Financial markets in central and east European countries before accession to the EU

In May of next year, ten countries, including eight from central and eastern Europe, are scheduled to join the European Union. Whereas Malta and Cyprus look back on a long market economy tradition, the central and east European economies underwent a profound restructuring in the 1990s. In the past few years, all eight countries have made significant progress in the areas of bank consolidation and the international integration of their financial markets. Compared to the euro area, however, there are still major structural differences in the financial sectors, which suggests that further adjustment is needed. The degree of integration of the central and east European financial markets with those of the euro area is also below the level of integration witnessed among the markets of existing countries participating in European economic and monetary union. Owing to the major importance of integrated financial markets for implementing a common monetary policy, further progress is necessary in this area before these countries can take the next step and accede to European monetary union. This report analyses the development of the financial markets in the central and east European acceding countries and also takes a look at their integration into the euro area.

Development and structure of the financial sectors

Copenhagen criteria demand developed financial sector

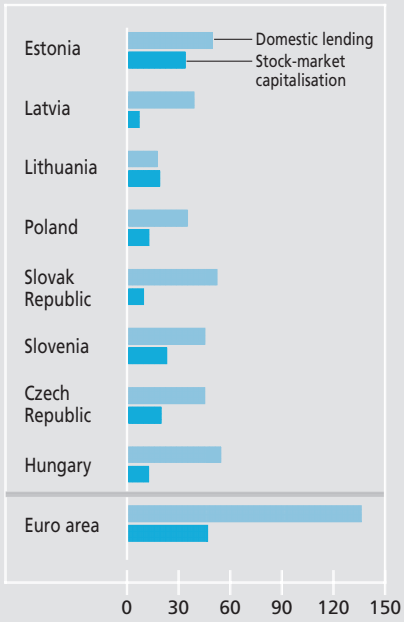
The prerequisite of having an efficient and competitive financial sector for joining the European Union arose, technically, in 1993 from the criteria which the Copenhagen European Council set for new members of the European Union. These include "the existence of a functioning market economy as well as the capacity to cope with competitive pressure and market forces within the Union." With respect to the financial sector, the most important requirements are a system of efficient financial intermediation, a sufficient equity capital base for banks as well as satisfactorily functioning supervisory systems. In addition, the criterion to incorporate the *aquis communautaire* places great demands, especially of an institutional kind, on the banking system and on the stability of the financial markets.

Healthy financial sector supports nominal and real convergence…

Moreover, an efficient financial sector supports both the nominal and real convergence of the acceding countries vis-à-vis the euro area. First, an efficient financial sector forms the link between the central bank and the real economy, playing an essential part in the transmission of monetary policy measures. Thus, a market-economy-oriented financial sector becomes an integral part of a stable monetary environment. Second, empirical studies on the new growth theory indicate a strong correlation between the functional viability of a country's domestic financial markets and real economic development.[1]

Domestic lending and stock-market capitalisation

as a percentage of GDP (2002)



Source: Eurostat

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… thus helping to fulfil the Maastricht criteria

A healthy and functionally viable financial sector is therefore indispensable for fulfilling the "convergence criteria" laid down in Article 121 of the EC Treaty, according to which the European Commission and the ECB regularly evaluate the fitness of the so-called preins to participate in the Eurosystem. Above all, an efficient and stable banking system facilitates the fulfilment of the inflation and interest-rate criteria.

Financial markets in central and eastern Europe still underdeveloped…

Even though the financial markets in central and east European acceding countries satisfy the formal criteria for acceptance into the EU, they still have a long way to go in terms of

1 See, for example, R Levine, N Loayza, T Beck (2000), Financial Intermediation and Growth: Causality and Causes, *Journal of Monetary Economics,* Vol 46, pp 31-77.

size and liquidity despite enormous reform efforts in the past few years. The rudimentary institutional structures in place at the beginning of the transformation process have been considerably strengthened and expanded in line with market economy criteria, but further adjustments towards the reference markets in the euro area are necessary. If one considers the ratio of commercial banks' domestic lending or the degree of stock-market capitalisation to gross domestic product (GDP), it becomes evident that in 2002 these variables, with the exception of the relatively large stock-market capitalisation in Estonia, were considerably less than half the corresponding levels in the euro area.

... with a considerably long way to go

The existing differences become even more apparent if account is taken of the fact that in 2002 per capita economic output ranged from only 16% (Latvia) to 48% (Slovenia) of the EU average. Measured in terms of purchasing power parities, these figures increase to between 35% and 74% of the EU average. Even so, this gap in real convergence implies a considerable need for adjustment with respect to the hitherto insufficient financial intermediation system in the central and east European financial markets if the desired catching-up process in the real economy is to materialise.

Deficits in banks' financial intermediation

Despite the prominent role played by commercial banks in the financial sector, their role in financial intermediation lags significantly behind that of commercial banks in the euro area. If any country achieved a ratio of bank deposits to GDP that was similar to that of the euro area in 2002, it was the Czech

Bank deposits of non-banks and loans to private sector

as a percentage of GDP (2002)

Source: Eurostat.

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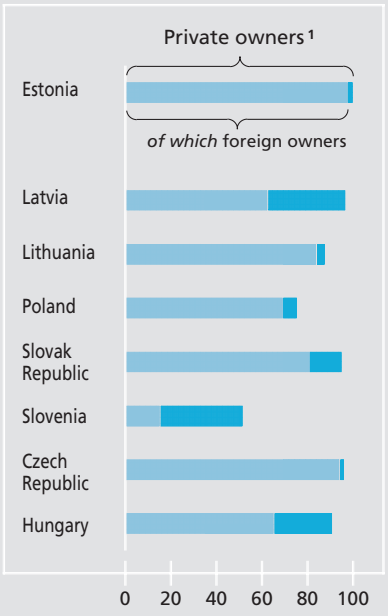
Republic; domestic loans to the private sector in relation to GDP lagged even further behind the reference value in the euro area. This results in considerable restrictions on financing investment. This problem can be partially offset through foreign loans or direct investments; however, this option is rarely available to small and medium-size enterprises.

