

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

2014

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## A INTRODUCTION

The Czech Republic has been participating automatically in the Economic and Monetary Union (EMU) since it joined the EU and acquired the status of a Member State with a derogation from adopting the euro. Consequently, it is not currently a member of the euro area, but has committed itself to joining the euro area and introducing the euro in the future. The balance between the benefits (mainly microeconomic) and costs associated with introducing the euro will depend on the resolution of the current problems in the euro area and subsequently on the ability of the Czech economy to operate without an independent monetary policy and without the possibility of exchange rate adjustment vis-à-vis its most important 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 single monetary conditions in the euro area to the current situation in the Czech Republic. The ability to adjust rapidly to asymmetric economic shocks will be another important factor.

The analyses of the Czech economy's alignment with the euro area in 2014 have been drawn up in line with the Czech Republic's Updated Euro-area Accession Strategy of 2007 and assess the current state of economic alignment in terms of long-term economic trends, the medium-term evolution of economic activity, the structural similarity of the Czech economy to the euro area economy, and the economy's ability to absorb and adjust flexibly to asymmetric shocks.

This set of analyses is a follow-up to the documents of the same name published by the CNB in previous years. As in previous years, this year's document contains a section on the economic alignment and public finance situation of euro area countries and on the institutional changes being made in response to the events of the European debt crisis. Changes in the economic and political framework of the euro area alter the view on the economic costs and benefits of adopting the single currency. Changes in the functioning of rescue mechanisms will probably imply new and unforeseen financial obligations for accession countries. From the perspective of future accession it is also necessary to monitor the use and potential impacts of the unconventional instruments applied by the European Central Bank.

The analyses of the Czech Republic's preparedness for euro adoption are divided into two basic groups according to the type of question they answer. The section entitled "Cyclical and Structural Alignment" deals with the assessment 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 potential asymmetric shocks using its own adjustment mechanisms.

These analyses are aimed at assessing the evolution of the alignment indicators over time and in comparison with selected countries. These countries either are euro area members already (Austria, Germany, Portugal, Slovakia and Slovenia) or aspire to such membership (Hungary and Poland).<sup>1</sup> 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. The values of the indicators for the euro area are defined at the EA-18 level.<sup>2</sup>

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<sup>1</sup> The selected euro area countries are countries that are comparable in terms of economic level and countries with which the Czech economy has trading links. This selection is not related to any assessment of how successfully these economies have performed in the euro area. Germany, the largest trading partner of the Czech Republic, also 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.

<sup>2</sup> The EA-18 comprises the euro area Member States: Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia and Spain. Only in exceptional cases, owing to data unavailability, does the analysis not cover all EA-18 countries.

## B EXECUTIVE SUMMARY

The Czech Republic's future entry into the euro area ensues from the commitments associated with EU membership. Adoption of the single European currency should lead to the elimination of exchange rate risk in relation to the euro area and to a related reduction in the costs of foreign trade and investment. This should further increase the benefits accruing to the Czech Republic from its intense involvement in international economic relations. Besides the aforementioned benefits, however, adoption of the euro will simultaneously imply costs and risks arising from the loss of independent monetary policy and exchange rate flexibility vis-à-vis major trading partners. The costs and benefits stemming from euro adoption will be affected by the situation in both the Czech economy and the euro area economy and its institutional framework. These factors will influence whether adoption of the euro by the Czech Republic will lead to an increase in the country's economic stability and performance.

However, developments in the **euro area** in recent years are pointing to misalignment within the monetary union itself and, for some countries, even to continuing divergence. This is leading to changes in the institutional architecture of the euro area, changes that are affecting the costs and benefits of euro adoption. These institutional changes partly also apply to non-euro area countries (changes to the Stability and Growth Pact and the introduction of the European semester and the macroeconomic imbalance procedure).

The **problems in the functioning of the euro area** have also been the subject of an ever-growing flow of academic literature in recent years. In particular, it is apparent that the optimum currency area endogeneity hypothesis has not been confirmed. By contrast, exchange rate fixing, sharp interest rate cuts on the periphery of the euro area and the absence of fiscal integration have resulted in a systematic accumulation of major imbalances in the euro area. With no option of exchange rate depreciation, the current single monetary policy seems too restrictive for the less competitive countries, which are often showing negative consumer price inflation and high debt ratios. Conversely, the single monetary conditions may be too easy for the countries with high competitiveness and rising prices of assets, especially property prices. These factors, combined with other effects, have been reflected in rising misalignment in a whole range of indicators, for example long-term interest rates, unemployment and partly also GDP growth. Although the situation in the euro area has improved recently, the economic and debt crisis still cannot be said to be definitively over.

The two key factors for the **Czech economy** as regards the costs and benefits of euro adoption will be (i) the economic and structural similarity between the Czech economy and the euro area, and (ii) the flexibility of the Czech economy and its ability to absorb potential asymmetric shocks. As usual, the analyses presented in this document therefore assess the similarity of the long-term economic trends, the medium-term development of economic activity and economic structure, including similarity of the functioning of monetary policy transmission, as well as the ability to adjust by means of autonomous fiscal policy and flexible labour and product markets. The characteristics of the Czech economy as regards its preparedness to adopt the euro can be divided into four groups.

The first group consists of **economic indicators that speak in the long run in favour of the Czech Republic adopting the euro**. These include the high degree of openness of the Czech economy and its close trade and ownership links with the euro area. These factors provide for the existence of microeconomic benefits of euro adoption, such as a reduction in transaction costs and the elimination of exchange rate risk. Strong trade links with the euro area are also reflected in a high correlation between the exchange rates of the koruna and euro against the dollar and are also fostering alignment of the business cycle with the euro area. Another favourable factor is the achievement of long-term convergence in the rate and persistence of inflation and in nominal interest rates, as this reduces the macrofinancial risks



associated with euro adoption. The Czech banking sector is not a barrier to joining the euro area either. Its sufficient capitalisation and high profitability make it capable of helping to absorb economic shocks, and it ensures that monetary policy is transmitted to the economy in a manner that does not differ fundamentally from that in the euro area. However, this could be affected by the Czech Republic's potential entry into the banking union due to the transfer of many banking supervision competences.

The second group contains **areas where convergence was disrupted by the crisis but where an improvement has been recorded again in recent years**. The increased volatility of the koruna's exchange rate against the euro has been replaced by gradual stabilisation. The use of the exchange rate as a monetary policy instrument at the zero lower bound on interest rates has recently led to high exchange rate stability. After rising substantially because of the global financial crisis, risk premia have decreased again and the standard transmission of monetary policy rates to client rates has thus been renewed. The alignment of financial markets has also resumed in recent years. This group also includes fiscal policy, where the general government structural deficit decreased markedly in 2010–2013. However, this deficit is expected to increase slightly again, representing a risk of procyclical fiscal policy and divergence from the medium-term objective (MTO).

The third group consists of **areas where positive trends were disrupted by the global crisis and a return to the convergence path has yet to occur**. The real economic convergence of the Czech Republic to the euro area observed until 2008 has halted since then, although the current data are indicating the possibility of renewed convergence. As measured by GDP per capita (converted using purchasing power parity), the Czech Republic is at a higher absolute level than the least developed euro area countries, but this is evidently no guarantee of future smooth functioning of the economy in the EMU. The long-term price level convergence trend has also been interrupted. The previous convergence of the price level to the euro area halted in 2008. Since then, the Czech price level has been flat on average relative to that in the euro area.

The fourth group contains **areas which are showing long-term problems or misalignment and which, moreover, are not showing any significant improvement**. This group includes population ageing, which poses a risk to the long-term sustainability and stabilisation function of public finances. There has been no significant – and, from the perspective of euro adoption, desirable – improvement in the flexibility of the Czech labour market since the Czech Republic joined the EU. The flexibility of the labour market thus remains average overall by comparison with the other European economies. Its weak points continue to include relatively low labour mobility and relatively high implicit labour taxation. On the other hand, the labour market is also showing signs of greater flexibility, particularly in the form of rising countercyclical use of the number of hours worked. Persisting administrative barriers to starting a business have long hampered the flexibility of the Czech product market. Significant differences vis-à-vis the euro area still exist in the structure of the Czech economy, which is characterised by a high share of industry and a low share of services. Differences also persist in the financial sector and in the structure of financial assets. These factors may be a source of asymmetric shocks and cause the single monetary policy to have different effects.

The following text summarises developments in the individual areas analysed. Part D examines the economic convergence of euro area countries, debt problems and changes in the institutional architecture of the EMU. Detailed results of the analyses of developments in the Czech Republic are presented in Part E.

## Situation in the euro area

**Economic alignment of euro area countries** is a basic prerequisite for the EMU to function smoothly. However, developments in recent years point to persisting shortcomings in this area. The southern periphery countries hit hardest by the debt crisis continue to record high unemployment, relatively high interest rates and low inflation (or even deflation) compared to the “core” EMU countries. The differences in GDP growth widened the most in 2008–2009 and then again in late 2012 and early 2013 as the economies were hit by recession in different periods and to different extents. By contrast, the unemployment rate was initially converging, but since 2009 has been rising much more strongly in some countries. The financial and economic crisis was accompanied by rising misalignment in the inflation rate. This misalignment has decreased again in recent years, but inflation convergence in euro area countries at very low average levels cannot be regarded as a positive trend, as it represents a risk to the still fragile economic recovery and complicates the resolution of the debt problems of the southern periphery countries. The risk of euro area countries falling into deflation and slipping back into recession has meanwhile increased further. In 2010–2012, very large divergence could be seen for long-term interest rates, reflecting the different magnitudes of the debt problems across euro area countries. This misalignment has decreased since 2012 thanks to a calming of the market situation and to measures adopted by the ECB. The fiscal criteria laid down in the Treaty on the Functioning of the EU are at present met only by five of the eighteen countries.

Major changes are being made to economic policy and the **institutional framework** in response to the euro area’s problems. In November 2014, the Single Supervisory Mechanism (SSM) was launched as part of the formation of the banking union. The SSM assumes supervisory powers over systemically important financial institutions in the euro area. A Single Resolution Mechanism (SRM) is being created at the same time. It will consist of a bank resolution fund financed by contributions from banks, and “backstops” at the national and European levels. These will take over the main role in bank crisis resolution from the European Stability Mechanism (ESM), whose financial capacity has so far been available for recapitalisation of problem banks and for the provision of assistance to overindebted countries. If it adopted the euro, the Czech Republic would – according to updated Czech Finance Ministry calculations – have to pay about CZK 51 billion into the ESM and undertake to supply a further amount of up to around CZK 391 billion in the event of non-repayment of certain loans or a large decrease in the contracting parties’ solvency. It is apparent that the euro area is undergoing substantial institutional change. The major shifts include the budget costs of joining the euro area rescue mechanisms and a reduction in national autonomy in the banking supervision area in an effort to increase the robustness of the monetary union to fiscal problems in individual countries and to shocks emanating from their banking systems.

## Cyclical and structural alignment of the Czech economy with the euro area economy

Greater alignment of the Czech economy with the euro area economy is a necessary condition for the euro adoption costs arising from the loss of the Czech Republic’s own monetary policy to be relatively small.

The **degree of real economic convergence** is an important indicator of the Czech economy’s similarity to the euro area. A higher level of such convergence fosters greater similarity of long-run equilibrium development. It can also foster a lower likelihood of misalignment in the shorter run. A higher degree of convergence in the economic level prior to ERM II entry and prior to euro adoption should further increase the relative price level, which will reduce the potential future pressures for growth of the price level and equilibrium appreciation of the real exchange rate after joining the euro area. The Czech economy had been gradually converging

towards the euro area in real terms before the crisis broke out. However, this trend halted in 2009, and the Czech Republic's economic level relative to that of the euro area has been flat since then. In recent years, GDP per capita has been about three-quarters of the euro area average. Owing to the crisis, the convergence process was also interrupted in the case of the price level of GDP, which has halted at around 70% of the euro area average. The wage level in the Czech Republic in 2013 was just under 40% of the average euro area level when converted using the exchange rate and about 60% when converted using purchasing power parity. The price level thus remains slightly below the level corresponding to the performance of the economy. This has its long-term structural cause and is also linked with the aforementioned halt in the real equilibrium appreciation of the koruna (on an HICP basis), as the weakened real exchange rate in the period following the onset of the global financial and economic crisis helped to absorb macroeconomic shocks (including, in November 2013, the commencement of use by the Czech National Bank of the nominal exchange rate as an additional instrument for easing monetary policy to avert the threat of deflation and facilitate a return of inflation to the 2% target and to support the economic recovery). According to the analyses, equilibrium real appreciation of the koruna against the euro, albeit at a lower rate than before the crisis, can be expected over the next five years provided that real GDP convergence is renewed. Continuing real appreciation of the exchange rate following euro area entry would mean a positive inflation differential vis-à-vis the euro area and related low (negative) real interest rates.

Sufficient **cyclical alignment of economic activity** increases the likelihood that the single monetary policy in the monetary union will be appropriately configured from the perspective of the Czech economy. The analyses indicate increased correlation of overall economic activity between the Czech Republic and the euro area in recent years; the same goes for activity in industry and export activity. The increase in the correlations monitored can be attributed partly to a greater significance of common extraordinary shocks in the form of the global financial and economic crisis and the subsequent gradual recovery. The domestic economy's strong trade links with the euro area suggest, however, that the high degree of alignment will persist in conditions of normal development.

Similarity of the **structure of economic activity** with the euro area should reduce the risk of asymmetric economic shocks. The persisting relatively high share of industry (moreover with an exceptionally significant share of the procyclical car industry) and a smaller share of services compared to the euro area may mean a higher risk of asymmetric shocks for the Czech economy, to which a potential single monetary policy will evidently not respond in full. In addition, the differences in the structure of the Czech economy vis-à-vis the euro area economy are widening gradually, and so structural misalignment is becoming one of the risks of adopting the single currency.

Fast convergence of **nominal interest rates** in connection with joining the euro area acted as an asymmetric shock in some economies in the past, generating macroeconomic imbalances and risks to financial stability. For a country planning to enter the monetary union, earlier gradual interest rate convergence is therefore an advantage. The fact that the difference between Czech and euro area interest rates has long been very low is favourable from this perspective. Three-month interbank market rates showed a slightly positive interest rate differential in 2009 and 2010, but this closed gradually and is now very close to zero. Government bond yield differentials against Germany also grew temporarily in early 2009 and again in 2012 H1, also due to increased financial market tensions linked with the escalation of the euro area debt crisis. However, the interest rate differential between Czech and German long-term interest rates has long been much lower than in the other non-euro area countries under review.

Another indicator of the possibility of sharing a single currency is long-term co-movement in the **exchange rate** of the national currency and the single currency against a reference third currency. This area has been strongly affected over the last year by a regime change in the form of the adoption of an exchange rate commitment by the Czech National Bank. After this commitment was announced in November 2013, the exchange rate stabilised just above CZK 27 to the euro. This led to an increase in the correlation between the exchange rate of the koruna against the dollar and the exchange rate of the euro against the dollar. However, this correlation had long been the highest and most stable of the Central European currencies and fell only temporarily during the global crisis and the subsequent European debt crisis.

The Czech economy's strong **trade and ownership links** with the euro area increase the benefits arising from the elimination of potential fluctuations in the exchange rate and the reduction in transaction costs. The euro area is the partner for 64% of Czech exports and 61% of Czech imports, a level comparable to, or even higher than, that in the other non-euro area countries under review. The share of intra-industry trade is relatively high as well. After declining modestly in 2011, the degree of ownership links in the Czech economy, as measured by direct investment from the euro area, has returned to growth and is the highest of all the countries under review.

The **financial sector** in the Czech Republic is still much smaller than that in the euro area. The depth of financial intermediation, as measured by the ratio of financial institutions' assets to GDP, is roughly one-quarter of the value for the euro area. In 2013, the share of bank loans to the private sector to GDP was 58% in the Czech Republic, less than half that in the euro area. However, the current level of the aforementioned indicators in the euro area is not necessarily optimal. On the contrary, in many countries it may reflect private and public sector overleveraging.

The **structure of the financial assets and liabilities of Czech non-financial corporations and households** is gradually converging to that of euro area entities, but still shows differences. For corporations, the difference is particularly visible in a lower weight of ownership shares (such as equities) at the expense of loans in their net debtor position, due to frequent foreign ownership. Corporations in the Czech Republic are showing the highest liquidity, although liquidity growth has also been visible in the euro area in recent years. The Czech corporate debt to equity ratio has been rising over time and is now higher than that in the core euro area countries under review. In response to tighter lending conditions, corporations in both the euro area and the Czech Republic have started to make greater use of bond financing. The structure of the financial assets and liabilities of Czech households converged to that of euro area households in the period under review, as the share of short-term liabilities decreased and total debt increased. The solvency of Czech households is close to the euro area average.

In the past, the **effect of monetary policy rates on client rates** in the Czech Republic was roughly the same as in the euro area. Rate transmission is fast, taking place within one month for most types of loans. The global financial and economic crisis led to a temporary slowdown and weakening of the transmission of monetary policy interest rates in the Czech economy as a result of rising client risk premia. However, this increase was comparable with that in the euro area core countries. The structure of interest rate fixations on new loans to non-financial corporations is similar to that in the euro area. The same basically goes for mortgage loans, although mortgages in the Czech Republic are dominated by loans with fixations of up to five years, while in the euro area longer fixations are more common.

Differences in **inflation persistence** in the monetary union countries could lead to the single monetary policy having different impacts. However, inflation persistence in the Czech Republic has long been average among the countries under comparison. The difference is not significant

even compared to the euro area core countries. Inflation persistence thus does not pose a significant risk to the symmetric effect of the single monetary policy in the Czech Republic.

The analysis of **alignment of financial markets** (the money, foreign exchange, bond and stock markets) with the euro area reveals that synchronisation in the individual segments of the Czech financial market has long been mostly high and comparable with the euro area countries. After a sharp increase in fragmentation following the outbreak of the global financial crisis, the situation in the Czech financial markets started to improve in 2009 and then returned gradually to the pre-crisis degree of alignment on all markets under review. However, this trend continues to be conditional on active central bank policy-making focused on mitigating the impacts of the crisis, including unconventional measures.

Despite a modest increase in the recent period, the degree of **euroisation** in the Czech Republic has long been low and is due to economic agents' high trust in the domestic currency amid sustained low and stable inflation and low interest rates. The use of foreign currency is thus concentrated primarily in the sector of corporations involved in foreign trade and in the commercial property sector. Unlike in the other countries in the region, Czech households' foreign currency debt is negligible.

### Adjustment mechanisms in the Czech economy

If set correctly, **fiscal policy** – like monetary policy – should have a countercyclical effect and thus be a stabilising element for the economy. Otherwise it becomes a source of deepening macroeconomic imbalances and economic shocks itself. The closer the structural part of the public budget deficit is to zero and the lower is the accumulated public finance debt, the more room there will be at a time of economic downturn for automatic stabilisers to function and countercyclical discretionary measures to be implemented. Czech budget policy was characterised by chronic deficits and a procyclical effect for a major part of the period under review. Windfall tax revenues in 2006–2008 were not employed to reduce the fiscal deficit, but instead tended to be used to generate new public expenditures. Similarly, tax cuts in the period of rapid economic growth were not accompanied by corresponding austerity measures on the public expenditure side. Fiscal policy had the desirable countercyclical nature particularly in 2009, when government anti-crisis and other measures were adopted. In 2010, fiscal consolidation was commenced and budget deficits shrank markedly, albeit at the cost of a strong procyclical restrictive effect of fiscal policy in 2010–2013. In addition, the fall of the economy into recession in 2012–2013 made the government abandon its originally declared intention to comply with the medium-term objective (MTO) in 2015. Meeting this objective is a precondition for fiscal policy to be ready to fulfil its macroeconomic stabilisation role effectively after the loss of independent monetary policy associated with euro adoption. By contrast, the structural component of the government deficit is expected to increase again. Although the Czech Republic's total general government debt is lower than that of many EU countries, it has been showing very fast growth in recent years. The high and rising share of mandatory expenditure combined with the expected effect of demographic changes on pension system expenditure (this effect is mitigated by an increase in the retirement age adopted as part of parametric reforms of the pension system) and health care system expenditure also poses a risk to public finance sustainability. The preparedness to enter the euro area has thus improved overall from the fiscal policy perspective, but is still a limiting area.

The **labour market** is another important mechanism through which the economy can cope with asymmetric shocks in the absence of an independent monetary policy. There has been no significant – and, from the perspective of euro adoption, desirable – improvement in the flexibility of the Czech labour market since the Czech Republic joined the EU. The flexibility of the Czech labour market thus remains average overall by comparison with the other European



economies. Both long-term unemployment and structural unemployment were rising slightly until 2013 owing to subdued economic activity, but are still among the lowest in the countries under comparison. The weak points in the labour market still include persisting relatively high implicit labour taxation and relatively low labour mobility. The total share of foreign nationals in the population was increasing until 2008 but then halted at lower levels than those typical of the advanced euro area countries owing to lower demand for foreign labour at a time of subdued economic activity. The Czech Republic still has large differences in unemployment across regions, despite the fact that they have shrunk by comparison with the pre-crisis period. On the other hand, the labour market is showing signs of greater flexibility, particularly in the form of rising countercyclical use of the number of hours worked.

The **institutional rules on the labour market** have a strong effect on its flexibility. The ratio of the minimum wage to the average wage was falling until mid-2013, when the minimum wage was increased. This has an effect mainly on low-skilled jobs, where a high minimum wage can greatly reduce wage flexibility and increase long-term unemployment. By contrast, overall labour taxation in the Czech Republic is relatively high, and has increased slightly further in recent years. The implicit taxation rate, expressing the average effective tax burden, is the second highest among the countries under comparison. The financial incentives for childless unemployed people to seek and accept a job are still low relative to the countries under comparison. Employment protection remains relatively strong for regular employment, but is lower for temporary jobs.

The **response of wages to the business cycle** can enhance the economy's ability to absorb shocks to which the single monetary policy cannot respond sufficiently. From the longer-term perspective, the Czech Republic shows a strong response of unemployment to the phase of the business cycle, although a slightly lower one compared to the euro area average. At the same time, a weaker, albeit positive, response to the business cycle is recorded for real wages, while in the euro area this relationship is not observed robustly. This suggests that in both the domestic and euro area economy the labour market absorbed negative shocks through higher unemployment rather than through wage cuts. In recent years, however, the Czech Republic has seen labour market adjustment through the aforementioned use of part-time work, and a decline in real wages has been recorded as well.

In the area of **product market flexibility** the Czech Republic is at a similar level in 2014 as in the previous year. However, the domestic business environment remains in some respects (starting a business in particular) more burdened with administrative obstacles than in the other countries under comparison. As far as the conditions for closing a business are concerned, the Czech Republic, along with the other countries under comparison except Hungary, is at a relatively good level in global terms. Although the Czech corporate tax rate, as measured by the statutory tax rate, is one of the lowest among the countries monitored, the overall tax burden as measured by implicit taxation of corporations in the Czech Republic is one of the highest.

Stability and effectiveness of the **banking sector** is a necessary condition for the sector to be able to absorb shocks. By contrast, an unsound banking sector can create shocks and propagate them to the real economy. It can also cause problems in the fiscal area, especially in the absence of an effective bail-in mechanism for involving shareholders and junior bond holders in resolving problems in banks. The Czech banking sector continues to display very good macroprudential indicators. Its high profitability, sufficient capital adequacy, relatively low NPL ratio and limited dependence on other countries rank it among the most stable sectors in the sample of countries under review. The domestic banking sector is therefore not a source of shocks and should be able to absorb fluctuations emanating from the domestic economy or from abroad. However, this could be affected by the Czech Republic's potential entry into the banking union due to the transfer of many banking supervision competences.

## C THEORETICAL FOUNDATIONS OF THE ANALYSES

The basic theoretical starting point for the analyses contained in this document is the **theory of optimum currency areas**.<sup>3</sup> This theory examines whether the individual countries are good candidates for introducing a single currency. In the context of the creation of the single European currency, knowledge of this theory is often used to assess the appropriateness of adoption of the single currency by the existing euro area countries and the suitability of the same step for the new EU Member States.

Although economists agree on the general set of fundamental **costs and benefits of the single currency**, the significance of the individual arguments may change over time or depending on the specific features of the respective economies. The main benefits are improved functionality of money and reduced trade costs (including, for example, lower transaction costs, easier-to-compare prices and the elimination of exchange rate risk and the costs of hedging against it) and potentially also increased macroeconomic and financial stability, reflected in a more favourable investment environment (thanks to the elimination of excessive exchange rate fluctuations, financial market integration and potentially an overall increase in the credibility of the monetary authority).<sup>4</sup>

The costs are broken down into non-recurring ones, associated with the change of legal tender,<sup>5</sup> and long-term ones. The latter include a reduction in the effectiveness of domestic macroeconomic policies and the risk of greater volatility in economic activity and consumption due to the loss of independent interest rate policy (and potentially also exchange rate policy) upon transition to the single currency. The reason is that the single monetary policy cannot respond to a sufficient extent to shocks which affect only a small part of the currency area's economy. The costs of the loss of an independent currency will depend on the extent to which the exchange rate absorbs real shocks or, on the contrary, generates real and/or financial shocks, on the degree of alignment of the domestic business cycle with the cycle of the currency area, and on the ability of the economy to employ other adjustment channels.<sup>6</sup> Additional costs may then arise from the build-up of imbalances in the monetary union as a result of suboptimal economic policy settings for individual economies or in connection with resolving the economic problems of monetary union members.

The potential costs and benefits differ depending on the specific situation, and the decision to introduce the single currency is – in addition to economic arguments – motivated by political and social demand (Eichengreen, 2008). However, knowledge of the theory of optimum currency areas can, *inter alia*, be applied to identify possible sources of macroeconomic imbalances associated with entering the monetary union and to assess the economy's ability to benefit from membership. Factors that contribute to the benefits of the single currency

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<sup>3</sup> Mundell (1961), McKinnon (1963) and Kenen (1969) are regarded as the cornerstones of this theory. A survey of literature can be found, for example, in Mongelli (2002), De Grauwe (2003) or Horváth (2003). A recent paper worth mentioning is Dellas and Tavlas (2009), who describe the history of the optimum currency area theory over the last fifty years. In a summary of the modern empirical literature they show, among other things, that pegged exchange rates tend to be associated with higher GDP volatility.

<sup>4</sup> The enhanced macroeconomic stability should 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. However, financial market integration can be a drawback at times of financial crises, which can spill over to other countries as the recent situation has shown. Similarly, the latest developments show that a fall in interest rates and the elimination of exchange rate volatility can reduce the pressure for macroeconomic discipline in individual countries, with negative consequences.

<sup>5</sup> The non-recurring costs include the physical exchange of money, the conversion of all contracts to the new accounting unit, and similar costs. In the context of transition to another currency, there is also a 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>6</sup> For new EU members planning to join the euro area, another possible cost is fulfilment of the Maastricht criteria prior to entry, especially the price stability criterion. A potential cost for converging countries is a persisting inflation differential, which may be reflected in a rise in nominal client rates and a fall in real client rates and may adversely affect the economy (the welfare cost of inflation theory – Hampl and Skořepa, 2011; Ahrend et al., 2008; Taylor, 2009; Martin, 2010).

(compared to a free nominal exchange rate) 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 reduces the costs of foreign trade and foreign investment and may lead to a strengthening of such relations.<sup>7</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 also 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>8</sup> Mongelli (2013) adds to the traditional criteria democratic legitimacy and economic agents' high trust in central institutions and their policies.

An important role in the theory of optimum currency areas was played by the **endogeneity hypothesis** (Frankel and Rose, 1998), which holds that changes leading to an optimum currency area will be an automatic result of the very introduction of the single currency.<sup>9</sup> The endogeneity paradigm was 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) show that high financial integration (including outside a monetary union) can have a similar impact thanks to risk sharing, which fosters greater specialisation. Agenor and Aizenman (2011) find that the benefits from joining a currency area depend on the efficiency of the domestic financial sector, and in particular on its ability to expand into other countries of the currency area. In recent years, the opinion has been gaining ground that the theory of endogeneity of currency areas has not been confirmed, particularly in the case of the EMU. On the contrary, it has been observed that less competitive economies are diverging from the core of the euro area (Caporale, Santis and Girardi, 2013).

The conclusions of **empirical analyses for the euro area** have evolved over time. On the basis of pre-crisis data, the review article by De Grauwe and Mongelli (2005) finds support primarily for the endogeneity hypothesis, i.e. that the similarity of economic shocks probably increases with greater economic integration. Babetskii (2005) shows an increase in the correlation of demand shocks in new EU member countries with the euro area and Germany

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<sup>7</sup> Micco, Stein and Ordóñez (2003) 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. A meta-analysis of this literature (Havránek, 2009) in fact demonstrates that the effect of euro adoption on trade between euro area countries is not statistically significant and with high probability is less than 5%. The first article, Rose (2000), finds effects of hundreds of per cent, while Micco, Stein and Ordóñez (2003) measure just a few per cent for the euro area.

<sup>8</sup> In the event of an asymmetric shock, fiscal policy can assist by means of either automatic 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). This is particularly true for small open economies. Nevertheless, discretionary fiscal measures regained importance during the recent financial and economic crisis.

<sup>9</sup> 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. Increased competition will then strengthen diversification and specialisation, which will further increase the intensity of trade and underline the benefits of the single currency. Greater trade integration can lead to greater business cycle correlation (Frankel and Rose, 1997). 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.



amid rising trade integration. By contrast, Giannone, Lenza and Reichlin (2009) state that euro adoption has not significantly changed the characteristics of member countries' business cycles, as countries with lower long-run volatility retain this characteristic after euro area entry. Likewise, the characteristics of countries with historically higher volatility in economic activity and lower business cycle correlation with the euro area average persist. Estrada, Galí and López-Salido (2013) show that price levels in euro area countries have converged, whereas the pace of convergence of other variables has been comparable with non-euro area countries. Similarly, Frankel (2008), despite supporting the endogeneity hypothesis in the euro area, considers the risks of asymmetric shocks in the transitory phase to be substantial; on the other hand, alignment increases over time even without euro adoption. Frankel therefore recommends that the new EU Member States should wait. An analysis of the causes of non-fulfilment of the endogeneity hypothesis is provided, for example, by De Grauwe (2010a). EEAG (2011) emphasises the significance of structural differences across economies in the monetary union and the resulting economic and financial divergence. On the other hand, Crespo-Cuaresma and Amador (2013) find that the euro area has shifted to a new equilibrium with smaller misalignment of business cycles compared to both historical data and other OECD countries. Ferreira-Lopes (2013) simulates the costs of euro adoption in Central European countries using a DSGE model. He concludes that the costs of the loss of independent monetary policy are high for the Czech Republic and Poland relative to Hungary because of the large significance of domestic demand shocks (e.g. government consumption).

The empirical literature analysing the **symmetry of economic shocks** hitting the euro area countries is divided. Giannone and Reichlin (2006), Eickmeier (2007) and Stavrev (2008) find the significance of common shocks to be decisive in explaining the variability of economic output. The increase in the significance of common shocks is attributed to financial market integration (Kalemli-Ozcan et al., 2013) and the effect of the single monetary policy on the synchronisation of cycles. However, different transmission of common shocks can also have an asymmetric effect. The impact of this channel, however, is found to be rather small. Eickmeier and Ng (2011) show that global financial and demand shocks have a very similar effect in euro area countries and European non-euro area countries, indicating a high degree of alignment of European financial markets regardless of euro area membership. Andrieu, Brůha and Solmaz (2013) find a strong relationship between inflation and GDP in the euro area, which suggests a strong significance of common demand shocks.

**Different transmission of the single monetary policy** in different currency area countries can also be a significant source of asymmetric shocks: whereas Havránek and Rusnák (2012) show that monetary transmission is faster in countries with more developed financial markets, Jarocinski (2010) concludes that monetary policy transmission is similar in new and old euro area countries. Matějů (2013) indicates that euro area countries show stronger responses to monetary policy shocks than inflation targeting countries, whereas De Santis and Surico (2013) find differences also between core euro area countries arising from the different structures of their banking sectors. Similarly, Leuvensteijn et al. (2013) show that greater competition in the banking sector (as observed, for example, in Germany and Italy compared to Spain and France) strengthens the transmission of monetary policy rates. Havránek et al. (2014) also find significant differences between European countries in the response of consumers to interest rate changes leading to differences in the transmission of monetary policy.

European Commission (2006) emphasises the importance of **idiosyncratic shocks for euro adoption**, including a fall in the risk premium, an easing of the monetary conditions, and the development of productivity in the tradable and non-tradable sectors. As a result of the monetary policy response, these shocks can also have secondary impacts on other countries. Ahrend et al. (2008) and Taylor (2009) point out that an excessive decrease (compared to that implied by the Taylor rule under independent monetary policy) in long-term interest rates after

the adoption of the single currency in some economies gave rise to bubbles in asset markets, property markets in particular.

A significant body of literature (e.g. De Grauwe, 2010b; Gros and Alcidi, 2010; Wyplosz, 2010 a,b) critically examines the **experience of the euro area during the crisis** and the efforts to strengthen fiscal policy coordination. Eichengreen (2009) considers the global crisis of 2008–2009 to be a textbook example of an asymmetric shock, but he also claims that small converging countries are better off inside the euro area than outside it during a crisis. Razin and Rosefield (2012) point out that the main problem in the euro area is weak political integration. Mongelli (2013) argues that the euro area may be functioning and beneficial to all members even without a fiscal union provided that rescue mechanisms are introduced within the banking union.

Another section of the literature assesses the **risks arising from high debt levels** in a large proportion of euro area countries. Baum et al. (2013) point out that a higher debt level in the euro area countries will not hinder economic growth until it exceeds about 70% of GDP. However, Corsetti et al. (2013) explain this by observing that governments have often started to adopt restrictive measures around this limit, which weakened economic growth. Arnold and Ewijk (2014) point out in a new article that the differences in rates on government bonds are the main factor causing the significant differences in credit conditions across euro area countries and are thus a risk to further convergence.

Brunnermeier (2010) points out the implications of **differences in inflation rates** for different monetary policy effects in the individual countries of the monetary union. He suggests that the centralised monetary policy should be supplemented with region-specific macroprudential instruments, e.g. regulation of the loan-to-collateral and loan-to-income ratios. These arguments thus go against the centralised concept of the banking union which is currently being created.

## **D ECONOMIC ALIGNMENT OF EURO AREA COUNTRIES**

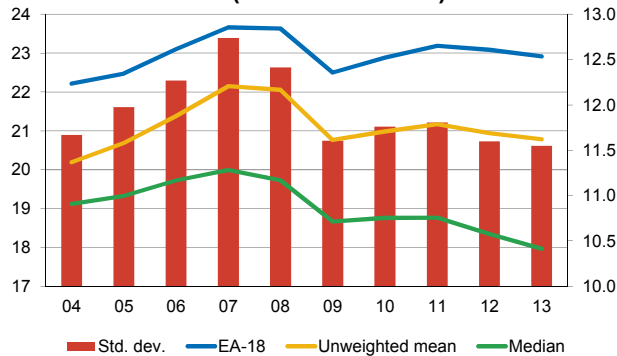
The global financial and economic crisis revealed structural weaknesses in some economies and low institutional readiness of the euro area to resolve such situations. To address this situation, a number of institutional changes have been made which are having large impacts on the functioning of the monetary union. It is thus important for countries that have undertaken to adopt the euro, such as the Czech Republic, to monitor institutional and economic developments in the euro area as a whole in addition to domestic parameters of economic alignment with the euro area.

### **1 ANALYSIS OF EURO AREA ECONOMIC COHESION**

The protracted subdued economic activity in the euro area, especially in the southern periphery, raises the question of whether it is optimal for the monetary union to exist in its current composition of differently performing economies. Despite having met the Maastricht criteria prior to euro adoption (thanks only to inaccurate statistics in the case of Greece), the euro area countries were and still are heterogeneous and some of the differences between them widened during the debt crisis. This section analyses the evolution of the alignment of key macroeconomic variables of euro area countries over the last ten years on the basis of simple descriptive statistics. Last year saw an improvement in some convergence indicators or a slowdown in divergence of the variables under review. On the other hand, persisting large differences in the unemployment rate, coupled with the still unsatisfactory fiscal situation of some member countries, represent a risk to further real convergence in the euro area. From this perspective, even the inflation convergence in euro area countries cannot be regarded as a positive trend, as it is taking place at low levels, which pose a risk to the still fragile economic recovery and make the resolution of debt problems more difficult.

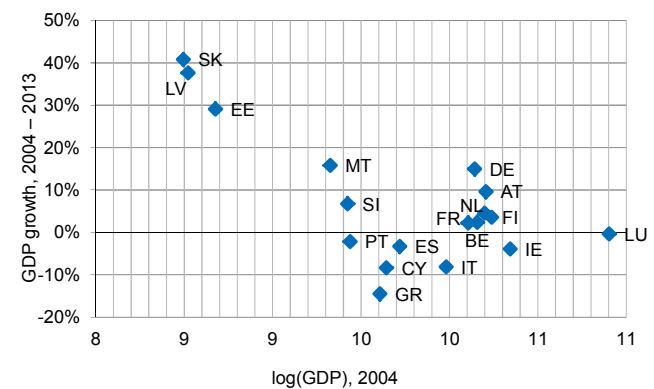
#### **1.1 CONVERGENCE OF REAL AND NOMINAL VARIABLES**

A prerequisite for an optimum currency area is a high degree of convergence of the level of economic activity as measured by real GDP per capita. In addition, the pursuit of a single monetary policy requires economies to be aligned in terms of the business cycle, in particular GDP growth and unemployment.

**Chart 1: Real GDP per capita in euro area countries (EUR thousands)**

Note: GDP at 2000 prices. Right-hand scale – standard deviation. The EA aggregate is created by dividing the real GDP of the euro area countries by the population.

Source: Eurostat, CNB calculations.

**Chart 2: Beta-convergence of real GDP in euro area countries**

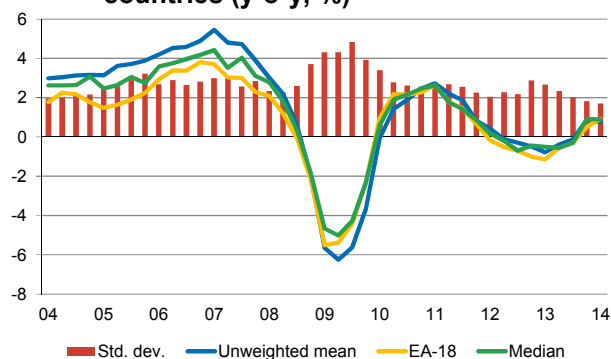
Source: Eurostat.

Chart 1 illustrates **real GDP per capita** and the differences in it across euro area countries in the last ten years. The chart shows that the differences in economic performance between member countries had been widening before the onset of the global financial crisis and then decreased. The decrease in the standard deviations<sup>10</sup> was mostly due to a larger absolute fall in real GDP in better performing countries in 2009. After increasing slightly in 2010 and 2011 as a result of the economies' different rates of recovery from the crisis-related contraction, the dispersion in the level of GDP per capita decreased again in 2012 and 2013, mainly due to similar impacts of the debt crisis on most euro area economies.

In addition to the cross-sectional view of the GDP level, it is important to monitor the **rate of growth of euro area countries**. In the optimum case, there should be beta-convergence in the monetary union, i.e. poorer countries should grow faster than wealthier ones and the differences in performance should thus level out. This faster growth should stem from their higher growth potential and the adoption of technologies from wealthier countries. Chart 2 suggests that some countries (mainly Slovakia, Latvia and Estonia) are indeed showing beta-convergence. On the other hand, countries with high or quickly rising government debt (particularly Portugal, Greece, Cyprus, Spain and Italy) have recorded a decline in economic activity per capita over the past ten years and have thus diverged from the best performing economies in terms of this measure.

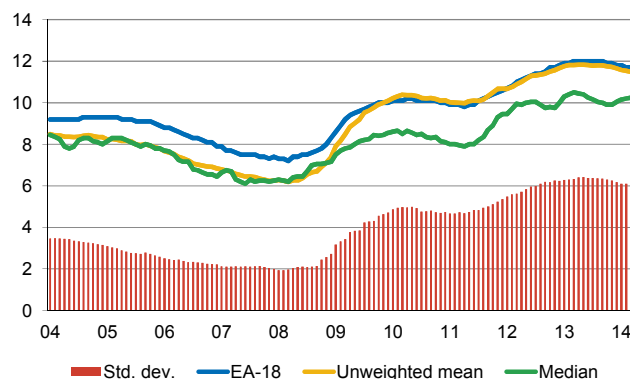
The **standard deviation of quarterly year-on-year GDP growth rates** in the economies under review shows no significant trend (Chart 3). This indicates that their business cycles are displaying no major change in alignment. However, the dispersion of the countries' growth rates increased in 2008–2010, as the economies were hit by recession in different periods and to different extents. At the end of 2012, the dispersion increased slightly again owing to the recession in the euro area. However, it has been falling gradually since 2013.

<sup>10</sup> When interpreting the standard deviation as an alignment indicator, we should point out a shortcoming in its construction. The standard deviation is unable to capture alignment in a multimodal distribution where clusters are formed within the group under review. In such case, the alignment within country subgroups (e.g. the euro area "core" or "southern periphery") may increase while the subgroups mutually diverge. Outliers with a large effect on the standard deviation (Greece in recent years) are another problem. These problems can be resolved, for example, by means of cluster analysis, which is described in Box 1.

**Chart 3: Real GDP growth in euro area countries (y-o-y, %)**

Note: The EA-18 aggregate represents GDP growth in the euro area as a whole. The source series are seasonally adjusted.

Source: Eurostat, EIU, CNB calculations.

**Chart 4: Unemployment in euro area countries (%)**

Note: The EA-18 aggregate represents unemployment in the euro area as a whole. The source series are seasonally adjusted.

Source: Eurostat, CNB calculations.

By contrast, the differences in the **unemployment rate** are following a trend (see Chart 4). The differences in the unemployment rate were on a downward trend as from 2004, mainly because of falling unemployment in the countries with the highest rates (primarily Slovakia, Latvia and Spain). During the financial crisis, conversely, unemployment rose in almost all countries and the rates in the hardest hit countries (Spain, Estonia, Slovakia, Ireland, Greece and Latvia) started to diverge from the other countries, resulting in a substantial increase of the mean above the median and widening misalignment between countries. This misalignment increased further in the following years, when unemployment rose mainly in the countries hit hardest by the debt crisis. The growth in unemployment rate misalignment moderated in early 2013 and switched to a modest decline in early 2014. Similarly, average unemployment started to decline slightly this year.

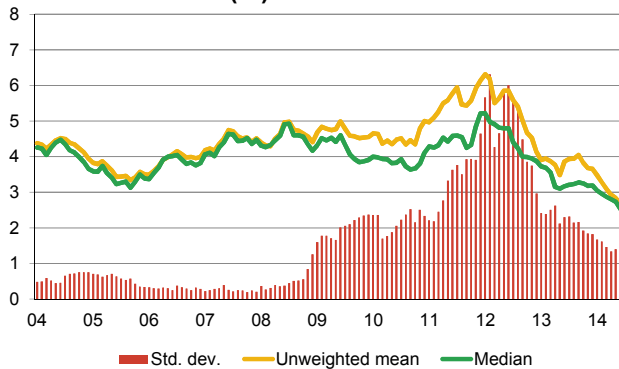
In addition to convergence of real variables, **nominal convergence** is important for the successful functioning of the monetary union. Differences in long-term interest and inflation rates signal structural differences and differences in competitiveness. They also lead to differing real interest rates and their subsequent different impacts on the economy.

**Long-term interest rates** recorded modest convergence in the pre-crisis years (see Chart 5). In 2009, however, they recorded a surge in misalignment. This decreased significantly only at the end of 2012 when the ECB announced its outright monetary transactions (OMT) programme, which led to a calming of the situation in euro area government bond markets. There was a temporary increase in yields last year after the Federal Reserve announced a planned tapering of its securities purchases. However, yields continued falling at the end of 2013 and reached historical lows in some countries in 2014.

Chart 6 shows that **inflation** recorded relative alignment after euro adoption, but the crisis years saw a temporary increase in misalignment. At present, inflation is well below the ECB's definition of price stability, and even the core euro area countries have been facing low inflation levels in recent months. This poses a problem for the euro area going forward for several reasons. First, the real debt of the southern countries, which are facing deflation, is rising faster than their nominal debt. The deflation in these countries coupled with still relatively high nominal interest rates (see also Chart 7) means high real interest rates and hence also large real debt servicing costs. Moreover, the observed low inflation differential of the core euro area countries vis-à-vis the southern countries and the low overall level of inflation mean that the adjustment process and the return of the southern countries' competitiveness will take longer than it would if the inflation differential or the overall inflation

level were higher. This implies that high nominal convergence may prevent the renewal of real convergence.

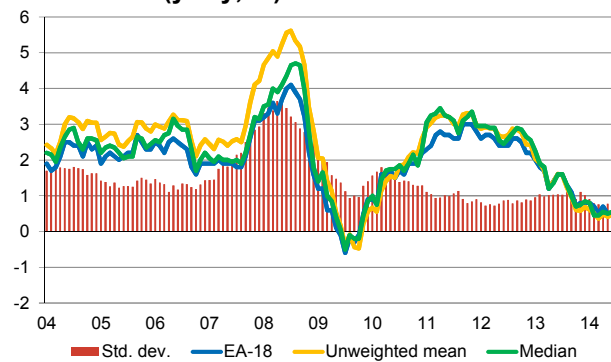
**Chart 5: Long-term interest rates in euro area countries (%)**



Note: Bond yields (on secondary markets) for the convergence criteria. The bond maturity is about ten years. Estonia is not included in the chart because a sufficiently long time series is not available.

