

ANALYSES OF THE CZECH REPUBLIC'S CURRENT  
ECONOMIC ALIGNMENT WITH THE EURO AREA

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# ANALYSES OF THE CZECH REPUBLIC'S CURRENT ECONOMIC ALIGNMENT WITH THE EURO AREA 2007

Authors:	Oxana Babetskaia-Kukharchuk	1.1.6, 1.1.7
	Ian Babetskii	1.1.3, 1.3.2, 2.2.1
	Kamil Galuščák	2.2.2, 2.3.1, 2.3.2.1, 2.3.3
	Dana Hájková	A, B, C, 3
	Jaroslav Heřmánek	1.3.1, 2.4
	Tomáš Holub	1.1.1
	Martina Horníková	1.1.2
	Roman Horváth	1.1.8, 2.2.3
	Luboš Komárek	1.3.2
	Zlataše Komárková	1.3.2
	Filip Novotný	1.1.5, 1.2
	Eduard Oplatek	2.3.2.2
	Štěpán Radkovský	1.1.2
	Filip Rozsypal	1.1.2
	Branislav Saxa	2.2.3
	Pavel Soukup	2.1
	Radka Štiková	1.1.4
Editor:	Dana Hájková	

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## CONTENTS

<b>A.</b>	<b>Introduction.....</b>	<b>5</b>
<b>B.</b>	<b>Executive Summary .....</b>	<b>7</b>
<b>C.</b>	<b>Theoretical Foundations of the Analyses.....</b>	<b>12</b>
<b>D.</b>	<b>Results of the Analyses .....</b>	<b>15</b>
1.	Cyclical and Structural Alignment.....	15
1.1	Direct alignment indicators .....	15
1.1.1	Real economic convergence.....	15
1.1.2	Correlation of economic activity.....	19
1.1.3	Synchronisation of economic shocks .....	23
1.1.4	Macroeconomic effects of financial flows from EU funds .....	25
1.1.5	Assessment of the economies' structural similarity.....	28
1.1.6	Convergence of the interest rate differential .....	29
1.1.7	Exchange rate convergence.....	31
1.1.8	Analysis of exchange rate volatility.....	33
1.2	The effect of international economic relations.....	35
1.2.1	The links of the economy with the euro area .....	35
1.2.2	Intra-industry trade.....	37
1.3	Financial market.....	38
1.3.1	Financial sector .....	38
1.3.2	Financial market integration.....	41
2.	Adjustment Mechanisms .....	44
2.1	Fiscal policy .....	44
2.1.1	The stabilisation function of public budgets .....	44
2.1.2	Government deficit and debt and the scope for stabilising fiscal policy .....	46
2.1.3	Sustainability of public finances .....	49
2.2	Wage elasticity and inflation persistence .....	50
2.2.1	The degree of adjustment of real wage growth to the unemployment rate – the Phillips curve.....	50
2.2.2	The degree of adjustment of regional real wages to the regional unemployment rate – the wage curve.....	50
2.2.3	Inflation persistence .....	52
2.3	Labour market flexibility .....	53
2.3.1	Unemployment and internal labour market flexibility.....	53
2.3.2	International labour mobility.....	57
2.3.3	Institutional environment .....	61
2.4	Flexibility and shock-absorbing capacity of the banking sector .....	69
3.	Summary of Results of Analyses – Comparison with 2006 Document.....	74
<b>E.</b>	<b>Methodological Part.....</b>	<b>80</b>
<b>F.</b>	<b>References .....</b>	<b>98</b>

## List of Tables

Table 1: GDP per capita at purchasing power parity (EA-12 = 100).....	16
Table 2: Average GDP price level (EA-12 = 100).....	16
Table 3: Real exchange rate against the euro (1998 = 100; HICP deflated).....	17
Table 4: Estimate of equilibrium real appreciation (in p.p.; annual average for 2008–2012).....	18
Table 5: Three-month ex-post real interest rates (in %; HICP deflated).....	19
Table 6: Correlation coefficients of economic activity – evolution over time.....	20
Table 7: Correlation coefficients of overall export activity and exports to the euro area GDP– evolution over time.....	23
Table 8: Correlation of economic shocks vis-à-vis the euro area.....	24
Table 9: Drawdown of financing from EU Structural Funds in the Czech Republic (CZK millions) ..	26
Table 10: Expected financial flows resulting from the Czech Republic’s EU membership (in CZK billions) and estimated impacts of drawdown of EU funds by the private sector on the economy.....	27
Table 11: Impact of the additional impulse due to the inflow of funds from the EU.....	28
Table 12: Shares of economic sectors in GDP in 2006 (%).....	29
Table 13: Historical and fundamental-based volatility of exchange rates vis-à-vis the euro (%).....	35
Table 14: Shares of FDI from the euro area in GDP (%).....	37
Table 15: Shares of DI in the euro area in GDP (%).....	37
Table 16: Financial system assets/GDP (%).....	39
Table 17: Bank loans to non-bank clients/GDP (%).....	39
Table 18: Banking sector assets/financial system assets (%).....	41
Table 19: Beta coefficients.....	42
Table 20: General government deficit (ESA95), European Commission estimate (% of GDP).....	47
Table 21: Shares of mandatory state budget expenditure (%).....	48
Table 22: Ratios of public revenue, expenditure and tax burden to GDP in 2006 (%).....	49
Table 23: Public debt (ESA95), European Commission estimate (% of GDP).....	49
Table 24: Debt service, European Commission estimate (% of GDP).....	50
Table 25: Gross public debt (% of GDP).....	50
Table 26: Elasticity of wages to the unemployment rate.....	51
Table 27: The wage curve in the Czech Republic (1994–2006).....	52
Table 28: Inflation persistence estimates.....	53
Table 29: Long-term unemployment rate (%).....	54
Table 30: Shares of the long-term unemployed (%).....	54
Table 31: Coefficients of variation of the unemployment rate.....	55
Table 32: Internal migration (per 1,000 inhabitants).....	56
Table 33: Immigration (number of persons per 10,000 inhabitants).....	57
Table 34: Shares of foreign nationals in the population (%).....	58
Table 35: Persisting administrative barriers for the new EU members.....	60
Table 36: Trade unions and collective bargaining.....	62
Table 37: Minimum wage (%).....	63
Table 38: Shares of employees earning the minimum wage (%).....	63
Table 39: Minimum wage and gross monthly wage in selected professions (%).....	63
Table 40: Employment protection legislation index (EPL).....	64
Table 41: Indices of administrative barriers to entrepreneurship.....	66
Table 42: Overall labour taxation.....	67
Table 43: Net replacement rates.....	68
Table 44: Non-performing loans/total loans in the banking sector (%).....	69
Table 45: Capital adequacy of the banking sector (%).....	70
Table 46: Net interest margin (NIM, %).....	70
Table 47: Net non-interest income/average assets (%).....	71
Table 48: Pre-tax profit/average assets (%).....	71

## List of Charts

Chart 1: Inflation structure in the Czech Republic (annual percentage changes, excluding tax effects)	17
Chart 2: Annual percentage changes in real GDP	20
Chart 3: Rolling correlation of economic activity	21
Chart 4: Dynamic correlation of economic activity (annual changes in real GDP) with the euro area	22
Chart 5: Year-on-year changes in the Industrial Production Index (%)	22
Chart 6: Structural similarity vis-à-vis the euro area	29
Chart 7: Differences in interest rates vis-à-vis the euro area 1998–2006 (percentage points)	30
Chart 8: Differences in interest rates vis-à-vis the euro area 1990–2006, long-term interest rates (percentage points)	31
Chart 9: Correlation coefficients of exchange rates against the US dollar	32
Chart 10: Historical volatility of exchange rates vis-à-vis the euro (%)	34
Chart 11: Implied volatility of exchange rates vis-à-vis the euro (%)	34
Chart 12: Shares of exports to the euro area in total exports (%)	36
Chart 13: Shares of imports from the euro area in total imports (%)	36
Chart 14: Intensity of intra-industry trade with the euro area	38
Chart 15: Bank loans to households (shares in GDP and in total bank lending in 2006, %)	40
Chart 16: Sigma coefficients	43
Chart 17: Decomposition of the history and outlook of the fiscal deficit into its cyclical and cyclically adjusted components, based on CNB analyses (% of GDP)	46
Chart 18: Beveridge curve	56
Chart 19: Foreign employees in the Czech Republic by industry (thousands of persons)	59
Chart 20: Foreign employees in the Czech Republic by profession (thousands of persons)	59
Chart 21: Costs of individual termination of an open-ended contract by employment contract duration in 2006 (number of days for which wage is paid)	65
Chart 22: Change in the net income of households with a non-working partner in 2007 compared to 2006 (CZK)	69
Chart 23: Profitability and capital adequacy of banks in 2006 (%)	72
Chart 24: Stress test results for the Czech banking sector (capital adequacy, in %)	73

## A. Introduction

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If the Czech economy is to reap the benefits associated with introducing the euro it will need to be able to operate without an independent monetary policy and without the option of exchange rate adjustment vis-à-vis its largest trading partners. This ability will be affected by the similarity of economic developments in the Czech economy with those in the euro area, since the degree of alignment will co-determine the appropriateness of the settings of the monetary conditions to the current situation. The ability to adjust rapidly to economic shocks will be also an important factor. The Czech economy's alignment and its preparedness to adopt the euro can thus be assessed in terms of the long-term economic trends, the medium-term development of economic activity and the structural similarity of the Czech economy to the euro area economy, all of which affect the probability of asymmetric developments and the occurrence of asymmetric shocks, and the ability of the economy to absorb shocks and adjust flexibly to them. The analyses presented in this document therefore examine the Czech Republic's degree of economic alignment with the euro area and the Czech economy's ability to use alternative possibilities of adjustment.

This set of analyses of the Czech economy's alignment with the euro area in 2007 has been drawn up in line with the Czech Republic's Updated Euro-area Accession Strategy and assesses the current state of economic alignment and flexibility in individual areas. The exception is the outlook for fiscal variables, which, to some extent, are predetermined by the current trend. This set of analyses is a follow-up to similar documents published by the CNB in the previous two years. Compared to last year, the scope of some of the analyses has been expanded slightly. The individual studies have been updated using the statistical data and information available in September 2007. The analysis of the stabilising function of public budgets thus incorporates the estimated impacts of the fiscal reform approved in September 2007. However, the impacts of this reform on other areas (e.g. the impacts of the changes to taxes and benefits on the financial incentive to keep or seek a job) have not been analysed. The analyses are divided into two basic groups according to the type of question they try to answer. The section entitled "Cyclical and Structural Alignment" indicates the size of the risk of different economic developments in the Czech Republic compared to the euro area and hence the risk of the single monetary policy being highly suboptimal for the Czech economy. The section entitled "Adjustment Mechanisms" answers the question of to what extent the Czech economy is capable of absorbing the impacts of possible asymmetric shocks using its own internal adjustment mechanisms.

These analyses are aimed at assessing the evolution of the alignment indicators over time and in comparison with selected countries. The countries under comparison either are euro area members already (Austria, Germany, Portugal and Slovenia)<sup>1</sup> or aspire to such membership (Poland, Slovakia and Hungary). All of the analyses attempted to make comparisons with all the selected countries. However, in some cases this was not possible owing to a lack of relevant statistical data. As in last year's document, the values of the indicators for the euro area are defined at the EA-12 level, since the time coverage of most of the analyses ends with 2006. The conclusion as to whether the degree of economic alignment in the individual

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<sup>1</sup> The selection of euro area countries included in the comparison comprises countries that are comparable in terms of economic level and countries with which the Czech economy has trading links. The above selection is not associated with any assessment of how successfully these economies have performed in the euro area. Germany, the largest trading partner of the Czech Republic, meanwhile provides a useful benchmark as a core country of the euro area, although when making comparisons with aggregate or average economic indicators the large weight of Germany in the calculation of those indicators must be taken into account.

indicators is sufficient for adopting the single currency cannot be made in absolute terms, but can ensue from the aforementioned comparison with other countries and the assessment of the evolution of the alignment indicators over time. In general, it can be expected that the benefits of adopting the single currency will grow with greater economic alignment and more flexible adjustment mechanisms.

## B. Executive Summary

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The Czech Republic's entry into the euro area will yield benefits for the Czech national economy, but will also generate risks linked primarily with the loss of two effective channels of adjustment, namely independent monetary policy and exchange rate flexibility vis-à-vis our major trading partners. The consequences of this change will be affected by the degree of similarity of overall economic development in the Czech Republic with that in the euro area and the Czech economy's flexibility and resilience to shocks. The analyses presented in this document examine the similarity of the long-term economic trends, the medium-term development of economic activity and economic structure, the adjustment capacity of fiscal policy and the labour and product markets, and the functionality of financial markets.

Some improvements have occurred recently in the functioning of Czech economy. However, some of them are linked with the Czech economic cycle. No major changes have yet occurred in the functioning of fiscal policy and in the institutional setup on the labour market leading to a long-term improvement in the flexibility of the Czech economy. However, it is also fair to say that none of the areas under review saw a significant deterioration last year. In terms of the current preparedness to adopt the euro, the characteristics of the Czech economy can be divided into three groups.

First, **numerous economic indicators speak in favour of the Czech Republic adopting the euro**, and some of them have done so for quite some time. This group includes the high degree of openness of the Czech economy, its close trade and ownership links with the euro area, and the achievement of convergence of the inflation rate and nominal interest rates.

The second group includes **areas which, in terms of euro adoption in the Czech Republic, continue to pose a risk of macroeconomic costs, but which have shown some improvement in recent years**. The positive developments include accelerating real economic convergence in the Czech Republic, including further modest convergence of the price level towards that in the euro area, even though a significant difference in the price level persists. According to analyses conducted, the alignment of economic activity between the Czech Republic and the euro area appears to have recently slightly increased. However, these results are not yet sufficiently robust. In terms of alignment, the shift in the characteristics of the financial market closer to the euro area conditions, coupled with a high degree of banking system stability and a further partial improvement in the conditions for doing business, are also good things.

The third group contains the **areas which continue to be bottlenecks as regards the economy's flexibility and ability to adjust to shocks**. This group includes an insufficient stabilising role of public finances and a limited capacity for flexible adjustment in the labour market and partly also in the product market. The current public finance deficits are largely structural in nature and do not provide sufficient room for the possible stabilising effect of fiscal policy. Adoption of the euro will require changes on the expenditure side of public finances leading to a substantial reduction in the deficit. In the long run, it will also be necessary to ensure that demographic changes do not adversely affect fiscal policy effectiveness and the sustainability of public budgets. The ability of the Czech labour market to absorb shocks is essentially unchanged from last year and remains average by European comparison. The recent improvement in its performance is largely associated with the high rate of economic growth, but long-term and structural unemployment remain relatively high, while regional mobility and wage elasticity are on the low side. Recent positive developments include a halt in the growth in overall labour taxation and in the growth in the ratio of the



minimum wage to the average wage. The tax and benefit system, however, continues to create a demotivating environment for the long-term unemployed in low-income families with children. Another problem is that the skills of the long-term unemployed do not meet the current needs of the corporate sector. The costs of terminating an open-ended employment contract after a short period of employment remain very high by international comparison.

The following text in this section summarises developments in the individual areas analysed. The detailed results are given in part D, and a comparison with the previous year's results is given in section 3 of part D.

### **Cyclical and Structural Alignment**

The degree of **real economic convergence** is an important indicator of similarity. A higher level of such convergence fosters greater similarity of long-run equilibrium development. Indirectly, it can also foster a lower likelihood of misalignment in the shorter run. A higher degree of convergence prior to ERM II entry and euro adoption should increase the relative price level, which will decrease potential future pressures for growth of the price level and equilibrium appreciation of the real exchange rate. Thanks to a pick-up in economic growth, GDP per capita in the Czech Republic has recently started to converge more quickly towards the euro area average. Its current level is comparable with the least advanced euro area countries (Portugal and Slovenia) and higher than in the other new EU Member States. The price level also converged further in 2006, owing mainly to nominal appreciation of the exchange rate. However, the difference in the price level relative to the euro area, including its least advanced countries, remains sizeable. Moreover, the price level in the Czech Republic lies below the level which, according to empirical estimates, corresponds to the economic level. Besides a tendency towards a narrowing of this difference, we can also expect a continuing equilibrium trend of real appreciation of the koruna against the euro as a result of the ongoing process of real convergence. As before, prior to euro adoption this process will involve a decline in prices of tradable goods and a rise in prices of non-tradable goods, including regulated prices, amid low inflation overall. The persistence of this trend following accession to the euro area will initially engender a higher rate of inflation in the Czech Republic than in the euro area and, as a result, lower domestic real interest rates (probably even negative in the case of short-term money market rates). If this situation persists in the long term, there would be a risk of an overheating of the economy which could be associated with adverse consequences for macroeconomic and financial stability.

**Alignment of economic activity and similarity of economic shocks** help the single monetary policy to have an effective and appropriate effect on an economy in a monetary union. The analyses suggest that the development of overall economic activity in the Czech Republic may be converging towards that in the euro area. However, the results are not unambiguous and this relationship may be partially distorted by the trend of the Czech economy. The observed correlations are meanwhile lower than in the other countries under review except Hungary. The analysis of the occurrence of demand-side and supply-side macroeconomic shocks does not find any alignment with the euro area. However, a relatively high degree of alignment with the euro area is observed for activity in industry. The results of analyses of export activity suggest the possibility of significant alignment between the Czech Republic and the euro area in this area, although these results are not robust. According to the analyses, however, the recent export activity of the Czech Republic is not statistically significantly correlated with GDP growth in the euro area. This may be linked with the integration of Czech exporters into the production chains of multinational companies.

Increased **drawdown of funds from EU structural funds** is a specific asymmetric shock that might impact on the Czech economy. Given a sufficient absorption capacity of the economy this could act as a considerable economic stimulus, materialising primarily in increased investment activity. However, the financial flows between the Czech Republic and the European Union have been very sluggish so far and the potential economic stimulus to domestic demand in this respect has shifted to 2008–2010 compared to the expectations in last year's analyses. The results of the analysis, however, indicate that this situation will not require a sizeable monetary policy reaction or a koruna exchange rate adjustment that would endanger the stay in ERM II or any assessment of the Maastricht exchange rate criterion. The financial flows between the Czech Republic and the EU can also be expected to affect the Czech public budgets. Overall, this effect will be slightly negative until 2008 and moderately positive thereafter.

In terms of output generation, the Czech economy retains a specific feature in the form of a higher share of industry and a smaller share of certain services in GDP compared to the euro area.

Another asymmetric shock that has hit some economies in the past is rapid convergence of **nominal interest rates** ahead of entry into the monetary union. For a country planning to enter, earlier gradual convergence of such rates is therefore preferable. The difference between Czech interest rates and euro area interest rates has been zero or negative since 2002. Although there is no guarantee that this situation will last until euro adoption, the effects of interest rate convergence when the Czech Republic joins the euro area can be expected to be generally small from the current perspective. The Czech koruna's **exchange rate** against the dollar has been moving very much in line with the euro's exchange rate against the dollar in recent years. This relationship loosened very slightly in 2007, mainly because of the increased volatility of the dollar's exchange rate. The macroeconomic characteristics of the Czech economy indicate potential for broadly similar or slightly lower medium-term exchange rate volatility than in the other new EU Member States compared. The observed medium-term volatility of the Czech koruna against the euro is lower than in the other monitored currencies of the new EU Member States in 2007.

The Czech economy's strong **trade and ownership links with the euro area** magnify the benefits arising from the elimination of potential fluctuations in the exchange rate. The euro area is the partner for approximately 60% of Czech exports and imports. Strong links are also apparent for the other economies under comparison. The Czech economy's ownership links with the euro area on the direct investment inflow side are slightly stronger than in the other countries compared and are continuing to strengthen. The Czech economy's strong economic integration with the euro area creates conditions for increasing its economic alignment with this area. Another positive aspect from this perspective is the high intensity of intra-industry trade with the euro area, which is comparable with Austria and Germany.

The analysis of the Czech **financial sector**, and, within it, the banking sector, reveals that despite its relatively small size by comparison with the euro area, it need not be expected to have a fundamentally different effect on the economy. The monitored indicators have recently recorded further slight convergence towards the euro area. The depth of financial intermediation in the Czech Republic is currently thus roughly one-third of the level in Germany, Austria and the euro area and 40% of that in Portugal. The Czech Republic lags behind these countries in particular in terms of lending. However, as a result of dynamic growth in loans to households and corporations in the Czech Republic, client loans are rising as a percentage of both total loans and GDP. On the one hand this trend represents gradual convergence towards the corresponding shares in the euro area, but on the other hand it could

pose a risk of loan defaults in the event of a further build-up in household debt. The historical experience of some current euro area countries with high growth in household borrowing suggests that such a trend does not necessarily lead to problems in the financial system, but less prudential assessment of client creditworthiness is a potential source of credit risk growth. The transmission of risk from the recent crisis on the US mortgage market has had a minimal effect on the Czech financial sector, thanks to the provision of mortgages on primary deposits, the issuing of mortgage bonds on high-quality claims, good collateralisation of mortgage loans and limited investment in bonds backed by subprime foreign mortgages.

The degree of the **integration of the Czech financial markets** (stock and bond markets) with the euro area markets is at a similar level as in the case of Portugal and Austria. The speed of elimination of shocks on the Czech stock market has recently increased. The degree of integration of the Czech money market with that in the euro area is at the level of Slovenia before it adopted the euro, whereas the degree of integration of the foreign exchange market with the euro area is at a slightly lower level for the Czech Republic than was the case for Slovenia before it joined the euro area.

### **Adjustment Mechanisms**

As regards the **public finances** of the Czech Republic, the effectiveness of the stabilisation function within the European fiscal regulations will be crucial. The Stability and Growth Pact commits the Czech Republic to steer towards achieving a structural (cyclically adjusted) public budgets deficit of no more than 1% of GDP in the medium term. The closer the deficit is to zero in its structural part, the more room there will be at a time of economic weakening for the functioning of automatic stabilisers and, in the extreme case, for the implementation of discretionary measures. The current public finance deficits, however, are largely structural in nature. The public finance deficit will rise again in 2007, at a time of solid economic growth. This is at odds with the effort to pursue anticyclical fiscal policy and with the commitment to consolidate public finances prior to introducing the euro. The adoption of fiscal stabilisation measures in September 2007 and their implementation in 2008, along with some other reform steps, may lead to a gradual improvement in this situation. The consolidation of public finances should also be accelerated in order to curb growth in nominal public debt, which would lead to increasing debt service costs. Another condition for maintaining fiscal policy effectiveness is to ensure public finance sustainability, especially by dealing with the effect of demographic changes on pension and health care system expenditures. The contribution of public finances to the economy's ability to respond flexibly to shocks will clearly be limited until these problems are tackled.

**Wage elasticity** can enhance the economy's ability to absorb shocks to which the single monetary policy cannot respond. The analyses indicate that real wage elasticity in the Czech Republic is currently low, just like in the other countries under comparison, and has decreased over time. Differences in **inflation persistence** in the countries of the monetary union may also imply different impacts of the single monetary policy. Inflation persistence in the Czech Republic is among the higher of the countries under comparison, but seems to be similar to that in Germany and Austria.

The ability of the Czech **labour market** to absorb shocks is virtually unchanged from last year and remains average by European comparison. The performance of the Czech labour market has recently seen some improvement. However, this improvement is largely associated with the high rate of economic growth observed since 2005. In some respects, though, the labour market is considerably less flexible than in the countries under comparison, and no major improvement is occurring. The institutional rules do not create the right

conditions for employment of people with low skills. The main risk factors are the interaction of taxes and social benefits and the costs of terminating open-ended employment contracts.

The Czech labour market is still characterised by relatively high long-term and structural unemployment, although the situation is rather better than in some other countries (Poland and Slovakia in particular). The Czech Republic still also has the largest regional differences in the unemployment rate. This may be due to significant regional gaps between the demand for, and supply of, labour and the low regional, occupational and sectoral mobility of the labour force, exacerbated, among other things, by the dominance of owner-occupied housing. It is thus reasonable to expect that cross-border mobility will probably not be an effective adjustment mechanism in the event of economic imbalances, even after movement of labour between the Czech Republic and all the original EU countries has been fully liberalised by 2011. Conversely, the inflow of foreign labour into the Czech Republic has recently been very dynamic, bearing witness to some degree of flexibility of the Czech labour market. On the other hand, however, it suggests that some serious problems persist in this market (in particular low incentives to seek employment for the long-unemployed with low skills), since the foreigners work mainly in jobs requiring few qualifications. The fact that movements of foreign workers are also going on in the wider context than just the Czech economy may pose some risk to labour supply, and might thus lead to unexpected changes with no links to the business cycle in the Czech Republic.

Labour market flexibility is determined to a great extent by the **institutional rules**. OECD analyses and some other new studies have revealed that collective bargaining has a fairly small effect on wage setting in the Czech Republic. The impact of the minimum wage on the flexibility of low wages and on job creation is also rather lower on average by international comparison. In addition, the halt in growth of the minimum wage as a percentage of the average wage can be regarded as positive, since high minimum wages coupled with high labour taxation can have an adverse effect on job creation. Overall labour taxation in the Czech Republic decreased slightly in 2006. This decline was more marked in low-income categories. The effect of taxation on long-term unemployment and job creation is roughly the same as in Austria, Hungary and Poland, but higher than in Poland and Slovakia. Compared to other countries, the financial incentives to accept a job given by the combination of taxes and benefits in 2006 were comparable or higher for the short-term unemployed, but average for the long-term unemployed. Simulations showed no improvements associated with the reform of the social benefit system in 2007. The level of social benefits coupled with the tax burden may diminish efforts to seek or keep a job, particularly in households with children. In the area of permanent employment the Czech Republic ranks among the countries with a higher degree of job protection, which may present a risk in particular as regards the entry of young people to the labour market. By contrast, the gradual steps to simplify the procedures for setting up businesses are likely to positively affect job creation. Despite these partial improvements the regulatory environment for doing business, by international comparison, remains hampered by major administrative obstacles.

Stability and effectiveness of the **banking sector** is a precondition for the sector to be able to assist in absorbing the impacts of economic shocks. The percentage of non-performing loans in the Czech Republic has recently recorded an overall decline to a level only just above the euro area average. Capital adequacy is currently at a sufficient level comparable with the other countries monitored, but has been falling slightly over the past five years owing to the growing lending activity and the distribution of profits to bank owners. The sector's resilience is enhanced by its high profitability. Stress test results indicate that the Czech banking sector is stable and resilient to external shocks, although this resilience has yet to be tested by a period of adverse economic developments.

## C. Theoretical Foundations of the Analyses

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The basic theoretical starting point for the analyses contained in this document is the theory of optimum currency areas.<sup>2</sup> This theory is one of the approaches often used to determine the appropriate exchange rate regime and, in particular, to determine whether the countries included in the analysis are suitable candidates for introducing a single currency. In the context of the creation of the single European currency, knowledge of this theory has been used recently to assess the appropriateness of adopting the single currency by the euro area countries and the suitability of the same step for the new EU Member States.

Generalising somewhat, one can say that economists agree on the set of fundamental benefits and costs of the single currency, although this set may change over time or depending on the specific features of each economy. The benefits consist chiefly in an improvement in the functionality of money (including, for example, the greater usability of the single currency, easier comparability of prices, and a reduction in transaction costs), the elimination of exchange rate risk and the costs of hedging against it, and increased macroeconomic and financial stability (thanks to the elimination of excessive exchange rate fluctuations, financial market integration, an increase in price stability and potentially an overall increase in the credibility of the monetary authority).<sup>3</sup>

The costs can be broken down into two groups. There are the costs associated with the change of legal tender, including the physical exchange of money, the conversion of all contracts to the new accounting unit, and similar costs, i.e. costs which can be viewed, to a large extent, as non-recurring.<sup>4</sup> The main long-term costs include in particular a reduction in the effectiveness of domestic macroeconomic policies and the risk of greater volatility in output and consumption, because with the transition to the single currency the economy will lose its independent exchange rate and interest rate policies. The single monetary policy will not be able to respond sufficiently to shocks which affect only a small part of the currency area's economy. The costs of this loss will depend on the extent to which the exchange rate of the national currency absorbs real shocks or, on the contrary, generates financial shocks, on the degree of alignment of the business cycle with the cycle to which the currency area's monetary policy responds, and on the ability of the economy to employ other adjustment channels.<sup>5</sup>

However, despite the more than 40-year history of the above theory, the consensus is that there is no unambiguous definition of an optimum exchange rate regime. The potential costs and benefits differ depending on the specific situation, and political decisions play a significant role in the selection of exchange rate regime. Similarly, there is no method which in practice can unambiguously measure the potential benefits and costs associated with fixing the exchange rate and entering a monetary union (Vaubel, 1990). However, the current level of knowledge in this field can, *inter alia*, be used to identify potential sources of

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<sup>2</sup> The papers by Mundell (1961), McKinnon (1963) and Kenen (1969) are regarded as the cornerstones of this theory. A survey of this literature can be found, for example, in Mongelli (2002), De Grauwe (2003) or Horváth (2003).

<sup>3</sup> The increased macroeconomic stability and lower risk will facilitate a low and relatively stable interest rate level and higher investment growth. An increase in foreign trade and competition, productivity growth and subsequent GDP growth per capita can also be expected.

<sup>4</sup> In the context of transition to another currency, there is also risk of incorrectly setting the conversion ratio, as an excessively appreciated exchange rate may damage the competitiveness of the economy in the long term, while an excessively depreciated exchange rate will generate inflationary pressures.

<sup>5</sup> From the viewpoint of the new EU members who are planning to join the euro area, another cost may be the fulfilment of the Maastricht criteria prior to entry, especially the inflation criterion.

macroeconomic imbalances associated with entering the monetary union and to assess the ability of the economy to benefit from such a move. Properties that reduce the usefulness of nominal exchange rate adjustments by fostering internal and external balance, reducing the impact of some types of shocks and facilitating adjustment, make up the set of “optimum currency area properties” (Mongelli, 2002).

One of the key properties determining the appropriateness of joining a currency area is the degree of the openness of the economy and its economic links with the other countries of the currency area. The greater the integration, the higher the potential benefits of the single currency against which the costs are gauged. These benefits reflect above all the elimination of exchange rate risk in economic relations, which will reduce the costs of foreign trade and foreign investment and lead to a strengthening of such relations (e.g. Rose, 2000). Micco, Stein and Ordóñez (2003) have found this effect to be economically significant for the euro area countries. Baldwin (2006), on the other hand, points out that euro area accession cannot be expected to have such an upward impact on foreign trade as implied by the results set out in the earlier literature. According to his results, the introduction of the euro itself tends to act as a non-discriminating unilateral liberalisation of the product market and could therefore have a greater impact on a country’s imports than on its exports.<sup>6</sup>

Other properties tend to reduce the negative aspects of the loss of certain macroeconomic adjustment instruments at country level, and can be summarised under the headings of symmetry and flexibility (De Grauwe and Mongelli, 2005). The traditional optimum currency area criteria therefore include similar economic structure and economic shocks, output and consumption diversification, a similar inflation rate, stable terms of trade, mobility of labour and other production factors, price and wage flexibility, and fiscal and political integration.<sup>7</sup>

Crucial to the discussion of the benefits and costs of the single currency was the formulation of the opinion that not only can the ability to benefit from a monetary union and the risks of unbalanced developments in a monetary union be affected by appropriate reforms, but that large shifts also seem to result from the very introduction of the single currency (the “endogeneity hypothesis”, Frankel and Rose, 1998). According to this hypothesis, the adoption of the single currency should lead to a strengthening of the free market (Engel and Rogers, 2004) and growth in trade with partners in the monetary union. Moreover, an increase in trade integration can lead to greater business cycle correlation (Frankel and Rose, 1997).<sup>8</sup> As regards the introduction of the euro in the new member countries, however, this channel acting via an increase in the share of mutual trade is likely to be fairly weak (Baldwin, 2006).

The endogeneity paradigm is opposed by the view that greater openness of the economy leads to a greater degree of specialisation, a decrease in structural similarity and thus a higher probability of asymmetric shocks, which increase the costs of currency area participation (the “specialisation hypothesis”, Krugman, 1993). Kalemli-Ozcan, Sorensen and Yosha (2003)

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<sup>6</sup> A developed financial sector is capable of effectively reducing exchange rate risk even outside the currency area; in such case, the overall net benefits of currency integration may be lower than for a country with a less developed financial sector.

<sup>7</sup> In the event of an asymmetric shock, fiscal policy can assist by means of either built-in stabilisers or discretionary measures. However, discretionary measures can give rise to further fluctuations (Feldstein, 2002). What is more, research has shown that a fiscal expansion can have a much lower impact on demand than expected (Blanchard and Perotti, 2002).

<sup>8</sup> However, Kenen (2000) finds that although trade intensity can increase the correlation between cycles, asymmetric shocks are not necessarily fully eliminated. Hughes Hallett and Piscitelli (2002) show that this causality between monetary union participation and cycle alignment exists provided that the convergence in institutional structures and the symmetry of shocks are sufficient.

find that high financial integration can have a similar impact, thanks to risk sharing, which fosters greater specialisation.

De Grauwe and Mongelli (2005) review the literature on the endogeneity of foreign trade, financial integration, symmetry of shocks and product and labour market flexibility. Based on developments to date in the euro area, they conclude that it is more likely that the endogeneity hypothesis holds, i.e. that the similarity of economic shocks probably increases with greater economic integration. According to Lane (2006), the introduction of the euro had a clear impact in terms of increasing the integration of the euro area financial markets; however, there was growth in foreign trade with both members and non-members of the euro area, hence it can be expected that it did not unambiguously cause a reduction in the probability of asymmetric shocks.

## **D. Results of the Analyses**

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### **1. CYCLICAL AND STRUCTURAL ALIGNMENT**

Greater similarity in economic structure and the business cycle between the Czech Republic and the euro area will lead to lower euro adoption costs.<sup>9</sup> For the Czech economy, the risk of time misalignment or a suboptimal intensity of the response of the single monetary policy to economic shocks will decrease. The functioning of the monetary policy transmission mechanism will also converge. The direct indicators of alignment (describing various aspects of convergence with the euro area) and the effect of international relations and the financial sector (which can increase or decrease alignment) are both monitored.

#### **1.1 Direct alignment indicators**

The key direct alignment indicators include the development of domestic economic activity, the exchange rate and interest rates compared to the euro area. Convergence in economic and price levels increases the likelihood of similar processes proceeding in the economy and of there being no major differences in equilibrium development. High synchronisation of the business cycle and economic shocks increases the probability that economic developments will not differ substantially going forward, either. Disequilibrium pressures may stem from different economic structures and from insufficient convergence at the real interest rate level.

##### **1.1.1 Real economic convergence**

The degree of real convergence, as measured by GDP per capita at purchasing power parity and the relative price level of GDP, is a fundamental indicator of an economy's similarity to the euro area. A high degree of real convergence is not a necessary condition for joining the monetary union, but a low degree of real convergence could indicate some challenges for the adoption of the single currency. The real convergence process is often associated with gradual alignment of price levels and structures with more advanced countries. The related real appreciation of the exchange rate vis-à-vis the euro may make fulfilment of the Maastricht convergence criteria more difficult and, in the run-up to joining the euro area, necessitate a combination of economic policies which will move the economy away from equilibrium.<sup>10</sup> This departure from equilibrium can be viewed as a type of asymmetric shock acting primarily in the initial years of monetary integration. Following the adoption of the euro, price convergence will imply a positive inflation differential compared to the euro area average because the option of a real strengthening of the exchange rate through nominal appreciation will be closed. One of the consequences, given the elimination of the risk premium thanks to euro adoption, will be lower (or even negative) real interest rates compared to the euro area average. Although the lower real interest rates may have many favourable impacts, they may also create some challenges for macroeconomic and financial stability and thus raise questions about the appropriateness of the single monetary policy for an accession country.

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<sup>9</sup> On the other hand, alignment in some areas, e.g. convergence of nominal interest rates, may reduce the benefits of the single currency.

<sup>10</sup> The simultaneous restriction placed on the inflation differential and the appreciation of the nominal exchange rate represents an implicit restriction on the appreciation of the real exchange rate. If the equilibrium real appreciation is faster than this restriction, fulfilment of the Maastricht convergence criteria may require a temporary departure of the exchange rate from equilibrium, with impacts on the development of the entire economy. However, this potential problem is mitigated by the fact that the exchange rate criterion is significantly more tolerant of appreciation than depreciation.



