{T}\left(\frac{J_N}{N}\right)$.

Next we assume that all the components μ_i, λ_t, and v_{it} are random such that $E\mu_i = 0, E\mu_i\mu_j = \sigma_\mu^2$ if $i = j, 0$ if $i \neq j; E\lambda_t\lambda_s = \sigma_\lambda^2$ if $t = s, 0$ if $t \neq s$; $Ev_{it} = 0, Ev_{it}\ v_{js} = \sigma_v^2$ if $i = j$ and $t = s$, 0 otherwise; μ_i, λ_t, and v_{it} are independent of each other and, furthermore, $T > K, N > K$ and the variances σ_μ^2, σ_λ^2, and σ_v^2 are unknown. True GLS would be the BLUE for this setting, but variance components are usually not given and have to be estimated. Feasible GLS estimators, however, are in principle asymptotically efficient. The resulting two-stage GLS estimator is then given by $\tilde{\beta} = \left(X^T\tilde{\Omega}^{-1}X\right)^{-1}X^T\tilde{\Omega}^{-1}y.$[2])

Fixed-effects versus random-effects: Whether the effects are considered fixed or random (for the following see Hsiao, 1990) can result in remarkable differences in parameter estimates. One way to unify the fixed-effects and the random-effects models might be to assume as starting point that the effects are random. While the fixed-effects model can be considered as one in which investigators make inferences conditional on the effects that are in the sample, the random-effects model can be seen as one in which investigators make unconditional or marginal inferences with respect to the population of all effects. Thus it should depend on the features of the respective paper whether inference will be made with respect to the population characteristics or only with respect to the effects that are in the sample. When inferences are restricted to the effects in the

1 *For estimation details regarding the variance-covariance matrix we refer to Baltagi (2001).*

2 *For presentation of estimation procedures when variance components are unknown (as it is the case in this work) we refer to Baltagi (2001).*

sample, the effects are appropriately considered fixed. If, however, inferences will be made about the whole population, effects should be treated random. In formulating the latter type of models the important issue is to find out if the conditional distribution of μ_i given x_i equals the unconditional distribution of μ_i. If in the linear regression framework μ_i is correlated with x_i, treating μ_i as fixed-effects leads to the same estimator of β as would be obtained when such correlation were explicitly allowed for in the construction of the estimator. One possibility to find out whether having to work with a fixed-effects or a random-effects model is to test for misspecification of (6), where μ_i is assumed random, by using the Hausman (1978) test statistic

$$m = \hat{q}^T \hat{V}ar(\hat{q})^{-1} \hat{q} \tag{10}$$

where $\hat{q} = \hat{\beta}_{CV} - \hat{\beta}_{GLS}$ and $\hat{V}ar(\hat{q}) = Var(\hat{\beta}_{CV}) - Var(\hat{\beta}_{GLS})$. The null hypothesis $\mathrm{E}(\mu_i \mid X_i) = 0$ is tested against the alternative $\mathrm{E}(\mu_i \mid X_i) \neq 0$. Under H_0 (μ_i and $\mathbf{x}_i$ are uncorrelated), this statistic will be asymptotically central chi-square distributed, with K degrees of freedom. Under H_1(μ_i and x_i are correlated), it exhibits a noncentral chi-square distribution with non-centrality parameter $\bar{q}^T Var(\hat{q})^{-1} \bar{q}$, where $\bar{q} = plim(\hat{\beta}_{CV} - \hat{\beta}_{GLS})$.

Dynamic models: Panel data offer the advantage of being better able to analyze dynamic economic relationships. Such dynamic relationships are characterized by the presence of a lagged dependent variable among the regressors,

$$y_{it} = \gamma y_{i,t-1} + x_{it}^T \beta + \mu_i + v_{it} \quad i = 1, ..., N;\ t = 1, ..., T \tag{11}$$

where γ is a scalar. For illustration purposes we assume the model to be a one-way error component model. In the fixed effects case (see Baltagi, 2001), the LSDV estimator will be biased of $\mathrm{O}\left(\frac{1}{T}\right)$ and its consistency depends on the dimension of T. Random effects, on the other hand, where we assume $\mu_i \sim IID(0, \sigma_\mu^2)$ and $v_{it} \sim IID(0, \sigma_v^2)$, independent of each other and among themselves, cannot simply and sufficiently be dealt with by GLS error-component techniques. They can alternatively be modelled by fixed effects procedures. But as it is well known that the LSDV estimator is inconsistent for finite T and $N \to \infty$; Kiviet (1995) introduced an approximation to the small-sample bias (finite N *and* finite T) for the LSDV estimator and demonstrated the construction of a bias-corrected LSDV estimator which compares with other consistent ($N \to \infty$, fixed T) estimators. From Kiviet's Monte Carlo experiments it follows that in many circumstances a bias-corrected version of the (in principle inconsistent) LSDV estimator is unexpectedly efficient compared to established consistent estimation methods. The remaining errors of the presented approach are $\mathrm{O}\left(N^{-1}T^{-\frac{3}{2}}\right)$. We did the suggested bias corrections, but found that for our results they were negligible.