Source: ECB, CNB calculations.

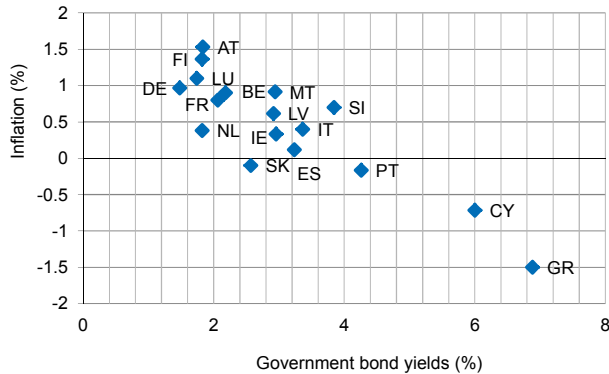
**Chart 6: The inflation rate in euro area countries (y-o-y, %)**



Note: The EA-18 series is a weighted average of the inflation rates of the euro area countries, where the weights are the shares of household expenditure of the given countries in household expenditure in the euro area. The source series are seasonally adjusted.

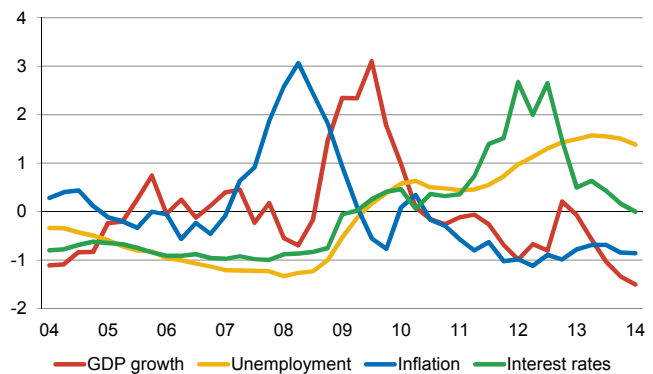
Source: Eurostat, CNB calculations.

To sum up, the evolution of the alignment of euro area economies can be illustrated using normalised standard deviations of key macroeconomic variables (GDP growth, the unemployment rate, the inflation rate and interest rates – see Chart 8). Negative (positive) values indicate that the dispersion of a variable is below (above) the long-term average. Most variables – except for GDP growth – were indicating relative alignment until the financial crisis broke out. After 2008, there is a clear upward trend in the misalignment of the variables, except for the inflation rate, whose dispersion – after rising temporarily in 2008 – fell back below its long-term average and is currently close to its historical lows. Until 2012, the biggest and fastest-growing misalignment could be seen for long-term interest rates, reflecting the differing magnitudes of the debt problems across euro area countries. Since 2013, however, this misalignment has decreased significantly, thanks in large part to the ECB's actions and communications. By contrast, high misalignment persists for the unemployment rate. Given the low GDP growth across the euro area, the standard deviation of this variable remains below its long-term average.

**Chart 7: Long-term nominal interest rates and inflation in euro area countries (%)**

Note: Average bond yields for convergence purposes in 2014 H1. Average annual inflation in 2014 H1. Ex post real yields are defined as the difference between nominal yields and inflation.

Source: ECB, CNB calculations.

**Chart 8: Evolution of the alignment of the variables under review**

Note: The individual series in the chart depict the normalised standard deviations of the variables under review.

Source: ECB, Eurostat, EIU, CNB calculations.

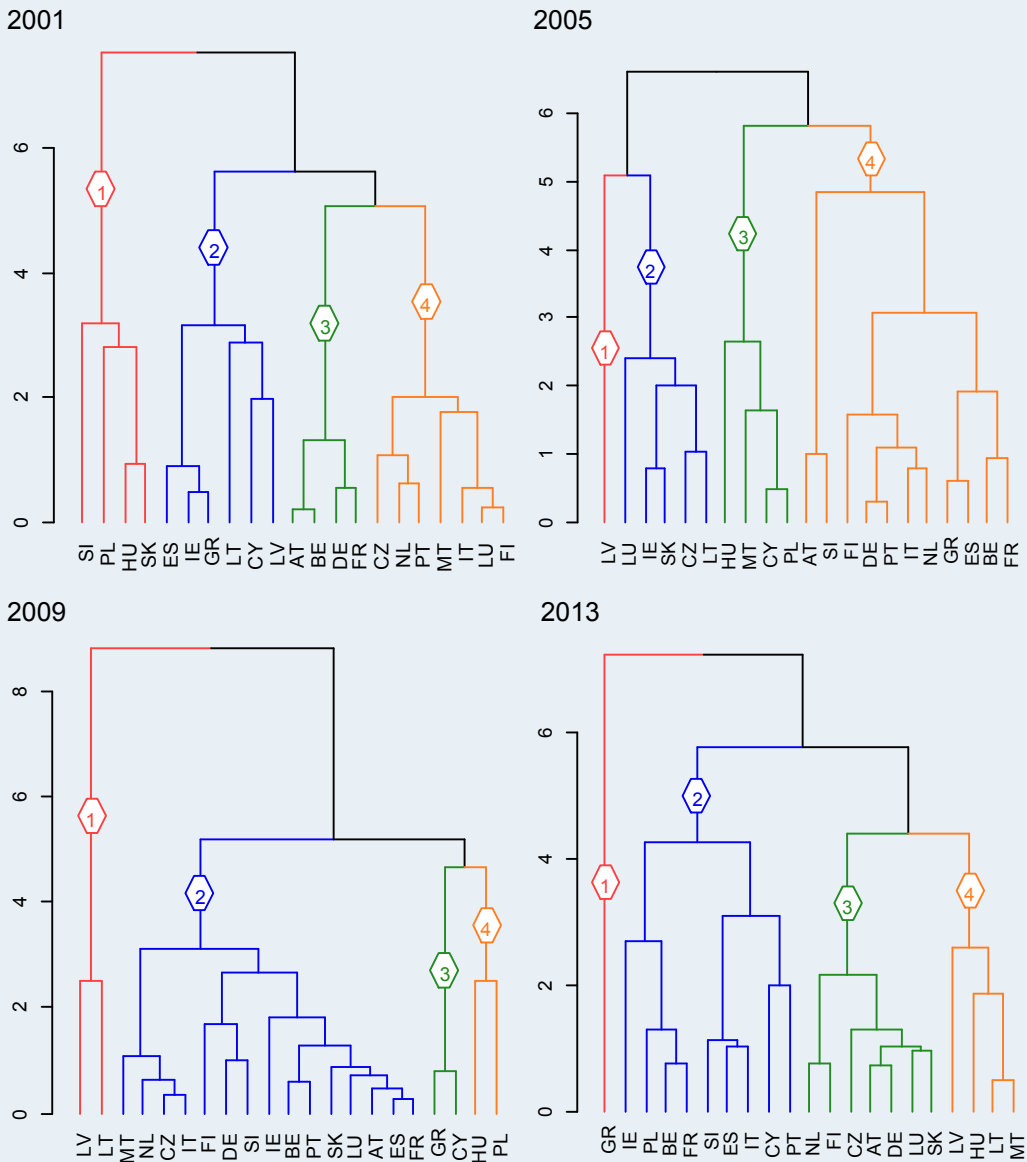
### Box 1: Economic alignment in euro area economies and the Central European region from the perspective of cluster analysis

The above analysis revealed the evolution of the overall misalignment of the euro area across individual indicators. However, the use of standard deviations does not allow us to look closely at the dynamics within the group of countries under review. Such an approach may be inaccurate if the sample contains homogeneous groups showing different trends. A multivariate approach is offered, for example, by a cluster analysis,<sup>11</sup> which divides elements into groups (clusters) based on similarity or distance, i.e. it maximises intra-group homogeneity and inter-group heterogeneity. It thus seeks groups of economically similar countries using all indicators simultaneously. This analysis applies Ward's method of hierarchical clustering. Using Ward's algorithm, clusters with the minimum distance between the indicators for individual countries are merged from the individual country level up in successive steps. This results in a dendrogram illustrating a country's allocation into clusters depending on the squared Euclidean distance.

Chart B1 shows the dendrograms in 2001, 2005, 2009 and 2013 based on four standardised indicators (inflation, GDP growth, unemployment and long-term interest rates) using colours that are different at the fourth level. In addition to the euro area, the chosen sample of countries contains three Central European economies (the Czech Republic, Poland and Hungary) and Lithuania as a new euro area member as from January 2015. The analysis does not cover all the euro area countries owing to missing data. The dendrograms show that homogeneous groups can be found within the enlarged euro area, but that the number of clusters at certain distances and the composition of the clusters have changed over time.

In the pre-crisis period, we can see a larger number of clusters with a uniform number of countries per cluster. The dendrogram for 2001 shows clusters of countries where we can identify the core of the euro area (cluster 3), the periphery countries and the acceding/ candidate countries. In 2005, the method identifies a single cluster for the euro area with the exception of Ireland (cluster 4).

<sup>11</sup> Simple cluster analysis is limited by the impossibility of defining the statistical significance of subclusters. The interpretation can also change according to the indicators chosen, so the literature uses aggregate indices of economic integration (e.g. König and Ohr, 2012). For comparability, however, we only use the indicators from section D 1.1 and do not consider geographical distance. More information on cluster analysis can be found in the *Methodological Part*.

**Chart B1: Dendrograms using Ward's method**

Source: ECB, CNB calculations.

Economic developments in numerous European economies have synchronised owing to the impact of the global financial crisis, and a large cluster at short distances was formed in 2009 (cluster 2). Three small separate clusters formed (cluster 1 – Latvia and Lithuania, cluster 3 – Greece and Cyprus, cluster 4 – Poland and Hungary). The groups of countries hit differently by the financial crisis thus deviated from the developments in cluster 2. Latvia and Lithuania recorded contractions in GDP and increases in inflation, while long-term rates doubled compared to 2008. Greece and Cyprus saw sharp rises in unemployment and very low consumer price inflation.

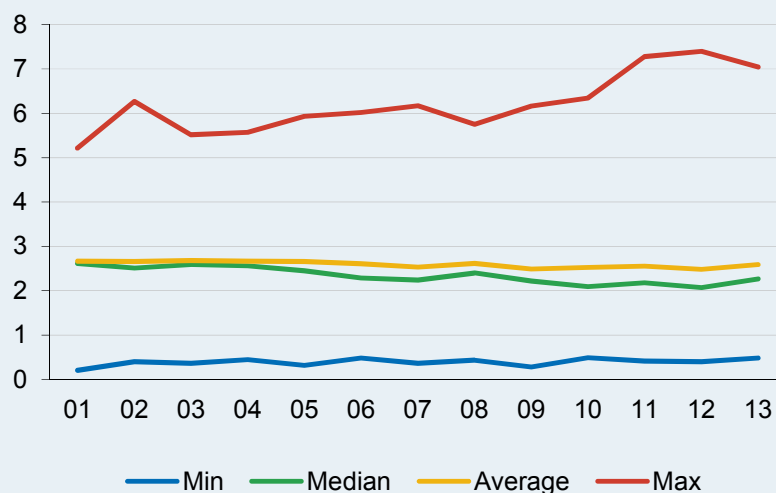
The number of small clusters increased again in 2013. However, the euro area can no longer be clearly identified as a single unit, and the countries that in 2001 could be identified as core countries are now economically closer to the countries hit by the debt crisis. The deviation persists for Greece, mainly because of deflation and a strong recession. The dendrograms show convergence with the euro area for two Central European countries – Hungary and Poland, which have not formed a clearly separate cluster as in 2001 since the middle of the period under review.



Cluster analysis identifies the Czech Republic in 2013 as an element of cluster 3, which can be called the narrower core of the EU. In this cluster, the Czech economy was the closest to the economies of Germany, Austria, Slovakia and Luxembourg in 2013. The narrower core of the EU in 2013 also included Finland and the Netherlands, but excluded traditional countries such as France and Belgium.

The fact that some countries deviated significantly from the core of the euro area in the post-crisis period is confirmed by the rising maximum value of the pairwise Euclidean distances (Chart B2). The rise in dispersion presented in section D2 was thus caused by fundamentally different economic developments in several countries (particularly Greece and the Baltic states). On the other hand, the median of these distances decreased, so the process of convergence between similar countries continued to a small extent.

**Chart B2: Diversity measures based on pairwise Euclidean distances**



Note: Pairwise Euclidean distance statistics from the entire sample in the given year.

Source: ECB, CNB calculations.

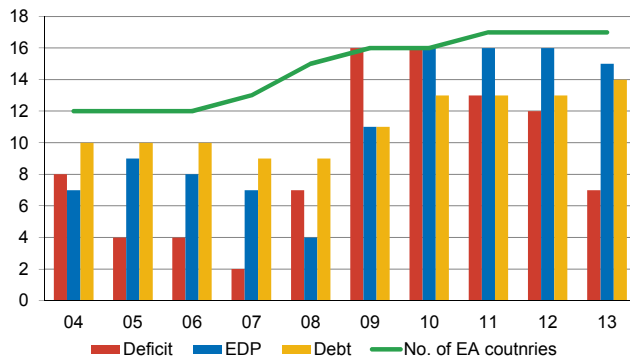
## 1.2 FISCAL SITUATION OF EURO AREA COUNTRIES

The fiscal situation of individual members is an important aspect of the economic alignment of euro area countries. It also determines the options available to national governments in the monetary union to stimulate the economy through spending in the event of adverse asymmetric shocks. Chart 9 shows the number of countries non-compliant with the Stability and Growth Pact (deficit and debt criteria) and the number of countries in an excessive deficit procedure (EDP). The developments to date point to long-lasting insufficient fiscal discipline of individual EMU members, which is the main cause of the euro area's current problems. Last year saw an improvement, particularly as regards the deficit criterion, thanks to fiscal consolidation in previous years and to a recovery in growth in some economies last year. This led to the abrogation of the EDP in four euro area countries (Belgium, the Netherlands, Austria and Slovakia) this year.

Looking at the fiscal situation of individual countries (see Chart 10), we can see that three of the five countries compliant with the deficit and debt criteria in 2013 were the youngest euro area members. Compared to previous years, fiscal deficits also decreased in countries non-compliant with the budgetary criterion. Nonetheless, no quick and substantial improvement in the fiscal situation in the euro area can be expected. In particular, the countries on the southern periphery of the euro area are afflicted by fiscal problems, and their budget imbalances are linked with general macroeconomic and financial instability. These countries'

problems include low economic growth, high unemployment and very low inflation or deflation, which is further increasing the real value of their debt.

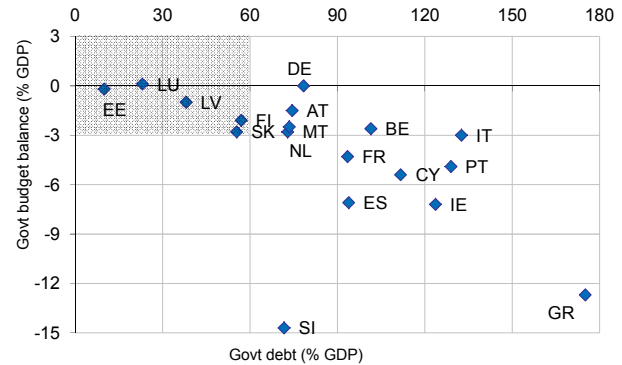
**Chart 9: Non-compliance with the fiscal criteria**



Note: The number of countries not compliant with the Stability and Growth Pact, which sets limits on government deficits (3% of GDP) and debt (60% of GDP). The EDP series shows the number of countries in an excessive deficit procedure. The number of countries in an excessive deficit can be higher than the number of countries with an excessive deficit, as EDPs usually last several years.

Source: Eurostat, European Commission, CNB calculations.

**Chart 10: Fiscal positions of euro area countries**



Note: 2013 data. Countries compliant with the Stability and Growth Pact lie in the grey area (see Chart 9).

Source: Eurostat.

## 2 ECONOMIC, POLICY AND INSTITUTIONAL DEVELOPMENTS IN THE EUROPEAN UNION AND THE EURO AREA

The **economic situation** in the EU and the euro area improved gradually last year. Economic activity recovered and the financial markets were mostly relatively calm. However, inflation in the euro area fell gradually and since October 2013 has been well below the ECB's definition of price stability (i.e. inflation just below 2%). Some countries even recorded deflation. A calming of the economic situation was also apparent in the discontinuation of economic stabilisation programmes in Ireland and Spain, programmes which had included financial support from the EU and in the case of Ireland also from the IMF. EU- and IMF-backed economic stabilisation programmes continue in Greece and Cyprus. The programme for Portugal was ended on 18 May 2014.<sup>12</sup>

Last year, the **economic policy** of EU countries was focused on continuing with differentiated fiscal consolidation (with a declared effort to support economic growth), restoring smooth flows of credit to the real economy, and promoting competitiveness and tackling unemployment and the social consequences of the crisis. All this was going on in a situation where, on the one hand, the economic situation was improving as described above, but, on the other hand, some degree of "reform fatigue" was being felt, a fact even admitted in some official EU documents.

In connection with the fourth **European semester**, the Ecofin Council (in the composition of the ministers of economy and finance) in mid-2014 prepared new recommendations addressed to the Eurogroup<sup>13</sup> directed at further increasing economic and fiscal policy coordination. This year's main priorities are to ensure the quality and sustainability of public finances and to

<sup>12</sup> This section follows on from the relevant section of last year's Alignment Analyses and describes the situation as of 8 September 2014.

<sup>13</sup> The Eurogroup (which acquired legal personality when the Lisbon Treaty took effect in 2009) consists of euro area finance ministers. Preparatory meetings are held at lower working levels in the same format.

increase the resilience of the banking sector. A review of earlier approved legislative packages regarding economic governance (the Sixpack<sup>14</sup> and the Two-pack<sup>15</sup>) is then planned for the end of this year.

In the course of 2014, discussions continued at the level of the European Council, the Ecofin Council and the Competitiveness Council on strengthened coordination of economic policies of EU countries. As part of this debate, proposals were made to create new mechanisms encouraging structural reforms in the form of bilateral contractual arrangements and associated solidarity mechanisms. Also discussed was the issue of joint funding of economies and the possibility of creating a new investment support fund as proposed by the new President of the European Commission Jean Claude Juncker. More specific outcomes from this discussion can probably be expected in 2015. In this context, the debate on potential changes to primary EU law to strengthen the position of the EU and its institutions in coordinating structural reforms will probably be renewed.

Last year, further steps were taken to establish a **banking union**, whose key building blocks are single supervision of systemically important financial institutions, single bank crisis resolution and the Single Rulebook.

The **Single Supervisory Mechanism** (SSM) should be fully operational from November 2014. The ECB will assume supervisory powers over systemically important financial institutions (at present about 120 institutions and groups representing almost 85% of euro area banking assets) and will be able to give instructions to national supervisors and determine macroprudential policy tools. Uniform rules will be created for financial services in the participating Member States. The SSM is supposed to contribute to the resilience of individual institutions and to the stability of the financial sector as a whole. Banks have undergone an Asset Quality Review (AQR) conducted by the ECB and stress tests coordinated by the European Banking Authority (EBA). The aim was to determine the likely need for capital increases assuming various future scenarios. The results of this comprehensive assessment were published in October 2014.

If a bank's capital is found to be insufficient, the bank will have to make it up within six to nine months. Should the bank be unable to make up the capital shortfall from its own funds, its shareholders or junior bond holders will be required to do so (bail-in). If this procedure fails to achieve the desired result, the **Single Resolution Mechanism** (SRM) will apply. Under the relevant regulation, bank resolution powers will be transferred to the Single Resolution Board (SRB). For these purposes, a Single Resolution Fund (SRF) will be created, which will be financed by contributions from financial institutions. The target capacity of the SRF for 2024 is EUR 56 billion, and banks will have to pay one-eighth of the required amount each year.<sup>16</sup>

Backstops will be the next step in resolving the recapitalisation of banks at the national and then the European level. These backstops will be financed from public funds. The creation of a single European backstop has been postponed, as agreement has not been reached on what form it should take. For the time being, it will be possible to recapitalise systemically important

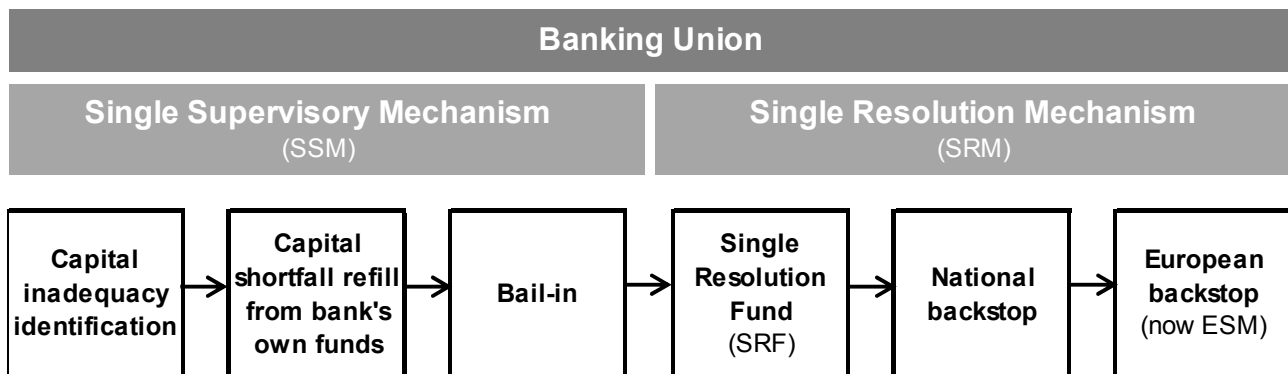
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<sup>14</sup> The Sixpack has been in effect since 2012 and consists of six legislative measures – an amendment to the preventive and dissuasive arms of the Stability and Growth Pact (SGP), a regulation on the effective enforcement of budgetary surveillance in the euro area, a regulation on the prevention and correction of macroeconomic imbalances, a regulation on enforcement action to correct excessive macroeconomic imbalances in the euro area, and a directive on requirements for national budgetary frameworks.

<sup>15</sup> The Two-pack of 2013 contains two regulations focused exclusively on euro area countries that have further increased the integration of their economic and fiscal policies. The new regulations introduce effective budgetary surveillance of euro area countries, with enhanced surveillance for those which are subject to excessive deficit procedures and those which need financial assistance. Last but not least, the Two-pack codifies and unifies the rules for submitting draft budgetary plans of euro area countries for the following year, as well as the rules governing adjustment programmes for countries experiencing financial difficulties.

<sup>16</sup> However, progressive filling of the SRF and burden-sharing had to be regulated in a special Inter-Governmental Agreement on the SRF (IGA-SRF), as the Treaty on the Functioning of the European Union does not allow the establishment and operation of the SRF under the existing European legislation adopted by a qualified majority.

banks from the European Stabilisation Mechanism (ESM), the original purpose of which was to resolve financial problems of national governments. At present, the overall ceiling on direct bank recapitalisation from the ESM is EUR 60 billion (although the Board of Governors of the ESM may change this amount). Recapitalisation will be conditional on compliance with a number of conditions. A burden-sharing scheme has been agreed stipulating the minimum level of regulatory capital that is to be covered solely by the Member State. Only after this level is reached will ESM funds come into play. Retroactivity of direct recapitalisation from the ESM is not ruled out and will be addressed on an individual basis following a request of a Member State and by mutual agreement of the ESM members.



However, the amount that will be available in the SRF and the ESM will be far from enough to resolve any major problems in the banking sector. The combined financial capacity of the SRF and the ESM will be less than EUR 120 billion in 2024. In 2013, the assets in the euro area banking sector totalled EUR 30 trillion (i.e. thirty thousand billion), of which EUR 10.5 trillion represented loans to the private sector, EUR 5 trillion interbank assets and EUR 1.7 trillion government securities. The current absence of an additional European backstop enabling sharing of liabilities for potential banking sector losses not covered by the SRF and the ESM thus represents one of the most important objections to the newly established banking union. Another risk relevant to the banking union and the euro area as a whole is moral hazard resulting from expectations that the costs of banks failures will always be covered by common funds.

By joining the banking union before adopting the euro, the Czech Republic would gain no higher guarantees or significant benefits in the area of financial stability compared to the current situation. On the contrary, Czech subsidiaries would be faced with the risk of potential asset transfers and liquidity outflows to their parent institutions or members of their banking groups, and the Czech authorities would have no effective way of preventing such transfers.<sup>17</sup> The Czech Republic could view non-participation in the banking union as a disadvantage only if the banking union was seen as an environment with higher regulatory standards, better compliance with, and enforcement of, such standards, and better financial securing of banking sector losses thanks to the common resolution fund and the fiscal mechanism of the banking union by comparison with conditions in countries outside the banking and monetary union. This, however, cannot be expected, as the above-mentioned preconditions for a stable environment already exist in respect of the Czech Republic's current position outside the banking union.

<sup>17</sup> Czech banks would therefore face potential contagion within banking groups, with a possible adverse effect on the stability of the domestic financial sector and the real economy. It is very likely that they would not attain higher credibility and lower financing costs compared to the current situation. Other risks of the Czech Republic's potential participation in the banking union include the separation of supervisory powers from the Czech Republic's continuing obligation to bear the costs of stabilising the sector, a possible need to spend money from national budgets, and the Czech Republic's limited position in the SSM's decision-making processes (supervision and recovery procedures) and in decisions on bailouts.

The accession of the Czech Republic to the banking union is therefore a step connected only with potential euro area entry, upon which the single currency, single supervision and the single lender of last resort will become logically connected. It thus effects the expected benefits and costs linked with future euro adoption.

The **monetary policy of the European Central Bank** last year was focused on further easing the monetary conditions and on supporting lending. After lowering rates in May, the Governing Council signalled the future monetary policy stance in July 2013 by announcing that the ECB interest rates would remain at present or lower levels for an extended period of time (forward guidance). In November 2013, the ECB lowered its key interest rate by 0.25 pp to 0.25%. The deposit rate remained at 0%. The ECB at the same time announced that it would continue providing liquidity to banks via fixed rate tender procedures with full allotment. It confirmed this decision in June 2014. June 2014 saw also a further rate cuts. The key interest rate was reduced to 0.15% and the deposit rate turned negative (-0.10%). At its June meeting, the ECB also decided to conduct targeted longer-term refinancing operations (TLTROs), the available amount of which would depend on the amount of loans provided by the counterparty to the private sector (excluding loans for house purchase). At its September meeting, the ECB lowered all its interest rates by another 0.10 pp. It also confirmed that it would not lower rates further. The ECB also announced the launch of massive outright purchases of asset-backed securities and covered bonds issued by financial institutions in primary and secondary markets. It will launch the two programmes in October. In this way it hopes to boost the fragile growth and steer inflation expectations towards the 2% target.

### 3 CONCLUSION

Last year, the euro area made further progress towards significantly strengthening economic policy coordination and integration. The main elements of the new architecture in the euro area, which will take the form of a banking union, are now defined more clearly than in previous years. In particular, the demands on national and EU resources have increased and new authorities have been established specifically for euro area countries.

If it became a banking union participant, and thus a contracting party of the ESM as a result of adopting the euro, the Czech Republic would have to pay about CZK 51 billion into the capital of the ESM (according to updated calculations of the Czech Ministry of Finance) and undertake to supply a further amount of up to around CZK 391 billion in the event of non-repayment of loans or a large decrease in the contracting parties' solvency. Were the Czech Republic to join the SSM, the obligation to pay the ECB a fee<sup>18</sup> would apply to all credit institutions in the Czech Republic, except for three foreign bank branches whose head offices are in the UK, which is not participating in the SSM. In such case, the total fee payable to the ECB by liable domestic credit institutions can be estimated at EUR 1.8 million, which is a trivial amount with regard to the total costs and benefits of adopting the euro.

Given these facts, it can be said that the uncertainty surrounding the future form of the basic economic, political and institutional architecture of the euro area, which in past years was a major obstacle to reliably assessing the costs and benefits to the Czech Republic of joining the euro area, has decreased compared to previous years. It is thus apparent that the euro area is undergoing substantial institutional change. The main shifts relate to the fiscal costs of joining the euro area rescue mechanisms and a reduction in national autonomy in the area of banking supervision in an effort to make the monetary union more resilient to fiscal problems in individual countries and to shocks originating in their banking systems.

<sup>18</sup> As from 2015, the ECB will levy supervisory fees on banks in all euro area countries and in all countries joining the SSM. The fee will apply both to systemically important banks directly supervised by the ECB and to less important banks indirectly supervised by the ECB. The total amount of the fees will be equal to the ECB's costs of supervision. For 2015, these costs are estimated at EUR 260 million.

## E RESULTS OF THE ANALYSES

### 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. For the Czech economy, the risk of time misalignment or 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 similarity 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 principal direct alignment indicators are the development of domestic economic activity, the exchange rate and interest rates compared to the euro area. Convergence in economic and price levels fosters a situation where similar long-term processes will proceed in the economy and there will be no major differences in equilibrium development compared to the euro area. High synchronisation of the business cycle increases the probability that cyclical developments in the economies will also be aligned in future. Disequilibrium in the business cycle can stem, among other things, from different economic structures and from insufficient convergence at the 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 derived from this parity, is a fundamental indicator of the similarity of two economies. A low degree of real convergence with the euro area may be a substantial disadvantage as regards euro adoption. Assuming that the gap in the relative GDP level will close gradually in the future, this process will probably be associated with convergence of the price level towards 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.<sup>19</sup> 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 will be lower real interest rates compared to the euro area average. Such rates have many favourable impacts, such as investment support, faster long-term convergence and lower public debt service costs. However, as the experience of many converging economies with fixed exchange rates in the last ten years or so shows, they can contribute to creating serious macro-financial imbalances such as excessive lending, property market bubbles and high current account deficits (Ahrend et al., 2008; Taylor, 2009; Martin, 2010).

As Table 1: GDP per capita at purchasing power parity (EA-18 = 100) shows, the convergence process of **GDP per capita at purchasing power parity** in the Czech Republic had not yet

<sup>19</sup> The simultaneous restriction (implied by the Maastricht criteria) placed on the inflation differential and the appreciation of the nominal exchange rate represents an implicit restriction on the speed of appreciation of the real exchange rate. If the equilibrium real appreciation is faster than this restriction, the fulfilment of the convergence criteria may require a temporary undervaluation of the exchange rate. However, this problem is mitigated by the fact that the exchange rate criterion is significantly more tolerant of nominal exchange rate appreciation than depreciation. Moreover, the increased emphasis laid in recent years on sustainable fulfilment of the price stability criterion means that a converging country – like Slovakia in 2009 – may be willing to adopt the euro with an overvalued real exchange rate so as to avoid inflationary pressures associated with price level convergence in the years following euro area entry.



renewed in 2013. The level of Czech economic activity now stands at almost 75% of the euro area average. This is lower than in 2007, when Europe had yet to be hit by the economic crisis. The Czech Republic thus still lags well behind the advanced euro area countries under review (Austria and Germany). Slovenia also has a slightly higher economic level, although the difference has narrowed considerably since 2007 owing to serious problems in the Slovenian economy. By contrast, some of the least advanced monetary union countries have lower GDP per capita than the Czech Republic (Slovakia and Portugal).<sup>20</sup> The same still applies to the new non-euro area EU Member States (Hungary and Poland).

**Table 1: GDP per capita at purchasing power parity (EA-18 = 100)**

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
<b>CZ</b>	71.9	73.0	73.5	76.0	74.5	76.4	74.3	74.4	75.0	74.4
<b>AT</b>	117.4	115.2	115.6	114.0	114.8	116.1	116.6	118.3	119.9	119.9
<b>DE</b>	106.4	106.6	106.2	106.3	107.0	105.9	110.2	112.8	114.1	115.5
<b>PT</b>	71.1	73.4	72.8	72.3	72.0	74.0	74.0	70.7	70.3	70.0
<b>HU</b>	57.9	58.2	58.0	56.5	58.7	60.2	60.8	61.9	61.6	62.1
<b>PL</b>	46.4	47.1	47.9	50.2	52.0	55.9	58.1	60.1	62.0	63.2
<b>SI</b>	79.6	80.3	80.5	81.5	83.8	79.5	77.7	77.7	77.5	76.9
<b>SK</b>	52.3	55.3	58.0	62.4	66.8	66.9	68.3	69.2	70.3	70.8

Source: Eurostat, CNB calculations.

Table 2: Average price level of GDP (EA-17 = 100) illustrates the **price level of GDP**. The Czech Republic's level in terms of this indicator is higher than in the pre-crisis period, but has decreased slightly overall since 2008, partly reversing the previous fast convergence. In 2013, the Czech price level was 67% of the euro area average,<sup>21</sup> still lagging well behind not only Austria and Germany, but, to a lesser extent, also Portugal and Slovenia. By contrast, Slovakia, and particularly Hungary and Poland, had a lower price level.

**Table 2: Average price level of GDP (EA-17 = 100)**

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
<b>CZ</b>	51.6	56.1	59.7	61.1	71.0	66.1	69.7	70.2	68.5	67.0
<b>AT</b>	100.7	103.5	103.3	105.5	105.8	106.2	106.2	106.5	106.9	107.8
<b>DE</b>	103.2	101.2	101.0	101.1	100.8	101.8	100.5	99.9	100.6	101.0
<b>PT</b>	82.4	79.9	79.9	80.2	80.6	79.6	79.8	80.5	78.4	78.8
<b>HU</b>	57.8	60.5	58.6	63.5	63.9	56.3	57.4	56.7	55.9	55.7
<b>PL</b>	47.3	54.3	57.1	59.3	65.6	54.2	57.5	56.7	56.2	56.0
<b>SI</b>	70.5	71.5	73.3	76.6	78.7	81.1	80.9	80.2	78.2	77.9
<b>SK</b>	49.7	51.6	54.1	59.2	63.7	64.3	64.4	65.2	65.9	65.7

Source: Eurostat, CNB calculations.

An **analysis of the empirical relationship** between the price level of GDP and GDP per capita at purchasing power parity for 36 European countries<sup>22</sup> reveals that the Czech price level in 2013 continued to lie below the level corresponding to the performance of the economy. According to the estimated relationship, the Czech price level should be roughly 12.5 pp higher in relation to the euro area average, i.e. it should be roughly the same as in

<sup>20</sup> In Portugal, this largely reflects the problems which the country has been facing in recent years. This applies even more so to Greece, which was clearly ahead of the Czech Republic in 2010 and now lags behind it (69.3% of the euro area average). Estonia, with GDP per capita at purchasing power parity of 67.1%, is also less advanced than the Czech Republic. The same holds true for Latvia (62.5%) and for Lithuania (69.0%), which is to enter the euro area in 2015. However, we do not comment on Greece and the Baltic States in the following parts of the Alignment Analyses.

<sup>21</sup> The price level was partly affected by the CNB's decision of November 2013 to start using the exchange rate as an additional instrument for easing the monetary conditions after its monetary policy rates had hit the zero lower bound. This factor will be fully reflected only in the data for 2014, but it does significantly affect the outlook for the real exchange rate for the period after 2014 (see Table 3).

<sup>22</sup> See the *Methodological Part* and Čihák and Holub (2003; 2005).

Slovenia or Portugal. On the other hand, the Czech Republic's main trading partner countries (Germany, Austria, Slovakia and Poland) showed deviations from the estimated price level in the same direction and to a similar or even greater extent (in some cases probably due partly to an above-average share of industries producing tradable commodities in overall economic activity). The Czech price level thus does not seem low relative to these main trading partners.

Table 3 presents the **evolution of the real exchange rate** against the euro. Between 2004 and 2013, the real exchange rate of the koruna appreciated by almost 30%, i.e. at an average rate of 2.4% a year. The real appreciation of the Czech currency was concentrated in the first half of the above ten-year period and its average rate was much higher than in the current euro area countries under comparison except Slovakia. In the case of Germany, the real exchange rate actually depreciated somewhat, increasing its price competitiveness.<sup>23</sup> The Hungarian forint and Polish zloty have also appreciated less than the Czech koruna in the last ten years. Since 2008, however, the real koruna-euro exchange rate has depreciated slightly, reflecting the relatively adverse evolution of the Czech economy over the last five years.

**Table 3: Real exchange rate against the euro (HICP deflated; 2003 = 100; average annual rate in %)**

	Basic index (2004=100)										Avg. annual rate	
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2004–2013	Outlook <sup>a)</sup>
<b>CZ</b>	100	107	112	115	132	125	130	133	131	127	2.4	( 2.4 ; 3.4 )
<b>AT</b>	100	100	99	99	99	99	99	100	100	101	0.1	( 0.5 ; 1.1 )
<b>DE</b>	100	99	99	99	99	98	98	98	97	98	-0.2	( 0.8 ; 1.5 )
<b>PT</b>	100	100	101	101	101	99	99	100	100	99	-0.1	(-0.1 ; 0.2 )
<b>HU</b>	105	108	103	115	118	110	115	115	114	112	1.1	( 3.0 ; 4.0 )
<b>PL</b>	99	111	113	117	127	107	117	115	115	114	1.3	( 3.3 ; 4.5 )
<b>SI</b>	99	99	100	101	103	104	104	104	104	105	0.5	( 0.7 ; 0.8 )
<b>SK</b>	109	114	120	132	144	150	149	151	152	153	4.3	( 1.8 ; 2.4 )

Note: a) Interval estimate of the average rate of equilibrium real appreciation for the next five years (see the *Methodological Part*).

Source: Eurostat, CNB calculations.

Continued **equilibrium real appreciation** can be expected for the currencies of the converging countries once the impacts of the European debt crisis and domestic fiscal consolidation have faded away and long-term convergence is renewed. Its pace will probably be lower than in the pre-crisis period and it is likely to take place partly via a slightly positive inflation differential vis-à-vis the euro area average. Interval estimates of equilibrium real appreciation for the next five years based on a panel estimation of price convergence (see the *Methodological Part* for details) are given in the last column of Table 3. The range for the Czech koruna is 2.4–3.4%. This estimate can be regarded as overstated,<sup>24</sup> but it is evidently higher than for all the existing euro area members (with the partial exception of Slovakia, where the difference is not so apparent). For countries outside the euro area, i.e. Hungary and Poland, the estimates are higher than those for the Czech koruna, reflecting their lower initial GDP per capita and, in the case of the Polish zloty, stronger real depreciation since 2008 compared to the Czech koruna. The above range corresponds to the average inflation

<sup>23</sup> The price levels of Germany and Austria are thus below the level corresponding to their GDP per capita in international comparison (see above). For this reason, the estimates presented in Table 3 predict equilibrium real appreciation going forward, even though these countries are not converging economies. This could occur, for example, via low inflation or even deflation in other euro area countries which have lost price competitiveness and must now undergo a process of "internal devaluation". One such example is Portugal, whose price level is above the level corresponding to its GDP per capita and whose outlook does not suggest any real appreciation (not even if one assumes real GDP convergence, which will be difficult for this country to achieve in practice over the next few years).

<sup>24</sup> Starting with Inflation Report IV/2013, the CNB's forecasts work on the assumption of long-term equilibrium real appreciation of the koruna vis-à-vis the "effective euro area" at a rate of 1.5% a year. One should bear in mind, however, that Germany, Slovakia and Austria have large weights in the effective euro area. For these countries, the method used implies equilibrium real appreciation vis-à-vis the euro area as a whole, and therefore above-average inflation. The real appreciation of the koruna will probably be lower vis-à-vis the effective indicator than vis-à-vis the euro area itself (the real exchange rate will probably appreciate vis-à-vis the latter partly via a positive inflation differential).



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 in line with the long-run forecasts,<sup>25</sup> inflation in the Czech Republic could therefore increase to about 4–5% during the initial years following euro area entry. This would mean a marked increase in inflation compared to the 2% target set by the Czech National Bank as from 2010.

Owing to higher inflation, the Czech Republic and the other countries in the region would have lower **real interest rates** (see Table 4) compared to the average in the euro area and to most of the euro area countries under review (Austria, Germany, Portugal and Slovenia) in the event of euro adoption. Short-term real money market interest rates could even be negative in the Czech Republic and in the other converging countries for an extended period. In the Czech Republic, the real three-month interest rate would be between -1.9% and -0.9% on average according to the above estimate. On the other hand, the Czech Republic has had low average real rates since 2004, so euro adoption would not generate such a strong economic shock in this respect as in the case of Hungary and Poland.

**Table 4: Three-month ex-post real interest rates (%; HICP deflated)**

	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Average <sup>a)</sup>	Outlook <sup>b)</sup>
<b>CZ</b>	-0.2	0.4	0.2	0.1	-2.1	1.6	0.1	-0.9	-2.4	-0.9	-0.4	(-1.9 ; -0.9)
<b>AT</b>	0.2	0.1	1.4	2.0	1.4	0.8	-0.9	-2.1	-2.0	-1.9	-0.1	( 0.4 ; 1.0)
<b>DE</b>	0.3	0.3	1.3	2.0	1.8	1.0	-0.3	-1.1	-1.5	-1.4	0.2	( 0.0 ; 0.7)
<b>PT</b>	-0.4	0.1	0.0	1.8	1.9	2.1	-0.6	-2.1	-2.1	-0.2	0.1	( 1.3 ; 1.6)
<b>HU</b>	4.5	3.1	3.1	-0.1	2.6	4.9	1.4	2.5	2.3	2.4	2.7	(-2.5 ; -1.5)
<b>PL</b>	2.5	3.0	2.9	2.1	2.1	0.4	1.2	0.6	1.2	2.2	1.8	(-3.0 ; -1.8)
<b>SI</b>	1.0	1.5	1.0	0.5	-0.9	0.4	-1.3	-0.7	-2.2	-1.7	-0.2	( 0.7 ; 0.8)
<b>SK</b>	-2.6	0.1	0.1	2.4	0.2	0.3	0.1	-2.6	-3.1	-1.2	-0.6	(-0.3 ; -0.9)

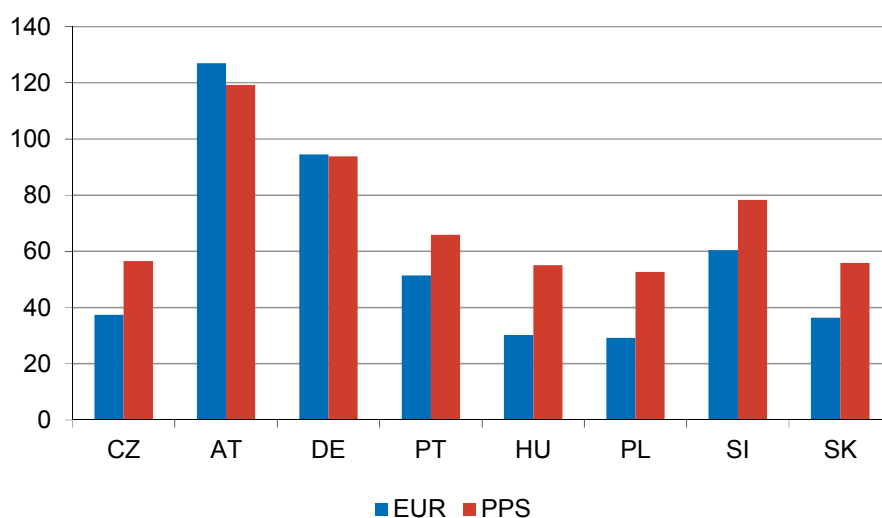
Note: <sup>a)</sup> Average for 2004-2013.

<sup>b)</sup> Estimated "equilibrium" real average interest rate for the next five years derived from the range of the estimated pace of equilibrium real exchange rate appreciation (see Table 3), assuming a zero money market risk premium and an equilibrium real interest rate in the euro area of 1.5%.

Source: Eurostat, CNB calculations.

**Wages** are another aspect of economic convergence. The evolution of wages in market economies is related mainly to labour productivity growth and the share of the service sector. Chart 11 compares the average annual wage with the figure for the euro area in 2013. The purchasing power of wages on the domestic market is described by the purchasing power parity (PPP) indicator, while the euro data converted using the market exchange rate reveal the external purchasing power and wage competitiveness of the economy. The chart shows a persisting large difference between the average wage level in the euro area as a whole and in Germany and Austria (and partly in Slovenia) on the one hand, and in the rest of the countries under comparison on the other hand. The wage level in the Czech Republic is just under 40% of the euro area average when converted using the exchange rate (compared to less than 30% in 2004) and roughly 57% using PPP data (which means virtual stagnation compared to 2004). Hungary, Poland and Slovakia have slightly lower wage levels. At the start of the global crisis in 2007–2008, the long-term convergence process also halted for wages. Looking to the future, however, it can be expected that the renewed convergence of GDP and labour productivity will be accompanied by further wage catch-up with the advanced euro area countries.

<sup>25</sup> The Consensus Forecasts long-term prediction of euro area inflation for the next five years is 1.6% on average.

**Chart 11: Average annual wage in 2013 (EA-18 = 100)**

Source: European Commission, CNB calculations.