Privatisation of commercial banking sector basically complete

Most of the acceding countries have demonstrated remarkable success in the privatisation of the commercial banking sector in the past few years. In all these countries more than half of bank assets are now held by commercial banks, the majority of which are privately owned. The average figure is actually over 85%. Given the considerable degree of private sector activity in the banking sector, it can be assumed that the privatisation process

Bank assets by owner

as a percentage of total bank assets (end-2001)



Source: European Commission. — **1** Commercial banks predominantly owned by private investors.

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in most of the central and east European acceding countries is largely complete.

Prominent role of foreign investors

The role played by foreign investors among new shareholders deserves special mention. With the exception of Slovenia, which protected its domestic financial sector from external influences for a long time and did not start to privatise the most important financial institutions until May 2001, the acceding countries pursued a consistent strategy of importing foreign expertise and capital. In these countries the share of bank assets owned by commercial banks that were predominantly in foreign hands steadily increased; at the end of 2001 this share was over 60%. In the light of the upcoming accession to the EU, the geographical proximity and legislation that was becoming increasingly EU compatible, it was mainly European Union banks which were deliberately attracted, and these now account for nine of the ten largest investors in this sector.

Efficiency of banking sector increases significantly

In connection with the privatisation process the efficiency of the banking sector has increased considerably in the past few years. For example, in 2002 only a few acceding countries had spreads between lending and deposit rates that were perceptibly greater than those in the euro area. Consequently, the banks provided market participants with financial intermediation services on favourable terms and conditions. In the past, however, banks' income from these transactions was sometimes not sufficient to cover the costs. Nonetheless, in the past few years the profitability of banks has improved considerably, and the average pre-tax profits in relation to total bank assets in 2001 were positive in all acceding countries except Lithuania.

Capital markets play only minor role

As already suggested, the development of the capital markets still lags behind that of the banking sector. Part of the reason is that the capital markets can be built up only gradually, ie in line with changes in corporate structures, complete market-economy orientation as well as a suitable legal and institutional environment. The development process has also been impeded by the fact that several countries suffered financial crises and, in part, an associated decline in economic output in the second half of the 1990s. Furthermore, during the initial years of the transition process, foreign direct investment largely substituted for the capital markets in providing corporate financing; this may also have

delayed capital market development for a time.

As a result, in 2002 the aggregate stock-market capitalisation of the eight acceding countries under review amounted to no more than €65 billion, which is 2% of the corresponding figure in the euro area. Only Poland, which has by far the largest stock market in the region and represents nearly 50% of the stock-market capitalisation of this group of countries, plays any role at all in international terms. The subordinated importance of stock markets is also evidenced by the concentration on a few listed companies and a low level of liquidity. The annual trading volume in Poland was around 60% of listed stock-market capital; the corresponding figure for the euro area was 150%.

Lending and deposit rates*

% (2002)

Source: IMF. — * Average interest rates; comparability limited in some cases owing to varying definitions.

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Even so, there is also a distinct degree of heterogeneity within the group of acceding countries. In 2002 stock-market capitalisation expressed as a percentage of GDP ranged from 8% in Latvia to 34% in Estonia. However, considerable differences in the significance of national stock markets also exist within the European Union itself, and the financial market structures of the acceding countries are not dissimilar to those of some of the smaller EU member states.

Varying privatisation strategies are decisive factor

Varying privatisation strategies are part of the reason for the disparities observed between the stock markets of the individual economies. In Hungary and Poland the sale of companies proceeded hand in hand with the development of institutional arrangements, and this promoted a moderate, but steady development process. By contrast, in the Czech Republic and the Slovak Republic mass privatisation was carried out at an early stage by distributing corporate vouchers to the public. Although this did contribute to the rapid expansion of the stock markets, the lack of a sufficient institutional framework together with the wide distribution of shareholders hindered an increase in liquidity as well as a better development of corporate governance and control. The loss of confidence that ensued was partly to blame for the Czech financial crisis in 1997, in the wake of which the number of listed companies fell drastically.

Rudimentary bond markets

As the bond markets are less developed than the stock markets, they have an even greater potential for growth. Poland, the Czech Re-

public and Hungary have the only notable secondary markets for government bonds. Since government bonds therefore cannot fully serve as a benchmark, liquidity on the corporate bond market is even more restricted. In some countries, the offering is limited to short-term bonds. In view of the impending EU accession, however, the number and volume of foreign currency bonds is increasingly rising.

Growing importance of pension funds and life insurance

As all of the acceding countries have decided as a matter of principle to base their old-age pension systems on a combination of the pay-as-you-go system and the funded system, pension funds and life insurance policies are becoming increasingly important in the development of the capital markets. However, this market segment has hitherto played a notable role only in Poland, which holds a leading position among the acceding countries in the area of funded pension systems.

Stability of the financial sectors

Financial sector stability as a prerequisite for common monetary policy

In addition to size and structure, the stability of the central and east European financial sectors is an essential element in the European integration process. During the 1990s, most of the acceding countries experienced more or less full-blown financial crises, which, as a rule, were due to a large share of non-performing loans together with an inadequate or non-existent institutional framework. However, outstanding loans from the Socialist era were not always the main problem. An even greater problem was the way commercial banks granted new loans. Owing to economic dependencies, non-performing loans sometimes went unnoticed as they were covered up by generous follow-up financing.

