

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

2016

Authors:	Kateřina Arnořtová	A, B
	Oxana Babecká Kucharčuková	1.1.4, 1.1.6
	Jan Babecký	1.2.5, Box 1
	Vojtěch Belling	D2
	Soňa Benecká	1.1.5, 1.1.7
	Jan Brůha	C, 2.2.5, Box 2
	Martin Gürtler	2.3.1, 2.3.2
	Tomáš Holub	A, B, 1.1.1
	Eva Hromádková	1.1.2, 2.1.3
	Luboř Komárek	D1, 1.2.5
	Zlatuře Komárková	1.2.5
	Petr Král	A, B
	Ivana Kubicová	1.2.2, 1.2.3
	Filip Novotný	1.1.8
	Lucie Matějková	A, B
	Renata Pařaličová	1.2.6
	Lukáš Pfeifer	1.2.1, 2.4
	Marek Rusnák	1.2.1, 2.4
	Luboř Růžička	2.2.1, 2.2.3, 2.2.4
	Branislav Saxa	1.2.4
	Pavel Soukup	2.1.1, 2.1.2, 2.1.3
	Radek Šnobl	1.1.3, 2.2.1, 2.2.3
	Jan Šolc	1.1.3, 2.2.2
	Martin Vojta	D2
	Mário Vozár	2.2.4
Editors:	Lucie Matějková	
	Kateřina Arnořtová	

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A INTRODUCTION

The Czech Republic has been participating automatically in the Economic and Monetary Union (EMU) since it joined the European Union and acquired the status of a Member State with a derogation from adopting the euro. It is not currently a member of the euro area, but has committed itself to joining and introducing the euro in the future. The balance between the benefits 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. This ability will be affected by the similarity of economic developments in the Czech economy with those in the euro area, since their 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. Its ability to adjust rapidly to asymmetric economic shocks will be another important factor.

The analyses of the Czech Republic's economic alignment with the euro area in 2016 have been drawn up in line with the Czech Republic's Updated Euro-area Accession Strategy of 2007. They 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 on an ongoing basis in response to new events in the European Union. 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, which may thus change over time for accession countries.

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. The countries under comparison either are euro area members already (Austria, Germany, Portugal, Slovakia and Slovenia) or are expected to join in the future (Hungary and Poland).¹ 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 statistical data. The values of the indicators for the euro area are defined at the EA19 level.²

¹ 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.

² The EA19 comprises the euro area Member States: Austria, Belgium, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia and Spain. Only in exceptional cases, owing to data unavailability, does the analysis not cover all EA19 countries. The euro area as a whole is abbreviated as EA in the tables and charts; unless indicated otherwise in a note, this refers to the EA19.

B 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 the 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 thus influence whether adoption of the euro by the Czech Republic will lead to an increase in the country's economic stability and performance.

Recent developments in the **euro area** continue to point to misalignment within the monetary union and continued divergence between southern periphery countries and euro area core countries. 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 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). In recent years, the euro area has in some respects set itself apart as a single block from the EU countries that have not yet adopted the euro.

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. Empirical analyses for the euro area based on the optimum currency area endogeneity hypothesis, according to which changes leading to an optimum currency area will be the automatic result of the very introduction of the single currency, yield mixed results. Some studies find growth in the economic alignment of euro area countries, while others find that developments in some countries continue to be affected by domestic shocks. The single monetary policy thus does not seem optimal for all countries, since it may be too restrictive for the less competitive countries without the option to weaken the exchange rate. Conversely, it may be too easy for countries with high competitiveness and rising prices of assets. These factors, combined with other effects, have been reflected in the euro area in rising misalignment in a whole range of indicators, for example long-term interest rates and unemployment. Although the situation in the euro area has recently improved somewhat, 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 the economic and structural similarity between the Czech economy and the euro area, and 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 the economic structure to the euro area, including the 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. As in previous years, 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 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 benefits of euro adoption, such as a reduction in transaction costs and the elimination of exchange rate risk. At the same time, strong trade integration reduces the potential costs associated with adopting the single monetary policy and has therefore long been one of the most significant arguments for the Czech Republic joining the euro area. The strong trade links

with the euro area are also fostering a high degree of alignment of the Czech business cycle with the euro area. A favourable factor is long-term alignment of inflation and nominal interest rates with the euro area. The Czech banking sector is not a barrier to joining the euro area either. It is stable and resilient to economic shocks, and it does not prevent the transmission of monetary policy to the economy from being similar to that in the euro area.

The second group contains **areas where convergence was disrupted by the crisis, but where an improvement has been recorded again in the following years.** These include the real economic convergence of the Czech Republic to the euro area, which halted during the crisis but has resumed since 2014. GDP per capita (converted using common purchasing power parity) slightly exceeded 80% of the euro area average for the first time in 2015. However, there remains considerable room for long-term economic convergence. Gradual stabilisation of financial markets and renewal of their alignment with the euro area have also been observed in recent years. An improvement has also been recorded for fiscal policy, where the general government structural deficit decreased markedly in 2010–2015. Compliance with the medium-term budgetary objective (MTO) in previous years is improving the ability of fiscal policy to fulfil its macroeconomic stabilisation role going forward.

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.** This includes long-term convergence of the price level, whose previous convergence towards the euro area halted in 2009. After euro adoption, the expected gradual renewal of the convergence trend would not be able to take place via appreciation of the exchange rate and would result in a positive inflation differential compared to the euro area average. This would lead to pressure for a further drop in equilibrium real interest rates, potentially to negative levels, which, in turn, could contribute to creating macro-financial imbalances.

The fourth group contains **areas which are showing long-term problems or misalignment and which, moreover, are not showing any significant improvement.** This group traditionally includes population ageing, which – not only in the Czech Republic – poses a risk to the sustainability and stabilisation function of public finances. The functioning of the Czech labour market is comparable to that in other EU Member States and has been showing signs of greater flexibility in recent years. However, it still has weak points, in particular relatively high overall labour taxation and relatively low labour mobility. The flexibility of the Czech product market has improved slightly, but is still being hampered by some administrative barriers. Quality of institutions (including enforceability of law), infrastructure and innovation remain weaknesses. Significant differences vis-à-vis the euro area persist in the structure of the Czech economy, which is characterised by a high share of industry and a relatively low share of services. Some differences also remain in the degree of financial intermediation and the structure of financial assets and liabilities of non-financial corporations and households. 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 Economic and Monetary Union. 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 smooth functioning of the monetary union. The persisting misalignment of economic performance across countries thus raises the question of whether it is optimal for the monetary union to exist in its current composition. The differences in GDP growth rates widened in 2008–2009 in