3 Empirical Results

For each of the variables we tested lagged versions as well as synchronous ones and chose those generating the most significant results for presentation in tables 1 to 6.

3.1 Results for Specification I

We started our investigations with the unmodified IPO series denominated in USD (for estimation results see table 1). Single-country regressions were additionally carried out in national currencies. The main points that can be seen from table 1 are: For all pooled estimations, the only significant (at the 1% level) parameters are those for the first lag of IPOs. At the same time, no significant dependence of IPO volume on stock index returns could be identified apart from the weak dependence in the individual country regressions for Austria and Finland. Furthermore, neither changes in savings deposits nor GDP growth exhibit a significant influence on IPO volume. These results are accompanied by relatively high R^2 figures of 0.492 for the pooled OLS regression, 0.560 for the one-way fixed-effects model, and 0.359 for one-way random effects.

However, on closer examination the pooled estimations turned out to be unstable. Our attempts to improve stability led us to exclude the Netherlands from the data set. The reason therefore were considerable swings in Dutch IPO volumes compared with the rest of the sample countries (for illustration purposes please refer to charts 1 to 6), supported by the value of its parameter estimate (–18.87) as well as its t-statistic (–0.26). With the Netherlands removed from the data set, pooled estimations (see table 2) produced, first, stable results and, second, highly significant parameter estimates for stock index returns, while estimates for the IPO lag stayed significant, though in a less pronounced manner. Obviously, the swings in Dutch IPO volumes were too large to be effectively captured by country-specific effects and therefore caused problems in the estimation process. Another point to be made is that only pooled estimation procedures generate significant parameter estimates while single-country analyses hardly do so (except for Austria and Finland). This might be interpreted in favor of pooled approaches and their ability of extracting relevant information from cross-sectional observations.

As already mentioned, the unmodified IPO series is not unambiguously stationary. Therefore, the next step was to investigate first differences of IPO volumes for all sample countries but the Netherlands (because the above-discussed problem affected this constellation as well). Again, the first lag of the dependent variable turned out to be highly significant, as did stock index returns. For example, pooled OLS regression (R^2: 0.24) generated a parameter estimate for the stock index return of 5.74 combined with a t-value of 2.79, and one-way fixed-effects (R^2: 0.25) produced an estimate of 5.88 with a t-value of 2.78. On the other hand, estimates for the first lag of first differences are not only highly significant but also persistently negative – both for pooled estimations and single-country regressions. Pooled OLS, again, yields a parameter estimate of –0.46 in combination with a t-value of –4.45, and one-way fixed effects an estimate of –0.46 with a t-value of –4.39. The highest single-country significance can be observed for France with a parameter estimate of –0.67 and

a t-value of –2.75. A supposition arising from this latter empirical observation might be the assumption of a mean-reverting tendency for the whole IPO process within the sample period.

Neither for changes in savings deposits nor for GDP growth could we identify any significant influence on unmodified IPO series or on first differences. The single occurrence of a t-value of 1.47 for GDPG in the case of the Netherlands (see table 1) does not seem to deserve further attention.

3.2 Results for Specification II

In model II we tried to incorporate the empirical observations made under model I analyses. This means, first of all, to put IPO volumes into proportion with GDP so that country-specific effects do not have to absorb differences in IPO volumes resulting from varying economy sizes. And, second, we wanted to investigate our assumption – additionally fostered by individual country results from model I – that a nonlinear (specifically a logarithmic) relationship could possibly better model any dependence of IPO volumes on included independent variables than a linear one. Again, this latter consideration refers to a period not characterized by pronounced fluctuations. Estimation results for model II are presented in tables 3 to 6.

Zero observations on IPO volumes were approximated by replacing $ln(\frac{IPO_{it}}{GDP_{it}}\ \% * 100) = 0$ with 0.00001 and, alternatively (to make a sensitivity check), with 0.0000001. Table 3 exhibits estimation results for model II when all six countries are included and $ln(\frac{IPO_{it}}{GDP_{it}}\ \% * 100) = 0$ is approximated with 0.0000001. What we can see from the results are predominantly significant estimates for the first lag of the dependent variable as well as for stock index return. But, in contrast to model I specifications, here also individual country regressions (apart from Belgium and the Netherlands) exhibit significant positive parameter estimates for stock index returns. This might be an indication that the functional form tested under model II is superior to the linearity assumption implied by model I.

Turning from pooled estimations including all sample countries to estimations excluding the Netherlands, we can hardly detect any effect on parameter estimates for stock index returns. Both the first lag of the dependent variable and the stock index return are characterized by highly significant estimates (the exception of two-way fixed-effects models may well result from some sort of overfitting). Also R^2-values are on average rather similar, irrespective of whether the Netherlands are included or excluded. In other words, working with IPO-to-GDP ratios appears to sufficiently absorb economy size effects.