Major elements include improved risk provisioning…

Given past experience and the European Union's strict regulations, the statutory regulations governing risk provisioning have been tightened in the past few years and adapted to international standards. The Basle capital rules are now fulfilled. To comply with so-called capital adequacy, a risk-weighted equity capital ratio of at least 8% must be maintained. In 2001 this figure was between 11.9% in Slovenia and 19.6% in the Slovak Republic. The problem of non-performing loans was also addressed. However, significant differences still exist between the individual countries. At the end of 2001 their share of total loans ranged from 1.5% in Estonia to 24.3% in the Slovak Republic and is still rising sharply.

The quality of loan portfolios should continue to be at the centre of attention in future. Given the expected expansion of the financial sector and the introduction of new market instruments, more care will have to be taken to ensure that the desired structural convergence with that of the euro area does not come at the cost of increased systemic risk.

… international competitiveness…

The rapid privatisation of the formerly state-owned credit institutions provided a substantial impetus towards stabilising the financial sector. It was precisely the large share of foreign investors mentioned above that made a significant contribution to consolidating the banking landscape in central and eastern Eur-

ope. The new parent companies not only help to spread banking expertise; they also foster technical efficiency in the banking industry and raise the level of competitiveness on the national financial markets.

... and effective financial supervision

All of the acceding countries have made enormous efforts to improve the effectiveness of their financial supervision. Central banks are typically integrated into financial supervision. Latvia was the only country to transfer this task entirely to a newly founded supervisory authority, doing so in July 2001. Further progress in stabilising the financial sector at the institutional level is expected to result from greater international cooperation. Last year, for example, a group of experts was sent by the European Commission to examine the effectiveness of financial supervision in the acceding countries. Furthermore, all of the acceding countries have undergone an evaluation by the IMF within the framework of the Financial Sector Assessment Program (FSAP). Looking ahead, it is essential that the deficiencies indicated in the reports are remedied on a sustainable basis and the recommendations therein quickly implemented.

Financial market integration and causes of international segmentation

Significance of international financial market integration ...

The international integration of the financial markets is also a significant factor. Integrated financial markets foster an efficient allocation of financial resources and thus increase the economic performance and the competitiveness of the entire economy. Consequently, they pave the way for sustainable, non-inflationary growth.

Stability indicators of the banking sector in 2001

Country	Non-performing loans as % of total bank loans	Capital adequacy [1]	Pre-tax profit as % of total bank assets
Czech Republic	13.7	15.4	0.8
Estonia	1.5	14.4	2.5
Hungary	3.1	15.6	1.7
Latvia	3.1	14.2	1.7
Lithuania	7.4	15.5	– 0.1
Poland	20.1 [2]	15.0	1.4
Slovak Republic	24.3	19.6	1.1
Slovenia	9.2	11.9	0.4

Sources: EBRD, European Commission. — **1** Equity capital as a percentage of risk-weighted bank assets. — **2** First half of 2001.

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The integration of the central and east European financial markets into the euro area will be especially important with respect to subsequent accession to European monetary union and to the common monetary policy within the Eurosystem. In segmented national financial markets the danger of asymmetrical monetary policy impulses increases. The efficacy of monetary policy within a monetary union consequently hinges on the integration of the financial markets.

Whereas hitherto the exchange rate channel has played a significant role in the transmission mechanism of monetary policy in most of the acceding countries, in the medium

Interest parity theory

The interest parity theory applies the law of one price to fixed-interest, homogeneous financial paper. A distinction is made between covered and uncovered interest parity, which are based on different assumptions and capture different segments of the financial markets.

Covered interest parity says that the return on domestic financial paper corresponds to the return on foreign paper with a hedged exchange rate risk. The interest rate differentials between two economies are therefore offset by the swap rate of the bilateral exchange rate.

(1) $\frac{1+i_t}{1+i_t^*} = \frac{E^T_{t,t+k}}{E_t}$ or simplified

(1a) $i_t - i_t^* = \frac{E^T_{t,t+k} - E_t}{E_t}$

where i = domestic interest rate; i* = foreign interest rate; E = spot rate; E^T = forward rate; t, k = time indices.

Equation (1) presupposes the possibility of complete arbitrage between domestic and foreign paper, ie there are no barriers in the form of transaction costs or default risk. For shorter maturities (of one year or less) the degree to which covered interest parity is valid represents a measure of the integration of national money markets while eliminating exchange rate risk.

In the case of uncovered interest parity, by contrast, there is no hedging against exchange rate risk. As a result, it is the expected exchange rate movements and not the swap rates that are compared with the national interest rate differentials.

(2) $\frac{1+i_t}{1+i_t^*} = \frac{E^e_{t,t+k}}{E_t}$ or simplified

(2a) $i_t - i_t^* = \frac{E^e_{t,t+k} - E_t}{E_t}$

where E^e = expected exchange rate.

Uncovered interest parity can be divided into two components, namely covered interest parity and speculative efficiency, which requires the forward rate to be the same as the expected exchange rate.

(3) $\frac{1+i_t}{1+i_t^*} = \frac{E^T_{t,t+k}}{E_t} \cdot \frac{E^e_{t,t+k}}{E^T_{t,t+k}}$ and

(3a) $i_t - i_t^* = \frac{E^T_{t,t+k} - E_t}{E_t} + \left\{ \frac{E^e_{t,t+k} - E_t}{E_t} - \frac{E^T_{t,t+k} - E_t}{E_t} \right\}$

In addition to the implications of covered interest parity, the validity of uncovered interest parity presupposes that no premia are paid in the foreign exchange markets for exchange rate risk. This is the precondition if financial securities denominated in different currencies are also to be regarded as perfect substitutes. Speculative efficiency requires perfectly integrated foreign exchange markets.