connection with the global economic crisis and in 2012 during the recession in the euro area as individual economies were hit in different periods and to different extents. GDP growth rates have been showing a modest convergence trend since 2013. Heterogeneity across euro area countries is also apparent in the labour market, where the differences in unemployment rates widened after 2009 due to the debt crisis. Although these differences have gradually been decreasing since mid-2013 as most economies have been recovering, they remain well above the pre-crisis level. Misalignment in the inflation rate in the euro area increased only temporarily due to the crisis in 2008–2009, but the current inflation convergence at very low or even negative levels cannot be regarded as a positive trend, as it represents a risk to the economic recovery and complicates the resolution of the debt problems of the southern periphery countries. Inflation in the euro area as a whole is currently well below the ECB's definition of price stability and more than a third of the euro area countries are facing deflation. As from the end of 2009, large divergence was also seen for long-term interest rates. This reflected the different magnitudes of the debt problems across euro area countries. This misalignment decreased at the end of 2012 following the announcement of the ECB's preparedness to take measures to protect the euro area, but the differences increased again in 2015. The fiscal criteria laid down in the Treaty on the Functioning of the EU are at present met only by five of the nineteen countries. The countries on the southern periphery of the euro area are still especially afflicted by fiscal problems, and their budget imbalances are linked with general macroeconomic and financial instability, which is hindering their economic growth.

The debate in the European Union and particularly in the euro area about **deepening Economic and Monetary Union** (EMU) and the future course of European integration was affected by the UK referendum and new security and social challenges in 2016. The result of the Brexit referendum, in which a majority of UK citizens voted in favour of the country leaving the EU, raises many new legal, institutional and political issues. In the interests of deepening EMU, steps continued to be taken to establish a **banking union**, whose pillars consist of a Single Supervisory Mechanism (SSM), a Single Resolution Mechanism (SRM), which has been in full operation since 2016, and a Single Rulebook. The ratification of the related intergovernmental agreement (IGA) on the transfer and mutualisation of contributions to the Single Resolution Fund was completed in the first half of 2016. The European debate about insurance/resolution mechanisms (backstops) continued in 2016, but no agreement was reached on the form of the common European backstop. The political debate on possible participation in the banking union (the SSM/SRM) continued in the Czech Republic. This debate was based on an updated *Impact Study of Participation or Non-participation of the Czech Republic in the Banking Union* prepared under the leadership of the Ministry of Finance. In May 2016, the Czech government reaffirmed its decision not to join the banking union in the current situation and to review the issue of the costs and benefits of participation in the banking union on the basis of a further update of the impact study to be submitted by the end of 2017. The debate in the EU about simplifying the Stability and Growth Pact fiscal rules, whose complexity has increased significantly due to post-crisis reforms and whose enforceability remains weak, also continued into 2016. In November 2015, the Commission established an independent advisory European Fiscal Board tasked with evaluating the implementation of the EU fiscal framework.

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

A high degree of 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. The Czech economy was converging towards the euro area in real

terms until 2008, when this trend was halted by the financial and subsequently economic crisis. It resumed in 2013, and in 2015 the level of Czech economic activity slightly exceeded 80% of the euro area average for the first time. The price level relative to the euro area remains below the historical high reached in 2008 (71.1%; in 2015 it was 63%). Its post-2008 drop initially corrected the excessive appreciation of the koruna recorded in the pre-crisis period and in 2013–2014 reflected the weakening of the koruna due to the Czech National Bank's use of the exchange rate as an additional instrument for easing the monetary conditions. The wage level in the Czech Republic in 2015 was just under 37% of the euro area average when converted using the exchange rate and about 59% when converted using purchasing power parity. Looking to the future, it can be expected that the renewed convergence of economic activity will be again accompanied by further price and wage catch-up with the advanced euro area countries. Renewed equilibrium real appreciation of the koruna against the euro can thus be expected, albeit probably at a lower pace than before the crisis. This is likely to take place partly via a slightly positive inflation differential vis-à-vis the euro area average. Euro adoption within the next five years would further increase the inflation differential and could lead to inflation rising noticeably above the current 2% target. This would result in lower real interest rates compared to the euro area average and related risks to macro-financial equilibrium.

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 a sustained high degree of alignment of the Czech Republic with the euro area in terms of overall economic activity, even when adjusted for the strong common external shock in the form of the global financial and economic crisis.

The alignment of the **cyclical component of unemployment**, defined as the difference between the actual unemployment rate and its estimated equilibrium level, is also relatively high in the case of the Czech Republic. In this respect, the single monetary policy of the euro area would therefore not necessarily imply increased costs for the Czech economy.

Similarity of the **structure of economic activity** with the euro area should reduce the risk of asymmetric economic shocks. The differences in the structure of the Czech economy compared to that of the euro area, consisting in a higher share of industry and a lower share of services, are not decreasing. For the Czech Republic, this may mean a higher risk of asymmetric shocks to which the potential single monetary policy will not be able to respond in full. Structural misalignment may thus pose a risk as regards adopting the single currency.

Fast convergence of **nominal interest rates** in connection with joining the euro area acted as an asymmetric shock in some countries in the past, generating macroeconomic imbalances and risks to financial stability. Smooth euro area entry should therefore be preceded by nominal interest rate convergence, which should be gradual and based on fundamentals. The difference between Czech and euro area market interest rates has long been very small due to sustained low and stable inflation. It did not increase significantly even during the financial turbulence episode in 2009 or during the euro area debt crisis in 2012. Consequently, there is no risk of euro adoption leading to a rapid fall in nominal rates and related emergence of macroeconomic imbalances. This also indicates that financial markets view the Czech Republic's government debt situation as sustainable.

The **exchange rate** of the koruna against the euro and dollar, as well as its volatility, has been fundamentally affected since November 2013 by the Czech National Bank's use of the exchange rate as an additional instrument for easing monetary policy. Following the announcement of the exchange rate commitment, 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 that of the euro against the dollar. Even in the previous period, however, this correlation was the highest and most stable by comparison with the currencies of

the Central European region. The **volatility of the exchange rate** of the koruna against the euro has been relatively low and stable (except during the crisis), 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 Czech economy's strong **trade and ownership links** with the euro area increase the benefits of eliminating potential fluctuations in the exchange rate and reducing transaction costs. The euro area is the destination for about 65% of Czech exports, the highest level among the countries under comparison, and the source of about 60% of Czech imports. The share of intra-industry trade is relatively high as well. The ownership linkages in the Czech economy, as measured by the ratio of foreign direct investment from the euro area to GDP, are the highest among the countries under comparison. The ownership linkages in the other direction (i.e. investment in the euro area) in the Czech Republic are the highest among the new Member States, but are still low relative to the old EU Member States.