As Table 1 shows, the Czech economy has been converging towards the euro area in terms of **GDP per capita** since 2001. This process has accelerated in recent years. With this indicator currently above 70% of the euro area average, the Czech Republic belongs to the group of countries whose standard of living is comparable with the least advanced euro area countries (Portugal and Slovenia). It is thus more advanced than the other new EU Member States (Hungary, Poland and Slovakia). However, it still lags well behind the wealthier euro area countries (e.g. Austria and Germany).

**Table 1: GDP per capita at purchasing power parity (EA-12 = 100)**

	1998	1999	2000	2001	2002	2003	2004	2005	2006
<b>CZ</b>	61.7	60.9	60.2	62.1	62.7	65.8	68.6	69.5	72.1
<b>AT</b>	116.1	116.1	117.1	112.2	113.3	115.2	116.1	115.8	117.1
<b>DE</b>	107.1	107.0	104.2	103.0	102.4	104.4	104.4	103.1	102.8
<b>PT</b>	67.0	68.6	68.6	68.2	68.5	68.8	67.8	68.0	67.7
<b>HU</b>	46.1	46.9	49.3	51.9	54.7	56.8	57.6	58.4	59.4
<b>PL</b>	41.8	42.5	42.5	42.0	42.9	43.9	45.8	45.9	48.1
<b>SK</b>	45.7	44.5	44.1	46.3	48.3	49.3	51.0	53.9	57.0
<b>SI</b>	67.1	68.7	68.1	68.2	70.8	72.3	75.1	76.4	78.8

Sources: Eurostat, CNB calculations.

Table 2 illustrates the **price level of GDP** compared to the euro area. In the case of the Czech Republic, this indicator showed the greatest convergence in 2001–2002 and again in 2005–2006. In both cases, this was due to an accelerated nominal appreciation of the koruna. The distance of the Czech Republic’s price level from the old EU countries, however, remains distinctly higher than in the case of GDP. The Czech Republic in this indicator lags markedly behind not only Austria and Germany, but also Portugal and Slovenia. Of the countries under review, the price level is slightly lower only in Poland, Hungary and Slovakia.<sup>11</sup>

**Table 2: Average price level of GDP (EA-12 = 100)**

	1998	1999	2000	2001	2002	2003	2004	2005	2006
<b>CZ</b>	43.4	42.9	45.1	47.6	53.2	50.0	50.7	55.3	57.8
<b>AT</b>	102.5	102.6	101.8	104.6	102.4	100.6	100.1	100.6	100.0
<b>DE</b>	110.3	109.1	109.3	109.0	107.7	104.2	103.1	103.1	102.5
<b>PT</b>	77.5	77.9	79.2	80.5	81.0	80.2	81.5	81.2	81.4
<b>HU</b>	44.0	44.7	46.9	49.2	54.1	54.0	56.9	59.1	56.5
<b>PL</b>	47.6	46.1	51.9	57.8	54.3	47.6	47.0	54.5	55.6
<b>SK</b>	40.3	38.2	42.1	41.4	42.6	45.8	49.6	51.3	53.7
<b>SI</b>	70.2	70.4	69.7	70.9	71.4	71.7	70.4	70.7	70.6

Sources: Eurostat, CNB calculations.

Table 3 presents the **evolution of the real exchange rate** vis-à-vis the euro. The real exchange rate of the koruna has appreciated by roughly 29% since 1998, i.e. at an average rate of 3.2% a year (and since 1993 by an average of 4.2% a year). Relative to the current euro area countries surveyed, the rate of real appreciation in the Czech economy has been distinctly higher since both 1998 and 1993, while in the case of Austria and Germany the real exchange rate has even depreciated somewhat. A somewhat lower rate of real appreciation than the Czech koruna has also been recorded by the Polish zloty and, from the longer-term perspective, the Hungarian forint. The Slovak koruna, on the other hand, has recorded a faster real appreciation than the Czech koruna.

<sup>11</sup> An analysis of the empirical relationship between the price level of final consumption of households and GDP at purchasing power parity for 32 European countries reveals that the price level in the Czech Republic lies below the level which, according to empirical estimates, corresponds to its economic level.

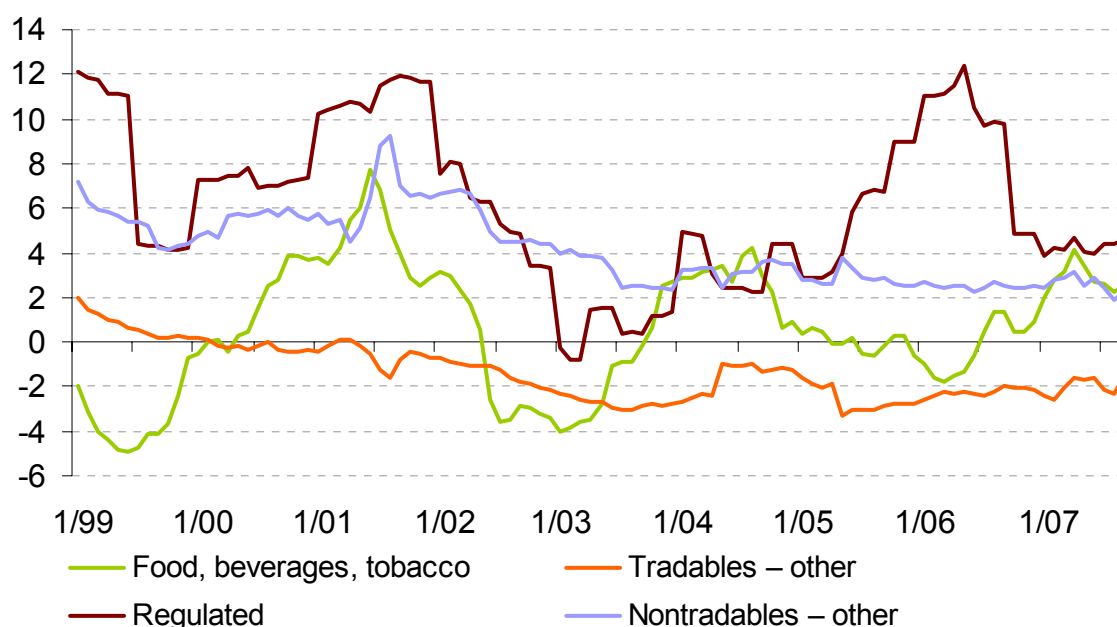
**Table 3: Real exchange rate against the euro (1998 = 100; HICP deflated)**

	1999	2000	2001	2002	2003	2004	2005	2006	Annual rate of appreciation	
									since 1993	since 1998
<b>CZ</b>	98	104	111	122	115	115	123	129	4.2%	3.2%
<b>AT</b>	100	100	100	99	99	98	98	98	-0.5%	-0.3%
<b>DE</b>	100	100	99	98	97	97	97	96	-0.6%	-0.5%
<b>PT</b>	102	102	104	106	107	107	107	108	0.5%	1.0%
<b>HU</b>	104	108	117	127	125	132	135	129	2.2%	3.3%
<b>PL</b>	98	112	125	119	103	101	114	117	3.2%	1.9%
<b>SK</b>	98	111	115	118	129	140	146	155	5.0%	5.6%
<b>SI</b>	100	101	101	103	103	102	102	102	1.1%	0.3%

Sources: Eurostat, CNB calculations.

The appreciation of the real exchange rate has had an uneven impact on the individual price categories so far. Prices of tradable goods generally have the least room for catching up to the level of the advanced countries, whereas prices of nontradable goods, regulated prices and partially also food prices have the most room. Chart 1 illustrates on the example of the Czech Republic that under inflation targeting and trend appreciation of the nominal exchange rate, prices of non-food tradable goods, which exhibit downward flexibility, can show a long-term decline. Prices of market nontradable goods, on the contrary, are recording long-term growth, as are regulated prices, which, however, are also showing considerable volatility over time. Overall, the existence of independent monetary policy enables the pressures associated with real convergence to be absorbed via nominal appreciation of the exchange rate amid low overall inflation. A country naturally gives up this possibility by introducing the euro.

**Chart 1: Inflation structure in the Czech Republic (annual percentage changes, excluding tax effects)**



Sources: CZSO, CNB calculations.

Based on the results of numerous studies (see Čihák and Holub, 2003 and 2005; Brůha and Podpiera, 2007), continued equilibrium real appreciation may be expected for the currencies of the countries striving to join the euro area (the Czech Republic, Hungary, Poland and

Slovakia). The range of the estimates of the future equilibrium real appreciation, derived using two alternative methods (see the Methodological Part for details), is presented in Table 4. As far as the Czech koruna is concerned, this range is 1.4%–3.4% and is wider than in most of the other economies under comparison.<sup>12</sup> Its midpoint is similar to that in the other Central European countries and markedly higher than that of the current members of the euro area. The higher upper boundary of this range reflects the fact that another source of equilibrium real appreciation in the Czech Republic, in addition to economic growth, will be convergence of the price level to values more in line with the internationally observed empirical relationship between the price level and the economic level. The estimated range corresponds to the average inflation differential vis-à-vis the euro area which could be expected in the Czech Republic if the euro were to be adopted within the next five years. Assuming average euro area inflation of around 2%, inflation in the Czech Republic could therefore increase to about 3.4%–5.4% during the initial years following euro area entry, as in the other countries aspiring to joining the euro area.

**Table 4: Estimate of equilibrium real appreciation (in p.p.; annual average for 2008–2012)**

	Method 1		Method 2	Range of estimates
	Min	Max		
<b>CZ</b>	2.3	3.4	1.4	(1,4 ; 3,4)
<b>AT</b>	0.4	1.0	.	(0,4 ; 1,0)
<b>DE</b>	0.2	0.3	.	(0,2 ; 0,3)
<b>PT</b>	0.3	0.5	.	(0,3 ; 0,5)
<b>HU</b>	2.1	2.8	2.8	(2,1 ; 2,8)
<b>PL</b>	1.7	1.8	3.3	(1,7 ; 3,3)
<b>SK</b>	2.2	3.0	3.3	(2,2 ; 3,3)
<b>SI</b>	1.3	1.8	0.0	(0,0 ; 1,8)

Source: CNB calculations.

As a result, the Czech Republic and the other countries of the region would face lower **real interest rates** (see Table 5) than the average for the euro area and its current member countries under comparison (Austria, Germany, Portugal and Slovenia). Their short-term real money-market interest rates would very probably be negative, in fact. In the Czech Republic, the real three-month interest rate would drop to -1.6%–0.4% on average. Compared to the results of the analyses in 2006 this is an increased estimate, reflecting in particular a higher assumption regarding equilibrium interest rates in the euro area (see the Methodological Part). This stated estimate, however, still contrasts with the estimates of the current equilibrium interest rate level.<sup>13</sup> On the other hand, the Czech Republic (along with Slovakia) has the advantage of a lower current level of real interest rates than Hungary and Poland, thus requiring a smaller future degree of adjustment towards the post-euro adoption situation.

<sup>12</sup> The estimate of the equilibrium real appreciation of the effective exchange rate of the koruna against the euro used in the CNB's forecasts is approximately 3% with a steadily declining tendency, and thus lies close to the upper boundary of the above range.

<sup>13</sup> The CNB's forecasts currently work on the assumption of a three-month equilibrium real money market rate of just below 1%.

**Table 5: Three-month ex-post real interest rates (in %; HICP deflated)**

	1998	1999	2000	2001	2002	2003	2004	2005	2006	Average	Outlook <sup>a)</sup>
<b>CZ</b>	4.2	5.0	1.4	0.6	2.1	2.4	-0.2	0.4	0.2	1.8	(-1,6;0,4)
<b>AT</b>	2.8	2.4	2.3	1.9	1.6	1.0	0.1	0.1	1.4	1.5	(0,8;1,4)
<b>DE</b>	2.9	2.3	2.9	2.3	1.9	1.3	0.3	0.3	1.3	1.7	(1,5;1,6)
<b>PT</b>	2.1	0.7	1.5	-0.1	-0.4	-0.9	-0.4	0.1	0.1	0.3	(1,3;1,5)
<b>HU</b>	3.3	4.6	1.3	1.6	3.8	3.6	4.4	3.1	3.1	3.2	(-1,0;-0,3)
<b>PL</b>	7.7	7.0	7.9	10.2	6.9	4.9	2.5	3.0	2.9	5.9	(-1,5;0,1)
<b>SK</b>	13.5	4.8	-3.2	0.5	4.1	-2.0	-2.6	0.1	0.3	1.7	(-1,5;-0,4)
<b>SI</b>	2.2	2.4	1.9	2.1	0.5	1.0	0.9	1.5	1.1	1.5	(0,0;1,8)

Note: a) Estimated real average interest rate for the next five years based on the range of the estimated rate of equilibrium real appreciation as set out in Table 4, assuming an unchanged nominal exchange rate.

Sources: Eurostat, CNB calculations.

To sum up, the Czech economy is gradually converging to the euro area level in terms of GDP per capita and the price level. In particular, the convergence of real GDP has been accelerating over approximately the last four years. Going forward, however, there is still substantial room for real convergence. The equilibrium real appreciation of the koruna associated with this process may thus still pose a challenge to the fulfilment of the Maastricht criteria and the operation of the economy in the euro area, in terms of higher inflation and negative real interest rates.

### 1.1.2 Correlation of economic activity

Upon joining a monetary union, a country relinquishes its monetary policy decision-making independence with the adoption of single union monetary policy decisions, which respond to average economic developments at the union-wide level. For a country that is in a different phase of the business cycle than the union average, the monetary policy setting is not necessarily entirely optimal and this can lead to additional economic costs. From the point of view of the optimum currency area theory, it is less costly for a country with a higher business cycle correlation to participate in a monetary union. The analysis below therefore focuses on to what degree the cyclical development of the Czech economy and the other countries under comparison is similar to the overall development at the euro area level.

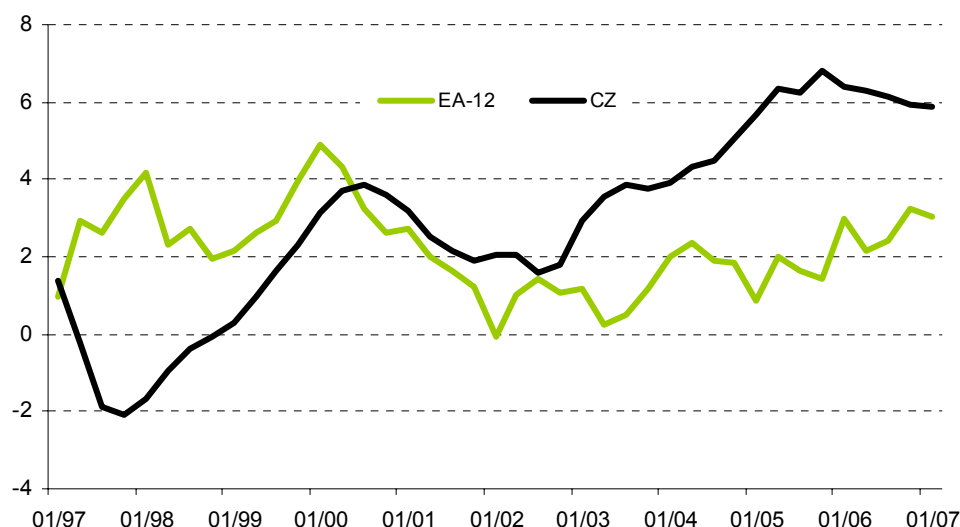
To measure the degree of cyclical alignment of economic activity in the selected economies with that in the euro area, a dynamic correlation method, based on the spectral analysis of time series, has been applied in addition to the simple correlation coefficient. For comparison, two detrending methods have been applied to the time series under comparison: year-on-year differences of logarithmed original time series and quarter-on-quarter (or month-on-month) differences of logarithmed seasonally adjusted time series.

To monitor the evolution of alignment over time, the data have been divided into two periods. This will also enable us to isolate the influence of clearly asymmetric developments at the start of the period under review which had non-cyclical causes. An additional view of the time development of the correlation of economic activity will permit the analysis to be extended to include calculation of the correlation for moving five-year time periods (rolling correlation).

The overall economic activity of the countries under review is described by real GDP growth. To obtain a more comprehensive picture, the correlation of economic activity in industry (as measured by the Industrial Production Index, PPI) and the correlation of export activity have also been examined (the correlation of the country's exports to the rest of the world and the correlation of the country's exports to the euro area<sup>14</sup> with euro area GDP have been used).

<sup>14</sup> Including trade between individual countries.

**Chart 2: Annual percentage changes in real GDP**



Sources: Eurostat, CNB calculations.

Chart 2 illustrates real GDP growth in the Czech Republic and the euro area. Divergent trends are apparent in these economies at the beginning of the period under review. The economic decline in the Czech Republic during that period was due to a combination of unwinding transformation problems, structural changes and the occurrence of some specific shocks (such as the financial crisis of 1997). The Czech Republic's internal problems caused Czech economic growth to copy the adverse trend in the euro area to a certain degree in 2000–2002. The growth of the Czech economy has increased rapidly since 2003 thanks to reforms and changes on the supply side. Growth in the euro area countries has also risen in this period, but has remained significantly slower than that of the Czech economy.

**Table 6: Correlation coefficients of economic activity – evolution over time**

		1997 Q1–2001 Q4		2002 Q1–2007 Q1		Jan 1999–Dec 2001		Jan 2002–May 2007	
		HDP		HDP		IPP		IPP	
<b>Method 1</b>	<b>CZ</b>	0.09	(-0,30 ; 0,45)	0.62 **	(0,32 ; 0,80)	0.29 *	(0,01 ; 0,53)	0.77 **	(0,68 ; 0,84)
	<b>AT</b>	0.69 **	(0,42 ; 0,85)	0.85 **	(0,69 ; 0,93)	0.82 **	(0,70 ; 0,89)	0.77 **	(0,67 ; 0,84)
	<b>DE</b>	0.93 **	(0,85 ; 0,97)	0.96 **	(0,92 ; 0,98)	0.98 **	(0,96 ; 0,99)	0.90 **	(0,85 ; 0,93)
	<b>PT</b>					-0.12	(-0,39 ; 0,16)	0.41 **	(0,22 ; 0,57)
	<b>HU</b>	0.74 **	(0,50 ; 0,87)	-0.13	(-0,47 ; 0,25)	0.86 **	(0,76 ; 0,92)	0.58 **	(0,42 ; 0,70)
	<b>PL</b>	0.55 **	(0,22 ; 0,77)	0.69 **	(0,43 ; 0,85)	0.77 **	(0,63 ; 0,86)	0.63 **	(0,49 ; 0,74)
	<b>SI</b>	0.46 **	(0,10 ; 0,72)	0.87 **	(0,74 ; 0,94)	0.65 **	(0,46 ; 0,79)	0.62 **	(0,48 ; 0,73)
	<b>SK</b>	-0.28	(-0,59 ; 0,11)	0.81 **	(0,62 ; 0,91)	0.41 **	(0,15 ; 0,62)	0.57 **	(0,42 ; 0,70)
	<b>Method 2</b>	<b>CZ</b>	0.00	(-0,38 ; 0,38)	0.33	(-0,05 ; 0,62)	0.54 **	(0,31 ; 0,71)	0.25 **
<b>AT</b>		0.35	(-0,04 ; 0,64)	0.30	(-0,08 ; 0,60)	0.34 **	(0,06 ; 0,56)	0.23 *	(0,03 ; 0,42)
<b>DE</b>		0.78 **	(0,56 ; 0,89)	0.83 **	(0,66 ; 0,92)	0.86 **	(0,77 ; 0,92)	0.49 **	(0,32 ; 0,63)
<b>PT</b>						0.10	(-0,18 ; 0,37)	0.26 **	(0,06 ; 0,44)
<b>HU</b>		0.71 **	(0,46 ; 0,86)	-0.33	(-0,62 ; 0,04)	0.11	(-0,18 ; 0,38)	-0.01	(-0,21 ; 0,20)
<b>PL</b>		0.35	(-0,03 ; 0,64)	0.54 **	(0,21 ; 0,76)	0.50 **	(0,26 ; 0,68)	0.32 **	(0,12 ; 0,49)
<b>SI</b>		-0.01	(-0,39 ; 0,37)	0.63 **	(0,33 ; 0,81)	0.36 **	(0,09 ; 0,58)	0.11	(-0,10 ; 0,31)
<b>SK</b>		0.17	(-0,23 ; 0,51)	0.63 **	(0,34 ; 0,81)	0.23	(-0,05 ; 0,48)	0.17	(-0,03 ; 0,37)

Note: Method 1 – year-on-year differences, Method 2 – quarter-on-quarter (month-on-month) differences.  
The significance of the correlation coefficient is marked \*\* and \* for the 5% and 10% significance levels respectively. The 90% confidence interval is in parentheses.

Sources: Eurostat, CNB calculations.

Table 6 summarises the results of the **simple correlation analysis** for GDP and the IPI. For the first period, neither of the methods finds a statistically significant correlation between GDP growth in the Czech Republic and that in the euro area. This result is not surprising given the aforementioned trend in the Czech Republic in the late 1990s. In the second period, the correlation takes on higher values. According to Method 1 the positive correlation is

statistically significant, while according to Method 2 it is not. Compared to last year's analysis, indicators show an improvement and it can be said that the alignment is possibly increasing over time. This improvement can be explained, among other things, by a longer time gap since the specific shocks at the start of the period under review. The question remains, however, to what extent the cyclical pattern in the euro area is going on in parallel with the trend growth in the Czech Republic associated with the real convergence of the transforming economies and changes on the supply side of economy. The correlation analysis is not able to differentiate these developments.

Compared to last year's results, the other new Member States under comparison also saw changes in the observed correlation of overall economic activity. Hungary recorded a marked decrease in measured correlation, probably due to the current decline in its rate of growth, whereas Poland and Slovakia shows a positive and relatively high degree of alignment.

The highest values of real GDP alignment are traditionally recorded by Germany. This is largely because Germany alone accounts for approximately 30% of euro area GDP, which distorts the result upwards. This indicator thus has only illustrative value. As in last year's analysis, only Method 1 confirms Austria's alignment.

Chart 3 shows the **rolling correlation** for the two methods. Although Method 1 in particular shows some upward trend in alignment for the Czech Republic, the positive correlation values do not become statistically significant<sup>15</sup> until the end of the period under review. The contention of a marked positive trend (i.e. a rapid increase in alignment) is also opposed by the results obtained using the other detrending method, shown in the right-hand chart, which do not achieve statistically significant values for the Czech Republic.

**Chart 3: Rolling correlation of economic activity**

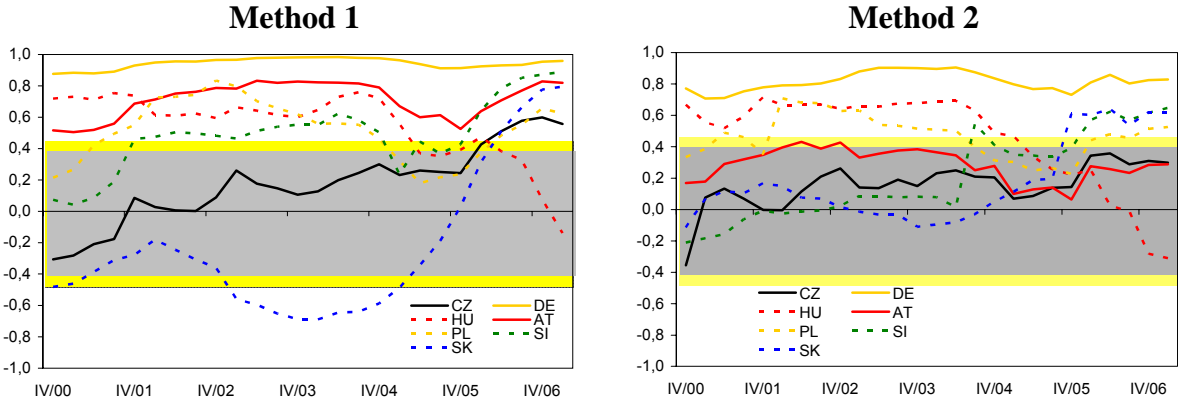


Chart 4 illustrates the results of the **dynamic correlation** using spectral analysis of the time series of annual GDP changes. In the second time period, the correlation for the Czech Republic is substantially higher across the entire spectrum of the possible business cycle length. Compared to last year's analysis, the Czech Republic recorded a rise in alignment, especially in the second period, as in most of the other countries included in the survey except for Hungary. For a period of around 1.5–8 years, i.e. the standard business cycle length considered, the correlation is higher than for shorter frequencies. This means that in the

<sup>15</sup> The statistical significance of the correlation coefficients is indicated in the chart: values statistically significant at the 5% level lie in the white area of the chart, and values statistically significant at the 10% level lie in the white and yellow parts of the chart.

analysis of alignment for economic policy purposes, the aforementioned values of the statistical correlation partially underestimate the real alignment.

**Chart 4: Dynamic correlation of economic activity (annual changes in real GDP) with the euro area**

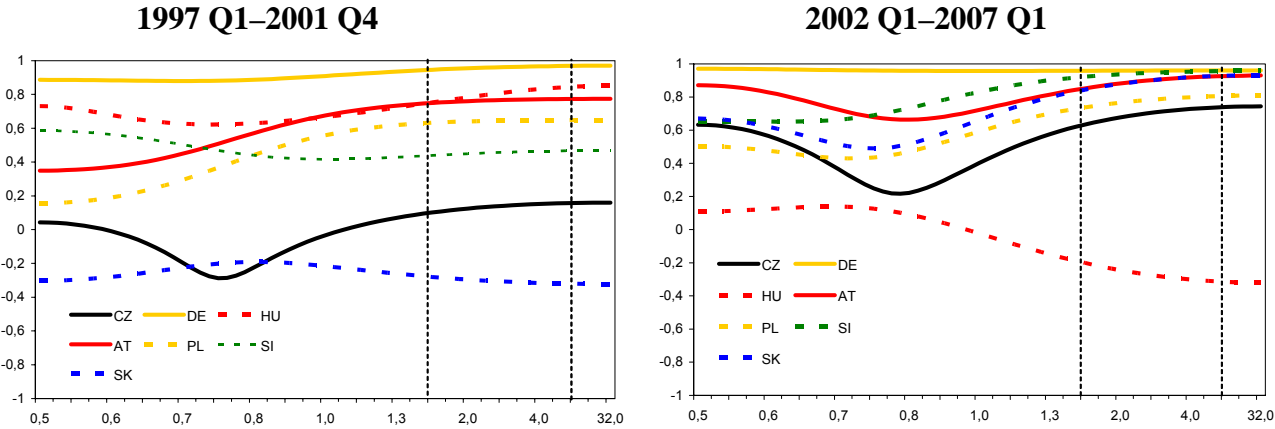
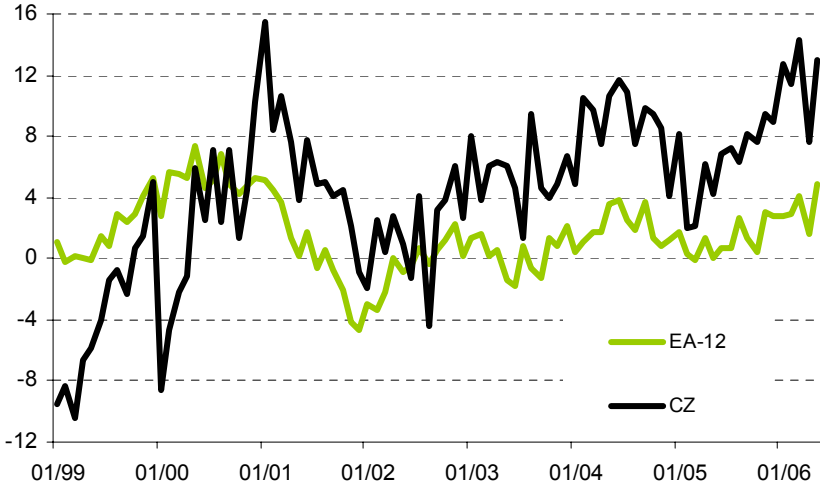


Chart 5 illustrates the industrial production index in the Czech Republic and the euro area. **The correlation analysis using the Industrial Production Index** (see Table 6) indicates a high degree of alignment over the entire period under review. The alignment is higher in the second half of this period than in the first. The high correlation estimates are similar for all the countries monitored. The information acquired by comparing the correlation of industrial production is complementary only, as industry typically accounts for less than one-third of total output in the advanced economies, and the economies of the countries under comparison also differ in terms of structure (see section 1.1.5).<sup>16</sup>

**Chart 5: Year-on-year changes in the Industrial Production Index (%)**



Sources: Eurostat, CNB calculations.

**The results of the export performance correlation analysis** are summarised in Table 7. The analysis of the overall export activity of the Czech Republic has mixed results as well. According to Method 1, the alignment is relatively high, and a similar result is also apparent

<sup>16</sup> Boone and Maurel (1999) criticise the use of the industrial production index for analysing the similarity of economies and business cycles, because of its high volatility.

for the other countries under comparison. According to Method 2, however, the correlation coefficient for the Czech Republic is statistically significant only in the first period. A similar result holds for Slovenia as well.

The analysis of the relationship between Czech exports to the euro area and euro area GDP does not find a statistically significant degree of alignment recently. It is reasonable to assume that in a phase of economic convergence, such as the Czech Republic is in now, the volume of exports is determined, *inter alia*, by high growth in export capacities (due, for example, to foreign direct investment). The export-oriented FDI in the Czech Republic often forms part of the production chains of multinational corporations, whose production is directed towards export to non-European markets as well and is not necessarily determined by domestic demand in the euro area, which of key importance in terms of GDP growth.

**Table 7: Correlation coefficients of overall export activity and exports to the euro area with euro area GDP– evolution over time**

		Jan 1997–Dec 2001	Jan 2002–Dec 2006	1997 Q1–2001 Q4	2002 Q1–2006 Q4
		EXP <sub>TOTAL</sub>	EXP <sub>TOTAL</sub>	EXP <sub>to EA-12</sub> vs GDP <sub>EA-12</sub>	EXP <sub>to EA-12</sub> vs GDP <sub>EA-12</sub>
Method 1	CZ	0.67 ** (0,53 ; 0,77)	0.63 ** (0,48 ; 0,74)	0.67 ** (0,38 ; 0,83)	0.38 (0,00 ; 0,66)
	AT	0.85 ** (0,78 ; 0,90)	0.78 ** (0,68 ; 0,85)	0.62 ** (0,32 ; 0,81)	0.83 ** (0,66 ; 0,92)
	DE	0.91 ** (0,86 ; 0,94)	0.82 ** (0,74 ; 0,88)	0.52 ** (0,18 ; 0,75)	0.82 ** (0,64 ; 0,91)
	PT	0.52 ** (0,35 ; 0,66)	0.67 ** (0,53 ; 0,77)	0.30 (-0,09 ; 0,61)	0.72 ** (0,46 ; 0,86)
	HU	0.52 ** (0,34 ; 0,66)	0.60 ** (0,44 ; 0,72)	0.30 (-0,09 ; 0,61)	0.72 ** (0,46 ; 0,86)
	PL	0.67 ** (0,54 ; 0,78)	0.25 * (0,03 ; 0,44)	0.27 (-0,12 ; 0,59)	0.65 ** (0,35 ; 0,82)
	SI	0.70 ** (0,57 ; 0,79)	0.41 ** (0,21 ; 0,57)	0.46 ** (0,10 ; 0,71)	0.34 (-0,04 ; 0,64)
	SK	0.42 ** (0,22 ; 0,58)	0.41 ** (0,21 ; 0,57)	-0.13 (-0,48 ; 0,26)	0.30 (-0,09 ; 0,61)
Method 2	CZ	0.22 * (0,01 ; 0,41)	-0.04 (-0,25 ; 0,17)	0.32 (-0,07 ; 0,62)	0.30 (-0,09 ; 0,61)
	AT	0.57 ** (0,41 ; 0,70)	0.45 ** (0,26 ; 0,61)	0.43 * (0,06 ; 0,70)	0.25 (-0,14 ; 0,57)
	DE	0.60 ** (0,45 ; 0,72)	0.45 ** (0,26 ; 0,61)	0.21 (-0,19 ; 0,54)	0.64 ** (0,34 ; 0,82)
	PT	0.15 (-0,07 ; 0,35)	0.47 ** (0,29 ; 0,62)	0.15 (-0,24 ; 0,50)	-0.16 (-0,51 ; 0,24)
	HU	0.30 ** (0,09 ; 0,48)	0.41 ** (0,22 ; 0,58)	0.15 (-0,24 ; 0,50)	-0.16 (-0,51 ; 0,24)
	PL	0.04 (-0,18 ; 0,25)	0.48 ** (0,29 ; 0,63)	0.32 (-0,07 ; 0,62)	0.26 (-0,13 ; 0,58)
	SI	0.35 ** (0,14 ; 0,52)	-0.02 (-0,23 ; 0,20)	0.42 * (0,05 ; 0,69)	0.08 (-0,31 ; 0,44)
	SK	-0.01 (-0,23 ; 0,20)	0.27 ** (0,06 ; 0,46)	-0.11 (-0,47 ; 0,28)	-0.03 (-0,40 ; 0,36)

Note: Method 1 – year-on-year differences, Method 2 – quarter-on-quarter (month-on-month) differences.

The significance of the correlation coefficient is marked \*\* and \* for the 5% and 10% significance levels respectively. The 90% confidence interval is in parentheses.

Source: IMF, CNB calculations.

### 1.1.3 Synchronisation of economic shocks

In the optimum currency area literature, similarity of economic shocks is viewed as another precondition for monetary policy effectiveness in a monetary union (e.g. Frankel and Rose, 1998). However, there is no consensus on the effect of demand and supply shocks. While asymmetry of demand shocks is a general argument against joining a monetary union, the literature does not provide a unanimous opinion on the need for the alignment of supply shocks.<sup>17</sup>

The following analysis assesses the degree of synchronisation of demand and supply shocks between the countries under review and the euro area. Estimates were made using a method identifying demand and supply shocks on quarterly data for 1996 Q1–2007 Q2. The correlation of the shocks can take values in the range of [-1, 1]. Positive values indicate that the shocks are symmetric with respect to the euro area. Low or even negative values

<sup>17</sup> Roisland and Torvik (2003) for example show that the monetary policy regime has to be taken into consideration when assessing the effect of symmetry of supply shocks. Asymmetry of supply shocks may increase the benefits of the monetary union for inflation-targeting countries by increasing output stability thanks to a smaller interest rate response to changes in inflation.



correspond to asymmetric shocks. Table 8 contains a summary of the results for 1996–2007 and for two sub-periods: 1996–2001 and 2002–2007.

Based on the results, we can say that the measured correlation of the demand shocks identified for the Czech Republic in relation to the euro area has been moving close to zero both for the overall period 1996–2007 and for the two sub-periods. So far, then, there has been no statistically significant change in the alignment of this type of shock. For the other countries under review except for Hungary and Slovenia, the demand shocks were also not statistically significantly correlated with the demand shocks affecting the euro area. Hungary records the most significant demand shock correlation, with a value of 0.35 for the whole of the period under review (and 0.44 for the period 2002–2007). In Slovenia, the correlation is negative for 1996–2001 but insignificant for the overall period. The low synchronisation of shocks on the demand side in the Czech Republic is in line with the average for the selected three current members of the euro area, while the low (or even zero in the first period) correlation measured in the case of Germany is somewhat surprising. This suggests that the risk due to asymmetry of shocks is no higher in the Czech economy than in the countries under comparison except for Hungary.

The correlation between the Czech Republic and the euro area as regards supply shocks changed from -0.18 in 1996–2001 to 0.06 in 2002–2007, but even here the correlation coefficients are not statistically significantly different from zero, nor are the changes therein statistically significant. A more significant decrease in the correlation of supply shocks was recorded for Hungary (from 0.45 to 0.01), and a more modest decrease occurred in Austria and Portugal. A change in alignment occurred in Poland and Slovenia (although only from negative to zero values). The strongest alignment of shocks is shown by Germany (whose coefficient is statistically significant and increased slightly from 0.63 to 0.67). The analysis revealed statistically significant differences in the direction of higher alignment of demand shocks than in the Czech Republic in the cases of Hungary, Austria and Germany, and in the direction of lower alignment in the case of Slovenia. In the other countries, no statistically significant differences were identified. It is possible that the correlation of demand and supply shocks has been partially distorted by the excessive exchange rate volatility recorded in some years, which would be eliminated on entry into the euro area.