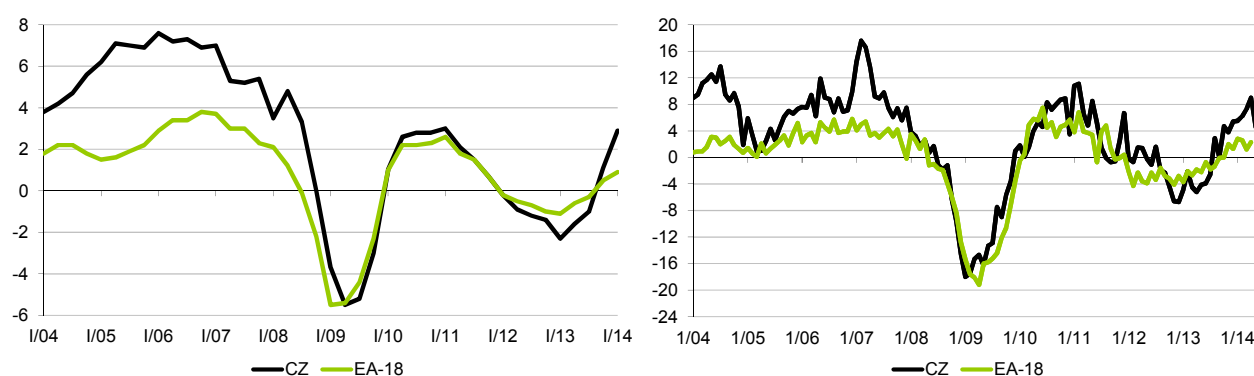
To sum up, the Czech Republic's convergence towards the euro area halted in 2008. Going forward, this leaves room for faster growth in economic activity compared to the euro area average and for an increase in the relative Czech price level. The equilibrium real appreciation of the exchange rate associated with this process may thus still imply higher inflation compared to the core of the monetary union and low or even negative real interest rates in the event of euro adoption.

### 1.1.2 Correlation of economic activity

Upon euro area entry, independent monetary policy decision-making of the individual countries will be replaced by a single monetary policy responding to economic developments at the monetary union level. For a country that is in a different phase of the business cycle than the euro area average, the monetary policy settings may be suboptimal and cause economic costs. From the point of view of the optimum currency area theory, the loss of independent monetary policy is less costly for a country with a more correlated business cycle. The following analysis focuses on the degree to which the cycles of the Czech economy and the other countries under review are similar to that of the euro area.

Chart 12 compares economic activity in the Czech Republic with that in the euro area both overall using annual real GDP growth and specifically in industry using the annual changes in the industrial production index (IIP).<sup>26</sup> In the pre-crisis period, the Czech economy recorded almost double the rate of growth of both GDP and the IPI compared to the euro area. With the onset of the global financial crisis the growth rates levelled off and remained the same not only in the subsequent period of recovery, but also during the renewed slowdown of economic growth due to the European debt crisis. The growth rates started to differ again in 2013 – the recovery in the Czech Republic initially lagged well behind that in the euro area, whereas since 2013 Q4 it has been much faster.

<sup>26</sup> The industrial production index responds to changes in the economic environment more flexibly than total GDP. The information obtained by comparing the correlation of industrial production is only complementary, as industry typically accounts for less than one-third of total output in the advanced economies, and, moreover, the economies of the countries under comparison differ in terms of structure (see section 1.1.3). 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.

**Chart 12: Year-on-year changes in real GDP and in the industrial production index (%)**

Source: Eurostat, CNB calculations.

Table 5 summarises the results of the **simple correlation analysis** for GDP and the IPI for various lags of the individual countries' time series compared to the euro area time series (lag  $t$  to  $t-2Q$  for GDP and  $t$  to  $t-3M$  for the IPI). This method allows us to assess whether and with what lag the economic activity of the euro area is correlated with economic activity in individual countries and to what extent this mechanism changed with the onset of the crisis. To sum up, the correlation between the GDP of the euro area and the countries under review (except Portugal) has been much higher since the financial crisis started than it was before the crisis, while the results for the IPI are mixed. In comparison with other countries, the correlations measured for the Czech Republic can be evaluated as above average. The rise in correlations in the case of GDP can partly be attributed to a significant effect of extraordinary common negative shocks affecting all the economies at the same time.

**Table 5: Correlation coefficients of economic activity – evolution over time**

	GDP			GDP		
	2004Q1–2008Q3			2008Q4–2014Q1		
	t	t-1	t-2	t	t-1	t-2
<b>CZ</b>	<b>0.71</b> **	-0.38	-0.17	<b>0.87</b> **	0.60 **	0.26
<b>AT</b>	<b>0.70</b> **	0.05	-0.05	<b>0.73</b> **	0.36	-0.01
<b>DE</b>	<b>0.87</b> **	-0.11	-0.03	<b>0.97</b> **	0.44 **	0.20
<b>PT</b>	<b>0.79</b> **	-0.03	0.01	<b>0.56</b> **	0.10	0.12
<b>HU</b>	<b>0.47</b> **	-0.25	-0.05	<b>0.76</b> **	0.63 **	0.42 **
<b>PL</b>	0.31	<b>0.48</b> **	-0.16	0.49 **	<b>0.51</b> **	0.27
<b>SI</b>	<b>0.66</b> **	-0.04	0.39 *	<b>0.89</b> **	0.47 **	0.31
<b>SK</b>	0.38	0.16	-0.18	<b>0.76</b> **	0.53 **	0.26

	IPI				IPI			
	2004M1–2008M9				2008M10–2014M5			
	t	t-1	t-2	t-3	t	t-1	t-2	t-3
<b>CZ</b>	<b>0.45</b> **	-0.02	0.27 **	-0.03	<b>0.37</b> **	0.22 *	0.36 **	0.19
<b>AT</b>	<b>0.35</b> **	-0.18	0.25 **	0.00	0.30 **	0.34 **	0.30 **	<b>0.36</b> **
<b>DE</b>	<b>0.57</b> **	-0.24 *	0.16	0.17	<b>0.85</b> **	0.42 **	0.36 **	0.40 **
<b>PT</b>	<b>0.52</b> **	-0.29 **	-0.05	0.19	<b>0.41</b> **	0.11	0.19	0.10
<b>HU</b>	0.17	<b>0.36</b> **	-0.10	-0.03	<b>0.47</b> **	0.35 **	0.25 **	0.16
<b>PL</b>	<b>0.50</b> **	0.06	-0.16	0.18	<b>0.37</b> **	0.14	0.24 **	0.06
<b>SI</b>	0.15	0.02	0.02	0.02	<b>0.39</b> **	0.38 **	0.09	0.20
<b>SK</b>	<b>0.36</b> **	-0.09	0.04	0.20 *	0.23 *	<b>0.36</b> **	0.24 **	0.05

Note: The calculation is based on the quarter-on-quarter/month-on-month differences in the logarithms of the data seasonally adjusted using the TRAMO-SEATS method. The significance of the correlation coefficient is marked \*\* and \* for the 5% and 10% significance levels respectively. The columns indicate the lag of the given country's time series relative to the euro area time series. For example,  $t-1$  denotes a lag of one period (quarter/month). The highest statistically significant correlations for each country in the period under review are highlighted in bold.

Source: Eurostat, CNB calculations.

Exports are the most important channel through which a small open economy such as the Czech Republic is linked with the euro area economy. The results of the analysis of the **correlation of exports to the euro area with euro area GDP** are summarised in Table 6. As in the case of overall economic activity, we can see a strong increase in correlation in the period since the outbreak of the crisis. The correlation of exports with euro area GDP increased in the Czech Republic, but not so strongly as in some other euro area countries with a similar initial level (Portugal and Slovakia). This may reflect their more intensive involvement in intra-euro area trade. Hungarian and Polish exports are an exception from the trend, as their correlation with euro area GDP tended to decrease in the second period.

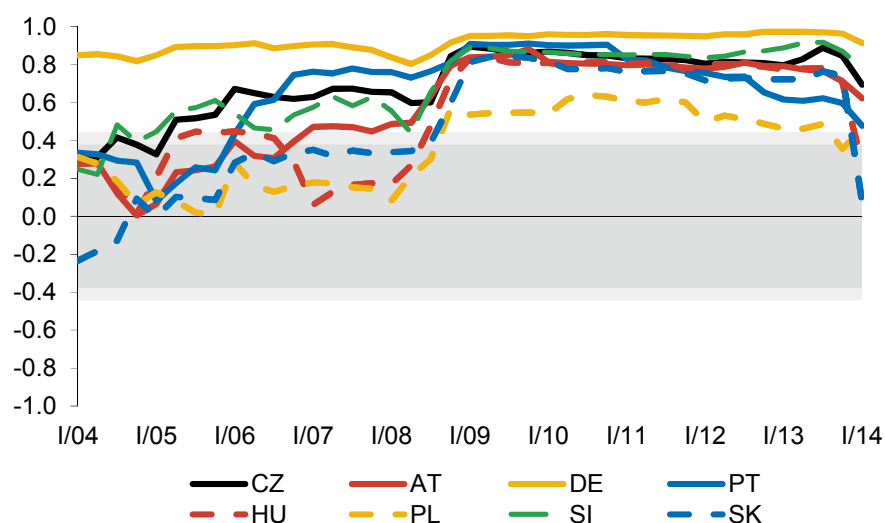
**Table 6: Correlation coefficients of exports to the euro area with euro area GDP – evolution over time**

EXP to EA vs. GDP EA						
	2004Q1–2008Q3			2008Q4–2014Q1		
	t	t-1	t-2	t	t-1	t-2
<b>CZ</b>	<b>0.48</b> **	0.09	0.02	<b>0.76</b> **	0.49 **	0.20
<b>AT</b>	<b>0.62</b> **	-0.32	0.12	<b>0.89</b> **	0.34	0.17
<b>DE</b>	<b>0.86</b> **	-0.12	0.00	<b>0.93</b> **	0.58 **	0.20
<b>PT</b>	<b>0.47</b> **	0.08	-0.34	<b>0.88</b> **	0.38 *	-0.03
<b>HU</b>	<b>0.63</b> **	-0.11	0.28	<b>0.42</b> **	0.30	0.28
<b>PL</b>	<b>0.57</b> **	0.04	0.11	-0.16	0.01	0.06
<b>SI</b>	0.37	-0.26	-0.12	<b>0.41</b> *	0.29	-0.04
<b>SK</b>	<b>0.41</b> *	0.27	-0.13	<b>0.81</b> **	0.48 **	0.04

Note: The calculation is based on the quarter-on-quarter differences in the logarithms of the data seasonally adjusted using the TRAMO-SEATS method. The significance of the correlation coefficient is marked \*\* and \* for the 5% and 10% significance levels respectively. The columns indicate the lag of the given country's time series relative to the euro area time series. For example, t-1 denotes a lag of one quarter. The highest statistically significant correlations for each country in the period under review are highlighted in bold.

Source: Eurostat, CNB calculations.

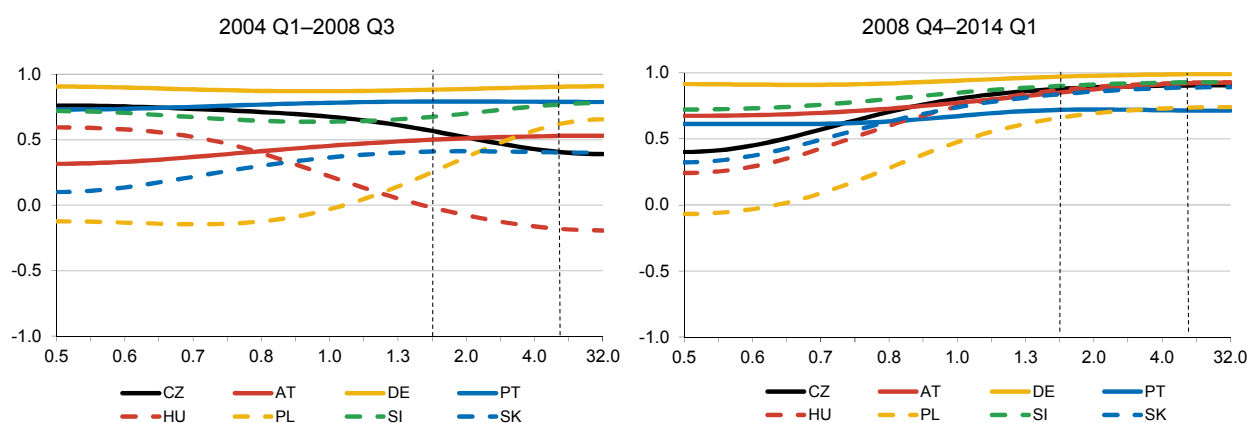
Supplementary information on the evolution of the correlation of economic activity over time is provided by an analysis of the correlation for moving five-year time periods (rolling correlation). Chart 13 shows the **rolling correlations** of real GDP growth. According to this method, the alignment has gradually increased over the last ten years. The correlation values have been positive and statistically significant for most of the countries under review since 2006. The correlation of economic activity rose sharply between 2009 and 2013 owing to the global financial crisis and the subsequent European debt crisis. Last year, however, the correlations started to decrease again owing to uneven economic growth. The decrease was modest for some countries (Germany, Slovenia, the Czech Republic and Austria) but substantial for others (Slovenia, Hungary, Poland and Portugal). Compared to the other countries under review, the Czech Republic still ranks among those with the highest correlation of economic activity with that in the euro area.

**Chart 13: Rolling correlations of economic activity**

Note: The time data indicate the end of the rolling window of 5 years. The calculation is based on the quarter-on-quarter differences in the logarithms of the data seasonally adjusted using the TRAMO-SEATS method. 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 light grey parts of the chart. Values in the dark grey part of the chart are not statistically significant at the 10% level.

Source: Eurostat, CNB calculations.

Chart 14 illustrates the **dynamic correlation** results based on spectral analysis of the time series of quarterly GDP changes. The aim of this method is to separate medium-term economic fluctuations, which correspond to the business cycle, from short-term and long-term movements of the variables describing economic activity. The standard cycle length of 1.5–8 years is depicted by vertical dashed lines. The results of this analysis indicate a fundamental increase in the correlation in the second period across all the countries under review.

**Chart 14: Dynamic correlations of economic activity (q-o-q changes in real GDP) with the euro area**

Note: The x-axis shows the spectrum of possible duration of the cycle in years on a logarithmic scale. The interval depicted by the two vertical dashed lines indicates the cycle length considered, i.e. 1.5–8 years. The calculation is based on the quarter-on-quarter differences in the logarithms of the data seasonally adjusted using the TRAMO-SEATS method.

Source: Eurostat, CNB calculations.

The increased values of the correlation of economic activity, industrial production and exports between the Czech Republic and the euro area in recent years have been greatly affected by strong common shocks in the form of the real economic impacts of the global financial and

economic crisis. One can therefore say that they were a result of the strong external impulse temporarily outweighing the shocks hitting the individual countries. The increase in correlations with a lag of one quarter may suggest a stronger response of individual countries to developments in the euro area, but they may also only reflect the lagged impact of common external shocks. To sum up, however, the cyclical alignment of economic activity in the Czech Republic and the euro area has increased compared to the pre-crisis period.

### Box 2: An analysis of the impacts of the loss of independent monetary policy using the g3 model

This box compares the change in the volatility of macroeconomic variables using the Czech National Bank's core prediction model (g3), whose second moments<sup>27</sup> are compared with a modification that describes the Czech economy in the hypothetical situation of adoption of the single currency. This is associated with a loss of independent monetary policy, which would be delegated to the European Central Bank. This modification of the g3 model differs from the original version in that the uncovered interest parity (UIP) equation and the equations describing autonomous monetary policy are removed, interest rates are taken from the euro area, and the fixed nominal exchange rate is the nominal anchor of the economy. The values of the structural parameters describing real and nominal rigidities and the utility and production functions are the same as in the original version of the model, and the assumption of long-term real exchange rate appreciation is also kept. Table B1 compares the results.

**Table B1: Standard deviations implied by the g3 model – growth rates, HP cycles**

	Independent monetary policy		ECB monetary policy	
	Model g3		Modified model	
	QoQ growth	H-P gaps	QoQ growth	H-P gaps
<b>CPI inflation</b>	0.04	0.04	0.12	0.16
<b>Real GDP</b>	0.08	0.06	0.09	0.07
<b>Real consumption</b>	0.09	0.07	0.10	0.08
<b>Real investment</b>	0.08	0.09	0.06	0.06
<b>Real exports</b>	0.12	0.12	0.12	0.12
<b>Real imports</b>	0.11	0.11	0.11	0.12

Note: The model parameters were calibrated on the data available as of October 2013.

Source: CNB calculations.

The results offer relatively clear conclusions. The volatility of real variables is little affected by the loss of independent monetary policy. According to the model simulations the volatility of most of them increases, but the difference is quantitatively negligible. Only in the case of real investment does the volatility rise given hypothetical adoption of the single currency (due to the high import intensity of investment). However, a dramatic difference can be observed in the volatility of CPI inflation, which would increase sharply after hypothetical adoption of the single currency. This is in line with economic intuition – the loss of monetary policy implies an inability to respond flexibly to domestic inflation pressures. These conclusions apply to volatility as measured by both the standard deviation of growth rates and the standard deviation of HP cycles.

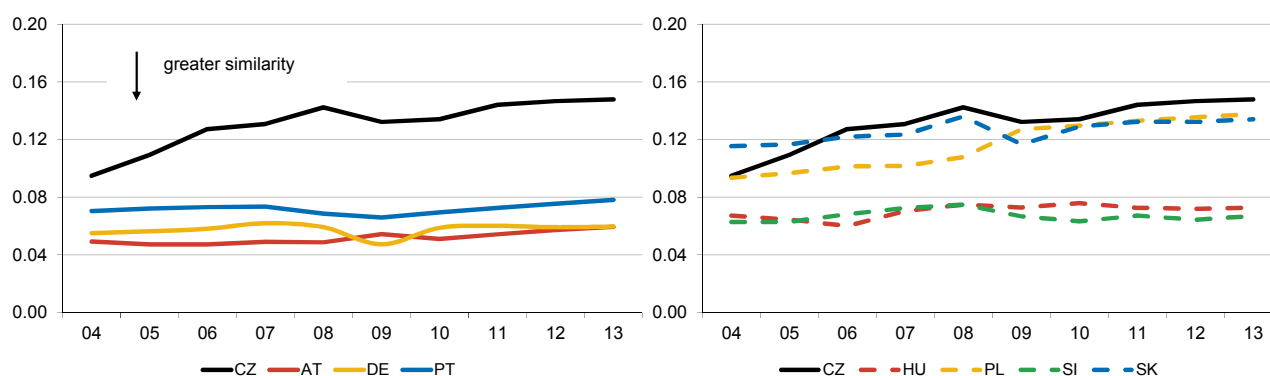
### 1.1.3 Structural similarity of the economies

The risk of occurrence of an asymmetric shock decreases with increasing similarity of the structure of economic activity between an acceding economy and the monetary union. The

<sup>27</sup> The calibrated g3 model (like every linearised DSGE model) has a reduced form in the form of a linear stock model. This stock model unequivocally determines the first two moments of all the endogenous variables, i.e. including the dispersion and the standard deviation.

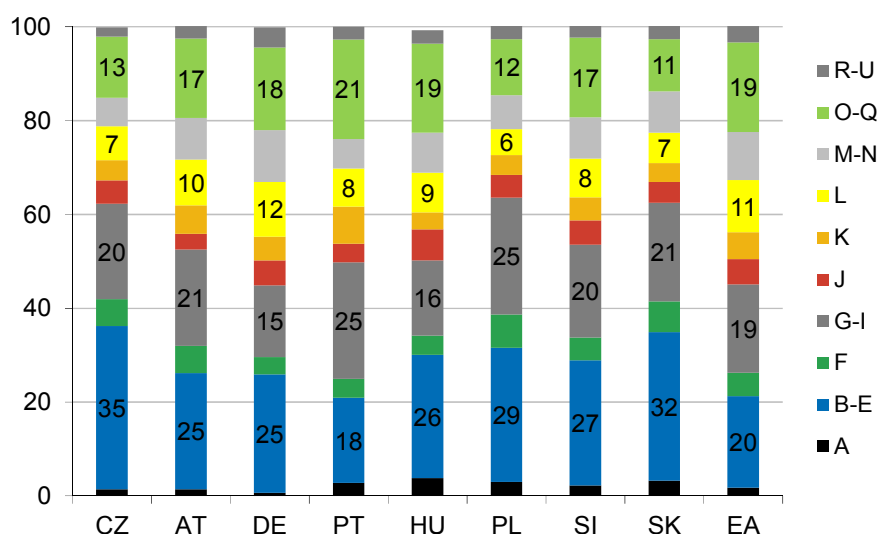
structural similarity of the economies of the countries under comparison with the euro area can be measured using the **Landesmann index**, which compares the shares of the ten main sectors of the economy (according to the NACE classification) in total value added between the countries under comparison and the euro area. The index takes values in the range [0, 1]. The closer the index is to zero, the more similar is the structure of the economies under comparison. Chart 15 shows a large difference in the structure of value added of Czech GDP compared to Austria, Germany and Portugal, which, moreover, is displaying a slight upward trend, i.e. the structural differences are significant and growing over time. The only exception was the period after the economic and financial crisis erupted, when the share of Czech industry in GDP decreased more than in the euro area and the structures of the two economies thus aligned temporarily. A return to rising levels of this index was observed in 2011. In 2013, the structure of economic activity in the Czech Republic, together with that in Slovakia and Poland, was the least similar to the euro area average. The difference in GDP structure in the above economies consists mainly in a higher share of industry and in a slightly lower share of value added in services (sectors K–U; see Chart 16). In Poland it also reflects a higher share of wholesale and retail trade, transport, accommodation and food service activities (sectors G–I). By contrast, the structural differences in Hungary and Slovenia compared to the euro area are only slightly higher than those in Germany and Austria and slightly lower than those in Portugal. Nevertheless, some differences in economic structure can be found in these countries as well.<sup>28</sup>

**Chart 15: Structural similarity vis-à-vis the euro area**



Source: Eurostat, CNB calculations.

<sup>28</sup> For example, a comparison of Hungary and Germany in 2013 reveals that Hungary has a higher share of value added in agriculture (A), construction (F) and public administration and defence, education, health and social care (O–Q), which is offset by a lower share in services included in categories K–N and R–U compared to Germany.

**Chart 16: Shares of economic sectors in GDP in 2013 (%)**

Note: The sectors are broken down according to the NACE classification: A – Agriculture, forestry and fishing, B–E – Industry (except construction), F – Construction, G–I – Wholesale and retail trade, transport, accommodation and food service activities, J – Information and communication, K – Financial and insurance activities, L – Real estate activities, M–N – Professional, scientific and technical activities; administrative and support service activities, O–Q – Public administration, defence, education, human health and social work activities, R–U – Arts, entertainment and recreation; other service activities; activities of household and extra-territorial organisations and bodies.

Source: Eurostat, CNB calculations.

In the case of the Czech economy, the high share of industry (car manufacture in particular) and the lower share of services compared to the euro area may lead to asymmetric shocks to which the single monetary policy is unable to respond in full. The relatively low structural similarity of the Czech economy to that of the euro area thus creates a risk with regard to adopting the single currency.

#### 1.1.4 Interest rate convergence

Some countries entering the euro area faced fast nominal interest rate convergence<sup>29</sup> to the union level, which acted as an asymmetric shock manifesting itself, for example, in the emergence of property market bubbles and weaker fiscal discipline. Earlier nominal interest rate convergence – gradual and based on fundamentals – is thus better for smoother accession to the euro area, as it will not leave room for the asymmetric shock associated with sudden elimination of the risk premium upon euro adoption.<sup>30</sup>

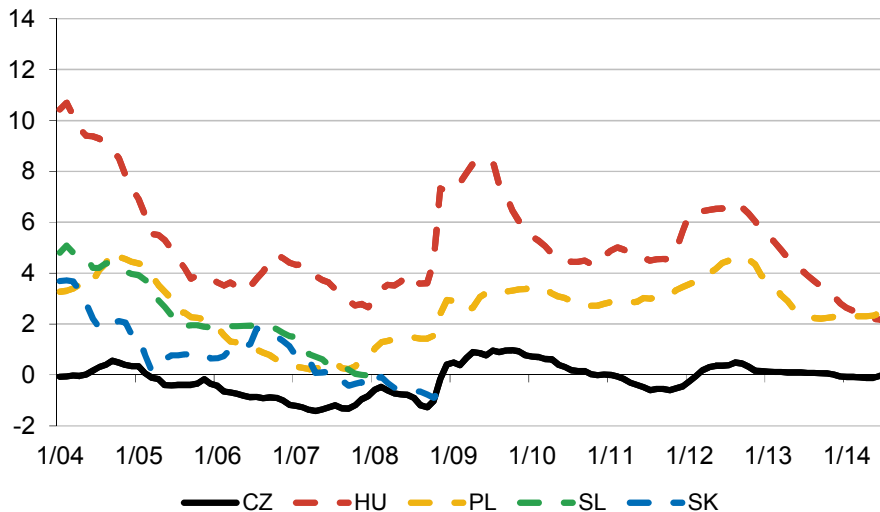
The following comparison of the **nominal interest rate differential** vis-à-vis the euro area/Germany<sup>31</sup> reflects the probability of the asymmetric shock described above. The closer the nominal interest rate differential is to zero, the smaller is the risk that joining the monetary union will cause a rapid change in both nominal and real interest rates, which would have a destabilising effect on the economy.

<sup>29</sup> Although real economic activity is affected primarily by real interest rates, nominal interest rates may also have a significant effect via some credit or budgetary constraints (e.g. the loan repayment to financial income ratio).

<sup>30</sup> See also section 1.1.1.

<sup>31</sup> EURIBOR is used as the reference rate for short-term rates. German government bond rates are used for long-term rates. The long-term rates of some euro area countries have been showing extreme values in recent years, so the euro area average influenced by such countries cannot be considered a suitable benchmark.



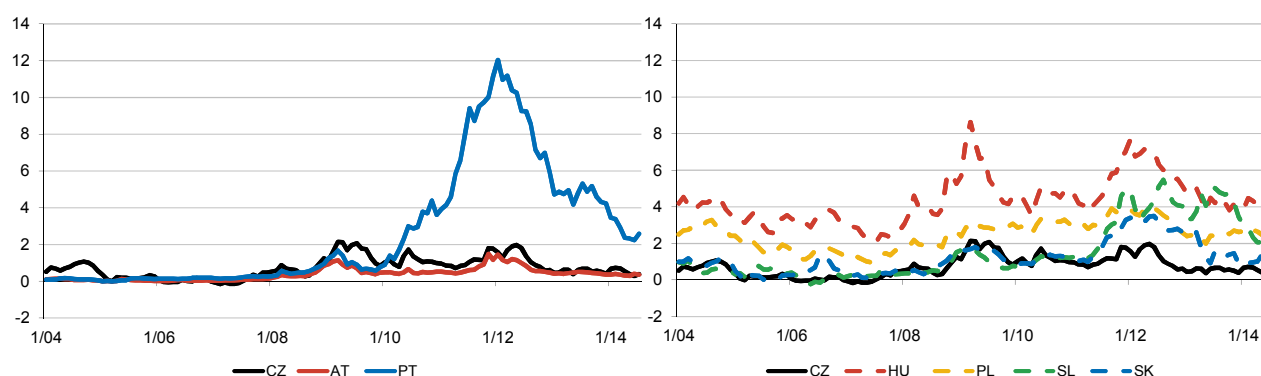
**Chart 17: Differences in three-month interest rates vis-à-vis the euro area (pp)**

Source: Datastream, CNB calculations.

Chart 17 shows the nominal interest rate differential for short-term rates. The short-term interest rate differential did not deviate significantly from zero in the Czech Republic throughout the period under review. Conversely, the financial turbulence in 2009 and the peak of the euro area debt crisis in 2013 resulted in an increase in the spread in Poland and Hungary. However, the spread for these two Central European economies has gradually shrunk since the start of 2013, reaching 2 pp in July 2014, representing a historical low in Hungary.

Chart 18 shows the interest rate differentials for ten-year government bonds. Compared to the other countries, long-term rates in the Czech Republic remain closest to the level in Germany, at the Austrian level. By contrast, as in the case of money market rates, long-term rate differentials in Hungary and, to a lesser extent, Poland recorded increases in 2009 and 2012. Over the last two years, however, the differences in their government bond yields relative to yields on German government bonds have narrowed, the same as in other euro area countries (Slovakia, Italy, Spain and Portugal). The only exception is Slovenia, which was hit by a major banking crisis and whose differential did not decrease until this year. The yield differentials in Slovakia, Slovenia and Poland are currently at around 2 pp, while the differences in long-term rates in Hungary are 1 pp higher.

To sum up, Czech nominal interest rates have long been close to rates in stable euro area countries and so do not create a risk of a rapid fall in rates and related generation of macroeconomic imbalances and threats to financial stability upon euro adoption. This also indicates that financial markets view the Czech Republic's government debt situation as sustainable.

**Chart 18: Differences in ten-year interest rates vis-à-vis Germany (pp)**

Source: Eurostat, CNB calculations.

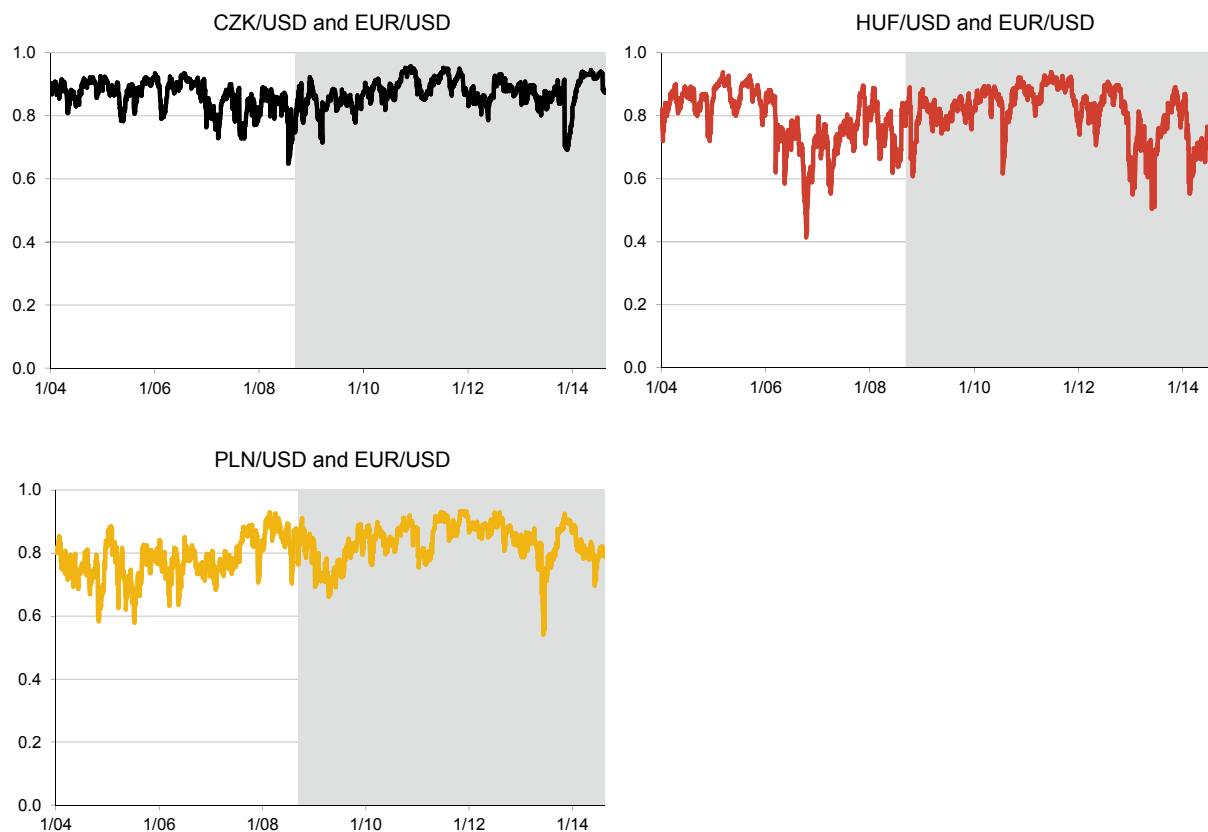
### 1.1.5 Exchange rate alignment

Long-term alignment of movements in the exchange rates of two currencies vis-à-vis a third (reference) currency reflects similarity in the factors which affect those exchange rates, implying a lower probability of major asymmetric shocks. A high **correlation of changes in the exchange rates** of two currencies vis-à-vis a reference currency is an indicator that the two countries could share a single currency.<sup>32</sup> The following analysis uses a GARCH model to estimate the correlation between the exchange rates of the Czech koruna, the Hungarian forint and the Polish zloty on the one hand and the euro on the other hand vis-à-vis the US dollar.<sup>33</sup> 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 19 plots the correlation coefficients for the new EU member countries under review which have not yet adopted the single European currency. This area has recently been strongly affected by a regime change in the form of the adoption of an exchange rate commitment by the Czech National Bank. After this commitment was announced in November 2013, the exchange rate stabilised just above CZK 27 to the euro. This led to an increase in the correlation between the Czech koruna against the dollar and the euro against the dollar. In the long run, this correlation remains the highest and most stable of all three currencies under review. As in previous years, the largest fluctuations in the correlation coefficient were recorded by the Hungarian forint. The correlation of the forint against the euro started to weaken in January. This tendency strengthened in February, and the correlation neared 0.5. The Hungarian central bank's intention to ease monetary policy and relatively high external debt resulted in a depreciation of the forint and an increase in its volatility against world currencies in this period. The exchange rate of the forint was also influenced by the escalation of the geopolitical conflict between Russia and Ukraine, to which Hungary has the largest banking sector exposure of all the EU countries. Ukraine is also a major trading partner for Hungary. The correlation between the Polish zloty and the euro also fell slightly in 2014 H1, but remained fairly high, standing at around 0.8 in mid-2014.

<sup>32</sup> See Aguilar and Hördahl (1998).

<sup>33</sup> GARCH estimates of the correlations of the Slovenian tolar and the Slovak koruna until joining the monetary union can be found in previous issues of this publication.

**Chart 19: Correlation coefficients of exchange rates against the US dollar**

Note: The grey colour of the background marks the period since the crisis began.

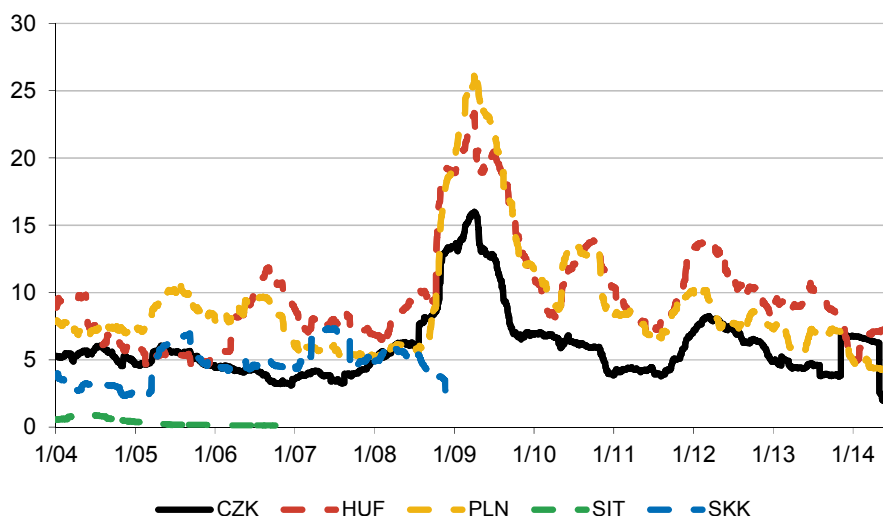
Source: Thomson Datastream, Eurostat, CNB calculations.

To sum up, the relatively high correlation between the exchange rate of the Czech koruna against the dollar and the exchange rate of the euro against the dollar observed in recent years suggests that the Czech currency responds to changes in the external environment outside the euro area similarly to the euro, indicating a high degree of alignment.

### 1.1.6 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 exchange rate volatility. Low volatility of the exchange rate between two countries may be regarded, under the current floating exchange rate regime, as an indicator of their potential to share a single currency (see also section 1.1.5).

Chart 20 describes the historical volatility of selected countries' exchange rates vis-à-vis the euro. The indicator of volatility is the annualised **standard deviation of daily returns** for the last six months. The volatility of the Czech koruna has been significantly lower than that of the currencies of the other Central European countries over the past ten years, despite the occasional use of foreign exchange interventions to stabilise the currency in the other countries and the weakening of the koruna by the Czech National Bank towards the end of last year.

**Chart 20: Historical volatility of exchange rates vis-à-vis the euro (%)**

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

Source: Datastream, CNB calculations.

Although all Central European currencies saw an increase in volatility due to the global financial and European debt crisis, the impact on the Czech currency was the smallest. The historical volatility of the currencies under review declined between the start of 2012 and mid-2013. The historical volatility of the Polish zloty and Hungarian forint decreased further at the end of 2013, whereas a one-off upward jump was seen for the Czech koruna, reflecting the Czech National Bank's decision to start using the exchange rate as an additional monetary policy instrument. After the adoption of the exchange rate commitment, the exchange rate stabilised just above CZK 27 to the euro. The koruna's exchange rate later fluctuated in a narrow range of CZK 27.3–27.6 to the euro. As a result, its volatility fell to the lowest level recorded in the entire period under review at the end of June 2014.

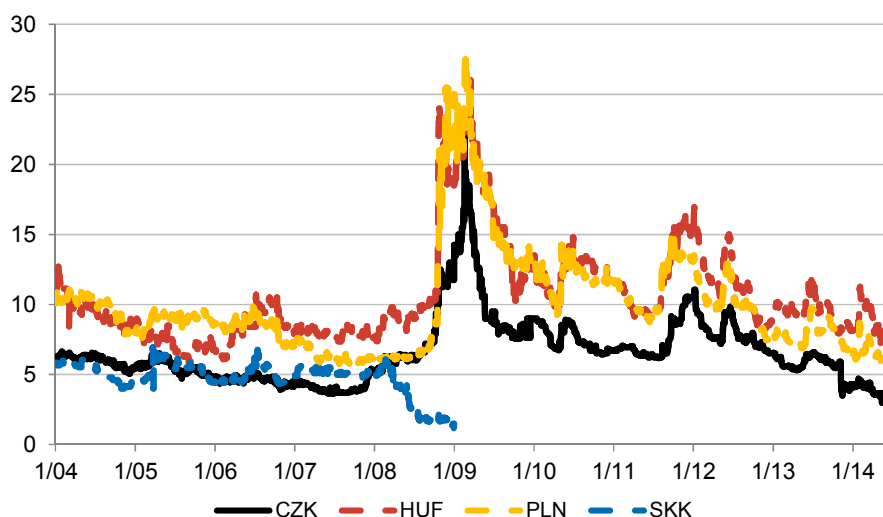
An outlook for **exchange rate volatility** can be derived from financial market data. Chart 21 shows the movements in the expected volatility of the exchange rates of the countries under review as reflected in the prices of options for the individual currencies (implied volatility). The relatively similar volatility in Central European economies, especially in the post-crisis period, suggests a spillover effect among Central European currency markets.<sup>34</sup> The implied volatility of all three Central European currencies has been falling since the start of 2012 and, despite temporary slight rises, has been gradually nearing the usual pre-crisis levels. A further decline in the implied volatility of the Czech koruna against the euro is apparent towards the end of the period under review. This reflected a major regime change in the form of the adoption of an exchange rate commitment by the Czech National Bank, which led to a fall in the sensitivity of the exchange rate to foreign financial market developments. The implied volatility of the Czech koruna dropped to a historical low in June 2014.

To sum up, except during the financial crisis, the volatility of the koruna's exchange rate against the euro was relatively low and stable, which is a favourable factor for euro adoption. At the same time, the relatively high volatility immediately before the crisis and after its onset largely reflects desirable dampening of the impacts of economic shocks on the Czech Republic via the exchange rate. The adoption of the exchange rate commitment caused a one-off

<sup>34</sup> According to Bubák, Kočenda and Žikeš (2011), the volatility spillover effects among markets are marked between the Polish and Czech currencies, while the MNB's interventions on the Hungarian foreign exchange market have dampened the effects on this currency. An overall increase in the spillover effects is apparent in the post-crisis period.

increase in the historical volatility of the Czech koruna against the euro, but subsequently led to a further decline in both the historical and implied volatility.

**Chart 21: Implied volatility of exchange rates vis-à-vis the euro (%)**



Source: Datastream, CNB calculations.

### 1.1.7 Integration of the economy with the euro area

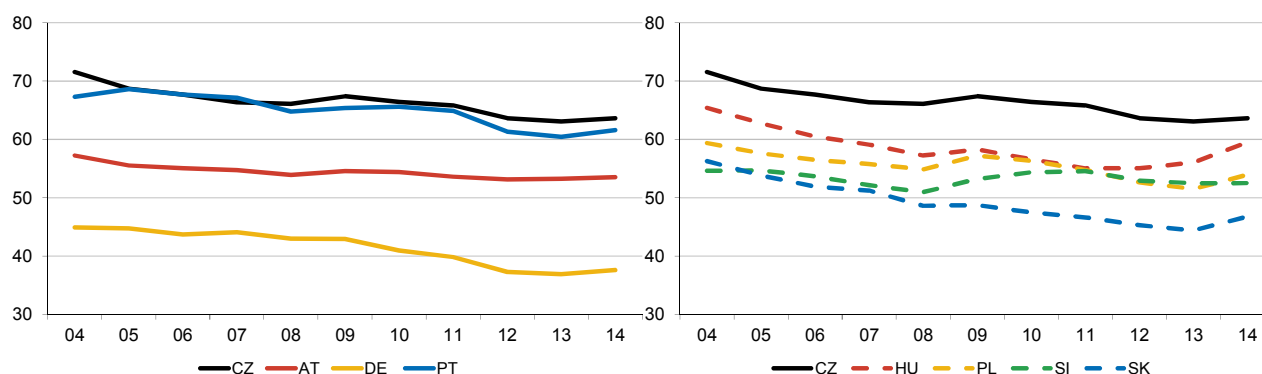
The degree of integration of an economy into trade and ownership relations with the monetary union states is crucial for assessing the costs and benefits of the single currency. Greater integration into trade with euro area countries increases the potential benefits of joining the monetary union, as the adoption of the single currency eliminates the exchange rate risk and reduces the transaction costs of such trade. At the same time, greater intensity of international economic relations usually leads to greater synchronisation of economic shocks, higher cyclical alignment and hence lower costs associated with the loss of independent monetary policy.<sup>35</sup>

#### International trade with the euro area

Greater trade integration increases the benefits of the single currency and simultaneously magnifies the transmission of shocks between economies. The **intensity of trade** between the countries under review and the other euro area countries is shown in Chart 22 and Chart 23. The share of exports to the euro area in total exports is very high in the Czech Republic,<sup>36</sup> higher than in any of the other economies under review; only Portugal has a similar level. The share for imports is similarly high, reaching the highest levels of the countries under review along with Portugal and Austria. However, these shares have shown a gradual downward trend in recent years as exporters have tried to penetrate emerging markets and non-European markets in general, which have been hit less hard by the global economic crisis or offer good prospects in some other respect.

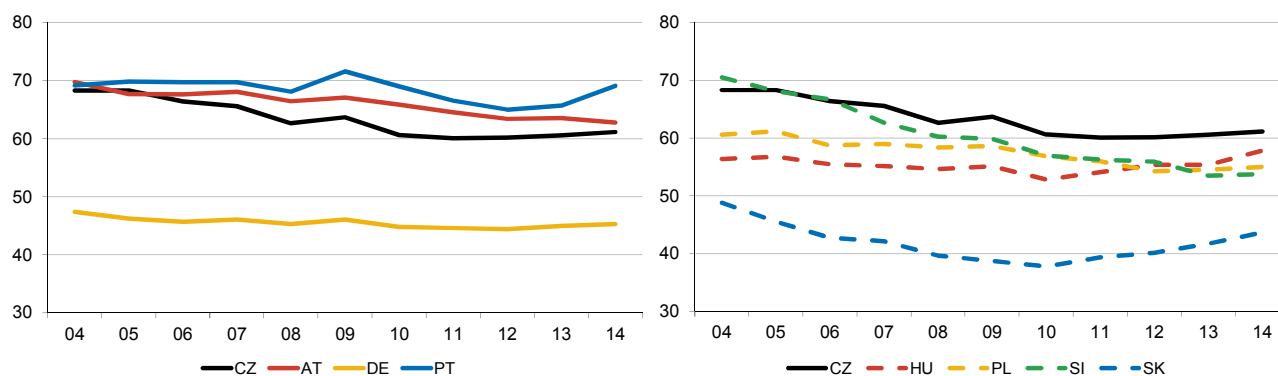
<sup>35</sup> Closer trade links thus foster higher correlation of economic activity within a single currency area (Frankel and Rose, 1997). On the other hand, higher trade intensity may lead to growing specialisation and decreasing structural similarity and thus to less economic symmetry (Krugman, 1993).

<sup>36</sup> Around half of Czech exports to the euro area go to Germany. Slovakia accounts for around 14% of total exports to the euro area. Other major trading partners in the euro area include France, Austria and Italy (5–8%).

**Chart 22: Shares of exports to the euro area in total exports (%)**

Note: The 2014 figure is for the first four months of the year.

Source: Eurostat, CNB calculations.