The **financial sector** in the Czech Republic is still significantly smaller than that in the euro area, and this difference increased further in 2015. The depth of financial intermediation in the Czech Republic, as measured by the ratio of financial institutions' assets to GDP, is less than half of that in Germany and only one-third of that in the euro area. However, the depth of financial intermediation in the euro area should not be regarded as a target, as the financial crisis highlighted the risk of having an excessively large financial sector. The shallower financial intermediation in the Czech Republic is mostly due to lower private sector debt. Nevertheless, gradual deleveraging of the private sector is taking place in the euro area (from 160% of GDP in 2011 to 139% of GDP in 2015), while the debt ratio is increasing slightly in the Czech Republic (from 58% of GDP to 59% of GDP in the same period).

The **structure of the financial assets and liabilities of Czech non-financial corporations and households** is similar overall to that of euro area entities, but still shows some differences, which could contribute to the single monetary policy having different impacts. Compared to advanced euro area countries, loans have a lower weight in the net debtor position of Czech corporations, while the weight of shares and other equity is higher due to a far lower proportion of shares in financial assets (a lower rate of corporate investment in other non-financial corporations). The net debtor position of Czech corporations fell between 2008 and 2016, mainly reflecting subdued growth in liabilities and faster growth in financial assets. Corporations in the Czech Republic have the highest levels of highly liquid assets as a percentage of GDP relative to the other countries under comparison. Due to higher issuance of securities in previous years, the ratio of liabilities in the form of securities to GDP is almost comparable with that in the euro area. The net creditor position of Czech households is about half that in the euro area. Moreover, as in the case of corporations, there are persisting differences in structure. On the liability side, the debt ratio of Czech households is half that in the euro area. On the asset side, there persists – despite slight convergence – an inverse ratio of the liquid to the investment component of household portfolios, with the liquid component dominating in the Czech Republic and the investment component dominating in the euro area.

A similar function of the interest rate channel of **monetary policy transmission** across the countries of the monetary union is a prerequisite for successful functioning of the single monetary policy. The effect of monetary policy rates on client rates in the Czech Republic does not differ greatly from that in the euro area. Rate transmission is fast, more than half of it taking place within one month. The global financial crisis led to a temporary weakening, or slowdown, of the transmission of monetary policy rates in the Czech economy 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. The spread between rates on new loans to non-financial corporations and the monetary policy rate in the Czech Republic is comparable to that in the

euro area. However, its components, expressing various aspects of financial risk differ, due mainly to persisting problems in some euro area countries. The structure of interest rate fixations on new loans to non-financial corporations in the Czech Republic is similar to that in the euro area. Mortgage loans in the Czech Republic are dominated by loans with fixations of over one year and up to five years, while in the euro area longer fixations are more common; however, this is not a significant difference in terms of future adoption of the euro.

Differences in **inflation persistence**, i.e. the speed at which inflation returns to equilibrium after a shock, can result in the single monetary policy having different impacts in the individual countries of the monetary union. Inflation persistence in the Czech Republic has been around or slightly below the average among the countries under comparison over the past ten years. 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 economy after euro adoption.

As in previous periods, the analysis of **alignment on 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. In 2009, the situation in the Czech financial markets started to return gradually to the pre-crisis degree of alignment of the markets under review. However, this trend is currently being affected by active central bank policy and measures.

The degree of **euroisation** in the Czech Republic has been gradually rising but remains relatively low, due mainly to high confidence in the macroeconomic and institutional environment. The use of foreign currency is concentrated in the sector of firms operating in the real estate services sector and in industrial corporations, where it is associated with trade integration with the euro area and where foreign currency loans have thus long been used as a form of natural hedging against exchange rate risk. Relative to the other countries in the region, Czech households' demand for foreign currency loans and deposits remains low. Czech households have a negligible amount of foreign currency loans.

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 general government balance is to zero and the lower is the general government 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. Fiscal policy had the desirable countercyclical nature in 2009, when government anti-crisis measures were adopted, and again in 2014–2015, when a fiscal policy easing helped the economy recover and boosted economic growth. By contrast, the fiscal consolidation launched in 2010 significantly reduced the budget deficits, albeit at the cost of a procyclical restrictive effect of fiscal policy and an economic downturn in 2012 and 2013. Overall, however, the structural deficit recorded a marked decrease in 2010–2015, culminating in compliance with the **medium-term objective** (MTO) in previous years. Meeting the MTO 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.

The Czech Republic's total **general government debt** is low compared to that of many EU countries. However, coping with population ageing, especially in the pension and health systems, will be of key importance for its sustainability. The relatively high share of mandatory expenditures, which are time-consuming and politically challenging to change, is also a risk.

Although compliance with the fiscal convergence criteria can be expected in the years ahead and the preparedness to enter the euro area has significantly improved in this respect, the functioning of fiscal adjustment mechanisms remains in some respects a possible limiting area in the assessment of the Czech Republic's ability to adopt the euro.

The **labour market** is another important mechanism through which the economy can cope with asymmetric shocks in the absence of independent monetary policy. The Czech Republic has seen a slight rise in labour force flexibility over the last ten years, manifested, among other things, in greater use of shorter working hours in response to the recession. A low long-term unemployment rate, a low and falling NAIRU and a high rate of economic activity of the population relative to the other countries under review can also be viewed as positive. Regional differences in unemployment are also gradually falling again. The weak points in the Czech labour market still include relatively low regional and international labour mobility.

Labour market flexibility is also significantly affected by **institutional rules on the labour market**. One of them is the minimum wage, whose ratio to the average wage is gradually rising in the Czech Republic but is still one of the lowest among the countries under comparison. The minimum wage may thus have an adverse effect on wage flexibility mainly in low-skilled jobs, where it makes up 95% of the average wage. Overall labour taxation in the Czech Republic is relatively high and has risen slightly further in the last year. The financial incentives to work arising from the configuration of taxes and social benefits remain relatively low in the Czech Republic, especially for the initial phase of unemployment of childless individuals and, compared to some countries, also for the long-term unemployed from families with children. Protection of regular employment is still relatively high, while protection of temporary jobs is relatively low. Labour market regulation in the Czech Republic is thus comparable to that in European countries, which are, however, among the least flexible by international comparison.