**Table 8: Correlation of economic shocks vis-à-vis the euro area**

**Demand shocks**

	1996–2007	1996–2001	2002–2007
<b>CZ</b>	-0.22	-0.01	-0.16
<b>AT</b>	-0.19	-0.05	-0.18
<b>DE</b>	0.15	0.02	0.33
<b>PT</b>	-0.03	0.06	-0.10
<b>HU</b>	0.35 **	0.28	0.44 **
<b>PL</b>	0.20	0.28	0.22
<b>SI</b>	-0.20	-0.41 **	0.11
<b>SK</b>	-0.09	0.02	-0.09

## Supply shocks

	1996–2007	1996–2001	2002–2007
CZ	-0.08	-0.18	0.06
AT	0.24 *	0.26	0.03
DE	0.62 ***	0.63 ***	0.67 ***
PT	0.01	0.15	-0.24
HU	0.44 ***	0.45 **	0.01
PL	-0.03	-0.44 **	0.29
SI	-0.22 *	-0.33 *	-0.14
SK	0.11	0.04	0.07

Notes: The significance of the correlation coefficient is marked \*\*\*, \*\* and \* for the 1%, 5% and 10% significance levels respectively.

Source: CNB calculations.

### 1.1.4 Macroeconomic effects of financial flows from EU funds

The EU Member States can draw on EU funds under the EU's common policies (particularly the economic and social cohesion policy and the common agricultural policy). In the case of the new EU Member States, the drawing of funds – and in particular the drawing of financial assistance – provides an additional stimulus for their economic activity, probably mainly in the area of investment activity.<sup>18</sup> The more funds a country draws, the greater the effect on its macroeconomic development. A larger impact on the business cycle can also be expected in the short run if the drawdown of funds shows significant year-on-year changes instead of recording a gradual inflow.

The financial flows between the Czech Republic and the EU have so far been steady. The net balance<sup>19</sup> of the Czech Republic vis-à-vis the EU increased slightly in 2006 compared to 2005, to CZK 6.1 billion. This was mostly due to higher levels of drawdown on financial assistance from the Structural Funds (SF) and the Cohesion Fund (CF). Overall, however, the drawing on SF and CF funds in 2004–2006 was much below the level allocated to the Czech Republic for structural operations for the programming period 2004–2006, since only about 35% of the above allocation had been drawn by the end of 2006.<sup>20</sup> The data on realised expenditure<sup>21</sup> on projects under operational programmes and single programming documents

<sup>18</sup> The analysis does not expect private investment to be crowded out by public sector investment. The expected increase in investment activity connected with the implementation of EU projects is financed largely from EU funds, i.e. it does not automatically call for additional government bond issues, which would exert upward pressure on interest rates with a negative impact on private investment. To prevent private investment from being crowded out, EU projects should be cofinanced as much as possible by re-directing funds from national economic and social cohesion projects to EU projects. Cofinancing of EU projects from public sources is classified as national expenditure, which simultaneously aids compliance with the additionality principle.

It can be argued, however, that this might not necessarily lead to additional investment activity by private firms, but just to a change in investment financing, since firms will now finance part of the investment which they would otherwise implement using their own funds or credit, from EU funds. However, the EU funds only support projects in clearly specified areas (i.e. they cannot be applied across the board) and focus chiefly on areas where investments are limited for some reason. If the absorption capacity of the economy is sufficient, one can expect that the use of EU funds really will lead to additional expenditure in most cases. The limited absorption capacity of the Czech economy is partially reflected in the analysis by relatively gradual drawdown of funds for structural operations.

<sup>19</sup> The net balance is defined as the difference between the country's total income from the EU and its contributions to the EU.

<sup>20</sup> The "n+2 rule" ensures that the SF and CF allocation for 2005 can still be drawn in 2007 and the allocation for 2006 in 2008.

<sup>21</sup> Realised expenditure includes funds applied for in the payment requests submitted by final beneficiaries to the intermediate body.

in 2007 H1 indicate that the drawdown from the EU Structural Funds is not currently accelerating. The volume of expenditure in 2007 H1 actually decreased compared to 2006 H2 (see Table 9). It can be expected that the funds allocated to the Czech Republic for structural operations in 2004–2006 will not be drawn in full.

**Table 9: Drawdown of financing from EU Structural Funds in the Czech Republic (CZK millions)**

		2005			2006			2007
		H1	H2	Total	H1	H2	Total	H1
Realised expenditure	Objective 1	692	1387	2079	4340	7891	12232	5721
	Objectives 2 + 3	0	7	7	112.9	818	930	409
	Total	692	1394	2086	4453	8709	13162	6130
Drawdown	Objective 1	312	1238	1551	3052	5958	9009	4393
	Objectives 2 + 3	0	3	3	78.3	624	702	304
	Total	312	1241	1554	3130	6581	9711	4697

Note: Drawdown for projects under operational programmes (Objective 1) and single programming documents (Objectives 2+3). Cofinancing excluded.

Objective 1 = Supporting development in the less prosperous regions (with GDP below 75% of the EU average); Objective 2 = Revitalising areas facing structural difficulties; Objective 3 = Supporting education, training and employment policies. Objectives 2 and 3 cover regions not eligible under Objective 1.

Source: Ministry for Regional Development.

The year 2007 marks the start of the new programming period 2007–2013. The Czech Republic's national strategic reference framework for this period was not approved by the European Commission until the end of July 2007. At the time this analysis was prepared, the operational programmes and documentations were being completed, the systems were being prepared and internal audits were being performed at the managing institutions. The first drawdown of funds for structural operations from allocations for this programming period is expected in 2008. Under the structural operations, the Czech Republic should in 2007 thus only receive the outstanding funds for projects from the previous programming period and advance payments for the current period. According to the Czech Ministry of Finance's preliminary estimates, the net balance vis-à-vis the EU should be CZK 17.2 billion in 2007. This estimate assumes, however, that the Czech Republic will obtain the above advance payments in full, i.e. that the programme documents will be approved on time and that financial inflows for projects from the SF and CF from the previous allocation will rise slightly. The Czech Republic's current net balance vis-à-vis EU institutions for 2007 H1 was CZK 1.1 billion. Inflows from the SF and CF totalled only CZK 3.3 billion in the same period (advance payments can be expected in 2007 Q4 at the earliest) and income from the Common Agricultural Policy (about CZK 13.2 billion) was thus the main income from the EU.

The Czech Ministry of Finance expects the net balance to increase from 2008 onwards, thanks mainly to a rise in drawings from the SF and CF. The current estimates of the net balances for 2008–2013 have been reduced slightly compared to last year's estimates, most of all for 2008. It is now assumed that the allocation for 2004–2006 will not be drawn in full and that the drawdown of financial assistance will be somewhat slower. However, the biggest year-on-year change in the inflow of EU funds is still expected in 2008, when the Czech Republic's net balance vis-à-vis the EU should increase by 0.6 percentage point to roughly 1.1% of GDP. It should then gradually increase to 2% of GDP in 2013 (see Table 10). The Czech Republic should obtain the most funding for projects from the Structural Funds and Cohesion Fund.

The financial flows between the Czech Republic and the EU are reflected in the public budget balance. The revenue side of the public budgets is positively affected by the at least partial use of SF and CF income for existing national public sector investment projects. The subsidies under the Common Agricultural Policy, which in large part substitute the national agricultural subsidies, also have a favourable effect. In addition, public sector revenues were raised in 2004–2006 by budgetary compensations. By contrast, the public expenditure side will reflect transfers of own resources to the European budget. EU funds for private sector projects are neutral in terms of their impact on the public finance deficit, since they will appear in the same amount on both the revenue and expenditure sides of the budget. The

overall effect of financial flows between the Czech Republic and the EU on the public budget balance can be expected to be negative (0.1–0.3 percentage point of GDP) in 2007 and 2008. In the following years, however, the positive impact of inflows of funds into agriculture and structural operations is likely to slightly exceed the very slowly rising transfers of own resources, and the overall effect on the public budgets will be slightly positive. Provided that there is no re-direction of part of the funds from national social cohesion projects to the cofinancing of EU projects, additional upward pressure on public expenditure (a rise of 0.3–0.4 percentage point of GDP at most) can be expected due to cofinancing at the end of the horizon shown in Table 10.

**Table 10: Expected financial flows resulting from the Czech Republic's EU membership (in CZK billions) and estimated impacts of drawdown of EU funds by the private sector on the economy**

	2005	2006	2007	2008	2009	2010	2011	2012	2013
Pre-accession aid	2.1	2.6	0.4	-	-	-	-	-	-
Agriculture	11.8	14.3	19.3	23.7	26.8	27.7	29.6	31.5	36.2
Structural operations	6.3	13.3	31.8	57.5	58.1	67.5	76.6	93.9	112.2
Internal policies	1.8	1.5	1.7	1.5	1.4	1.3	1.3	1.3	1.2
Compensation	8.9	5.7	-	-	-	-	-	-	-
EEA / Norway financial instrument	-	0.1	-	-	-	-	-	-	-
<b>Total income from EU</b>	<b>31.0</b>	<b>37.4</b>	<b>53.3</b>	<b>82.8</b>	<b>86.4</b>	<b>96.4</b>	<b>107.5</b>	<b>126.7</b>	<b>149.6</b>
Own resources	28.6	30.3	34.3	39.7	36.8	32.0	37.8	39.0	38.8
Payments to EIB, RFCS, etc.	0.8	1.0	1.8	2.0	1.3	0.3	0.3	0.4	0.4
<b>Total payments to EU</b>	<b>29.4</b>	<b>31.3</b>	<b>36.1</b>	<b>41.7</b>	<b>38.1</b>	<b>32.3</b>	<b>38.1</b>	<b>39.4</b>	<b>39.2</b>
<b>Net balance</b>	<b>1.6</b>	<b>6.1</b>	<b>17.2</b>	<b>41.1</b>	<b>48.3</b>	<b>64.2</b>	<b>69.4</b>	<b>87.3</b>	<b>110.4</b>
Net position in % of GDP	0.05	0.19	0.49	1.08	1.18	1.47	1.48	1.72	2.02
<b>Impulse in pp of GDP</b>	<b>0.18</b>	<b>0.15</b>	<b>0.03</b>	<b>0.12</b>	<b>0.09</b>	<b>0.10</b>	<b>0.03</b>	<b>0.06</b>	<b>0.07</b>

Note: 2005 and 2006 data = true situation; an outlook for the CZK/EUR exchange rate according to the CNB's macroeconomic forecast (July 2007) is used to translate the source data stated in EUR to CZK. "-" indicates that the instrument did not or will not operate at the given time. "." means that no data are available.

Sources: Ministry of Finance (working estimates in EUR) and CNB calculations.

Any increased inflow of funds will imply an additional impulse for economic activity. For the purposes of this analysis, the derivation of the additional economic impulse from the inflow of money from the EU is based on an expert estimate of the real drawdown of funds from the EU by the private sector and not on the expected financial flows between the Czech Republic and the EU. The positive net balance and the inflow of funds from the EU to the Czech Republic does not necessarily mean an increase in net demand, since the financial flows recorded with the EU also include advance payments, which will not necessarily be paid to the final beneficiaries. The numerical expression of the additional economic impulse from the inflow of funds from the EU in percentage points of GDP respects the standard method applied in the CNB's forecasting system to calculate the fiscal impulse (see the Methodological Part for details).

According to revised estimates, the effects of drawdown of funds from the EU will be lower than expected in last year's analysis. The originally expected increased inflow of funds and their drawdown in 2007–2008 is delayed by one year and its effects are currently expected to manifest themselves in 2008–2010. In the future, the impulse stemming from the inflow of funds from the EU will peak in 2008, but, according to estimates, will be lower than the additional impulse in 2005–2006. The higher impulses in the past were due to the step start of financial flows under the Common Agricultural Policy. Hence no significant asymmetric shock arising from the drawing of financial assistance from the EU is expected in the future.

The simulation of the macroeconomic effects of the additional income from the EU takes account in particular of the short-term and medium-term demand impacts of the newly identified impulse arising from the inflow of funds from the EU; the impacts on the supply side of the economy are expected more in the long term. It is also assumed that the drawdown of EU funding is generally expected and will not affect the exchange rate in terms of

conversion of EUR into CZK.<sup>22</sup> Table 11 shows the simulation results, which are presented in the form of deviations of the inflation path, output gap, CZK/EUR exchange rate and interest rates from the baseline scenario of the CNB's July 2007 macroeconomic forecast.

**Table 11: Impact of the additional impulse due to the inflow of funds from the EU (deviations from the baseline scenario of the CNB's July forecast)**

	2006	2007	2008	2009	2010	2011	2012	2013
Inflation (pp)	0.00	0.00	0.00	-0.01	-0.01	0.00	0.00	0.01
3M PRIBOR (pp)	0.00	0.00	0.01	0.01	0.00	-0.01	-0.01	0.01
Output gap (pp)	0.00	0.01	0.08	0.06	0.02	-0.04	-0.03	0.00
CZK/EUR (CZK)	0.00	-0.01	-0.06	-0.08	-0.08	-0.06	-0.05	-0.04

Source: CNB calculations.

The results of the simulation show that the impact of the inflow of funds from the EU on the variables under review will be insignificant in 2007–2013. Both inflation and the interest rate path will move in line with the baseline scenario. Very modest impacts can also be expected in the case of the output gap and the exchange rate. The decrease in the expected impact compared to last year is largely due to lower estimated drawdown of EU funds and a more even distribution thereof over time. In this respect, the impact on the CZK's participation in the ERM II system and the fulfilment of the convergence criteria is insignificant. The results of the simulation should, however, be taken as tentative and conditional on the methodology used.

### 1.1.5 Assessment of the economies' structural similarity

Greater similarity of the structure of economic activity between the acceding economy and the other economies of the monetary union decreases the risk of occurrence of an asymmetric economic shock.

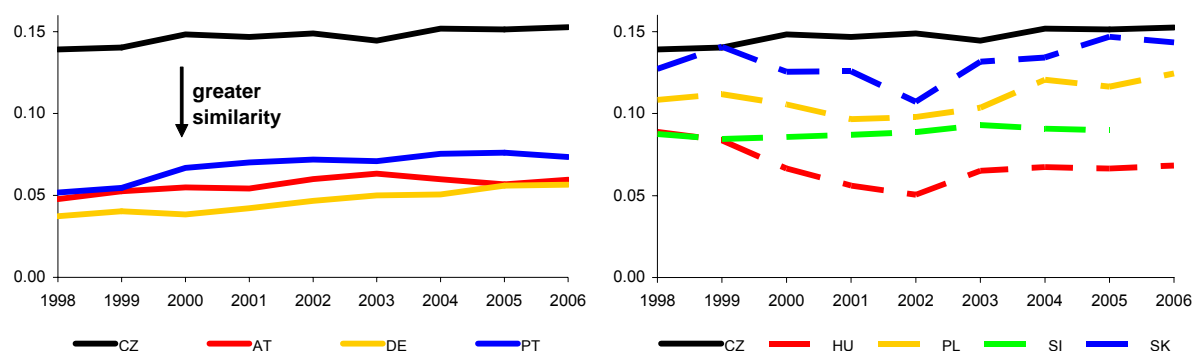
The **structural similarity of the economies** of the countries under comparison with the euro area is expressed using the Landesmann structural coefficient, which compares the shares of six sectors of the economy in total value added in the countries compared and the euro area. The coefficient takes values in the range of [0, 1]. The closer the coefficient is to zero, the more similar is the structure of the economies.

Chart 6 shows that the Landesmann coefficient for the Czech Republic is the highest of all the selected countries.<sup>23</sup> The structure of economic activity is therefore more similar to the euro area average for all the countries under review as compared to the Czech Republic. However, the index for the Czech Republic is still relatively close to the lower boundary of the interval [0, 1] and only slightly higher than that for Slovakia. The difference in the structure of value added in the Czech economy consists mainly in a high share for industry and in a lower share for services, in particular financial intermediation, real estate and other services (see Table 12).

<sup>22</sup> The assumption is derived from the fact that financial transactions in relation to the EU are mostly carried out via CNB accounts and converted directly into foreign exchange reserves.

<sup>23</sup> Owing to missing 2006 observations for the Czech Republic in the Eurostat database, the data used for the calculation of the entire time series are taken from the CZSO. The values of the indicators for 1998–2005 are identical for both data sources.

**Chart 6: Structural similarity vis-à-vis the euro area**



Sources: Eurostat and CZSO, CNB calculations.

**Table 12: Shares of economic sectors in GDP in 2006 (%)<sup>a</sup>**

	A, B	C, D, E	F	G, H, I	J, K	L-P
<b>EA-12</b>	2	20	6	21	28	23
<b>CZ</b>	3	32	7	24	17	17
<b>AT</b>	2	23	8	24	23	21
<b>DE</b>	1	26	4	18	29	22
<b>PT</b>	3	19	6	24	22	26
<b>HU</b>	4	26	5	20	22	23
<b>PL</b>	4	25	7	28	18	19
<b>SI<sup>b</sup></b>	3	28	6	22	21	21
<b>SK</b>	4	28	7	27	19	15

Notes: a) The sectors are classified according to the NACE classification: A, B – agriculture, forestry and fishing, C, D, E – industry, F – construction, G, H, I – wholesale and retail trade, repair, accommodation, transport and communication, J, K – financial intermediation, real estate, renting and business activities, L–P – other services.  
 b) 2005 data.

Sources: Eurostat, CNB calculations.

### 1.1.6 Convergence of the interest rate differential

Some countries entering the currency area in the past faced rapid nominal interest rate convergence to the union level, which acted as an asymmetric shock.<sup>24</sup> Therefore, earlier nominal interest rate convergence is better for smooth accession to the euro area, as it will facilitate better adjustment of economic processes and eliminate the additional asymmetric shock associated with euro adoption and a step elimination of the risk premium.<sup>25</sup>

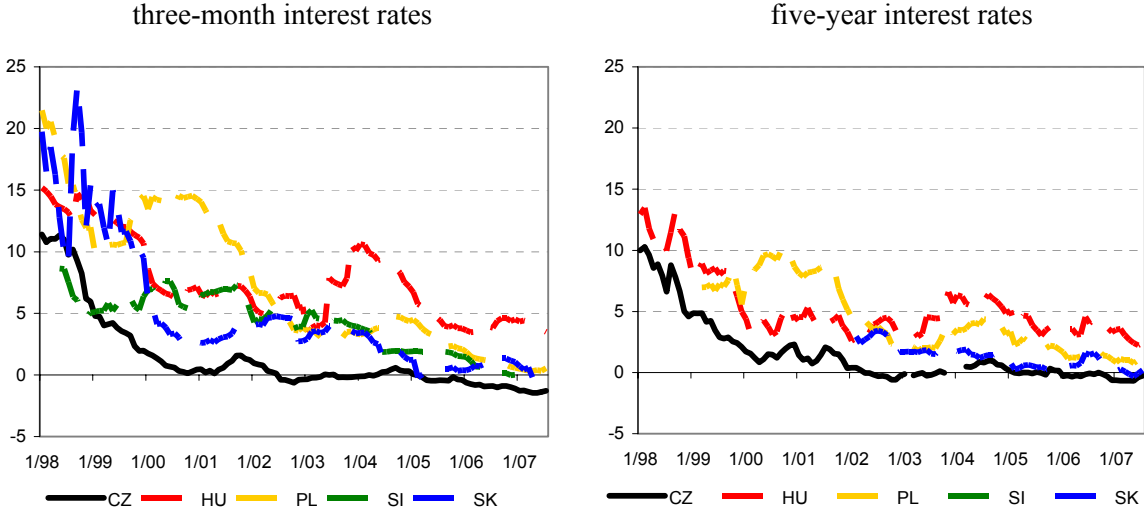
The following comparison of the **nominal interest rate differential** vis-à-vis the euro area attempts to express the probability of the asymmetric shock described above. The closer the nominal interest rate differential is to zero, the smaller is the risk that joining the monetary union will cause a rapid change in both nominal and real interest rates, which would have a destabilising effect on the economy. Chart 7 illustrates the interest rate differentials in the

<sup>24</sup> Although real economic activity is affected primarily by real interest rates, nominal interest rates may also have a significant effect via some credit constraints (e.g. the loan repayment to financial income ratio).

<sup>25</sup> See also section 1.1.1.

Czech Republic, Hungary, Poland, Slovenia and Slovakia vis-à-vis the euro area for three-month rates on the interbank market and five-year government bonds.

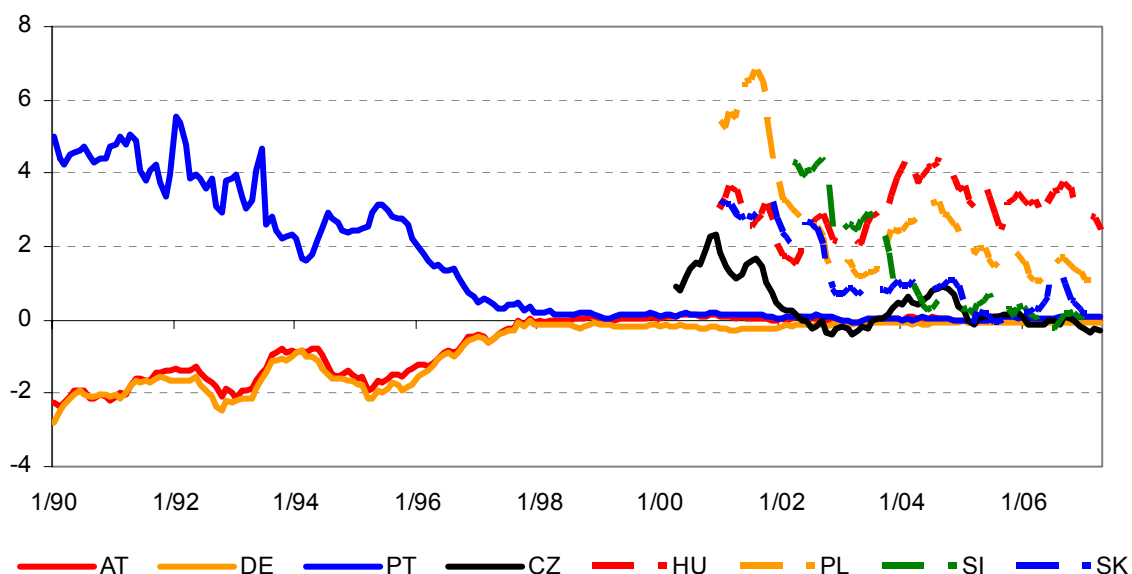
**Chart 7: Differences in interest rates vis-à-vis the euro area 1998–2006 (percentage points)**



Sources: Bloomberg, CNB calculations.

Interest rate convergence is observable for all the countries compared and for both maturities. The only exception in recent years has been Hungary, where a significant difference in interest rates still persists. The Czech Republic remains the only country under review with a negative interest rate differential. In 2007, the negative differential in three-month rates widened further, reaching its highest ever values. A lower differential for five-year interest rates compared to three-month rates suggests expectations of convergence to the euro area in the future. The evolution of interest rates in the euro area countries prior to the introduction of the euro can serve as an indication for countries planning to introduce the euro. Chart 8 shows, for all the countries under review, the trend in the differential of ten-year government bond yields, which are monitored as one of the Maastricht convergence criteria, against the euro area average. For Austria, Germany and Portugal, the run-up to the introduction of the euro is included. However, when comparing the levels and evolution of these interest rate differentials, the fact that the structural characteristics of the economies have changed since the 1990s should be taken into account.

**Chart 8: Differences in interest rates vis-à-vis the euro area 1990–2006, long-term interest rates (percentage points)**



Sources: Eurostat, CNB calculations.

The current average level in the new Member States is broadly comparable to the time-corresponding level of the interest rate differential in Portugal. Among non-euro area countries, the lowest long-term interest rates are in the Czech Republic and Slovakia, which are showing a negative or zero interest rate differential in 2007 and have thus progressed the furthest in terms of interest rate convergence.<sup>26</sup> Although it is not possible to guarantee that this situation will persist until adoption of the euro, it can be expected from the current perspective that the effects of interest rate convergence will be rather small upon the Czech Republic's future entry into the euro area.

### 1.1.7 Exchange rate convergence

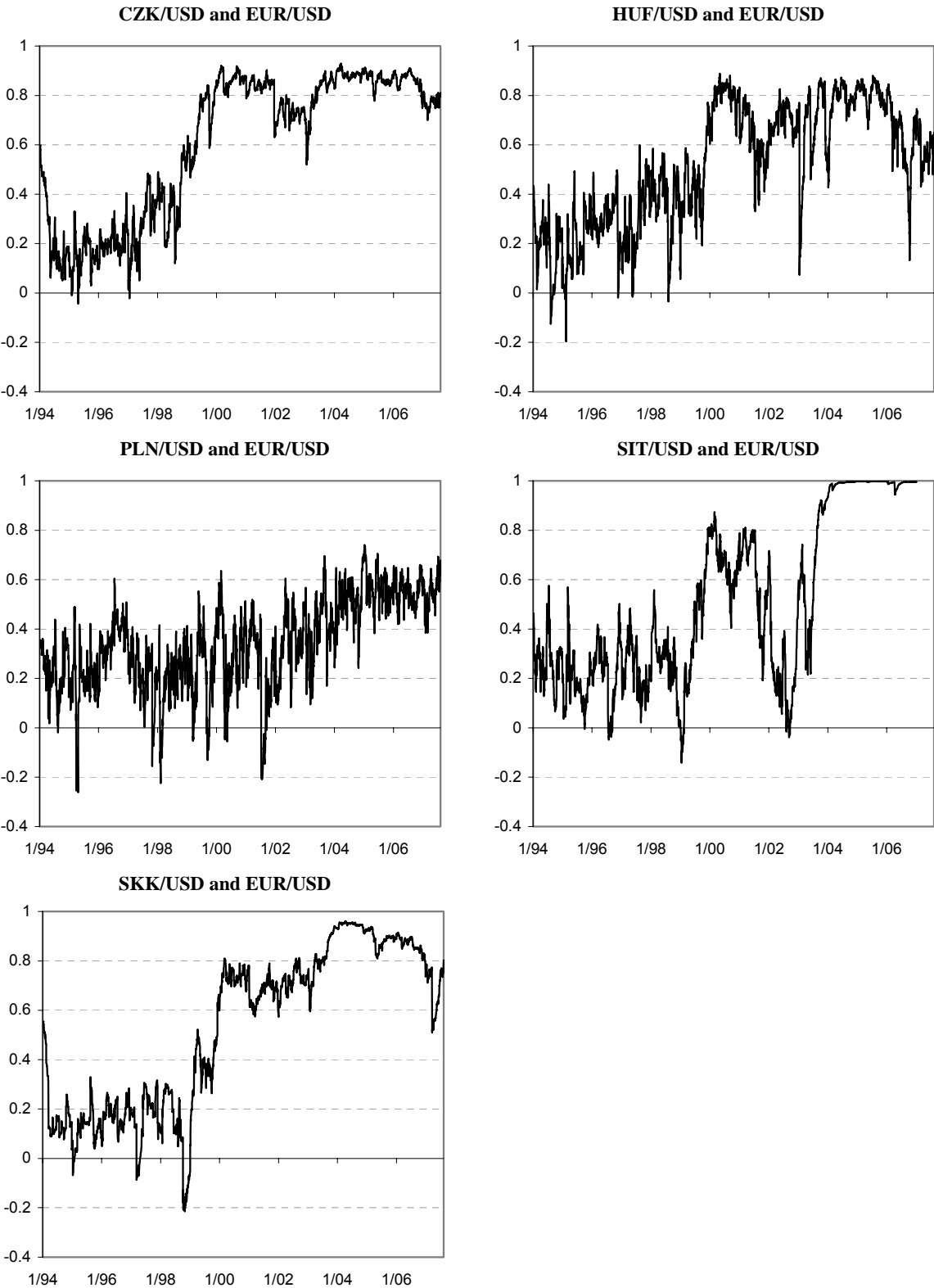
Similar movement in the exchange rates of two currencies in the long term vis-à-vis a third (reference) currency reflects similarity in the factors which affect those exchange rates. A high **exchange rate correlation** of two currencies vis-à-vis a third currency can thus be an indicator that the two countries could share a single currency (Aguilar and Hördahl, 1998).<sup>27</sup> The following analysis uses a bivariate GARCH model to estimate the correlation between the exchange rates of the Czech koruna, the Hungarian forint, the Polish zloty, the Slovenian tolar and the Slovak koruna and the euro vis-à-vis the US dollar. A high degree of correlation reflects high similarity of exchange rate movements and less intense asymmetric pressures; the exchange rate correlation of currencies in a monetary union would be one. Chart 9 illustrates the development of the correlation coefficients.

<sup>26</sup> Holinka (2005) uses data for 1999–2004 and explains the decrease in the differential of five- and ten-year interest rates in the Czech Republic vis-à-vis the euro area over the period under review in terms of expectations of a lower short-term rate due to a decrease in inflation expectations in the Czech Republic and the inflation premiums. However, the impact of short-term rate expectations becomes lower for ten-year interest rates.

<sup>27</sup> Aguilar and Hördahl (1998) express the probability of euro adoption in the countries which at that time were EMU candidate countries using the correlation of the exchange rates of their currencies and the Deutsche Mark (as a proxy for the euro) vis-à-vis the US dollar. Babetskaia-Kukharchuk et al. (2007) use the same method to calculate the correlation of four Central European currencies vis-à-vis the euro.



**Chart 9: Correlation coefficients of exchange rates against the US dollar**



Sources: Bloomberg, CNB calculations.

The charts show that the correlation between the Czech koruna and the euro has been relatively high since 2000 (although the period 2001–2002 saw a short-lived decline related to an appreciation episode) and has been moving around 80% in recent years. In 2007, we can observe a modest decline in the correlation coefficient, but this can be partly explained by the dollar's exchange rate volatility and by appreciation of the region's currencies. We can see that the Czech and Slovak korunas have a higher and less volatile correlation with the euro by comparison with the Polish zloty and recently also the Hungarian forint. The temporary decrease in the Slovak koruna's correlation at the start of 2007 was due to an NBS intervention and a central rate revaluation of 8.5% in March.

Slovakia currently participates in ERM II. It can be seen from the chart that the correlation coefficient for the Slovak koruna shows a larger degree of similarity to the correlation coefficient for the Czech Republic than that for Slovenia before it entered the euro area. The observed difference in the convergence of the exchange rates of Slovenia and Slovakia reflects in particular differences in their foreign exchange regimes and the fact that Slovakia has continued to pursue implicit inflation targeting since it joined ERM II (see NBS, 2004).

To assess the importance of exchange rate convergence it would be useful to compare the aforementioned results with the exchange rate correlation of the Austrian and Portuguese currencies and the Deutsche Mark before they adopted the euro. However, the direct comparison unfortunately has a limited information value, owing to the different exchange rate regimes in these countries. The Austrian and Portuguese currencies were in essence pegged to the Deutsche Mark since 1985,<sup>28</sup> so the observed correlation should be very close to one, as the data confirm.

### 1.1.8 Analysis of exchange rate volatility

Another way of assessing the risk of occurrence of asymmetric shocks in the Czech economy vis-à-vis the euro area is to analyse the determinants of exchange rate volatility. Low volatility of the exchange rate between two countries may be regarded, in the case of a floating exchange rate regime, as an indicator of their potential to share a single currency (see also section 1.1.7).

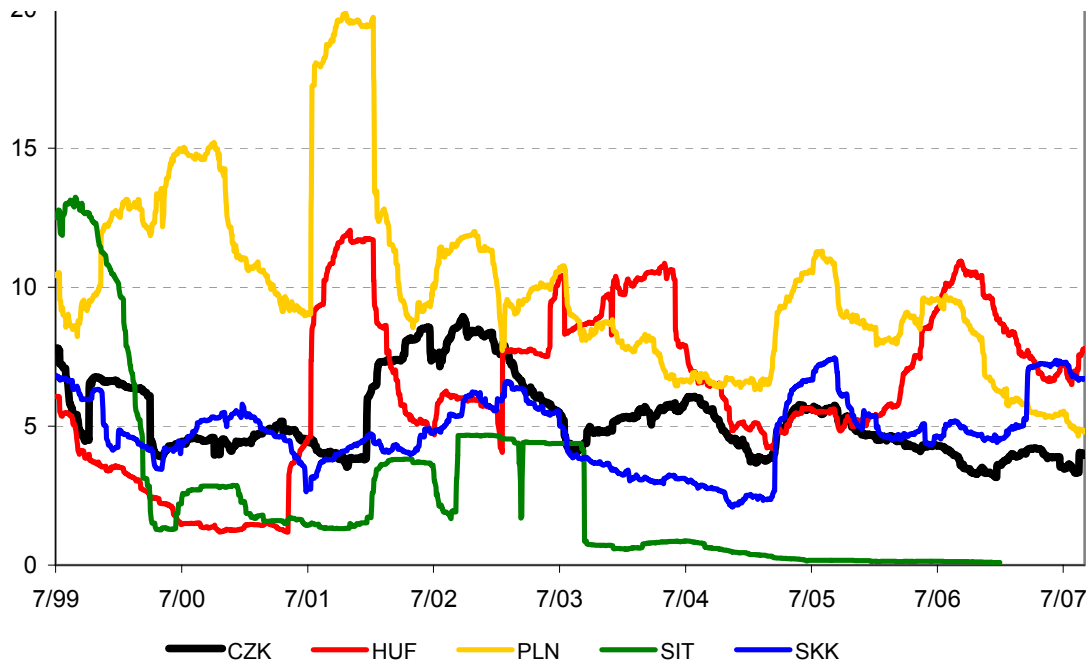
Chart 10 describes the historical evolution of the volatility of the exchange rates of the new EU Member States under review vis-à-vis the euro between 1999 and 2007.<sup>29</sup> The measure of historical volatility is based on the annualised standard deviation of daily returns for the last six months. The chart shows that the Czech koruna was among the currencies with average to lower volatility in the sample of countries under comparison. During 2006, the volatility of the Czech koruna was second lowest, the lowest being the Slovenian tolar, whose daily changes were negligible due to a different exchange rate regime. As Slovenia has adopted the euro, the volatility of the Czech koruna has been the lowest among the countries of the sample since the start of 2007. The Slovak koruna for a long time recorded below-average volatility; in 2007, however, this volatility has increased, and, together with the Hungarian forint, it is the highest in the countries under comparison. The volatility of the Polish zloty decreased last year.

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<sup>28</sup> From 1985 on, these countries essentially had a fixed rate, a crawling peg or a moving band of up to  $\pm 2\%$  vis-à-vis the Deutsche Mark (Reinhart and Rogoff, 2004). This link undoubtedly reduced the costs and benefits of entering the euro area.

<sup>29</sup> The calculation of the historical volatility uses the standard deviation of returns over a six-month period. This is why the data in the chart start in mid-1999.

**Chart 10: Historical volatility of exchange rates vis-à-vis the euro (%)**

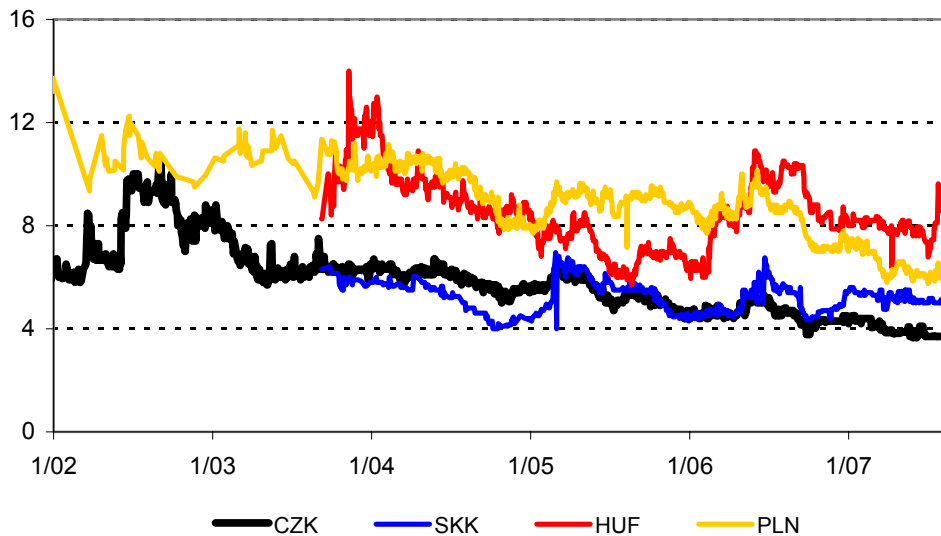


Source: CNB.