**Chart 23: Shares of imports from the euro area in total imports (%)**

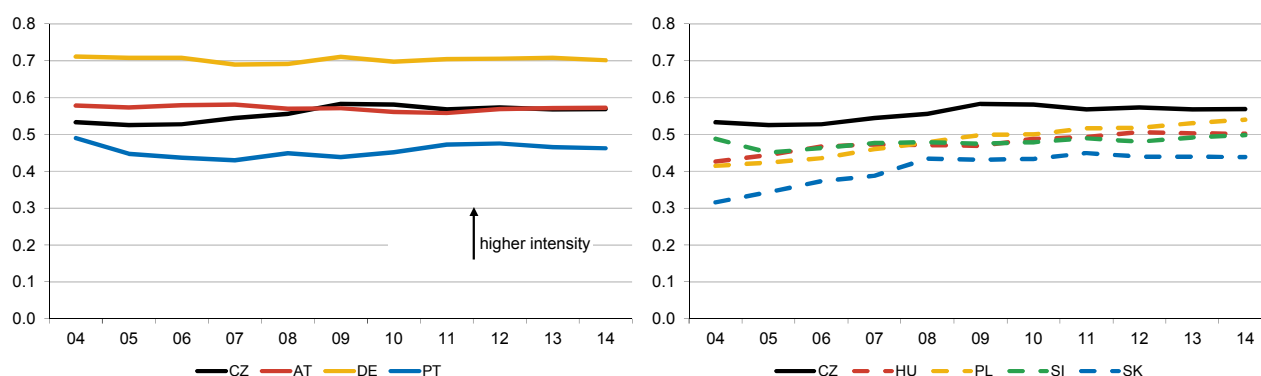
Note: The 2014 figure is for the first four months of the year.

Source: Eurostat, CNB calculations.

The statistics on **intra-industry trade** (international trade within a single industry) give a more detailed view of trade. Intra-industry trade is usually particularly significant for technology-intensive products, which similarly advanced countries trade among themselves. It is thus another indicator of the structural similarity of economies. Strong intra-industry trade fosters cyclical convergence<sup>37</sup> and can also affect the economy's ability to absorb economic shocks.<sup>38</sup> The theory of intra-industry trade 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 industries with high market concentration. On the other hand, the lowest level can be expected in industries associated with 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 with the euro area in total foreign trade turnover. Chart 24 plots this indicator for the countries under review.

<sup>37</sup> Frankel and Rose (1997). For the theory of intra-industry trade see also Krugman (1981) and Hoekman and Djankov (1996).

<sup>38</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 rather than between industries. An increase in the proportion of intra-industry trade (horizontal in particular) after accession to a monetary union may also indicate refutation of the specialisation hypothesis, which would predict an increase in inter-industry foreign trade.

**Chart 24: The intensity of intra-industry trade with the euro area under SITC5**

Note: The results were calculated using the five-digit SITC classification. The 2014 figure is for the first four months of the year.

Source: Eurostat, CNB calculations.

The SITC5-based Grubel-Lloyd index (see Table 7) shows relatively high values for the Czech Republic, values comparable with those for Austria. Only Germany has a higher intensity of intra-industry trade with the euro area. Portugal has similar Grubel-Lloyd index values (i.e. lower than those in the Czech Republic) to the remaining EU Member States, which, however, are mostly showing a slight upward trend. Overall, then, the Czech Republic has an above-average share of intra-industry trade with the euro area compared to the other countries.

**Table 7: Grubel–Lloyd indices for 2013 by degree of aggregation**

	SITC 1	SITC 2	SITC 3	SITC 5
CZ	0.83	0.76	0.69	0.57
AT	0.88	0.78	0.71	0.57
DE	0.92	0.86	0.81	0.71
PT	0.77	0.69	0.61	0.47
HU	0.85	0.76	0.69	0.50
PL	0.85	0.77	0.66	0.53
SI	0.85	0.76	0.64	0.49
SK	0.88	0.77	0.57	0.44

Note: SITC 1, 2, 3 and 5 represent the one-, two-, three- and five-digit SITC breakdowns.

Source: Eurostat, CNB calculations.

Intensive foreign trade thus remains a wide channel for the transmission of economic impulses from the euro area to the Czech economy. Swings in euro area demand have been one of the main sources of the business cycle in the Czech Republic in the last ten years. This link creates potential for large benefits stemming from the removal of exchange rate risk and from transaction cost savings upon euro adoption, and has therefore long been one of the most significant arguments for the Czech Republic's joining the euro area.

### Foreign direct investment

Ownership links also foster higher alignment of economic activity. If domestic companies are part of multinational groups, this may help to transmit economic impulses.<sup>39</sup> In addition, capital integration between two countries can help to dampen negative unilateral demand

<sup>39</sup> Thanks to the penetration of technology, foreign investment also has a favourable effect on the productivity of domestic firms (Javorcik, 2004; Havránek and Iršová, 2010); the high investment volumes from the euro area are therefore furthering convergence.



shocks. Ownership links with the euro area are measured by the share of **foreign direct investment** stock (FDI) from the euro area in the countries under review in GDP (see Table 8) and by the share of direct investment stock (DI) from the surveyed country in the euro area in GDP (see Table 9).

**Table 8: Shares of FDI stock from the euro area in GDP (%)**

	2007	2008	2009	2010	2011	2012
<b>CZ</b>	47.8	42.6	46.4	47.5	44.5	51.7
<b>AT</b>	28.4	31.7	33.8	31.5	33.4	37.4
<b>DE</b>	15.6	16.4	18.2	18.1	17.9	17.8
<b>PT</b>	33.8	33.3	37.5	43.4	40.4	44.6
<b>HU</b>		43.4	50.5	51.5	49.4	58.5
<b>PL</b>	26.2	22.3	27.7	27.0	25.8	27.6
<b>SI</b>	17.1	16.8	17.6	19.5	17.5	17.2
<b>SK</b>	33.4	36.8	37.5	39.9	45.6	40.8

Note: The euro area is only the EA-17.

Source: Eurostat, Hungarian central bank for Hungary, CNB calculations.

The share of FDI from euro area countries to GDP in the Czech Republic was second highest behind Hungary among the countries under comparison in 2012. High levels of ownership links were also recorded by Portugal and Slovakia.

**Table 9: Shares of DI stock in the euro area in GDP (%)**

	2007	2008	2009	2010	2011	2012
<b>CZ</b>	4.2	5.0	6.3	8.0	7.5	7.7
<b>AT</b>	16.7	20.3	23.3	23.8	22.6	22.5
<b>DE</b>	14.3	15.3	17.0	18.3	15.0	15.7
<b>PT</b>	12.1	11.8	13.8	16.9	18.7	19.1
<b>HU</b>		4.7	4.5	3.4	3.7	8.4
<b>PL</b>	0.8	1.2	1.8	2.9	1.8	2.1
<b>SI</b>	0.5	0.3	0.2	2.7	1.0	1.1
<b>SK</b>	0.4	1.6	2.6	4.7	4.8	4.5

Note: The euro area is only the EA-17.

Source: Eurostat, Hungarian central bank for Hungary, CNB calculations.

By contrast, ownership links with the euro area defined in the other direction, i.e. direct investment from the countries under review in the euro area as a percentage of their GDP, are still low in the case of the new EU members. Among the new Member States, the Czech Republic and Hungary are characterised by higher ownership links to the euro area, but those links are still at less than half the level as in the old EU Member States.

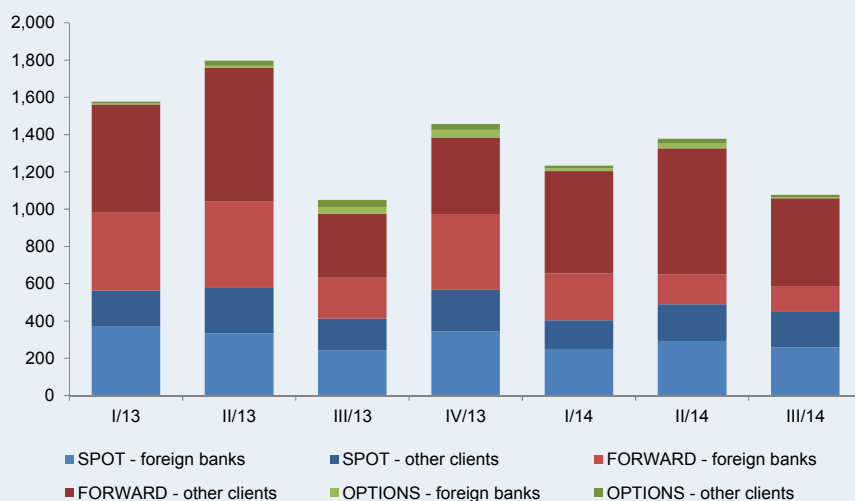
The Czech economy's intensive ownership integration with the euro area, as represented by a high level of FDI from the euro area in the Czech Republic, coupled with its high degree of openness, increases the probability of economic alignment with the monetary union economy, thus reducing the risk of asymmetric shocks if the euro were to be adopted.

### Box 3: Estimate of the benefits of lower transaction costs and the elimination of exchange rate risk

While Box 2 assessed the potential macroeconomic risks of euro adoption, Box 3 examines the possible microeconomic benefits. The most significant of these would stem from the elimination of the transaction costs of currency conversions and the elimination of exchange rate risk. As the true costs of exchange

rate risk are very difficult to quantify, this box focuses on quantifying the currency conversion costs. By doing so, the analysis covers also the largest component of the observed costs of hedging against exchange rate risk, namely the costs of forward contracts.<sup>40</sup>

**Chart B3: Foreign exchange market turnover by counterparties of Czech banks (CZK billions)**



Source: Quarterly survey of average daily foreign exchange market trading volumes, CNB calculations

The quantification of currency conversion costs is done by valuing turnovers on the euro foreign exchange market in terms of their transaction costs. Chart B3 shows the turnovers. In 2014, the turnovers were affected by the use of the exchange rate as a monetary policy instrument. Because of this we use the 2013 annualised turnovers for the purpose of quantification. The bulk of the foreign exchange trades executed by Czech banks (around 62%) take the form of forward contracts or FX swaps, while 35% are spot trades and only 3% involve options. The costs of the individual trades are approximated by 50% of the relevant bid-ask spread. Several simplifying assumptions were used regarding the average margins for individual trades. These constitute a source of uncertainty about the resulting estimate.<sup>41</sup>

The results (see Table B2) suggest that currency conversion transaction costs amounted to 0.25–0.50% of GDP in 2013. This quantification is comparable with the transaction costs calculated for Slovakia (0.36% of GDP; NBS, 2006) and Hungary (0.11–0.22%; Csajbók and Csermely, 2002). It is reasonable to assume that these costs (and hence the possible benefits of introducing the euro) are still underestimated, as we abstract from the hard-to-quantify administrative costs of converting currencies. These include keeping accounts in two currencies (or “hedge accounting”) and dual liquidity management. As mentioned above, the estimate omits a large part of the costs of exchange rate risk. The estimate represents only the lower bound on the microeconomic benefits of introducing the euro. However, it cannot be said that eliminating transaction costs would lead to an immediate increase in GDP of the same magnitude, as a large part of the transaction costs are at the same time revenues of financial intermediaries. From the long-term perspective, the transaction costs should be redirected towards more productive use within the GDP structure, leading to an increase in total welfare.

<sup>40</sup> Many firms, however, use natural hedging (according to Saxa et al., 2009, natural hedging accounts for 56% of the total), where hard-to-quantify costs of an administrative nature arise. Furthermore, it is reasonable to assume that there are many small firms with open foreign exchange positions which do not employ exchange rate hedging in the financial market due to the high marginal costs of derivative hedging at low volumes, and which are thus exposed to exchange rate risk. They would benefit from exchange rate stability. For these reasons, any estimate of the costs of exchange rate risk is subject to a high degree of uncertainty.

<sup>41</sup> The greatest uncertainty regarding transaction costs surrounds the estimate of the costs of spot trades with clients. While large firms have contracts with banks enabling them to exchange at rates very close to the interbank market rate, smaller clients exchange at less favourable exchange rates with far higher exchange rate spreads. We therefore present the results as ranges of costs assuming the lowest (all clients trading at interbank market rates) and the highest (half the volume traded at retail exchange rates) possible average exchange rate spread for client spot trades.

**Table B2: Currency conversion transaction costs**

Transaction type	Volume (bil. CZK)	Fee approximation (1/2 of spread)	Transaction costs (bil. CZK)		
			avg	min	max
SPOT - foreign banks	1304.04	Spot bid-ask spread on interbank market	1.68	1.68	1.68
SPOT - non-financial clients	842.15	Weighted average of commercial and interbank bid-ask spread	<b>6.99</b>	<b>2.05</b>	<b>11.93</b>
FORWARD + FX swap - foreign banks	1494.63	6M FWD bid-ask spread on interbank market	1.53	1.53	1.53
FORWARD + FX swap - non-financial clients	2018.98	2*6M FWD bid-ask spread on interbank market	4.12	4.12	4.12
OPTIONS - foreign banks	105.16	6M FWD bid-ask spread on interbank market	0.14	0.14	0.14
OPTIONS - non-financial clients	115.33	2*6M FWD bid-ask spread on interbank market	0.28	0.28	0.28
<b>Total</b>	5880.31		14.74	9.80	19.68
<b>Share of GDP (%)</b>			<b>0.38</b>	<b>0.25</b>	<b>0.51</b>

Source: Quarterly survey of average daily turnovers on foreign exchange markets, CNB calculations.

## 1.2 SIMILARITY OF MONETARY POLICY TRANSMISSION

An important issue when assessing entry into a monetary union is the extent to which similar transmission of the single monetary policy can be expected. Given the high degree of alignment of real economic activity and strong links between the Czech economy and the euro area core, the chances are relatively high that the European Central Bank's single monetary policy would be in line with the needs of the Czech economy. However, to take advantage of this possible benefit, monetary policy transmission in the Czech Republic, i.e. the transmission of an impulse from monetary policy rates (or other monetary policy instruments) through the money market, client rates, loan demand and supply, and investment and consumer decision-making of firms and households, to real economic activity and inflation, needs to be similar to the transmission mechanism in the euro area as a whole.

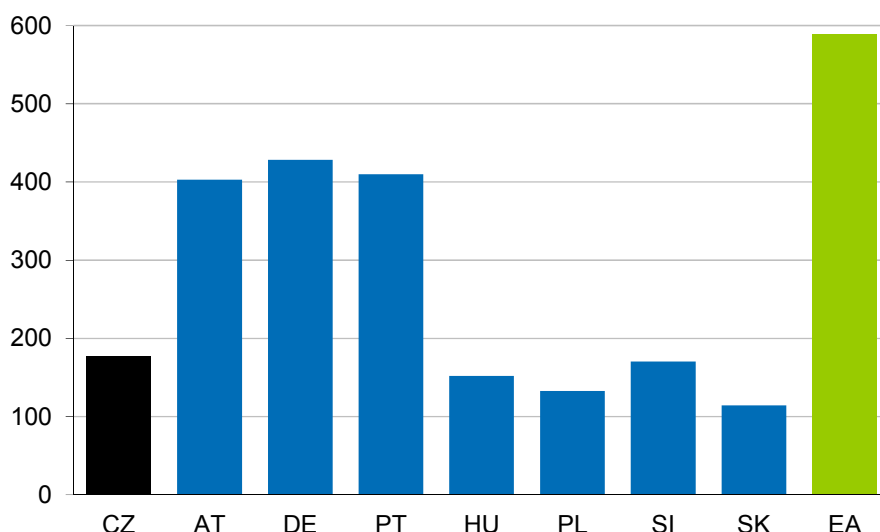
This section presents analyses of alignment in areas relating to monetary policy transmission. These areas include similarity of the financial system, the structure of assets and liabilities of households and firms, the relationship between market and client rates, the degree of financial market integration, inflation persistence and the degree of euroisation of the Czech economy.

### 1.2.1 Financial system

The **depth of financial intermediation** in the Czech Republic stood at 178% of GDP at the end of 2013. It was thus much lower than that of the euro area financial sector, where assets amounted to 589% of GDP (see Chart 25). The extent of financial intermediation in the Czech Republic continues to be more comparable with that in Hungary, Poland, Slovakia and Slovenia. Nevertheless, the depth of financial intermediation in the euro area cannot be considered a target to which the Czech financial sector should converge. On the contrary, a too

large financial sector can represent a source of substantial risks, limiting the ability of institutions or states to solve current and potential future problems in the financial system.<sup>42</sup>

**Chart 25: Depth of financial intermediation (assets of financial institutions as % of GDP, 2013)**



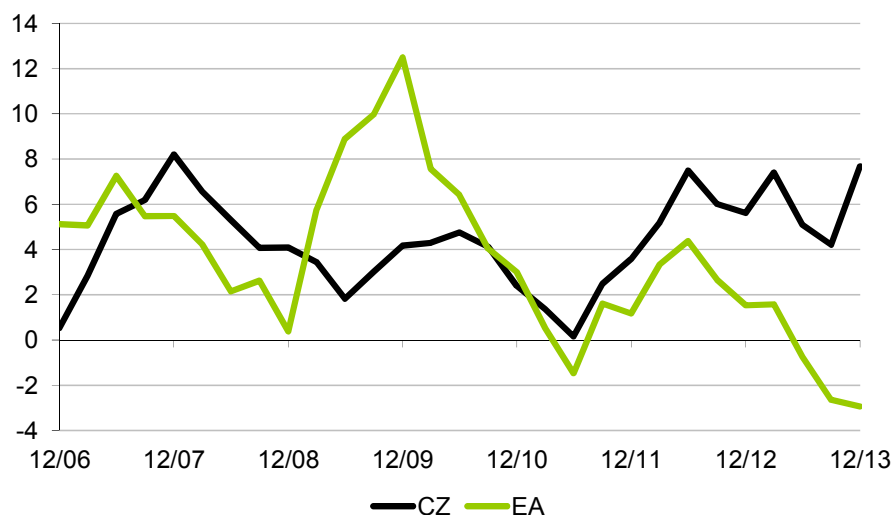
Note: The euro area value exceeds the other countries in the charts owing to the large volume of assets of financial corporations in Luxembourg, Ireland, the Netherlands and France both as a percentage of their GDP and in comparison with the total financial assets of the euro area.

Source: CNB, ECB, Eurostat, central banks.

Financial intermediation in the Czech Republic continued to show year-on-year growth, while in the euro area the opposite trend was observed in 2013, leading to a decrease in the assets balance sheet totals of financial institutions (see Chart 26). Year-on-year growth in the ratio of financial institutions' assets to GDP in the Czech Republic was seen in every quarter of 2013. The increase in the ratio in Q4 was due in part to the weakening of the koruna in November 2013, which acted via revaluation of foreign currency items and a rise in the liabilities of the banking sector to non-residents (see section 2.5). The depth of financial intermediation in the Czech Republic increased by roughly 8% year-on-year. In the euro area, by contrast, the assets of financial institutions decreased both in absolute terms and as a percentage of GDP. The 3% total year-on-year decline in the ratio of assets of financial institutions to GDP in the euro area was due mainly to a decrease in the assets of European banks.

<sup>42</sup> Financial accounts statistics and monetary and financial statistics data were used to prepare this section. These statistics enable international comparisons to be made, but may not always be identical to the national supervisory statistics on supervised financial institutions in individual countries due to certain methodological differences.

**Chart 26: Growth in financial intermediation (annual change in ratio of assets of financial institutions to GDP, %)**



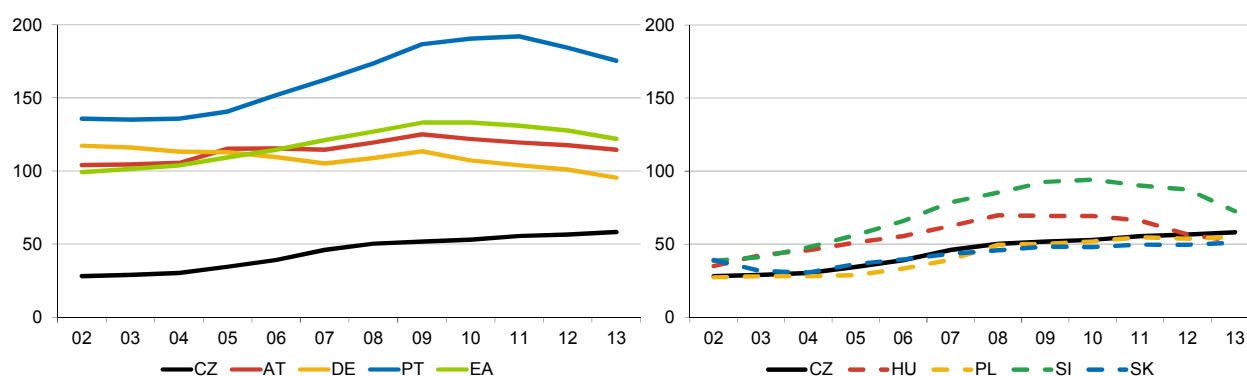
Source: CNB, ECB.

The above information shows that the Czech Republic converged towards the euro area values last year. This was due to both growth in the assets of the Czech financial sector and a decline in the depth of financial intermediation in the euro area.

The depth of financial intermediation is closely linked to the **private sector indebtedness**. Czech households and firms remain significantly less indebted than their euro area counterparts and are comparable more with Central European countries such as Hungary, Poland and Slovakia in this respect (see Chart 27). Although loan growth in the Czech Republic has slowed considerably from the pre-crisis levels in 2005–2007 (around 15% annually) as a result of the global financial crisis, it has stayed positive, unlike in many euro area countries. For this reason, private sector debt in the Czech Republic has continued to edge up in recent years, reaching 58% of GDP in 2013.

Expectations regarding future developments in the global and domestic economy are an important factor affecting the supply of, and demand for, loans. The uncertainty surrounding future developments has played an important role since the outbreak of the crisis, and its effect was again apparent in 2013. It can be assumed that private sector debt in the Czech Republic is still below its long-term equilibrium level and convergence to it will continue when the economy recovers.<sup>43</sup> By contrast, numerous euro area countries are showing signs of private sector overleveraging. The gradual decline in private sector debt that occurred in the euro area in 2013 may also aid convergence.

<sup>43</sup> See Geršl and Seidler (2011).

**Chart 27: Private sector debt (% of GDP)**

Note: EA represents the average of the euro area member countries weighted by the size of GDP.

Source: IMF IFS, Eurostat.

### 1.2.2 Structure of financial assets and liabilities of corporations and households

A similar financial position and structure of financial assets and liabilities of real sectors of individual economies is a key condition for the single monetary policy to have a symmetric effect and for the transmission mechanism to function. Given the different responses of different financial asset and liability items to a monetary policy impulse, it is necessary to compare not only the level, but also the structure of the net position. The strength of the exposures of financial institutions (especially the banking sector) to real sectors is high in all the economies under review. This is because bank loans are historically the primary source of external financing of non-financial corporations and households in continental Europe. The current issue is to what extent capital financing and the corporate bond market will develop as an alternative to bank loans, since favourable market conditions (low interest rates and increased demand for corporate bonds) and institutional (administrative) conditions for issuing corporate bonds have been observed over the last two years.<sup>44</sup>

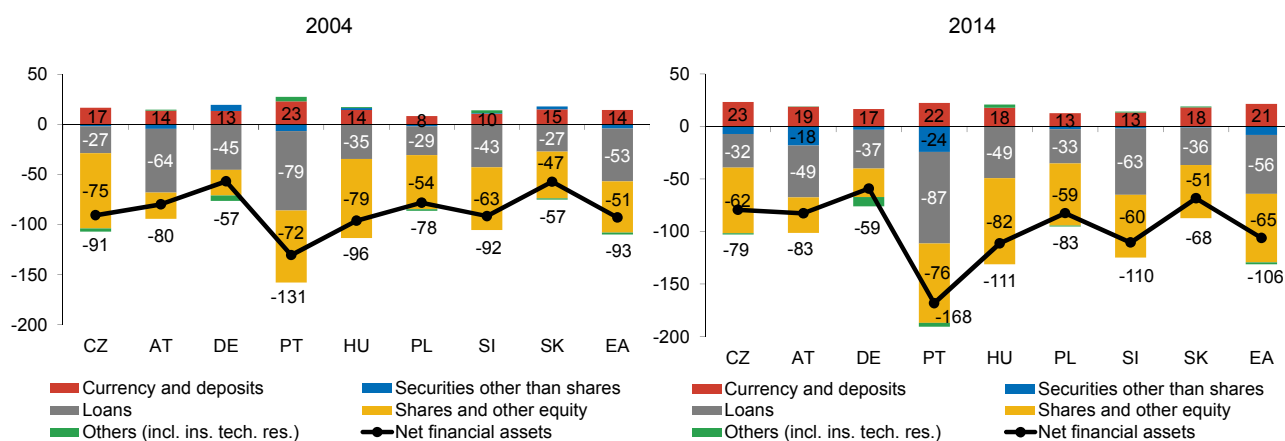
#### Structure of assets and liabilities of non-financial corporations

Chart 28 shows the **net financial assets of non-financial corporations** as a percentage of GDP. The net debtor position of the non-financial corporations sector, which is due generally to a large proportion of non-financial assets in the balance sheet, increased in most countries compared to 2004. In around half of the countries, most notably Portugal, Slovenia and Slovakia, the deterioration in the net financial position was fostered by an increase in loan debt. By contrast, Germany and Austria saw a decline in net loan debt as a ratio to GDP. The debt structure in Austria also saw some changes, specifically an increase in net issuance of securities other than shares (especially corporate bonds) at the expense of loans. Over the last two years, issuance of corporate bonds has been a major source of external corporate financing due to favourable market conditions and reduced financing costs (see Chart 29). The negative financial position of corporations decreased in the Czech Republic. This change mainly reflects developments in the last four quarters, when liabilities showed slower growth, while financial assets in the form of currency, deposits, shares and other accounts receivable grew faster. As regards the level of corporate loan debt, the Czech Republic is broadly comparable

<sup>44</sup> The tighter capital requirements for banks are acting in the same direction, i.e. supporting market-based financing, as they are limiting non-investment-grade loans due to stricter regulation.

with Germany but below the euro area level. The ratio of currency and deposits of non-financial corporations to GDP in the Czech Republic is comparable with that in the euro area.

**Chart 28: Ratios of net financial assets of non-financial corporations to GDP (%)**



Note: Data are available from 2004 onwards. The 2004 and 2014 data are for Q1.

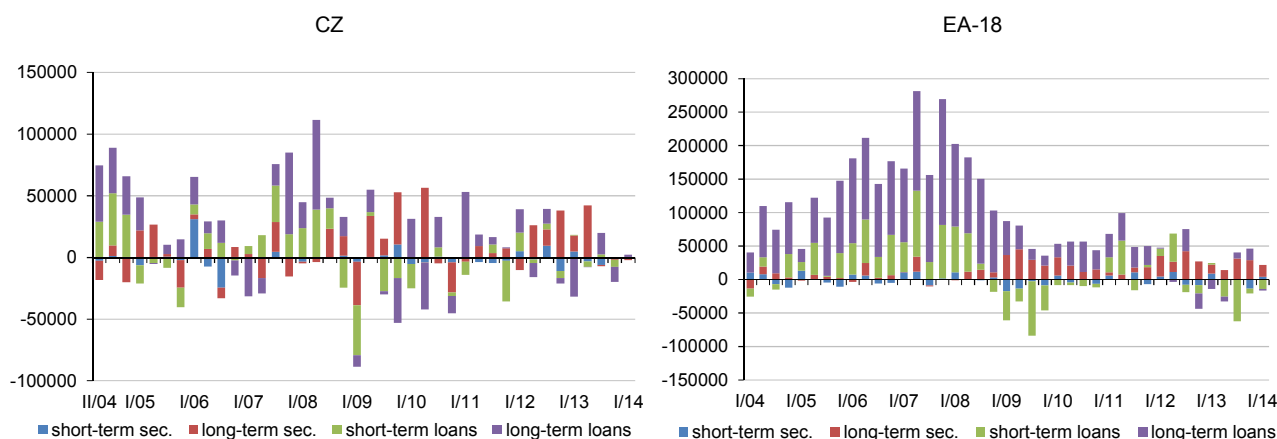
Source: ECB, CNB calculations.

Unlike in Germany and Austria, ownership shares (such as unquoted shares) have a higher weight in the net debtor position in the other countries under review (including the Czech Republic). This is due mainly to a lower proportion of ownership shares in financial assets, related to lower ownership links between corporations and other non-financial corporations both in the domestic economy and, in particular, abroad. Although debt securities have a higher weight in corporate financing in the Czech Republic and in some of the euro area countries under review (Austria and Portugal in particular) compared to 2004, they still contribute to corporate financing to a rather limited extent (unlike loans). Corporate bond issuance conditions mostly improved in Europe and the Czech Republic over the last two years.<sup>45</sup> This was reflected in increased issuance activity among large non-financial corporations in particular. This is documented by Chart 29, which shows two periods with increased issuance activity. For the euro area, the first period ran from 2009 Q1 to 2010 Q2, while for the Czech Republic, it was lagged by one quarter. The second period lasted from 2012 Q1 to 2013 Q1, and in the Czech Republic it came one quarter later. The tendency to use the capital market for external financing in Europe spilled partially over to Czech non-financial corporations. Overall, taking into account the financial and debt crisis as a shock to financial systems, non-financial corporations in the euro area and the Czech Republic behaved similarly in seeking external financing methods other than bank loans. Market-based financing was boosted by favourable conditions, with the low long-term interest rates offered to investors for standard financial products resulting in a partial shift of investor demand to better remunerated corporate bonds.

<sup>45</sup> In the Czech Republic this involved not only market conditions, but also specific tax-optimised conditions.



**Chart 29: External liabilities of corporations in the Czech Republic and the EA-18 (transactions, CZK and EUR millions)**



Note: Data for the Czech Republic are available from 2004 onwards. Transactions of non-financial corporations excluding other accounts payable.

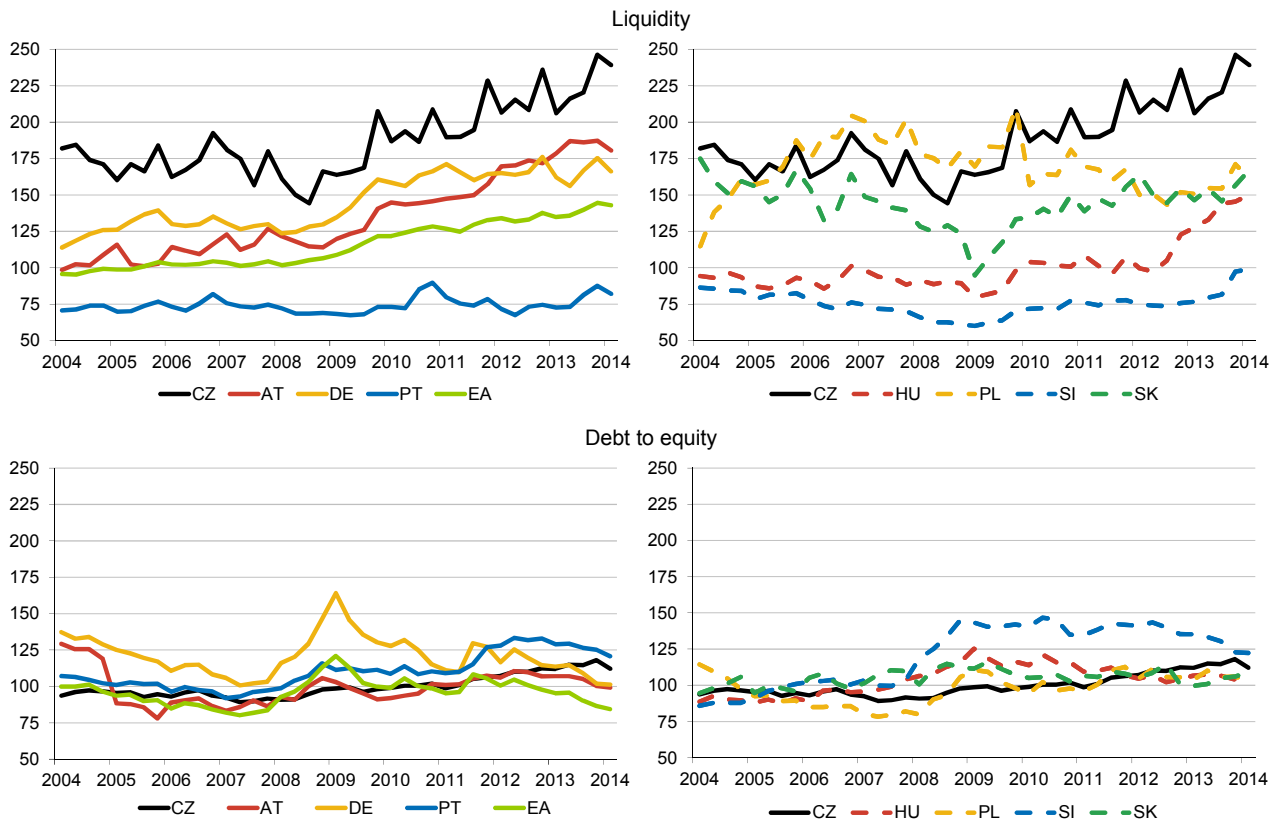
Source: ECB, CNB calculations.

However, the observed rise in the issuance of long-term debt securities (especially corporate bonds) supplemented external financing rather than crowding out credit financing, which has been weak in recent years. In the euro area, it was due to new issues of corporate bonds for long-term financing, since banks were unwilling to finance long-term projects in large amounts owing to increased risk perceptions. In the Czech Republic, it was due more to a weaker ability of banks to provide loans in large amounts. In both cases it involved a shift towards greater use of market financing, with bank loan financing having dominated in previous decades.

Selected **balance sheet indicators** can be used to describe a sector's balance sheet structure over time.<sup>46</sup> The purpose of these indicators is to reveal any mismatch between financial asset and liability items. This determines the vulnerability of the sector (and, given the links between sectors, the vulnerability of the whole economy) to adverse shocks. Balance sheet indicators are therefore assessed in terms of the similarity of their levels and trends to the euro area provided that the levels of the euro area indicators are not indicating elevated risks. It is reasonable to assume that a high degree of similarity to some extent guarantees the same reaction to economic shocks.

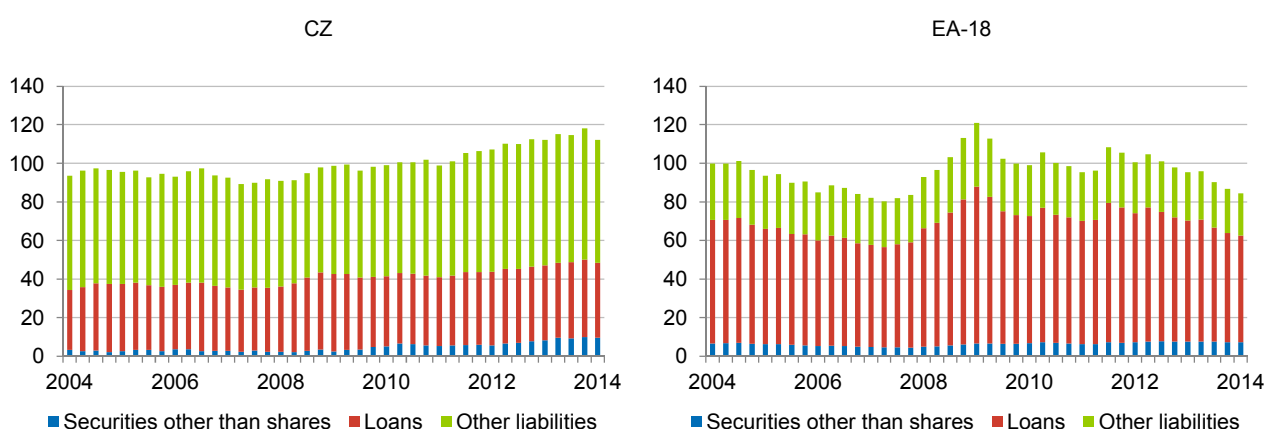
Most countries, including the Czech Republic, recorded an increase in **liquidity in non-financial corporations** in response to the financial crisis. When assessed using this indicator, non-financial corporations in the Czech Republic overtook the other countries under comparison. The movement in this indicator is due to steady growth in currency and corporate deposits both in the Czech Republic and in the other countries except Portugal. A fall in short-term loans after the outbreak of the financial crisis also had an effect on the euro area countries and partly also the Czech Republic (see Chart 30). This development is linked with deleveraging in the banking sectors of euro area countries, whereas in the Czech Republic it is more a reflection of falling corporate demand for loans due to a lower number of profitable projects. In Hungary and Germany, by contrast, short-term loans maintained a slightly rising trend. The liquidity indicator in the euro area is displaying a stable upward trend, but is lower than that in the Czech Republic.

<sup>46</sup> Balance sheet indicators are based on the balance sheet approach to studying financial crises, which was comprehensively defined in Allen et al. (2002). Applications of the balance approach to the Czech Republic can be found in Kalous (2009) and especially in Kubicová, Komárek and Plašil (2012).

**Chart 300: Selected balance sheet indicators of the non-financial corporations sector (%)**

Source: ECB, CNB calculations.

Although debt financing of the non-financial corporations sector as expressed by the **debt to equity ratio** rose significantly in most of the countries under review after the onset of the financial crisis, it has been falling again in most countries since then. The Czech Republic is showing the opposite trend, with debt financing rising slowly but steadily since 2007 and breaking through the 100% level in 2012. The debt ratio dropped significantly for Slovenia and partly also Hungary. A more detailed analysis of the components of the debt to equity ratio reveals a dissimilar debt structure of Czech non-financial corporations compared to corporate debt in the euro area (see Chart 31). Other accounts payable have a larger share in the structure of the external liabilities of Czech non-financial corporations compared to the euro area. As a category containing trade payables between corporations, other accounts payable are used for short-term financing, but no interest or penalty is paid if they are repaid in time. This makes them independent of interest rates in the economy. The ratio of securities other than shares to equity is currently at the same level in both economies. For the Czech Republic this is due to increased issuing activity by non-financial corporations over the last few years.

**Chart 311: Breakdown of the debt to equity ratio (stocks, %)**

Note: Other accounts payable contain two subcategories, one of which reflects short-term trade payables (around 70% for the Czech Republic) and the other a balancing item in the financial accounts.

Source: ECB, CNB calculations.

The non-financial corporations sector in the Czech Republic is generally showing differences from the euro area in terms of the levels of the indicators and their evolution over time. The extent of debt financing is more stable and is not subject to such large fluctuations as in some other countries with higher debt ratios. Non-financial corporations have longer liability maturity and a related greater predominance of short-term assets over short-term liabilities. In response to more favourable issuance conditions on the bond market and to constraints on obtaining large bank loans, corporations in both the euro area and the Czech Republic have started to make more use of bond financing.

### Structure of household assets and liabilities

Unlike non-financial corporations, the **household sector** is in a net creditor position (see Chart 32). The ratio of the net creditor position of households to GDP has increased slightly in all the countries under review except Poland since 2004. The net financial position of Czech households is about half that in the euro area, corresponding to about half the level of financial wealth.

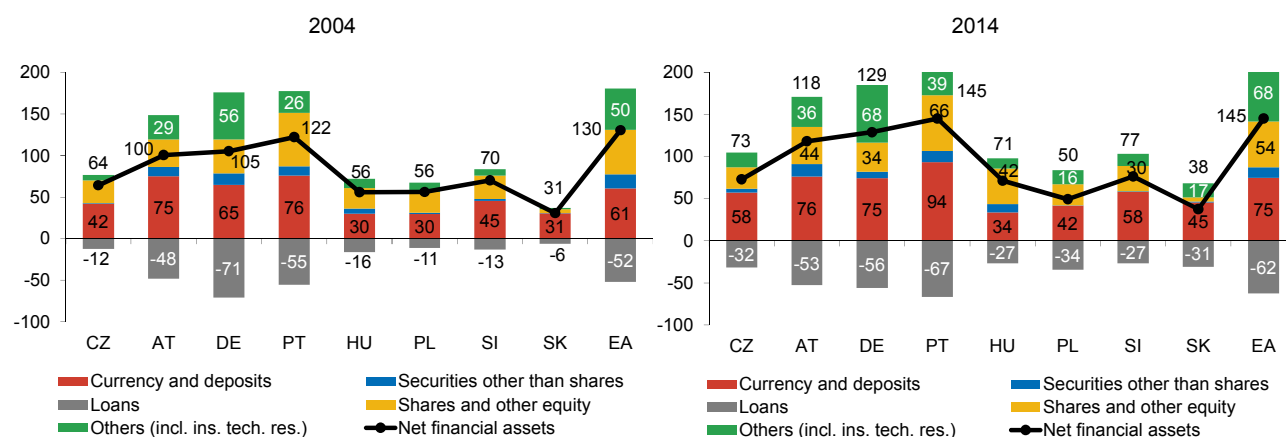
Households in the Czech Republic slightly reduced their share holdings in favour of currency and deposits and other assets. The euro area also recorded a shift towards more liquid assets and other assets including insurance reserves. The share of currency and deposits increased in all the countries under review, and most of all in Portugal, the Czech Republic, Germany and Slovenia. The ratio of currency and deposits to total financial assets of residents in 2014 was highest in Slovakia (63%), the Czech Republic (53%) and Slovenia (53%). These relatively high levels reflect the historically conservative investment behaviour of households in these countries.

Over the last two years, Czech households have been investing in securities other than shares, especially government saving bonds. The portfolio of Czech households has thus seen structural changes towards greater diversification, as the value of this investment amounts to 5% of GDP. In terms of structure, the portfolio of Czech households is converging towards the portfolios of households in Germany, Austria and Portugal.

With the exception of Germany, all the countries recorded an increase in household loan debt. The ratio of debt to GDP rose by around 20 pp compared to 2004 in the Czech Republic and

showed similar growth in the other non-euro area countries and in Slovakia, Portugal and Slovenia. Nevertheless, Czech household debt remains around half that in the euro area.

**Chart 322: Ratios of net financial assets of households to GDP (%)**



Note: The 2004 and 2014 data are for Q1; the EA comprises 18 countries.

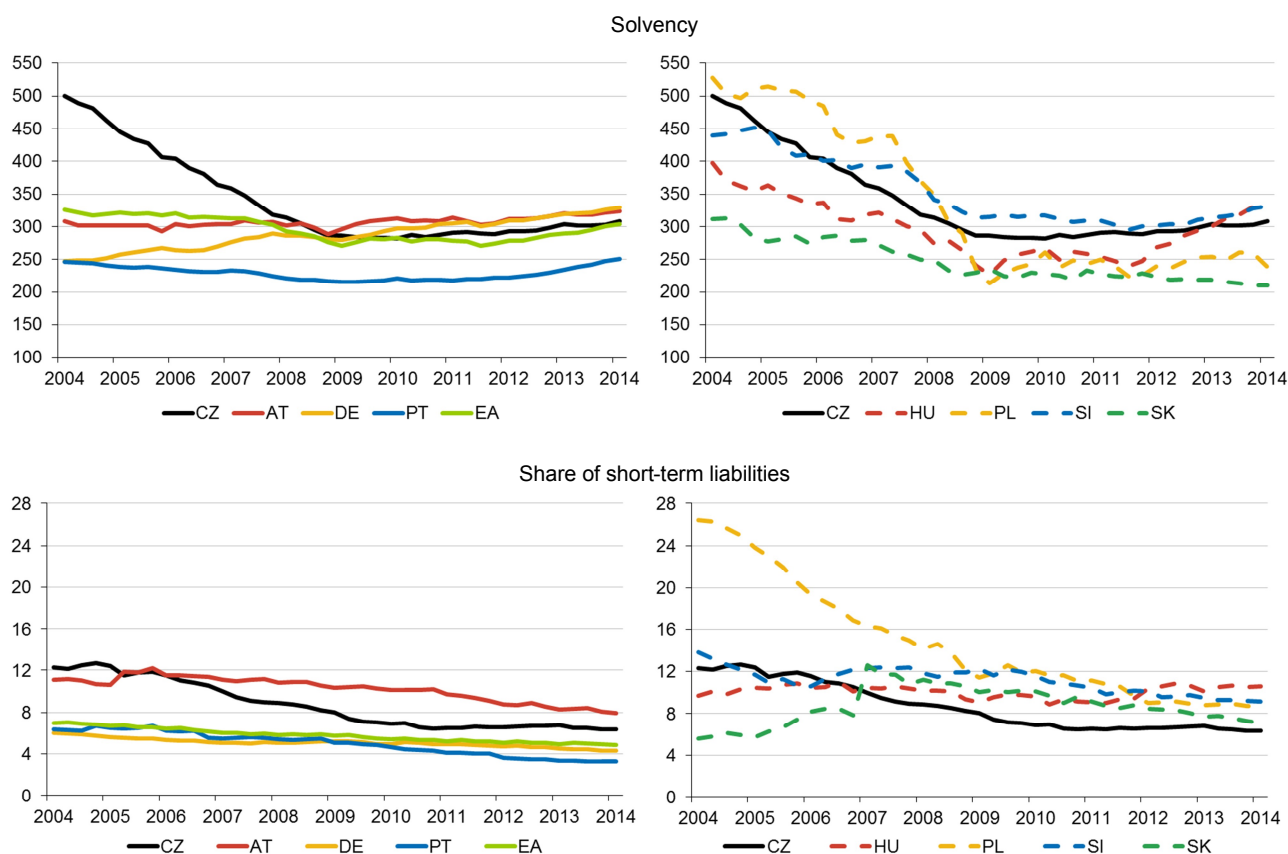
Source: ECB, CNB calculations.

The net creditor position of the Czech household sector is roughly one-half of the level in the euro area. Moreover, as in the case of non-financial corporations, there are persisting differences in structure – in particular the above-mentioned 50% lower debt level and a much lower share of equity and other assets including insurance reserves. These differences may give rise to an asymmetric effect of the single monetary policy after the possible future accession of the Czech Republic and other countries to the euro area, as the lower ratio of assets and liabilities of households to GDP may lead to weaker transmission of the ECB's monetary policy in these countries. The lower share of debt financing of corporations than in the euro area may also lead to a weaker response to interest rate changes.