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. Firms in the Czech Republic adjusted their wage bill in response to the drop in demand in the post-crisis years more often than firms in the euro area, in particular by reducing bonuses and benefits in addition to indexing and freezing wages. Given the above-average share of flexible wage components in the total wage bill, this indicates the possibility of some substitution between base wage and flexible wage component flexibility at the firm level in the Czech Republic.

Although the Czech Republic's position in the area of **product market flexibility** improved slightly compared to the previous year, its business environment is more burdened by administrative and regulatory barriers than those in the other countries under comparison. The Czech Republic's ranking as regards barriers to growth and competitiveness is unchanged since 2006. Its score for factors affecting economic growth is relatively good, but quality of institutions (including enforceability of law), infrastructure and innovation remain weaknesses. These shortcomings in the business environment reduce product market flexibility.

Stability and effectiveness of the **banking sector** play a key role in the economy's ability to absorb shocks. By contrast, an unsound banking sector can generate shocks and propagate them to the real economy. It can also cause problems in the fiscal area. Thanks to sufficient capitalisation and operating profits, the resilience of the Czech banking sector to adverse shocks is high and domestic banks thus should be able to withstand potential large credit losses. The quality of the loan portfolio has improved a little recently. Risks are linked with the implementation of the banking union project, which the Czech Republic would automatically join upon euro adoption. These risks are due to the transfer of some powers to the EU level without transfer of responsibility for the overall condition of the national financial sector.

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**,³ which examines whether 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 the adoption of the euro by the existing euro area countries and the rationality 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 economies concerned. The main benefits are improved functionality of money and reduced trade costs, including in particular the elimination of exchange rate risk and the costs of hedging against it, as well as lower transaction costs and easier-to-compare prices. Further benefits may potentially arise from 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.⁴

The costs are broken down into non-recurring ones, associated with the change of legal tender,⁵ 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 the exchange rate 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,⁶ 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 mechanisms.⁷ 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.

³ Mundell (1961), McKinnon (1963) and Kenen (1969) are regarded as the cornerstones of this theory. A newer literature survey can be found, for example, in De Grauwe (2013). Also worth mentioning is Dellas and Tavlas (2009), who describe the history of the optimum currency area theory over the last fifty years, including the contributions of modern macroeconomic models. Beetsma and Giuliodori (2010) is a recent overview relating specifically to the euro. Unlike the other studies, it mentions the elimination of the risk of currency wars (competitive devaluations) as one of the benefits of the single currency.

⁴ The enhanced macroeconomic stability should facilitate a low and relatively stable interest rate level and a higher level of investment. 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, recent developments have shown 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.

⁵ The non-recurring costs include the physical exchange of money, the conversion of all contracts to the new accounting unit and so on. In the context of transition to another currency, there is also a risk of incorrectly setting the conversion ratio, as an overvalued exchange rate may damage the competitiveness of the economy in the long term, while an undervalued exchange rate may generate inflationary pressures.

⁶ A fundamental study in this area is Farrant and Peersman (2006), who, on a panel of advanced countries data, find evidence that the exchange rate is a source rather than an absorber of real shocks. Similarly, Alexius and Post (2008) find that exchange rates are disconnected from real shocks and are thus not an absorber of real shocks. By contrast, Audzei and Brazdik (2015a) (for Czech data) and Audzei and Brazdik (2015b) (for data of Central European countries) conclude that the exchange rate operates as an absorber rather than a generator of shocks. Skořepa and Komárek (2015) arrive at a similar conclusion.

⁷ For new EU members planning to join the euro area, another possible cost is fulfilment of the Maastricht criteria prior to euro adoption, especially the price stability criterion. A potential cost for converging countries is a persisting inflation differential (Brůha and Podpiera, 2007), which may be reflected in a rise in nominal client rates and a fall in real client rates and may adversely affect the economy (examples for individual countries can be found in the following papers: Ahrend et al. (2008), Martin (2010), Hampl and Skořepa (2011) and Lin and Treichel (2012)).

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.⁸ However, knowledge of the theory of optimum currency areas can also 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 (compared to a free nominal exchange rate) make up the set of **optimum currency area properties**.⁹

One of the key properties determining the appropriateness of joining a currency area is the degree of 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. However, empirical studies have not produced robust conclusions regarding the impact of the introduction of the single currency on trade.¹⁰

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**.¹¹ 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. Some papers add to the traditional criteria democratic legitimacy and economic agents' trust in central institutions and their policies.¹²

An important role in the theory of optimum currency areas was played by the **endogeneity hypothesis**,¹³ which holds that changes leading to an optimum currency area will be an automatic result of the very introduction of the single currency. However, it should be noted that greater integration does not necessarily mean convergence of economic structures. On the contrary, the elimination of trade or financial barriers may lead to growth in specialisation, which may increase the probability of asymmetric shocks.¹⁴ That said, increased specialisation need not be undesirable for macroeconomic stability and welfare in the monetary union. On the contrary, it may increase the intensity of trade and hence amplify the benefits of the single currency.¹⁵ Stronger trade integration may result in greater alignment of business cycles.¹⁶

The conclusions of **empirical analyses for the euro area** are mixed. On the basis of pre-crisis data, the review article by De Grauwe and Mongelli (2005) finds support primarily for the

⁸ Eichengreen (2008) and Spolaore (2013).

⁹ Mongelli (2002).

¹⁰ The original literature was fairly optimistic as regards the effects of the single currency on trade. Rose (2000), for example, found effects amounting to hundreds of per cent. Micco et al. (2003) report estimates that are much lower (a few per cent), but are statistically significant. However, some later estimates – such as Baldwin (2006) – are far more sceptical, and Havránek (2010) even finds in a meta-analysis that the effect of euro adoption on trade between euro area countries is not statistically significant and with high probability is less than 5%. Glick and Rose (2015) revised the original study by Rose (2000) and showed that the results of that study are too sensitive to the econometric specification of the model. Conversely, selected newer literature returns to positive, albeit much more modest estimates than the original study by Rose (2000) (for instance, Gavin and Siedschlag, 2011, find a statistically significant effect for Ireland; the estimates are consistent with the results of Micco et al., 2003). Furthermore, Bergin and Lin (2012) present evidence that the effects of the single currency on trade may be visible before euro adoption and this should be taken into account in empirical studies. The differences between the results of individual studies and the sensitivity of those results to econometric assumptions thus indicate that the impact of the monetary union on trade cannot be reliably estimated at present, as stated by Glick and Rose (2015).

¹¹ De Grauwe and Mongelli (2005).

¹² Mongelli (2013)

¹³ Frankel and Rose (1998).

¹⁴ Krugman (1993) and Kalemli-Ozcan et al. 2003.