When checking speculative efficiency, however, one encounters the problem that exchange rate expectations cannot be observed directly. The hypothesis of rational exchange rate expectations offers one solution, implying that, on average, the actual subsequent exchange rate equals the previously expected exchange rate.

(4) $E_{t+k} = E^e_{t,t+k} + u_t$

where u_t = expectation error.

Conversely, this means that the subsequent spot rate can be used as a proxy for the expected exchange rate. This leads to the following as a test for speculative efficiency.

(5) $\frac{E_{t+k}}{E^T_{t,t+k}} = 1 + \rho_t$ and

(5a) $\frac{E_{t+k} - E_t}{E_t} - \frac{E^T_{t,t+k} - E_t}{E_t} = v_t$

This approach involves a combined hypothesis test which links the hypothesis of rational exchange rate expectations (ie the rate reached is an unbiased estimator of the expected spot rate) with the hypothesis of efficient foreign exchange markets ("unbiased hypothesis", ie the forward rate is an unbiased estimator of the expected spot rate) and the absence of exchange rate premia. Rejection of the null hypothesis, namely that the disturbance terms ρ_t and v_t have an expected value of zero, must therefore be interpreted with caution. It may be due to both inaccurate modelling of the exchange rate expectations and to the existence of transaction costs or of a risk premium.

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term the interest rate channel will acquire increasing importance.[2] Therefore, with respect to the Eurosystem, the money markets and foreign exchange markets in central and eastern Europe are the focus of interest. Their integration into the euro area will be examined more closely below.

... and its definition

Financial market integration is defined in a number of ways in the literature. Whereas an interpretation in the broader sense considers only the institutional conditions necessary for integration, a definition in the narrower sense also considers the willingness of investors to enter into cross-border transactions. Based on this more precise definition, there are two categories of measurement concepts.[3]

Quantity-oriented...

The first quantity-oriented category focuses on the volume of cross-border financial transactions. With methods of this category, for example, international integration of the markets is reflected in a relatively slight home bias. Methodological flaws are the main reason for not using quantity-oriented measurement concepts. On the one hand, a smaller volume of international financial transactions does not automatically imply market segmentation. It is possible that there are simply no incentives to make cross-border transactions because, from the investor's point of view, there is no difference between domestic investment and foreign investment. On the other hand, capital flight in connection with monetary and financial crises can hardly be seen as a sign of a high level of integration.

If one were less concerned about the actual volume of transactions but, instead, primarily interested in the structure and extent of competition in the market and the attendant efficiency, one would use the second category based on the "the law of one price". The lower the price discrepancies for comparable (financial) products, the more integrated the respective markets. In the money and foreign exchange markets, this price-oriented measurement concept is incorporated into the interest parity theory (see the explanatory notes on page 46).

... and price-oriented measurement concepts

Underlying causes of segmentation

The existing level of integration alone, however, provides only a limited indication of possible difficulties that could arise in carrying out a common monetary policy in an enlarged monetary union. While every deviation from interest parity, both covered and uncovered, is an expression of segmentation which hampers cross-border transactions, the underlying causes can vary greatly and, accordingly, must be assessed differently.

Risk premia

Partial segmentation, for example, may reflect the preferences of market players. Despite imperfect integration of the financial markets in the sense of the validity of the "law of one price", there would still be an efficient allocation of capital. Under these assumed conditions, a deviation from interest parity can occur if market participants demand a risk premium for investing in one of the alternative forms of investment. In the case of covered interest parity this would mean that

2 See C Thimann (ed) (2002), Financial Sectors in EU Accession Countries, ECB, Frankfurt am Main, p 11.
3 See M Obstfeld, Capital Mobility in the World Economy: Theory and Measurement in the National Bureau Method, in K Brunner and A H Meltzer, (eds) (1986), *The National Bureau Method, International Capital Mobility and other Essays,* Amsterdam, p 55 ff.

Econometric studies on the international integration of the money and foreign exchange markets in central and eastern Europe

The integration of the money and foreign exchange markets in Poland, the Czech Republic, the Slovak Republic and Hungary with those of the euro area were examined for the period from January 1999 to June 2002.[1] The tests for the validity of covered interest parity and speculative efficiency are based on a regression model of the following type.

$$(1) \quad \frac{1+i_t}{1+i_t^*} = \alpha+\beta \frac{E^T_{t,t+3}}{E_t} + u_t$$

and

$$(2) \quad \frac{E^T_{t,t+3}}{E_t} = \alpha+\beta \frac{E_{t+3}}{E_t} + v_t ,$$

where i and i^* are the three-month money market rates in the various central and east European countries and in the euro area respectively; $E^T_{t,t+3}$ is the three-month forward rate of the national currency and E_t is the spot exchange rate; u_t and v_t are disturbance terms.

A necessary condition for money market and/or foreign exchange market integration as defined here is a long-run equilibrium between the interest rate ratio and the swap rate, and the swap rate and exchange rate movement. This requires the time series on the left and right sides of equation (1) and (2) to be either both stationary or both non-stationary and cointegrated. Furthermore, to meet the required conditions for perfect integration α has to equal 0 and β equal 1 and the residuals have to be serially uncorrelated ("white noise"). If the residuals do not have the characteristics of "white noise", inefficiencies are not corrected immediately and the forward rate does not contain all the relevant information.