The **balance sheet indicators** of the Czech household sector show that **solvency** was declining until the end of 2008 (see Chart 33), signalling faster growth in debt than in total financial assets. Since 2009, the rate of growth of debt has slowed and the decline in the solvency ratio has halted. This is in line with the other non-euro area economies and also with Slovenia and Slovakia. The solvency of Czech households has been comparable with the euro area in recent years, while Germany and Austria remain at a slightly higher level. The solvency ratios of the household sectors in Portugal, Slovakia and Poland are noticeably lower.

As for the maturity structure in the Czech household sector, the **share of short-term liabilities** was slowly decreasing until the end of 2010. It is now above the level in Germany and the euro area. Austria is an exception among the advanced countries, having a higher share of short-term liabilities. The Czech Republic has been recording lower levels than the other countries under comparison, as the liability side of Czech households' balance sheet is dominated by long-term loans.

Overall, in terms of the balance sheet indicators under comparison, the Czech household sector neared the levels typical of euro area households in the second half of the period under examination. In this respect, therefore, the household sector is aligned with the euro area and shows an identically low risk of overall insolvency.

**Chart 33: Selected balance sheet indicators of the household sector (%)**

Source: ECB, CNB calculations.

### 1.2.3 Effect of monetary policy on client interest rates

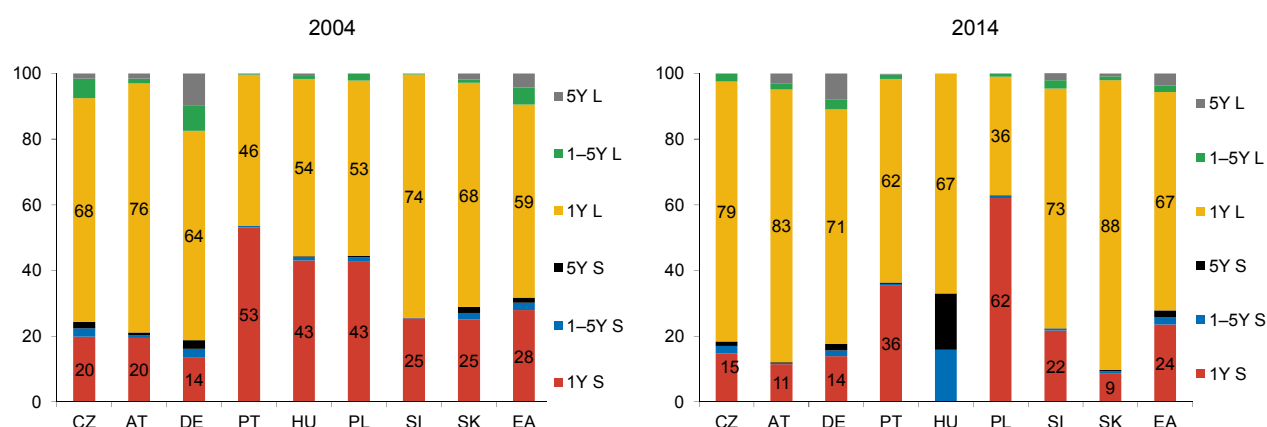
A similar function of the interest rate channel of monetary policy transmission, i.e. transmission of changes in financial market interest rates to client rates, is a prerequisite for successful functioning of an economy under a single monetary policy.

The **transmission of changes in financial market interest rates** to client rates is relatively fast in the Czech Republic, although full pass-through is observed only for mortgage loans. Rates on large and small loans with short fixations or floating rates follow money market developments relatively quickly, with around 60% of the transmission taking place within a month (Horváth and Podpiera, 2009; Babecká-Kucharčuková et al., 2013). Client rates on corporate loans with a fixation of over one year (whose weight is low though; see below) are linked more to long-term government bond yields, with the transmission taking around 2–3 months. The pass-through time for mortgage loan rates, which are also linked to government bond rates, is about three months. The transmission of interest rates during the financial crisis was somewhat weakened as a result of an increase in client risk premia. This, however, is a traditional sign of cyclicity associated with a tightening of credit conditions due to the increasing level of risk associated with clients and their projects and with more prudential behaviour by banks. In the euro area, client interest rates with short fixations are also derived from money market rates, and long-term rates are traditionally derived from long-term government bond yields. Client rates on loans to non-financial corporations are more affected by changes in interbank rates than loans to households. This applies both to financial crisis

episodes (higher volatility) and to quiet times (Aristei and Gallo, 2012). The strength of transmission differs greatly across the euro area member states. The pass-through of changes in financial market rates to client rates is usually incomplete and the dynamics of adjustment of client rates are different for rises and falls in money market rates (Beckmann et al., 2013).

Chart 34 shows the structure of new loans to non-financial corporations broken down by interest rate fixation period. A higher share of loans with short-term rates generally indicates greater **sensitivity of new loans to non-financial corporations to changes in** monetary policy rates and, subsequently, **market rates**. In all the countries under review, a large majority of corporations take out loans with floating rates or rates with a fixation of up to one year. Of the countries under review, only Hungary<sup>47</sup> and Germany have a larger share of loans with longer fixations. A high share of loans with short fixations enables relatively fast transmission of client interest rates to corporate balance sheets and is quickly reflected in demand for loans. Large loans (i.e. those over EUR 1 million) have the largest share in all the countries except Poland, and this share has generally increased since 2004. Only in Poland has the share of small loans increased significantly since 2004.

**Chart 34: Structure of new loans to non-financial corporations by interest rate fixation (%)**



Note: 1Y S and 1Y L stand, respectively, for small (up to EUR 1 million) and large (over EUR 1 million) loans with a floating rate or a rate fixed for up to one year, and the other items in the key denote such loans with longer interest rate fixations. The structure of the euro area total varies according to the increasing number of euro area member countries. The 2014 data are as of June. Data for Poland were not available for 2004 and are therefore replaced by the 2005 data.

Source: ECB, CNB calculations.

A simplified estimate of the strength and lag of the transmission from market to client rates in the countries under review can be obtained by conducting a correlation analysis of changes in these rates. This analysis identifies the maximum value of the coefficients of correlation between interest rates on client loans and the relevant market interest rate for several possible lags. Table 10 shows the correlations between three-month money rates and rates on loans to non-financial corporations (fixed for up to one year), lagged by 0–2 months. The correlations of most countries reach statistically significant levels with no lag, suggesting fast pass-through of changes in market rates to client rates. The exceptions are Portugal, where there is a one-month lag for both small and large loans, and Slovakia, where the one-month lag pertains only to large loans. These results indicate strong and largely symmetrical links between client interest rates and the relevant interbank rates.

<sup>47</sup> Hungary has seen a major change in maturities over the last twelve months, as the share of small forint-denominated loans fixed for over 1 year and up to 5 years and for over 5 years in total loans has gone up. This is due mainly to institutional conditions created by the state, as a Funding for Growth Scheme was established. It provides small and medium-sized enterprises with access to medium-term forint-denominated loans with an average maturity of 7 years and a 2.5% interest rate. These loans are funded by interest-free loans of a specified amount provided to commercial banks by the central bank.

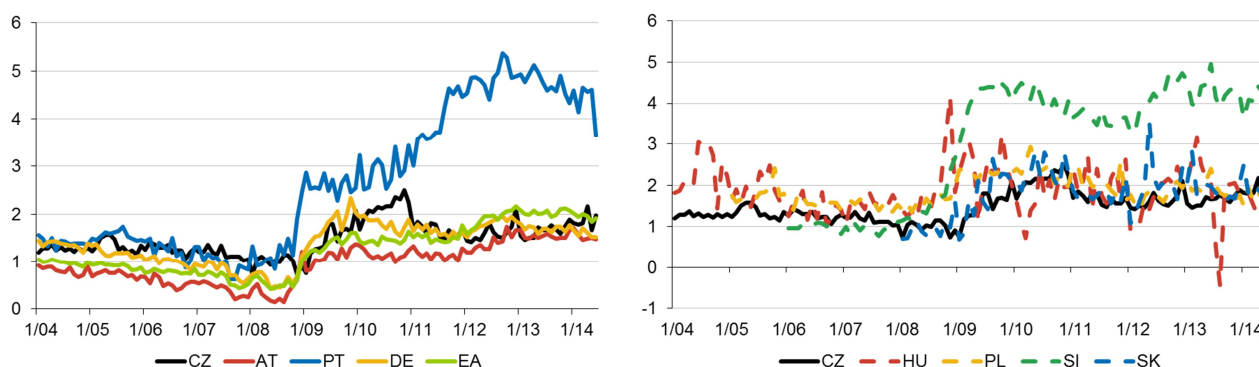
**Table 10: Correlation between changes in rates on loans to non-financial corporations (fixed for up to one year) and changes in three-month market rates**

	loans up to EUR 1 million 2004M1–2014M6			loans over EUR 1 million 2004M1–2014M6		
	t	t-1	t-2	t	t-1	t-2
CZ	<b>0.36</b> **	0.13	0.03	<b>0.45</b> **	0.18	0.08
AT	<b>0.85</b> **	0.71 **	0.58 **	<b>0.78</b> **	0.58 **	0.48 **
DE	<b>0.76</b> **	0.64 **	0.45 **	<b>0.74</b> **	0.47 **	0.32 **
PT	0.53 **	<b>0.67</b> **	0.41 **	0.31 **	<b>0.44</b> **	0.30 **
HU	<b>0.31</b> **	0.25 **	0.12	<b>0.35</b> **	0.17	0.12
PL	<b>0.70</b> **	0.60 **	0.40 **	<b>0.15</b> *	0.08	0.08
SI	<b>0.54</b> **	0.38 **	0.17 *	<b>0.42</b> **	0.26 **	0.11
SK	<b>0.35</b> **	0.12	0.09	0.13	<b>0.25</b> **	0.09
EA	<b>0.90</b> **	0.77 **	0.54 **	<b>0.86</b> **	0.60 **	0.46 **

Note: The highest correlations between the interest rate on loans to non-financial corporations and the relevant three-month market interest rate (mostly the 3M EURIBOR, otherwise the 3M PRIBOR, the 3M WIBOR or the 3M BUBOR) are shown in bold. The correlation analysis was performed on the first differences of the individual time series.

Source: ECB, CNB calculations.

Different risk premia may be another source of asymmetric of client interest rates after entry into a monetary union. Chart 35 shows the **spreads between the interest rate on new loans to non-financial corporations and the relevant market rates**. The chart reveals that the spread in the Czech Republic is comparable with that in the euro area as a whole and slightly higher than that in Germany and Austria. The current developments in the Czech Republic are due to banks' very low interest margins on new loans to non-financial corporations and the historically low three-month interbank rate. A much higher spread is observed in Portugal and Slovenia. This may be limiting the effect of the single monetary policy in these countries. The countries hit by the debt crisis may thus see the emergence of undesirable tighter monetary (or credit) conditions due to a higher premium than in the core euro area countries. The fluctuation in the Hungarian premium in August 2013 was due to the introduction of the Finance for Growth Scheme, through which non-financial SMEs can obtain medium-term bank loans at roughly one-half the interest rate implied by the loan market.

**Chart 35: Spreads between interest rates on loans to non-financial corporations and 3M market rates (pp)**

Note: The spreads for Poland and Hungary are calculated from interest rates on domestic currency loans. The rates are calculated from the weighted rate on total corporate loans. The structure of the euro area total varies according to the number of countries.

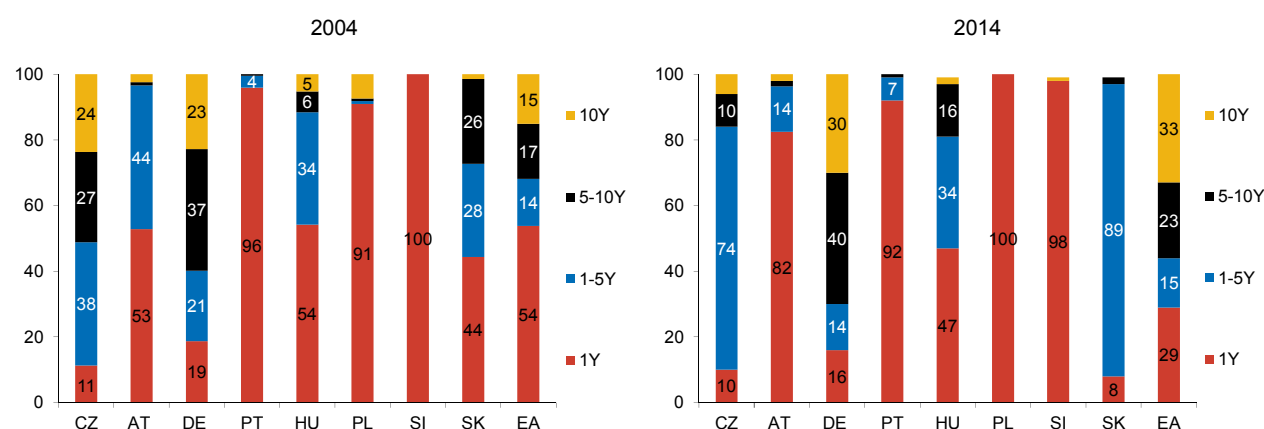
Source: ECB, CNB calculations.

Chart 36 shows the structure of new **loans for house purchase broken down by interest rate fixation period**. Such loans make up the main segment of household debt. In the Czech Republic, as in Germany, Slovakia and the euro area as a whole, households mostly take out



loans with fixations of over one year. This creates conditions for similar monetary policy transmission to households' balance sheets. While loans with fixations of over one year and up to five years are predominant in the Czech Republic, loans with longer fixations dominate in the euro area on average. In recent years, the share of loans fixed for up to one year in the Czech Republic at first increased to 30% in 2012, but then fell sharply to 9% in 2013 and has remained at this level. Given the favourable market conditions, households also started to make use of mortgage with fixations of over ten years. This can be attributed to very low interest rates and households' motive to fix mortgage loans at these low levels for a longer period of time. A majority share of loans fixed for up to one year, and thus a higher sensitivity of transmission, can be observed in Austria, Portugal, Hungary, Poland and Slovenia. The differences between countries are due to different financial products, market structure and some regulatory measures.<sup>48</sup>

**Chart 36: Structure of new loans to households for house purchase by interest rate fixation (%)**



Note: The structure of the euro area total varies according to the number countries. The 2014 data are as of June.

Source: ECB, CNB calculations.

In all the countries under review, changes in mortgage rates fixed for up to one year are correlated most strongly with changes in relevant three-month market rates with a one-month lag. This suggests that interest rate transmission is fairly fast in the countries under review (see Table 11). Rates on new mortgage loans fixed for over one year are statistically significantly correlated with yields on ten-year government bonds in the Czech Republic, Germany, Slovakia and the euro area as a whole.<sup>49</sup> Most mortgage loans in these countries are fixed for a period of longer than one year, usually between one year and five years, or up to ten years in Germany. The lag on the strongest response of client rates to a change in market rates on these loans ranges between one month in Germany and two months in the euro area and Slovakia. As regards Hungary, where there is also a higher share of mortgage loans fixed for over one year, the weaker correlation with government bonds may be due to an elevated and fairly volatile risk premium since the outbreak of the financial crisis.

<sup>48</sup> In Poland, for example, standard mortgages have a floating interest rate linked to the WIBOR and are usually changed once every three or six months. The volume of longer fixations is negligible.

<sup>49</sup> Links between client rates and government bonds are observed for two reasons. First, ten-year bonds approximate the longer end of the yield curve, thus representing the long-term cost of financing. The other reason is the previously econometrically confirmed link between Czech government bonds and koruna mortgage loans (Babecká Kucharčuková et al., 2013).

**Table 11: Correlation between changes in rates on mortgage loans and changes in market rates**

	fixed rate up to one year 3M market interest rates 2004M1–2014M6			fixed rate over one year 10Y government bonds 2004M1–2014M6		
	t	t-1	t-2	t	t-1	t-2
	<b>CZ</b>	0.13	<b>0.22</b> *	0.17	0.04	<b>0.32</b> **
<b>AT</b>	0.52 **	<b>0.52</b> **	0.51 **	0.02	-0.08	0.04
<b>DE</b>	0.68 **	<b>0.72</b> **	0.49 **	0.43 **	<b>0.72</b> **	0.56 **
<b>PT</b>	0.67 **	<b>0.90</b> **	0.66 **	0.01	0.05	0.03
<b>HU</b>	-0.12	-0.08	0.02	0.07	-0.02	0.00
<b>PL</b>	0.18 **	<b>0.29</b> **	0.23 *		–	
<b>SI</b>	0.77 **	<b>0.85</b> **	0.60 **		–	
<b>SK</b>	0.13	<b>0.47</b> **	0.25 **	0.06	0.20 **	<b>0.24</b> **
<b>EA</b>	0.80 **	<b>0.87</b> **	0.72 **	0.28 **	0.54 **	<b>0.54</b> **

Note: The highest correlations over time between the interest rate on mortgage loans and the relevant three-month market interest rate (the 3M EURIBOR for the euro area countries, otherwise the 3M PRIBOR for the Czech Republic, the 3M WIBOR for Poland and the 3M BUBOR for Hungary) are shown in bold; the figures for bonds relate to the ten-year government bonds of the given country. For the euro area, the table shows the correlation with German government bonds. In Poland and Slovenia, the share of mortgage loans fixed for over one year is almost negligible. The correlation analysis was performed on the first differences of the individual time series.

Source: ECB, CNB calculations.

To sum up, the degree of heterogeneity of client interest rates in the euro area has increased further due to the financial crisis and subsequently the debt crisis. This represents one of the main challenges to ensuring that the single monetary policy has a symmetric effect. Client interest rates in EU countries are likely to remain more differentiated in the future. Liquidity and risk premia, which reflect the financial soundness of each economy, will probably continue to play a much more important role than in the pre-crisis period. However, greater competition for clients, and thus greater differentiation among clients by banks, can also be expected. Moreover, the effect of schemes targeted at promoting favourable lending conditions in some countries can be expected (e.g. Hungary). The spread of client rates on loans to non-financial corporations in the Czech Republic is currently slightly above the German and Austrian level, but at a similar level as the spread in Poland. The correlation between client rates on loans to non-financial corporations and market rates in the Czech Republic is strong and similar to that in euro area and accession countries. As regards mortgage loans, maturities of over one year are significant in terms of volume in the Czech Republic, as they are in Germany and the euro area as a whole. This is related to a stronger correlation between client rates and government bond yields in these countries. The pass-through of changes in financial market interest rates to client rates in the Czech Republic thus does not differ greatly from that in the euro area and represents no barrier to future euro adoption.

#### 1.2.4 Inflation persistence

The ability of the economy to absorb shocks effectively and the functioning of monetary policy transmission also depend 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, 2009). Substantial differences in inflation persistence in the countries of a monetary union can result in the single monetary policy having different impacts. According to Angeloni and Ehrmann (2004), the differences in inflation observed between individual euro area countries can largely be 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. The values of persistence indicators in Methods 2 and 3 (as in Method 1) increase with inflation persistence. Method 2 assumes a constant mean value of inflation. However, 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 contains structural changes or breaks in trend which the model process does not allow for, the inflation persistence estimate is typically biased upwards. Because of the transformation process, accompanied by disinflation, price convergence, gradual price deregulation and changes in monetary policy regime, it is the time series of transition countries that are most affected by breaks in the mean values of inflation. Method 3 therefore models the autoregressive process with the mean value of inflation changing over time.

Table 12 summarises the inflation persistence estimates for 2004 Q1–2014 Q2. According to the non-parametric Method 1, the inflation persistence in the Czech Republic is one of the highest of the countries under review. According to the estimates made using the other two methods, though, it is roughly in the middle of the sample. However, the differences in the estimated persistence between the countries in the tested group are economically insignificant for all three methods and there is no obvious difference between the existing euro area countries and the non-euro area countries.<sup>50</sup> The potential impacts of the single monetary policy would thus be similar in this respect.

**Table 12: Inflation persistence estimates**

	Method 1	Method 2	Method 3
<b>CZ</b>	0.86	0.81	0.50
<b>AT</b>	0.81	0.76	0.51
<b>DE</b>	0.75	0.75	0.69
<b>PT</b>	0.83	0.89	0.61
<b>HU</b>	0.81	0.97	0.44
<b>PL</b>	0.86	1.00	0.52
<b>SI</b>	0.86	0.93	0.43
<b>SK</b>	0.81	1.00	0.41

Notes: Method 1 – non-parametric technique.

Method 2 – sum of autoregression coefficients, constant mean assumed.

Method 3 – sum of autoregression coefficients, time-varying mean assumed.

Source: OECD MEI, CNB calculations.

### 1.2.5 Financial market alignment

Financial markets can be identified as aligned if financial assets having comparable risk factors and yields are priced identically by the markets no matter which country they are traded in. The similarity in the behaviour of prices of comparable financial assets across markets thus illustrates the level of financial market alignment or synchronisation in the countries under review. This application of the law of one price was used – with awareness of its limitations –

<sup>50</sup> Baxa et al. (2012) estimate inflation persistence through the lens of the new Keynesian Phillips curve with an assumption of stochastic volatility and show that inflation persistence in the Czech Republic is considerably lower than that in Poland and Hungary and is thus the closest to the low persistence levels observed in the euro area.

to measure the alignment of the financial markets of selected countries with the euro area. The more the individual segments of the financial markets of countries planning to adopt the euro become aligned with the euro area market, the more these asset prices should be affected by common (global) factors rather than by national (local) factors.

The following analysis of the alignment of financial markets (money, foreign exchange, government bond and stock markets) applies two methods: (i) price-based measures and (ii) news-based measures.<sup>51</sup> Price-based measures use the concepts of beta-convergence and sigma-convergence. Beta-convergence enables identification of the speed of convergence of the national market to the euro area, while sigma-convergence identifies the degree of convergence. News-based measures are based on the assumption that in the case of an aligned market, prices of individual national assets respond to common news rather than to local news. The sensitivity of asset prices to global news is measured by gamma, which shows the extent to which countries' asset prices respond to news in the same way as euro area asset prices.<sup>52</sup>

The results of the analysis for the individual financial market segments are shown in Table 13 for beta, in Chart 37 for sigma and in Chart 38 for gamma. When interpreting the results, we compare the pre-crisis period with the period following the outbreak of the financial crisis, which was marked by generally high market price volatility.

**Table 13: Beta coefficients**

	Money market		Forex market		Bond market		Stock market	
	1/02–7/07	8/07–6/14	1/02–7/07	8/07–6/14	1/02–7/07	8/07–6/14	1/02–7/07	8/07–6/14
<b>CZ</b>	-0.66	-0.39	-0.89	-0.86	-0.74	-0.74	-0.93	-0.80
<b>AT</b>	-	-	-	-	-1.09	-0.88	-1.03	-0.69
<b>DE</b>	-	-	-	-	B	B	-0.71	-0.85
<b>PT</b>	-	-	-	-	-0.68	-0.88	-1.05	-0.91
<b>HU</b>	-0.83	-0.77	-0.96	-0.90	-0.90	-0.69	-0.86	-1.01
<b>PL</b>	-0.48	-0.44	-0.82	-0.97	-0.81	-0.80	-0.93	-0.87
<b>SI</b>	-	-	-	-	-	-0.87	-0.73***	-0.99
<b>SK</b>	-0.79	-0.56*	-0.98	-	-0.99**	-0.84	-0.78	-0.94
<b>EA</b>	B	B	B	B	-	-	B	B

Note: The closer the value of the beta coefficient is to -1, the higher is the speed of convergence; the first time interval in the analyses is the period before the outbreak of the financial crisis (up to July 2007); the second is the ongoing financial crisis period. Other symbols: B – benchmark; "-" – data not available; \* – up to 31 December 2008; \*\* – from 22 June 2002, \*\*\* – from 1 April 2003. All the estimates were statistically significant at the 1% level.

Source: Thomson Datastream, CNB calculations.

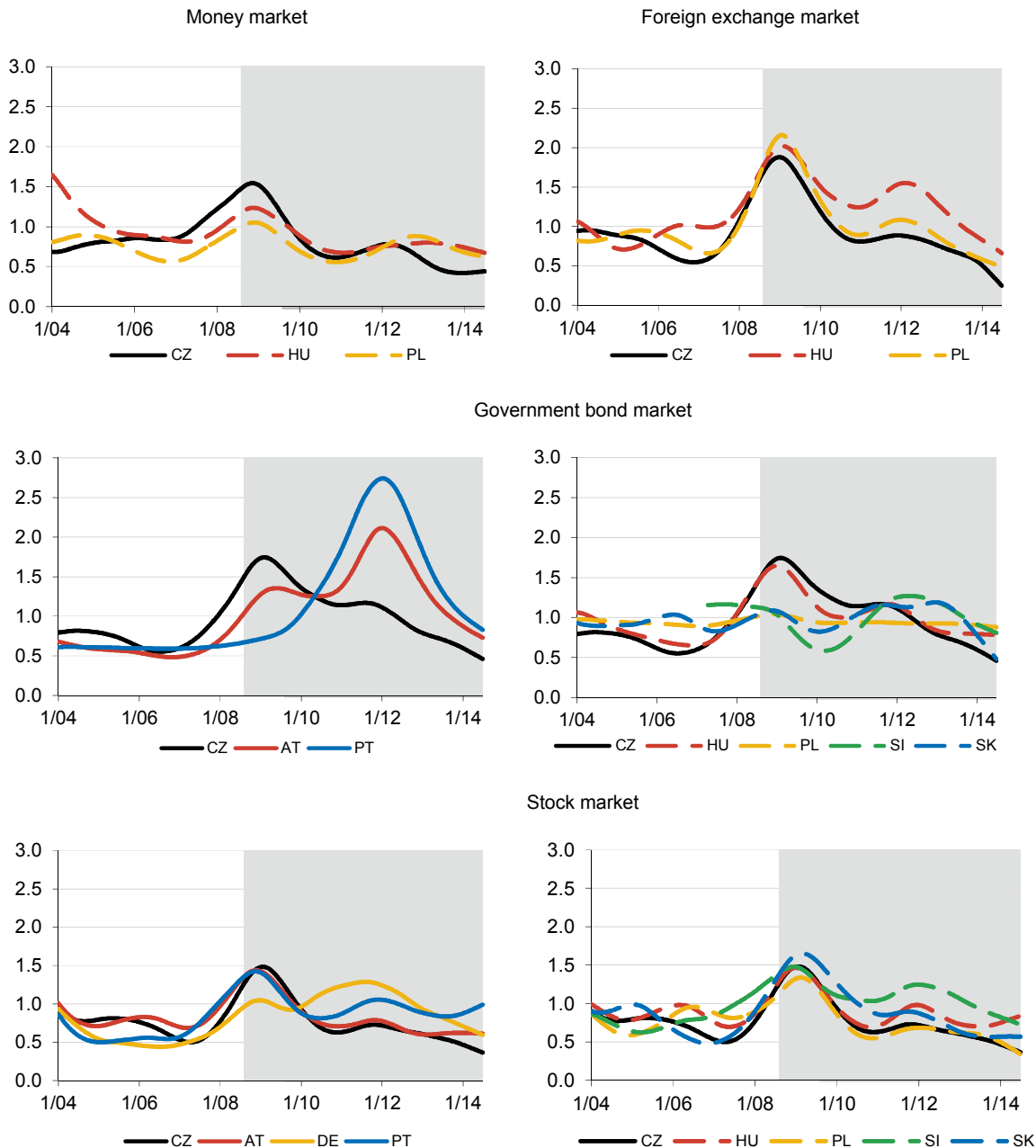
The results of **price-based measures** signal that in the pre-crisis period the speed of price beta-convergence/divergence on the stock, bond and foreign exchange markets of the countries under review vis-à-vis the euro area (or Germany in the case of the government bond market) was relatively high (beta coefficients close to -1; see Table 13), declining only slightly in most cases during the crisis. The level of sigma-convergence did not differ much across the countries under review in the case of these markets for most of the period (sigma coefficients; see Chart 37). The results of the beta- and sigma-convergence of individual financial markets rank the Czech Republic among the countries with a higher degree of alignment, i.e. those where global factors have a greater effect on financial asset prices.

<sup>51</sup> The literature also provides some other approaches to measuring alignment which are based not on the law of one price but, for example, on quantitative indicators (quantity-based measures). These usually entail various surveys of statistical information monitoring change in investor behaviour in the process of financial market integration.

<sup>52</sup> Asset prices are monitored at an aggregate level and it is assumed that euro area assets respond primarily to global news.

Moreover, alignment of the said three Czech markets with the euro area has been increasing since 2009.<sup>53</sup>

**Chart 37: Sigma coefficients**



Note: Lower standard deviation values (y-axis) correspond to a higher convergence level. The grey area marks the period since August 2007. The differences in the standard deviations in individual markets are not statistically significant, except for the Slovenian and Slovakian foreign exchange markets, where volatility dropped to zero due to euro adoption.

Source: Thomson Datastream, CNB calculations.

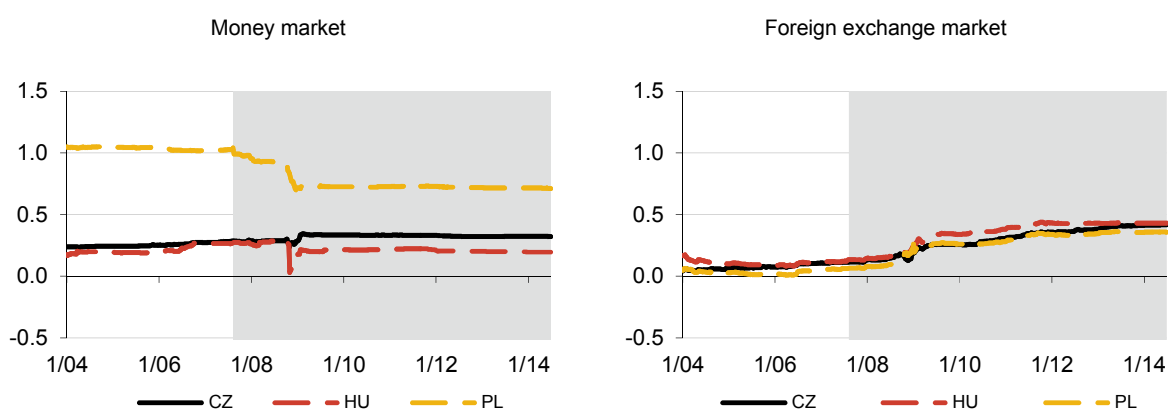
<sup>53</sup> In a detailed analysis of the bilateral linkages between EU sovereign bond markets, Claeys and Vašíček (2012) show that the spillover between markets has increased substantially over time. The Czech, Polish and Hungarian markets affect one another and are simultaneously significantly affected by developments in the euro area. This effect of euro area markets on Central European markets is more pronounced than that on, for example, other non-euro area EU countries such as Denmark, Sweden and the United Kingdom.

The results of **news-based measures** (see Chart 38) indicate that the local factors affecting the national markets were quite significant in the pre-crisis period. Increased importance of global news is generally apparent on stock and foreign exchange markets in the crisis period. The transmission of global shocks also intensified on these markets in the Czech Republic. Higher sensitivity to global shocks can be expected for both these markets given the greater influence of foreign investors there. The reaction to common news is low in the Czech Republic relative to the advanced euro area countries (a lower gamma coefficient). On the other hand, it is one of the highest among the Central European countries under review, especially on the stock and bond markets.

Both methods signal a visible stabilisation and a renewed process of alignment of financial markets in all the monitored countries with the euro area after the escalation of the **euro area financial and debt crisis**, which, however, remains conditional on active central bank policy and actions, including unconventional measures. As Chart 37 shows,<sup>54</sup> the start of the debt crisis brought about divergent movements in financial markets and increased price volatility. This was particularly observable in the Austrian and Portuguese government bond markets, although higher sensitivity of market prices to common or global news is evident in Austria, while largely domestic effects can be seen in Portugal in the recent past (see Chart 38).<sup>55</sup> Convergence can be seen again for most markets and countries, with asset prices being greatly affected by the measures taken by the ECB and the persisting easy policy of G4 central banks.<sup>56</sup> These central bank measures reduced the short-term risks associated with financial assets and hence the market volatility of their prices (e.g. on the Portuguese government bond market). Despite this calm-down and apparent convergence, some fragmentation prevails on European markets. This is due to the behaviour of investors, who on the one hand are seeking highly demanded and overvalued “safe” assets (generating low returns) owing to the persisting uncertainty (“flight to quality”), and on the other hand are trying to find financial returns in an environment of sustained low rates (“search for yield”).

To sum up, the temporarily suspended process of financial integration with the euro area has continued to renew in individual segments of the Czech financial market. However, the assessment of alignment must be seen in the light of the measures taken by central banks.

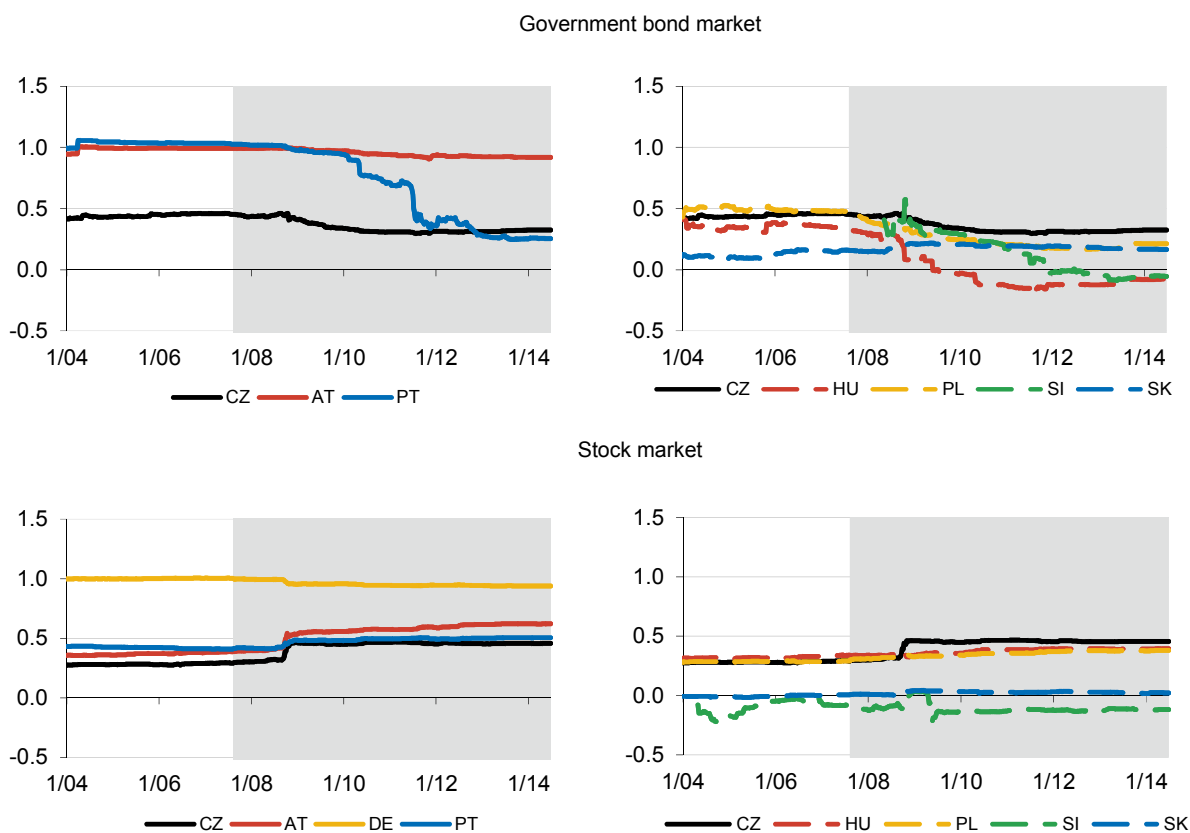
**Chart 38: Gamma coefficients**



<sup>54</sup> Only the Slovak forex market recorded “artificial” convergence at the beginning of the crisis, owing to euro adoption.

<sup>55</sup> The sources of the response of asset prices are different for these two countries. While the response of assets in Portugal stems from adverse macroeconomic developments and deepening structural imbalances, that in Austria stems from financial sector developments.

<sup>56</sup> The G4 comprises the Bank of England, the Bank of Japan, the European Central Bank and the Federal Reserve System.



Note: Positive (negative) gamma values close to one express same (opposite) directional and similarly strong sensitivity to news and therefore a higher degree of integration; values close to zero express low integration. The grey area marks the crisis period.

Source: Thomson Datastream, CNB calculations.

### 1.2.6 Spontaneous euroisation

A high degree of euroisation limits the conduct of independent monetary policy. Moreover, rising demand among economic agents for foreign currency assets and liabilities poses a risk to financial stability in the event of a sharp depreciation of the domestic currency. The adoption of the single currency may be a natural solution, and the costs of entering the monetary union may be lower for a highly euroised economy.

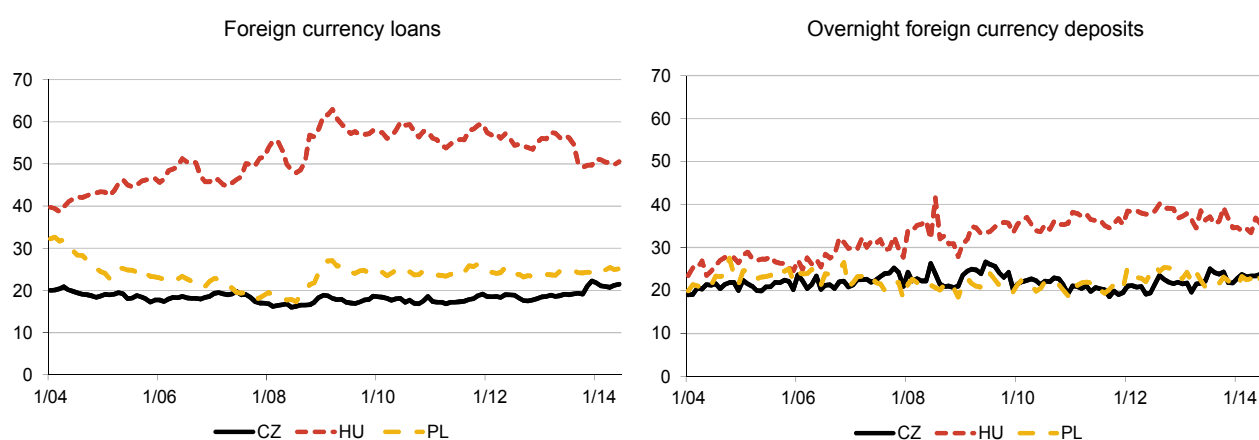
The **degree of euroisation** in the Czech Republic rose slightly last year. Foreign currency is used in financial transactions mainly by corporations involved in international trade, naturally as a result of their high trade integration with the euro area. The weakening of the Czech koruna in November 2013 was reflected in increased efforts by some enterprises to hedge naturally (to align cash flow in terms of the currency used). Despite this, the degree of euroisation in the Czech Republic remains relatively low thanks to trust in the macroeconomic and institutional environment. The share of total foreign currency loans and deposits at banks is the lowest in the Central European region.

The shares of foreign currency deposits and loans of **non-financial corporations** with domestic banks in the Czech Republic have increased slightly and currently stand at 22% and 24% respectively (see Chart 39). The higher interest in foreign currency loans was fostered mainly by loans to developers, since the construction of commercial development projects is usually funded by euro-denominated loans in order to naturally hedge against foreign exchange risk so that rents can be set in euro. Growth in foreign currency loans in some



industrial sectors and in trade – observed also in response to the weakening of the koruna at the end of 2013 – slowed in the first half of 2014. Moreover, exporting corporations hedge using foreign currency loans and other liabilities directly abroad. The share of foreign currency payments and receipts in total domestic payments and receipts of corporations has also increased over the last one and a half years and was fluctuating around 17% in 2014 Q2 (as compared to around 10% in the past). Greater interest in foreign currency loans is currently also apparent in insurance and financial intermediation. While the shares of foreign currency deposits and loans of non-financial corporations with domestic banks in Poland are similar to those in the Czech Republic, they remain significantly higher in Hungary, at around 36% for deposits and 50% for loans.

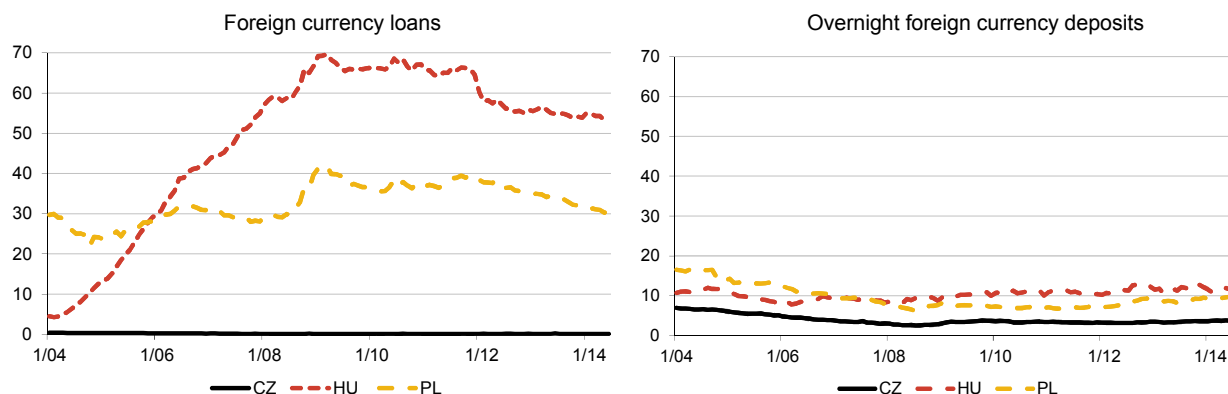
**Chart 39: Foreign currency loans and overnight deposits of non-financial corporations (shares in total loans and overnight deposits of non-financial corporations with domestic banks, %)**



Source: Central banks, CNB calculations.

The demand of **households** for foreign currency deposits and loans has long been very low in the Czech Republic. Foreign currency overnight deposits account for 3.7% of households' total overnight deposits with banks (see Chart 40). The share of foreign currency time deposits is also low and has long been declining. Households' foreign currency loans remain negligible in the Czech Republic, while accounting for a still sizeable 30% and 50% in Poland and Hungary respectively. The large proportion of foreign currency loans in these economies was influenced in the past mainly by higher nominal interest rates in the domestic currency than in foreign currencies and by the supply of foreign currency loans from banks financed from abroad in order to eliminate their exchange rate risk. However, the foreign currency debt of households has been decreasing in both economies since 2008.

**Chart 40: Foreign currency loans and overnight deposits of households (shares in total loans and overnight deposits of households with domestic banks, %)**



Source: Central banks, CNB calculations.

To sum up, demand for foreign currency continues to be associated mainly with the export orientation of Czech corporations and is naturally in line with the high openness of the domestic economy. Czech households make minimal use of euro. Despite a slight increase, the degree of euroisation remains relatively low and, beyond the framework of corporations' global integration, does not represent a risk to the effective operation of the CNB's independent monetary policy or an additional argument for adopting the euro.

## 2 ADJUSTMENT MECHANISMS

The adoption of the single currency and the related loss of independent monetary policy will place higher demands on other adjustment mechanisms, by means of which the economy will be able to adjust to asymmetric shocks. The optimum currency area theory points mainly to the importance of the stabilising function of public budgets and labour market flexibility.

### 2.2 FISCAL POLICY

In the absence of independent monetary policy, the stabilising effect of fiscal policy can to some extent substitute for the missing monetary adjustment mechanisms in the event of asymmetric shocks. Nevertheless, as the European debt crisis has shown, inappropriate fiscal policy itself may become a source of asymmetric shocks. The current condition of, and in particular the outlook for, public finances are therefore important measures of the preparedness of the Czech economy to join the euro area.

#### 2.2.1 Stabilising function of public budgets

Fiscal policy can affect the economy either directly, i.e. via discretionary measures on the revenue or the expenditure side of the public budgets, or indirectly, by creating conditions for optimal functioning of automatic fiscal stabilisers. 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 even counterproductive.<sup>57</sup> This was also reflected in a paradigm shift in theoretical economics, with belief in the effectiveness of discretionary measures being replaced by a hypothesis that adherence to pre-defined rules is more effective. In the fiscal area, such rules consist primarily in a simple, stable tax system, consolidated and sustainable public finance and predictable government expenditure based on fiscal discipline. However, numerous discretionary measures of a fiscal nature were adopted during the financial and economic crisis in 2008–2010, since the economic decline was so large that the political representation considered automatic stabilisers to be insufficient on their own.<sup>58</sup> In addition to the positive impacts of discretionary measures, the related sizeable increase in fiscal deficits entails costs and risks, especially in countries with a high initial level of government debt. This was subsequently reflected in the response of the financial markets. Stabilisation of public budgets therefore became a fiscal policy priority in 2011–2012. This, however, led to procyclically restrictive fiscal policy, which magnified the economic contraction. In response to the fall of the economy into recession in 2012–2013, therefore, this objective was reassessed, with support for economic growth through easier fiscal policy being prioritised at the cost of a temporary slowdown in fiscal consolidation in 2014 and in the outlook for 2015.

The EU fiscal rules recommend a broadly balanced government budget policy over the business cycle. This allows automatic fiscal stabilisers, which can absorb shocks without the need for ad hoc discretionary fiscal measures, to operate freely. In a period of recession, public finances should thus stimulate aggregate demand by means of lower collection of taxes and higher transfers (deficits), while in a period of expansion they should subdue demand by creating

<sup>57</sup> The long 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 are generally regarded as the main causes. A typical example of this problem is the risk of "procyclical 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.