Note: Six-month annualised historical volatility of daily returns.

An outlook for exchange rate volatility can also be derived from financial markets data. Chart 11 shows movements in the volatility of the exchange rates under comparison which is expected by the financial markets and reflected in the prices of options for the individual currencies. Implied volatility has been falling moderately for all currencies and has been lower for the Czech Republic and Slovakia than for Hungary and Poland throughout the period under review.

**Chart 11: Implied volatility of exchange rates vis-à-vis the euro (%)**



Source: Bloomberg.

In addition to changes in historical exchange rate volatility or volatility expected by the markets, their determinants can also be monitored and used to compile an indicator of fundamental-based (i.e. theoretically expected) exchange rate volatility. It can be said that the lower the fundamental-based exchange rate volatility, the higher the ability of two countries to share a common currency.<sup>30</sup> This concept of exchange rate volatility is more general and may also be applied to the case where a country does not have a floating rate.

Table 13 provides a comparison of historical and fundamental-based exchange rate volatility for the Czech and Slovak korunas, the Hungarian forint, the Polish zloty and the Slovenian tolar vis-à-vis the euro based on data from the period 1999–2006. For the purposes of comparison with fundamental-based exchange rate volatility, historical volatility is calculated as an annualised standard deviation of quarterly returns for the whole period under review.

**Table 13: Historical and fundamental-based volatility of exchange rates vis-à-vis the euro (%)**

Exchange rate volatility	CZ	HU	PL	SK	SI
Historical	3.6	4.4	8.4	4.1	1.3
Fundamental-based	5.9	6.2	7.0	5.9	6.1

Source: CNB calculations.

The historical volatility of the exchange rate of the Czech koruna in 1999–2006 so defined was similar to that of the Hungarian forint and Slovak koruna, which is consistent with the aforementioned results based on high-frequency data. Fundamental-based exchange rate volatility is similar for all the currencies analysed except the Polish zloty. The macroeconomic characteristics of the Czech economy therefore suggest potential for exchange rate volatility that is roughly similar to that in the other new EU Member States under comparison.

## 1.2 The effect of international economic relations

The integration of an economy into international economic relations has an influence on the effectiveness of independent monetary policy and the probability of asymmetric economic shocks. Similarity of economic developments of two economies can be fostered both by trade links and by ownership links. An analysis of the openness of the economy is therefore an important addition to the other analyses of structural alignment.

### 1.2.1 The links of the economy with the euro area

Greater economic integration with countries using a single currency, as measured by the share of foreign trade on both the export and import sides, leads to a lower risk of markedly different economic developments in the observed country with respect to the other countries of the single currency area. Closer trade links thus foster higher correlation of economic activity within a single currency area (Frankel and Rose, 1997).<sup>31</sup>

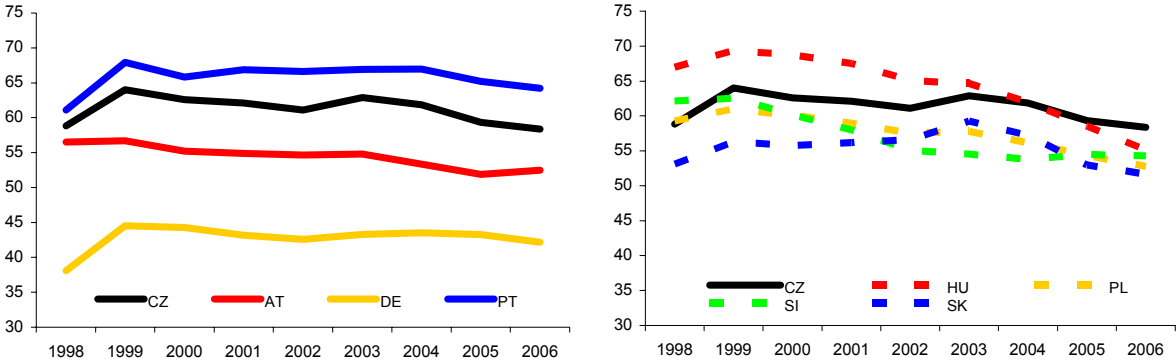
The **intensity of mutual trade** of the countries under review with the euro area is illustrated in Chart 12 and Chart 13. All the countries under review currently have a high degree of economic integration with the euro area. The Czech Republic's mutual trade with the euro

<sup>30</sup> Horváth (2005) shows that the exchange rate stability of two currencies is greatly affected by the extent to which those countries meet the criteria for optimum currency areas.

<sup>31</sup> On the other hand, higher trade intensity may lead to growing specialisation and thus to less economic symmetry (Krugman, 1993).

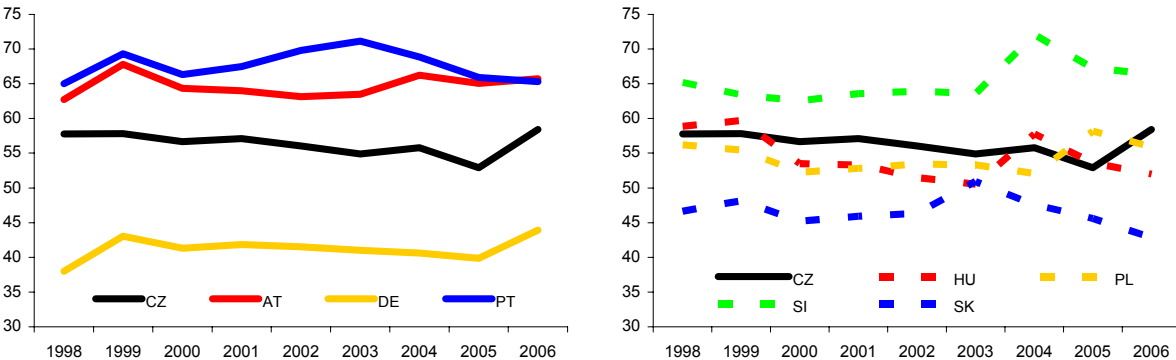
area accounts for 60% of its total exports and imports,<sup>32</sup> which is a level comparable to, or even higher than, that of the euro area countries under comparison. Thus there exists a relatively wide channel for transmission of economic impulses from the euro area to the Czech economy.

**Chart 12: Shares of exports to the euro area in total exports (%)**



Sources: IMF, CNB calculations.

**Chart 13: Shares of imports from the euro area in total imports (%)**



Sources: IMF, CNB calculations.

Like trade links, **ownership links** foster higher correlation of economic activity. If domestic companies are part of multinational groups, this may help to transmit economic impulses. In addition, capital integration between two countries can help to dampen a negative unilateral demand shock.<sup>33</sup>

Ownership links with the euro area are measured by the share of foreign direct investment (FDI) from the euro area in the surveyed countries in GDP (Table 14) and by the share of direct investment (DI) from the surveyed country in the euro area in GDP (Table 15).

<sup>32</sup> The main determinants of the dynamics and structure of Czech foreign trade are analysed in the paper by Benáček et al. (2005).

<sup>33</sup> A negative demand shock hitting one country may be partly offset by holding diversified investment portfolios. In this way, there may be “private insurance” against potential asymmetric shocks in addition to public transfers between countries (De Grauwe, 2003).

**Table 14: Shares of FDI from the euro area in GDP (%)**

	1998	1999	2000	2001	2002	2003	2004	2005
CZ	16.7	24.4	29.6	34.3	37.7	34.9	37.8	42.2
AT	6.9	7.2	10.8	11.7	11.2	10.8	.	.
DE	5.1	7.3	15.7	13.8	15.1	15.5	14.2	.
PT	11.7	12.7	16.9	19.1	20.7	20.5	21.6	.
HU	.	.	.	.	.	.	37.0	35.6
PL	.	11.7	13.9	16.1	15.9	17.5	22.7	22.5
SI	.	.	.	10.5	11.8	12.6	14.3	14.9
SK	6.4	.	.	.	22.9	20.6	.	.

Sources: Eurostat, CNB calculations.

The Czech Republic's share of foreign direct investment in the euro area in GDP has gradually been rising and, together with Hungary, is the highest among the countries under review.<sup>34</sup> The ownership links of the other new member countries under review with the euro area has also grown gradually over time, albeit at a slower rate, testifying to an increasingly important role played by multinational companies and the external environment in the economies of the countries surveyed.

**Table 15: Shares of DI in the euro area in GDP (%)**

	1998	1999	2000	2001	2002	2003	2004	2005
CZ	0.3	0.2	0.2	0.2	0.2	0.5	0.7	0.8
AT	2.6	2.8	4.0	4.4	5.4	5.3	.	.
DE	6.0	7.1	9.8	10.5	11.3	11.1	10.6	.
PT	3.9	2.6	5.3	8.9	10.1	10.9	13.0	.
HU	.	.	.	.	.	.	0.6	1.5
PL	.	0.2	0.2	0.2	0.3	0.4	0.5	0.4
SI	.	.	.	0.8	1.2	1.4	1.8	2.7
SK	0.1	.	.	.	0.3	0.3	.	.

Sources: Eurostat, CNB calculations.

Ownership links the other way round, i.e. direct investment from the surveyed countries in the euro area as a percentage of their GDP, are insignificant, particularly in the case of the new EU members. However, an upward trend can be seen for this indicator as well.

### 1.2.2 Intra-industry trade

**Intra-industry trade** is typical of countries with a similar factor structure and is thus one of many indicators of the structural similarity of economies. Intra-industry trade fosters cyclical convergence (Frankel and Rose, 1997) and can also affect the economy's ability to absorb economic shocks.<sup>35</sup> The theory of intra-industry trade (Krugman, 1981, Hoekman and Djankov, 1996) assumes the greatest intensity of intra-industry trade in capital- and research-intensive industries which can benefit most from economies of scale; as a rule these are

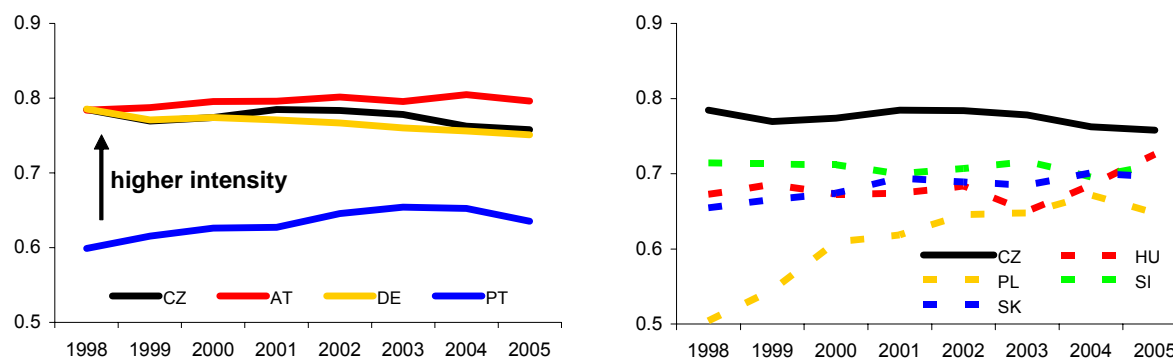
<sup>34</sup> Approximately 30% of FDI in the Czech Republic comes from the Netherlands, via which non-European companies often invest in Europe. The actual ownership links with the euro area may thus be slightly overestimated. For the other countries surveyed, the share of direct investment from the Netherlands was lower, reaching 24% at most.

<sup>35</sup> Among other things, intra-industry trade growth may have a positive effect on the costs and speed of restructuring, since the transfer of resources may be faster and less expensive if effected within an industry than between industries. A larger proportion of intra-industry trade also acts to refute the specialisation hypothesis based on inter-industry foreign trade.

industries with high market concentration. The lowest level can be expected in industries associated with particular natural resources.

To analyse intra-industry trade we used the Grubel–Lloyd index, which indicates the share of the absolute amount of intra-industry trade in foreign trade turnover. Chart 14 illustrates the evolution of this indicator in the countries under comparison.

**Chart 14: Intensity of intra-industry trade with the euro area**



Sources: OECD, CNB calculations.

The Czech Republic's share of intra-industry trade with the euro area remains stable. This indicator was comparable with that for Austria and Germany throughout the period under review and was higher than for all the other countries compared.<sup>36</sup> This can be assessed as a positive factor in terms of euro area accession.

## 1.3 Financial market

From the viewpoint of the optimum currency area theory it is useful to examine how advanced and similar the financial sectors and capital markets of the countries considering participation in a monetary union are to the markets within that union.<sup>37</sup> The financial sector and capital market play an important role in the functioning of transmission mechanisms, and at the same time they can be a source of asymmetric shocks. Their structural similarity and their integration into European markets will be a positive signal.

### 1.3.1 Financial sector

A similar level of financial sector development and functioning increases the probability that the financial sectors in both economies will transmit external economic shocks and monetary policy impulses in the same way. The main characteristics under review are the depth and structure of financial intermediation.

The **depth of financial intermediation** in the Czech Republic, as measured by the ratio of financial system assets to GDP, is approximately one-third of the value for the euro area, Germany and Austria, and around 40% compared to Portugal. The ratio of Czech financial system assets to GDP is, however, greater than that in some of the other Central European countries, especially in comparison with Poland. Nonetheless, the financial sector's assets as a percentage of GDP had gradually fallen in the Czech Republic, from 147% in 1996 to 127% in 2004, as a result of their slower pace of absolute growth in past years (see Table 16). In 2005, the year-on-year rate of growth of financial system assets accelerated to 12%, which

<sup>36</sup> Our conclusions in this respect are identical to those of Fidrmuc (1999).

<sup>37</sup> For completeness it should be added that the advanced state of the financial sector may also be reflected in its high ability to cover exchange rate risks and thereby reduce the costs associated with an independent currency.

was reflected in an increase in their percentage of GDP. In 2006, the annual rate of growth of these assets was 7%, similar to GDP growth at current prices.

**Table 16: Financial system assets/GDP (%)**

	1998	1999	2000	2001	2002	2003	2004	2005	2006 <sup>a</sup>
CZ	136.6	138.6	140.1	137.1	133.8	132.5	127.1	134.1	133.4
AT <sup>c</sup>	295.7	317.4	332.5	341.2	327.8	339.7	354.2	392.5	407.3
DE <sup>b,c</sup>	337.9	363.8	379.2	378.9	378.8	383.1	386.9	399.0	397.8
PT <sup>c</sup>	342.6	338.7	329.7	282.6	281.2	307.3	296.9	308.3	326.9
HU	78.2	79.8	79.1	80.8	83.6	93.0	100.0	114.7	129.5
PL	57.4	60.4	65.6	71.0	72.3	76.0	78.7	85.2	96.9
SI <sup>b</sup>	97.3	100.5	104.8	113.7	118.5	121.0	128.8	147.3	158.0
SK <sup>b</sup>	108.9	98.1	99.2	100.6	102.8	92.9	100.5	110.9	101.5
EA-12 <sup>c,d</sup>	331.7	357.2	364.8	348.4	340.6	351.3	367.6	401.2	423.0

Notes:

a) Preliminary data.

b) Excluding pension funds (SI until 2001, SK until 2004). DE includes only part of private pension funds.

c) Total assets of credit institutions, insurance companies, pension funds and investment funds.

d) Weighted average.

Sources: CNB, national central banks. Unconsolidated data.

Table 17 shows the ratio of credit to GDP, revealing that the Czech Republic lags behind the euro area countries surveyed in this indicator. Compared to Germany, Austria and Portugal, the volume of loans (including general government) is three times lower in relative terms. Of the selected new EU Member States, Slovenia has the highest ratio of loans to GDP. Bank loans in the Czech Republic are still rising fast – both loans to corporate clients (21% year on year as at the end of 2006, and 20% as at 30 June 2007) and loans to households (30% and 32% respectively).

**Table 17: Bank loans to non-bank clients/GDP (%)**

	1998	1999	2000	2001	2002	2003	2004	2005	2006 <sup>a</sup>
CZ	55.2	50.6	48.1	41.4	38.5	39.8	39.0	40.2	45.3
AT	117.6	119.8	125.4	124.3	123.6	122.5	125.1	133.5	135.5
DE	138.2	141.0	143.6	144.4	141.0	140.0	136.3	134.9	132.2
PT	93.5	113.9	132.8	131.9	135.3	134.1	135.2	140.5	148.8
HU <sup>b</sup>	21.7	22.9	25.4	26.0	26.3	32.2	35.1	39.3	43.4
PL <sup>b</sup>	20.9	23.7	24.9	25.5	25.5	26.3	24.7	26.4	30.9
SI <sup>b</sup>	31.7	35.4	38.0	39.9	40.7	43.7	48.9	58.5	68.7
SK <sup>b</sup>	52.3	49.2	44.9	34.2	31.9	33.1	33.4	38.0	40.7
EA-12 <sup>c</sup>	107.9	111.6	116.1	113.4	112.7	113.9	116.1	123.2	129.3

Notes:

a) Preliminary data.

b) Loans to the non-financial sector (excluding general government).

c) Weighted average.

Sources: CNB, national central banks. Unconsolidated data.

From the point of view of the effects on the transmission mechanism and financial sector stability it has been necessary in recent years to monitor above all the very dynamic growth in **loans to households**.<sup>38</sup> The share of bank loans to households in total lending is currently 38% in the Czech Republic, while the share for the euro area is about 42%. The ratio of bank loans to households to GDP is currently around 17% in the Czech Republic and is considerably lower than the corresponding figure for the euro area (roughly 54%; see Chart 15). Both these indicators, however, have risen sharply in the Czech Republic in recent years. High growth in lending to the household sector has occurred previously in some of the current euro area countries (e.g. Portugal and Austria) and has not generated any problems in

<sup>38</sup> Loans extended to households by non-banking institutions are not taken into consideration.



their financial systems.<sup>39</sup> Dynamic growth in such lending has also been recorded in other Central European countries. The pace of growth in debt and less prudential assessment of creditworthiness are potential credit risk growth factors. For example, default on mortgage loans by less creditworthy clients may generate a liquidity crisis and transmission of credit risk on financial markets. The transmission of risk from the recent crisis in the US mortgage market has had a minimal effect on the Czech financial sector. The provision of mortgages on primary deposits, the issuing of mortgage bonds on high-quality claims, relatively good collateralisation of loans and, above all, limited investment in bonds backed by subprime foreign mortgages, are all having positive effects on the Czech market.

**Chart 15: Bank loans to households (shares in GDP and in total bank lending in 2006, %)**



Sources: CNB, national central banks.

The banking sector accounts for 73% of the Czech Republic's total financial system assets.<sup>40</sup> This ratio is only slightly less than those for Slovenia (72%) and Poland (70%). The structure of the Czech financial sector is approaching that of other European countries; banking assets account for about 70% of financial system assets in euro area countries on average, and for roughly 75% in Germany and Austria (see Table 18).

**Table 18: Banking sector assets/financial system assets (%)**

	1998	1999	2000	2001	2002	2003	2004	2005	2006 <sup>a</sup>
CZ	81.4	80.0	81.0	77.5	75.9	74.0	73.6	73.6	73.3
AT <sup>c</sup>	81.0	78.0	77.5	77.8	76.6	76.3	76.0	74.9	75.2
DE <sup>b,c</sup>	80.1	78.4	78.4	78.3	78.5	77.2	77.1	76.4	77.5
PT <sup>c</sup>	83.8	83.0	83.2	81.7	81.5	81.9	80.7	78.4	78.3
HU	88.0	85.8	83.8	82.2	80.7	82.2	81.0	78.4	77.6
PL	92.4	90.3	87.7	84.9	79.9	76.4	74.2	70.2	66.9
SI <sup>b</sup>	69.9	69.7	71.5	72.9	73.2	73.1	70.7	72.0	72.4
SK <sup>b</sup>	94.3	93.9	93.9	93.3	91.8	88.7	87.3	86.0	84.8
EA-12 <sup>c,d</sup>	.	.	74.5	72.0	73.2	72.1	71.7	70.4	70.4

Notes:

a) Preliminary data.

b) Excluding pension funds (SI until 2001, SK until 2004). DE includes only part of private pension funds.

c) Total assets of credit institutions, insurance companies, pension funds and investment funds.

d) Weighted average.

Sources: CNB, national central banks. Unconsolidated data.

<sup>39</sup> See also Table 44.

<sup>40</sup> A total of 97% of banking assets are controlled by foreign capital (and 87% by banks from EU countries).

The Czech financial sector can be described as relatively similar to that of the euro area from the structural point of view, despite its smaller depth of financial intermediation relative to the euro area countries surveyed. It can be assumed on this basis that the sector operates in a standard manner and, its ownership structure being settled, is able to ensure a monetary policy transmission process comparable with that in the euro area.

### 1.3.2 Financial market integration

Financial market integration has been achieved when financial assets having similar risk factors and yields are priced identically by the markets no matter where they are traded. This follows from the law of one price.<sup>41</sup> The more the individual segments of the financial markets of countries planning to adopt the euro become integrated with the European market, the more financial asset prices will be affected by global (European) factors associated with symmetric shocks rather than by local (national) effects associated with asymmetric shocks. Such shocks may be due to any factors capable of affecting asset prices. It can be assumed that with increasing integration the individual financial market segments will become a less likely source of asymmetric shocks. These reasons make it desirable for monetary policy makers to know the degree of, and trends in, integration of financial market segments. This analysis focuses on the integration of the money, foreign exchange, bond and stock markets.

Adam et al. (2002) used the concepts of beta-convergence and sigma-convergence to demonstrate the process of financial market integration in the euro area countries.<sup>42</sup> The concept of beta-convergence enables identification of the speed at which shocks are eliminated on individual financial markets. A negative beta coefficient signals the existence of convergence, and the magnitude of the beta coefficient expresses the speed of convergence, i.e. the speed of elimination of shocks to the yield differential vis-à-vis the euro area. The closer the absolute value of the beta coefficient is to unity, the higher is the speed of convergence. The concept of sigma-convergence captures the differences between the yields on identical assets in different countries at a given moment in time and thus identifies the degree of integration vis-à-vis the euro area achieved at that moment in the individual financial market segments in the countries under review. Sigma-convergence arises if and when the sigma coefficient falls to zero. Beta-convergence may be accompanied by sigma-divergence, so both concepts must be tracked concurrently in order to prove financial integration.

The results of a beta-convergence analysis, as applied to the individual financial market segments, are given in Table 19. The table shows that yields on the Czech stock and bond markets are converging towards those on corresponding euro area financial instruments relatively quickly, at a pace similar to that observed in Portugal and Austria. The speed of elimination of shocks on the Czech stock market has recently increased. On the foreign exchange market, the speed of convergence of the Czech Republic is comparable to other new Member States except Slovenia, but on the money market it is lower.<sup>43</sup> Yield convergence towards the euro area (towards Germany in the case of bond markets) is occurring in all the

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<sup>41</sup> If the law of one price did not apply, there would be room for arbitrage. If we assume a fully integrated market with no barriers (economic, legal, cultural, etc.), then any investor will be able to use this arbitrage opportunity, causing the law of one price to apply again.

<sup>42</sup> The terms beta-convergence and sigma-convergence originate from the literature on economic growth and its dynamics; see, for example, Barro and Sala-i-Martin (1992, 1995).

<sup>43</sup> Yields on money market assets are affected to some extent by the monetary policy decisions of the state in question, so the validity of the law of one price is somewhat limited. Therefore, the speed of beta convergence is lower on the money market than on the other markets.

countries under review. The absolute values of the beta coefficient are close to one for all the countries and markets except the money market, which means that the levelling of newly arising differences in yield differentials between the relevant national economy and the euro area can be labelled as fast. A comparison of the periods 1995–2000 and 2001–2007 reveals that the pace of beta-convergence of the stock markets of the new EU Member States under review has increased over time. As regards the money and foreign exchange markets, the speed of convergence rose only in Hungary, but the new Member States are generally achieving high levels of beta-convergence of their financial markets towards the euro area.

**Table 19: Beta coefficients**

	Money market			Foreign exchange market			Bond market	Stock market		
	1999- 2007	1999- 2000	2001- 2007	1995- 2007	1995- 2000	2001- 2007	2002-2007	1995- 2007	1995- 2000	2001- 2007
<b>CZ</b>	-0.57	-0.61	-0.6	-0.86	-0.86	-0.87	-0.91	-0.79	-0.74	-0.89
<b>AT</b>	.	.	.	.	.	.	-0.87	-0.85	-0.91	-0.87
<b>DE</b>	.	.	.	.	.	.	*	-0.75	-0.79	-0.72
<b>PT</b>	.	.	.	.	.	.	-0.6	-0.89	-0.85	-0.95
<b>HU</b>	-0.79	-0.54	-0.83	-0.83	-0.8	-0.87	-0.84	-0.82	-0.78	-0.87
<b>PL</b>	-0.68	-0.69	-0.64	-0.87	-0.88	-0.86	-0.75	-0.87	-0.86	-0.92
<b>SI</b>	-0,57 <sup>a</sup>	.	-0,57 <sup>a</sup>	-0,92 <sup>b</sup>	-0.82	-1,04 <sup>b</sup>	.	-0.78	-0.77	-0.85
<b>SK</b>	-0.75	-0.77	-0.77	-1	-1.08	-0.84	-0.78	-0.71	-0.71	-0.78
<b>EA-12</b>	*	*	*	*	*	*	.	*	*	*

Note: \* – benchmark. All estimates statistically significant at the 1% significance level.

a) data from January 2002 onwards.

b) data up to the end of 2006.

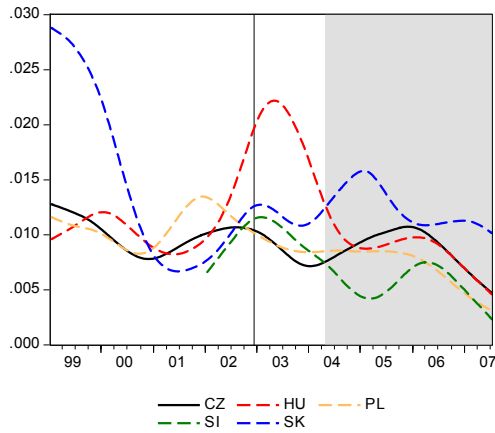
Source: CNB calculations.

The results of the sigma-convergence analysis for the individual segments of the financial market and the countries under review vis-à-vis the euro area (Germany<sup>44</sup> for the bond markets) are shown in Chart 16. Compared to the markets of the other new Member States, the Czech financial market appears more integrated (especially in the case of the foreign exchange and stock markets). Only the Slovenian money and foreign exchange markets achieved a higher degree of integration; this is linked with Slovenia's adoption of the euro. However, significant differences in the yields on the Slovenian stock market persist. The foreign exchange markets may seem more volatile, but the sigma values are very low there, reflecting the already relatively strong integration of these markets. As regards stock markets, the degree of integration achieved in the Czech Republic is comparable to that observed in Portugal, Austria and Germany. The same cannot yet be said in the case of the bond markets. Overall, it can be seen that gradual trend sigma-convergence of stock, bond and money markets has been taking place in all the observed countries since 2001–2002. This may be linked with the announcement of EU enlargement (12–13 December 2002).

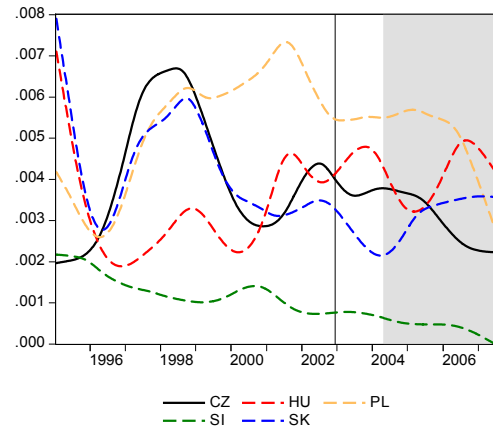
<sup>44</sup> As in section 1.1.2, for example, any interpretation of the values for Germany should also take into account the fact that the data for Germany have a significant weight in the calculation of the data for the euro area (see the Methodological Part for details).

## Chart 16: Sigma coefficients

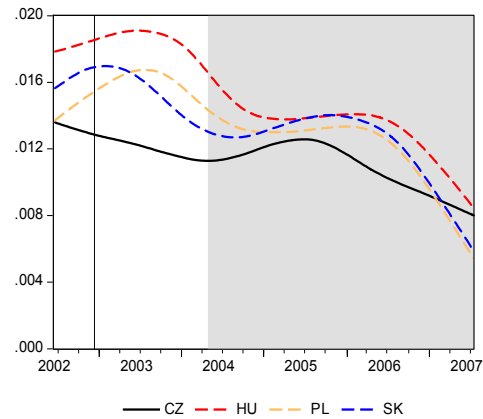
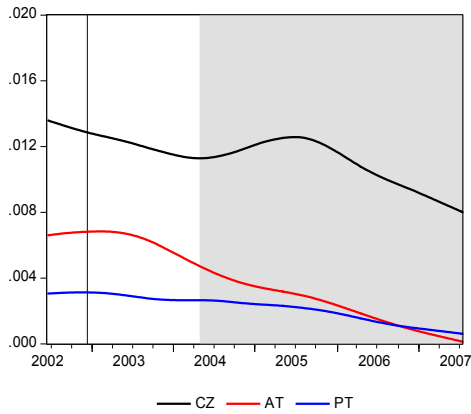
### a) money market



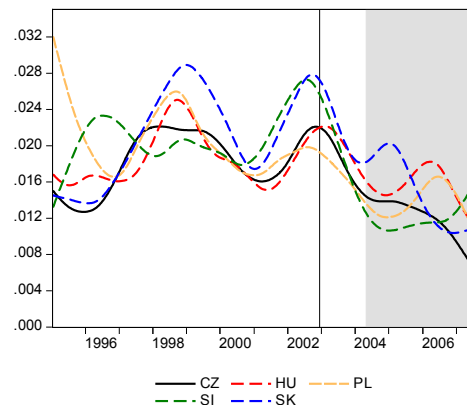
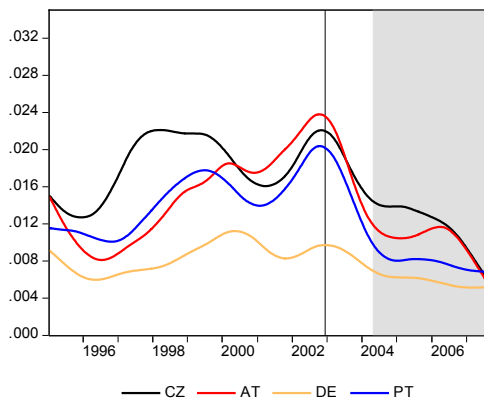
### b) foreign exchange market



### c) bond market



### d) stock market



Note: Lower standard deviation values (vertical axis) correspond to a higher convergence level. For illustration, the grey area represents EU enlargement on 1 May 2004 and the vertical line represents the announcement thereof on 12–13 December 2002.

Source: CNB calculations.

## 2. ADJUSTMENT MECHANISMS

The adoption of the single currency and the loss of an independent monetary policy will mean that the adjustment of the economy to shocks will place higher demands on other adjustment mechanisms. The theory of optimum currency areas indicates the importance of the stabilising function of public budgets, price and wage elasticity, labour market flexibility and the ability of the financial system to absorb shocks.

### 2.1 Fiscal policy

Automatic fiscal stabilisers or discretionary fiscal policy measures may to some extent substitute for missing adjustment channels in the event of asymmetric shocks and thus contribute where necessary to stabilisation of the economy. The current condition of, and in particular the outlook for, public finances is therefore an important factor that must be taken into account when considering the preparedness of the Czech economy to join the euro area.

#### 2.1.1 The stabilisation function of public budgets

On the adoption of the euro, fiscal policy will have to move within a corridor defined on one side by a greater need for a fiscal policy stabilisation effect and on the other side by the requirements for common EU fiscal discipline (laid down primarily in the Stability and Growth Pact). From the perspective of the stabilising function of public budgets, a desirable public finance policy is one that does not cause large changes in market agents' expectations and creates a stable economic environment.

Fiscal policy has two sets of instruments through which it can affect the economy – discretionary measures and automatic fiscal stabilisers. However, the negative experience with activist fiscal policy in the advanced countries in the 1970s is an argument against the wider application of discretionary fiscal measures, since such policy failed to produce the desired results or was counterproductive.<sup>45</sup> This was also reflected in a paradigm shift in theoretical economics and a change from believing in the effectiveness of activist fiscal policy to a hypothesis that adherence to rules is more effective. Such rules consist primarily in a simple, stable and predictable system of tax and expenditure regulations and standards operating within a consolidated and sustainable public finance system. By contrast, discretionary fiscal policy can destabilise the economic environment.

The EU fiscal rules therefore consider the optimal situation to be a roughly balanced government budget policy within the business cycle and the free operation of automatic fiscal stabilisers, which can moderate shocks without the need for discretionary fiscal measures. In a period of recession, public finances thus stimulate aggregate demand by means of deficits. By contrast, in a period of expansion they should subdue demand by creating fiscal surpluses. In order for the automatic function to work, while avoiding breaches of the maximum allowed deficits, public finances must be balanced or in surplus during a growth phase of the business cycle. This reasoning serves as the basis for the convergence criterion for the public budget deficit, where a 3% limit is considered sufficient to allow “free” functioning of automatic stabilisers in the event of a minor economic recession. If the recession is deeper, discretionary

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<sup>45</sup> In general, the main causes are the long and unpredictable lags that arise between the identification of shocks, the implementation of fiscal measures and the effects of those measures, the existence of institutional constraints and the inertia of fiscal decisions. A typical example of this problem is the risk of “pro-cyclical fiscal policy”, i.e. fiscal policy that tries to smooth the business cycle (which can be viewed as one specific type of economic shock) but in reality – owing to the aforementioned lags – amplifies the cycle.

fiscal policy intervention is assumed necessary, with a greater likely impact on the deficit, and so an exemption from fulfilling this criterion is applied.

The influences of the macroeconomic environment and of interventions by the government on public budgets can be differentiated by decomposing the fiscal balance into the part that results from the business cycle or from extraordinary one-off measures, and the other part consisting in the “cyclically adjusted” (structural) balance, which yields information on how the fiscal balance would look if the economy were at its potential. Chart 17 illustrates the CNB’s current estimate of **the Czech Republic’s general government balance** broken down into its cyclical and structural components.<sup>46</sup> It is evident that the cyclical component played a negligible role in the past and the total fiscal deficit was practically identical to the cyclically adjusted component. The effects of automatic stabilisers, i.e. the various elements built into the tax and expenditure rules which respond automatically to the business cycle and dampen its fluctuations, are still very limited in the Czech Republic.<sup>47</sup>

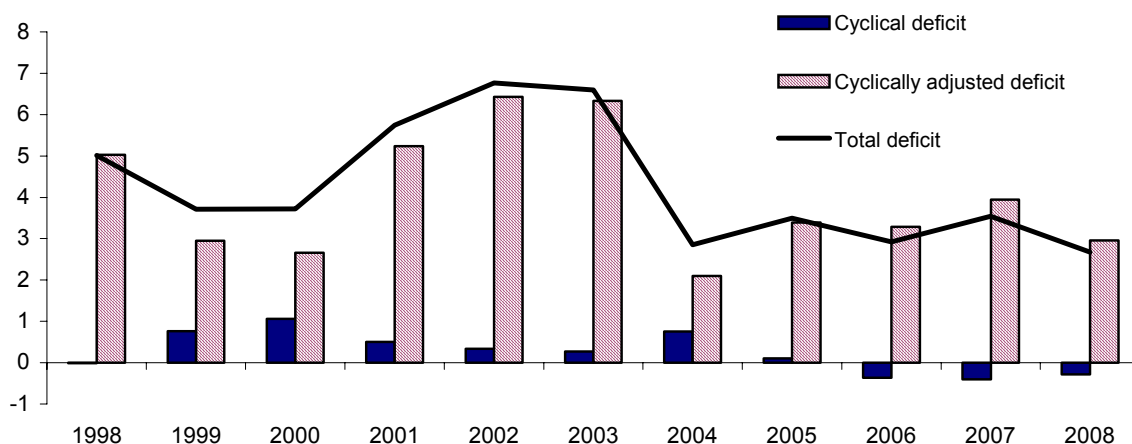
The total deficit was worsened mainly by pro-cyclical government policy, since additional tax receipts were not consistently employed to reduce the fiscal deficit, but rather to generate new public expenditures, and tax cuts were not accompanied by corresponding measures on the public expenditure side even during years of solid economic growth. In other words, the current deficit nature of the government sector in the Czech Republic is due mainly to structural effects and is not cyclical in nature. The removal of these non-cyclical effects is an important precondition for the ability to fulfil the Stability and Growth Pact in the long term and to make use of the stabilising function of public budgets. The adoption of fiscal stabilisation measures in August 2007 and their implementation in 2008, along with some other reform steps, suggest a gradual future improvement in this situation. According to the CNB’s estimates, this improvement should start to manifest itself in 2008 in a decrease in the structural deficit to 3.0% of GDP.