With respect to the integration of the money markets, unit root tests were performed on the basis of the Augmented Dickey-Fuller test (ADF), the Phillips-Perron-Test (PPT) and the Kwiatkowski-Phillips-Schmidt-Shin test (KPSS). They showed that the time series $(1+i_t)/(1+i_t^*)$ is not stationary and I(1) for all countries. The same is true of $E^T_{t,t+3}/E_t$. In a first step, equation (1) was estimated using OLS. The unit root tests of the residuals confirm that a cointegration relationship between the two time series exists in all countries.[2] In a second step parameters α and β were estimated robustly with a dynamic OLS (DOLS). In doing so, account was taken of both the endogeneity problem and a possible heteroscedasticity and autocorrelation in the data. The overview in the table clearly shows that the null hypothesis of covered interest parity being fulfilled is rejected for all four countries. This not only confirms the results of the Wald test for the simultaneous existence of α=0 and β=1; the t-values of the individual coefficients are also highly significant.

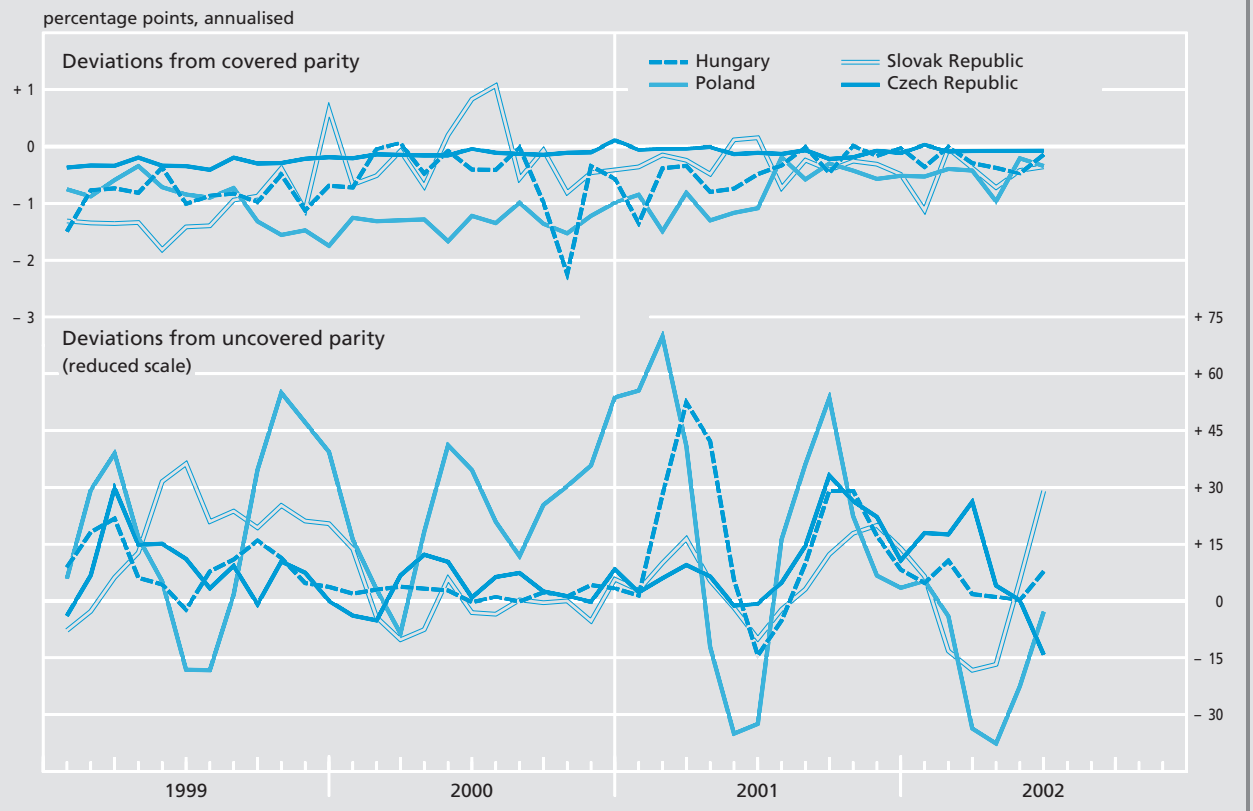
Validity of covered interest parity

Country	α (t-value, α=0)	β (t-value, β=1)	Wald test F-statistic (probability)
Poland	-0.15 (-3.20)***	1.14 (3.47)***	207.87 (0.000)
Slovak Republic	-0.12 (-4.42)***	1.12 (4.62)***	35.51 (0.000)
Czech Republic	-0.08 (-7.52)***	1.08 (7.62)***	69.81 (0.000)
Hungary	-0.09 (-3.76)***	1.09 (4.13)***	39.47 (0.000)

*** Rejection of the null hypothesis at the level of 1%.

1 Monthly data; data sources: Bloomberg, Thomson Financial, national central banks. — **2** For a detailed illustration of the estimates presented here see S Herrmann and A Jochem, The international integration of money markets in the central and east European accession countries, Economic Research Centre of the Deutsche Bundesbank, *Discussion paper* 07/03, and S Herrmann and A Jochem, The inter-

Deviations in three-month interest parities
in central and east European countries vis-à-vis the euro area



The situation is different with respect to the integration of the foreign exchange markets. The non-stationary time series $E^{T}_{t,t+3}/E_t$ now contrasts with $E_{t+3}/E_{t'}$ which in all countries shows a stationarity pattern. Since a long-run equilibrium relationship between variables with a different level of integration is ruled out, the results of the stationarity test mean that the necessary condition for fully integrated foreign exchange markets must be rejected for all four acceding countries.