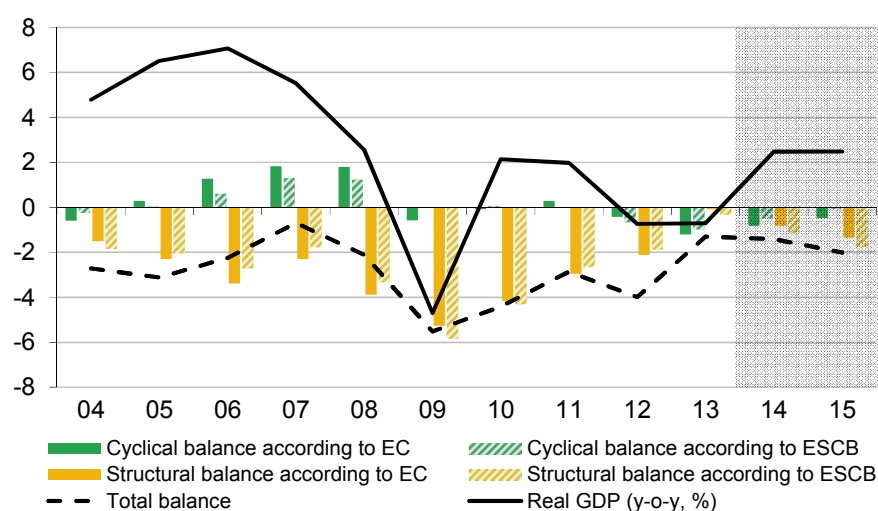
<sup>58</sup> For details on the assessment of the impact of discretionary measures and the operation of automatic stabilisers in the Czech Republic in 2001–2011, see Ambriško et al. (2012).

fiscal surpluses. In order for the automatic function of public budgets to work, while avoiding – except in very exceptional cases – breaches of the maximum agreed deficits, public finance must be balanced or, preferably, in surplus during a growth phase of the business cycle. This reasoning serves as the basis for the convergence criterion for the general government deficit as a percentage of GDP, where the 3% limit is considered sufficient to allow automatic stabilisers to function freely in the event of a minor economic downswing.

The influences of the macroeconomic environment and of interventions by the government on public budgets can be differentiated by decomposing the general government balance into the cyclical component, i.e. the part that results from the business cycle, and the “cyclically adjusted balance”, which yields information on how government fiscal policy contributed to fiscal performance. Moreover, for a more precise assessment of the nature of the government’s fiscal policy in a given period, the “structural balance” is used. In addition to fluctuations caused by the economic cycle, this is adjusted for temporary or one-off fiscal measures.

Chart 41 shows the current estimates of the **cyclical and structural components of the Czech Republic’s general government balance** based on the CNB’s analyses. The estimates are carried out using both the European Commission method and the ESCB approach (see the *Methodological Part*).

**Chart 41: General government balance and its cyclical and structural components (in % of GDP)**



Note: Positive values represent a public budget surplus and negative values a public budget deficit. The sum of the cyclical and structural balances does not equal the total balance since the structural balance is adjusted for extraordinary one-off fiscal measures in addition to the effect of the cycle.

Source: CZSO, CNB calculations (the 2014 and 2015 figures – in the grey shaded area – come from the CNB’s forecast published in Inflation Report IV/2014).

The assessment of the trend in the structural component and its share in the overall deficit is basically the same for both methods. The structural balance<sup>59</sup> shown in the chart indicates that the government’s fiscal policy was persistently in deficit and procyclical for most of the period under review, since the structural deficit was not reduced even in the years of economic growth in 2004–2008. In this period, windfall tax revenues were employed to generate new public expenditures rather than reduce the deficit. Tax cuts affecting the revenue side were not

<sup>59</sup> The quantification of the structural and cyclical components of the public finance balance depends on the value of potential GDP (EC method) or on the trend values of macroeconomic tax bases (ESCB method), which are unobserved variables whose estimation is usually subject to a relatively high level of uncertainty.

accompanied by relevant austerity measures on the public expenditure side. Fiscal policy was countercyclical in 2009, the year most affected by the crisis, when government anti-crisis measures leading to a widening of the structural deficit were adopted. In the following period, fiscal policy turned procyclical again, with fiscal consolidation (of around 1.5–2% of GDP year on year depending on the methodology selected) being one of the reasons for the economic downturn in 2012 and 2013. Fiscal policy will also have a procyclical tendency (albeit in the opposite, i.e. expansionary direction) in 2014–2015. According to the CNB's current forecast in Inflation Report IV/2014, the general government structural deficit will increase again despite relatively buoyant economic growth and rapid closure of the negative output gap.

The cyclical component of the total budget balance for the most part played a less important role in the period under review. The action of automatic stabilisers, which smooth the business cycle, was very limited, so the total balance was made mainly up of its structural component. Economic growth had a stronger effect on the cyclical balance in 2006–2008, when favourable economic growth gave rise to extraordinary tax revenues. In 2009, the cyclical balance returned to levels of around zero, where it remained until 2012, when the contribution of the cyclical component to the increase in the overall general government deficit was apparent again. According to the CNB's forecast, however, its effect will weaken again in 2014–2015.

The overall budget deficit in 2009 was well above the reference value of 3% laid down in the Stability and Growth Pact, owing mainly to the government's anti-crisis fiscal policy and the simultaneous action of automatic stabilisers. The Excessive Deficit Procedure (EDP) was therefore opened against the Czech Republic at the end of 2009. A deadline of 2013 was set for bringing the deficit below the reference value. The European Council also recommended ensuring an average annual decline in the structural deficit of 1% in 2010–2013, specifying measures necessary to correct the deficit within the deadline, and speeding up the reduction of the deficit if economic or budgetary conditions improve. In response to these requirements, but mainly in order to stabilise public budgets, the government adopted numerous revenue and expenditure measures starting in 2010, which greatly contributed to reducing the public finance deficit in 2010–2013. In 2013, the general government deficit reached 1.5% of GDP. As a result, the Ecofin Council terminated the Excessive Deficit Procedure (EDP) against the Czech Republic in June 2014.

Nevertheless, the fall of the economy into recession in 2012–2013 resulted in a reassessment of the pace of fiscal consolidation and a withdrawal from the previously declared fulfilment of the medium-term objective (MTO)<sup>60</sup> in the form of a structural deficit of 1% of GDP in 2015.<sup>61</sup> This objective has been postponed until the confidence of economic agents is restored and sustainable growth has been started up again.<sup>62</sup> Fulfilment of the MTO is not included among the government's fiscal policy objectives in the current Convergence Programme.<sup>63</sup> This poses a risk in terms of the preparedness to adopt the euro. According to the Czech Republic's Updated Euro-area Accession Strategy of 2007, fulfilment of the MTO is a condition for fiscal policy to be able to effectively perform its macroeconomic stabilising role following the loss of independent monetary policy. It can thus be stated that due to consolidation efforts in past years, the preparedness of fiscal policy to take over the stabilising function of monetary policy has improved visibly, but it is not yet clear whether this improvement is of a permanent nature.

<sup>60</sup> Convergence Programme of the Czech Republic, April 2012.

<sup>61</sup> The originally uniform requirement of balanced finances has been replaced under the amended European fiscal rules (Council Regulation No. 1055/2005 of 27 June 2005) by country-specific medium-term objectives, which differ from economy to economy depending on the existing level of public government debt, future population ageing costs and the prospects for economic growth. Fast growing economies with a low general government public debt level may, instead of maintaining balanced public sector accounts, reach a deficit of up to 1% of GDP. The MTO was set at this level for the Czech Republic as well.

<sup>62</sup> Convergence Programme of the Czech Republic, April 2013.

<sup>63</sup> Convergence Programme of the Czech Republic, April 2014.

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

Ensuring long-term sustainability of public budgets is a precondition for effective use of their stabilising function and an important condition for the ability of the Czech Republic to fulfil its commitments under the Stability and Growth Pact in the long term. 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 to the MTO) so that sufficient room is left for stabilising fiscal policy in bad times.

Table 14 summarises the forecast for the **general government balance** of the countries under review as published by the European Commission in autumn 2014. The left-hand side of the table shows the total general government balance, while the right-hand side contains the structural balance calculated under EC methodology. The last line in the table gives the current estimate of the total and structural balance according to the CNB forecast. Although the forecast for the total general government balance is below the 3% reference value in 2015 in all the countries under review except Slovenia, the forecast expects the structural balance to be relatively high in all countries except Germany and even to show an upward trend in the Czech Republic and Hungary.

**Table 14: General government balance, European Commission estimate (% of GDP)**

	Total balance						Structural balance					
	2004	2011	2012	2013	2014	2015	2004	2011	2012	2013	2014	2015
<b>CZ</b>	-2.7	-2.9	-4.0	-1.3	-1.4	-2.1	-	-2.6	-1.4	0.2	-0.7	-1.7
<b>AT</b>	-4.8	-2.6	-2.3	-1.5	-2.9	-1.8	-	-2.5	-1.8	-1.3	-1.1	-1.0
<b>DE</b>	-3.7	-0.9	0.1	0.1	0.2	0.0	-	-1.3	0.0	0.6	0.7	0.6
<b>PT</b>	-6.2	-7.4	-5.5	-4.9	-4.9	-3.3	-	-5.4	-2.3	-1.9	-1.3	-1.7
<b>HU</b>	-6.4	-5.5	-2.3	-2.4	-2.9	-2.8	-	-4.2	-1.3	-1.3	-2.7	-2.8
<b>PL</b>	-	-4.9	-3.7	-4.0	-3.4	-2.9	-	-6.0	-4.0	-3.5	-2.9	-2.5
<b>SI</b>	-2.2	-6.2	-3.7	-14.6	-4.4	-2.9	-	-4.5	-1.8	-1.8	-2.5	-2.2
<b>SK</b>	-2.3	-4.1	-4.2	-2.6	-3.0	-2.6	-	-4.1	-3.4	-1.4	-2.1	-1.3
<b>EA-18</b>	-	-4.1	-3.6	-2.9	-2.6	-2.4	-	-3.6	-2.1	-1.2	-1.1	-1.1
<b>CZ<sup>a)</sup></b>	-2.7	-2.9	-4.0	-1.3	-1.4	-2.0	-1.8	-2.6	-1.9	-0.3	-1.1	-1.8

Note: The general government deficit is calculated according to ESA 95 methodology and the "Excessive Deficit Procedure" definition.

<sup>a)</sup> Total balance: data according to the CZSO's statistics and notifications (autumn 2014) for 2004 and 2011–2013, and the CNB's forecast for 2014 and 2015 in Inflation Report IV/2014. The structural balance is calculated under EC methodology. The difference from the European Commission's data for the Czech Republic stems mainly from differences in the GDP forecast and related public budget revenues and expenditures.

Source: European Commission (2014a, 2014b), CNB.

In addition to other factors, the government's room for manoeuvre for the application of discretionary fiscal policy measures is determined by the nature of fiscal expenditure. While the adoption of a government resolution or a change to a statutory instrument is sufficient to allow a change in some expenditures, changes to other expenditures require time-consuming and politically difficult amendments to laws or international treaties. The classification into mandatory, quasi-mandatory and non-mandatory expenditures is thus a measure of the speed at which the government is able to alter such expenditures if the need arises, with mandatory expenditures being the least flexible.<sup>64</sup> On the one hand, high mandatory expenditures can restrict the room for discretionary measures; on the other hand, they can have a countercyclical effect as automatic stabilisers. However, in a phase of economic contraction, a large share of mandatory expenditures implies a risk for public finances, especially when tax revenues are very sensitive to changes in GDP growth.<sup>65</sup>

<sup>64</sup> The definition of mandatory expenditures used in this analysis is given in the *Methodological Part*.

<sup>65</sup> This risk materialised fully in the Czech Republic after the outbreak of the financial crisis, when the high share of mandatory expenditures was reflected in a sharp rise in the public finance deficit.

The share of mandatory expenditures has long been rising in the Czech Republic. Following a decline in the share of mandatory expenditure in total state budget expenditure and revenues in 2007, the share increased again in 2008–2009 (see Table 15) as a result of adverse cyclical effects and thereafter also as a result of the government's budget austerity measures. Moreover, the current data, based on the government's draft state budget for 2015, imply a further rise in the share of mandatory expenditure.

**Table 15: Shares of mandatory state budget expenditure (%)**

	2004	2008	2009	2010	2011	2012	2013	2014	2015
Shares of mandatory expenditure in total SB expenditure	53.0	53.7	53.3	54.3	56.5	56.7	57.2	58.1	58.7
Shares of mandatory expenditure in total SB revenue	59.0	54.6	63.8	62.8	64.4	62.1	61.5	64.0	63.9

Note: Data for 2004–2013 are actual figures; data for 2014 and 2015 are based on the government's August 2014 draft state budget (state budget compilation methodology).

Source: Ministry of Finance of the Czech Republic (2014), CNB calculations.

The mandatory expenditures of individual countries are not directly comparable, as there is no harmonised definition of the term. However, the structure of general government revenue and expenditure provides some insight (see Table 16). "Statutory" mandatory expenditures consist of social payments (social benefits – pension and sickness insurance benefits in particular – as well as government payments for health insurance) and debt service spending.<sup>66</sup> For both indicators as a percentage of GDP, the Czech Republic ranked among the countries with lower figures in 2013, below the euro area average. The Czech Republic's low debt service expenditure ratio is a consequence of its still relatively low government debt in an environment of exceptionally low interest rates. The ratio of compensation of employees (salaries in budgetary and subsidised organisations) to GDP is comparable with that in Germany and Slovakia and lower than in the other countries and the euro area average.

**Table 16: Public revenues and expenditures in 2013 (% of GDP)**

	CZ	AT	DE	PT	HU	PL	SI	SK	EA-18
<b>Total revenues</b>	40.7	49.5	44.5	45.2	47.3	38.2	45.2	38.4	46.5
- taxes	19.9	27.7	22.7	25.0	25.3	19.5	22.0	16.8	25.4
- social contributions	14.8	15.3	16.6	11.9	13.1	13.2	15.0	13.5	15.4
<b>Total expenditures</b>	42.0	50.9	44.3	50.1	49.7	42.2	59.7	41.0	49.4
- compensation of employees	7.2	10.6	7.7	12.4	10.1	10.3	12.5	8.5	10.4
- intermediate consumption	5.1	6.4	4.7	5.7	7.5	5.9	6.8	5.2	5.3
- social payments	19.0	23.0	23.8	20.3	17.2	16.2	19.2	19.0	22.9
- gross fixed capital formation	3.4	2.9	2.2	2.2	4.4	4.1	4.3	3.0	2.8
- interest expenditure	1.4	2.6	2.0	5.0	4.6	2.5	2.5	1.9	2.8

Source: European Commission (2014b).

The current stock of, and especially prospects for, **government debt** are other factors limiting the stabilising ability of fiscal policy. Changes thereto significantly affect both the level of debt service spending and the government's ability to finance budget deficits and to refinance

<sup>66</sup> Part of expenditure on intermediate consumption and investment in the government sector is also included in mandatory expenditures, but the available statistical data do not make it possible to quantify more precisely the share of the mandatory component in this category of expenditure.



maturing government debt. This may have serious macroeconomic impacts.<sup>67</sup> Moreover, fiscal policy will have to take into account the fact that in the reform of the Stability and Growth Pact the debt criterion gains much greater weight than before, comparable with that of the deficit criterion. Table 17 provides a comparison of the ratios of government debt to GDP.

**Table 17: General government debt, European Commission estimate (% of GDP)**

	2004	2008	2009	2010	2011	2012	2013	2014	2015
<b>CZ</b>	28.5	28.7	34.1	38.2	41.0	45.5	45.7	44.4	44.7
<b>AT</b>	64.8	68.5	79.7	82.4	82.1	81.7	81.2	87.0	86.1
<b>DE</b>	64.6	64.9	72.4	80.3	77.6	79.0	76.9	74.5	72.4
<b>PT</b>	62.0	71.7	83.6	96.2	111.1	124.8	128.0	127.7	125.1
<b>HU</b>	58.8	71.9	78.2	80.9	81.0	78.5	77.3	76.9	76.4
<b>PL</b>	45.1	46.6	49.8	53.6	54.8	54.4	55.7	49.1	50.2
<b>SI</b>	26.8	21.6	34.5	37.9	46.2	53.4	70.4	82.2	82.9
<b>SK</b>	40.6	28.2	36.0	41.1	43.5	52.1	54.6	54.1	54.9
<b>EA-18</b>	68.2	68.5	78.3	83.8	86.4	90.8	93.1	94.5	94.8
<b>CZ<sup>a)</sup></b>	28.5	28.7	34.1	38.2	41.0	45.5	45.7	44.0	44.0

Note: <sup>a)</sup> Data according to the CZSO's statistics and notifications (autumn 2014) for 2004 and 2008–2013, and the CNB's estimate in Inflation Report IV/2014 for 2014 and 2015. The creation of a government debt financing reserve (excess issuance of bonds in a situation of extremely low interest rates) contributed to the increase of several percentage points in the debt-to-GDP ratio in 2011–2013.

Source: European Commission (2014b), CZSO, CNB calculations.

Like the other fiscal indicators, debt was affected by dramatic changes in the economic situation in 2008–2010. In the countries under review, the slightly declining government debt path as a percentage of GDP observed in the pre-crisis years was replaced by a more or less sharp increase in line with the growth in deficits and other extraordinary fiscal measures taken by individual countries to dampen the impacts of the financial and economic crisis. Although Czech government debt is still below the reference value of 60% of GDP, its sustainability – stemming from unresolved structural problems in the Czech economy – is a major risk (see section 2.2.3). Debt service, European Commission estimate (% of GDP)

**Table 18: Debt service, European Commission estimate (% of GDP)**

	2004	2008	2009	2010	2011	2012	2013	2014	2015
<b>CZ</b>	1.1	1.0	1.2	1.3	1.3	1.4	1.4	1.3	1.3
<b>AT</b>	3.0	3.0	3.2	2.9	2.8	2.7	2.6	2.5	2.5
<b>DE</b>	2.8	2.7	2.6	2.5	2.5	2.3	2.0	1.9	1.8
<b>PT</b>	2.6	3.1	3.0	2.9	4.3	4.9	5.0	5.0	5.0
<b>HU</b>	4.4	4.1	4.5	4.1	4.2	4.6	4.6	4.1	3.9
<b>PL</b>	-	-	-	2.5	2.5	2.7	2.5	2.1	2.1
<b>SI</b>	1.7	1.1	1.3	1.6	1.9	2.0	2.5	3.3	3.2
<b>SK</b>	2.1	1.2	1.4	1.3	1.5	1.8	1.9	1.8	1.7
<b>EA-18</b>	-	-	-	2.7	3.0	3.0	2.8	2.7	2.7

Source: European Commission (2014b).

At the same time, it should be taken into account that the level of debt is being reflected in a further rise in mandatory expenditure connected with debt service (see Table 18), although this trend has so far been reduced by the exceptionally low interest rates. Nevertheless, the overview in the table shows that the Czech Republic is succeeding in maintaining a low debt

<sup>67</sup> As the euro area debt crisis has shown, if it is unable to finance its government debt, the state may be forced to take tough consolidation measures even in a strongly adverse macroeconomic situation. The absence of an independent currency and monetary policy is particularly costly in this situation.

service expenditure level compared to the other countries under review, well below the euro area average, in the outlook up to 2015.

### 2.2.3 Public finance sustainability

Sustainability of public finance, i.e. controlled (“financeable”) government deficits and debt in the long term, is a key prerequisite for those finances to have a stabilising effect on the economy. In the long run, however, 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. The long-term outlook for age-related government expenditure (mainly on pensions, health care and long-term care) is shown in Table 19.

**Table 19: Age-related government expenditures (% of GDP)**

	Pensions		Health care		Long-term care		Total	
	2010	2060	2010	2060	2010	2060	2010	2060
<b>CZ</b>	9.1	11.8	6.9	8.6	0.8	1.5	16.8	21.9
<b>AT</b>	14.1	16.1	7.4	9.0	1.6	2.8	23.1	27.9
<b>DE</b>	10.8	13.4	8.0	9.4	1.4	3.1	20.2	25.9
<b>PT</b>	12.5	12.7	7.2	8.3	0.3	0.6	20.0	21.6
<b>HU</b>	11.9	14.7	4.9	6.0	0.8	1.4	17.6	22.1
<b>PL</b>	11.8	9.6	4.9	6.8	0.7	1.7	17.4	18.1
<b>SI</b>	11.2	18.3	6.1	7.2	1.4	3.0	18.7	28.5
<b>SK</b>	8.0	13.2	6.2	8.3	0.3	0.7	14.5	22.2
<b>EA</b>	12.2	14.2	7.3	8.4	1.8	3.5	21.3	26.1

Source: European Commission (2012).

The Czech Republic (together with Slovakia) has the lowest initial level of expenditure which will be affected by population ageing in the long run compared to the other selected countries (and also in the broader context of the EU) in 2010. Due to positive effects of parametric changes in the pension system (the “small” pension reform), the Czech Republic also maintains a position among the countries with expenditure below the euro area average at the long-term forecast horizon, despite the expected sharp increase in expenditure.

Ensuring public finance sustainability therefore remains a key condition for the future smooth functioning of the Czech economy within the euro area. Limiting growth in age-related expenditure was one of the major objectives of the reforms of the pension system prepared by the previous government and approved by the parliament. The “small” pension reform, which started gradually raising the retirement age, had an immediate and positive long-term effect on public finances. However, this legislative change cannot be considered a sufficient systemic solution. The solution was meant to be the introduction of another pillar of the pension system in the form of retirement savings. However, this “second pillar” has met with little interest from the general public, not least because it has not been communicated consensually by the political representation, and it is likely to be abolished.

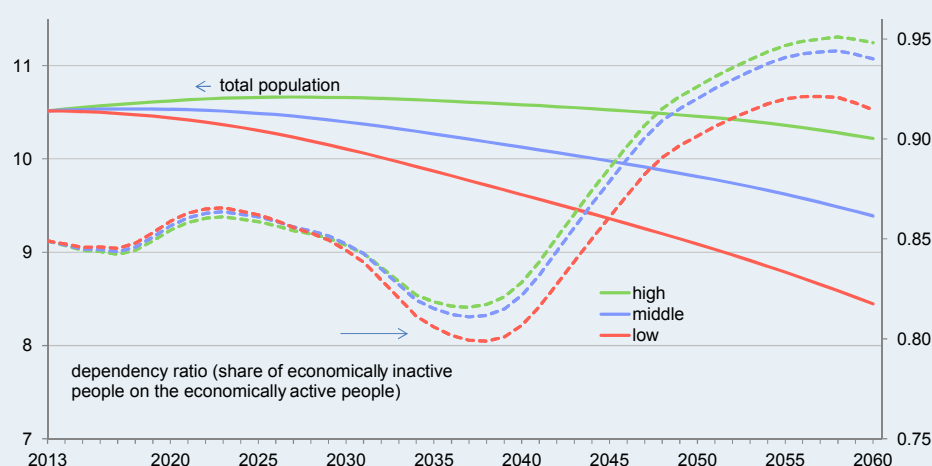
#### Box 4: Czech public finance sustainability

This box presents a model of Czech public finance sustainability. The model describes the evolution of government debt in relation to the demographic forecast, population ageing costs and other selected parameters. The aim of the model is to show the main tendencies in government debt in the long run and the sensitivity of government debt to changes in basic input data and parameters. Using model scenarios, we can then assess possible legislative and economic changes relating to the pension system, health

care, taxes and so on, and simulate various debt paths depending on expected developments in financial markets.

The current demographic forecasts of the Czech Statistical Office show that the population of the Czech Republic is highly likely to decrease in the years ahead, amid significant growth in the proportion of older people, according to all three variants of the population forecast (see Chart B4). These changes in the composition of the population will be reflected in the evolution of the labour force and GDP, i.e. the productive part of the economy, and will also result in an increase in pension, health and social costs.

**Chart B4: Variants of population forecast (total population in millions) and ratio of economically dependent to economically active (right-hand scale)**



Note: The number of economically dependent takes into account the gradual raising of the retirement age. The individual variants are also affected by the assumed birth rate, life expectancy and net migration profiles. The low/high variant assumes the lowest/highest total birth rate, life expectancy and net migration. The low population variant thus implies a more favourable profile of the ratio of economically dependent than the medium variant.

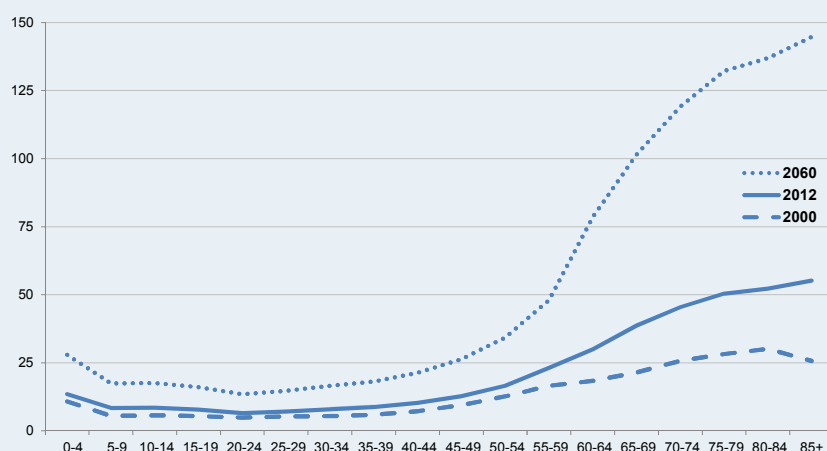
Source: CZSO, CNB calculations.

The public finance sustainability model consists of several interconnected blocks describing the individual parts of the economy (especially the labour force, productivity and GDP, public expenditure on pensions, health and long-term social care, tax revenues and debt service costs) which affect the government deficit/surplus and government debt.

The GDP forecast is based on a simple Solow model with two variables – labour productivity and the size of the labour force. The size and growth rate of the labour force are based on the demographic projection by age and gender<sup>68</sup> and reflect the current trends in economic activity and preferences of Czech households (length of education, maternity and parental leave-taking, disability pensions, retirement, etc.) and legislative parameters (the replacement rate, the retirement age, health and social insurance contributions, etc.).

The primary government sector balance is modelled on the basis of the individual components of government revenues and expenditures. On the government revenue side, the decline in the proportion of working-age people will be reflected mainly in lower collected personal income taxes and social security contributions. The expenditure side of the population ageing model will be most affected by spending on old-age pensions and health care. Old-age pension expenditure is a function of the number of future pensioners, the life expectancy of those pensioners and the amount of their pensions, assuming the current pension-increase scheme for already awarded pensions and a constant replacement rate for newly awarded pensions. Health care expenditure is based on the cost profiles for each age and gender population category, and their time profile takes into account expected changes in medical technology and the different needs of the ageing population (see Chart B5). Other revenues and expenditures are simulated in the current version of the model based on constant ratios to GDP.

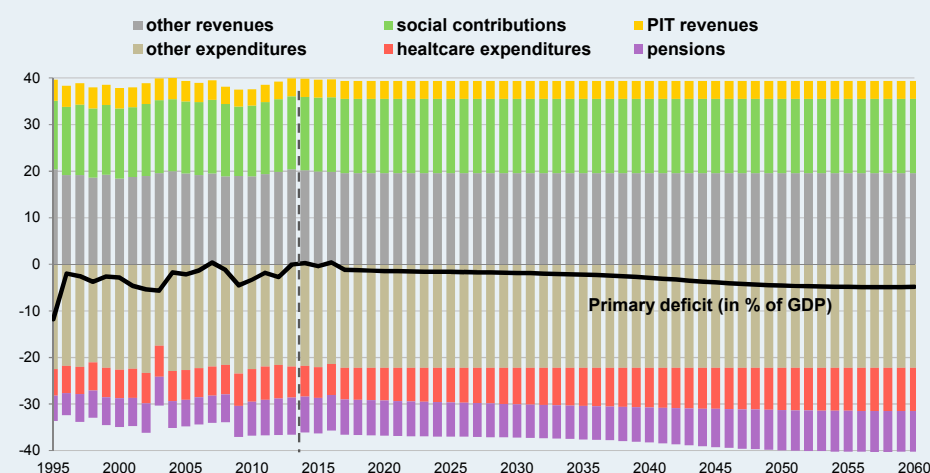
<sup>68</sup> The CZSO's demographic projections are produced in three variants (low, medium, high) reflecting differences in the assumed fertility rate, life expectancy and net migration profiles. The medium variant enters the baseline version of the model.

**Chart B5: Health care cost profile (males, CZK thousands, 2005 prices)**

Note: The growth in the cost profiles takes into account the higher expected relative expenditure on the older population.

Source: CZSO, CNB calculations.

The financial markets block describes the evolution of interest rates on newly issued government debt in relation to the amount and time structure of the debt. Assuming that the current fiscal and social policy parameters are maintained in the future, the primary deficit is estimated at around 2% of GDP in 2013 and 5% of GDP in 2060 (see Chart B6). This will be influenced mainly by growth in expenditure on old-age pensions and health and long-term care. According to the model's estimates, government expenditure on old-age pensions and health and long-term care will amount to 11.5% and 9.3% of GDP respectively in 2060. The European Commission's projections assume a similar level of expenditure associated with the ageing of the Czech population (see Table 18).

**Chart B6: General government primary balance**

Source: CZSO, CNB calculations.

If the debt ratio is penalised slightly by the financial markets (by 0.05 pp for each additional per cent by which the government debt-to-GDP ratio exceeds 60%) interest payments (debt service) will also increase significantly. The government debt-to-GDP ratio will near 60% in 2030 and exceed 170% in 2060. This suggests that the current pension, social and health care funding systems are unsustainable given the current conditions.

To sum up, fiscal policy in the Czech Republic grappled with a relatively high structural deficit until 2012, despite a relatively low level of general government debt. Following a period of decline associated with (mostly procyclical) fiscal consolidation, the structural deficit returns to

a rising path in the outlook. The relatively high share of mandatory expenditures, which are time-consuming and politically challenging to change, is a limiting factor for fiscal policy. Coping with population ageing by reforming the pension and health systems will also be of key importance for sustainability. Although compliance with the fiscal convergence criteria can thus be expected in the years ahead and the preparedness to enter the euro area has improved in this respect, the effectiveness of fiscal adjustment mechanisms remains a limiting area in the assessment of the Czech Republic's ability to adopt the euro.

## 2.3 LABOUR MARKET FLEXIBILITY

According to the optimum currency area theory, labour market flexibility is one of the most important adjustment mechanisms. Adjustment through wages, employment or employment structure can significantly aid in absorbing the negative impacts of asymmetric shocks in a currency area. Labour market flexibility is defined by both labour force flexibility and institutional factors.

### 2.3.1 Unemployment and internal labour market flexibility

As regards labour market flexibility, it is particularly important to track long-term unemployment and regional differences and skills mismatches in the supply of and demand for labour. High long-term unemployment is one of the indicators of high structural unemployment, and a low participation rate indicates that the economy has unused potential. Regional differences in unemployment may be related to low labour mobility, and professional and skills mismatches may point to inappropriate configuration of the education system.

Table 20 shows the **long-term unemployment** rate, which increased in most countries in 2010 as the impacts of the recession hit the labour market with a lag. The exception is Germany, where the long-term unemployment rate continued to decrease. The long-term unemployment rate in the Czech Republic is one of the lowest in the sample of countries under review despite increasing in 2010 and then stagnating at around 3%. Of the countries under review, only Austria and Germany have lower rates. By contrast, much higher levels are recorded in Slovakia, Portugal and Hungary.

**Table 20: Long-term unemployment rate (%)**

	2004	2008	2009	2010	2011	2012	2013
<b>CZ</b>	4.2	2.2	2.0	3.0	2.7	3.0	3.0
<b>AT</b>	1.4	0.9	1.0	1.1	1.1	1.1	1.2
<b>DE</b>	5.9	4.0	3.5	3.4	2.8	2.5	2.4
<b>PT</b>	3.3	4.0	4.7	6.3	6.2	7.7	9.3
<b>HU</b>	2.7	3.6	4.2	5.5	5.2	4.9	5.0
<b>PL</b>	10.3	2.4	2.5	3.0	3.6	4.1	4.4
<b>SI</b>	3.2	1.9	1.8	3.2	3.6	4.3	5.2
<b>SK</b>	11.9	6.7	6.5	9.3	9.3	9.4	10.0

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

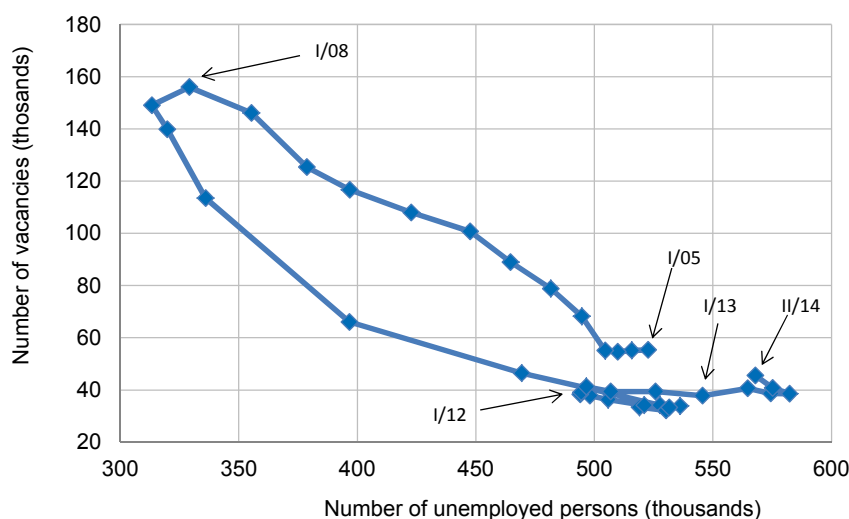
Source: Eurostat.

**Cyclical and structural unemployment** can be analysed by means of the Beveridge curve.<sup>69</sup> The Beveridge curve plots the vacancy rate against the unemployment rate (see Chart 42).

<sup>69</sup> In this section, structural unemployment means the sum of structural and frictional unemployment. Classical structural unemployment refers to the case where it would be possible with a given of supply vacancies to reduce unemployment by transferring

Decreasing unemployment amid a rising number of vacancies is associated with cyclical changes on the labour market, i.e. with movements along the Beveridge curve, whereas movements of unemployment and vacancies in the same direction signal changes in structural unemployment, i.e. movements of the curve itself.<sup>70</sup> There was a cyclical decline in unemployment from 2005 until mid-2008 amid strong demand for labour stemming from robust growth in economic activity. Amid a decline in vacancies, the number of unemployed persons then started to record a cyclical rise in approximately mid-2008 as the economy cooled. This was reflected in a shift along the Beveridge curve in the south-easterly direction. A gradual shift in the westerly direction was observed from 2010 Q2 onwards in line with the weak economic recovery in 2010 and 2011. A renewed decline in economic activity at the start of 2012 led to a resumed gradual increase in the number of job applicants, which reached a historical high at the end of 2013. And opposite shift, i.e. a fall in the number of unemployed persons amid a gradual rise in job vacancies, then occurred in 2014 H1 as the economy recovered. Overall, cyclical effects have thus dominated structural ones in the Beveridge curve in recent years, so labour market flexibility is not likely to have changed significantly.

**Chart 42: Beveridge curve**



Note: Seasonally adjusted quarterly data.

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

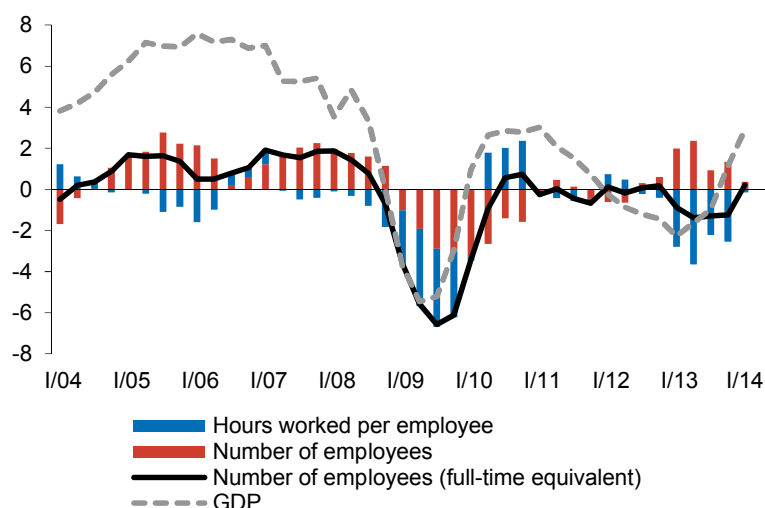
The evolution of employment in recent years has been significantly influenced by the use of alternative forms of employment, especially **shorter working hours**, i.e. a lower number of hours worked per employee. By cutting hours worked, employers addressed the issue of adjusting employment in the face of falling demand and uncertainty about its future evolution, and streamlined their labour costs. This is well illustrated by the situation in 2013, when average hours worked per employee declined substantially amid falling GDP. The decrease in hours worked per employee halted as year-on-year growth in economic activity was renewed in 2014 H1 (see Chart 43). In addition to these cyclical causes, the rising occurrence of shorter

the unemployed between industries, professions or regions (Jackman and Roper, 1987). On the other hand, frictional unemployment reflects the duration of job seeking (the unemployed find a job in the end, so this is not structural unemployment). As the duration of job seeking may change depending on the phase of the business cycle, the presented indicators of structural unemployment may be cyclically conditional.

<sup>70</sup> Horizontal or vertical shifts of the Beveridge curve reflect not only changes in structural unemployment, but often also administrative effects on the number of unemployed persons and vacancies. Such shifts occurred probably at the end of 2004 and 2005 in connection with an amendment of the Employment Act and at the start of 2006 in response to tighter conditions for reporting vacancies to labour offices (see CNB, 2006). The duty of firms to report vacancies to labour offices was terminated at the start of 2012 (although this change did not visibly affect the Beveridge curve).

working hours and part-time employment is due to structural factors, reflecting convergence towards standards in more advanced countries in this area (greater use of part-time employment by women after returning to work from parental leave, etc.).

**Chart 43: Average hours worked per employee**



Note: Annual percentage changes, contributions in percentage points.

Source: LFS, CNB calculations.

**Table 21: Rate of economic activity in the 15–64 age category**

	2004	2008	2009	2010	2011	2012	2013
<b>CZ</b>	70.0	69.7	70.1	70.2	70.5	71.6	72.9
<b>AT</b>	71.3	75.0	75.3	75.1	75.3	75.9	76.1
<b>DE</b>	72.6	75.9	76.3	76.6	77.2	77.1	77.5
<b>PT</b>	73.0	74.2	73.7	74.0	74.1	73.9	73.6
<b>HU</b>	60.5	61.5	61.6	62.4	62.7	64.3	65.1
<b>PL</b>	64.0	63.8	64.7	65.3	65.7	66.5	67.0
<b>SI</b>	69.8	71.8	71.8	71.5	70.3	70.4	70.5
<b>SK</b>	69.7	68.8	68.4	68.7	68.7	69.4	69.9

Note: The rate of economic activity is the share of economically active persons (employed and unemployed) in the population.

Source: Eurostat (LFS).

The **rate of economic activity** rose noticeably in most countries, including the Czech Republic. The largest increases – almost 5 pp over the last ten years – were recorded in Austria and Germany (see Table 21). The rise was due, among other things, to increases in the retirement age and to greater use of shorter working hours. The exceptions were Portugal, Slovakia and Slovenia, where the rate of economic activity was almost flat over the past ten years.

**Regional differences in unemployment** can be quantified using the coefficient of variation of the unemployment rate for areas (NUTS II) and regions (NUTS III). Table 22 shows that the coefficient of variation of the unemployment rate in the Czech Republic had been gradually decreasing since 2008. The 2012 rebound suggests a slight increase in the mismatch between the regional supply of and demand for labour, with growth in unemployment having been recorded in regions with a traditionally unfavourable labour market situation. The coefficient of variation also increased in Austria in 2012, while remaining broadly flat in the other countries. The regional differences in unemployment rates in the Czech Republic were among the highest



of the countries under review in 2012, although not when compared with the core euro area countries (Germany and Austria), which show even greater regional mismatches.

**Table 22: Coefficient of variation of the unemployment rate (%)**

	NUTS II regions								NUTS III regions							
	2004	2007	2008	2009	2010	2011	2012	2013	2004	2007	2008	2009	2010	2011	2012	2013
<b>CZ</b>	40	42	44	34	31	28	33	31	43	43	46	35	32	29	34	32
<b>AT</b>	44	45	40	31	35	38	44	38	45	46	41	33	37	40	46	40
<b>DE</b>	45	43	45	37	36	41	40	39	49	49	51	43	42	48	48	46
<b>PT</b>	26	20	18	18	20	12	13	16	34	27	-	-	-	-	-	-
<b>HU</b>	29	39	43	31	23	27	25	22	33	45	48	36	28	31	28	26
<b>PL</b>	18	14	18	20	14	15	15	16	26	39	30	32	28	27	27	26
<b>SK</b>	31	38	41	32	27	32	31	29	37	46	51	38	29	34	33	31

Note: The coefficient of variation is the ratio of the standard deviation weighted by region size to the average unemployment rate in per cent.

Source: Eurostat (LFS).

Labour market flexibility is also affected by the regional mobility of the population, as described by the **internal migration** indicator (see Table 23). This indicator has long been higher in the Czech Republic than in Poland and Slovakia. It is more or less constant over time; the slight upward swing seen before the crisis was only temporary. By contrast, mobility is much higher in Austria and especially in Germany, and is still rising moderately in Austria.<sup>71</sup>

**Table 23: Internal migration (per 1,000 inhabitants)**

	2004	2008	2009	2010	2011	2012	2013
<b>CZ</b>	21	24	22	23	22	22	-
<b>AT</b>	35	38	37	37	38	39	-
<b>DE</b>	45	44	44	44	46	46	-
<b>HU</b>	22	24	21	20	20	19	19
<b>PL</b>	11	11	11	11	11	10	-
<b>SI</b>	15	53	48	52	53	55	55
<b>SK</b>	16	17	15	16	16	15	16

Note: Migration between municipalities (HU, PL and SI – all changes in permanent residence); SI – only Slovenian nationals until 2007.

Source: Statistical yearbooks, Eurostat, CNB calculations.

To sum up, structural problems persist in unemployment and internal labour market flexibility. In particular, internal geographical labour mobility remains low by comparison with advanced European countries, so the lower ability to adjust to asymmetric shocks persists. On the other hand, the labour market has also been showing signs of greater flexibility in recent years in response to the economic crisis, particularly through the use of shorter working hours. The rate of economic activity among the working age population also went up. Although the regional differences in unemployment in the Czech Republic are still among the highest, they have in recent years been lower than those in Germany and Austria. The long-term unemployment trend in the Czech Republic is similar to that in the other countries under comparison, although its rate is among the lowest.

<sup>71</sup> Sánchez and Andrews (2011) also point to very low population mobility in Slovenia, Slovakia, Poland and the Czech Republic in 2007.

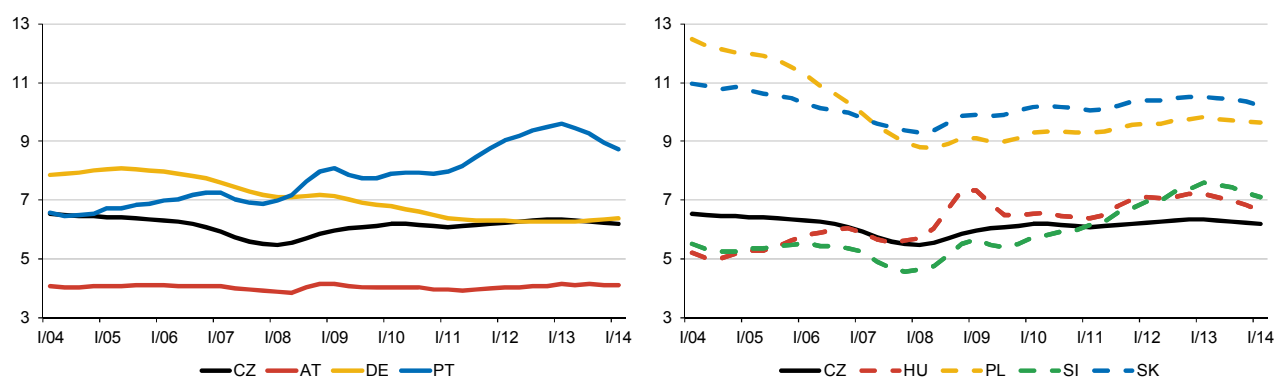
### 2.3.2 Estimate of structural unemployment using the NAIRU

High structural unemployment in the economy is a sign of labour market inflexibility. Changes in structural unemployment are usually estimated by means of changes in the NAIRU, i.e. the unemployment rate consistent with stable inflation, which abstracts from unemployment due to cyclical effects. However, this economic variable is not directly observable and is estimated by filtering time series using a structural model (for details see the *Methodological Part*).

Chart 44 compares the NAIRUs in the countries under review. Portugal, which was immediately hit by a debt crisis following the global economic crisis, has seen a marked rise in the NAIRU since 2008. NAIRU estimates are traditionally high for Slovakia and Poland.