¹⁵ Hughes-Hallett and Piscitelli (2002) show that this effect occurs if the convergence in institutional structures and the symmetry of shocks are sufficient.

¹⁶ Frankel and Rose (1997).

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 amid rising trade integration. Similarly, Giannone and Reichlin (2006) and Stavrev (2008) find the significance of common shocks to be decisive in explaining the dynamics of economic output. Studies covering the crisis period typically arrive at the opposite conclusion. For example, Ferroni and Klaus (2015) find that macroeconomic fluctuations in Spain are caused by domestic shocks and diverge from those in Germany, France and Italy, where common shocks dominate. Similarly, Cavallo and Ribba (2015) conclude that economic fluctuations in three large euro area countries (Germany, France and Italy) are due significantly to common shocks, while those in small countries (Ireland, Portugal and Greece) are explained by domestic shocks. On the other hand, Crespo-Cuaresma and Amador (2013) find that, even for the period covering the crisis, the euro area has shifted to a new equilibrium with less misalignment of business cycles compared to both historical data and other OECD countries.

Different transmission of the single monetary policy in different currency area countries can also be a significant source of asymmetric effects. Again, there is currently no satisfactory agreement among empirical studies in this area. Jarocinski (2010) concludes that monetary policy transmission is similar in new and old euro area countries. Similarly, Cavallo and Ribba (2015) find evidence for a homogeneous response to monetary policy shocks in euro area countries. On the other hand, Havránek and Rusnák (2012) show that monetary transmission is faster in countries with more advanced financial markets. This is confirmed for the euro area by van Leuvensteijn et al. (2013), who find differences arising from differences in the structure of banking sectors in individual countries. Georgiadis (2015) finds differences in the reaction to monetary policy and contributes them to differences in labour market regulation. Barigozzi et al. (2014) find convergence in responses to monetary shocks in euro area countries, but assert that this convergence is not complete yet and major differences persist across countries.

Duran and Ferreira-Lopes (2015) explore the **determinants of business cycle alignment** in the euro area, concluding that trade aligns business cycles while differences in labour market regulation act in the opposite direction. Similarly, Inklaar et al. (2008) find support for the assertion that trade increases cycle synchronisation, but this effect is not significantly greater than the effect of differences in fiscal and structural policies; those differences conversely reduce cycle alignment. Neither Giannone et al. (2009) nor Enders et al. (2013) find that introduction of the euro would significantly change the properties of business cycles, it is reasonable to assume that these contrary effects largely cancel each other out for euro area countries.

The above studies exploring the symmetry and transmission of shocks are typically empirical. However, there are also studies based on **structural macroeconomic models**. The currently most common modelling technique involves dynamic stochastic general equilibrium (DSGE) models. Ferreira-Lopes (2010) explores the costs of euro adoption for Sweden and the UK, concluding that the costs of euro adoption would outweigh the benefits in these countries. A general conclusion of the model analyses is that the costs increase as domestic demand shocks (fiscal shocks in particular) grow in importance and decrease as the degree of trade integration declines. Ferreira-Lopes (2014) simulates the costs of euro adoption in Central European countries using a DSGE model and 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 general conclusions of structural models are confirmed by an ex-post empirical study by Gomis-Porqueras and Puzzello (2015).

European Commission (2006) discusses the importance of the **impacts of euro adoption in the transition phase**. These include a fall in the risk premium, an easing of the credit

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 Lin and Treichel (2012) point out that an excessive decrease in long-term interest rates (compared to that implied by the Taylor rule under independent monetary policy) after the adoption of the single currency in some economies gave rise to bubbles in asset markets, property markets in particular. Overvaluation of the real exchange rate, identified for Greece and Portugal by El-Shagi et al. (2014), may also be a risk to macroeconomic stability. Similarly, Frankel (2008), despite supporting the endogeneity hypothesis in the euro area, considers the risk of asymmetric shocks in the transition phase to be substantial; on the other hand, alignment increases over time even without euro adoption.

A significant body of literature (e.g. De Grauwe, 2010a,b) critically examines the experience of the euro area during the crisis with regard to the importance of the **efficient operation of institutions**. Razin and Rosefielde (2012) point out that the main problem in the euro area during the crisis was weak political integration. This fact is also noted by Wyplosz (2012), who shows that fiscal rules can be effective if there is an institution to enforce them, even though that institution does not have to be a full fiscal union. 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. Similarly, a study by Neri and Ropele (2015) shows that the ECB's monetary policy helped reduce the impacts of the debt crisis even without fiscal coordination. However, Podpiera et al. (2015) argues that uncertainty about the future functioning of euro area institutions provides a rationale for new Member States to wait at least until the rules of operation of euro area institutions are clarified before joining the monetary union.

Also associated with the functioning of institutions are the **risks arising from high debt levels** in a large proportion of euro area countries, which may pose a risk to sustainable economic growth in the monetary union as a whole. 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 van Ewijk (2014) point out that the differences in rates on government bonds are a factor causing differences in credit conditions across euro area countries and are thus a risk to further convergence.

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 persisting different developments in the euro area countries raise the question of whether it is optimal or even sustainable for the monetary union to exist in its current composition of differently performing economies. Despite having met the Maastricht criteria prior to euro adoption, the euro area countries were and still are heterogeneous and in many respects less aligned than they were when the euro area was established. The recent debt crisis has added to this misalignment. The past years have seen some 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 positive, as it is taking place at low levels, dangerously close to the deflation band. This poses a risk to both economic growth and financial stability.

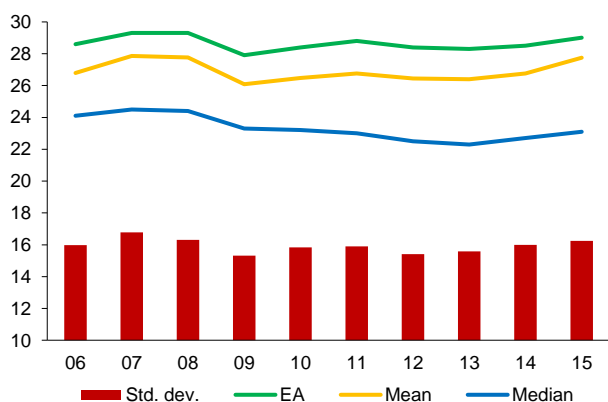
1.1 CONVERGENCE OF REAL AND NOMINAL VARIABLES

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

Chart 1 illustrates **real GDP per capita** and the differences in it across euro area countries over the past ten years. The high levels of the standard deviation and the differences between the median and the arithmetic mean reveal that the euro area member states have very different GDP per capita levels. The differences in economic performance between the member countries saw some fluctuations in the period under review but are currently slightly above the 2006 level and have been showing an upward trend since 2012.