A study of deviations from covered and uncovered interest parity during the observation period clearly shows that the segmentation of the money and foreign exchange markets varied greatly, both between the individual acceding countries and over time. In the past few years, considerable progress has been made on the money markets in particular. The deviations from uncovered interest parity, by contrast, have shown no apparent trend and have undergone fairly large fluctuations, at least some of which are probably due to expectation errors.

national integration of the foreign exchange markets in central and east European accession countries, Economic Research Centre of the Deutsche Bundesbank, *Discussion paper* 08/03.

one of the investments has been assigned a higher default risk. However, exchange rate risks, which occur in unsecured financial market transactions, play a more important role and lead to a violation of uncovered interest parity.

Capital controls

Transaction costs are another reason for segmentation; they prevent a pareto-optimal allocation of capital and consequently are to be considered inefficient. These, in turn, can be classified into institutional barriers and economic shortcomings. Institutional barriers can be influenced – at least theoretically – through policies. Restrictions on capital movements head the list. If, for instance, foreign paper, in view of the expected exchange rate development, offers a higher yield than comparable domestic paper this, in the absence of any other explanations, indicates restrictions on capital exports. In this case, domestic investors have only a limited opportunity to invest their money in higher-yielding foreign paper and to balance out yield differentials via cross-border transactions by way of induced interest rate and exchange rate adjustments. Conversely, if the home country has a yield advantage over the foreign country, one may conclude that capital imports are being restricted.

In practice, it is often difficult to separate clearly the effects of restrictions on capital movements from the aforementioned default risks. Actually these are often in danger of being exposed to future (additional) restrictions upon repatriation of capital invested abroad and/or any income earned there. For this reason, capital controls and default risks have sometimes been generally classified as "political risks"[4] although, as shown, they are actually two distinct issues.

Underdeveloped financial sectors

Imperfect markets and an underdeveloped financial sector can also be underlying causes for a violation of the law of one price in the financial markets. Such economic factors are typically reflected in greater bid-ask spreads. Depending on the current market situation, these can result in both positive and negative deviations from interest parity.

Financial market integration in selected acceding countries

Database

The interest parity theory is a suitable instrument for examining to what extent the central and east European financial markets are already integrated with the euro-area markets. The following empirical studies focus on the Visegrád Group, ie Poland, the Czech Republic, the Slovak Republic and Hungary.[5] The countries were selected owing to the availability of required data; the selection also reflects the liquidity of the national money and foreign exchange markets. The observation period begins with the introduction of the euro in January 1999 and ends in June 2002 (see explanatory notes on pages 48-49).

Integration of money markets in acceding countries increases

At the beginning of the observation period there was still a significant lack of integration in the central and east European money mar-

4 See R Aliber, The Interest Parity Theorem: A Reinterpretation, *Journal of Political Economy,* Vol 81 (1973), pp 1451-1459.
5 The calculations are based on three-month money market rates, spot rates and three-month forward rates.

Causes of incomplete integration of money markets in central and eastern Europe

As was demonstrated on pages 48-49 covered interest parity for Poland, the Czech Republic, the Slovak Republic and Hungary was not fulfilled for the period from January 1999 to June 2002. There are a number of possible reasons for this. The following econometric analysis will examine which institutional and economic factors are relevant in this context. The absolute deviations from covered interest parity are taken here as the variable to be explained. This is because all fluctuations around interest parity, ie positive and negative deviations alike, are a sign of the existence of transaction costs. The following regression equation was used. [1]

$$ABSCIP_{it} = \delta_i + \gamma_1 M2BIP_{it} + \gamma_2 CRPCRG_{it} + \gamma_3 ZLZD_{it} + \gamma_4 WCRR_{it} + \gamma_5 DUMKV_{it} + \gamma_6 TIME_t + \eta_{it}$$

where

ABSCIP = absolute deviation from covered interest parity
M2BIP = ratio of M2 to GDP
CRPCRG = ratio of private loans to total loans
ZLZD = ratio of the lending rate to the deposit rate
WCRR = monthly growth rate of lending at constant prices
DUMKV = capital controls dummy
TIME = trend
η = disturbance term
i = country index
t = time index

The variables M2GDP, CRPCRG, ZLZD and WCRR are used as a measure of the performance and efficiency of the financial sector. Dummies are used to represent capital controls. Initially, they take on the value of 1 and after a distinct liberalisation of short-term capital movements assume the value of zero; if no such move can be detected in the observation period, the dummy retains the value of 1. A trend is additionally used as a collective term for the steady evolution of the financial sector unless it is already captured by the above-mentioned variables. A negative sign is expected for γ_1, γ_2, γ_4 and γ_6 since the variables are positively correlated with the maturity and efficiency of the financial sector. They are intended to reduce existing market imperfections and the associated monopoly gains and, consequently, to diminish the absolute deviations from covered interest parity. By contrast, γ_3 and γ_5 are expected to have positive signs since ZLZD expresses imperfect competition in the banking sector and capital controls hamper the harmonisation of domestic and foreign yields.

The robustly estimated results of a Feasible Generalized Least Squares estimate (FGLS) with fixed effects for explaining absolute deviations from covered interest parity are listed in the following table. [2]

FGLS estimate to explain absolute deviations from uncovered interest parity in selected central and east European countries

Explanatory variable	Parameter	Standard error	t-statistic (probability)
M2BIP	– 0.047	0.017	– 2.74 (0.007)
CRPCRG	– 0.007	0.003	– 2.36 (0.020)
ZLZD	0.064	0.034	1.90 (0.060)
WCRR	– 0.009	0.001	– 6.14 (0.000)
DUMKV	0.050	0.016	3.08 (0.003)
TIME	– 0.004	0.002	– 2.90 (0.004)

All parameters have the expected sign and, with the exception of the interest rate spread ZLZD, are all significant at the level of 5%. Following the liberalisation and subsequent development of the financial markets in the countries examined, the fairly large, mostly negative deviations from covered interest parity witnessed at the beginning of 1999 declined. The degree of integration has naturally not yet reached the level existing between the western industrial countries.