The next point was to carry out a sensitivity check with respect to the approximation of $ln(\frac{IPO_{it}}{GDP_{it}}\ \% * 100) = 0$. Therefore we tested exactly the same model specification as presented in table 4 except for approximation details (table 4: 0.0000001). Table 5 contains estimation results when approximation is done with 0.00001. Notwithstanding minor changes, the deviations are insubstantial for the purpose of this paper. Our last step in testing the stability of model II estimation results was to exclude the first lag of the dependent variable as an explanatory variable (see table 6). Estimation and test results for stock index returns were hardly affected by this reduction. The only remarkable as well as expected consequence was a significant drop in R^2 – in the case of

pooled OLS, for example, from 0.25 to 0.09, for one-way fixed-effects from 0.46 to 0.39, or for one-way random-effects from 0.23 to 0.12.

Again, across all specifications tested neither changes in savings deposits nor GDP growth exhibit any significant influence on IPO volume. With regard to changes in savings deposits (included in order to identify possible flows of funds between savings deposits and investment in stocks) the results therefore seem to contradict any significant effect of a liquidity supply via savings reductions on IPO volumes. The significant results in case of two-way specifications for GDP growth may well stem from an overfitting tendency arising from the additional inclusion of time effects, but do not seem to deserve further attention.

3.3 Results for Specification III

Model III was designed to test the potential influence of interest rates on IPO volumes, with interest rates indicating the price of a competing financing form. The analyzed data series were first differences of IPO volumes. Due to the difficulties with respect to Finnish government bond yield data, elaborated under section 2.1, analyses had to be restricted to the four remaining countries. Estimates for the influence of government bond yields on IPOs turned out to be highly insignificant, both for individual country analyses and for pooled estimations. R^2, without having included the first lag of the dependent variable as an explanatory variable, was close to zero throughout. The indication of these results is therefore: The price of competing financing does not perceivably influence demand for raising equity through IPOs.

4 Conclusion

Only few empirical studies have been carried out to establish why and when companies go public, and what consequences IPOs have, which is particularly surprising given the considerable implications for many internal and external issues. This paper investigates the explanatory power selected macroeconomic factors have for IPOs by analyzing a data set of annual IPO volumes for six continental European countries over a time period of 18 years. Microeconomic aspects are explicitly excluded in order to keep the problem formulation manageable. The main results obtained in this work are: In order to study the influence of stock index returns on IPOs volumes we see a necessity for problem segmentation with respect to stock market levels, given that, on closer examination, successful efforts to optimally time an IPO with respect to the stock price level cannot evidently be accompanied by a significantly positive homogeneous parameter for stock index return across all stock price levels. Hence, we investigated the question if there are stable indications that IPOs depend on stock index returns for what we termed consolidated periods. While all pooled procedures yielded significantly positive parameter estimates, individual country regressions working with untransformed IPO volumes did not generate significant parameter estimates (except for Finland and Austria). In contrast, logarithmic transformation of IPO volumes (representing our supposition of a nonlinear relationship between IPO volumes and stock index returns) leads to persistently significant estimates for both pooled and individual country regressions. Across all specifications tested, the hypothesis that percentage

changes in savings and GDP growth have explanatory power for IPO volumes could not be supported by empirical evidence; neither of the two factors exhibits any significant influence. The same holds for interest rates (indicating the price of competing financing sources), which have not been found to perceivably influence demand for raising equity through IPOs.

One possible direction of future research on the questions addressed in this paper would be, first, to extend the data set underlying the investigation – evaluations on the basis of a broader (but still homogeneous) sample could increase the degree of representativeness. And second, analyses of periods characterized by extreme market sentiments, either positive or negative, would complement and enrich the discussion.

References

Ahn, S. C. and Schmidt, P. (1995). Efficient estimation of models for dynamic panel data. In: Journal of Econometrics 68, 5–27.

Anderson, T. W. and Hsiao, C. (1981). Estimation of dynamic models with error components. In: Journal of the American Statistical Association 76, 589–606.

Anderson, T. W. and Hsiao, C. (1982). Formulation and estimation of dynamic models using panel data. In: Journal of Econometrics 18, 47–82.

Arellano, B. and Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. In: Review of Economic Studies 58, 277–297.

Baltagi, B. H. (1981). Pooling: An experimental study of alternative testing and estimation procedures in a two-way error component model, Journal of Econometrics 17, 21–49.

Baltagi, B. H. (2001). Econometric analysis of panel data, Chichester.

Baltagi, B. H. and Griffin, J. M. (1997). Pooled estimators vs. their heterogeneous counterparts in the context of dynamic demand for gasoline. In: Journal of Econometrics 77, 303–327.

Beggs, J. J. and Nerlove, M. (1988). Biases in dynamic models with fixed effects. In: Economics Letters 26, 29–31.