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<sup>46</sup> The CNB’s estimates were prepared in accordance with the ESCB method on data according to the ESA methodology, whereas Table 20 on page 46 contains the prediction of the European Commission and the cyclical adjustments are carried out using the European Commission’s method.

<sup>47</sup> Automatic stabilisers act in the direction of a deterioration in the fiscal balance at a time of economic recession and in the direction of an improvement in years of economic growth.

**Chart 17: Decomposition of the history and outlook of the fiscal deficit into its cyclical and cyclically adjusted components, based on CNB analyses (% of GDP)**



Note: Positive values represent public budgets deficit, negative values represent public budgets surplus.  
Source: CNB calculations.

### 2.1.2 Government deficit and debt and the scope for stabilising fiscal policy

Given the requirements of the Stability and Growth Pact, the ability of fiscal policy to react discretionarily or automatically to unforeseen shocks is determined primarily by the gap between the general government structural deficit and the reference value of 3% of GDP and by the gap between the public debt and the reference value of 60% of GDP. The fiscal policy objective in the run-up to euro area accession should be to take the public budgets close to a zero balance (or close to the MTO)<sup>48</sup> so that sufficient room is left for stabilising fiscal policy in less favourable times. Table 20 sums up the spring 2007 figures and forecasts of the European Commission regarding the **fiscal balance** for a selected sample of countries. The left-hand part of the table provides information on the unadjusted public sector balance, while the right-hand side contains the structural balance, i.e. the fiscal balance adjusted for cyclical, one-off and temporary effects.

**Table 20: General government deficit (ESA95), European Commission estimate (% of GDP)<sup>a</sup>**

	not adjusted				cyclically adjusted balance			
	2005	2006	2007	2008	2005	2006	2007	2008
CZ	-3.5	-2.9	-3.9	-3.6	-2.0	-2.8	-4.1	-3.8
AT	-1.6	-1.1	-0.9	-0.8	-1.1	-1.0	-1.1	-1.2
DE	-3.2	-1.7	-0.6	-0.3	-2.4	-1.5	-0.8	-0.7
PT	-6.1	-3.9	-3.5	-3.2	-5.0	-2.9	-2.7	-2.6
HU	-7.8	-9.2	-6.8	-4.9	-8.4	-9.4	-6.1	-4.6
PL	-4.3	-3.9	-3.4	-3.3	-4.2	-4.0	-3.6	-3.3
SI	-1.5	-1.4	-1.5	-1.5	-1.1	-1.5	-1.7	-1.7
SK	-2.8	-3.4	-2.9	-2.8	-1.2	-3.3	-3.4	-3.3
CZ <sup>b</sup>	-3.5	-2.9	-3.5	-2.7	-3.4	-3.3	-3.9	-3.0

<sup>48</sup> The originally uniform requirement of balanced finances has been replaced under the amended European fiscal rules by country-specific medium-term objectives (MTOs), which differ from economy to economy depending on the existing level of public debt and the prospects for economic growth. Fast-growing economies with a low level of public debt may, instead of maintaining balanced public sector accounts, reach a deficit of up to 1% of GDP, which is also the medium-term objective for the Czech Republic.

Notes: a) Cyclical adjustment using the European Commission method.

b) Current CNB estimate, cyclical adjustment using the ESCB method. The difference in the cyclically adjusted balance for the Czech Republic consists in a different method of cyclical adjustment, the level of the unadjusted balance used (the last line in the table includes the estimated effects of the fiscal reform approved in August 2007), the level of GDP trend growth and one-off and other temporary measures deducted from the unadjusted balance prior to its cyclical adjustment.

Sources: European Commission (2007), CNB.

Table 20 shows that, of all the countries under review, the European Commission expects a deteriorating fiscal situation – as expressed by the unadjusted balance – only in the Czech Republic and, to a much lesser extent, in Slovenia. Austria and Slovakia will also see a modest structural deterioration. The 3% deficit will be exceeded in the Czech Republic, Portugal, Hungary and Poland in both 2007 and 2008. By contrast, Germany, Austria, Slovenia and Slovakia will, according to the European Commission's prediction, improve their fiscal management by 2008 and comply with the Stability and Growth Pact or the Maastricht criterion for the maximum allowed deficit.

In addition to other effects, the government's room for manoeuvre is determined by the **nature of fiscal expenditure**. While a change to a government resolution or statutory instrument is sufficient to allow a change in some expenditures, changes to other expenditures require time-consuming amendments to laws or international treaties. From the economic perspective, the classification into mandatory, quasi-mandatory and non-mandatory expenditures is just a classification of the speed at which the government is able to alter such expenditures if the need arises.<sup>49</sup> Mandatory expenditures are the least flexible; nevertheless, most of them can be modified by means of suitable legislative amendments in the shorter or longer term. Table 21 summarises the evolution of mandatory state budget expenditures in relation to total state budget revenue and expenditure and total public sector revenue and expenditure.

**Table 21: Shares of mandatory state budget expenditure (%)**

	2004	2005	2006	2007	2008
- in state budget revenue	59	54	57	60	57
- in state budget expenditure	53	51	53	55	53
- in general government revenue (ESA95)	39	39	39	41	40
- in general government expenditure (ESA95)	37	36	36	38	38

Notes: Data for 2004–2006 are actual results, 2007 data correspond to the adopted state budget and 2008 data represent the second version of the draft state budget. Estimated developments in public sector revenue and expenditure have been taken from the European Commission document.

Sources: European Commission (2007), CNB calculations.

According to the approved budget, mandatory expenditures in 2007 account for 60% of state budget cash revenues, or 41% of general government revenues (ESA methodology). The expected marked increase in mandatory expenditure in 2007 is due to the political cycle. The election year 2006 saw the adoption of laws under which social transfers are to increase by more than CZK 70 billion in 2007. The government's policy statement commitment, which aims to reduce the share of mandatory expenditures in total state budget expenditure below 50% by 2010, and a moratorium on the adoption of laws leading to any further increase in these expenditures, promise a gradual improvement. The first indication of a change in trend in mandatory expenditures is visible in 2008, when, according to the draft state budget, these expenditures should either decrease or remain unchanged compared to 2007.

<sup>49</sup> The definition of mandatory expenditures applied in this analysis is given in the Methodological Part.



The individual countries under review do not monitor their mandatory expenditures in a directly comparable form, as there is no harmonised definition of the term. However, some inter-country comparison of the structure of general government revenue and expenditure is possible. Such a comparison is given in Table 22; “mandatory expenditures” consist mainly of social transfers and debt service. The Czech Republic ranked among the countries with the lowest figures in the selected sample. In terms of government investment, by contrast, the Czech Republic was among the EU members with the largest capital formation in 2006.

**Table 22: Ratios of public revenue, expenditure and tax burden to GDP in 2006 (%)**

	CZ	AT	DE	PT	HU	PL	SI	SK
<b>Total revenue</b>	39.5	48.0	44.0	42.2	43.7	39.4	44.8	33.9
- taxes	19.8	13.2	10.8	24.3	24.5	21.4	24.9	17.4
- social contributions	15.0	16.0	17.4	12.5	12.8	12.2	14.9	12.1
<b>Total expenditure</b>	42.5	49.1	45.7	46.1	52.9	43.3	46.3	37.3
- collective consumption	10.8	6.9	7.5	.	9.9	7.9	7.8	11.5
- social transfers	22.0	29.5	29.6	.	27.7	25.5	27.4	19.7
- debt service	1.1	2.7	2.8	2.8	3.9	2.4	1.6	1.4
- gross capital formation	5.1	1.1	1.4	2.3	4.5	4.1	3.7	2.2

Source: European Commission (2007).

The current stock of, and prospects for, **government debt** may also become factors limiting the stabilising ability of fiscal policy. Table 23 provides a comparison of the ratio of gross consolidated debt to GDP. For the sake of comparability, the data are again taken from the European Commission’s spring prediction.

**Table 23: Public debt (ESA95), European Commission estimate (% of GDP)**

	2005	2006	2007	2008
CZ	30.4	30.6	30.6	30.9
AT	63.4	62.2	60.6	59.2
DE	67.9	67.9	65.4	63.6
PT	64.0	67.4	65.4	65.8
HU	61.7	67.5	67.1	68.1
PL	41.9	42.0	48.4	49.1
SI	28.0	28.5	27.5	27.2
SK	34.5	33.1	29.7	29.4
CZ <sup>a</sup>	30.4	30.6	30.5	31.3

Notes: a) Data from the updated version of the Convergence Programme of the Czech Republic, March 2007.  
Source: European Commission (2007).

In 2006, the gross consolidated debt of the Czech government sector amounted to 30.6% of GDP and was the second lowest among the countries under comparison, immediately behind Slovenia. The country’s outlook for 2008 remains stabilised. The threat does not consist in the amount of the public debt as a percentage of GDP, but in its longer-term growth rate. In 1995, the general government debt was only 14.9% of GDP, but in the following ten years it virtually doubled to its current level of 30% of GDP.

Thanks to the low public debt and low interest rates, the debt service as a percentage of GDP estimated for the Czech Republic is relatively favourable (see Table 24). However, debt service will increase in the future as a result of the rising debt volume and the probable increase in interest rates. The consolidation of public finances should also be accelerated in order to prevent further increases in mandatory expenditure connected with debt service.

**Table 24: Debt service, European Commission estimate (% of GDP)**

	2005	2006	2007	2008
CZ	1.2	1.1	1.1	1.0
AT	2.9	2.7	2.6	2.6
DE	2.8	2.8	2.8	2.8
PT	2.7	2.8	2.9	3.0
HU	4.1	3.9	4.1	3.9
PL	2.8	2.4	2.6	2.6
SI	1.7	1.6	1.5	1.4
SK	1.5	1.4	1.3	1.3

Source: European Commission (2007).

The scope for an active fiscal policy able to respond to unexpected serious negative exogenous shocks is limited in the Czech Republic largely by the fact that the government has not been reducing the fiscal deficit at a sufficient pace at a time of favourable economic growth. The high GDP growth rates of 5%–6% would correspond to much lower state budget deficits than those proposed by the government under the public finance reform. A persisting problem on the expenditure side of the Czech budget is the absence of performance budgeting, which would serve as a tool for cutting non-priority and inefficient public expenditures.<sup>50</sup> The flexibility and long-term growth of the economy, on the other hand, may be aided by the policy of reducing direct taxes (corporate and personal income tax), made up for by rises in indirect taxation.

### 2.1.3 Sustainability of public finances

Sustainability of public finances is a key prerequisite for those finances to have a stabilising effect on the economy. Virtually all EU countries are exposed to the problem of population ageing and the related rise in pension, social and health expenditure, which may generate instability in the future. In the Czech Republic and in some other countries, this problem is compounded by the current imbalance of short-term government economic policy, which is predominantly structural in nature.

Table 25 shows a long-term extrapolation of government debt (up to 2050) carried out by the European Commission.

**Table 25: Gross public debt (% of GDP)**

	2006	2010	2030	2050
CZ	30.6	34.0	91.0	315.0
AT	62.2	57.0	11.0	-15.0
DE	67.9	64.0	51.0	99.0
PT	67.4	62.0	63.0	210.0
HU	67.5	68.0	81.0	226.0
PL	42.0	49.0	-9.0	-102.0
SI	28.5	27.0	66.0	273.0
SK	33.1	30.0	44.0	149.0

Source: European Commission (2007).

<sup>50</sup> Under the performance/programme budgeting system, public expenditures are conditional on the fulfilment of specific performance indicators or programme objectives characterising the level of provision of certain public services. This is different from the situation currently prevailing in the Czech Republic, where the expenditures assigned to the individual budget chapters are essentially raised automatically every year.

Although this is a simplified simulation, it points to a serious rise in fiscal uncertainty during 2030–2050 related to demographic changes in the Czech Republic, Portugal, Hungary and Slovenia. By contrast, Poland and Austria may achieve a pension system surplus, as well as a positive net public sector position, by 2050. The current trajectory of ageing-related expenditure in the Czech Republic appears unsustainable in the long term. If essential pension and health reforms are not carried out, it is likely to lead to a debt level exceeding 90% of GDP in 2030. For this reason, the Czech Republic, Hungary, Portugal and Slovenia are classified as the countries with the highest risk to public finance sustainability in the European Union.

## 2.2 Wage elasticity and inflation persistence

Adjustment of real wages and prices is another mechanism, in addition to stabilising fiscal policy, that should aid in efficient absorption of shocks. Changes in real wages act as an impulse for economic agents to change their behaviour in a direction corresponding to a given shock.

### 2.2.1 The degree of adjustment of real wage growth to the unemployment rate – the Phillips curve

**The response of wages to changes in demand for labour** is one of the methods of economic adjustment and a means of preserving a high employment rate. The following analysis assesses the ability of the Czech economy to dampen the impacts of shocks by means of real wage adjustment. The degree of real adjustment of wages to changes in unemployment, i.e. real wage elasticity, is measured using a simple Phillips curve.

Real wage elasticity may be either positive or negative. Negative values suggest that wages are flexible (growth in unemployment suppresses growth in wage costs). By contrast, positive or insignificant values of wage elasticity point to the absence of wage flexibility (a phenomenon known as *hysteresis*). The Phillips curve estimates were made using the least squares method (OLS) on quarterly data for the periods 1996 Q1–2001 Q4 and 2002 Q1–2007 Q1. Table 26 sums up the results.

**Table 26: Elasticity of wages to the unemployment rate**

	1996–2001	2002–2007
CZ	-0.020 **	-0.019
AT	-0.026 *	0.048
DE	-0.020 *	-0.037
PT	0.003	-0.005
HU	0.035	-0.107
PL	-0.009	0.053
SI	-0.003	0.046
SK	-0.016 **	0.076

Note: \*\*\*, \*\* and \* denote significance levels of 1%, 5% and 10% respectively.

Source: CNB calculations.

The results of the analysis suggest that the Czech Republic recorded a decline in wage elasticity (the estimated elasticity became insignificant in 2002–2007). The situation is very similar in Austria, Germany and Slovakia. Recently, wage elasticity has been insignificant in all the aforementioned countries. In the cases of Hungary, Poland, Portugal and Slovenia, wages probably failed to play an adjusting role throughout the period under review.

## 2.2.2 The degree of adjustment of regional real wages to the regional unemployment rate – the wage curve

A supplementary view of wage elasticity is provided by wage curve estimates, measuring real wage elasticity by the degree of adjustment of regional wage levels to the level of regional unemployment (Nickell, 1997). A low absolute coefficient or even a positive coefficient means that the relationship between regional unemployment and wage levels is weak. The coefficient can theoretically be expected to take negative values. Blanchflower and Oswald (1994) found that the coefficient of the logarithm of the regional unemployment rate is negative at around -0.1 in a number of advanced and transition countries.

Table 27 for 1994–2006 shows that wage elasticity is cyclically conditional on GDP growth, fluctuating between -0.08 and -0.13 in 1994–2001, except for a cyclically conditional weakening at the time of the 1997–1999 economic recession. Galuščák and München (2005) interpret cyclically conditional wage elasticity in the context of the theory of efficiency wages (Shapiro and Stiglitz, 1984). Wage formation in the Czech economy is dependent on regional, and especially short-term, unemployment. The statistically insignificant decline in wage elasticity in the period since 2000 may have been associated with the marked increase in long-term unemployment in the late 1990s.<sup>51</sup> Wage elasticity did not increase in the period of fast economic growth in 2005–2006.

**Table 27: The wage curve in the Czech Republic (1994–2006)**

	Workplace method	Business method	GDP (%) <sup>a</sup>
1994–1995	-0,10 ***	-0,1 **	4,1
1995–1996	-0,13 ***	-0,1 **	4,9
1996–1997	-0,05	-0,02	1,6
1997–1998	-0,02	0,03	-0,7
1998–1999	-0,06	-0,14	0,3
1999–2000	-0,11 ***	-0,17 *	2,5
2000–2001	-0,08 **	-0,09 *	3,1
2001–2002		-0,07 **	2,2
2002–2003		-0,03	2,7
2003–2004		0,08	4,1
2004–2005		0,06	5,5
2005–2006		0,06	6,4

Notes: Estimated by 2SLS method; unemployment rate is instrumented.

Wage data according to workplace method (up to 2001; based on the place where the employees really worked) and business method (based on the place where the business headquarter is registered).

\*\*\*, \*\* and \* denote significance levels of 1%, 5% and 10% respectively.

a) Average annual GDP growth at constant prices in given period.

Sources: CNB calculations, methodology taken from Galuščák and München (2005).

## 2.2.3 Inflation persistence

The ability of the economy to absorb shocks also depends on price flexibility. One of the ways of examining price flexibility is to analyse inflation persistence (inertia), i.e. the speed at which inflation returns to equilibrium after a shock. It can be said that high inflation persistence signals price inflexibility (Coricelli and Horváth, 2007). Substantial local differences in inflation persistence in the countries of a monetary union may also imply

<sup>51</sup> Besides long-term unemployment, wage elasticity may have been affected by the institutional framework for collective bargaining. For low wages, the minimum wage and the tax and benefit system are wage elasticity factors (see section 2.3.3).

different impacts of the single monetary policy. According to Angeloni and Ehrmann (2004), the differences in inflation observed among individual euro area countries can be largely explained by different inflation persistence.

Inflation persistence is measured by three different methods. The first, non-parametric, method (Method 1) uses a procedure proposed by Marques (2004), according to which the longer it takes actual inflation to return to its mean value, the more rigid is the inflation. This indicator takes values between 0 and 1. The closer the values are to one, the more persistent is inflation.

The second and third methods are based on a model of inflation as an autoregressive process, monitoring the sum of the coefficients of the autoregressive terms. Method 2 assumes a constant mean value of inflation. Marques (2004) and Cecchetti and Debelle (2006) showed that the results of modelling inflation persistence are largely dependent on the assumption regarding the mean to which inflation converges. If the inflation time series contain structural breaks, which the model process does not allow for, the inflation persistence estimate is typically biased upwards. Because of the transformation process, accompanied by price convergence, gradual price deregulation and changes in monetary policy, it is the time series of transition countries that are mainly affected by breaks in the mean values of inflation. Method 3 therefore models the autoregressive process with the assumption that the mean value of inflation changes over time. The values of persistence indicators in Methods 2 and 3 increase with inflation persistence.

Table 28 shows the inflation persistence indicators for 1998–2006. Under Method 1, inflation persistence in the Czech Republic is one of the highest among the countries surveyed, despite having recorded a very slight decline compared to the 2006 assessment. The estimates under Method 2 indicate higher persistence for most of the new Member States than observed in the euro area countries. The estimates for the Czech Republic are somewhat lower than in the new EU Member States under comparison, being comparable with those for Austria. Method 3 assesses inflation persistence in the Czech Republic as comparable with that in Austria and Germany. As this method best takes into account the transition nature of the Czech economy, it can be given the greatest weight when interpreting the results in the Table.

**Table 28: Inflation persistence estimates<sup>a</sup>**

	Method 1	Method 2 <sup>b</sup>			Method 3 <sup>b</sup>		
		lower bound	mean	upper bound	lower bound	mean	upper bound
<b>CZ</b>	0.92	0.47	<b>0.74</b>	0.97	0.45	<b>0.45</b>	0.45
<b>AT</b>	0.84	0.36	<b>0.73</b>	1.04	0.20	<b>0.50</b>	0.83
<b>DE</b>	0.85	-0.50	<b>0.29</b>	0.85	0.12	<b>0.45</b>	0.85
<b>PT</b>	0.85	-1.13	<b>-0.22</b>	0.65	-0.12	<b>0.19</b>	0.55
<b>HU</b>	0.89	0.42	<b>0.81</b>	1.06	.	.	.
<b>PL</b>	0.95	0.54	<b>0.83</b>	1.05	.	.	.
<b>SI</b>	0.72	0.46	<b>1.00</b>	1.11	-0.08	<b>0.26</b>	0.32
<b>SK</b>	0.91	0.12	<b>0.54</b>	1.06	0.27	<b>0.39</b>	0.48
<b>EU<sup>c</sup></b>	.	0.00	<b>0.36</b>	0.91	0.21	<b>0.47</b>	0.74

Notes:

a) **Method 1** – non-parametric technique. **Method 2** – sum of autoregression coefficients, constant mean assumed. **Method 3** – sum of autoregression coefficients, time-varying mean assumed.

b) Upper and lower bounds of 90% confidence interval are reported.

c) The estimates for the EU are not directly comparable with the estimates for individual countries owing to the aggregation bias described in Cecchetti and Debelle (2006).

Sources: Eurostat, CNB calculations.

## 2.3 Labour market flexibility

Labour market adjustment is a significant equilibrating process which, like wage and price adjustment, increases in importance after euro area entry. Changes in employment, as well as wage adjustment, may dampen the negative impacts of asymmetric shocks. Labour market flexibility is defined by labour force flexibility and institutional factors.

### 2.3.1 Unemployment and internal labour market flexibility

An insufficiently flexible labour market is generally associated with higher long-term unemployment and significant regional differences in the unemployment rate. While long-term unemployment suggests a high structural component of unemployment, regional differences in unemployment may be due to low regional mobility of labour.

Table 29 illustrates the evolution of the **long-term unemployment** rate in the countries surveyed. In the late 1990s, this indicator saw a marked deterioration in the Czech Republic. In 2006, the long-term unemployment rate declined slightly compared to the previous year, but was still higher than in Austria, Portugal, Hungary and Slovenia. Nonetheless, long-term unemployment in the Czech Republic is still much lower than in Poland and Slovakia. The same conclusions can be drawn from the data on the long-term unemployed as a proportion of total unemployment (see Table 30). The share of the long-term unemployed exceeds 50% and has been constantly rising since 2004.<sup>52</sup> The high long-term unemployment is due to relatively low outflows from unemployment (Galuščák and Münich, 2007), which may be connected, for example, with the configuration of the tax and benefit system, which probably did not sufficiently motivate job-seeking in 2006 (see section 2.3.3).<sup>53</sup>

<sup>52</sup> The share of the long-term unemployed has been rising because of higher demand for labour linked with the buoyant economic growth, with mainly the short-term unemployed finding jobs.

<sup>53</sup> Persons with lower educational attainment are more prone to long-term unemployment in the Czech Republic. CZSO data for 2006 show that while 70.5% of the unemployed have basic or secondary education, this share among the long-term unemployed was 77.2% in 2006. At the same time, persons with lower educational

**Table 29: Long-term unemployment rate (%)**

	1998	1999	2000	2001	2002	2003	2004	2005	2006
<b>CZ</b>	2.0	3.2	4.2	4.2	3.7	3.8	4.2	4.2	3.9
<b>AT</b>	1.3	1.2	1.0	0.9	1.1	1.1	1.3	1.3	1.3
<b>DE</b>	4.5	4.1	3.7	3.7	3.9	4.5	5.4	5.0	4.7
<b>PT</b>	2.2	1.8	1.7	1.5	1.7	2.2	2.9	3.7	3.8
<b>HU</b>	4.2	3.3	3.1	2.6	2.5	2.4	2.7	3.2	3.4
<b>PL</b>	4.7	5.8	7.4	9.2	10.9	11.0	10.3	10.2	7.8
<b>SI</b>	3.3	3.3	4.1	3.7	3.5	3.5	3.2	3.1	2.9
<b>SK</b>	6.5	7.8	10.3	11.3	12.2	11.4	11.8	11.7	10.2

Note: Share of persons unemployed for 12 months or more under ILO methodology in the labour force.

Source: Eurostat.

**Table 30: Shares of the long-term unemployed (%)**

	1998	1999	2000	2001	2002	2003	2004	2005	2006
<b>CZ</b>	31	37	49	52	50	49	51	53	54
<b>AT</b>	30	30	28	24	27	26	28	25	27
<b>DE</b>	51	51	51	50	48	50	56	53	56
<b>PT</b>	43	39	42	38	35	35	44	48	50
<b>HU</b>	50	48	48	45	43	41	44	45	45
<b>PL</b>	47	43	46	50	55	56	54	58	56
<b>SI</b>	45	45	61	60	56	53	52	47	49
<b>SK</b>	52	48	55	59	65	65	65	72	76

Note: Shares of long-term unemployed (12 months or more) in all the unemployed under ILO methodology.

Source: Eurostat.

**Regional differences in unemployment** can be quantified using a coefficient of variation for areas (NUTS 2) and regions (NUTS 3). Table 31 shows that the regional differences in the unemployment rate in the Czech Republic compared to other countries were the highest in 2005, and increased against 2004. The increase in regional differences in 2005 seems to have been related to renewed demand for labour, manifesting itself in a marked decline in unemployment in regions with lower unemployment.<sup>54</sup> The long-lasting high regional differences in unemployment in the Czech Republic point to low labour market flexibility in the area of population mobility.<sup>55</sup>

attainment move house less frequently (World Bank, 2006). Social benefits increase the reservation wage of the unemployed, which reduces their job-seeking motivation (see also section 2.3.3).

<sup>54</sup> Unemployment in districts with prevailing lower unemployment varies significantly over the business cycle as compared to regions with prevailing high unemployment. The coefficient of variation is therefore cyclical in nature. At the same time, it is apparent that the decline in the long-term unemployment rate in 2006 (see Table 29) is concentrated in districts with low unemployment.

<sup>55</sup> Much of the regional differences in unemployment are explained by differences in the education of the workforce (OECD, 2000; Jurajda and Terrell, 2006). According to OECD (2005), in addition to demographic factors, regional differences in unemployment are affected by demand for labour, initial sector specialisation and housing policy (rent regulation, support for private ownership; see also OECD, 2006).

**Table 31: Coefficients of variation of the unemployment rate**

	NUTS 2 regions							NUTS 3 regions						
	1999	2000	2001	2002	2003	2004	2005	1999	2000	2001	2002	2003	2004	2005
<b>CZ</b>	33	39	39	44	42	42	46	39	44	45	48	45	44	47
<b>AT</b>	29	33	36	43	43	41	40	31	36	39	44	44	42	41
<b>DE</b>	51	59	62	54	47	46	41	.	.	65	59	52	51	45
<b>PT</b>	31	31	29	31	30	25	22	37	36	35	35	35	33	30
<b>HU</b>	35	32	31	32	33	28	27	37	36	35	36	37	32	30
<b>PL</b>	23	19	18	17	16	16	15	36	38	36	27	26	23	22
<b>SI</b>	.	.	.	.	.	.	.	.	33	34	35	34	32	31
<b>SK</b>	27	27	25	23	27	31	37	31	29	28	31	36	37	42

Note: Ratios of the standard deviation weighted by region size and the average unemployment rate. Labour Force Survey data.

The coefficients of variation depend on the degree of disaggregation.

No data are available for 2006.

Source: Eurostat.

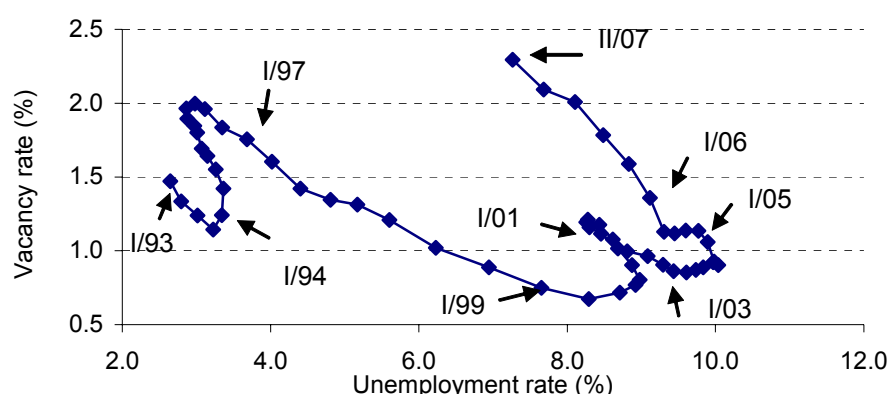
The differences between cyclical and **structural unemployment** can be observed by means of the Beveridge curve, which expresses the dependence between vacancies and unemployment. Decreasing (increasing) unemployment amid a rising (falling) number of vacancies is associated with changes in the cyclical component of unemployment, whereas simultaneous movements of unemployment and vacancies in the same direction signal changes in structural unemployment. The Beveridge curve for the Czech Republic (see Chart 18) shows that cyclical unemployment has been decreasing since around mid-2004, reflecting higher demand for labour, with the rate of decline of cyclical unemployment increasing since 2006. It is also clear that the labour market in the Czech Republic suffers from significant hysteretic phenomena, where a period of economic recession is accompanied by a rise in structural unemployment, manifesting itself in an increase in long-term unemployment. This occurred, for example, in 1999–2000 and 2003–2004. The increase in long-term unemployment in these periods is apparent in the data given in Tables 29 and 30.<sup>56</sup> So far, there has been no decline in the high structural unemployment. This would give rise to a simultaneous fall in the number of vacancies and unemployment and cause the Beveridge curve to move towards the origin.<sup>57</sup>

<sup>56</sup> A large structural mismatch between vacancies and unemployment is also seen in the matching function estimates (Galuščák and Münich, 2007).

<sup>57</sup> Growth in the number of vacancies, which was not accompanied by a corresponding decline in unemployment, was observed in late 2004 following the coming into force of the new Employment Act in October 2004, and again at the start of 2006. In both cases, the conditions for reporting vacancies to labour offices had been tightened. These administrative changes had little effect on the Beveridge curve.



**Chart 18: Beveridge curve**



Note: Seasonally adjusted quarterly data.

Sources: Ministry of Labour and Social Affairs, CNB calculations.

The large regional differences in unemployment in the Czech Republic may be due to low regional mobility. Although **internal mobility** (see Table 32) in the Czech Republic is greater than in Slovakia, Poland and Slovenia, it is lower than in Austria and Germany. This indicator has remained almost unchanged in the Czech Republic, and has not changed significantly since accession to the EU.<sup>58</sup>

**Table 32: Internal migration (per 1,000 inhabitants)**

	1999	2000	2001	2002	2003	2004	2005	2006
<b>CZ</b>	19.6	19.4	20.0	21.9	20.7	21.2	20.9	21.9
<b>AT</b>	33.0	32.3	34.8	42.9	43.9	34.8	35.3	.
<b>DE</b>	48.3	.	47.1	46.6	46.1	45.3	.	.
<b>HU</b>	.	22.4	21.3	22.9	23.9	21.6	22.0	.
<b>PL</b>	11.2	10.2	9.7	10.6	11.3	11.3	.	.
<b>SI</b>	15.4	15.0	15.5	17.5	14.0	15.1	16.1	.
<b>SK</b>	14.6	14.3	14.9	16.7	15.7	15.8	16.2	.

Note: Changes in permanent residence; SI – Slovenian nationals only.

Sources: Statistical yearbooks, Eurostat, CNB calculations.

<sup>58</sup> Fidrmuc (2004) examines the level to which migration responds to idiosyncratic shocks. It is clear from the results for the Czech Republic, Hungary, Poland and Slovakia that the impact of migration in terms of reducing regional differences in unemployment is limited in these countries. While prosperous regions have relatively high numbers of emigrants and immigrants, less advanced regions have a comparatively immobile population. According to a World Bank report (World Bank, 2006), young people and people with higher education move more frequently. This may widen the regional gaps. Important reasons for moving include family reasons, housing, standard of living and traditions, while economic motives, according to the report, have only a limited effect on moving (see also Erbenová, 1997, and Fidrmuc, 2005). Commuting to work is more significant in terms of smoothing regional differences in the above countries, and has been increasing in recent years. The high level of commuting as compared to migration, on the other hand, indirectly suggests deficiencies in the housing market.

## 2.3.2 International labour mobility

According to the theory of optimum currency areas, international mobility may be an important channel for the economy's ability to absorb asymmetric shocks, in particular those of a long-term nature, through changes in labour supply.

### 2.3.2.1 Migration abroad

Not only do the inhabitants of the Czech Republic not move much within the Czech Republic, they do not move abroad much either. Only 0.49% of the Czech population was living in the selected EU countries after 2000, compared to 0.58%, 0.75% and 0.99% for the Slovaks, Hungarians and Poles respectively (Alvarez-Plata et al., 2003).<sup>59</sup>

The number of immigrants is an important indicator of international mobility and the ability of the economy to absorb shocks. The data on recorded mobility show that the **number of immigrants** coming to the Czech Republic is higher than in Hungary, Poland, Slovakia and Portugal (see Table 33). By contrast, international mobility as regards immigrants is higher in Austria, Germany and, since 2005, Slovenia. The increase in the number of immigrants coming to the Czech Republic in the post-2002 period may be related to a partial relaxation of administrative requirements applicable to immigrants in 2002 and to the development of demand for labour in 2006.<sup>60</sup>

The data on international mobility correspond with the data on the **proportion of foreigners in the population** (see Table 34). The share of foreigners in the population in the Czech Republic is similar to that in Portugal and Slovenia and higher than that in Hungary, Poland and Slovakia. Austria and Germany have considerably higher shares of foreigners in their populations. The proportion of foreigners in the Czech Republic recorded a rise in 2006 compared to previous years. This was linked with large increases in employed foreigners.

**Table 33: Immigration (number of persons per 10,000 inhabitants)**

	1999	2000	2001	2002	2003	2004	2005	2006
<b>CZ</b>	9.6	7.6	12.6	43.8	58.8	52.3	58.9	66.4
<b>AT</b>	108.5	101.9	111.8	140.0	139.8	155.9	144.6	121.9
<b>DE</b>	106.5	102.3	106.8	102.1	93.2	94.5	90.3	80.4
<b>PT</b>	.	.	.	.	.	55.2	46.6	36.7
<b>HU</b>	18.0	19.8	20.8	17.3	21.1	24.0	.	.
<b>PL</b>	1.9	1.9	1.7	.	.	2.5	2.5	2.8
<b>SI</b>	24.9	31.1	39.2	45.8	46.5	50.9	76.6	100.3
<b>SK</b>	3.8	4.2	3.8	4.3	4.8	8.3	9.8	10.4

Note: CZ: data comparable from 2001 onwards.

Sources: Eurostat, CZSO, statistical yearbooks, CNB calculations.

<sup>59</sup> This involves persons from the above-mentioned countries dwelling in selected EU countries as follows: 2001 Austria, Finland, Germany, Sweden; 2002 Italy, Netherlands; 2003 Denmark, Luxembourg.

<sup>60</sup> Similar conclusions are provided by the data on the number of emigrants. Unlike the number of immigrants, the number of emigrants remained broadly unchanged in the Czech Republic in 2006 compared to previous years. This shows that the higher number of immigrants coming to the Czech Republic in 2006 does not signal higher international mobility, but rather rigidity in the Czech labour market, as demand for labour is not being satisfied from domestic sources. However, the available data on the number of emigrants are not comparable at the international level.

**Table 34: Shares of foreign nationals in the population (%)**

	1998	1999	2000	2001	2002	2003	2004	2005	2006
<b>CZ</b>	2.0	2.1	2.2	1.8	1.6	1.8	1.9	1.9	2.5
<b>AT</b>	9.3	9.4	9.5	9.5	9.1	9.3	9.4	9.6	9.8
<b>DE</b>	9.0	8.9	8.9	8.9	8.9	8.9	8.9	8.8	.
<b>PT</b>	1.7	1.8	1.9	2.0	2.2	2.3	.	.	.
<b>HU</b>	1.4	1.5	1.5	1.1	1.1	1.1	1.3	1.4	1.6
<b>PL</b>	.	.	.	.	1.8	.	.	.	.
<b>SI</b>	2.1	1.7	2.1	2.1	.	2.2	2.3	2.2	2.4
<b>SK</b>	.	.	.	.	.	0.6	0.6	0.4	0.5

Sources: Eurostat, CNB calculations.