In addition to descriptive GDP statistics, it is appropriate to look at the **rate of growth of individual 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. The faster growth in poorer economies is theoretically due to their higher growth potential, the adoption of technologies from wealthier countries and deepening trade integration within the monetary union. Chart 2 shows that the new euro area countries (especially Lithuania, Latvia, Slovakia and Estonia) have been showing beta-convergence in the longer run. On the other hand, there are euro area economies with high or quickly rising government debt (Greece, Cyprus and Spain) which should still be converging to the euro area core in conformity with the beta-convergence concept but whose debt problems are making it difficult for them. As a result, their economic level has decreased and they have diverged from the "most successful" euro area countries over the past ten years.

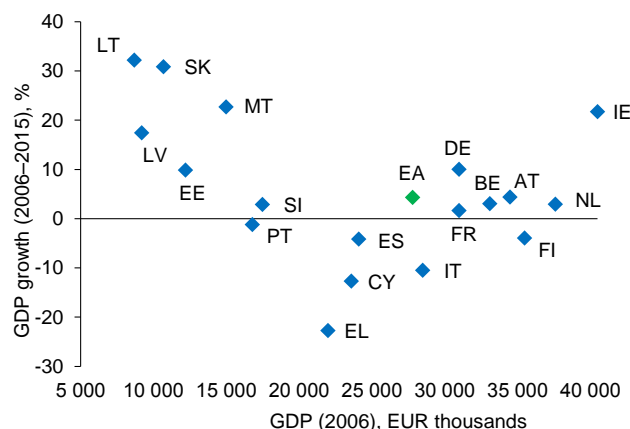
Chart 1: Real GDP per capita in euro area countries (EUR thousands)



Note: GDP at 2010 prices. The mean series depicts the unweighted arithmetic mean of real GDP per capita in the given year across euro area countries.

Source: Eurostat, CNB calculations.

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

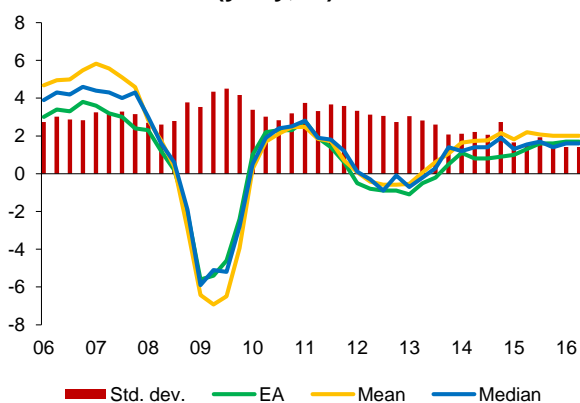


Note: The chart depicts the relation between GDP growth per capita in each country and its initial level (beta-convergence). X-axis – the GDP per capita of each country in 2006 at 2010 prices. Luxembourg is not given in the chart due to the high number of foreign workers in that country who are not Luxembourg citizens, which results in exceptionally high GDP per capita in the country.

Source: Eurostat.

The **standard deviation of the year-on-year GDP growth rates** in the economies under review at quarterly frequency decreased slightly in the period under review (see Chart 3). However, this is mainly a result of a slight downward trend since 2013; upswings were recorded during the recessions in 2008–2009 and 2012.

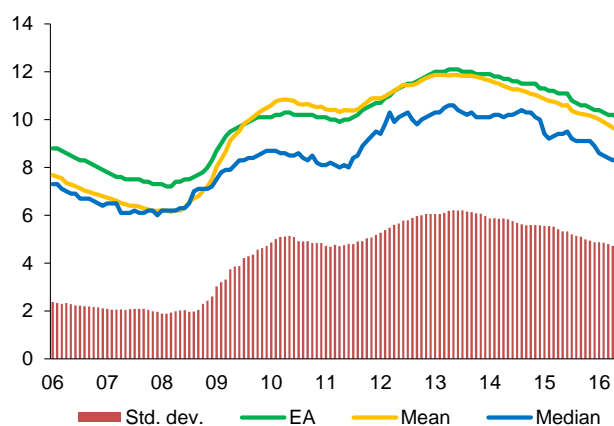
Chart 3: Real GDP growth in euro area countries (y-o-y, %)



Note: The mean series depicts the unweighted arithmetic mean of GDP growth in the given quarter across euro area countries. Data for Ireland were not included in the 2015 calculation due to inconsistency. The source series are seasonally adjusted.

Source: Eurostat, EIU, CNB calculations.

Chart 4: Unemployment in euro area countries (%)



Note: The mean series depicts the arithmetic mean of unemployment in the given month across euro area countries. The source series are seasonally adjusted.

Source: Eurostat, CNB calculations.

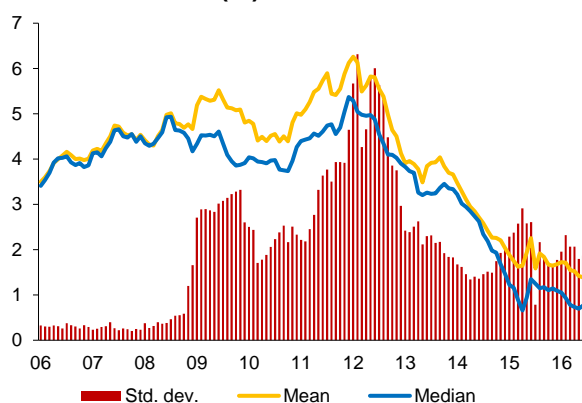
In the case of the **unemployment rate** (see Chart 4), the mean and the standard deviation declined in the pre-crisis period, mainly because of falling unemployment in the countries with

the highest rates (Slovakia, Latvia and Spain). During the financial crisis, however, unemployment rose in almost all countries and the rates in the hardest hit countries (Spain, Estonia, Slovakia, Ireland, Greece and Latvia) started to diverge upwards 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. Since mid-2013, unemployment rate misalignment has been declining and the mean rate decreasing as the economy has gradually been recovering. However, unemployment rates remain very mixed across countries – some countries are experiencing lower levels than before the crisis (Germany and Slovakia), while the unemployment rates in Greece and Spain still exceed 20%.

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 the evolution of competitiveness across economies. They also lead to differing real interest rates and thus differing monetary conditions in individual countries.