The evolution of the labour market in the Czech Republic was similar to that in neighbouring countries. The rise in the NAIRU is estimated to have halted just above 6% in 2010 H1. The subsequent growth in 2012–2013 was only modest. In recent years the Czech labour market has been adjusting through changes in hours worked (the use of shorter working hours during the economic downturn). An increase in part-time work increases the flexibility of the labour market and is also reflected in a lower NAIRU estimate, as a low general unemployment rate is not necessarily accompanied by rapid growth in the volume of wages and salaries and a resulting rise in inflation pressures. The estimated NAIRU for the Czech Republic is currently the second lowest (behind Austria) in the sample of countries under review, and is very close to the estimated NAIRU for Germany.

Chart 44: The NAIRU (%)



Source: Eurostat, CNB calculations.

### 2.3.3 International labour mobility

International labour mobility within a currency area is one of the most important channels for the ability of individual member economies to absorb asymmetric shocks, in particular those of a long-term nature, through changes in labour supply.

The share of foreign nationals in the population (see Table 24) is one of the indicators of international labour mobility. The share of foreigners in the population roughly doubled shortly after accession to the EU, but has been flat at 4% in recent years. This is less than one-half of the ratio recorded in Germany and Austria. Moreover, the share of foreign nationals in these countries continues to rise steadily. Of the neighbouring EU countries which entered the EU in 2004, only Slovakia recorded similar developments as the Czech Republic. By contrast, the

share of foreign nationals in the population in Hungary and Poland changed negligibly in the entire period under review. In Poland, moreover, it stood at extremely low levels.<sup>72</sup>

At the same time, the Czech population has long been characterised by a low willingness to move abroad in search of work. Cross-border migration of Czech nationals is several times lower compared to other EU countries, and especially compared to Poland among the countries under review.

**Table 24: Share of foreign nationals in the population (%)**

	2004	2008	2009	2010	2011	2012	2013
<b>CZ</b>	1.9	3.3	3.9	4.0	4.0	4.0	4.0
<b>AT</b>	9.3	9.9	10.2	10.5	10.8	11.2	11.8
<b>DE</b>	8.9	8.8	8.8	8.7	8.8	9.1	9.4
<b>PT</b>		4.2	4.2	4.3	4.2	4.1	4.0
<b>HU</b>	1.3	1.8	1.9	2.0	2.1	1.4	1.4
<b>PL</b>	0.1	0.2	0.1	0.1	0.1	0.1	0.2
<b>SI</b>	2.3	3.4	3.5	4.0	4.0	4.2	4.4
<b>SK</b>	0.6	0.8	1.0	1.2	1.3	1.3	1.3

Source: Eurostat, CNB calculations.

### 2.3.4 Institutional environment

The institutional set-up of the labour market has a fundamental influence on its function as an adjustment mechanism. Economic adjustment in the event of a shock may be limited by a distorted relationship between wages and labour productivity, overly strict employment protection measures, or a social system which fails to sufficiently motivate unemployed people to seek jobs.

#### Minimum wage

The administrative setting of a minimum wage reduces wage differentiation and wage flexibility for low-wage employees. If the minimum wage is too high, it may reduce demand for less skilled labour and for graduates and thereby increase the total and long-term unemployment of people with low skills and unemployment among graduates and school-leavers (OECD, 1998; Gregg, 2000).

The ratio of the **minimum wage** to the average wage in the Czech Republic decreased gradually from 2004 until 2012, owing chiefly to a stagnation of the minimum wage. In 2013 the ratio rose modestly on account of an increase in the minimum wage from CZK 8,000 to CZK 8,500 valid from August 2013 (see Table 25).<sup>73</sup> Together with Austria, the ratio of the minimum wage to the average wage in the Czech Republic is the lowest among the countries under review. By contrast, Slovenia has the highest ratio, exceeding 50% in recent years. From this perspective, therefore, the minimum wage in the Czech Republic probably does not have a stronger negative impact on the labour market than in the other countries.

<sup>72</sup> The above data are also in line with OECD (2012), according to which the Czech Republic recorded the highest level of immigration from non-EU countries of all the countries that joined the EU in 2004.

<sup>73</sup> In 2015 the minimum wage will rise by a further CZK 700 to CZK 9,200.

**Table 25: Minimum wage (% of the average wage)**

	2004	2008	2009	2010	2011	2012	2013
<b>CZ</b>	38.4	35.2	34.3	33.3	32.4	31.6	31.7
<b>PT</b>	40.0	44.2	42.8	42.4	42.2	42.9	42.9
<b>HU</b>	41.2	38.8	38.3	38.0	38.6	42.5	43.3
<b>PL</b>	35.1	35.7	40.0	38.7	38.5	40.3	44.8
<b>SI</b>	45.9	43.4	44.2	50.5	51.7	52.2	53.2
<b>SK</b>	34.1	33.6	35.7	36.0	36.1	35.6	36.0

Note: Until 2008, the minimum wage as a percentage of the average wage in industry and services (excluding public administration). After 2008, the same ratio in industry, construction and services. No minimum wage has been defined at the national level in Germany. In Austria it represents around 30% of the average wage.

Source: Eurostat.

However, the minimum wage may have a negative impact on wage flexibility in sectors and professions where the wage is well below the national average. The minimum wage as a percentage of the wage in the first (lowest) decile of the wage distribution is traditionally high in low-skilled professions (see Table 26). This relationship indicates that for the 10% of lowest-income persons employed in elementary occupations, the minimum wage made up almost 90% of their average earnings in 2013. The ratio of the minimum wage to the wage in the first decile increased on average in the business sector in 2013, owing to a rise in the minimum wage valid from August 2013.<sup>74</sup>

**Table 26: Minimum wage and gross monthly wage in selected professions (%)**

Main employment class	Minimum wage / 1 <sup>st</sup> decile						
	2004	2008	2009	2010	2011	2012	2013
Total for the Czech Republic (business sector)	66.1	63.2	63.9	63.5	72.9	69.9	70.5
- services and shop workers	89.2	85.0	85.9	86.5	91.4	85.2	84.1
- skilled agricultural and fishery workers	74.3	67.2	67.9	65.2	71.9	61.5	60.8
- elementary occupations	86.3	87.7	88.1	89.1	91.7	89.4	89.5

Note: Besides data for the Czech Republic as a whole, the table lists the three professions with the highest figures in 2011.

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

## Employment protection

Strict legislative **conditions for the recruitment and dismissal of employees** tend to reduce labour market flexibility and increase long-term unemployment (OECD, 2004; OECD, 2010).<sup>75</sup> It is also appropriate to monitor the relative strictness of the legal framework for temporary and regular employment, as the combination of high costs of dismissing employees with permanent contracts and low regulation of temporary jobs discourages employers from creating permanent jobs.

According to recent OECD data on the EPL index, protection of regular employment continued to decrease and protection of temporary employment continued to increase in the Czech Republic in 2013 (see Table 27). Protection against collective dismissal has long been stable.

<sup>74</sup> This ratio increased in all monitored employment categories except two low-skilled ones given in the table, where growth in the minimum wage was accompanied by even stronger wage growth.

<sup>75</sup> By contrast, Bassanini and Duval (2006) confirm the conclusions of other papers that employment protection, as measured by the EPL index (Employment Protection Legislation), has no clear impact on the overall unemployment 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.

By international comparison, protection of regular employment was still among the highest, while temporary jobs were generally still protected less than in the other countries. Overall, labour market regulation in the Czech Republic is roughly at the same level as in the other countries except for Hungary, where it is lower owing to relatively weak protection of permanent jobs. However, European labour markets are generally rather inflexible and as a benchmark they offer a rather low standard in this case.

**Table 27: Employment protection legislation (EPL) index<sup>a)</sup>**

	Regular employment <sup>b)</sup>			Temporary employment <sup>c)</sup>			Collective dismissals <sup>d)</sup>		
	2004	2009	2013	2004	2009	2013	2004	2009	2013
<b>CZ</b>	3.3	3.1	2.9	0.5	1.1	1.4	2.1	2.1	2.1
<b>AT</b>	2.4	2.4	2.4	1.3	1.3	1.3	3.3	3.3	3.3
<b>DE</b>	2.9	2.9	2.9	1.0	1.0	1.1	3.6	3.6	3.6
<b>PT</b>	4.4	4.4	3.2	2.6	1.9	1.8	2.9	1.9	1.9
<b>HU</b>	2.0	2.0	1.6	1.1	1.1	1.3	3.4	3.4	3.6
<b>PL</b>	2.2	2.2	2.2	1.8	1.8	1.8	2.9	2.9	2.9
<b>SI</b>	-	2.7	2.6	-	1.8	1.8	-	3.4	3.4
<b>SK</b>	2.2	2.2	1.8	0.6	1.6	1.8	3.8	3.8	3.4

Note: <sup>a)</sup> The indices take values ranging from 1 to 6, a higher value meaning greater employment protection.

<sup>b)</sup> Protection against individual dismissal.

<sup>c)</sup> Fixed-term contracts, temporary work agencies.

<sup>d)</sup> Over and above individual dismissals.

Source: OECD. For a description of the methodology, see Venn (2009).

A major revision to the Labour Code implemented in 2012 (see the 2012 Alignment Analyses) was followed up with an amendment effective from August 2013 which allows repetition of fixed-term contracts in selected seasonal jobs (agriculture, construction and culture), thereby slightly increasing the flexibility of the Czech labour market.

## Labour taxation

Labour taxation inclusive of relevant contributions directly affects labour costs, which are an important determinant of job creation. Thus, higher taxation may reduce the ability of the labour market to respond flexibly to asymmetric shocks. Moreover, high labour taxation increases the share of the grey economy<sup>76</sup> and can significantly increase unemployment if the minimum wage is high.<sup>77</sup> The taxation of high earners is also important from the perspective of international competition, as persons with high skills and high incomes are more willing to migrate in search of work.

**Overall labour taxation** in the Czech Republic in 2013 and throughout the period under review was higher than in Portugal, Poland and Slovakia both at the average wage level and for low earners (see Table 28). By contrast, labour taxation is markedly lower in the Czech Republic than in its advanced neighbouring countries – Germany and Austria – and also Hungary. Compared to the previous year, overall labour taxation was unchanged for both monitored income levels in the Czech Republic despite the introduction of a “solidarity tax”,<sup>78</sup> whereas in most countries it increased for low earners.

<sup>76</sup> Brandt et al. (2005)

<sup>77</sup> Bassanini and Duval (2006).

<sup>78</sup> Under an amendment to the Act on Income Tax, the income tax rate on income exceeding four times the average wage was raised by 7 pp for 2013–2015 (a “solidarity tax”).

Table 28: Overall labour taxation

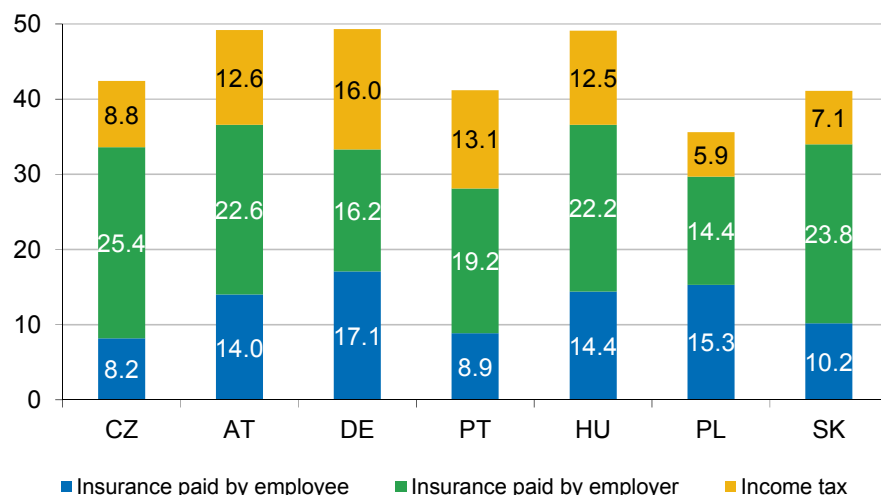
	100% of average wage					67% of average wage				
	2004	2010	2011	2012	2013	2004	2010	2011	2012	2013
<b>CZ</b>	43.6	42.2	42.5	42.4	42.4	41.9	38.9	39.5	39.3	39.3
<b>AT</b>	44.9	47.9	48.4	48.9	49.1	38.6	43.3	43.7	44.2	44.5
<b>DE</b>	50.7	49.1	49.8	49.8	49.3	45.4	44.9	45.6	45.6	45.1
<b>PT</b>	32.6	37.7	39.0	36.7	41.1	29.6	32.8	33.1	32.0	34.7
<b>HU</b>	45.8	46.4	49.4	49.4	49.0	41.5	43.6	45.2	47.6	49.0
<b>PL</b>	43.1	34.3	34.3	35.5	35.6	41.9	33.3	33.4	34.6	34.7
<b>SK</b>	42.0	37.8	38.9	39.6	41.1	38.8	34.5	36.1	36.9	38.4

Note: Income tax and contributions paid by employees and employers as a percentage of total labour costs. Data for employees (individuals without children) earning 100% (left-hand part of the table) and 67% (right-hand part of the table) of the average wage.

Source: OECD (2013).

The data on the components of labour taxation (see Chart 45) show that in all the selected countries health and social insurance affects overall labour taxation to a considerably greater extent than income tax. Compared to the other countries, the level of insurance in the Czech Republic is similar to that in Germany and lower than in Hungary and Austria. By contrast, Portugal and Poland have the lowest insurance burden. Since 2006, overall taxation has risen in all the countries under review. The rise in overall taxation in all the countries was mostly due to contributions paid, while the rise in income tax was only moderate (except in Poland, where income tax fell).<sup>79</sup>

Chart 45: Components of labour taxation in 2013 (% of average wage)



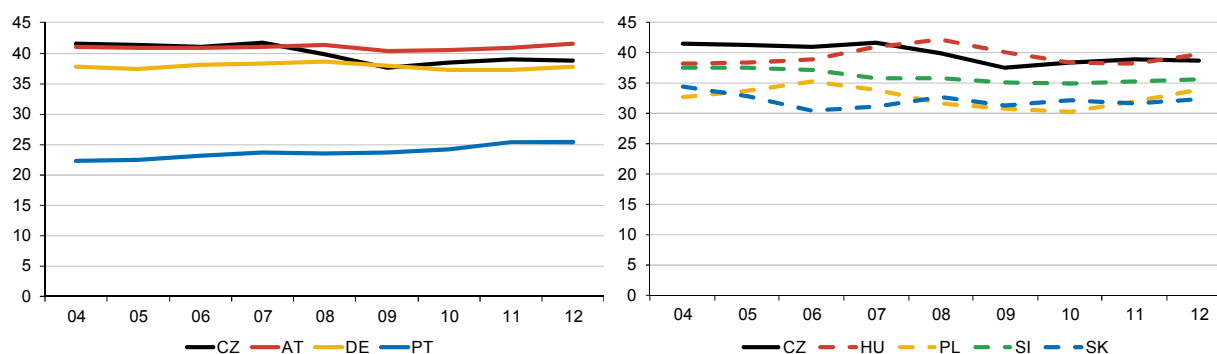
Source: OECD (2013).

The real tax burden, i.e. aggregate tax revenues as a percentage of total compensation of employees, is described by **implicit tax rates** (see Chart 46). Until 2007 the implicit labour taxation rate in the Czech Republic had been the highest of all the countries under review, but in 2008 and 2009 it decreased substantially. This decrease was due to a change in the tax system (a shift to a flat income tax rate calculated from the "super-gross wage") in 2008 and to a reduction in health and social insurance rates and the introduction of a maximum

<sup>79</sup> In the Czech Republic, an amendment to the Act on Income Tax abolished the cap on health insurance contributions in 2013.

assessment base for both types of insurance in 2009. Since 2010, however, the implicit tax burden has been edging up again, reaching about 39% in 2012. While lower than in Austria, it is still considerably higher than in Portugal, Poland, Slovenia and Slovakia and slightly higher than in Germany. In 2012 the implicit tax rate increased in Hungary, where implicit labour taxation thus became slightly higher than that in the Czech Republic.

**Chart 46: Implicit labour taxation rate (%)**



Note: The implicit taxation rate expresses aggregate tax revenues (related to the costs of the production factor of labour) as a percentage of total compensation of employees.

Source: Eurostat (2014).

## Work-incentive indicators

Taxes affect not only demand for labour, but also, in combination with social benefits, the net income of households and thereby the motivation of unemployed or inactive persons to enter employment (i.e. they affect labour supply). This motivation is measured using the **net replacement rate**. This 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 and thus indirectly measures the financial incentive for the unemployed to seek work. Table 29 compares the net replacement rates for short-term and long-term unemployment and for two types of households.

As in previous years, the financial incentives to accept a job in the initial phase of unemployment among childless individuals in 2012 were highest in Austria (the lowest replacement rate), followed by Germany and Slovakia. In the Czech Republic, by contrast, the incentive to seek work was again the lowest, with the net replacement rate being unchanged from the previous year. In the case of a family with two children, the financial incentive to find work was the highest in Slovakia. Austria, the Czech Republic and Germany have the highest net replacement rates (i.e. the lowest incentives to work) in the case of long-term unemployment of childless individuals. In Portugal, by contrast, a long-term unemployed person receives only around 24% of potential employment income, which is about one-half the level in the Czech Republic. The net replacement rates for the long-term unemployed in Slovakia, Poland and Hungary were similar to that in Portugal. There are also marked differences in the support provided to families with small children in the event of long-term unemployment. As in the initial phase of unemployment, the support provided to families with children is highest in Austria, where the net replacement rate moved even closer to 100%.



**Table 29: Net replacement rates**

	Initial phase of unemployment <sup>a)</sup>								Long-term unemployment <sup>b)</sup>							
	Individuals without children				Family (2 children) <sup>c)</sup>				Individuals without children				Family (2 children) <sup>c)</sup>			
	2004	2010	2011	2012	2004	2010	2011	2012	2004	2010	2011	2012	2004	2010	2011	2012
<b>CZ</b>	56	77	77	77	82	79	75	74	45	48	49	49	82	74	74	76
<b>AT</b>	55	55	55	55	84	83	97	98	55	54	53	54	84	83	97	98
<b>DE</b>	60	59	59	59	80	92	91	92	57	48	47	48	80	77	77	79
<b>PT</b>	78	75	75	75	85	77	76	76	25	24	25	24	74	73	68	52
<b>HU</b>	53	72	71	69	63	80	78	76	29	32	31	26	60	48	44	39
<b>PL</b>	75	75	73	74	70	71	70	70	44	33	32	32	94	71	67	65
<b>SK</b>	61	61	62	62	58	59	58	57	29	28	27	27	58	59	58	56

Note: The ratio of net household income when the breadwinner is unemployed and employed (data in %). Income from employment of the breadwinner at 67% of the average wage.

<sup>a)</sup> Unemployed persons entitled to unemployment benefits.

<sup>b)</sup> Unemployed persons after five years.

<sup>c)</sup> The other adult is economically inactive, children of 4 and 6 years of age.

Source: OECD tax benefit models.

Several legislative changes affecting the incentive to work have been made in the Czech Republic in recent years. In the event of termination of an employment contract by the employee or by agreement with the employer, the unemployment benefit was reduced to 45% of the previous net wage over the entire support period.<sup>80</sup> Unemployment benefits by law cannot be paid to an applicant who simultaneously receives severance pay, gratuity or termination settlement and will start to be paid only after the applicant ceases to receive these funds. Another important change is the abolition of payment of unemployment benefits together with so-called "non-clashing" employment, which should increase the incentive to seek "proper" work.<sup>81</sup> In addition to a rise in the tax discount for children and increases in the minimum subsistence level and the minimum living level affecting claims for some other social benefits (child allowance, maternity allowance and social assistance benefits), normative (deductible) housing expenses were also increased in 2012 and a maximum time limit for drawing housing benefit was introduced. The conditions of unemployment benefits were tightened, as the period within which an applicant must work for at least 12 months was shortened from three to two years.

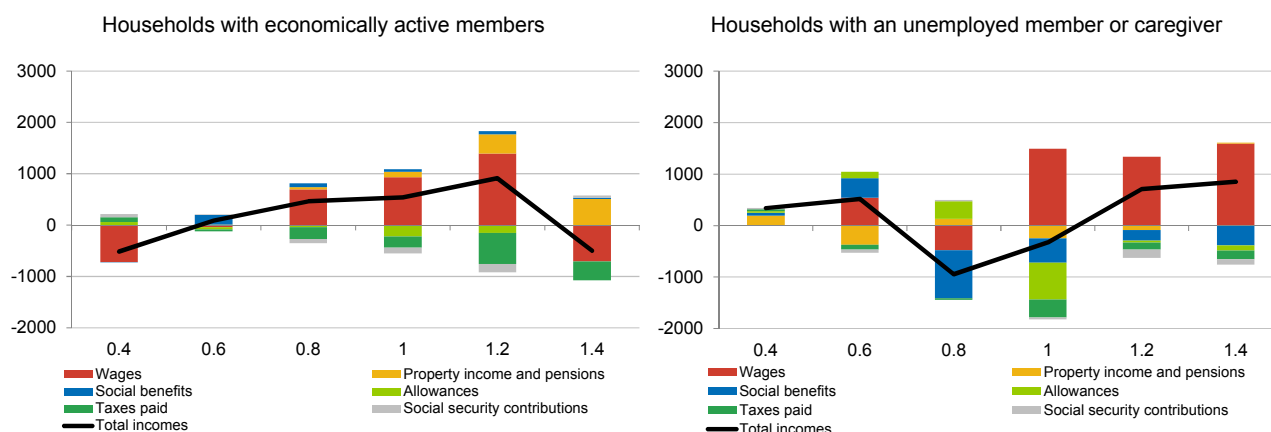
An analysis of individual data from the household budget surveys in 2011 and 2013 revealed no marked changes in the differentiation of the nominal income of a household with an unemployed person or caregiver as compared to a household with economically active persons (see Chart 47). In the case of households with economically active members and of households with an unemployed person, a person receiving parental allowance or a person caring for a disabled person, nominal income increased slightly in most of the monitored wage categories<sup>82</sup> in 2012–2013. In both groups, the total nominal income of households was driven mainly by changes in nominal wages. Nominal wages contributed to growth in total income mainly in the case of households with average and slightly above-average income. Slightly higher taxes paid fostered a decrease in total nominal household income. In the upper segment of the wage distribution for households with an unemployed person or caregiver, they were accompanied by a drop in social benefits. It is therefore likely that the negative contribution of benefits and allowances to income growth is giving rise to a greater incentive to work.

<sup>80</sup> Employees who prove that they terminated the employment contract for serious reasons are exempt from the reduction in unemployment benefits.

<sup>81</sup> In the case of "non-clashing" employment, unemployed people were allowed to earn up to 50% of the minimum wage (i.e. CZK 4,000) on top of their unemployment benefit. Since 2011 it has not been possible to combine unemployment benefits with "non-clashing" employment.

<sup>82</sup> The wage distribution calculated as the ratio to the gross average wage per economically active household member.

**Chart 47: Change in household income in 2013 compared to 2012 (CZK) by type of household and total income per economically active household member**



Note: The horizontal axis consists of the wage distribution calculated as the ratio of total household income per economically active member of the household to the gross average wage in 2012. The vertical axis shows the absolute change in household income from 2012 to 2013.

Source: Household budget survey, CNB calculations.

To sum up, the institutional set-up of the labour market in the Czech Republic saw no major changes over the last year. The ratio of the minimum wage to the average wage rose only marginally as a result of an increase in the minimum wage. Labour taxation was unchanged in the Czech Republic over the last year and its implicit rate is relatively high among the countries under review. The incentives to work arising from the configuration of taxes and benefits remain relatively low, especially in the initial phase of unemployment of childless individuals. In the case of families of unemployed people with children, by contrast, the configuration of taxes and benefits in the Czech Republic is comparable with the other countries under review in terms of the incentives to work. Despite a slight decrease, protection of regular employment is still relatively high, while temporary jobs are protected slightly less than in the other countries.

### 2.3.5 Rate of adjustment of real wage growth to the business cycle

The degree of flexibility with which wages respond to the business cycle is an important indicator of an economy's ability to adjust to asymmetric shocks. In countries with weaker or slower wage adjustment, asymmetric shocks have a stronger impact on the real economy in the absence of independent monetary policy. On the other hand, the effects of real shocks on wage inflation are weaker in economies with such inflexible labour markets. The following analysis examines the correlation between the cyclical components of output, the unemployment rate and real wages.

The results (see Table 30) indicate that the correlation between the cyclical components of unemployment and output is significant and robust over time and across countries, and the Czech Republic is no exception. Conversely, the correlation between the cyclical components of wages and output is unstable, varies over time and differs considerably between the countries under review.<sup>83</sup> The Czech Republic is one of the countries where the relationship between the

<sup>83</sup> These conclusions are confirmed by Brůha and Polanský (2014) on a different sample of countries, including all the advanced economies, and using longer time series.

wage gap and the output gap is closer. The euro area itself does not show significant correlation between these variables.<sup>84</sup>

To sum up, there is significant heterogeneity across countries as regards the sensitivity of the analysed variables to the business cycle. This heterogeneity is particularly pronounced in the case of wage sensitivity. Therefore, we cannot say that the monitored countries are aligned in these characteristics, but on the other hand the analysis does not find a systemic difference between old euro area members, new members and acceding countries. The results for the Czech Republic are similar to those for Germany and Austria.

**Table 30: Correlations of the cyclical components of output, unemployment and wages**

	wages and output	unemployment and output
EA	0.16	-0.94 ***
CZ	0.56 *	-0.87 ***
AT	0.74 ***	-0.77 ***
DE	0.51 ***	-0.76 ***
PT	0.02	-0.54 ***
HU	0.63 ***	-0.72 ***
PL	0.23 *	-0.74 ***
SI	-0.05	-0.88 ***
SK	0.74 ***	-0.89 ***

Note: Results for 2004 Q1–2014 Q1. The typical phase shift for the correlation between output and unemployment is one quarter, while for the correlation between output and wages it is four to five quarters. Statistical significance: \*\*\* significance at 1%, \*\* significance at 5%, \* significance at 10%.

Source: Eurostat, CNB calculations.

## 2.4 PRODUCT MARKET FLEXIBILITY

### 2.4.1 Administrative barriers to entrepreneurship

High **business start-up costs and barriers** and **complicated administrative regulations** governing entrepreneurship reduce competitive pressures, productivity and thus flexibility on product markets. In the long run, this also has a negative impact on job creation and employment.<sup>85</sup> Lower product market flexibility limits adjustment mechanisms in the event of an asymmetric shock.

According to a World Bank assessment forming part of a regular survey of conditions for doing business, the Czech Republic ranked 44th out of the total of 189 countries assessed in 2014. This means an improvement of three places compared to 2013. World Bank data (see Table 31) indicate that access to loans improved in the Czech Republic.<sup>86</sup> In other parameters, the Czech Republic's position changed by just a few places. The conditions for starting a business

<sup>84</sup> The data thus do not support the hypothesis that economies in which wages are more sensitive to the business cycle are able to absorb shocks better thanks to a flexible labour market, thereby reducing their impact on unemployment. Therefore, no robust relationship can be found between the correlation of the cyclical components of unemployment and output on the one hand and the correlation of the cyclical components of wages and output on the other. These conclusions hold even if the cyclical components of the variables are estimated using the Christiano-Fitzgerald filter instead of the Hodrick-Prescott filter or using sensitivity (elasticity) instead of correlation.

<sup>85</sup> Nicoletti and Scarpetta (2004).

<sup>86</sup> This move up the table is due to the adoption of new transaction security legislation which improves the registration of claims in the collateral register and also allows for better out-of-court realisation of collateral. To some extent it is also due to a relative fall in other countries.

in the Czech Republic remain the same as in the previous year and are the second-worst behind Germany among the countries under comparison. Starting a business is relatively time-consuming and costly, with registration at the Trade Licensing Office and the Commercial Register still taking the most time. The closing a business parameter also stagnated, although in a generally much better position. The conditions for closing a business are therefore similar to those in most of the other countries under comparison except Hungary, where closing a business is administratively more difficult.

**Table 31: Conditions for starting and closing a business**

	Starting a business					Closing a business				
	2010	2011	2012	2013	2014	2010	2011	2012	2013	2014
<b>CZ</b>	130	138	140	110	110	32	33	35	20	20
<b>AT</b>	125	134	133	113	101	20	21	12	16	16
<b>DE</b>	88	98	104	103	114	35	36	19	3	3
<b>PT</b>	59	26	25	10	10	21	22	22	11	10
<b>HU</b>	35	39	54	24	57	62	66	69	64	64
<b>PL</b>	113	126	124	80	85	81	87	37	30	32
<b>SI</b>	28	28	33	14	15	38	39	41	39	42
<b>SK</b>	68	76	80	83	77	33	35	38	28	31

Note: Country rankings for the conditions for starting and closing a business. Starting a business: number of procedures, time (days), cost and minimum capital requirements in % of income per capita. Closing a business: time (years), cost in % of total assets and recovery rate in cents on the dollar. The rankings for 2010–2012 are according to the Doing Business methodology valid until 2013. The figures for 2013 and 2014 were recalculated to reflect data changes and revisions. More information can be found at <http://www.doingbusiness.org/methodology/methodology-note>.

Source: World Bank (2014).

## 2.4.2 Tax burden on businesses

The tax burden on businesses significantly affects product market flexibility, since, given the high international mobility of capital, the taxation rate can be one of the deciding factors for investment allocation. The corporate tax rate is assessed by means of the statutory corporate income tax rate and the implicit corporate tax rate.

The Czech Republic has been applying a **corporate income tax rate** of 19% since 2010. Together with Slovenia and Poland, this is the lowest figure among the countries under comparison (see Table 32). Except for Hungary, which already had the lowest tax burden at the beginning of the period under review and where the tax rate was roughly flat afterwards, corporate income tax rates declined sharply in the countries under comparison between 2004 and 2009. The tax burden on businesses in the countries under comparison has been flat over the last five years, with the exception of Portugal, which has been increasing its highest corporate income tax rate since 2009, and Slovakia, which raised its corporate income tax rate to 23% in 2013 and then lowered it to 22% this year. Slovenia has maintained the lowest level of corporate taxation over the last three years.

**Table 32: Highest statutory corporate income tax rate (%)**

	2004	2008	2009	2010	2011	2012	2013	2014	Change (pp)
<b>CZ</b>	28.0	21.0	20.0	19.0	19.0	19.0	19.0	19.0	-9.0
<b>AT</b>	34.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	-9.0
<b>DE</b>	38.3	30.2	30.2	30.2	30.2	30.2	30.2	30.2	-8.1
<b>PT</b>	27.5	26.5	26.5	29.0	29.0	31.5	31.5	31.5	4.0
<b>HU</b>	17.6	21.3	21.3	20.6	20.6	20.6	20.6	20.6	3.0
<b>PL</b>	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	0.0
<b>SI</b>	25.0	22.0	21.0	20.0	20.0	18.0	17.0	17.0	-8.0
<b>SK</b>	19.0	19.0	19.0	19.0	19.0	19.0	23.0	22.0	3.0

Note: Changes in pp for 2004–2014.

Source: Eurostat.

The level of tax rates is a simple indicator of the taxation rate. However, the tax burden is also determined by the tax base, which is affected by depreciation, amortisation and tax exemptions. **Implicit tax rates**, defined as aggregate corporate income tax revenues as percentage of the potential tax base, are a complementary indicator of the tax rate (see Table 33). Following a decrease in the implicit tax rate in the Czech Republic in 2004–2010 and a stagnation in 2011, this rate rose by 1.2 pp in 2012. Implicit taxation in the Czech Republic is the second highest among the countries under review.<sup>87</sup> This shows that a low tax rate does not mean a low tax burden. Higher taxation and administrative costs can thus act as a barrier to flexible reaction of the goods and services market and to the potential absorption of asymmetric shocks in the event of euro adoption even when tax rates themselves are relatively low.

**Table 33: Implicit corporate income taxation rate (%)**

	2004	2008	2009	2010	2011	2012	Change (pp)
<b>CZ</b>	27.5	22.0	20.5	19.8	20.2	21.4	-6.1
<b>AT</b>	26.1	25.2	24.1	21.9	22.6	23.9	-2.1
<b>PT</b>	20.1	36.0	21.8	18.2	22.6	20.9	0.8
<b>HU</b>	17.6	19.0	21.0	9.8	8.2	10.6	-6.9
<b>PL</b>	18.7	20.3	15.0	12.5	12.4	13.0	-5.7
<b>SI</b>	23.1	27.0	22.3	22.9	19.6	15.2	-7.8
<b>SK</b>	22.6	21.8	21.8	18.5	17.7	18.2	-4.4

Note: The implicit taxation rate expresses aggregate corporate tax revenues as a percentage of the potential tax base. Changes in pp for 2004–2012. Data on the implicit taxation of corporate income are not available for Germany.

Source: Eurostat.

## 2.5 THE BANKING SECTOR AND ITS SHOCK-ABSORBING CAPACITY

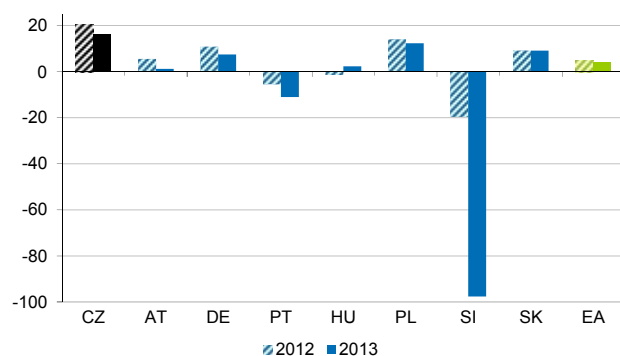
The banking sector is the largest segment of the financial sector in the Czech Republic (accounting for around 78% of the total assets of financial institutions excluding the CNB) and continues to report favourable levels of standard macroprudential indicators. The stability of the banking sector therefore significantly increases the probability of it performing its adjustment and stabilisation mechanism function in the event of euro adoption. On the other hand, experience from the euro area shows that the resilience of the banking sectors of some countries weakened rapidly following euro adoption. In this respect, the risks linked with the banking union project, which the Czech Republic would enter upon euro adoption, may also be

<sup>87</sup> In addition to the tax rate, implicit taxation is affected by the tax base and the system of tax exemptions.

significant for countries like the Czech Republic. Separating national governments and national supervisory authorities from responsibility for the overall situation of the national financial sector may increase the likelihood of bubbles forming on asset markets, which often requires intervention using a mix of supervisory, macroprudential and fiscal measures. Separation of the state from the national financial system may also further weaken the responsibility of national governments for long-term fiscal sustainability. In addition, the concepts of group interests and intra-group support, which are part of the banking union framework, create potential for the emergence of an autonomous channel for the problems of foreign parent banks to spill over into the balance sheets of Czech banks and into macroeconomic developments in the Czech Republic.

The banking sector has long been showing sufficient profitability as well as very good levels of capital adequacy and liquidity. The fact that its dependence on funding from abroad has long been limited is also having a favourable effect. Despite the recession in the Czech economy in 2013 and persisting low interest rates, which were reflected in a year-on-year decline in the sector's net profit, the domestic banking sector remains profitable. However, this could be affected by the Czech Republic's potential entry into the banking union due to the transfer of many banking supervision competences. By international comparison,<sup>88</sup> the profitability of the Czech banking sector, as measured by return on equity and return on assets, significantly exceeds the euro area average (see Chart 48 and Chart 49). The fact that its profits are generated mostly from traditional banking activities also contributes to the sector's long-running high profitability. The stable funding structure of banks, largely comprising primary deposits of clients, is also having a positive effect on profitability. The Slovak and Polish banking sectors are also showing good profitability. By contrast, the Slovenian banking sector posted a sizeable loss (EUR 3.3 billion) in 2013 owing to a significant deterioration in loan portfolio quality, with return on assets and return on equity reaching highly negative levels.

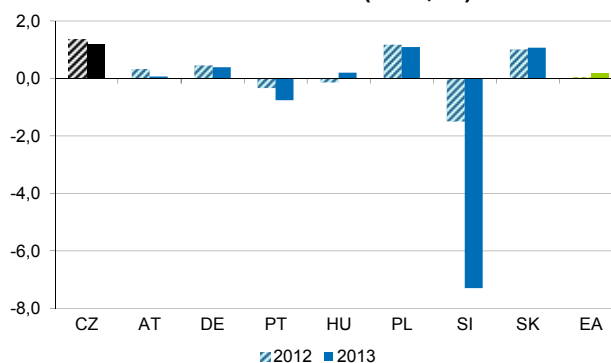
**Chart 48: Return on equity (RoE, %)**



Note: EA represents the GDP-weighted average of the euro area member countries.

Source: IMF FSI.

**Chart 49: Return on assets (RoA, %)**



Note: EA represents the GDP-weighted average of the euro area member countries.

Source: IMF FSI.

At 5.9%, credit risk in the Czech banking sector, as expressed by the ratio of non-performing loans (NPLs), remained in 2013 on a similar level as in the previous year (see Table 34). Despite the fall in economic activity in 2013, there was no major increase in NPLs on bank balance sheets. The evolution of credit quality is still heterogeneous across the countries under review; while some countries are now recording a slight drop in NPLs, in other countries the NPL ratio is still rising (Hungary and Portugal). The NPL ratio in the Slovenian banking sector

<sup>88</sup> Data presenting international comparisons are only indicative, as the methods for calculating individual indicators and consolidating can differ across countries (with the exception of non-performing loans, the IMF FSI data for the Czech Republic are always consolidated); moreover, data revisions occur in some cases.

decreased year on year, mainly on account of the transfer of some NPLs from commercial bank balance sheets to a state-governed consolidation bank (Bank Asset Management Company).

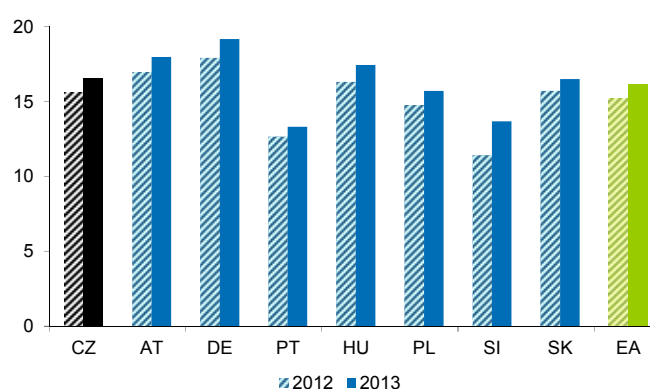
The stability and shock-absorbing capacity of the Czech banking sector is based on a sufficiently strong capital buffer, consisting mainly of retained earnings. The capital adequacy ratio of the banking sector continued to rise in 2013 – from 15.6% to 16.5%. Compared to the other countries under review, this is the fourth highest figure behind Germany, Austria and Hungary (see Chart 50). Thanks to their sufficient capitalisation and operating profits, domestic banks should be able to withstand potential large credit losses, as also evidenced by the latest banking sector stress tests performed by the CNB and published in [Financial Stability Report 2013/2014](#).

**Table 34: Non-performing loans, NPLs (% of total bank loans)**

	2011	2012	2013
<b>CZ</b>	6.0	6.0	5.9
<b>AT</b>	2.7	2.8	2.9
<b>DE</b>	3.0	2.9	2.7
<b>PT</b>	7.5	9.8	10.6
<b>HU</b>	13.4	15.8	16.7
<b>PL</b>	4.7	5.2	5.0
<b>SI</b>	11.8	15.2	13.3
<b>SK</b>	5.6	5.2	5.1
<b>EA</b>	5.6	6.5	7.3

Note: EA represents the GDP-weighted average of the euro area member countries.  
Source: IMF FSI, CNB.

**Chart 50: Capital adequacy ratio (%)**

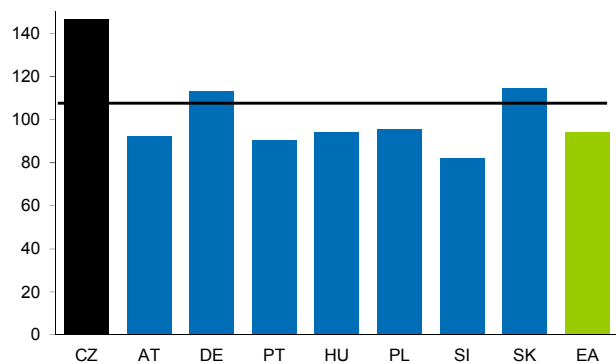


Note: EA represents the GDP-weighted average of the euro area member countries.  
Source: IMF FSI.

Most domestic banks focus on a conservative business model that involves accepting deposits and providing loans, mainly to households and non-financial corporations.<sup>89</sup> The ratio of deposits to loans to residents in the Czech banking sector is 147% (see Chart 51), the highest figure in the countries under review, while almost 85% of deposits and 76% of loans are vis-à-vis residents in the domestic currency. Despite a year-on-year decrease, the net external position of the Czech banking sector remained positive, reaching 5.1% of GDP at the end of 2013 (see Chart 52). Of the other countries under review, Germany, Austria, Slovakia and, to a small extent, Portugal have a positive net external position of banks. Czech banks' exposure to highly indebted euro area countries (not only to governments, but also to private sectors) is low, and the stress test results moreover indicate that even a drop in its value should not have a significant effect on the banking sector as a whole.

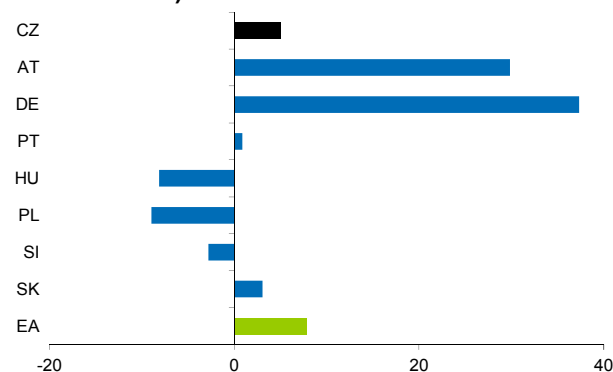
<sup>89</sup> The share of domestic government bonds in the balance sheets of banks, insurance companies and funds decreased slightly year on year, but remains high.



**Chart 51: Ratio of deposits to loans in selected EU countries (%)**

Note: Data as at the end of 2013; deposits/loans to residents. EA represents the euro area.

Source: ECB.

**Chart 52: Net external position of banking sector (net external assets in % of GDP, 2013)**

Source: IMF IFS, central banks.

The above information suggests that Czech banks are affected mainly by the real economy and have limited links to foreign financial markets. Moreover, the relatively high excess of funds over loans preserves room for banks to further expand their lending while maintaining sufficiently high liquid assets. Thus, the link of domestic banks to the European banking sector is due mainly to the foreign ownership structure of the domestic banking sector.<sup>90</sup>

<sup>90</sup> At the end of 2013, foreign owners directly or indirectly controlled 95.7% of the banking sector's assets.

### 3 SUMMARY OF RESULTS OF ANALYSES

Analysis Method / Category	Section	Indicator value available as of 31 July 2014							Commentary
		2004	2008	2009	2010	2011	2012	2013	

#### Economic alignment of euro area countries

Convergence of real and nominal variables in the euro area									
GDP per capita	D 1.1	divergence	convergence	stability			Following convergence of GDP per capita levels during crisis, differences have stabilised since 2010.		
GDP growth	D 1.1	stability		divergence	stab.			Following divergence in 2009–2010, GDP growth rates have synchronised again at previous levels.	
Unemployment	D 1.1	convergence		divergence		stab.		Divergence in unemployment rate peaked in 2013.	
Inflation rate	D 1.1	misal.	divergence		convergence			Temporarily higher misalignment in inflation rates falling again since 2011, but at low inflation levels posing risk to economic recovery.	
Long-term interest rates	D 1.1	convergence			strong divg.		conv.		Strong divergence of long-term interest rates halted in 2012.
Fiscal positions of euro area countries									
Number of countries not compliant with SGP deficit criterion	D 1.2	8	7	16	16	13	12	7	Sizeable crisis-related increase gradually subsiding. However, number of countries above 3% remains high.

#### Cyclical and structural alignment

##### Direct alignment indicators

Real economic convergence									
GDP per capita, PPP, EA-18=100	1.1.1	71.9	74.5	76.4	74.3	74.4	75.0	74.4	Czech convergence process not yet resumed. Indicator above levels of PT, HU, SK and PL, but slightly lower than SI.
Price level of GDP, EA-18=100	1.1.1	51.6	71.0	66.1	69.7	70.2	68.5	67.0	Czech convergence process not yet resumed. Czech Republic lagging well behind AT and DE, but also PT and SI.
Real exchange rate against euro, 2004=100	1.1.1	100	132	125	130	133	131	127	Real rate of appreciation 2.4% a year on average so far, but halted at start of crisis. Further real appreciation of koruna against euro can be expected going forward, but at slower rate than before crisis.
3M real interest rates	1.1.1	-0.2	-2.1	1.6	0.1	-0.9	-2.4	-0.9	Relatively low real rates mean lower need for adjustment after euro adoption. 3M real interest rates would reach (-1.9:-0.9) over next five years.