At the end of April 2007, 198,700 foreign workers were registered in the Czech Republic.<sup>61</sup> Most of these were Slovaks (47%), followed by Ukrainians (25%) and Poles (10%). The number of foreign workers has been increasing very rapidly since the beginning of 2005, with 43,800 and 33,300 newcomers recorded in 2005 and 2006 respectively. The main factor of foreign employment in the Czech Republic is probably demand for labour. Accession to the EU in 2004 and the related relaxation of conditions for foreign employees had only a limited effect (Galušćák, 2006).<sup>62</sup>

Foreign workers are employed in the Czech Republic mainly in manufacturing, construction, real estate and renting, and wholesale and retail trade (see Chart 19). These industries are reporting the highest growth in the number of foreign workers. Foreign workers find employment in jobs requiring lower skills (see Chart 20), the largest increases being recorded for plant and machine operators and workers in elementary occupations.<sup>63</sup>

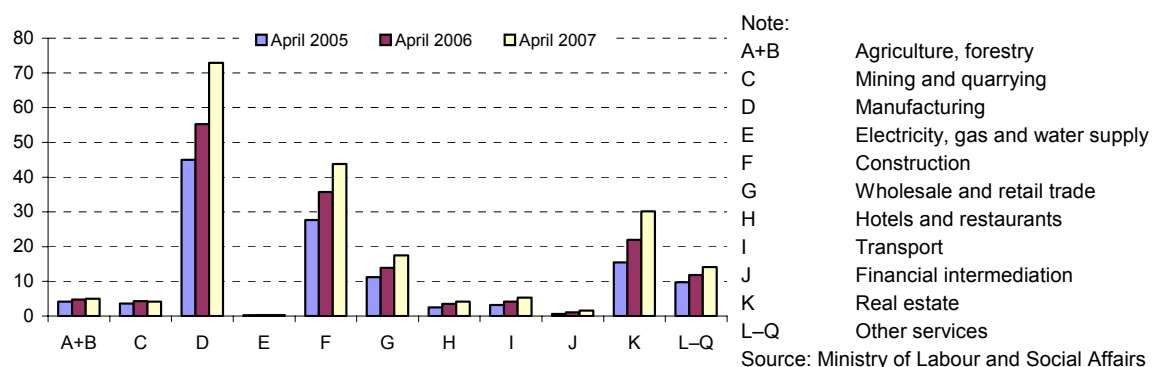
International mobility, according to data on recorded mobility, is lower in the Czech Republic than in Austria and Germany. The high growth in foreign employment in the Czech Republic since 2005 is due to increasing demand for labour and can be viewed as evidence of an ability to adjust. However, this trend is probably linked with the other rigidities on the Czech labour market, causing demand for labour of workers with lower skills not to be met from domestic sources (see section 2.3.1). Moreover, the mobility of the foreign labour force may itself pose some risk to the supply of labour in a country, as movements of foreign workers are affected by other factors in addition to demand (potential earnings, language barriers, geographical distance, etc.). Unexpected changes in foreign employment flows may thus occur despite unchanged domestic conditions.

<sup>61</sup> Data from labour offices on the numbers of workers subject to the recording obligation and on the numbers of workers who require a work permit.

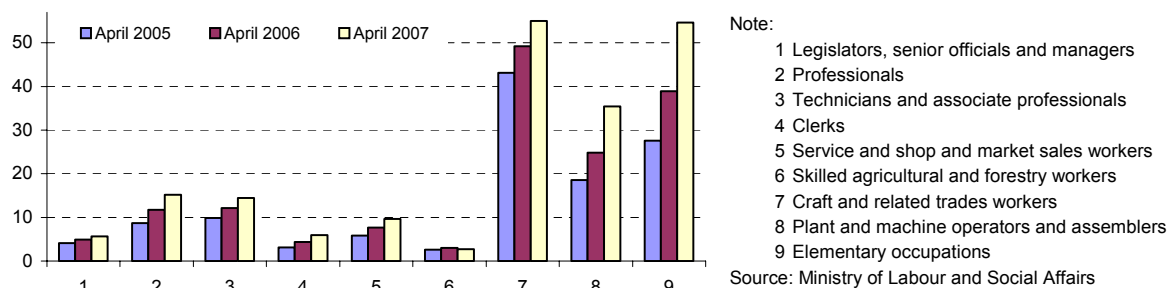
<sup>62</sup> Since May 2004, EU nationals have been able to work in the Czech Republic without restrictions (Slovak nationals did not require a work permit even prior to EU accession). However, the numbers of foreign workers began to increase more significantly only in 2005. The numbers of foreign workers in the Czech Republic since 1996, when data on foreign employment began to be available, correlate very closely with economic activity as measured by GDP growth. The extraordinary increase in foreign workers in 2005 and 2006 is probably related primarily to the high GDP growth and a related increase in demand for labour.

<sup>63</sup> This is particularly apparent for Ukrainian nationals. Slovaks, in addition to these jobs, find employment in skilled jobs, presumably due to the lack of a language barrier.

**Chart 19: Foreign employees in the Czech Republic by industry (thousands of persons)**



**Chart 20: Foreign employees in the Czech Republic by profession (thousands of persons)**



### 2.3.2.2 Administrative restrictions on international labour mobility

The free movement of persons, including workers, is one of the four fundamental economic freedoms enshrined in the EU Treaty (Articles 39 to 42). However, during the negotiations on EU enlargement, on 1 May 2004 most of the “old” Member States adopted **transitional restrictions on the free movement of workers from the new countries**. These transitional restrictions are stipulated in Annex V to the Act of Accession. Their adoption gives the new Member States the right to apply reciprocal measures. This right has not yet been exercised by the Czech Republic.<sup>64</sup>

Of the twelve old euro area countries, only Ireland opened its labour market to workers from the new Member States surveyed as of 1 May 2004 (when ten new Member States joined the EU).<sup>65</sup> The other euro area countries applied a two-year transition period to workers from the new Member States surveyed, during which a work permit was necessary to employ them. During 2006, the above transitional period was cancelled in Finland, Italy, Portugal, Greece and Spain, and the labour markets in Belgium, France and the Netherlands were also partially liberalised in 2006. On 1 May 2007, the Netherlands lifted all restrictions. Specific circumstances relating to the individual euro area countries that have extended their transition periods and in the new member countries under review are provided in more detail in Table 35. If serious labour market disturbances occur, these specific measures may be applied until the end of a seven-year period after accession. As of 1 May 2011, all EU Member States must introduce free movement of labour for all citizens of the countries which acceded to the EU on 1 May 2004.

<sup>64</sup> The position of the Czech government is included in its resolution No. 13 of 7 January 2004.

<sup>65</sup> However, job applicants from the new Member States are not entitled to draw any social benefits.

**Table 35: Persisting administrative barriers for the new EU members**

<b>Country</b>	<b>Current situation</b>	<b>Outlook</b>
Austria	A transition period applies until 30 April 2009 to workers from the new Member States surveyed. A quota known as the “Bundeshöchstzahl” is set in Austria, stipulating that the percentage of foreigners employed may not exceed 8% of the entire Austrian labour force. The individual federal states then set quotas known as “Landeshöchstzahlen”	Austria has notified the European Commission of its intent to keep the transition period until 30 April 2009.
Belgium	A transition period applies until 30 April 2009 to workers from the new Member States surveyed. Workers from the new Member States surveyed may receive a one-year work permit. The work permit is applied for by the employer. As from 30 April 2006, issuance of permits was simplified for professions in demand.	If certain conditions are fulfilled, all restrictions might be lifted before 30 April 2009.
France	A transition period applies until 30 April 2009 to workers from the Czech Republic and Slovakia. Workers from the new Member States surveyed may receive a one-year work permit. The work permit is applied for by the employer. As from 1 May 2006, issuance of permits was simplified for professions in demand.	Further development is <i>unclear</i> .
Germany	A transition period applies until 30 April 2009 to workers from the new Member States surveyed. The situation of job applicants from the Czech Republic and Slovakia is facilitated by bilateral agreements. These include an agreement on procedures relating to employment in Germany for a period of up to three months during one year, an agreement on mutual employment of Czech, Slovak and German citizens for the purpose of extending their professional and language skills, and an agreement on the secondment of Czech and Slovak workers from companies with registered offices in the Czech and Slovak Republics on the basis of work performance contracts.	Although Germany has notified the European Commission of its intent to keep the transition period until 30 April 2009, the government is currently considering opening the labour market to workers from the new Member States surveyed.
Luxembourg	A transition period applies until 30 April 2009 to workers from the new Member States surveyed. As from 1 May 2006, issuance of permits was simplified for some professions.	Further development is <i>unclear</i> .
Czech Republic	No restrictions apply to workers from the countries surveyed or from other euro area countries.	
Hungary	A transition period applies to those euro area countries which do likewise.	
Poland	No restrictions apply to workers from the countries surveyed or from other euro area countries.	
Slovakia	No restrictions apply to workers from the countries surveyed or from other euro area countries.	
Slovenia	No restrictions apply to workers from the countries surveyed or from other euro area countries.	

### 2.3.3 Institutional environment

The institutional environment has a fundamental influence on the labour market. Economic adjustment may be limited by the relationship between wages and labour productivity, strict employment protection measures, administrative barriers to entrepreneurship, or a social system which fails to sufficiently motivate unemployed people to seek jobs.

#### *Trade unions and collective bargaining*

In the economy, wages represent price signals which influence the allocation of production resources. Wage-setting at the company level with regard to corporate labour productivity is an important prerequisite for wage flexibility. If industry-level collective bargaining plays a significant role, it may weaken the link to labour productivity and lead to a higher wage level and higher unemployment (Calmfors and Driffill, 1988).<sup>66</sup> If industry-level bargaining predominates, it may result in lower wage flexibility. The negative impact of industry-level bargaining can be intensified by regulations extending the binding effect of collective pay agreements beyond the contractual parties (Brandt, Burniaux and Duval, 2005).

**Trade union density** is relatively low in the Czech Republic, as in most of the other countries under comparison, with a sharp decline recorded in the 1990s (see Table 36). According to OECD data, collective bargaining coverage is high in Austria and Portugal, while it is lowest in the Czech Republic.<sup>67</sup> In the Czech Republic, collective bargaining takes place mainly at the company level, as in Hungary and Poland. The coordination of bargaining in the Czech Republic, Hungary and Poland is low. Wage flexibility in the Czech Republic is not fundamentally limited by wage setting except in the non-business sector, where wages are set at the central level with a weak link to labour productivity.

In July 2005, an amendment to the law on collective bargaining came into force, introducing new regulations on the extension of the binding effect of higher-level collective agreements to other employers. This greater significance for industry-level collective bargaining might imply a weaker relationship between wages and labour productivity growth at the corporate level, with a negative impact on wage flexibility and employment. However, the figures shown in Table 36 relate to 2000, when the extension of the binding effect of higher-level collective agreements was also in force.<sup>68</sup>

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<sup>66</sup> While some studies confirm this hypothesis, Flanagan (1999) argues that in the case of an open economy, a high degree of economic integration or a large non-trade union organised sector, the given macroeconomic variables can be more or less independent of the collective bargaining structure.

<sup>67</sup> Some of the more recent work investigating collective agreement coverage has generated results that differ from the information given in Table 36. Using a sample of businesses from the Average Earnings Information System (MLSA), Jurajda (2005) estimated that the coverage of employees in the business sector by collective agreements was more than 50% in 2004. Furthermore, the coverage is over 70% when extension of the binding effect of higher-level collective agreements is taken into account. Moreover, it is likely that more than 80% of firms with more than 250 employees have a collective agreement. Comparing firms in the same industry and size categories, Jurajda finds no major differences in wage levels, except for highly skilled personnel, whose wages seem to be lower in firms with a collective agreement. This suggests that coverage by collective agreements is higher in the Czech Republic than set out in Table 36, while the impact of collective bargaining on wages may be rather limited.

<sup>68</sup> The reason for the amendment was that the Constitutional Court had repealed, with effect from April 2004, the original provision on the extension of higher-level collective agreements. The new legislation introduces a definition of all employers in the given sector to which the binding effect of collective agreements should be extended. The extension of the binding effect of higher-level agreements does not apply to businesses employing less than 20 people, businesses employing more than 50% disabled people or businesses subject to a higher-level collective agreement. An analysis of Labour Force Survey data reveals that extended higher-level collective agreements cover approximately 10% of employees (as of August 2007). Therefore, the practice of extending higher-level collective agreements has not been applied very widely.

**Table 36: Trade unions and collective bargaining**

	Trade union density (%)		Collective bargaining coverage (%) <sup>c</sup>		Centralisation of bargaining <sup>d</sup>		Coordination of bargaining <sup>e</sup>	
	1990 <sup>a</sup>	2000 <sup>b</sup>	1990	2000	1990–1994	1995–2000	1990–1994	1995–2000
<b>CZ</b>	46	27		25+	1	1	1	1
<b>AT</b>	47	37	95+	95+	3	3	4	4
<b>DE</b>	31	25	80+	68	3	3	4	4
<b>PT</b>	32	24	70+	80+	4	4	4	4
<b>HU</b>	63	20		30+	1	1	1	1
<b>PL</b>	33	15		40+	1	1	1	1
<b>SK</b>	57	36		50+	2	2	2	2

Notes: a) 1995 data for the Czech Republic, Hungary, Poland and Slovakia.  
b) 1997 data for Portugal, 2001 data for the Czech Republic, Hungary and Poland, 2002 data for Slovakia.  
c) + denotes the lower boundary of the estimate.  
d) 1: Company level predominant.  
2: Combination of industry and company level, with company bargains predominant.  
3: Industry level predominant.  
4: Predominantly industrial bargaining, but also recurrent central level agreements.  
5: Central level agreements of overriding importance.  
e) Degree of coordination in wage bargaining. An index of 1 to 5; higher values mean higher degrees of bargaining coordination.

Source: OECD (2004).

### Minimum wage

The minimum wage reduces wage differentiation and wage flexibility at the low end of the wage scale, and consequently lowers demand for less-skilled labour and for graduates. This is likely to increase the total and long-term unemployment of people with low skill levels and unemployment among graduates and school-leavers (OECD, 1998; Gregg, 2000).

In the Czech Republic, the **minimum wage** as a percentage of the average wage was relatively low in the 1990s. This indicator has risen continuously since 1999, reaching 39.1% in 2005 (see Table 37).<sup>69</sup> By international comparison, the minimum wage as a proportion of the average wage in the Czech Republic is roughly the same as in Hungary and Portugal, while it is higher than in Poland and Slovakia and lower than in Slovenia.<sup>70</sup> In Slovenia, Hungary and Slovakia, the minimum wage is paid to about the same proportion of employees as in the Czech Republic (see Table 38). Portugal and Poland have a much greater share of employees on the minimum wage compared to the Czech Republic. The effect of the minimum wage on the flexibility of low wages and creation of low-skilled jobs is thus probably lower in the Czech Republic than in the two countries above.

<sup>69</sup> The figure for the Czech Republic on the ratio of the minimum wage to the average wage in 2006 is not available from the Eurostat database. However, according to CNB calculations (the ratio to the average wage in all surveyed organisations), there was a further increase of 0.6 percentage point in 2006. In 2007, the minimum wage stands at CZK 8,000. The minimum wage as a share of the average wage is thus around 1 percentage point lower than in 2005 (see Table 37). The assumed negative impact of the minimum wage on wage flexibility and job creation is not increasing further. In 2007, for the first time since 1998, the rise in the minimum wage will not exceed the increase in the average wage.

<sup>70</sup> No minimum wage has been defined at the national level in Austria and Germany.

**Table 37: Minimum wage (%)**

	2002	2003	2004	2005	2006
<b>CZ</b>	36.9	38.1	38.4	39.1	.
<b>PT</b>	43.0	40.7	40.0	40.5	.
<b>HU</b>	42.1	38.6	40.7	38.2	.
<b>PL</b>	33.0	33.9	35.1	33.7	.
<b>SI</b>	45.3	46.3	44.1	45.6	.
<b>SK</b>	32.4	34.0	34.1	34.4	34.8

Note: Monthly minimum wage as a percentage of the average wage in industry and services (excluding public administration).

Source: Eurostat.

**Table 38: Shares of employees earning the minimum wage (%)**

	2000	2001	2002	2003	2004	2005	2006
<b>CZ</b>	1.6	1.7	2.0	2.0	2.0	2.0	.
<b>PT</b>	3.9	8.4	11.4	8.1	8.0	8.0	.
<b>HU</b>	.	2.9	4.0	.	4.5	2.9	.
<b>PL</b>	6.2	4.0	4.0	5.7	5.3	4.7	.
<b>SI</b>	2.0	2.6	2.6	2.7	2.0	2.8	.
<b>SK</b>	.	0.2	0.1	0.4	1.9	1.7	1.9

Note: Percentage of full-time employees earning the minimum wage.

Source: Eurostat.

The minimum wage's negative impact on wage flexibility can be more pronounced in some sectors and professions. The minimum wage as a percentage of the wage in the first decile of wage distribution is high in low-skilled professions (see Table 39). This relation indicates that for 10% of persons employed in the services and retail sector and in elementary occupations, the minimum wage as a proportion of their earnings in 2006 was around 90% or more.

**Table 39: Minimum wage and gross monthly wage in selected professions (%)**

Classification of occupation	Minimum wage / 1st decile			
	2003	2004	2005	2006
Total for the Czech Republic – business sector	63.9	66.1	68.0	69.6
Service and shop workers	87.6	89.2	90.1	89.8
Skilled agricultural and forestry workers	74.4	74.3	76.3	75.0
Elementary occupations	84.3	86.3	89.1	90.1

Note: The table only lists those professions with a ratio to the median wage of over 50% in 2006.

Sources: Average Earnings Information System (Ministry of Labour and Social Affairs), CNB calculations.



## Employment protection

Strict **conditions for the recruitment and dismissal of employees** reduce flows on the labour market and increase long-term unemployment (OECD, 2004).<sup>71</sup> The high costs of dismissing individual employees (in particular during the period shortly after conclusion of the employment contract, once the probationary period has expired) result in lower job creation, especially for graduates and young people. The combination of the high costs of dismissing permanent employees and weak regulations for temporary work strengthens the position of permanent employees relative to temporary workers, whose chance of gaining permanent employment is thus lower.

According to OECD data, the conditions for the dismissal of individual employees were stricter in the Czech Republic in 2006 than in the countries under comparison except for Portugal (see Table 40). In the Czech Republic, the cost of dismissing employees is relatively high, especially with regard to short-term contracts (see Chart 21). This institutional setup may adversely affect job creation and long-term employment in the Czech Republic.

**Table 40: Employment protection legislation index (EPL)<sup>a</sup>**

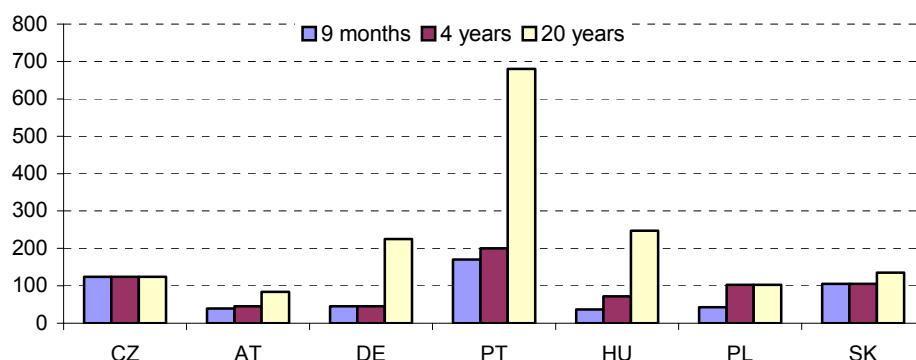
	Permanent employment <sup>b</sup>		Temporary employment <sup>c</sup>		Collective dismissals <sup>d</sup>		Overall index <sup>e</sup>	
	2003	2006	2003	2006	2003	2006	2003	2006
<b>CZ</b>	3.3	3.3	0.5	1.1	2.1	2.1	1.9	2.2
<b>AT</b>	2.4	2.4	1.5	1.5	3.3	3.3	2.2	2.2
<b>DE</b>	2.7	2.7	1.8	1.8	3.8	3.8	2.5	2.5
<b>PT</b>	4.2	4.2	2.8	2.8	3.6	2.9	3.5	3.4
<b>HU</b>	1.9	1.9	1.1	1.1	2.9	2.9	1.7	1.7
<b>PL</b>	2.2	2.2	1.3	1.8	4.1	4.1	2.1	2.3
<b>SK</b>	2.8	2.8	0.4	0.4	2.5	2.5	1.7	1.7

Notes: a) The indices take values ranging from 1 to 6, a higher value meaning greater employment protection.  
b) protection against individual dismissal  
c) fixed-term contracts, temporary work agencies  
d) relative to individual dismissals  
e) weighted average of indicators of permanent employment, temporary employment and collective dismissals.

Sources: OECD, CNB calculations for CZ and SK (for SK permanent employment only).

<sup>71</sup> However, Bassanini and Duval (2006) confirm the conclusions of other papers that employment protection, as measured by the EPL index (see Table 40), has no clear impact on the overall employment rate. Higher EPL values, however, adversely affect the entry of young people onto the labour market. A higher EPL index, according to these authors, is also associated with substitution of part-time contracts with full-time contracts for women.

**Chart 21: Costs of individual termination of an open-ended contract by employment contract duration in 2006 (number of days for which wage is paid)**



Note: Sum of data for days of notice, severance pay and delay to start of notice.

CZ, SK: notice due to redundancy and other cases;

AT: average for higher and lower skilled persons.

Sources: OECD, CNB calculations.

A very low index for the protection of temporary employment combined with high protection of permanent employment in the Czech Republic (see Table 40) suggests the risk of labour market duality, where temporary workers have only a small chance of gaining permanent employment. In 2004, the Czech Republic introduced regulations for temporary employment which increased the temporary employment index from 0.5 to 1.1.<sup>72</sup> With respect to collective dismissals of employees (above the level of individual dismissals), the Czech Republic applies the lowest restrictions by comparison with the countries under review.

In terms of the aggregate index of employment protection, which is a weighted average of the three foregoing components, the Czech Republic ranked among the countries with average labour market regulation in 2006 as compared to the sampled countries.<sup>73</sup> However, one should take into account that there is a disparate intensity of protection of permanent and temporary jobs behind the average figure, which may result in the above issue of labour market duality.

Under the new Labour Code, effective from January 2007, conditions for the dismissal of employees remained practically unchanged. The notice period for redundancy has been reduced from three to two months, while severance payment has been increased from two to three monthly salaries. The draft does not even grade these conditions according to the duration of employment. The analysis of this and other factors in the draft new Labour Code shows that the permanent employment protection index will decline only slightly, from 3.3 in 2006 to 3.2.<sup>74</sup> The temporary employment index and the index of conditions for collective dismissals will be the same as in 2006. Thus, the adverse impact of permanent employment

<sup>72</sup> Since October 2004, the maximum cumulative period for which fixed-term contracts may be signed with a single employer is two years. Similarly, the maximum period of employment that can be mediated by a labour agency with a single employer is 12 months. On the other hand, the conditions applicable to temporary jobs have been relaxed slightly since March 2004, as fixed-term contracts may be offered to graduates.

<sup>73</sup> European labour markets are generally rather inflexible, so the benchmark offers a rather low standard in this case.

<sup>74</sup> The difficulty in dismissing employees has decreased slightly since January 2007, as employers, in the case of redundancy dismissals, are no longer required to consider the option of transferring employees to another job or retraining them.

protection on job creation and long-term unemployment is still higher than in the countries under comparison except for Portugal.

### Administrative barriers to entrepreneurship

High costs and barriers involved in starting up businesses and complicated administrative regulations governing business reduce competitive pressures on product markets. In the long run, this has a negative impact on job creation and employment (Nicoletti and Scarpetta, 2004). According to Bassanini and Duval (2006), regulation on the product markets increases overall unemployment.

The OECD index is used for the international comparison of the above-mentioned administrative barriers to entrepreneurship (Conway et al., 2005). In 2003, administrative barriers to entrepreneurship were higher in the Czech Republic than in the countries under comparison except Poland (see Table 41, last column). The overall index in the Czech Republic remained almost unchanged against 1998, while it fell significantly in Germany, Portugal and Poland. By international comparison, the regulatory and administrative conditions in the Czech Republic are very difficult to understand, in particular those relating to licences and permits.

**Table 41: Indices of administrative barriers to entrepreneurship<sup>a</sup>**

	Costs related to startups <sup>b</sup>		Regulatory and administrative opacity <sup>c</sup>		Barriers to competition <sup>d</sup>		Barriers to entrepreneurship, total	
	1998	2003	1998	2003	1998	2003	1998	2003
<b>CZ</b>	2.2	2.3	2.7	2.3	0.6	0.5	2.0	1.9
<b>AT</b>	2.6	2.8	0.6	0.4	1.0	0.8	1.7	1.6
<b>DE</b>	2.4	1.6	2.6	2.2	0.4	0.5	2.0	1.6
<b>PT</b>	2.1	1.7	1.8	1.2	1.0	0.5	1.8	1.3
<b>HU</b>	2.4	2.3	0.4	0.4	1.5	1.1	1.6	1.4
<b>PL</b>	3.8	3.7	2.0	1.5	1.6	0.3	2.8	2.3
<b>SK</b>	.	1.9	.	0.7	.	0.3	.	1.2

Note: a) The indices take values ranging from 1 to 6, a higher value meaning greater barriers. The overall index is a weighted average of indicators in 7 basic areas grouped in the 3 areas given in the table.

b) Administrative burdens for corporations, administrative burdens for sole proprietors, and sector specific administrative burdens.

c) Licences and permits system, government strategy of communication and simplification of rules and procedures.

d) Legal barriers to entry into the industry and antitrust exemptions for public enterprises.

Source: Conway et al. (2005).

An amended Commercial Code took effect in July 2005, simplifying and accelerating corporate registration. This makes it easier to establish businesses and is likely to decrease the index concerning the complexity of regulatory and administrative conditions, where the Czech Republic recorded the highest value of all the countries under review in 2003. A further decrease in the index for the above area will result from the amended Trade Licensing Act effective since August 2006, due to the introduction of central registration points to facilitate incorporation of businesses. The amendment also decreases business startup costs, as the number of required documents has been cut. The digitisation of the Companies Register as of January 2007 was another step towards reducing administrative barriers. The administrative requirements have thus partially improved in the Czech Republic, with conditions that ease the potential adverse impact on labour market flexibility in the area of job creation.

## Labour taxation

Labour taxation directly affects labour costs and job creation, in particular those for people with low skills and for specific groups (women, school-leavers, older people). Moreover, high labour taxation increases the proportion of entrepreneurs in the labour force and the size of the grey economy (Brandt et al., 2005). Higher taxation of labour may have more pronounced effects on unemployment in the case of a high minimum wage (Bassanini and Duval, 2006).<sup>75</sup> The taxation of people with high incomes is important in conditions of international competition, as people with high skills and high incomes have a greater propensity to migrate.

**Overall labour taxation** in the Czech Republic is comparable to that of Poland and lower than in Austria, Germany and Hungary. Taxation of labour at the average wage level in the Czech Republic is higher than in Portugal and Slovakia (see Table 42). Taxation of low-income earners in the Czech Republic in 2006 was comparable to that in Austria, Hungary and Poland. The impact of labour taxation on job creation and long-term unemployment can therefore be expected to be broadly the same as in these three countries. However, it is greater than in Greece and Slovakia. Labour taxation remained broadly unchanged in 2000–2006, with the exception of 2006, when it declined slightly in low-income categories. Labour taxation is falling sharply in Hungary and Slovakia.

**Table 42: Overall labour taxation<sup>a</sup>**

	100% of average wage				67% of average wage			
	2000	2005	2006	Change <sup>b</sup>	2000	2005	2006	Change <sup>b</sup>
<b>CZ</b>	42.7	43.8	42.6	0.1	41.4	42.0	40.1	-0.1
<b>AT</b>	47.3	47.9	48.1	0.2	43.2	43.1	43.5	0.1
<b>DE</b>	54.0	52.4	52.5	-0.2	48.6	47.3	47.4	-0.2
<b>PT</b>	37.3	36.3	36.3	-0.1	33.2	31.8	31.7	-0.2
<b>HU</b>	54.6	51.1	51.0	-0.8	51.4	43.1	42.9	-1.6
<b>PL</b>	43.2	43.5	43.7	0.1	42.2	42.3	42.5	0.1
<b>SK</b>	41.8	38.3	38.5	-0.7	40.6	35.2	35.6	-1.0

Notes: a) Income tax and social security contributions paid by employees and employers as a percentage of total labour costs. Data for employees (individuals without children) earning 100% (left part of the table) and 67% (right part of the table) of the average wage.  
b) Average annual change in percentage points for 2000–2006 (calculation based on regression relationship).

Sources: OECD (2007b), CNB calculations.

## Work-incentive indicators

**Net replacement rates (NRRs)** measure the extent to which the combination of taxes and benefits affects the financial gain from work and thereby the motivation of unemployed or inactive persons to enter employment. The indicator is defined as the ratio of net household income when the person under consideration is jobless to that when the same person has a job. Table 43 compares the net replacement rates for short-term and long-term unemployment and for two types of households.

<sup>75</sup> Higher taxation cannot be shifted onto employees in this case.

**Table 43: Net replacement rates<sup>a</sup>**

	Initial phase of unemployment <sup>b</sup>						Long-term unemployment <sup>c</sup>					
	Individuals without children			Family (2 children) <sup>d</sup>			Individuals without children			Family (2 children) <sup>d</sup>		
	2001	2005	2006	2001	2005	2006	2001	2005	2006	2001	2005	2006
<b>CZ</b>	59	56	59	65	57	59	53	45	42	92	76	74
<b>AT</b>	55	55	55	73	72	75	55	51	51	88	79	80
<b>DE</b>	60	60	63	81	78	82	57	48	48	81	79	79
<b>PT</b>	78	77	77	76	85	89	24	26	27	72	78	79
<b>HU</b>	58	52	71	61	66	77	28	25	31	54	60	77
<b>PL</b>	72	74	98	67	69	81	43	42	41	62	62	61
<b>SK</b>	67	61	59	76	57	56	75	26	28	122	52	53

Notes: a) The ratio of the net household income when the breadwinner is unemployed (nominator) and employed (denominator). Income from employment of the breadwinner at 67% of the average wage.  
b) Unemployed persons entitled to unemployment benefits, excluding social assistance benefits.  
c) Unemployed persons after five years.  
d) The other adult is economically inactive, children of 4 and 6 years of age.

Sources: OECD (2007a), OECD tax benefit models (2006 data).

Data on short-term unemployment show that the incentive to accept employment in the Czech Republic is higher than, or similar to, the levels in the other countries surveyed. In particular, short-term unemployed people in Portugal and Poland and, in the case of families with children, in Germany are less motivated to seek employment than those in the Czech Republic. The financial reasons for seeking a job are less strong in the Czech Republic than in Slovakia among the long-term unemployed. Long-term unemployed people, however, have a greater incentive to seek work than in Austria and Germany. The reduction of the tax burden on low-income persons in the Czech Republic introduced in January 2006 had a negligible impact on net replacement rates.<sup>76</sup> The NRRs for long-term unemployed people from households with an economically inactive partner and children declined slightly from 76% in 2005 to 74% in 2006. The tax and benefit system probably contributes to pushing these persons into inactivity and the grey economy.<sup>77</sup>

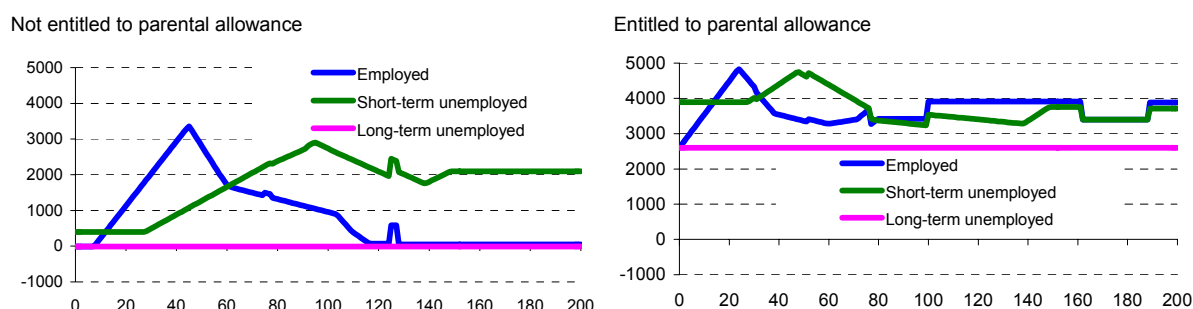
Simulations using a micro-simulation model of taxes and benefits (Galuščák and Pavel, 2007) show that the level of social benefits may diminish efforts to seek or keep a job, in particular in some categories of households. About one-third of the employed experience a decline in net household income of no more than 20% if they lose their job, provided that such persons are entitled to unemployment benefit. High NRRs can be also observed for a large proportion of the unemployed.

The reform of social benefits introduced in January 2007 further deepens these structural problems on the labour market. Although the new social benefit structure financially disadvantages households with no employment income, the newly defined housing benefit, which takes housing expenses into account, causes distortions. The simulation in Galuščák and Pavel (2007) shows that, compared to 2006, the financial incentive to seek a job has reduced in households with children (see Chart 22), but has changed less significantly for other types of households. The sharp rise in parental allowance may weaken the incentive of non-working parents to seek work, thereby further exacerbating the loss of their job skills.

<sup>76</sup> These indicators are affected primarily by social security contributions and entitlements to social benefits (Carone and Salomäki, 2005).

<sup>77</sup> The data in Table 43 probably do not fully capture the potential partial improvement in the incentive to seek employment connected with the coming into force of the Employment Act in October 2004 and other follow-up measures, which lay down stricter conditions for qualifying for unemployment benefit and registering with labour offices.

**Chart 22: Change in the net income of households with a non-working partner in 2007 compared to 2006 (CZK)**



Note: Change in net household income as a function of the wage of employed persons/potential wage of unemployed persons (in per cent of average wage, horizontal axis). Short-term unemployed persons entitled to unemployment benefits.

Households with a non-working partner and two children of 4 and 6 years of age (left) and 4 and 2 years of age (right).

Source: Galuščák and Pavel (2007)

## 2.4 Flexibility and shock-absorbing capacity of the banking sector

The capacity of the financial sector to absorb shocks depends, among other things, on its performance and stability. While a profitable and sound financial sector may be effective in helping to eliminate the impact of economic shocks, unsound financial institutions may increase the unfavourable effects of negative shocks.<sup>78</sup> The following analyses will concentrate on the banking sector, which has the greatest weight in the financial sector in the countries surveyed.

Recent years have seen qualitative improvements in banking credit portfolios in the Czech Republic. The Czech banking sector showed **better-quality loan portfolios** than the banking sectors in Poland and Slovenia at the end of 2006, while the ratio of non-performing loans to total loans has been lower than in Germany during recent years (see Table 44).

**Table 44: Non-performing loans/total loans in the banking sector (%)**

	1998	1999	2000	2001	2002	2003	2004	2005	2006 <sup>a</sup>
CZ <sup>b</sup>	21.0	22.4	19.9	13.7	8.9	4.8	4.0	3.9	3.7
AT	3.2	3.0	2.9	3.1	3.9	3.7	3.3	2.6	2.9
DE	4.5	4.2	4.7	4.6	5.0	5.3	5.1	4.8	4.0
PT			2.2	2.1	2.3	2.4	2.0	1.6	1.7
HU	5.9	3.4	2.5	2.7	3.1	2.7	2.7	2.5	2.5
PL	10.9	13.2	14.9	17.8	21.1	21.2	14.9	11.0	7.3
SI	5.4	5.2	5.2	7.0	7.0	6.5	5.5	4.8	4.1
SK	35.0	29.0	21.7	22.0	11.2	9.2	7.2	5.6	3.3
EA-12 <sup>c</sup>	.	.	3.3	4.1	3.3	3.4	3.1	3.0	.

Notes:

a) Preliminary data.

b) Data for the Czech Republic exclude Konsolidační banka and banks under conservatorship.

c) Weighted average.

Sources: CNB, national central banks. Unconsolidated data.