Long-term interest rates were at similar levels in the pre-crisis years (see Chart 5). In 2009, however, they recorded a surge in misalignment as the financial crisis hit individual monetary union member states to different extents and also due to the emerging debt crisis in the euro area. The differences 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. Both the mean and median yields have been showing a downward trend since the end of 2012. Although the yields recorded a temporary increase in 2013 after the Federal Reserve announced a planned tapering of its securities purchases, they have been declining since the end of 2013, due, among other things, to the ECB's government bond purchase programme. Long-term rates are currently at historical lows.

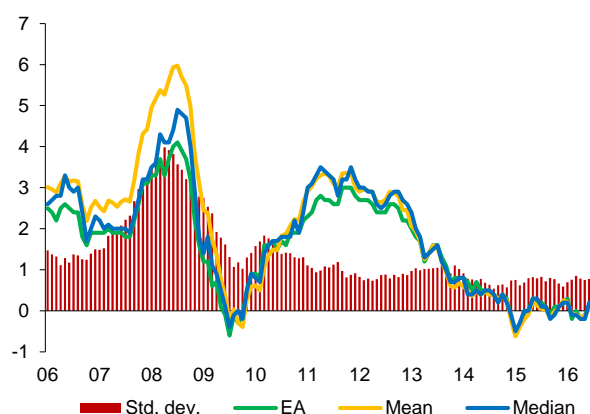
Chart 5: Long-term interest rates in euro area countries (%)



Note: Bond yields for the convergence criteria. The bond maturity is about ten years. Estonia is not included in the chart because the time series is not available.

Source: ECB, CNB calculations.

Chart 6: Inflation in euro area countries (y-o-y, %)



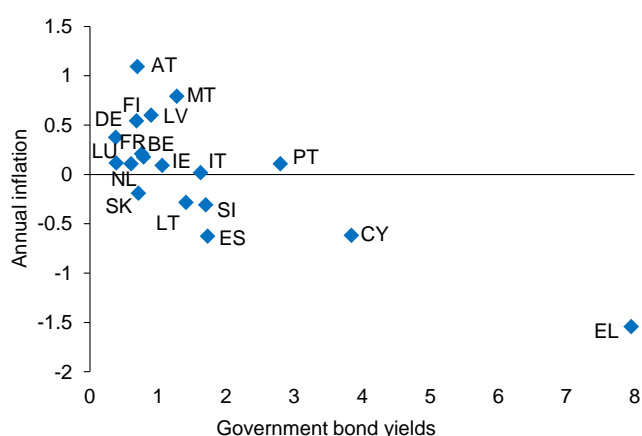
Note: The EA series is a weighted average of the inflation rates of the euro area countries, where the weights are the shares of household expenditure of the given countries in household expenditure in the euro area. The mean series depicts the unweighted arithmetic mean of inflation in the given year across euro area countries.

Source: Eurostat, CNB calculations.

As regards **consumer price inflation** (see Chart 6), relative alignment can be observed until 2007, followed by a temporary rise in misalignment ending with the onset of the financial crisis and subsequently the debt crisis. The decrease in economic growth was accompanied by a sharp fall in inflation, which, after a temporary increase before 2012, is showing a downward trend again, mainly because of a decline in oil prices. Inflation is currently well below the ECB's

definition of price stability in all euro area countries, and more than a third of the euro area countries are facing deflation, which is strongest in Greece, Cyprus and Spain. These low or even negative levels of inflation pose a problem for further convergence of euro area countries 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. Second, the observed low inflation differential of the core euro area countries vis-à-vis the southern countries means that the adjustment process and the return of the southern countries' price competitiveness (via internal devaluation) will be only gradual. This implies that high nominal convergence may prevent the renewal of real convergence.

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



Note: Average bond yields for convergence purposes and average annual inflation from July 2015 to June 2016. Ex post real yields are defined as the difference between nominal yields and inflation. Estonia is not included in the chart because the time series is not available.

Source: ECB, CNB calculations.

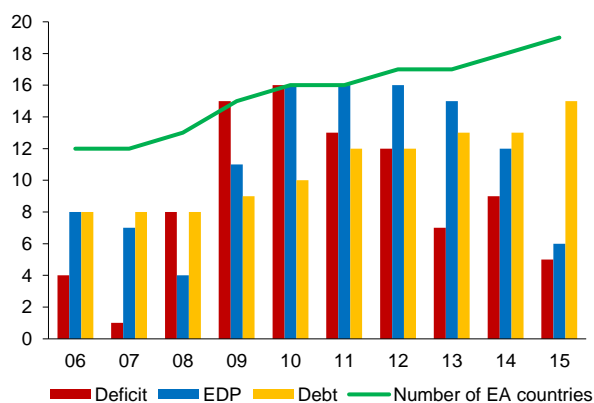
1.2 FISCAL POSITIONS OF EURO AREA COUNTRIES

For successful functioning of the monetary union without fiscal transfers among its members, it is important that individual governments have room to stimulate the national economy with fiscal expansion (i.e. government expenditure or tax cuts) in the event of negative asymmetric shocks. The **history of 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; see Chart 8) points to long-lasting insufficient fiscal discipline of individual EMU members, which is the main cause of the euro area's current problems. However, the last two years have seen an improvement, particularly as regards the deficit criterion, thanks to fiscal consolidation in previous years and to a recovery in growth in some economies. The EDP could thus be abrogated in six euro area countries in 2015.

Looking at the **fiscal positions** of the individual countries (see Chart 9), only five euro area countries are compliant with both the deficit and debt criteria, of which only Luxembourg is one of the founding countries of the EMU. 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, which is hindering their economic growth. Moreover, these countries' problems include very low inflation or deflation, which on

the one hand is necessary for restoring price competitiveness in the EMU, but on the other is further increasing the real value of their debt.

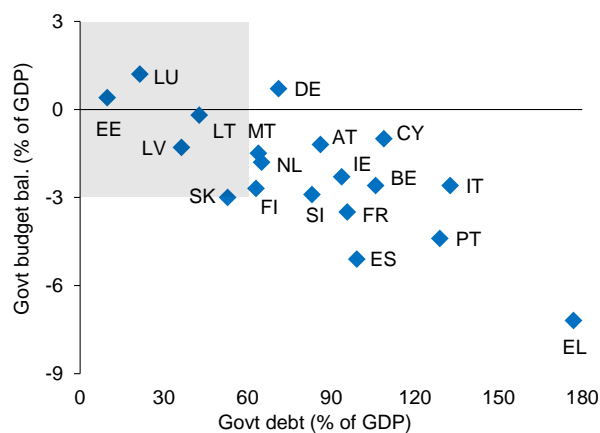
Chart 8: Non-compliance with the fiscal criteria



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 EDP 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 9: Fiscal positions of euro area countries (%)



Note: 2015 data. Countries compliant with the Stability and Growth Pact lie in the grey area.