Analysis Method / Category	Section	Indicator value available as of 31 July 2014							Commentary
		2004	2008	2009	2010	2011	2012	2013	
<b>Correlation coefficients of real economic activity</b>									
GDP	t	1.1.2	<b>0.71**</b>			<b>0.87**</b>			Correlation of economic activity points to rise in intensity and speed of transfer of shocks from euro area economy to Czech Republic. Result may have been affected by significant extraordinary external shocks during crisis.
	t-1	1.1.2	-0.38			0.60**			
	t-2	1.1.2	-0.17			0.26			
IPI	t	1.1.2	<b>0.45**</b>			<b>0.37**</b>			Increase in correlation is also visible in monthly industrial production data.
	t-1	1.1.2	-0.02			0.22*			
	t-2	1.1.2	0.27**			0.36**			
	t-3	1.1.2	-0.03			0.19			
Czech exports to EA vs. EA GDP	t	1.1.2	<b>0.48**</b>			<b>0.76**</b>			Increased correlation is visible mainly between euro area GDP (proxy for external demand) and Czech exports to euro area member countries.
	t-1	1.1.2	0.09			0.49**			
	t-2	1.1.2	0.02			0.20			
<b>Structural similarity of the Czech economy and EA-18 economy</b>									
Landesmann index	1.1.3	0.09	0.14	0.13	0.13	0.14	0.15	0.15	Czech Republic has highest structural dissimilarity among countries compared, owing to higher share of industry and lower share of services (financial intermediation among others).
<b>Interest rate convergence</b>									
Differences in three-month and ten-year interest rates vis-à-vis euro area.	1.1.4	Sustained high alignment						Sustained low interest rate differentials increased slightly in 2012 and then saw correction. Lower than in HU and PL.	
<b>Alignment of exchange rates to euro</b>									
Bivariate GARCH	1.1.5	high correlation	slight fall in corr.	strong corr., short-term fall after 11/2013				Correlation of exchange rates of koruna and euro against dollar is high at 0.85–0.95, higher than for other countries under comparison. Temporary rise in volatility occurred only in connection with financial crisis and koruna weakening in late 2013.	
<b>Exchange rate volatility (exchange rate to euro, annualised, in %)</b>									
Historical volatility (daily returns for period of six months)	1.1.6	5	5–8	13–16	6–7	4	7–8	4–7	Koruna weakening in late 2013 following Czech National Bank's adoption of exchange rate commitment caused one-off rise in historical volatility, but thereafter exchange rate movements were exceptionally stable.
Implied volatility (options)	1.1.6	6	5–7	9–19	6–10	6–7	8–10	4–7	

Analysis Method / Category	Section	Indicator value available as of 31 July 2014							Commentary
		2004	2008	2009	2010	2011	2012	2013	
<b>Integration of the economy with the euro area</b>									
Exports, %	1.1.7	71.6	66.1	67.4	66.5	65.8	63.6	63.1	Relatively high level of trade links. Falling trend in exports reflects search for sales opportunities in emerging markets.
Imports, %	1.1.7	68.3	62.6	63.7	60.6	60.1	60.2	60.6	
Inflow of direct investment, % of GDP (stock)	1.1.7	-	42.6	46.4	47.5	44.5	51.7	-	Sustained high level of ownership links, particularly on FDI inflow side.
Outflow of direct investment, % of GDP (stock)	1.1.7	-	5.0	6.3	8.0	7.5	7.7	-	
Intra-industry trade, Grubel-Lloyd index	1.1.7	-	-	0.4	0.4	0.46	0.45	0.57	High share of intra-industry trade (only DE has higher share; AT has identical share).

### Similarity of monetary policy transmission

<b>Financial sector</b>									
Financial system assets (% of GDP)	1.2.1	-	142	148	151	157	166	178	Ratios of financial system assets to GDP and private sector debt to GDP are substantially lower than in AT, DE and PT, and slightly higher than in HU, PL and SK.
Private sector debt (% of GDP)	1.2.1	30	50	52	53	56	57	58	

<b>Structure of financial assets and liabilities, transmission of policy rates to client rates</b>									
Structure of financial assets and liabilities of corporations and households	1.2.2	-	-	differences apparent				Differences apparent mainly in non-financial corporations sector, where loans with longer maturity and short-term liquid assets are dominant.	
Effect of monetary policy on client interest rates	1.2.3	-	-	similarity				Effect of money and financial market rates on client rates is similar in Czech Republic as in euro area.	

<b>Inflation persistence</b>									
Method 1 (non-parametric)	1.2.4	-	0.79	0.81	0.81	0.81	0.86	0.86	Inflation persistence in Czech Republic is average compared to other countries under review.
Method 2 (sum of AR coefficients, constant mean)	1.2.4	-	0.82	0.91	0.81	0.84	0.85	0.81	
Method 3 (sum of AR coefficients, time-varying mean)	1.2.4	-	0.32	0.38	0.38	0.43	0.42	0.50	

Analysis Method / Category	Section	Indicator value available as of 31 July 2014							Commentary
		2004	2008	2009	2010	2011	2012	2013	
<b>Financial market integration</b>									
Money market	1.2.5	-	-0.39	-0.38	-0.37	-0.38	-0.39	-0.39	In recent years situation has improved and alignment has risen in most monitored markets. However, this situation is conditional on active implementation of unconventional monetary policy by central banks.
Foreign exchange market	1.2.5	-	-0.89	-0.90	-0.88	-0.89	-0.88	-0.86	
Bond market	1.2.5	-	-0.73	-0.69	-0.73	-0.73	-0.74	-0.74	
Stock market	1.2.5	-	-0.84	-0.77	-0.79	-0.80	-0.80	-0.80	
<b>Spontaneous euroisation</b>									
Degree of euroisation	1.2.6	low							Use of euro by Czech corporations is consistent with openness of Czech economy. Czech households make minimal use of euro.

## Adjustment mechanisms

### Fiscal policy

<b>General government balance and debt</b>									
Overall general government balance % of GDP, ESA 95 (outturns until 2013, CNB forecast from 2014)	2.1.2	-2.7	-4.4 (2010)	-2.9 (2011)	-4.0 (2012)	-1.3 (2013)	-1.4 (2014)	-2.1 (2015)	Significant (but procyclical) consolidation in recent years. Deficit is in line with Maastricht criterion, but its outlook is rising again.
General government structural balance % of GDP, ESA 95, EC methodology (outturns until 2013, CNB forecast from 2014)	2.1.2	-1.8	-4.3 (2010)	-2.6 (2011)	-1.9 (2012)	-0.3 (2013)	-1.1 (2014)	-1.8 (2015)	Fiscal consolidation led to decline in structural deficit, but at cost of procyclical restrictive effect on economy. However, outlook is rising again, albeit not significantly above MTO according to CNB prediction.
Government debt % of GDP, ESA 95 (outturns until 2013, CNB forecast from 2014)	2.1.2	28.5	38.2 (2010)	41.0 (2011)	45.5 (2012)	45.7 (2013)	44.4 (2014)	44.7 (2015)	Total government debt is rising. Ratio of government debt to GDP remains below Maastricht convergence criterion, but risk to its sustainability remains.

Analysis Method / Category	Section	Indicator value available as of 31 July 2014							Commentary
		2004	2008	2009	2010	2011	2012	2013	

## Labour market flexibility

Unemployment and internal labour market flexibility									
Long-term unemployment rate, %	2.2.1	4.2	2.2	2.0	3.0	2.7	3.0	3.0	Long-running economic downturn visible in evolution of long-term unemployment. However, its rate is one of lowest among countries under review.
Regional coefficient of variation in unemployment rate (at regional level, NUTS III)	2.2.1	43	46	35	32	29	34	-	Decrease in regional differences in unemployment rate in recent years. However, slight rebound was recorded in 2012.
Internal migration – per 1,000 inhabitants	2.2.1	21	24	22	23	22	22	-	Internal migration lower than in AT, DE and SI.
Structural unemployment									
NAIRU structural unemployment rate, %	2.2.2	6.5	5.6	6.1	6.2	6.1	6.3	6.3	Structural unemployment rate among lowest of countries compared (behind DE).
International migration									
Share of foreign nationals in population (%)	2.2.3	1.9	3.3	3.9	4.0	4.0	4.0	4.0	Growth in share of foreign nationals in population halted in 2009.
Institutional environment									
Minimum wage as % of average wage in industry and services	2.2.4	38.4	35.2	34.3	33.3	32.4	31.6	31.7	Falling since 2004. Level in Czech Republic is lowest among countries compared.
Overall labour taxation (persons on average wage, %)	2.2.4	43.6			42.2	42.5	42.4	42.4	Overall labour taxation in Czech Republic is higher than in PT, PL and SK and lower than in DE, AT and HU.
Overall labour taxation (persons on two-thirds of average wage, %)	2.2.4	41.9			38.9	39.5	39.3	39.3	Overall labour taxation in Czech Republic is higher than in AT, PT, HU and SK, lower than in DE, comparable with PL.
Ratio of net household income when breadwinner is unemployed / employed, %	2.2.4	56			77	77	77	-	Financial incentive to work in case of short-term and long-term unemployment in Czech Republic is among lowest in countries under review.

Analysis Method / Category	Section	Indicator value available as of 31 July 2014							Commentary
		2004	2008	2009	2010	2011	2012	2013	
<b>Rate of adjustment of real wage growth to unemployment rate</b>									
Correlation of cyclical components of output and unemployment	2.2.5	-	-	-	-	-	-0.94 ***	-0.94 ***	Fluctuations in economic activity reflected strongly in unemployment.
Correlation of cyclical components of output and wages	2.2.5	-	-	-	-	-	-0.11	0.56 *	Real wage flexibility is lower.

### Product market flexibility

<b>Administrative conditions for business</b>									
Conditions for starting a business (ranking, WB)	1.3.2.	-	-	130 (2010)	138 (2011)	140 (2012)	110 (2013)	110 (2014)	Conditions in Czech Republic are worst among countries compared.
Conditions for closing a business (ranking, WB)	1.3.2.	-	-	32 (2010)	33 (2011)	35 (2012)	20 (2013)	130 (2014)	Conditions worse than in DE, AT and PT, better than in other new Member States.
<b>Taxation rate</b>									
Implicit corporate taxation rate	2.3.2	27.5	22.0	20.5	19.8	20.2	21.4	-	Implicit tax rates higher than in HU, PL, PT, SK and SI, lower than in AT.

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

<b>Macroprudential indicators of banking sector</b>									
Return on Tier 1 capital, on consolidated basis, %	2.4	-	20.7	26.4	19.7	18.3	20.4	16.2	Profitability of banking sector as measured by return on capital and assets is high by comparison with countries under review.
Return on assets, on consolidated basis, %	2.4	-	1.1	1.5	1.3	1.2	1.4	1.2	
Non-performing loans/total loans, %	2.4	-	3.2	5.2	6.2	6.0	6.0	5.9	Growth as a result of recession. Ratios stable in recent years.
Capital adequacy, on consolidated basis, %	2.4	-	11.6	14.0	15.3	15.0	15.6	16.5	Capital adequacy at levels comparable with other countries under review.
Deposit-to-loan ratio, in relation to residents, %	2.4	-	128	134	134	134	141	147	Sufficient deposit financing sources ensure relative independence of Czech banks on both Czech interbank market and foreign financial markets.
Net external position of banking sector, %	2.4	-	6.6	6.2	5.7	5.0	7.5	5.1	Net external position of banking sector has long been positive.



## F METHODOLOGICAL PART

### D *Economic alignment of euro area countries*

The economic alignment of the euro area countries was analysed using simple descriptive statistics of macroeconomic fundamentals – GDP per capita, real GDP growth, unemployment, the inflation rate and long-term interest rates. The individual descriptive statistics were calculated across countries, i.e. with no weight adjustment for the size of the given economy or the population of the given country. In addition to unweighted values, the charts show values for the euro area as a whole.

In the charts, therefore, the standard deviation at time  $t$  is calculated using the formula

$$\sigma_t = \sqrt{\frac{\sum_{i=1}^n (x_{i,t} - \bar{x}_t)^2}{(n-1)}}, \text{ where } x_{i,t} \text{ is the value of the macroeconomic variable for country } i,$$

$$\bar{x}_t = \frac{\sum_{i=1}^n x_{i,t}}{n} \text{ is the arithmetic (unweighted) mean of the variable across countries at time } t \text{ and}$$

$n$  is the number of countries under review. In addition to the standard deviation and the mean, the median is analysed. It indicates the value of the variable lying in the middle of the set sorted by magnitude. This means that one-half of the countries have values above the median.

The relative alignment of the variables in the euro area (see Chart 8) is depicted using their normalised standard deviations. A negative value means that alignment is above the long-term mean.

#### BOX 1

Cluster analysis divides elements into groups (clusters) based on similarity or distance, i.e. it maximises intra-group homogeneity and inter-group heterogeneity and enables concurrent analysis of multiple indicators. It thus seeks groups of similar elements using all indicators simultaneously and then in a dendrogram plots the allocation of the elements into clusters depending on the squared Euclidean distance. Cluster analysis can be performed using various algorithms, agglomerative hierarchical clustering being the most commonly used in the literature. The objective is to find the nearest neighbouring element. In the first step, the distances between elements  $C_i, C_m$  are defined:

$$d(C_i, C_j) = d_{ij}$$

In the second and subsequent steps, the distances are minimised:

$$d(C_i \cup C_j, C_m) = \min(d(C_i, C_m), d(C_j, C_m))$$

In Ward's method, clusters with the minimum increase in the total intra-group sum of the squared deviations of the individual values from the cluster average are merged in successive steps. The result is a dendrogram illustrating the arrangement of elements into clusters depending on the squared Euclidean distance. The smallest cluster, with zero distance, is therefore the element itself.

## **E Analyses of the Czech Republic's Alignment with the Euro Area**

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

#### **1.1 DIRECT ALIGNMENT INDICATORS**

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

The comparison of GDP per capita at purchasing power parity (PPS – Purchasing Power Standard) and the average price level of GDP is based on Eurostat data. The real exchange rate against the euro is based on the Harmonised Index of Consumer Prices. The average annual rate of real appreciation is calculated as the geometric mean of the appreciation in 2004–2013.

The outlook for future real appreciation for the next five years 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 36 European countries between 1995 and 2013 (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:

$$P_{C,t} = 20.38 + 0.82 GDP_{PPS,t} + 0.88 AR(1)_t$$

where  $P_{C,t}$  is the price level of final consumption of households in year  $t$ ,  $GDP_{PPS,t}$  is gross domestic product at purchasing power parity per capita in year  $t$  (in both cases EA-18 = 100) and  $AR(1)_t$  is the first-order autoregressive term. The simulations of the future pace of equilibrium real exchange rate appreciation take as their starting point the estimates of GDP and the price level for 2014 based on European Commission and Eurostat forecasts for real GDP growth, nominal exchange rates and inflation in the individual countries in that year. They also assume beta-convergence of GDP towards the level of the EA-17 at a rate of 2.5% a year. A range around the mean appreciation estimate is obtained by increasing or decreasing the autoregression coefficient by one standard error of its estimate (i.e. the coefficient is within a range of roughly 0.85–0.92 in the simulations).

Real interest rates are derived from three-month money market interest rates. Three-month interest rates were selected for reasons of data availability in the Eurostat database for all the monitored countries over the whole period under review. The average annual level of interest rates is deflated by the annual inflation rate for the country concerned, using the Harmonised Index of Consumer Prices. The estimate of real “equilibrium” rates going forward is based on the assumptions of full elimination of the money market risk premium thanks to euro adoption and an equilibrium three-month real rate in the euro area of 1.5%. From this figure, the range of the estimates of future equilibrium real exchange rate appreciation for each of the countries (see above) is subtracted, corresponding to the future expected inflation differential vis-à-vis the euro area average.

The wage level data are taken from the European Commission's AMECO database (indicator “Nominal compensation per employee: total economy”) in both euro and PPS.

##### **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, taking into account the different lags of the time series in the different countries relative to the euro area series.

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 the alignment of 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 a half and eight years long are considered most frequently. **Dynamic correlation**,<sup>91</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 co-spectrum, 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 quarterly time series of exports to the euro 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.

Data on exports to the euro area are available only in USD in the IMF database, so they were converted into national currencies using average quarterly exchange rates according to the IMF.

Time series are expressed in logs, seasonally adjusted and detrended. For detrending we used the method of quarter-on-quarter (or month-on-month) differences of 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 method succeeds in detrending. As regards GDP in the Czech Republic, Hungary and Portugal, 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.

<sup>91</sup> Croux, Forni and Reichlin (2001).

Given the requirement to assess 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: 2004 Q1–2008 Q3 and 2008 Q4–2014 Q1. An analysis using rolling correlations was prepared as an alternative to the breakdown into two periods.

### 1.1.3 Structural similarity of the economies

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-18). 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:

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

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 source of the data is Eurostat. 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>92</sup> The modified coefficient takes values in the range [0, 1]. The closer the coefficient is to zero, the more similar in structure are the economies.

### 1.1.4 Interest rate convergence

The simple method of a chart showing the interest rate differential vis-à-vis the euro area is used to analyse the convergence of interest rates in the Czech Republic, Hungary, Poland, Slovenia and Slovakia.<sup>93</sup> Datastream data based on central bank data (three-month interbank market rates) and Eurostat data (ten-year government bonds) were used to measure the interest rate differentials between three-month and ten-year rates in the euro area and these countries.

The time series start in January 2004 and end in June 2014 for both three-month rates and ten-year rates. The time series "EMU convergence criterion bond yields" from the Eurostat database, compiled for the purposes of assessment of the Maastricht convergence criterion on long-term interest rates, were used to compare 10Y government bond yields. These time

$$^{92} SL = \sum_{i=1}^n \sqrt{\left( I_{sh_A^i} \cdot 100 - I_{sh_B^i} \cdot 100 \right)^2 \cdot \left( \frac{I_{sh_A^i} \cdot 100}{100} \right)} = 100 \sum_{i=1}^n \sqrt{\left( I_{sh_A^i} - I_{sh_B^i} \right)^2 \cdot I_{sh_A^i}} = 100 \cdot I_{SL}$$

<sup>92</sup> In this case, indices are used rather than the percentage shares of individual sectors in the total.

<sup>93</sup> Interest rate convergence can be examined using the unit root test (see, for example, Lee and Wu, 2004, and Kočenda, 2001). However, the analyses must take into account the relatively short length of the available time series, as well as breaks in the time series.

series are based on the gross yield on government bonds on the secondary market with approximately ten years to maturity.

### 1.1.5 Exchange rate alignment

Aguilar and Hördahl (1998) express the probability of adoption of the euro by eleven EMU candidate countries using the correlation of the exchange rates of their currencies and the Deutsche Mark (as a substitute for the euro) vis-à-vis the US dollar.<sup>94</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.

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

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

$$corr_t = \frac{\text{cov}(X/USD, EUR/USD)_t}{\sqrt{\text{var}(X/USD)_t * \text{var}(EUR/USD)_t}}, \text{ where } X \text{ represents the national currencies.}$$

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 2004 to 1 July 2014 and uses daily data from Thomson Datastream and Eurostat.

### 1.1.6 Analysis of exchange rate volatility

The historical exchange rate volatility is calculated as the 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 logarithmic daily returns to an annualised form:

$\sigma_{ann} = \sigma \sqrt{N}$ , where  $N = 252$  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 the exchange rates announced by the CNB.

<sup>94</sup> The same method is used in Castrén and Mazzotta (2005).

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 Datastream.

### 1.1.7 Integration of the economy with the euro area

#### International trade with the euro area

The Grubel-Lloyd (GL) index was used to analyse intra-industry trade:

$$GL_t = 1 - \frac{\sum_k \sum_i |X_{it}^k - M_{it}^k|}{\sum_k \sum_i |X_{it}^k + M_{it}^k|}$$

$GL_t$  is the ratio of the absolute value of net intra-industry trade to foreign trade turnover.  $X_{it}^k$  and  $M_{it}^k$  denote exports to and imports from the  $k$ -th country of the  $i$ -th commodity at time  $t$ . The index takes values ranging from 0 to 1. A value of 0 means that all trade is inter-industry trade and that there is specialisation in different commodities. By contrast, a value of 1 indicates that all trade is intra-industry trade (Flek et al., 2001).

The GL index is calculated using data on total exports and imports to and from the euro area in the countries under review.<sup>95</sup> To calculate the index, foreign trade is broken down on the basis of the SITC classification (the commodities  $i$  are thus given by SITC groups at the one- to five-digit level). The data source is the Eurostat COMEXT database.

The value of the GL index depends, among other things, on the level of detail of the branch breakdown. The breakdown according to the one- or two-digit SITC is a rather broader sector breakdown which may put together in one category branches whose output is not closely related,<sup>96</sup> resulting as expected in a higher value of this indicator for all countries. Although the qualitative message of the analysis is relatively independent of the degree of aggregation selected, the cross-country differences are largest when using the five-digit (most detailed) breakdown.<sup>97</sup>

#### Foreign direct investment

The data for the calculation of the shares of exports to and imports from the euro area in total exports and imports are taken from Eurostat (January 2004–July 2013, monthly data).

The source of data for the analysis of the euro area's share in direct investment is the Eurostat database, for the Czech Republic the CNB, for Austria the OeNB, for Germany the Bundesbank and for Slovakia the NBS. Stock data on foreign direct investment (FDI) from euro area countries and direct investment (DI) to euro area countries were used. The GDP statistics are from the Eurostat database.

#### BOX 3

Transaction costs are quantified on the basis of estimated trade volumes on the euro foreign exchange market according to the Czech National Bank's quarterly survey of domestic banks

<sup>95</sup> As the trade balances of euro area countries can take either positive or negative values, it is recommended to calculate the aggregated Grubel-Lloyd index using bilateral export and import flows.

<sup>96</sup> This is particularly so in SITC 7 (Machinery and transport equipment).

<sup>97</sup> The simplest calculation of the Gruber-Lloyd index, using SITC 1, is based on 10 categories.

concerning average daily trades. The volumes of individual transactions are valued using their estimated unit transaction costs, which represent one-half of the relevant bid-ask spread (see Table B2). The results (see **Table B2**) suggest that currency conversion transaction costs amounted to 0.25–0.50% of GDP in 2013. This quantification is comparable with the transaction costs calculated for Slovakia (0.36% of GDP; NBS, 2006) and Hungary (0.11–0.22%; Csajbók and Csermely, 2002). It is reasonable to assume that these costs (and hence the possible benefits of introducing the euro) are still underestimated, as we abstract from the hard-to-quantify administrative costs of converting currencies. These include keeping accounts in two currencies (or “hedge accounting”) and dual liquidity management. As mentioned above, the estimate omits a large part of the costs of exchange rate risk. The estimate represents only the lower bound on the microeconomic benefits of introducing the euro. However, it cannot be said that eliminating transaction costs would lead to an immediate increase in GDP of the same magnitude, as a large part of the transaction costs are at the same time revenues of financial intermediaries. From the long-term perspective, the transaction costs should be redirected towards more productive use within the GDP structure, leading to an increase in total welfare.

Table B2). The spread on spot trades with foreign banks is approximated by the interbank market spread, and the spread on spot trades with clients is a weighted average of the interbank spread and the commercial spread of bureaux de change and banks. Spreads on derivatives trades with foreign banks are based on interbank market data (the bid-ask spread on three-month forwards). In the case of derivatives trades with clients, the spread is approximated by doubling the interbank spread.

## 1.2 SIMILARITY OF MONETARY POLICY TRANSMISSION

### 1.2.1 Financial system

**Depth of financial intermediation** (the ratio of the 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, management 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.

**Indebtedness of the private sector** (the ratio of the gross book value of loans to non-bank clients, corporations and households to GDP at current prices) expresses the level of lending by banks. Usually, the more advanced the market, the larger this ratio, but an excessively high value may reflect overleveraging of the private sector.

### 1.2.2 Structure of financial assets and liabilities of corporations and households

**Quarterly financial accounts** data published by national central banks and the ECB are used as the input data for the analysis of the alignment of the structure of the financial assets and liabilities of non-financial corporations and households. The quarterly financial accounts are compiled according to ESA 95 methodology. In line with national accounting, a unified classification of **institutional units** and **financial instruments** is being promoted. As regards institutional units, the analysis provides a detailed examination of real sectors, i.e. non-financial corporations (S.11) and the merged sector of households (S.14) and non-profit institutions serving households (S.15). The analysis distinguishes five main types of financial instruments: currency and deposits, securities other than shares, loans, shares and other



equity, and other accounts receivable/payable including insurance technical reserves and financial derivatives.

The analysis works with **outstanding amounts of financial assets and liabilities** as at the end of the period (quarter) under review. Consequently, the effect of transactions, revaluation and other changes in the volume of assets/liabilities on the change between the initial and final balance in each quarter is not explicitly taken into account. The analysis discusses the net positions of the aforementioned sectors in detail. The net position, expressed as **net financial assets**, is obtained as the balance of financial assets and liabilities and indicates the sector's financing ability or financing needs.

A detailed look at the structure of financial assets and liabilities is provided by **balance sheet indicators**, which capture the degree of risk arising from any mismatch between individual items of the financial balance sheet. The main indicators are:

Liquidity	= $(\text{currency} + \text{deposits}^{98} + \text{short-term securities} + \text{short-term loans provided}) / (\text{short-term debt securities issued} + \text{short-term loans accepted})$
	...measures the maturity mismatch by the ratio of short-term assets to short-term liabilities; an entity is able to pay its short-term liabilities if this indicator exceeds 100%.
Solvency	= $\text{total financial assets} / \text{liabilities excluding equity}$
	...measures the risk of overall insolvency
Debt/equity	= $(\text{bonds issued} + \text{loans accepted} + \text{other liabilities}) / \text{equity issued}$
	...measures the risk of mismatch between capital structure and excessive debt

For non-financial corporations, liquidity and the share of short-term liabilities may be affected by omission of the short-term component of other liabilities. In the case of the liquidity indicator, this omission is less problematic, as it is reasonable to assume that the shares of short-term other assets and liabilities (trade credits etc.) are approximately equal.

The debt/equity ratio cannot be used for the household sector. Given its insufficient information content with regard to the objective of the analysis, the liquidity indicator for the household sector was also excluded.

### 1.2.3 Effect of monetary policy on client interest rates

The **interest rate sensitivity of loans to non-financial corporations and loans for house purchase** is expressed by the breakdown of new loans by initial interest rate fixation. Subsequently, the degrees of similarity between the breakdown of loans in the Czech Republic and in the other countries under review are compared with that for the euro area as a whole. For the single monetary policy to operate effectively, it is important that the interest rate sensitivity of these loan types to changes in market and client interest rates is similar, thereby eliminating some asymmetry in the event of economic shocks.

Average weighted interest rates on new business, which reflect the rates agreed for all new business during the month, and three-month money market interest rates were used in the graphical comparison of interest rate spreads between client and market rates.

<sup>98</sup> Strictly speaking, only transferable deposits (excluding other deposits) should be included. However, this breakdown is not available for most countries or for the euro area.

The strength of the relationship between client and market rates in the countries under review and in the euro area is assessed using correlation analysis. The simple (Pearson) correlation coefficient is used to assess the strength of the linear relationship (see the *Methodological Part*, section 1.1.2 *Correlation of economic activity*). The maximum value of the coefficients of correlation between interest rates on client loans and the relevant market interest rate is also determined for several possible lags.

#### 1.2.4 Inflation persistence

Inflation persistence is measured by three different methods. Quarterly data on HICP inflation (annual HICP changes) from 2004 Q1 to 2014 Q2 are used for the calculation. The source of the data is OECD MEI.

##### Method 1

Method 1 uses 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 medium-term inflation value and  $T$  is the number of observations. Medium-term inflation is approximated using the Hodrick-Prescott (HP) filter with the parameter  $\lambda = 1,600$ . As the HP filter gives a biased trend estimate at the beginning and the end of the time series, the data for 2005 Q1 to 2013 Q4 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 the coefficients of the autoregressive terms are estimated. The modelled process used in Method 2 is described as

$$\pi_t = \mu + \sum_{i=1}^4 \alpha_i \pi_{t-i} + \varepsilon_t,$$

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

$$\rho_K = \sum_{i=1}^4 \alpha_i$$

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:

$$\pi_{t+1}^T = \pi_t^T + \eta_{1t}$$

$$\pi_{t+1}^P = (1 - \delta)\pi_t^P + \delta\pi_{t+1}^T, 0 < \delta < 1,$$

$$\pi_t = \left(1 - \sum_{i=1}^4 \varphi_i\right) \pi_t^P + \sum_{i=1}^4 \varphi_i L^i \pi_t + \varepsilon_{1t}, \sum_{i=1}^4 \varphi_i < 1,$$

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 observed variable and medium-term inflation  $\pi_t^T$  is approximated with the inflation time series smoothed using the HP filter. The Kalman filter and Bayesian estimation are used to estimate the model parameters. The methodology draws on the article by Franta, Saxa and Šmídková (2007), where it is applied to data from a different source and period.

### 1.2.5 Financial market alignment

#### Price-based measures

These measures use the concepts of beta-convergence and sigma-convergence (Adam et al., 2002).<sup>99</sup> The concept of beta-convergence enables identification of the speed at which differences in yields are eliminated on individual financial markets (selected against the benchmark). A negative beta coefficient signals the existence of convergence. The closer the value of the beta coefficient is to -1, the higher is the speed of convergence. To quantify beta-convergence, common regression analysis or the panel estimation method is applied (as in Babetskii et. al., 2007), 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  $i$ <sup>100</sup> and a selected reference territory (a benchmark, B) at time  $t$ ,  $\Delta$  is the difference operator,  $\alpha_i$  is a dummy variable for the respective country,  $L$  is the maximum lag considered (four weeks) 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. The  $\beta$  coefficient can take values ranging from -2 to 0. The closer the value of the  $\beta$  coefficient to 1, the higher the speed of convergence. If  $\beta = -2$  or  $\beta = 0$ , no convergence is observed.  $\beta$  values from -1 to 0 indicate monotonous convergence, while oscillating convergence occurs for values from -2 to -1.

The concept of sigma-convergence focuses on the dispersion of the yields on identical asset types in different countries at a given moment in time and thus identifies the degree of integration vis-à-vis the benchmark country achieved at that moment in the individual selected financial market segments. Sigma-convergence increases as the sigma parameter falls to zero. To quantify sigma-convergence, a calculation is used of the (cross-section) standard deviation ( $\sigma$ ), according to the formula:

<sup>99</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>100</sup>  $Y_{i,t} = [\ln(A_{i,t}) - \ln(A_{i,t-1})]$  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.

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

where  $Y$  is the asset yield,  $\bar{Y}_t$  is the mean value of the yield over time  $t$  and  $i$  stands for the individual countries ( $i = 1, 2, \dots, N$ ). For the purposes of this analysis, we use  $N = 2$ , i.e. we explore the evolution of sigma-convergence over time between the euro area and one of the countries under review.<sup>101</sup> In theory,  $\sigma$  takes only positive values. The lower is  $\sigma$ , the higher is the level of convergence. In theory, full integration is achieved when the standard deviation is zero,<sup>102</sup> while high (several digit) values of  $\sigma$  reflect a very low degree of integration. For graphical illustration, the results were normalised over the whole time period and filtered using the Hodrick-Prescott filter with the recommended weekly time series coefficient  $\lambda = 270,400$ .

### News-based measures

This method (Baele et al., 2004) assumes that potential local shocks, which get more alike with increasing integration, can be diversified in an integrated region by investment in other comparable assets. In line with these assumptions, the price movements of a benchmark asset should reflect all relevant common (global) news. So, in a fully integrated market, the price changes of an asset in a single country should not be systematically higher or lower than the price changes of the benchmark asset. Quantification of the degree of shock integration can be estimated (as in Baele et al., 2004) for the money, foreign exchange and government bond markets using the following regression:

$$\Delta Y_{i,t} = \alpha_{i,t} + \gamma_{i,t} \Delta Y_{b,t} + \varphi_{i,t}$$

where  $Y_{i,t}$  represents individual asset yields in country  $i$  at time  $t$ , and  $b$  denotes the benchmark country (Germany for the government bond market, otherwise the euro area).  $\alpha_{i,t}$  is a specific constant for each country,  $\Delta$  denotes the difference operator and  $\varphi_{i,t}$  is a random term. An increase in this type of integration requires  $\alpha$  to converge to zero,  $\gamma$  to converge to one and the proportion of the variance of coefficients  $\gamma$  (for benchmark and national assets) to be close to one. The time-varying parameters  $\gamma$  were estimated using recursive estimation.

To quantify the degree of stock market shock integration between the countries under review and the euro area, the above equation must be adjusted for the impact of the US stock market on the monitored markets and the euro area market. This is due to the lower comparability of the individual national stock indices relative to the other monitored assets (exchange rates, money market rates and government bonds). The modified equation for the stock market has the following form:

$$\Delta Y_{i,t} = c_{i,t} + \gamma_{i,t}^b \Delta Y_{b,t} + \gamma_{i,t}^{US} \Delta Y_{us,t} + v_{i,t}$$

The magnitude of parameters  $\gamma$  expresses the degree of identical response of an asset of a selected country and a comparable benchmark asset to certain news.

### Data

The calculations for both measures of financial integration were carried out using weekly data (daily data averages) from Thomson Datastream, covering the period January 2004 to June 2014. Three-month interbank rates were used for the money market, national currencies

<sup>101</sup> For pairs of countries, the calculated values in each period are essentially equal to half the square of the yield differential.

<sup>102</sup> This occurs on the money and foreign exchange markets for countries entering the euro area on a given date.

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. The relevant time series were adjusted for exchange rate effects.

Thomson Datastream codes for the data sources used:

	<b>Peněžní trh</b>	<b>Devizový trh</b>	<b>Dluhopisový trh</b>	<b>Akciový trh</b>
<b>CZ</b>	PRIBK3M	PRUSDSP	BMCZ05Y-(RY)	CZPXIDX
<b>AT</b>	–	–	BMOE05Y-(RY)	ATXINDX
<b>DE</b>	–	–	BMBD05Y-(RY) <sup>B)</sup>	DAXINDX
<b>PT</b>	–	–	BMPT05Y-(RY)	POPSI20
<b>HU</b>	HNIBK3M	HNUSDNB	BMHN05Y-(RY)	BUXINDX
<b>PL</b>	POIBK3M	POUSDSP	BMPOZ05Y-(RY)	POLWIGI
<b>SI</b>	–	SJUSDSP	TRSI5YT	SLOETOP
<b>SK</b>	SXIBK3M	SXUSDSP	SXGOVT1	SXSAX16
<b>EA</b>	BBEUR3M <sup>B)</sup>	USECBSP <sup>B)</sup>	–	DJES50I <sup>B),a)</sup>

Note: <sup>B)</sup> benchmark; <sup>a)</sup> DJES50I consists of stocks from euro area member countries with the following weights: France 34.6%, Germany 28.0%, Spain 16.7%, Italy 11.0%, the Netherlands 5.6%, Finland 2.5% and Luxembourg 1.7%.

### 1.2.6 Spontaneous euroisation

A comparison of the level of euroisation in the Czech Republic and selected Central European countries, namely Poland, Hungary and Slovakia, and an assessment of the effects of the debt crisis on households' trust in the euro area were performed using a survey conducted by Oesterreichische Nationalbank and published in 2014 Q2.

## 2 ADJUSTMENT MECHANISMS

### 2.1 FISCAL POLICY

#### 2.1.1 Stabilising function of public budgets

There are two main approaches to determining the cyclical component of the budget balance. The first is based on the methodology used by the European Commission and other international institutions (OECD, IMF), which assumes a direct relationship between the output gap and revenue/expenditure budgetary items which are subject to cyclicity. The second approach, used by the ECB and central banks within the ESCB, is based on the relationship between individual revenue and expenditure budgetary items and their macroeconomic bases.

Of key importance in the computation of the cyclically adjusted balance using the output gap approach are the estimation of potential product, i.e. the identification of the phase of the economy, and the determination of the sensitivity of budgetary items to change in the output gap. In this approach, the cyclical changes in economic activity in a given year are fully reflected in the computation of the cyclical component of the budget balance.

By contrast, the ECB's approach works not with potential output, but with the trends in relevant macroeconomic variables linked to the revenue and expenditure components of the budget ("macroeconomic bases"). Specifically, these bases comprise compensation of employees, employment, household consumption and operating surplus in the corporate sector. The first step in the computation of the cyclically adjusted balance by this method involves determining the cyclical positions of the individual macroeconomic bases on the basis

of the difference between the actual value and the trend value obtained using the Hodrick-Prescott filter. The second step involves quantifying the effect of the cyclical position on the relevant budget variable by means of the tax/expenditure elasticity estimated in advance and then summing the individual cyclical components. Three of the five macroeconomic bases used are labour market variables, and economic shocks affect the labour market with a time lag and hence do not reflect changes in GDP immediately. In this approach, therefore, changes in economic activity – especially when they are sharp fluctuations – show up in the cyclical component of the budget balance only partially or with a lag.

The two approaches naturally provide somewhat different results. When interpreted correctly, however, they are sufficient to identify the basic characteristics of fiscal policy and the main trends in public budgets.

### **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 and unsuccessful arbitrations.

In addition to the aforementioned mandatory expenditures, there are 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 an 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 Public finance sustainability**

The extrapolation of sustainability was taken from the publication "The 2012 Ageing Report: Economic and Budgetary Projections for the EU-27 Member States (2010–2060)" (European Commission, 2012c).

## 2.2 LABOUR MARKET FLEXIBILITY

### 2.2.1 Unemployment and internal labour market flexibility

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

The **Beveridge curve** is an instrument frequently used to differentiate between cyclical and structural unemployment. It expresses the dependence between vacancies and the number of unemployed persons. A decreasing (increasing) number of unemployed persons amid a rising (falling) number of vacancies is associated with cyclical changes, whereas simultaneous movements of the two variables in the same direction signal structural changes. Data on the number of unemployed persons and vacancies are from the Ministry of Labour and Social Affairs (MLSA). The numbers of employees converted into full-time equivalents are from a quarterly CZSO survey.

**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 II or NUTS III) and the evolution of the coefficient of variation over time can be used for comparison. The source of the data is Eurostat.

The CZSO publishes the volume of **internal migration** (movement between municipalities). Data on registered internal migration in other countries are published in statistical yearbooks. In the Czech Republic, migration of foreigners with long-term residence (over 1 year) is included in the statistics.

### 2.2.2 Estimate of structural unemployment using the NAIRU

The NAIRU analysis presented in the main part of the text focuses on the medium-term NAIRU concept,<sup>103</sup> which defines the NAIRU as the equilibrium rate towards which unemployment converges in the absence of temporary supply shocks once the dynamic adjustment of inflation to previous shocks is completed. A semi-structural approach using the Kalman filter is applied (Richardson et al., 2000; Szeto and Guy, 2004).

The estimate of the NAIRU as an unobserved variable is based on the assumption that stable inflation (i.e. inflation equal to inflation expectations) means, *ceteris paribus*, a rate of unemployment equal to the NAIRU. However, rising (falling) inflation indicates a shift in the unemployment rate below (above) the NAIRU. The basic model equation captures the relationship determined by the Phillips curve, modelling inflation as a function of lagged inflation, the deviation of unemployment from the NAIRU and two variables helping to explain short-term supply shocks. The next equation specifies the process generating the NAIRU time series, which is assumed to follow a random walk process. Inflation expectations are not modelled endogenously. Lagged inflation was used to proxy for inflation expectations. Short-term supply shocks are captured using import prices and oil prices. These two variables help explain short-term movements in inflation, which allows us to estimate the NAIRU compatible with non-rising inflation in the absence of such temporary supply shocks. The unemployment

<sup>103</sup> The OECD distinguishes three different NAIRU concepts according to their time frame. Short-term and long-term NAIRU concepts exist in addition to the medium-term NAIRU. The short-term NAIRU is the rate of unemployment consistent with stabilising the inflation rate at its current level in the next period. The long-term NAIRU is the equilibrium rate of unemployment corresponding to a long-term steady state, once the NAIRU has fully adjusted to long-term and short-term supply shocks and economic policy influences.



gap, i.e. the difference between the unemployment rate and the NAIRU, can be regarded as representing demand pressures in the equation.

$$(\pi_t - \pi_t^e) = \alpha(\pi_{t-1} - \pi_{t-1}^e) + \beta(u_t - u_t^*) + \gamma\Delta x_t + \varepsilon_t, \quad \varepsilon_t \sim N(0, \sigma_\varepsilon^2),$$

$$u_t^* = u_{t-1}^* + v_t, \quad v_t \sim N(0, \sigma_v^2).$$

In these equations  $\pi_t$  is inflation,  $\pi_t^e$  is expected inflation,  $u_t^*$  is the NAIRU,  $(u_t - u_t^*)$  is the unemployment gap and  $x_t$  represents short-term supply shocks.

Determining the volatility of the NAIRU is an important part of the estimation. The smoothness of the estimated NAIRU series is determined by the variances of the residuals in the two equations above (Phillips curve, random walk) and the relationship between those two variances. The larger is the ratio of the NAIRU variance to the inflation variance, the more volatile is the estimated NAIRU series, i.e. the unemployment gap explains almost the entire variance in inflation. By contrast, a low ratio of the variances means that the estimated NAIRU changes very little over time. The ratio of the estimated standard deviations is roughly 1:5.

### 2.2.3 International labour mobility

International mobility is assessed using foreign migration and the proportion of foreigners in the population. The source of the data on registered international mobility for individual countries (immigration and emigration) and the proportion of foreigners in the population is Eurostat.

### 2.2.4 Institutional environment

#### Minimum wage

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

#### Labour taxation

**Overall labour taxation** (the tax wedge) is defined as social security contributions paid by employees and employers and income taxes relative to overall labour costs. This indicator is calculated in line with the applicable tax legislation for model types of households. The data are from OECD.

The average effective tax burden is described by **implicit tax rates**, which are calculated as ratios, with the numerator containing the sum of aggregate revenue from direct taxes (in some countries also indirect taxes paid by the employer) and social contributions paid by both employees and employers, while the denominator comprises total compensation of employees (data under ESA 95 methodology). The disadvantage of this indicator is that it is dependent on the business cycle. Inflation and real income growth increase the tax component of implicit tax rates where the income tax is progressive. Social contributions, which are usually degressive with rising income, can have the opposite effect. The overall effect of the cycle on implicit rates depends on which of the two factors is dominant. The data on implicit tax rates are taken from Eurostat.

The **components of labour taxation** give the decomposition of labour costs into income tax and the contributions paid by employees and employers. The source of the data is OECD.

### 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 incentive for 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 unchanged in both cases. NRRs only identify 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.

The data on net replacement rates (NRRs) are taken from OECD tax and 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 for the Czech Republic analysing the incentive to work on the basis of a comparison of total household income for families claiming unemployment benefits, parental allowances or caregiver allowances and for families with economically active members are calculated from individual household budget data for 2012 and 2013.

### 2.2.5 Rate of adjustment of wage growth to the business cycle

A measure of the cyclical components of the relevant variables. For the purposes of this section, the cyclical components are estimated using the Hodrick-Prescott filter. The standard smoothness parameter value for quarterly data, i.e.  $\lambda = 1,600$ , was chosen. The Christiano-Fitzgerald filter was used to test the robustness of the cycle estimates.

The correlations in the table take into account the potential phase shift, which may be up to six quarters. If we denote the cyclical component of output by  $Y_t$  and the cyclical component of unemployment by  $U_t$ , then we report the highest absolute value of the correlation  $\text{corr}(Y_t, U_{t+k})$ , where  $k \in \{0, \dots, 6\}$ . Analogously, we report the highest absolute value for the correlation between the cyclical components of output and wages.

## 2.3 PRODUCT MARKET FLEXIBILITY

### 2.3.1 Administrative barriers to entrepreneurship

**Administrative barriers to entrepreneurship.** The index of barriers to entrepreneurship is taken from the OECD Product Market Regulation Database, where it is a part of a broader OECD indicator assessing the degree of regulation on product markets. The index consists of individual items aggregated in three areas: administrative burdens on start-ups (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, antitrust exemptions for public enterprises, barriers in network sectors, and barriers in services).

The **rankings of countries in the area of starting or closing a business** are taken from the World Bank's Doing Business database. As regards starting a business, number of procedures, time (days), cost and minimum capital requirements in % of income per capita are taken into account. The area of closing a business includes data on time in years, cost in % of total assets and recovery rate in cents on the dollar.

### 2.3.2 Tax burden on businesses

The highest **statutory tax rates** are taken from Eurostat. **Implicit tax rates on corporate income**, defined as the ratio of total tax revenues to the potential tax base (national accounts data under ESA 95 methodology), are an additional indicator. The potential tax base is approximated using national accounts output and income statistics. In contrast to statutory rates, implicit tax rates take into account depreciation, amortisation and tax exemptions, hence they express the actual average effective tax burden on corporate income. Their disadvantage is that they depend on the business cycle. For example, a decrease in the statutory tax rate does not affect the implicit rates if it is offset by a broadening of the tax base. The data are taken from Eurostat.

## 2.4 THE BANKING SECTOR AND ITS SHOCK-ABSORBING CAPACITY

**Return on equity (RoE, %) and return on assets (RoA, %)** can be regarded as measures of the profitability of banking business, assessing its economic efficiency. They aggregate the results of the extent and diversification of banks' activities and the business risks undertaken.

**Non-performing loans (NPLs)/total loans (%)** – NPLs ("loans in default" in Czech accounting terminology) in gross book value 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. NPLs are loans that are classed as substandard, doubtful or loss loans.

**Capital adequacy (%)** – expressed as the ratio of a bank's capital to the corresponding coverage of unexpected losses from the risks it undertakes – assesses the outlook for the bank's financial situation and indicates its ability to cover potential future losses with capital. Capital adequacy is an aggregate indicator reflecting all activities of a 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.

The **ratio of deposits to loans provided** (deposits/loans to residents) expresses the extent to which loans provided are financed by deposits of private sector residents. Values of this indicator above 100% indicate that banks have a sufficient volume of deposits relative to the volume of loans provided and their long-term financing is thus less dependent on other sources.

The **external position of the banking sector** (net external assets in % of GDP) represents the difference between the external assets and liabilities of the domestic banking sector, indicating its degree of dependence on foreign sources.

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