Bhargava, A., Franzini, L. and Narendranathan, W. (1982). Serial correlation and fixed effects model. In: Review of Economic Studies 49, 533–549.

Greene, W. H. (2000). Econometric analysis, Englewood Cliffs, New Jersey.

Hausman, J. A. (1978). Specification tests in econometrics. In: Econometrica 46, 1251–1271.

Hsiao, C. (1990). Analysis of panel data, Cambridge.

Kiviet, J. F. (1995). On bias, inconsistency, and efficiency of various estimators in dynamic panel data models. In: Journal of Econometrics 68, 53–78.

La Porta, R., Lopez de Silanes, F., Shleifer, A., Vishny, R. (1997). Legal determinants of external finance,. In: Journal of Finance 52, 1131–1150.

Ljungqvist, A. P. (1995). When do firms go public? Poisson evidence from Germany, Working Paper, University of Oxford.

Loughran, T. Ritter, J. R. and Rydqvist, K. (1994). Initial public offerings: International insights. In: Pacific-Basin Finance Journal 2(2), 165–200.

Pagano, M., Panetta, F. and Zingales, L. (1998). Why do companies go public? An empirical analysis. In: Journal of Finance 53(1), 27–64.

Pesaran, M. H. and Smith, R. (1995). Estimating long-run relationships from dynamic heterogeneous panels. In: Journal of Econometrics 68(1), 79–113.

Rees, W. P. (1997). The arrival rate of initial public offers in the UK. In: European Financial Management 3 (1), 45–62.

Rydqvist, K. and Högholm, K. (1995). Going public in the 1980s: Evidence from Sweden. In: European Financial Management 1, 287–315.

Wansbeek, T. and Bekker, P. (1996). On IV, GMM and ML in a dynamic panel data model. In: Economics Letters 51, 145–152.

Following abbreviations are used throughout:
OLSp: OLS regression pooled over all countries and all time periods
OLS-BL, OLS-DK, OLS-FL, OLS-FR, OLS-NL, and OLS-AT characterize country-specific OLS regressions carried out separately for Belgium, Denmark, Finland, France, the Netherlands, and Austria
FE1W / FE2W: fixed-effects one-way / two-way error component model
RE1W / RE2W: random-effects one-way / two way error component model evaluated by applying LSDV-residuals
***, **, and * mark coefficients as being significant at the 1 per cent, 5 per cent, and 10 per cent level respectively.

$$IPO_{it} = \alpha + \beta_1 IPO_{it-1} + \beta_2 SR_{it-1} + \beta_3 SG_{it-1} + \beta_4 GDPG_{it} + u_{it} \quad I$$

Table 1

Estimation Results for Model I (a)

Lag 1 of dependent variable as explanatory; pooled results: 6 countries

Method	R^2	x_1 = Dep. V.-lag 1		x_2 = SR-lag 1		x_3 = SG-lag 1		x_4 = GDPG	
		Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value
OLSp.	0.492	0.7330	9.5081***	5.3140	0.6301	– 6.8994	–0.4914	– 21.2106	–0.3374
OLS-BL	0.051	–0.0125	–0.0411	2.1465	0.5671	– 0.8782	–0.3300	– 17.2288	–0.5277
OLS-DK	0.158	0.0049	0.0145	– 0.1205	–0.0314	– 4.8791	–1.2562	0.2219	0.0077
OLS-FL	0.321	0.2313	0.9187	2.2467	1.4914*	0.4626	0.1476	– 0.4738	–0.0448
OLS-FR	0.211	–0.1859	–0.6523	3.4901	0.5301	33.9448	0.7867	– 72.2531	–1.7211
OLS-NL	0.441	0.4134	1.7617**	–18.8725	–0.2605	–448.2796	–1.3208	1,136.3743	1.4689*
OLS-AT	0.385	0.4147	1.7434**	7.2957	1.8094**	– 28.9314	–0.5807	63.1408	0.5504
FE1W	0.560	0.5462	6.1630***	3.3910	0.4191	– 5.4492	–0.3904	24.9731	0.3988
RE1W	0.359	0.6119	7.3122***	4.0679	0.5033	– 5.9558	–0.4313	8.5601	0.1384
FE2W	0.659	0.5098	4.9573***	– 4.4912	–0.4468	– 3.4133	–0.2300	112.3377	1.2250
RE2W	0.339	0.5901	6.9360***	1.5046	0.1787	– 5.1069	–0.3765	31.9909	0.4717

Source: OeNB.
Pooled results are based on 102 observations, each of the single country regressions uses 17 oberservations.