1 Monthly data; data sources: Bloomberg, Thomson Financial, IMF, national central banks. — **2** For further details of the estimate and of the tests carried out, see S Herrmann and A Jochem, The international integration of the money markets in the central and east European accession countries, *loc cit*.

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kets. The deviations from covered interest parity in all four countries were mostly negative, which implies a yield disadvantage vis-à-vis the reference values of the euro area. In the past few years considerable progress has been made in all of the economies observed. The discrepancies had clearly been reduced, especially from the end of 2001.

Furthermore, the Czech Republic had by far the lowest deviation from covered interest parity throughout the entire observation period. By contrast, in other countries, especially in Poland and the Slovak Republic, no sustainable international integration of the money markets was achieved until the beginning of the new millennium.

Complete integration in euro-area markets

By comparison, numerous empirical studies have shown that the networking of the money markets in the western industrial countries picked up significantly during the 1980s and that these markets can now be assumed to be completely integrated. Within the EMS and ERM II, covered interest parity has been considered to hold since overcoming the exchange rate crises in 1992-1993 and the removal of the last capital controls in the spring of 1994.[6]

Uncovered interest parity in central and eastern Europe considerably violated…

If instead of the swap rate, ie the difference between the forward exchange rate and the spot exchange rate, the expected interest rate development in the foreign exchange markets is used to compare yields, investments in central and eastern Europe were generally more profitable than corresponding assets in the euro area. Moreover, the deviations from uncovered interest parity were markedly greater than in the case of covered interest parity. However, this is at least partly explained by possible expectation errors which arise when using the subsequent actual exchange rate instead of the expected exchange rate, which cannot be directly observed, and are reflected along with the other causes in yield differentials between domestic and foreign investments.

… but also unconfirmed in western industrial countries

In western industrial countries and in the EU, the validity of uncovered interest parity has not been empirically confirmed either. However, relevant studies mainly show that spot and forward rates between the currencies of these countries are at least cointegrated and thus have a long-run equilibrium relationship.[7] No such link can be established for the central and east European currencies.

Segmentation of money and foreign exchange markets…

In view of the mainly negative deviations from covered interest parity, the default risk of short-term financial investments in central and eastern Europe, at least since 1999, no longer seems to have had any decisive influence on the formation of prices. Instead, transaction costs and market imperfections which are attributable either to the impact of

6 For an overview see D Jandura, *Die Integration internationaler Finanzmärkte – Definitionen, Messkonzepte, empirische Analysen, Bad Soden.* However, Holmes and Wu are unable to prove the stationarity of the CIP deviations for a panel of four EU member countries between May 1990 and January 1996. The authors' main explanation for the rejection of covered interest parity is the EMS crisis in the first half of the observation period. See M J Holmes and Y Wu (1997), Capital Controls and Covered Interest Parity in the EU: Evidence from a Panel-Data Unit Root Test, *Weltwirtschaftliches Archiv,* Vol 133, 1, pp 76-89.

7 See for example F G M C Nieuwland, W F C Verschoor, C C P Wolff (2000), Exchange Risk Premia in the European Monetary System, *Applied Financial Economics,* Vol 10, pp 351-360.

Exchange rate premia on assets denominated in central and east European currencies

Using the general asset pricing model developed by Lucas (1982), an attempt will be made to divide the exchange rate premia paid from January 1999 to June 2002 on assets in Poland, the Czech Republic, the Slovak Republic and Hungary into a constant term and a time-dependent component. According to this model, exchange rate premia can be explained by the volatilities in the growth rates of consumption, monetary stock and asset prices. [1] On the assumption of rational expectations, the actual subsequent spot rate is a suitable proxy for the expected exchange rate, and the regression equation of the exchange rate premium, defined as the difference between the logarithms of the forward exchange rate and the expected spot rate, is as follows. [2]

$$e^{T}_{t,t+3} - e_{t+3} = c + \beta_1 hm_{i,t} + \beta_2 hm_{E,t} + \beta_3 hy_{i,t} + \beta_4 hy_{E,t} + \beta_5 hk_{i,t} + \beta_6 hk_{E,t} + \varepsilon_t$$

where
$e^{T}_{t,t+3}$ = logarithm of the forward exchange rate
e_{t+3} = logarithm of the spot exchange rate in t+3

hm = conditional variance of monetary growth
hy = conditional variance of the growth in industrial output as a proxy for consumption, which is not captured monthly
hk = conditional variance of the relative changes in the share price index
ε = disturbance term
t = time index
i = index for acceding countries
E = index for euro area.

The endogenous variable is defined in such a way that positive deviations indicate a yield advantage and therefore a possible exchange rate premium to the detriment of investment in central and eastern Europe. According to the asset pricing model, a high degree of volatility in the rate of monetary growth and in the rise in consumption and share prices abroad increases the expected yield of a foreign investment. This effect is the result of the convexity of the yield as a function of the above-mentioned growth rates and, at first glance, leads to a surprising result: with risk-neutral investors, a high degree of volatility in foreign markets lowers the exchange rate premia on foreign financial investments. [3] Market participants' aversion to risk can (partly) offset this effect. In the regression the expected signs of the parameters of the acceding countries' variables (β_1, β_3, β_5) are therefore negative and those of the parameters of the euro-area variables (β_2, β_4, β_6) positive.

The conditional variances were established by means of a GARCH equation system. Then the parameters for identifying the exchange rate premium were estimated using an OLS regression model and taking account of autocorrelation. [4] The results of the regression are summarised in the following table.