**The capital adequacy ratio** of the Czech banking sector, at an average of 11.4%, is above the required threshold of 8% and is at levels similar to those in the other countries under review (see Table 45).<sup>79</sup> This indicator thus testifies to sufficient coverage of potential risks as well as to the relatively less risky business activities of domestic banks, which include trading

<sup>78</sup> An unstable sector may also be a source of asymmetric shocks.

<sup>79</sup> The decreases in capital adequacy between 2004 and 2006 were mostly related to the use of retained profits for the payment of dividends and bonuses or to the repatriation of profits to the foreign owners of the banks.

in treasury bills and also, according to the banks' records, in mortgage loans to households. The ratio of non-performing loans to total household loans did not exceed 3.3%. However, the rapid growth in household loans and their worse quality in the consumer credit segment may indicate a certain risk.<sup>80</sup>

**Table 45: Capital adequacy of the banking sector (%)**

	1998	1999	2000	2001	2002	2003	2004	2005	2006 <sup>a</sup>
CZ <sup>b</sup>	11.9	13.6	14.9	15.4	14.2	14.5	12.6	11.9	11.4
AT <sup>c</sup>	11.6	11.0	10.6	11.5	11.3	12.1	11.9	11.5	11.6
DE <sup>b</sup>	11.4	11.5	11.7	12.0	12.7	13.4	13.2	12.2	11.7
PT <sup>c</sup>	11.1	10.8	9.2	9.5	9.8	10.0	10.4	11.3	10.9
HU <sup>b</sup>	15.3	14.2	13.7	13.9	13.0	11.8	12.4	11.6	11.3
PL <sup>b</sup>	11.7	13.2	12.9	15.0	14.2	13.8	15.5	14.5	13.1
SI <sup>b</sup>	16.0	14.0	13.5	11.9	11.9	11.5	11.8	10.5	11.0
SK <sup>b</sup>	3.2	5.3	2.4	13.4	21.3	21.6	18.7	14.8	13.1
EA-12 <sup>c,d</sup>	11.6	12.1	11.6	12.1	11.9	11.9	11.8	11.8	12.0

Notes:

a) Preliminary data.

b) Unconsolidated data; data for the Czech Republic exclude Konsolidační banka and banks under conservatorship.

c) Consolidated data.

d) Weighted average for the reporting banks in the given year.

Sources: CNB, national central banks.

The stability of the banking sector stems from the **prosperity of the banking business**. In the last three years, it was possible to attain a net interest margin of 2.4% on average in the Czech banking business (see Table 46). In an environment of increasing competition and a low level of key rates, interest rates on loans and deposits somewhat declined and remained relatively low until the end of 2006. The availability of loans to households and prospering businesses thus increased. Stable interest margins were provided by higher interest rate spreads and profits on developed retail transactions with households. Compared to some of the selected new EU members, banks in the Czech Republic operate under tighter economic conditions – this is reflected in lower margins as well as lower operating expenses. The lower margins also reflect the relatively low level of interest rates. A comparison of net non-interest income per unit of assets is shown in Table 47. This indicator shows values for the Czech banking sector in recent years at higher levels than those for the euro area countries under comparison and, except for Slovakia, at lower levels than in the new member countries surveyed.

**Table 46: Net interest margin (NIM, %)**

	1998	1999	2000	2001	2002	2003	2004	2005	2006 <sup>a</sup>
CZ <sup>b</sup>	3.45	2.83	2.53	2.47	2.35	2.26	2.36	2.37	2.41
AT <sup>b,c</sup>	1.32	1.20	1.20	1.21	1.23	1.17	1.09	0.98	0.90
DE <sup>b,c</sup>	1.37	1.28	1.14	1.12	1.20	1.16	1.18	1.17	1.15
PT <sup>b,c,d</sup>	2.65	2.57	2.25	2.31	2.21	2.04	2.00	1.86	1.89
HU <sup>b</sup>	4.62	4.11	4.00	4.05	4.19	3.96	4.00	3.92	3.60
PL <sup>b</sup>	4.58	4.01	4.26	3.38	3.39	3.13	3.24	3.30	3.26
SI <sup>b</sup>	4.25	3.86	4.41	3.37	3.41	3.05	2.70	2.42	2.19
SK <sup>d</sup>	1.20	0.45	1.85	2.28	2.69	2.91	2.85	2.15	2.42

Notes:

a) Preliminary data.

b) Unconsolidated data; data for the Czech Republic exclude Konsolidační banka and banks under conservatorship.

c) The share of net interest in average total balance-sheet assets, in the case of Germany since 1999.

d) 2005 and 2006 data on an unconsolidated basis.

Sources: CNB, national central banks.

<sup>80</sup> In mid-2007, 1.6% of housing loans and 7.7% of consumer credit were at risk of default.

**Table 47: Net non-interest income/average assets (%)**

	1998	1999	2000	2001	2002	2003	2004	2005	2006 <sup>a</sup>
CZ <sup>b</sup>	1.29	1.49	1.22	1.37	1.46	1.43	1.69	1.61	1.48
AT <sup>c</sup>	1.68	1.62	1.59	0.89	0.75	0.83	0.84	0.94	0.87
DE <sup>b</sup>	0.34	0.37	0.42	0.36	0.34	0.35	0.35	0.37	0.39
PT <sup>c</sup>	1.19	1.04	1.07	0.88	0.88	1.02	1.06	1.39	1.36
HU <sup>b</sup>	-1.08	0.99	1.06	1.34	1.50	1.70	1.67	1.66	1.77
PL <sup>b</sup>	2.01	2.48	2.73	3.05	2.73	2.52	2.37	2.32	2.28
SI <sup>b</sup>	1.19	1.29	1.41	1.47	1.84	1.63	1.72	1.60	1.67
SK <sup>b</sup>	1.70	1.75	1.14	1.09	1.25	0.95	1.44	1.48	1.36
EA-12 <sup>c,d</sup>	1.09	1.00	1.07	0.84	0.90	1.11	0.82	0.96	1.25

Notes:

a) Preliminary data.

b) Unconsolidated data, data for the Czech Republic exclude Konsolidační banka and banks under conservatorship.

c) Consolidated data. Net non-interest income/assets as at year-end.

d) Weighted average; arithmetic mean since 2005.

Sources: CNB, national central banks.

In recent years, the Czech banking sector has shown a high pre-tax **return on assets**. This has been enabled chiefly by interest rate and fee policies, together with a smaller need for provisioning for risks undertaken. Except for Hungary and Poland, which posted higher pre-tax returns on assets in 2006, the Czech banks in total showed greater returns than those in the other monitored countries, according to consolidated results. Compared to the euro area countries, they posted higher return on equity and return on assets. In 2006, the Austrian banking sector came near the Czech banking sector in terms of return on equity (see Table 48 and Chart 23).

**Table 48: Pre-tax profit/average assets (%)**

	1998	1999	2000	2001	2002	2003	2004	2005	2006 <sup>a</sup>
CZ <sup>b</sup>	-0.34	-0.21	0.56	0.93	1.59	1.64	1.76	1.76	1.61
AT <sup>c</sup>	1.25	1.21	1.39	1.25	0.53	0.60	0.96	0.65	0.91
DE <sup>b</sup>	0.61	0.35	0.29	0.20	0.15	0.03	0.14	0.44	0.36
PT <sup>c</sup>	1.09	1.05	1.05	0.96	0.78	0.89	0.84	1.03	1.18
HU <sup>b</sup>	-1.60	0.52	1.31	1.58	1.68	1.86	2.34	2.40	2.20
PL <sup>b</sup>	1.75	1.60	1.51	1.36	0.82	0.95	1.57	1.96	2.05
SI <sup>b</sup>	1.22	0.82	1.14	0.45	1.11	1.00	1.06	1.00	1.25
SK <sup>b</sup>	-0.45	-3.99	0.54	1.02	1.16	1.17	1.15	1.05	1.13
EA-12 <sup>c,d</sup>	0.69	0.73	0.83	0.47	0.40	0.47	0.58	.	.

Notes:

a) Preliminary data.

b) Unconsolidated data; data for the Czech Republic exclude Konsolidační banka and banks under conservatorship.

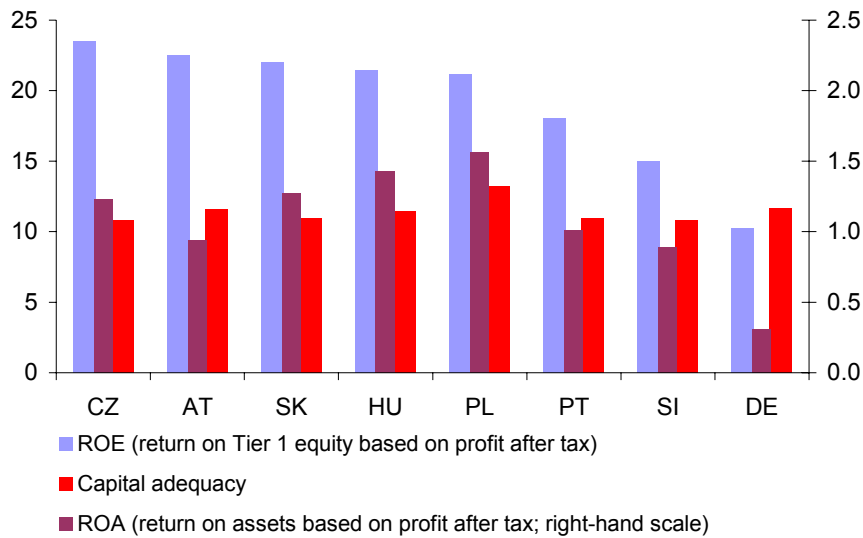
c) Consolidated data. Pre-tax profit/assets as at year-end.

d) Weighted average.

Sources: CNB, national central banks.



**Chart 23: Profitability and capital adequacy of banks in 2006 (%)**



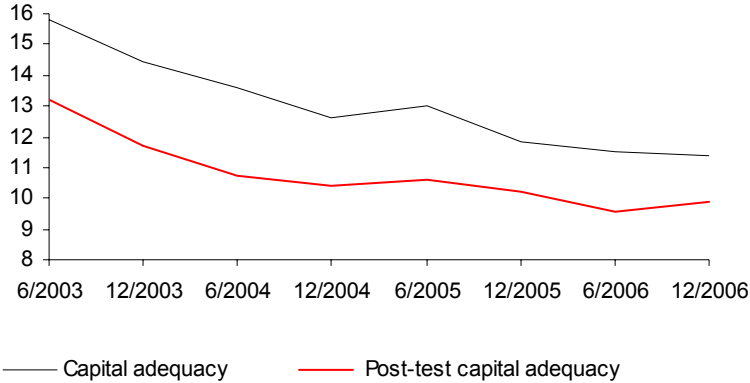
Note: Consolidated data.

Sources: CNB, national central banks, ECB.

The banking sector as a whole secured stability for both the given and following year and maintained its ability to absorb potential external shocks and unfavourable macroeconomic factors. This was also indicated by the **results of stress tests**. The banking sector was stress-tested by adverse changes in interest rates, the exchange rate and loan quality. This stress stemmed from the scenario of a hypothetical 2 percentage point rise in interest rates, a 20% depreciation of the exchange rate and a 3 percentage point rise in the ratio of non-performing loans to total loans. The effects of combinations of these shocks were assessed by comparing the capital adequacy ratio before and after the shocks affected banks' portfolios. The banking sector did well as a whole, with a capital adequacy ratio of 9.9% after significant hypothetical shocks with the data as of the end of 2006 (see Chart 24).

The scenario, including an in-built outlook for macroeconomic variables from the CNB forecast and the credit model of credit risk development, indicates only mild impacts on banks' solvency over the next year. Under the worst macroeconomic scenario considered, the capital adequacy of the banking sector could drop to 10.5%.

**Chart 24: Stress test results for the Czech banking sector (capital adequacy, in %)**



Source: CNB

In conditions of domestic economic growth and economic recovery in EU countries, the banking sector as a whole meets the capital, profit and prudential prerequisites for further development of lending to the corporate sector and households, even though bank loans to households are increasing by 32% year on year.

In the context of completed structural changes, the Czech banking sector has created suitable conditions for coping with potential economic shocks. The favourable impact of the changes is, however, partly spent, due to declining solvency and capital adequacy of banks following the distribution of profits to bank owners. The transition of the banking system to the Basel II requirements in 2007 may cause increased capital requirements, connected internally with increased coverage of banks’ operational risk, and externally with coverage of credit risk vis-à-vis the corporate sector. In conditions of gradually rising interest rates, it cannot be ruled out that some households might have difficulties repaying their loans. This would be reflected in a deterioration of the loan portfolio. A further rise in household indebtedness could necessitate higher additions to provisions within the banking sector if banks underestimate the inability to repay debts. The 2007 situation is still acceptable in this respect, but going forward the development of banking transactions may require capital reinforcement of banks.

### 3. SUMMARY OF RESULTS OF ANALYSES – COMPARISON WITH 2006 DOCUMENT

Analysis	Method / Category	Section	Value 2006 <sup>a</sup>	Value 2007 <sup>b</sup>	Commentary
<b>CYCLICAL AND STRUCTURAL ALIGNMENT</b>					
<b>Direct alignment indicators</b>					
Real economic convergence	GDP per capita, PPP, EA-12=100	1.1.1	68.5	72.1 <sup>c</sup>	The Czech Republic continues to converge. Indicator above the levels of PT, HU, SK and PL.
	Price level of GDP, EA-12=100	1.1.1	55.0	57.8 <sup>c</sup>	Further convergence in 2006, but still lagging well behind AT, DE, PT and SI.
	Real exchange rate against the euro, 1998=100	1.1.1	123	129	Real appreciation present (higher on average since 1998 than in all the countries compared except SK and HU).
	3M real interest rates	1.1.1	0.4	0.2	Together with PT and SK by far the lowest level in 2006. Although lower interest rates are beneficial for adoption of the euro, further real appreciation may lead to negative short-term money market rates in real terms.
Correlation coefficients of real economic activity (CZ and EA-12).  2006 value: 2001 Q1–2006 Q1 2007 value: 2002 Q1–2007 Q1  Method 1: year-on-year difference Method 2: quarter-on-quarter (or, month-on-month) difference	GDP (Method 1)	1.1.2	0.29	0.62 <sup>c</sup>	The correlation under Method 1 is statistically significantly different from zero and the coefficient is rising over time. However, the relationship may have been affected by the cycle in the euro area and the trend in the Czech Republic. Correlation coefficient lower than in other countries compared except HU. Method 2 finds no statistically significant correlation.
	GDP (Method 2)	1.1.2	0.26	0.33 <sup>c</sup>	
	GDP (Method 1, dynamic correlation, average for cycle lengths considered)	1.1.2	0.33	0.70 <sup>c</sup>	
	IPI (Method 1)	1.1.2	0.77	0.77 <sup>c</sup>	The correlation is statistically significant; the value is comparable with or higher than in most countries compared except DE. Indicator describes only part of the economy.
	IPI (Method 2)	1.1.2	0.41	0.25 <sup>c</sup>	
	Total exports (Method 1)	1.1.2	0.64	0.63 <sup>c</sup>	The methods provide different results. Method 1 shows a statistically significant correlation.
	Total exports (Method 2)	1.1.2	0	-0.04 <sup>c</sup>	
	Czech exports to EA-12 vs. GDP EA-12 (Method 1)	1.1.2	0.42	0.38 <sup>c</sup>	Method 1 shows a decline in correlation between periods. Both methods reject a statistically significant relationship in the recent period.
Czech exports to EA-12 vs. GDP EA-12 (Method 2)	1.1.2	0.24	0.30 <sup>c</sup>		

Analysis	Method / Category	Section	Value 2006 <sup>a</sup>	Value 2007 <sup>b</sup>	Commentary
Synchronisation of demand shocks	Structural vector autoregression, correlation	1.1.3	asymmetry	asymmetry <sup>c</sup>	Zero correlation of shocks, unchanged between the periods under review. Other countries compared except HU also show no statistically significant correlation.
Synchronisation of supply shocks	Structural vector autoregression, correlation	1.1.3	asymmetry	asymmetry <sup>c</sup>	Since 2001, the correlation has moved from negative values closer to zero.
Impact of an asymmetric shock brought about by an inflow of EU funds	Calculation using fiscal impulse method and CNB's quarterly prediction model	1.1.4	insignificant impact	insignificant impact <sup>c</sup>	A smoother commencement of EU fund drawdown is expected. No significant pressure will be created on monetary policy and the exchange rate.
Structural similarity of the Czech economy and the EU-12 economy	Landesmann index	1.1.5	0.15	0.15	The Czech Republic has the highest structural discrepancy among the countries compared.
Convergence of the interest rate differential	Difference in three-month and five-year interest rates	1.1.6	convergence	convergence <sup>c</sup>	The Czech Republic has a zero to slightly negative interest rate differential.
Convergence of exchange rates to the euro	Bivariate GARCH	1.1.7	high correlation	high correlation	The high correlation has decreased slightly since last year owing to the volatility of the dollar exchange rate.
Exchange rate volatility (exchange rate to euro, annualised, in %)	historical (daily returns for a period of six months)	1.1.8	<5 (2006)	4 (2007)	Decreasing volatility over time. CZK has recently had the lowest volatility among the countries compared.
	implied (options)	1.1.8	<5,5 (2006)	4 (2007)	A slightly downward tendency over time, lower than SK, HU and PL.
	historical (quarterly returns, 1999–2006)	1.1.8	3.8	3.6	Variability higher than SI, lower than PL, HU and SK.
	fundamental (OCA criteria)	1.1.8	6.0	5.9	Expected variability similar to HU and SK.
<b>The effect of international economic relations</b>					
Share of foreign trade with the euro area in total foreign trade	Exports, %	1.2.1	59.3	58.4	A high level of trade links. Among the higher ones on the export side, although declining slightly. Rising on the import side.
	Imports, %	1.2.1	52.9	58.4	
Ratio of direct investment to/from the euro area to GDP	Inflow of direct investment, % (stock)	1.2.1	38 (2004)	42 (2005)	A high level of ownership links, particularly on the FDI inflow side.
	Outflow of direct investment, % (stock)	1.2.1	1 (2004)	1 (2005)	
Share of intra-industry trade	Grubel-Lloyd index	1.2.2	0.8 (2004)	0.8 (2005)	The high share of intra-industry trade (only AT has a higher share) remains broadly unchanged.

Analysis	Method / Category	Section	Value 2006 <sup>a</sup>	Value 2007 <sup>b</sup>	Commentary
<b>Financial market</b>					
Financial sector	Financial system assets, % of GDP	1.3.1	134.8	133.4 <sup>c</sup>	The ratio of financial system assets to GDP and the ratio of loans to GDP are substantially lower than in AT, DE and PT, slightly lower than in SI and higher than in SK and PL. As regards the structure of the Czech financial sector, similar to the euro area average. The ratio of loans to households is rising dynamically.
	Bank loans to non-bank clients, % of GDP	1.3.1	40.5	45.3 <sup>c</sup>	
	Banking sector assets /financial system assets, %	1.3.1	73.6	73.3	
	Bank loans to households, % of total loans	1.3.1	34.7	38.2	
Stock market integration Speed of convergence of yields with yields in the euro area (beta-konvergence coefficient, 2001–2007)	Money market	1.3.2	-	-0.6	High speed of adjustment on the stock and bonds markets, comparable to that in AT and PT. On the foreign exchange market comparable to the other countries under review except SI; lower on the money market.
	Foreign exchange market	1.3.2	-	-0.9	
	Bond market (2002–2007)	1.3.2	-	-0.9	
	Stock market	1.3.2	-0.9	-0.9	

Analysis	Method / Category	Section	Value 2006 <sup>a</sup>	Value 2007 <sup>b</sup>	Commentary
<b>ADJUSTMENT MECHANISMS</b>					
<b>Fiscal policy</b>					
General government deficit (estimate for the current year)	CNB estimate % of GDP, ESA 95	2.1.2	-3.5 (2006)	-3.5 <sup>c</sup> (2007)	Despite worse expectations the Maastricht criterium was ultimately narrowly fulfilled in 2006. A deterioration is expected in 2007.
Public debt (estimate for the current year)	CNB estimate % of GDP, ESA 95	2.1.2	30.6 (2006)	30.5 (2007)	Outlook for virtually no change in percentage (due to GDP growth).
<b>Wage and price flexibility</b>					
Real wage elasticity 2001–2006 Q1 or 2002–2007 Q1	Phillips curve	2.2.1	-0.008	-0.019	No statistically significant change in wage elasticity compared to the previous analysis. There seems to have been a decline in elasticity to statistically insignificant values since the 1990s. Low elasticity is also observed for the other countries compared.
Real wage elasticity 2005–2006	Wage curve	2.2.2	-	0.06	No statistically significant relationship between regional unemployment and wages has been observed in the Czech economy recently.
Inflation persistence 1998–2006	Method 1 (non-parametric)	2.2.3	0.93	0.92	The methods yield different results. Method 3, which probably best takes into account the transition nature of the Czech economy, assesses inflation persistence as comparable with AT and DE, but higher than PT and SI.
	Method 2 (sum of AR coeffs, constant mean)	2.2.3	-	0.74	
	Method 3 (sum of AR coeffs, time-varying mean)	2.2.3	-	0.45	
<b>Labour market flexibility</b>					
Long-term unemployment	Long-term unemployment rate, %	2.3.1	4.2	3.9	Modest fall in long-term unemployment; higher values than in AT, PT, HU and SI. The share of the long-term unemployed is high and rising (related to the cycle).
	Long-term unemployment as a share of total unemployment, %	2.3.1	53	54	
Regional differences in unemployment	Coefficient of variation in the unemployment rate (at regional level, NUTS-3)	2.3.1	44 (2004)	47 (2005)	Together with DE the highest values among the countries compared (in DE the difference is chiefly between the eastern and western states); growth since last year (cyclical in nature).
Population mobility	Internal migration – per 1,000 inhabitants	2.3.1	20.9	21.9	Internal migration probably lower than in AT and DE and higher than in PL, SI and SK.
International migration	Immigrants – per 10,000 inhabitants	2.3.2	59	66	Less intensity than in AT, DE and SI and more than in HU, PL and SK. The rise in CZ since 2002 may be linked with a partial relaxation of administrative requirements and in 2006 to the development of demand for labour.

Analysis	Method / Category	Section	Value 2006 <sup>a</sup>	Value 2007 <sup>b</sup>	Commentary
Institutional environment	Trade unions and collective bargaining	2.3.3			According to OECD a relatively low effect of collective bargaining on wage creation by international comparison (2000 data). New studies indicate potential higher coverage by collective agreements in the Czech Republic, even though the effect of collective bargaining is rather limited.
	Minimum wage as % of average wage in industry and services	2.3.3	38.8 (2004)	39.1 <sup>c</sup> (2005)	According to CNB estimates the percentage increased by 0.6 p.p. in 2006, but fell in 2007.
	Employment protection legislation index – permanent employment	2.3.3	3.3 (2003)	3.3 (2006)	Behind PT the highest among the countries compared (OECD data for 2006). According to CNB estimates the index fell slightly in 2007 owing to the change in labour law in the Czech Republic.
	Employment protection legislation index – temporary employment	2.3.3	0.5 (2003)	1.1 (2006)	Behind SK the lowest level among the countries compared.
	Index of administrative barriers to entrepreneurship	2.3.3	1.9 (2003)	1.9 (2003)	The highest behind PL. There was probably a partial improvement in 2005–2007 (amendments to the Commercial Code and the Trades Licensing Act), with a possible positive impact on job creation.
	Overall labour taxation (persons at the average wage level, %)	2.3.3	43.8	42.6	A slight decline. Lower than in AT, DE, HU and PL, but higher than in the other countries compared.
	Overall labour taxation (persons at two-thirds of the average wage level, %)	2.3.3	42.1	40.1 <sup>c</sup>	
	Share of net income of households without and with employment, % <sup>e</sup>	2.3.3	81 (2004)	74 <sup>c</sup> (2006)	A decline in 2006, but the financial incentive for the long-term unemployed (families with children) to seek a job is still quite low. Simulations show a weakening of the financial incentive to seek a job for households with children following the reform of social benefits in January 2007.

Analysis	Method / Category	Section	Value 2006 <sup>a</sup>	Value 2007 <sup>b</sup>	Commentary
<b>Flexibility and shock-absorbing capacity of the financial sector</b>					
Non-performing loans in the banking sector	Percentage share of total loans	2.4	3.9	3.7	Percentage virtually unchanged from the previous year. Slightly higher than in PT, AT and HU, but lower than in PL, SI, SK and DE.
Net interest margin	%	2.4	2.4	2.4	Interest margin broadly stable. Lower than in HU and PL. Higher than in the euro area countries compared.
Net non-interest income	Percentage of average assets	2.4	1.6	1.5	Higher than in the euro area countries compared and SK.
Pre-tax profit/average assets	%	2.4	1.8	1.6	Behind HU and PL the highest among the countries compared.
Capital adequacy in banks	%	2.4	11.9	11.4	A modest decline; remains at an acceptable level similar to that in the other countries compared.
Capital adequacy in banks after stress tests	%	2.4	10.2	9.9	Sufficient level.

Note: a) "Value 2006" is the most recent value of the indicator compared in the 2006 document. Unless stated otherwise, the data are for 2005.

b) "Value 2007" is the most recent value of the indicator compared in the 2007 document. Unless stated otherwise, the data are for 2006.

c) Value 2007 is not fully comparable with value 2006. The reasons include in particular a revision of the data on the variable observed, a change in calculation, or a different implementation (in the case of fiscal policy).

d) The share of direct investment from/to the euro area in total direct investment to/from the Czech Republic.

e) Unemployed after five years, potential income from employment at 67% of the average wage. Second person economically inactive, children 4 and 6 years old.



## E. Methodological Part

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The analyses in this document are based on data published up to the end of August 2007. Given the time coverage, which for most of the analyses ends with 2006, the euro area as a whole is defined as the EA-12. Unavailable data are indicated with “.” in the tables in part D; “-” in part 3 means that the analysis was not performed in that particular year.

### 1. CYCLICAL AND STRUCTURAL ALIGNMENT

#### 1.1 Direct alignment indicators

##### 1.1.1 Real economic convergence

The comparison of GDP per capita in purchasing power parity and the average price level of GDP is based on Eurostat data, derived from the International Comparison Program (ICP). The real exchange rate against the euro is based on the Harmonised Index of Consumer Prices (or national consumer price indices where HICP data are missing). The annual rate of appreciation is calculated as the geometric mean of the appreciation since 1993 or 1998. The chart showing the breakdown of inflation in the Czech Republic into food prices, other tradables prices, regulated prices and other nontradables prices is based on regular CNB analyses conducted for monetary policy purposes (see also the Inflation Reports published by the CNB). These analyses use CZSO data on the prices of individual consumer basket items.

The estimate of future appreciation over the next five years is based on two methods. Method 1 is based on a panel estimate, which links the price level of final consumption of households with GDP at purchasing power parity per capita for 32 European countries between 1995 and 2006 (see also Čihák and Holub, 2003 and 2005). The following relationship was estimated using a two-stage least-squares panel method with no fixed or random effects:

$$P_{C,t} = 28.14 + 0.75 GDP_{PPP,t} + 0.92 AR(1)_t,$$

where  $P_{C,t}$  is the price level of final consumption of households in year  $t$ ,  $GDP_{PPP,t}$  is gross domestic product at purchasing power parity per capita in year  $t$  (in both cases EA-12 = 100) and  $AR(1)_t$  is the first-order autoregression term.<sup>81</sup> The simulations of the rate of equilibrium real appreciation assume beta-convergence of GDP towards the level of the EA-12 at a rate of 3% a year. A range of estimates around the mean appreciation estimate is obtained by increasing or decreasing the coefficient of the autoregression term by one standard deviation of its estimate (i.e. within a range of roughly 0.89–0.95).<sup>82</sup>

Method 2 uses estimates of equilibrium real appreciation for the Czech Republic, Hungary, Poland, Slovakia and Slovenia presented in an analysis by Brůha and Podpiera (2007). This analysis is based on a calibrated dynamic general equilibrium model for two unequally

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<sup>81</sup> A constant,  $P_{C,t-1}$ ,  $P_{C,t-2}$ ,  $GDP_{PPP,t-1}$  and  $GDP_{PPP,t-2}$  were used as the instrumental variables.

<sup>82</sup> The method used has thus been refined in two respects compared to the analyses for 2006. First, panel regression is used instead of country comparisons for a single year (“cross-country estimates”), substantially increasing the number of observations. Second, panel regression permits direct estimation of the autoregression process involving the residuals for the individual countries, and quantification of the degree of uncertainty of this estimation, whereas the previous analyses assumed an ad hoc interval (0.9–0.975) for the autoregression term.

developed countries in which real appreciation is going on owing mainly to investment in product quality.

Real interest rates are derived from three-month money market interest rates. Their average annual level is deflated by the average annual inflation rate for the country concerned, using the Harmonised Index of Consumer Prices. The estimate of real rates going forward is based on the assumptions of full elimination of the risk premium thanks to euro adoption and an equilibrium three-month real rate in the euro area of approximately 1.8%.<sup>83</sup> From this figure, the range of the estimates of equilibrium real appreciation for each of the countries (see above) is subtracted, corresponding to the future expected inflation differential vis-à-vis the euro area average.

### 1.1.2 Correlation of economic activity

The alignment of economic activity in the selected countries with the euro area is analysed using correlation analysis. Mutual relationships between individual countries and the euro area are assessed using the pairwise correlation coefficients applied to real GDP time series, industrial production indices (IPIs) and export indices.

The simple (Pearson) correlation coefficient is used to assess the strength of the linear relationship:

$$r_{xy} = \frac{s_{xy}}{\sqrt{\sigma_x^2 \sigma_y^2}},$$

where  $s_{xy}$  is the estimate of covariance and  $\sigma_x$  and  $\sigma_y$  are estimates of the standard deviation of time series  $x$  and  $y$ .

Simple correlations are calculated over a moving time window to obtain the rolling correlation. The corresponding time window for a given quarter is defined as the last 20 observations (5 years). The rolling correlation should help to reveal trends in alignment.

When examining alignment of the cyclical behaviour between selected economies in order to assess the impact of economic policy, it is appropriate to monitor the correlation only within a certain band. Cycles between one and half and eight years long are considered most frequently. Dynamic correlation<sup>84</sup>, which allows this requirement to be met, was therefore used as a third method. Dynamic correlation is based on spectral analysis of time series, takes values in the range [-1,1] and, analogously to the static correlation coefficient, is defined by the relationship:

$$\rho_{xy}(\lambda) = \frac{C_{xy}(\lambda)}{\sqrt{S_x(\lambda)S_y(\lambda)}},$$

where  $S_x(\lambda)$  and  $S_y(\lambda)$  are spectral density functions and  $C_{xy}(\lambda)$  is a cospectrum, while  $\lambda$  takes values in the range  $[-\pi, \pi]$ . The simple static correlation is then a function (approximately the average) of the dynamic correlations across the entire observed spectrum.

The analysis uses quarterly real GDP time series at 2000 constant prices (expressed in national currencies), monthly time series of the Industrial Production Index adjusted for working days, and monthly or quarterly time series of total exports and exports to the euro

<sup>83</sup> Compared to the 2006 analyses, the assumption for the three-month real rate in the euro area was raised by 0.8 percentage point, in line with the change in the estimated equilibrium real rate in the euro area in the CNB forecasts.

<sup>84</sup> Croux, Forni and Reichlin (2001).

area expressed in the national currency. The source of the GDP and IPI data is Eurostat; the export data are obtained from the IMF database.

As in the previous years, results for Portugal are not included in the analysis of real GDP correlation, since no comparable data are available for the country. Export data are available only in USD from the IMF database, so they had to be converted into national currencies. Average monthly or quarterly exchange rates according to the IMF were used for the conversion.

Time series are expressed in logs, seasonally adjusted and detrended. As the literature<sup>85</sup> does not offer a consensus on the optimal detrending method, the analysis applies two different detrending methods – namely year-on-year differences between the original time series and quarter-on-quarter (month-on-month) differences between the seasonally adjusted time series:

### **Method 1**

Year-on-year differences in the seasonally unadjusted (log) time series are given by:

$$\ln y_t - \ln y_{t-s},$$

where  $y$  denotes the variable under investigation,  $t$  is the time period and  $s$  is seasonality ( $s = 4$  for quarterly data,  $s = 12$  for monthly data).

### **Method 2**

The correlation of economic activity can also be analysed using quarter-on-quarter or month-on-month changes in the seasonally adjusted time series ( $\ln y_{sa,t}$ ):

$$\ln y_{sa,t} - \ln y_{sa,t-1},$$

where  $y_{sa}$  is seasonally adjusted using the TRAMO/SEATS method.

In most cases, it is possible – based on the resulting time series – to conclude that the above methods succeed in detrending. As regards GDP in the Czech Republic or Slovakia, the results are not entirely clear. However, the shortness of the time series makes it impossible to check reliably whether the resulting series are stationary. Moreover, the same detrending method has to be used for all the series under review to maintain comparability.

Given the requirement to assess the development in the alignment of the business cycles of individual countries vis-à-vis the euro area, correlation coefficients (both static and dynamic), with respect to the quarterly real GDP time series are calculated separately for two time periods: 1997 Q1–2001 Q4 and 2002 Q1–2007 Q1. An analysis using rolling correlations was prepared as an alternative to the breakdown into two periods. As the time series of the Industrial Production Index begin at different points in time for different countries, the periods are defined as January 1999–December 2001 and January 2002–May 2007 in this case. Relatively long time series are available for export data, so it was possible to calculate all correlation coefficients for two periods as in the case of GDP. Specifically, these periods are 1997 Q1–2001 Q4 and 2002 Q1–2006 Q4 for quarterly data and January 1997–December 2001 and January 2002–December 2006 for monthly data. The choice of intervals was motivated by maximum possible unification to make results mutually comparable.

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<sup>85</sup> For example, Frankel and Rose (1997). The features of the individual methods are described in Canova (1998).

### 1.1.3 Synchronisation of economic shocks

A bi-variate structural vector autoregressive (SVAR) procedure is applied to identify demand and supply shocks (see Blanchard and Quah, 1989; Bayoumi and Eichengreen, 1993; and Babetskii, 2004 and 2005). Quarterly seasonally adjusted GDP series at constant prices and the GDP deflator in selected new EU countries (Czech Republic, Hungary, Poland, Slovakia and Slovenia) and current euro area members (Germany, Portugal and Austria) are the inputs for the SVAR model. The source of the data is Eurostat and the data cover the period 1996–2007 Q2. The calculation of the correlation of shocks between the group of new EU Member States and the current euro area members and the whole EA-12 indicates the degree of asymmetry of shocks vis-à-vis the euro area.

As the mean correlation of the shocks for the whole estimated period represents a simplified view for the new Member States and may have been affected by their transition to a market economy and the EU accession negotiations, the correlation was also calculated for an earlier and a later period, namely 1996–2001 and 2002 to date.

### 1.1.4 Macroeconomic effects of financial flows from EU funds

Ministry of Finance working estimates of financial flows between the Czech Republic and the EU in 2007–2013 are used as the input data for the analysis of the macroeconomic effects of financial flows from the EU funds. These estimates are primarily in euros and respect the methodology for drawing on EU funds. The analysis also includes data on actual financial flows between the Czech Republic and the EU in 2005 and 2006. The forecasted CZK/EUR exchange rate according to the CNB's July macroeconomic forecast is used to translate the data in EUR into CZK.

The macroeconomic effects of flows from the EU funds are simulated using the CNB's quarterly prediction model.<sup>86</sup> In addition to the standard fiscal impulse, the additional impulse from the inflow of EU funds is included in the output gap equation as a residual. The macroeconomic effects are expressed as deviations of the monitored indicators from the baseline scenario of the CNB's July 2007 macroeconomic forecast.

The economic impulse from flows of EU funds is derived from the volumes of additional income that the private sector has drawn or is expected to draw from the EU funds beyond the funds included under public sector expenditure (hereinafter additional income from the EU). The additional income includes the SAPARD and PHARE pre-accession instruments, funds for support of agriculture, approximately 70% of the funds for projects from the structural funds and funds for internal policies. By contrast, the calculation of the impulse does not include income from the Cohesion Fund and the ISPA pre-accession instrument<sup>87</sup>, which is aimed at large infrastructure projects and environmental protection projects. As these funds are applied for mainly by the state, they should be included under public sector investment. Compensations that represent direct revenue of the state budget are also not taken into account. The additional demand of the public sector due to these incomes is included in the fiscal impulse, which is a standard input to the CNB forecast.