Table 2

Estimation Results for Model I (b)

Lag 1 of dependent variable as explanatory; pooled results: 5 countries (excl. NL)

Method	R^2	x_1 = Dep. V.-lag 1		x_2 = SR-lag 1		x_3 = SG-lag 1		x_4 = GDPG	
		Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value
OLSp	0.210	0.3740	3.6424***	4.3417	2.4527***	−1.0133	−0.3567	−16.8043	−1.2644
FE1W	0.344	0.1718	1.5746*	4.8559	2.9240***	−0.2987	0.1082	−18.8606	−1.4808
RE1W	0.150	0.2297	2.1706**	4.7112	2.8321***	−0.5139	−0.1875	−18.2581	−1.4385
FE2W	0.489	0.0931	0.7075	3.9825	1.9052**	1.3010	0.4261	− 3.0757	−0.1511
RE2W	0.121	0.1989	1.8508**	4.6141	2.7009***	0.1109	0.0408	−16.3117	−1.1813

Source: OeNB.

Pooled results are based on 85 observations, each of the single country regressions uses 17 oberservations.

$$ln\left(\frac{IPO_{it}}{GDP_{it}}\% * 100\right) = \alpha + \beta_1 ln\left(\frac{IPO_{it-1}}{GDP_{it-1}}\% * 100\right) + \beta_2 SR_{it-1} + \\ + \beta_3 SG_{it-1} + \beta_4 GDPG_{it} + u_{it} \qquad II$$

Table 3

Estimation Results for Model II (a)

Lag 1 of dependent variable as explanatory; pooled results: 6 countries

Method	R^2	x_1 = Dep. V.-lag 1		x_2 = SR-lag 1		x_3 = SG-lag 1		x_4 = GDPG	
		Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value
OLSp	0.166	0.0287	3.3902***	0.0729	2.1643**	−0.0630	−1.1252	0.1142	0.4553
OLS-BL	0.142	0.2026	1.0838	0.0525	0.3213	−0.0538	−0.4684	0.4213	0.2991
OLS-DK	0.344	−0.0210	−0.2793	0.1719	2.1766**	0.0648	0.7957	−1.0953	−1.9043
OLS-FL	0.517	0.1675	1.4380*	0.1943	2.6339***	−0.0777	−0.5037	−0.1607	−0.3105
OLS-FR	0.376	−0.0352	−0.5654	0.0214	1.6791*	0.0785	0.9539	−0.1669	−2.1492
OLS-NL	0.276	0.0288	2.0359**	0.0532	0.3425	−0.1281	−0.1798	−0.5701	−0.3428
OLS-AT	0.378	0.0483	1.5061*	0.0507	1.4163*	−0.5389	−1.2281	0.1177	0.1159
FE1W	0.389	0.0313	3.4647***	0.0845	2.8433***	−0.0441	−0.8596	0.0232	0.1008
RE1W	0.819	0.0307	3.5202***	0.0825	2.7662***	−0.0475	−0.9291	0.0414	0.1806
FE2W	0.705	0.0142	1.6737**	0.0104	0.3557	−0.0558	−1.2980*	1.0860	4.0191***
RE2W	0.215	0.0235	2.9299***	0.0415	1.4709*	−0.0542	−1.2374	0.5878	2.4525***

Source: OeNB.

Pooled results are based on 102 observations, each of the single country regressions uses 17 oberservations (zero approximation with 0.0000001 [see section 2.2]).

Table 4

Estimation Results for Model II (b)

Lag 1 of dependent variable as explanatory; pooled results: 5 countries (excl. NL)

Method	R^2	x_1 = Dep. V.-lag 1		x_2 = SR-lag 1		x_3 = SG-lag 1		x_4 = GDPG	
		Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value
OLSp	0.209	0.1128	3.5425***	0.0714	2.1567**	−0.0634	−1.1958	0.1399	0.5667
FE1W	0.441	0.0843	2.2896***	0.0828	2.8892***	−0.0438	−0.9195	0.0647	0.2970
RE1W	0.200	0.0898	2.8255***	0.0810	2.8171***	−0.0469	−0.9867	0.0755	0.3463
FE2W	0.677	0.0197	0.5681	0.0223	0.7195	−0.0472	−1.0425	0.8880	2.8543***
RE2W	0.168	0.0585	1.8939**	0.0504	1.779**	−0.0460	−1.0573	0.4215	1.6991**

Source: OeNB.

Pooled results are based on 85 observations (zero approximation with 0.0000001 [see section 2.2]).

Table 5

Estimation Results for Model II (c)

Lag 1 of dependent variable as explanatory; pooled results: 5 countries (excl. NL)