Regression model for explaining exchange rate risk premia on investments denominated in central and east European currencies

Country	C	hm_i	hm_E	hy_i	hy_E	hk_i	hk_E	R^2
Czech Republic	0.01 (12.43)***	– 273.72 (– 7.09)***	1640.15 (3.64)***	75.19 (10.30)***	– 62.24 (– 1.31)	– 3.95 (– 3.15)***	1.59 (0.75)	0.7
Hungary	0.04 (5.11)***	– 1022.73 (– 10.17)***	2301.16 (10.86)***	– 16.24 (– 2.43)***	43.25 (2.18)	– 10.81 (– 4.24)***	10.13 (6.30)***	0.6
Poland	– 0.09 (– 812.08)***	– 220.84 (– 3.94)***	3625.72 (5.77)***	– 62.61 (– 7.05)***	738.81 (6.05)***	5.21 (1.27)	27.42 (8.80)***	0.7
Slovak Republic	0.13 (78.30)***	– 240.88 (– 1.19)	1931.34 (3.00)***	– 158.60 (– 7.22)***	– 774.11 (– 11.10)***	– 11.73 (– 5.64)***	– 1.54 (– 0.64)	0.5

*** Significant at the 1% level.

The variables derived from the asset price model are mostly significant at the 1% level and have the expected sign. The volatility of monetary growth and the development of stock markets clearly have an effect on the level of the exchange rate premia. By contrast, the influence of the variability of growth in industrial output is ambivalent and often not significant. Possible explanations include market participants' strong aversion to risk or poor suitability of this variable as a proxy for the level of consumer demand, which is actually requested but available only on a quarterly basis. In addition to a time-variable component, a constant component of exchange rate premia can also be proved in all countries.

1 R E Lucas (1982), Interest Rates and Currency Prices in a Two-Country World, *Journal of Monetary Economics,* Vol 10, pp 335-359, and C Jiang, and T C Chiang (2000), Do Foreign Exchange Risk Premiums Relate to the Volatility in the Foreign Exchange and Equity Markets?, *Applied Financial Economics,* Vol 10, pp 95-104. — **2** Monthly data; data sources: Bloomberg, Thomson Financial, national central banks. — **3** In other words, the volatility of the foreign growth rates increases the expected purchasing power of the foreign currency. This leads to an increase in the forward rate, which is a function of the expected purchasing power both at home and abroad. — **4** The estimate is consistent but displays standard errors of the estimated parameters that are too low as the explanatory variables (the conditional variances) used are not exogenous, rather have been estimated; see A Pagan, Econometric Issues in the Analysis of Regressions with General Regressors, *International Economic Review,* Vol 25, 1, pp 221-247. Account is taken of this problem by placing especially high demands on the significance level (1%). For details on the procedure see S Herrmann, and A Jochem, The international integration of the foreign exchange markets in central and east European accession countries, *loc cit.*

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restrictions on capital exports or to inefficiencies related to the underdevelopment of the financial sector are to blame for the insufficient fulfilment of covered interest parity. The observed yield advantages based on uncovered interest parity also indicate that the currency markets demanded an exchange rate premium for purchases of financial paper denominated in the currency of a central or east European accession country which more than offset the amount of transaction costs incurred.

... due to restrictions on capital movements and underdeveloped financial sectors ...

This interpretation of the price discrepancies observed on the international financial markets can also be tested econometrically. A panel study on covered interest parity showed that in the past both capital export restrictions and inefficiencies of the financial sectors in the acceding countries hampered the total integration of the central and east European financial markets under observation (see the explanatory notes on page 51). However, capital controls have now been almost totally dismantled within the framework of EU accession negotiations and are not likely to play any role in future. By contrast, it can be expected that the integration barriers arising from an underdeveloped financial sector are of a more permanent nature and cannot be simply removed by EU membership alone.

Above all, a high level of liquidity in the markets, a market-economy-oriented banking sector and further efficiency improvements coupled with a satisfactory degree of competition in the domestic financial markets can make a positive contribution to further integration. Evidently, the momentum of the financial sector is also associated with a fall in international segmentation.

... and exchange rate premia ...

Another study on the significance of exchange rate premia in the foreign exchange markets looked for factors which may be responsible for the varying results on covered and uncovered interest parity and for the discrepancies between the swap rate and the actual exchange rate development (see the explanatory notes on page 53).

... consisting of a time-dependent component ...

In order to record possible changes over time the study examined the extent to which a time-dependent component of exchange rate premia could be established and explained by developments in exogenous variables. The study showed that the exchange rate premium was significantly influenced by internationally differing levels of volatility in monetary growth and stock-price developments. By contrast, the volatility of consumption growth does not provide any significant or uniform explanation for the development of exchange rate premia.

... and a constant component

In all countries the exchange rate premia also have a constant element. This component, which is not explained by the model, prevents a complete yield adjustment at home and abroad and reflects the reticence of investors to invest in central and east European currencies in the period observed. The underdeveloped financial sectors and the resulting market imperfections could also be reasons for the constant component, which could therefore not be considered part of the exchange rate premium but rather an expression of inefficient foreign exchange markets.

Conclusion

Now that the system of banking and financial market supervision has been strengthened and the liberalisation of the financial system is nearly complete, the central and east European acceding countries have already fulfilled important preconditions for upcoming EU membership. Nonetheless, all of the market segments, including the especially important banking sector, are still considerably underdeveloped. Consequently, this area of these economies has enormous future growth potential that needs to be tapped. With regard to the acceding countries' future participation in ERM II and desired membership of the euro area – no "opting-out" clause has been envisaged for these countries – it is important to improve the performance of the financial sector still further and to step up the integration of the central and east European financial markets with the euro area. In doing so, direct efficiency gains can be achieved in the respective economies. At the same time, this will help to prepare for monetary union.