For the purposes of calculating the economic impulse, the additional income from the EU does not comprise actually reported financial flows under the Czech Republic's net balance

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<sup>86</sup> For more details on the CNB's quarterly prediction model, see Beneš et al. (2003).

<sup>87</sup> The ISPA pre-accession instrument was the predecessor of financial aid from the Cohesion Fund in the period before the Czech Republic's accession to the EU.

vis-à-vis the EU, but only include “realised expenditure”.<sup>88</sup> Thus, for example, advance payments as yet unspent to reimburse for implemented projects are excluded. The amounts of realised expenditure in 2005, 2006 and the first half of 2007 are taken from the document “The Course of Drawdown of Structural Funds” compiled by the Ministry for Regional Development<sup>89</sup>. The forecast for realised expenditure in 2007–2013 is an expert estimate by the CNB. The calculations consider the potential non-existence of a long lag between project implementation and the subsequent submission of the payment request by the final beneficiaries.

The final value of the impulse expressing the effects of additional income from the EU on annual real GDP growth in percentage points is derived using the same procedure as in the calculation of the fiscal impulse in the CNB’s forecasting system, i.e. the year-on-year change in the additional income from the EU as a percentage of GDP, multiplied by an estimated multiplier. The data on Czech GDP in 2007–2013 are taken from the CNB’s July forecast (it is also assumed that the GDP deflator index will be close to the inflation target).

### 1.1.5 Assessment of the economies’ structural similarity

The structural similarity of the economies is compared using the Landesmann structural coefficient. The coefficient is calculated by comparing the shares of individual sectors, e.g. industry or construction, in total value added in country A (in our case, the Czech Republic, Germany, Austria, Portugal, Hungary, Poland, Slovenia and Slovakia) vis-à-vis country B (i.e. the EA-12). The difference between the shares is weighted by the share of the sector in country A in the total, and the weighted shares are then summed.

The calculation of the coefficient can be expressed formally as follows:

$$SL = \sum_{i=1}^n \sqrt{(sh_A^i - sh_B^i)^2} \cdot \left( \frac{sh_A^i}{100} \right)$$

where  $sh_A^i$  is the percentage share of the i-th sector in value added as a whole in country A and  $sh_B^i$  is the percentage share of the i-th sector in value added as a whole in country B. The calculation is performed separately for each selected period. In our case, it is based on annual data. The structure of the coefficient is described in detail in Landesmann (1995) and also in Flek et al. (2001).

For the purposes of the analysis the coefficient was modified to  $SL/100$ .<sup>90</sup> Adjusted in this way, the coefficient takes a value in the range of [0, 1]. The closer the coefficient is to zero, the more similar in structure are the economies.

<sup>88</sup> Realised expenditure includes funds applied for in the payment requests submitted by final beneficiaries to the intermediate body.

<sup>89</sup> [www.strukturalni-fondy.cz](http://www.strukturalni-fondy.cz)

<sup>90</sup>  $SL = \sum_{i=1}^n \sqrt{(I_{sh_A^i} \cdot 100 - I_{sh_B^i} \cdot 100)^2} \cdot \left( \frac{I_{sh_A^i} \cdot 100}{100} \right) = 100 \sum_{i=1}^n \sqrt{(I_{sh_A^i} - I_{sh_B^i})^2} \cdot I_{sh_A^i} = 100 \cdot I_{SL}$

In this case, indices are used rather than the percentage shares of individual sectors in the total.

### 1.1.6 Convergence of the interest rate differential

Interest rate convergence can be examined using the unit root test (see, for example, Lee and Wu, 2004, and Kočenda, 2001). However, the relatively short length of the available time series, as well as breaks in the time series, must be taken into account when analysing the convergence of interest rates in the Czech Republic, Hungary, Poland, Slovenia and Slovakia. The simple method of a chart showing the interest rate differentials vis-à-vis the euro area is therefore used.

Bloomberg data were used to measure the interest rate differentials between three-month and five-year rates in the euro area and the Czech Republic, Hungary, Poland, Slovenia and Slovakia. Instruments with a maturity of three months are compared using the Euro Area Interbank Offered Rate (EURIBOR), Prague Interbank Offered Rate (PRIBOR), Budapest Interbank Offered Rate (BUBOR), Warsaw Interbank Offer/Bid Rate (WIBO), Slovenia Interbank Rate (SITI) and Bratislava Interbank Offered Rate (BRIBOR).<sup>91</sup> The interest rate on five-year government bonds is used to compare longer-term interest rates.<sup>92</sup>

The time series of three-month interest rates starts in January 1998 for all of the countries monitored, excluding Slovenia, whose time series starts in May 1998. The time series of five-year interest rates starts in January 1998 for the euro area, the Czech Republic and Hungary, March 1999 for Poland and February 2002 for Slovakia; no data are available for Slovenia. All the time series terminate in July 2007.

The time series “EMU convergence criterion bond yields” from the New Cronos database (Eurostat) were used to compare 10Y government bond yields. These time series are based on the gross yield on government bonds on the secondary market with approximately ten years to maturity. A weighted yield is created by Eurostat for the EA-12, in which the weights applied are the nominal stocks of government bonds in each country. For the period before 1999, the weights are based on national GDP in purchasing power parity.

The compared data cover the period between January 1990 and April 2007 and are published monthly.

### 1.1.7 Exchange rate convergence

Aguilar and Hördahl (1998) express the probability of adoption of the euro by the then EMU candidate countries using the correlation of the exchange rates of their currencies and the Deutsche Mark (as a proxy for the euro) vis-à-vis the US dollar.<sup>93</sup> The exchange rates of the two currencies are thus expressed in terms of the currency of a third country which is not an EMU member. The correlation between the movements of two currencies in a monetary union should by definition equal 1; therefore, a higher correlation means higher probability of participation in the EMU since its creation.

The analysis in this document uses the same method to assess how close the Czech Republic, Hungary, Poland, Slovenia and Slovakia are to adopting the euro.

The correlation coefficient is based on a bivariate GARCH estimate and is calculated according to the following formula:

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<sup>91</sup> Missing data were adopted from the New Cronos database. They include three-month interest rates of the euro area until December 1998 and three-month interest rates of Slovenia from May 1998 to December 2001.

<sup>92</sup> The codes in the Bloomberg system are as follows: EUR003M Index, PRIB03M Index, BUBOR03M Index, WIBO03M Index, SITI03M Index, BBOR03M Index, and GECU5YR Index, CZGB5YR Index, GHGB5YR Index, POGB5YR Index, and CTSKK5YR Corp.

<sup>93</sup> The same method is used in Castrén and Mazzotta (2005).

$$corr = \frac{\text{cov}(NC / USD, EUR / USD)}{\sqrt{\text{var}(NC / USD) * \text{var}(EUR / USD)}}$$

, where *NC* represents the national currencies.

This method returns a correlation coefficient which changes over time and therefore provides more information than a simple correlation coefficient of the exchange rate of the national currency against the euro. Moreover, the use of the GARCH technique allows all the information in the data to be utilised. A higher GARCH correlation means similar developments in exchange rate volatility, which can be interpreted as synchronisation of exchange rate shocks in the countries under review.

The analysis covers the period from 1 January 1994 to 10 August 2007 and uses daily Bloomberg data. The Slovenian tolar rate until 1998 was obtained from the website of the Bank of Slovenia.

### 1.1.8 Analysis of exchange rate volatility

The historical exchange rate volatility is calculated as a standard deviation of the logarithmic daily returns for a period of six months:

$$\sigma = \sqrt{\frac{1}{T-1} \sum_{t=1}^T (r_t - \bar{r})^2},$$

where  $\sigma$  is the standard deviation,  $r_t$  is the daily return and  $T$  is the number of working days in the period of six months (126 for a year with 252 working days). We use the following relationship to translate the standard deviation of the logarithmic daily returns to an annual form:

$$\sigma_{ann} = \sigma \sqrt{N}, \text{ where } N=252 \text{ represents the approximate number of business days in the year.}$$

The historical volatility of the exchange rates of the countries under comparison against the euro is calculated using exchange rates announced by the CNB.

The implied volatility is derived from market prices of options using the given valuation model. This volatility is directly quoted in the trading system. The source of the data is Bloomberg, and the index codes are EURCZKV6M, EURSKKV6M, EURPLNV6M and EURHUF6VM.

The fundamental-based exchange rate volatility ( $FVOL_{ij}$ ) is calculated as a weighted average of the selected economic values describing the alignment between the analysed countries and the euro area:

$FVOL_{ij} = \alpha + \beta OPENNESS_{ij} + \chi FIN_{ij} + \mu DISSIM_{ij} + \rho TRADE_{ij}$ , where  $OPENNESS_{ij}$  describes the openness of the economies,  $FIN_{ij}$  financial development,  $DISSIM_{ij}$  dissimilar commodity structure of exports and  $TRADE_{ij}$  integration of international trade. The respective weights ( $\alpha, \beta, \chi, \mu, \rho$ ) are assumed based on the estimates in Horváth (2005), as well as the methodology of calculation of the above economic variables. The justification of selection of the respective economic variables can be found in Bayoumi and Eichengreen (1997), and Horváth (2005).

As the calculation of the fundamental-based volatility is based on quarterly economic data, the historical exchange rate volatility used for comparison with the fundamental-based volatility is calculated using quarterly data in 1999–2006 as follows:  $VOL_{ij} = SD[\Delta(\log e_{ij})]$ ,

where  $SD$  is the standard deviation of the quarter-on-quarter change ( $\Delta$ ) in the logarithm of the nominal rate ( $e_{ij}$ ) between countries  $i$  and  $j$ . The fundamental-based and historical volatilities are then translated to their annualised value in accordance with the above formula.

## 1.2 The effect of international economic relations

### 1.2.1 The links of the economy with the euro area

The data for the calculation of the shares of exports to the euro area and imports from the euro area in total exports and imports are taken from the Direction of Trade Statistics database of the International Monetary Fund (IMF).

The source of data for the analysis of the regional structure of direct investment is the Eurostat database. Data on the inflow of foreign direct investment (FDI) from euro area countries and the outflow of direct investment (DI) to euro area countries were used.

### 1.2.2 Intra-industry trade

The Grubel-Lloyd index (GLI) was used to analyse intra-industry trade. The GLI is the ratio of the absolute value of intra-industry trade to foreign trade turnover.  $X_{it}$  and  $M_{it}$  denote total exports and imports of the  $i$ -th commodity at time  $t$ . The index takes values ranging from 0 to 1. A value of 0 indicates that all trade is inter-industry trade and that there is specialisation in different commodities. A value of 1 indicates that all trade is intra-industry trade (Flek et al., 2001).

$$GLI_i = 1 - \frac{\sum_i |X_{it} - M_{it}|}{\sum_i |X_{it} + M_{it}|}$$

The GLI is calculated using data on total exports and imports in the countries under review, broken down according to the two-digit SITC classification (the commodities  $i$  are thus given by SITC groups at the two-digit level). The data source is the OECD OLISnext database.

## 1.3 Financial market

### 1.3.1 Financial sector

**Financial system assets/GDP** (ratio of net book value of financial sector assets to GDP at current prices) – expresses the asset strength of intermediation by banks and non-bank financial institutions: insurance corporations, pension funds, credit unions, investment companies and investment funds (unit trusts), financial leasing corporations and other financial corporations (forfeiting and factoring companies, investment firms, bureaux de change, etc.). Generally speaking, the more advanced the market, the larger the assets and the deeper the financial intermediation relative to GDP.

The inclusion of assets provided to both residents and non-residents is a methodological problem. For the purposes of economic interpretation, it is appropriate also to analyse the share of residents' assets alone.

**Bank loans to non-bank clients/GDP** (ratio of gross book value of loans to non-bank clients, corporations and households to GDP at current prices) – expresses the depth of financial



intermediation by banks. Loans to both residents and non-residents present the business dimension of financial intermediation.

For the purposes of economic interpretation it would be more appropriate to use the ratio of loans granted to residents, which forms part of the monetary survey and macroeconomic analyses. However, it is sometimes difficult to exclude loans to the government, which are usually included in client loans.

**Banking sector assets/financial system assets** – expresses the share of the banking sector in the financial system of the country and at the same time banks' financial intermediation potential. In general, the more advanced the market, the larger the assets and the deeper the financial intermediation by non-bank financial institutions, which at the same time are usually internalised in strong bank and non-bank financial groups.

Structural change over time is important for economic interpretation – the share of banks in the financial system usually declines in developing market economies (unless one takes into account the formation of bank financial groups).

**Loans to households** in the Czech Republic mostly include debit balances on current accounts and balances on credit accounts of natural persons, i.e. loans to individuals (residents) and loans to small businesses (residents).

### 1.3.2 Financial market integration

For quantification of beta-convergence, it is useful to apply common regression analysis or the panel estimate method, in the form of the equation:

$$\Delta R_{i,t} = \alpha_i + \beta R_{i,t-1} + \sum_{l=1}^L \gamma_l \Delta R_{i,t-l} + \varepsilon_{i,t},$$

where  $R_{i,t} = Y_{i,t} - Y_{i,t}^B$  is the difference between the asset yields of country  $i$  and a selected reference territory (a benchmark, a European stock index) at time  $t$ ,<sup>94</sup>  $\Delta$  is the difference operator,  $\alpha_i$  is a dummy variable for the respective country,  $L$  is the maximum lag and  $\varepsilon_{i,t}$  is a random term. The size of coefficient  $\beta$  may be interpreted as a direct measure of the convergence speed. A negative beta coefficient indicates the occurrence of convergence, and the absolute value of the beta coefficient indicates the convergence speed. The  $\beta$  coefficient can take values ranging from 0 to -2. The closer the absolute value of the  $\beta$  coefficient to 1, the higher the speed of convergence. If  $\beta = 0$  or  $\beta = -2$ , no convergence is observed.  $\beta$  values from 0 to -1 indicate monotonous convergence, while fluctuating convergence occurs for values from -1 and -2.

For quantification of sigma-convergence, a calculation is used of the (cross-section) standard deviation ( $\sigma$ ), according to the formula:

$$\sigma_t = \sqrt{\left(\frac{1}{N-1}\right) \sum_{i=1}^N [\ln(y_{i,t}) - \ln(\bar{y}_t)]^2},$$

where  $y$  is the asset yield,  $\bar{y}$  is the mean value of the data-set over time  $t$  and  $i$  stands for the individual countries ( $i = 1, 2, \dots, N$ ). For the purposes of this analysis, we introduce  $N = 2$ , i.e. we examine the evolution of sigma-convergence over time between the euro area and one

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<sup>94</sup>  $Y_{i,t} = \left[ \ln(A_{i,t}) - \ln(A_{i,t-1}) \right]$ , where  $Y$  denotes the yield on the relevant asset,  $A$  the price index of the relevant asset (expressed as a basic index) and  $i$  the individual country.

of the countries under review.<sup>95</sup>  $\sigma$  takes only positive values in theory. The lower is  $\sigma$ , the higher is the level of convergence. In theory, full integration is reached when the standard deviation is zero, while high (several digit) values of  $\sigma$  reflect a very low degree of integration. For chart type expression, the results were filtered using the Hodrick-Prescott filter with the recommended weekly time series coefficient  $\lambda = 270,400$ .

The calculations were carried out using weekly data (daily data averages) from Bloomberg, covering the period January 1995 to July 2007 for the foreign exchange and stock markets, 2001–2007 for the money market and 2002–2007 for the bond market – see Table E.1. Three-month interbank rates were used for the money market, national currencies quoted against the US dollar for the foreign exchange market, five-year government bonds for the bond market and national stock indices for the stock market.

**Table E.1: Data sources**

	Money market	Forex market	Bond market	Stock market
	1999–2007	1995–2007	2002–2007	1995–2007
CZ	PRIB03M INDEX	CZK CURRENCY	CZGB5YR INDEX	PX INDEX
AT	n.a.	n.a.	EC504050 GOVT	ATX INDEX
DE	n.a.	n.a.	GDBR5 INDEX*	DAX INDEX
PT	n.a.	n.a.	GSPT5YR INDEX	BVLX INDEX
HU	BUBOR03M INDEX	HUF CURRENCY	GHGB5YR INDEX	BUX INDEX
PL	WIB03M INDEX	PLN CURRENCY	POGB5YR INDEX	WIG INDEX
SI	SITI3M Index <sup>a</sup>	SIT CURRENCY <sup>b</sup>	n.a.	SVSM INDEX
SK	BBOR3M INDEX	SKK CURRENCY	CTSCK5YR GOVT	SKSM INDEX
EA-12	EUR003M INDEX*	USEU CURRENCY*	n.a.	SX5P INDEX*. <sup>c</sup>

Notes: \* – benchmark, n.a. – data not available, a – data from January 2002 onwards, b – data up to end-2006, c – SX5P is made up of the following weights of the national stock indices of the selected euro area countries: France 34.9%, Germany 23.3%, Spain 13.5%, Netherlands 12%, Italy 11.8%, Finland 3.5% and Ireland 0.9%.

Source: Bloomberg.

## 2. ADJUSTMENT MECHANISMS

### 2.1 Fiscal policy

#### 2.1.1 The stabilisation function of public budgets

##### Decomposition of the fiscal deficit into the cyclical and structural component

The general government fiscal balance (deficit or surplus) inherently reflects both the intended effects of fiscal policy and the effect of the business cycle. The effect of the current phase of the business cycle manifests itself in the collection of direct and indirect taxes and some cycle-sensitive expenditure items, such as unemployment-related outlays. The assessment of fiscal policy therefore usually focuses on the cyclically adjusted component of the general government balance, as that component is fully controlled by the public sector.

The overall general government balance can therefore be divided into a cyclical component and a structural component (sometimes referred to as the cyclically adjusted component,

<sup>95</sup> For pairs of countries, the calculated values in each period are essentially equal to half the square of the yield differential.

depending on the treatment of one-off fiscal measures). We applied the ESCB method<sup>96</sup> to estimate the cyclical component, which uses a higher level of disaggregation compared to the alternative approaches of the European Commission, the International Monetary Fund and the OECD. Thus, the cyclically adjusted component is a residual indicating the impact of fiscal policy alone. Using the cyclically adjusted balance, we can answer the question of what the government sector's performance would be if the economy were at its potential.

### **2.1.2 Government deficit and debt and the scope for stabilising fiscal policy**

All the debt and deficit figures are based on the ESA 95 methodology, which is the key methodology with regard to considerations of euro area accession, except for the part of the table covering mandatory expenditures in the Czech Republic, which also includes figures from the state budget, which is monitored on a cash (non-accrual) basis.

The description of mandatory expenditures is based on the definition used by the Ministry of Finance. These include mandatory expenditures arising from statutory requirements and other mandatory expenditures (namely expenditure arising under international treaties or due to judicial and extra-judicial decisions on disputes that are binding upon the Czech Republic). Included in particular are pension insurance benefits, government payments for health insurance, government social assistance, sickness insurance benefits, debt service expenditure, state contributions related to the support of building savings schemes and private pension schemes, allocations to state funds, expenditure on contributions to political parties, payments to the EU budget, unsuccessful arbitrations, etc.

In addition to the aforementioned mandatory expenditures, there are also so-called *quasi-mandatory expenditures*, which include, for example, wages to public sector employees, defence expenditures and international humanitarian assistance, investment incentives and active employment policy. Such quasi-mandatory expenditures are not considered here, as it is within the government's powers to adjust them quite significantly through its own actions.

Macroeconomic interpretation of mandatory (and quasi-mandatory) expenditure is, however, not entirely trivial. In the short run, these expenditures limit the government's reactive ability to execute active discretionary policy (in cases of unforeseen economic shocks). On the other hand, thanks to their inertia, they stabilise the business cycle to a certain extent. The key problem related to an increase in mandatory expenditures is that their expected growth is not compensated by any corresponding reductions in other expenditures and/or by increased taxation, which results in an increased fiscal imbalance.

### **2.1.3 Sustainability of public finances**

The extrapolation of sustainability was taken from the publication "Public Finance in EMU" (European Commission, 2007).

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<sup>96</sup> See Bouthevillain et al. (2001).

## 2.2 Wage elasticity and inflation persistence

### 2.2.1 The degree of adjustment of real wage growth to the unemployment rate – the Phillips curve

A basic one-equation Phillips curve is used to estimate the elasticity of wages to the national unemployment rate (see, for example, Alogoskoufis and Smith, 1991, or Hycklak and Johnes, 1992, or Babetskii, 2006).

$$\Delta w_t = c_1 + c_2 u_t + c_3 \Delta p_{t-1} + \varepsilon_t$$

Where  $\Delta w_t = \ln(w_t) - \ln(w_{t-1})$ ,  $\Delta p_{t-1} = \ln(p_{t-1}) - \ln(p_{t-2})$ ,  $w_t$  is the nominal monthly wage (average for the economy),  $p_t$  is the CPI index, and  $u_t$  is the natural logarithm of the standardised unemployment rate. The coefficient  $c_2$  represents the elasticity of wages to the unemployment rate, i.e. it characterises wage flexibility. Although the left-hand side of the equation contains nominal wages, the coefficient  $c_2$  in fact assesses the flexibility of real wages, because price inflation is also present on the right-hand side of the equation. The rest of the variation in wages (e.g. as a result of changes in productivity, growth in import prices, etc.) is included in the constant  $c_1$ . The sources of the data (quarterly, seasonally adjusted time series) are OECD, Main Economic Indicators, IMF, International Financial Statistics, Eurostat and New Cronos. To assess its evolution over time, wage elasticity is calculated for the whole estimated period (1996 Q1–2007 Q1), and for two sub-periods, i.e. 1996–2001 and 2002–2007.

### 2.2.2 The degree of adjustment of regional real wages to the regional unemployment rate – the wage curve

This analysis uses the methodology from the paper by Galuščák and Münich (2005). The authors estimate the wage curve using annual data on wages and unemployment for individual districts in the Czech Republic between 1993 and 2006. The wage curve equation can be written as follows:

$$w_{rt} = \alpha_r + \beta u_{rt} + \delta_t + \varepsilon_{rt}, \quad (1)$$

where  $w_{rt}$  is the logarithm of the nominal wage in region  $r$  and at time  $t$ , and  $u_{rt}$  is the logarithm of regional unemployment. Regional ( $\alpha_r$ ) and time ( $\delta_t$ ) fixed effects capture differences in regional price levels and price changes over time. The equation assumes that regional differences persist, whereas time fixed effects (annual dummy variables) measure aggregate shocks which affect all regions in the same way. Fixed effects also substitute for the deflation of nominal wages. The coefficient  $\beta$  measures the elasticity of real wages.

The first difference of equation (1) removes regional fixed effects:

$$w_{rt} - w_{r,t-1} = \beta(u_{rt} - u_{r,t-1}) + \delta_t - \delta_{t-1} + \varepsilon_{rt} - \varepsilon_{r,t-1}. \quad (2)$$

Equation (2) is estimated by the least squares method using instruments for the unemployment rate on the right-hand side of the equation. For example, the evolution of real wage elasticity can be seen from estimates for two-year periods between 1994 and 2006.

The wage curve is estimated on wage data for districts obtained by workplace method (based on the place where the employees really worked) and business method (based on the place where the business headquarter is registered); estimates of the  $\beta$  coefficient are presented.

Wages in districts were monitored for individual workplaces between 1993 and 2001. Since 2002, the CZSO has monitored wages by district for whole businesses only, aggregating the data for their branches under the district of their headquarters. For this reason, the estimates of the wage curve on wage data collected for whole businesses in 1993–2006 are less robust.

### 2.2.3 Price flexibility – inflation persistence

#### Method 1

Method 1 consists in the use of the non-parametric technique proposed by Marques (2004) to estimate inflation persistence. This approach defines inflation persistence,  $\gamma$ , as  $\gamma = 1 - n/T$ , where  $n$  is the number of times actual inflation crosses the equilibrium inflation value and  $T$  is the number of observations. Medium-term inflation is approximated using the Hodrick-Prescott (HP) filter. Monthly data on HICP inflation (annual changes) from January 1997 to July 2007 are used for the calculation. As the HP filter gives a biased trend estimate at the beginning and the end of the sample, the data for January 1998 to December 2006 were used for the actual calculation of inflation persistence.

#### Method 2

Inflation persistence is measured as the sum of autoregressive coefficients. For the purposes of the calculation, inflation is modelled as an autoregressive process and coefficients for the autoregressive terms are estimated. The modelled process used in Method 2 is described as

$$\pi_t = \mu + \sum_{i=1}^K \alpha_i \pi_{t-i} + \varepsilon_t,$$

where  $\pi_t$  is inflation observed at time  $t$ . The sum of autoregression coefficients is defined as

$$\rho_K = \sum_{i=1}^K \alpha_i$$

and estimated using the method proposed by Hansen (1999), which provides an unbiased estimate and asymptotically correct confidence intervals.

#### Method 3

Inflation persistence is again measured as the sum of autoregressive coefficients. The following model is considered:

$$\begin{aligned} \pi_{t+1}^T &= \pi_t^T + \eta_{1t} \\ \pi_{t+1}^P &= (1 - \delta)\pi_t^P + \delta\pi_{t+1}^T, 0 < \delta < 1, \\ \pi_t &= \left(1 - \sum_{i=1}^4 \varphi_i\right)\pi_t^P + \sum_{i=1}^4 \varphi_i L^i \pi_t + \varepsilon_{1t}, \sum_{i=1}^4 \varphi_i < 1, \end{aligned}$$

where  $\pi_t^T$  is medium-term inflation (or the central bank's implicit inflation target),  $\pi_t^P$  is the inflation target perceived by the public,  $\eta_{1t}$  and  $\varepsilon_{1t}$  represent independent white noises,  $L^i$  is

the lag operator and  $\sum_{i=1}^4 \varphi_i$  is the sum of autoregressive coefficients. Inflation  $\pi_t$  is the only observed variable; the Kalman filter and the Bayesian approach combined with the *importance sampling* method are used to estimate the model parameters. The methodology is described in detail in Franta, Saxa and Šmídková (2007), where it is applied to data from a different source and period. Quarterly CPI data for 1995 Q1–2007 Q1 are used in the calculations using methods 2 and 3.

## 2.3 Labour market flexibility

### 2.3.1 Unemployment and internal labour mobility

**Long-term unemployment** is analysed by comparing the long-term unemployment rate (the share of those unemployed for 12 months or more under ILO methodology in the labour force). The source of the data is Eurostat.

**Regional differences in unemployment** are measured by the coefficient of variation. The coefficient of variation in the regional unemployment rate is the ratio of the standard deviation weighted by the district size to the average unemployment rate. The size of the coefficient of variation depends on the degree of disaggregation. Data for similar region sizes (e.g. NUTS 2 or NUTS 3) and the evolution of the coefficient of variation over time can be used for comparison. The source of the data is Eurostat.

The **Beveridge curve** is an instrument frequently used to differentiate between cyclical and structural unemployment (Jackman, Pissarides and Savouri, 1990; Petrongolo and Pissarides, 2001; Galuščák and Munich, 2007). It expresses the dependence between vacancies and unemployment. Decreasing (increasing) unemployment amid a rising (falling) number of vacancies is associated with changes in the cyclical component of unemployment, whereas simultaneous movements of unemployment and vacancies in the same direction signal changes in structural unemployment. Simultaneous increases (decreases) in the number of vacancies and unemployment are linked with increases (decreases) in structural unemployment. The job vacancy rate is defined as the ratio of the number of vacancies to employment, where employment equals the labour force minus unemployment. Data on unemployment, the labour force and vacancies are from the Ministry of Labour and Social Affairs (MLSA).

The CZSO publishes the volume of **internal migration** (movement between municipalities). Data on registered internal migration in other countries are published in statistical yearbooks. Since 2001, migration of foreigners with long-term residence (over 1 year) has been included in the statistics, whereas before 2001 only migration of Czech citizens and foreigners with permanent residence permits was monitored. Consequently, the pre-2001 data are not comparable with the more recent data. Another reason for this non-comparability is that the data for 2001 onwards include the results of the 2001 census.

### 2.3.2 International labour mobility

**International mobility.** The data on registered international mobility for individual countries are not fully comparable. The data on the share of foreigners in the total population and on numbers of immigrants are according to Eurostat, and the data on registered foreign employment in the Czech Republic are obtained from the MLSA.

### 2.3.3 Institutional environment

Labour market flexibility is determined to a great extent by institutional factors, among which we examine the role of trade unions and collective bargaining, the minimum wage, the degree of job protection, administrative barriers to entrepreneurship, the taxation of labour and net replacement rates. The methodology for assessing labour market flexibility is based largely on the recommendations included in the OECD Jobs Strategy (OECD 1994, OECD 1995). The assessment of fulfilment of these recommendations (see, e.g., OECD 1998, 2000, 2004 and 2005, or Brandt, Burniaux and Duval, 2005) is based on international evidence on the impact of institutional factors on macroeconomic variables.

**Trade unions and collective bargaining.** The relevant indicators in the area of the institutional arrangements for collective bargaining are trade union density, collective agreement coverage, the centralisation of collective bargaining and the degree of coordination of bargaining. Taken from OECD (2004).

**Minimum wage.** The relationship of the minimum wage to the average wage and to the wage in the first decile of the wage distribution, and the share of employees earning the minimum wage. The data used are from Eurostat and the Average Earnings Information System (MLSA).

The **Employment Protection Legislation (EPL) Index** is taken from OECD. The data for CZ and SK are the CNB's own calculations (only permanent employment for SK). The index relates to 2003 and 2006. It consists of 18 items assessed in accordance with the Labour Code in force. These items are aggregated for the areas of permanent employment, temporary employment and collective dismissals. The 2007 data for the Czech Republic were updated according to the Labour Code in force.

**Costs of individual termination of an open-ended contract,** in number of days for which the wage has been paid since notice was given by the employer. This includes the number of days of notice, the severance pay and the delay to start of notice. In the Czech Republic and Slovakia, these costs differ according to the notice reasons, and the number of wage-paying days will be higher in the case of redundancy dismissals. The indicator is therefore an average of the costs incurred when giving notice due to redundancy and for other reasons. In Austria, for similar reasons, this indicator is the average for higher and lower skilled persons.

**Administrative barriers to entrepreneurship.** The index of barriers to entrepreneurship is taken from a paper by Conway, Janod and Nicoletti (2005), where it is a part of a broader OECD indicator assessing the degree of regulation on product markets. The index consists of seven items aggregated in three areas: Administrative burdens on startups (Administrative burdens for corporations, Administrative burdens for sole proprietors, and Sector specific administrative burdens), Regulatory and administrative opacity (Licences and permits system, and Government communication and simplification of rules and procedures) and Barriers to competition (Legal barriers to entry into the industry – limitations on the number of entities, and Antitrust exemptions for public enterprises).

Later period data for the Czech Republic were updated according to amendments to the Commercial Code and the Trades Licensing Act.

**Overall labour taxation** is defined as social security contributions paid by employees and employers and income taxes relative to overall labour costs (OECD, 2007b).

**Work-incentive indicators.** The data on the **net replacement rates (NRRs)** are taken from OECD tax benefit models for individual types of households, persons in the initial phase of unemployment who are entitled to unemployment benefits and persons not entitled to

unemployment benefits (inactive or long-term unemployed). More detailed data and the distribution of NRRs for the Czech Republic are calculated using a micro-simulation tax and benefit model (Galuščák and Pavel 2007).

Net replacement rates measure the extent to which the combination of taxes and benefits affects the financial gain from work and thereby the motivation of unemployed or inactive persons to enter employment. The NRR is defined as the ratio of net household income when the person under consideration is jobless to that when the same person has a job. Gross incomes of the other members of the household are supposed to be identical in both cases.

NRRs identify only financial entitlements to social benefits. Provided that there is sufficient monitoring of the job-seeking activity of the unemployed, even high NRRs may be associated with sufficient job-seeking incentives.

## **2.4 Flexibility and shock-absorbing capacity of the banking sector**

Indicators reflecting the size of credit risk and the extent of control over credit risk through the creation of reserves and provisions, and indicators showing business success in the banking sector were selected to assess the stability and shock-absorbing capacity of the banking sector.

### **Non-performing loans (NPLs)/total loans (%)**

NPLs (in gross book value) in the banking sector (“loans in default” in Czech accounting terminology) as a percentage of total loans in gross book value express how large or how concentrated is the credit risk faced by the country’s banking sector.

### **Capital adequacy (%)**

The indicator of capital adequacy expresses a bank’s internal resources relative to the structure of risk-weighted assets and selected off-balance sheet assets and market risks. It is an aggregate indicator reflecting all activities of the bank (both balance sheet and off-balance sheet) as well as the potential losses (reducing profit) which a bank may incur from the risks it undertakes and the depreciation of assets through the creation of provisions and reserves. A bank’s capital adequacy should exceed the solvency threshold of 8% under the relevant CNB Decree and CNB Provision.

Capital adequacy expressed as the ratio of a bank’s capital to the corresponding coverage of potential losses from risks it undertakes assesses the outlook for the bank’s financial situation. Capital adequacy indicates its ability to cover potential future losses with capital. A positive capital adequacy ratio means that the bank is solvent, assuming that all potential future losses connected with present risks will be or should be covered by shareholders’ equity.

In addition to this prudential function, capital is used to develop future business activities. The higher the capital adequacy, the better the bank is protected against risks, but the less it is using its potential earnings per unit of capital. By developing the bank’s business, shareholders – represented by management – increase the profit while retaining capital coverage of risks, i.e. within the limits of appropriate use of capital.

### **Pre-tax profit/average assets (%)**

This indicator can be viewed as a synthetic measure of the profitability of the banking business, aggregating the results of the extent and diversification of banks’ activities and the business risks undertaken. Under less stable conditions, the profitability indicator is more



volatile; the negative values of this indicator in some countries reflect losses caused mostly by failure of the business risk management system, inefficiency and other factors.

### **Net interest margin (NIM) (%)**

$NIM = (\text{interest income} - \text{interest costs}) / \text{interest bearing assets}$ . The indicator shows the rate of profitability and business success in banking. If rates on the interbank market fall, the margin on loans and deposits usually also decreases. This is a sensitive and less available indicator.

### **Net non-interest income/average assets (%)**

The ratio of net non-interest income (from fees and commissions and other financial operations) to average assets. Banks' net non-interest income does not include other operating revenues and costs. Banks generally show a tendency towards rising non-interest income if the margin on interest-bearing bank operations declines, primarily through rising fees and commissions. The conduct of competitors is a significant corrective factor.

It is difficult to determine from the available data on net non-interest income whether other operating costs and revenues were included in addition to fees and commissions and other net income on financial operations. For technical reasons, the indicators for the EU and the euro area are usually calculated relative to assets at the year-end rather than to average assets. The ratio to average assets provides a clearer picture of the distribution of costs and revenues per unit.

### **Basic stress test scenarios**

To assess the resilience of the Czech banking sector, stress tests are performed which subject banks to hypothetical changes in key macroeconomic variables. The CNB's unified stress testing methodology was used. The proposed scenarios consist of combinations of adverse changes in interest rates, the exchange rate and loan quality.

The selected baseline scenario assumes significant adverse changes and consists in a combination of a 2 percentage point increase in interest rates, a 20% depreciation of the exchange rate and a 3 percentage point increase in the ratio of NPLs to total loans. The effects of combinations of these shocks were assessed by comparing the capital adequacy ratio before and after the shocks affected banks' portfolios. The calculations assume that had no shocks occurred, banks would be generating the same profits as they averaged over the last five years; otherwise profits in the stress situation are lower than usual. In the case of insufficient profits, the impacts of the shock are subtracted directly from capital.

The scenarios are based on extreme historical shocks. In the Czech economy they relate to the mid-1997 experience of a depreciation of the exchange rate and a rise in interest rates. The scenario of a rise in the NPL ratio is based on developments in 1997–1999. The model situations will not necessarily repeat – the scenarios are of a cautionary nature and will not necessarily materialise.

The baseline historical scenarios were further developed and complemented with a macroeconomic stress test that uses consistent model scenarios derived from the CNB's prediction model. A credit model was used to estimate the development of non-performing loans in bank portfolios, taking into account the expected evolution of macroeconomic variables (GDP growth, inflation, interest rates and the exchange rate). This resulted in a

qualitative shift in the stress tests, which work with future shock scenarios of different degrees of probability.<sup>97</sup>

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<sup>97</sup> Summaries of the stress test results are included in the Financial Stability Reports published by the Czech National Bank.

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