Method	R^2	x_1 = Dep. V.-lag 1		x_2 = SR-lag 1		x_3 = SG-lag 1		x_4 = GDPG	
		Estimate	t-value	Estimate	t-value	Estimate	t-value	Estimate	t-value
OLSp	0.245	0.0782	3.9799***	0.0510	2.4935***	−0.0364	−1.1113	0.0625	0.4103
OLS-BL	0.129	0.1172	1.0057	0.0355	0.3489	0.0330	−0.4610	0.2444	0.2782
OLS-DK	0.301	−0.0023	−0.0453	0.1010	1.8857**	0.0336	0.6051	−0.6115	−1.5585
OLS-FL	0.547	0.1032	1.4811*	0.1238	2.8070***	−0.0406	−0.4404	−0.1053	−0.3400
OLS-FR	0.376	−0.0352	−0.5654	0.0214	1.6791*	0.0785	0.9539	−0.1669	−2.1492
OLS-AT	0.462	0.0391	1.9023**	0.0398	1.7308*	−0.3807	−1.3510*	0.1532	0.2348
FE1W	0.459	0.0581	2.8728***	0.0579	3.2523***	−0.0256	−0.8643	0.0215	0.1588
RE1W	0.233	0.0621	3.1493***	0.0568	3.1775***	−0.0274	−0.9265	0.0275	0.2027
FE2W	0.704	0.0177	0.8462	0.0209	1.1140	−0.0256	−0,9338	0.5285	2.1800***
RE2W	0.200	0.0413	2.1920**	0.0375	2.1688**	−0.0253	−0.9565	0.2485	1.6321*

Source: OeNB.

Pooled results are based on 85 observations, each of the single country regressions uses 17 oberservations (zero approximation with 0.00001 [see section 2.2]).

Table 6

Estimation Results for Model II (d)

Lag 1 of dependent variable excluded; pooled results: 5 countries (excl. NL)

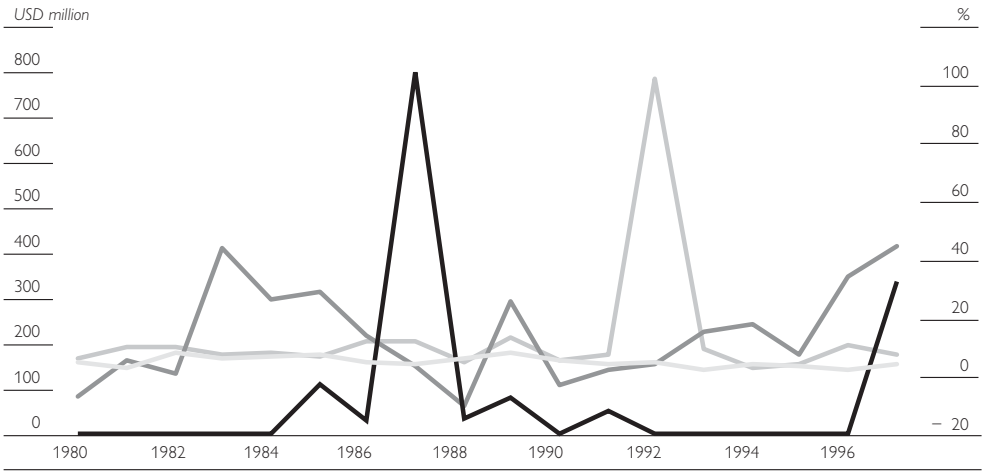
Method	R^2	x_1 = SR-lag 1		x_2 = SG-lag 1		x_3 = GDPG	
		Estimate	t-value	Estimate	t-value	Estimate	t-value
OLSp	0.085	0.0777	2.1988**	−0.0674	−1.1900	0.0730	0.2776
OLS-BL	0.058	0.0300	0.1841	−0.0512	−0.4428	0.7151	0.5139
OLS-DK	0.340	0.1599	2.4435**	0.0629	0.8039	−1.0127	−2.1295
OLS-FL	0.433	0.2029	2.6529***	−0.0196	−0.1268	−0.1621	−0.3010
OLS-FR	0.359	0.0203	1.6552*	0.0777	0.9698	−0.1586	−2.1364
OLS-AT	0.260	0.0528	1.4094*	−0.5928	−1.2939*	−0.1120	−0.1064
FE1W	0.391	0.0878	2.9618***	−0.0448	−0.9084	0.0431	0.1911
RE1W	0.121	0.0865	2.9060***	−0.0478	−0.9688	0.0473	0.2093
FE2W	0.675	0.0210	0.6836	−0.0473	−1,0510	0.9402	3.1814***
RE2W	0.134	0.0489	1.7052**	−0.0460	−1.0471	0.5077	2.0303**

Source: OeNB.

Pooled results are based on 85 observations, each of the single country regressions uses 17 oberservations (zero approximation with 0.00001 [see section 2.2]).

Figure 1

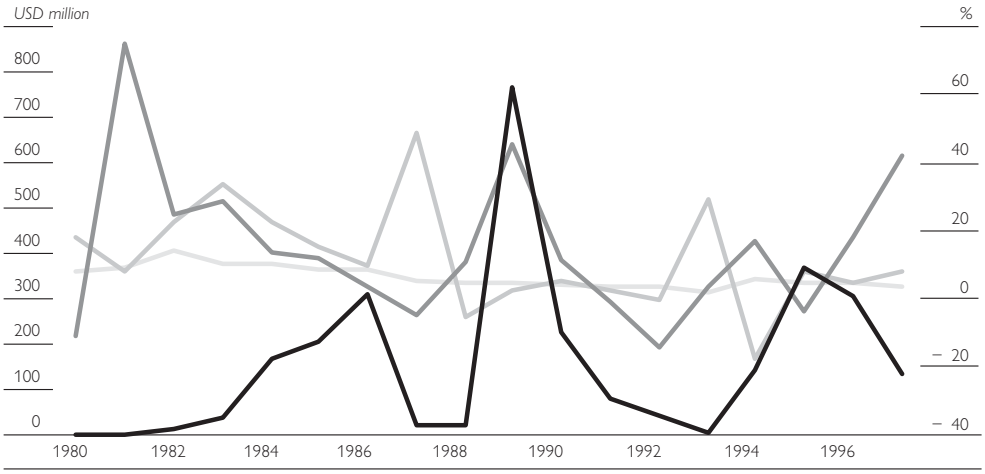
Belgium



Source: Main stock exchange, IMF, OECD.

Figure 2

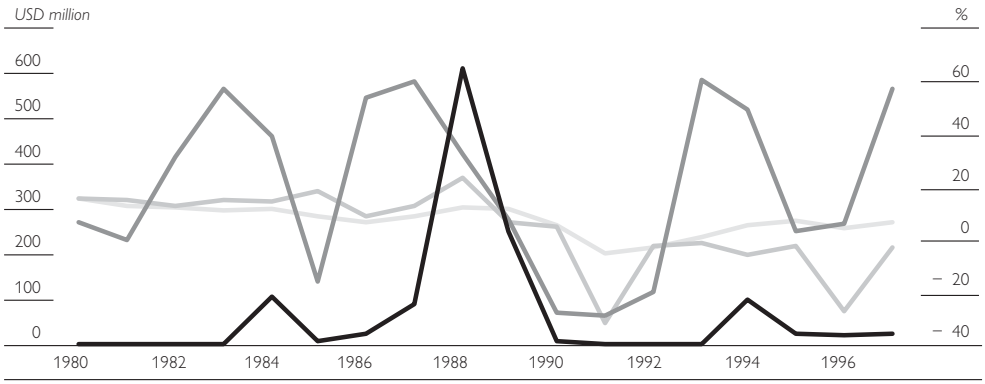
Denmark



Source: Main stock exchange, IMF, OECD.

Figure 3

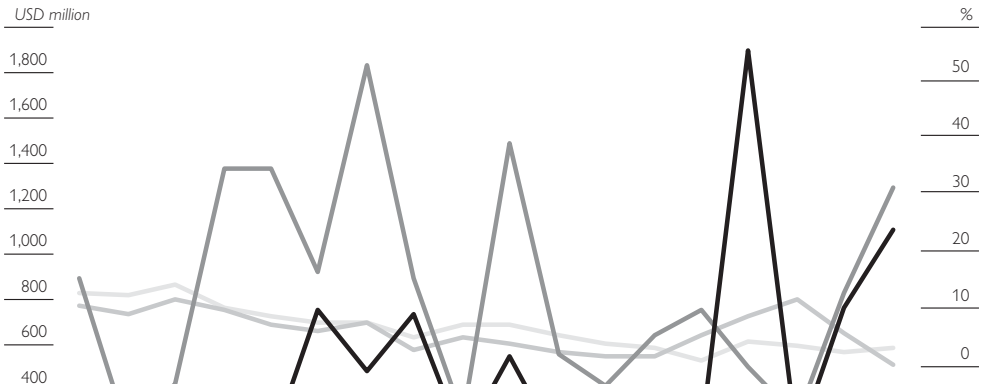
Finland



Source: Main stock exchange, IMF, OECD.

Figure 4

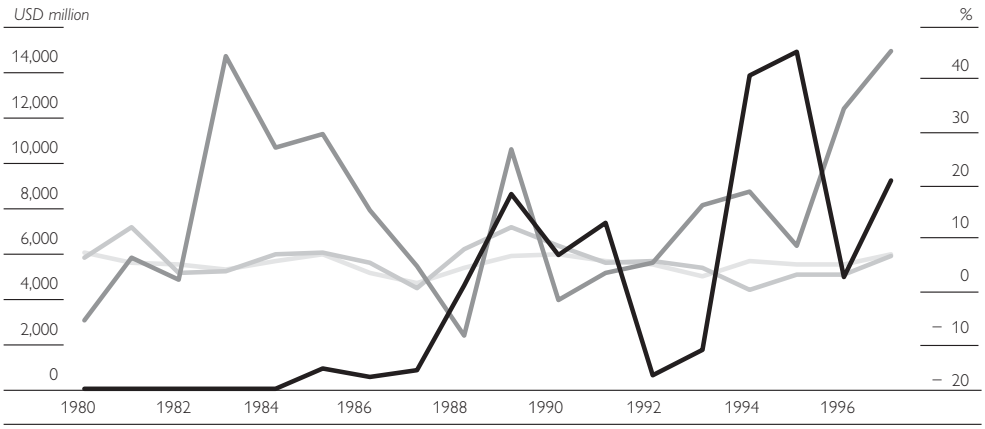
France



Source: Main stock exchange, IMF, OECD.

Figure 5

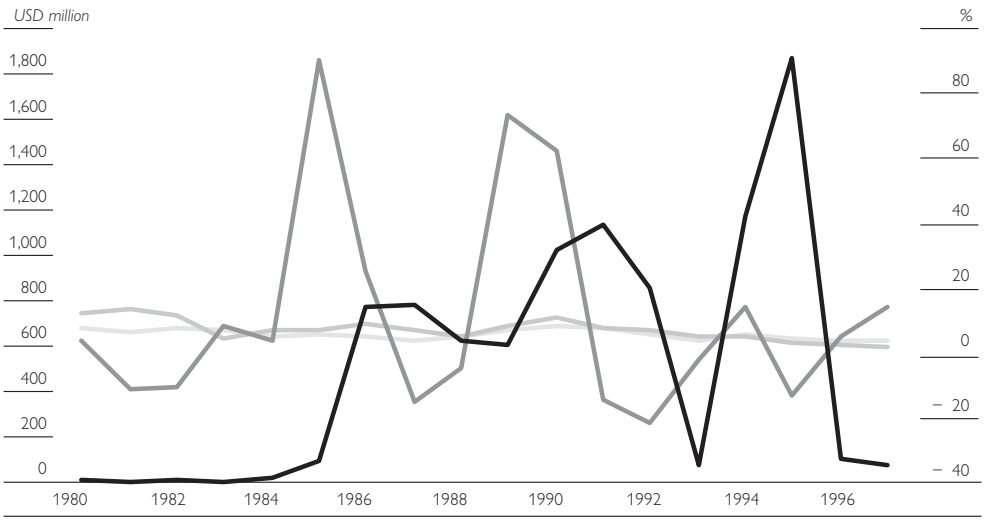
Netherlands



Source: Main stock exchange, IMF, OECD.

Figure 6

Austria



Source: Main stock exchange, IMF, OECD.

Conventions used in the tables

– = The numerical value is zero
. . = Data not available at the reporting date
× = For technical reasons no data can be indicated
0 = A quantity which is smaller than half of the unit indicated
∅ = Mean value
_ = New series

Discrepancies may arise from rounding.

Abbreviations

ARTIS	Austrian Real-Time Interbank Settlement
A-SIT	Secure Information Technology Center – Austria
ATX	Austrian Traded Index
BIS	Bank for International Settlements
BWG	Bankwesengesetz (Banking Act)
CEECs	Central and Eastern European Countries
CPA	Certified Public Accountant
CPI	consumer price index
DAX	Deutscher Aktienindex (German Stock Index)
DJIA	Dow Jones Industrial Average
EBRD	European Bank for Reconstruction and Development
EC	European Community
ECB	European Central Bank
EEC	European Economic Community
EMU	Economic and Monetary Union
EONIA	Euro OverNight Index Average
ESCB	European System of Central Banks
EU	European Union
EURIBOR	European Interbank Offered Rate
Eurostat	Statistical Office of the European Communities
Fed	Federal Reserve System
FEFSI	Fédération Européenne des Fonds et Sociétés d'Investissement
FMA	Finanzmarktaufsichtsbehörde (Financial Market Supervisory Authority)
FOMC	Federal Open Market Committee
FRAs	forward rate agreements
FSLIC	Federal Savings and Loan Corporation
GDP	gross domestic product
GNP	gross national product
GFCF	gross fixed capital formation
HGB	Handelsgesetzbuch (Commercial Code)
HICP	Harmonized Index of Consumer Prices
IAS	International Accounting Standards
IATX	Immobilien-Austrian-Traded-Index (real estate Austrian Traded Index)
IFS	International Financial Statistics
IHS	Institut für Höhere Studien (Institute for Advanced Studies)
IMF	International Monetary Fund
IPO	initial public offerings
LLP	loan loss provision
LTCM	Long-Term Capital Management
NASDAQ	National Association of Securities Dealers Automated Quotation System
NEMAX	stock price index on Frankfurt's Neuer Markt
OECD	Organisation for Economic Co-operation and Development
OeKB	Oesterreichische Kontrollbank (specialized bank for export financing, central depository for securities)
OeNB	Oesterreichische Nationalbank
OLS	Ordinary Least Squares
P/E ratio	price/earnings ratio
ROA	return on assets
ROE	return on equity
TARGET	Trans-European Automated Real-time Gross settlement Express Transfer
VAG	Versicherungsaufsichtsgesetz (Insurance Supervision Act)
VaR	value at risk
ViDX	Vienna Dynamic Index
VÖIG	Vereinigung Österreichischer Investment-gesellschaften
WIFO	Österreichisches Institut für Wirtschafts-forschung (Austrian Institute of Economic Research)