Source: Eurostat.

An aggregate evaluation of the alignment of euro area countries from the perspective of cluster analysis

The individual indicators therefore reveal that major differences persist across the euro area. A comprehensive **cluster analysis** of the cyclical and structural alignment of euro area countries and Central European countries was offered in boxes in the 2014 and 2015 Alignment Analyses.¹⁷ Based on the analysis in these boxes, Chart 10 classes euro area countries into clusters according to six macroeconomic indicators (unemployment, GDP growth, inflation, long-term interest rates, government debt and government deficit) and shows the deviation of each indicator from the euro area average using different tile colours. The classification into clusters therefore sums up the information from all the above indicators.

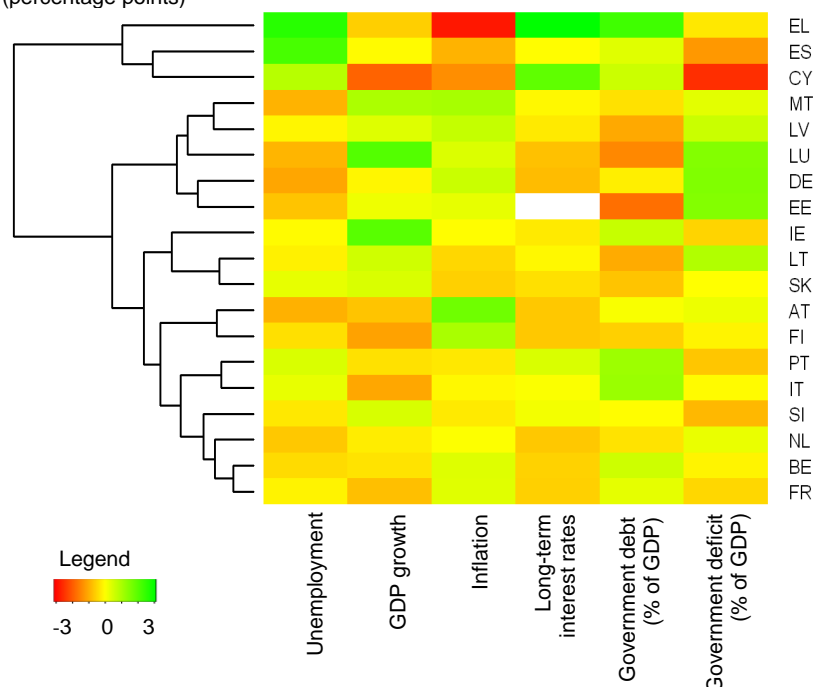
The southern countries (Greece, Spain and Cyprus) form a separate cluster and differ from the rest of the euro area in several respects. They show lower GDP growth and inflation and higher long-term rates and unemployment. Germany and some other countries, such as the Baltic states (Lithuania, Latvia and Estonia) have lower unemployment and interest rates and greater fiscal space amid average or above-average growth. The other countries, including France, Belgium and the Netherlands, are close to the euro area average in most parameters.

Overall, it holds that the problem of misalignment from the perspective of the cyclical and fiscal position persists within the euro area. The southern countries are still going through a process of adjustment and restoration of competitiveness, while the Baltic economies continue to benefit from the process of convergence.

¹⁷ *Economic alignment in euro area countries and the Central European region from the perspective of cluster analysis* (Box 1, Alignment Analyses 2014) and *Structural alignment of euro area countries and the Central European region from the perspective of cluster analysis* (Box 1, Alignment Analyses 2015)

Chart 10: Summary of key macroeconomic indicators in euro area countries

(percentage points)



Note: The tile colour indicates the country's deviation from the average indicator value for January 2015–June 2016. Red expresses a negative deviation (i.e. the indicator for the given country is lower than the average for the sample of countries) and green a positive deviation; indicators close to the average are shown in yellow. Countries are arranged into clusters according to indicators in the hierarchy shown on the left-hand side. No time series of long-term interest rates is available for Estonia.

Source: ECB, Eurostat, CNB calculations.

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

The euro area and EU Member States (except for Greece)¹⁸ recorded continued **economic growth** in 2016. Despite this recovery, however, the deflationary pressures and the resulting easy monetary policy of the ECB and other central banks persisted in the EU. Economic growth was supported by low prices of oil and other commodities and a weaker exchange rate of the euro. Uncertainty regarding the impacts of the Brexit decision, geopolitical developments (including the migration and refugee crisis), economic growth in emerging economies, high private and public debt in many EU Member States and persisting problems in the banking sectors of numerous EU countries (insufficient credit portfolio quality and weak profitability associated with the environment of low interest rates) acted in the opposite direction.

No major changes were recorded in economic policy coordination in the EU within the regular **European Semester** compared to previous years. Its sixth year opened in November 2015 with the 2016 Annual Growth Survey, which set out the EU's main economic and social priorities: (i) re-launching investment, (ii) pursuing structural reforms to modernise economies and (iii) responsible fiscal policies.¹⁹ At the same time, recommendations were published for

¹⁸ Greece recorded a decline in GDP, due, among other things, to capital controls and temporary high uncertainty regarding the country's stay in the euro area. This uncertainty peaked in summer 2015 and was subsequently staved off, at least temporarily, by the reaching of an agreement on a third bailout programme financed by the European Stability Mechanism (ESM).

¹⁹ European Commission (2015a).

the euro area as a whole. As in the past, these are focused on correcting macroeconomic imbalances, promoting competitiveness, employment and investment, reforming the labour market (including lowering labour taxation) and social protection, pursuing differentiated fiscal policy combining sustainability and support for growth and investment, and consolidating non-performing loans in banking sectors and improving insolvency proceedings.²⁰

The next step in the European Semester came in February 2016 with the publication by the European Commission of Country Reports for individual Member States. This was followed in April by national reform programmes and convergence/stability programmes drawn up by individual Member States. The Commission then issued a proposal for country-specific recommendations of the Council in the areas of economic and fiscal policy and employment policy, which were subsequently approved in July 2016.²¹ The downward trend in the number of recommendations for individual countries and more general formulations has continued also this year. The main **problem with the effectiveness of this system of economic policy coordination** is still the low rate of compliance with the recommendations, which are not legally binding as they fall outside the powers conferred on the EU. Efforts to provide for de facto enforceability by means of fines within the European Semester or within the EU's cohesion policy have so far proved unsuccessful.

As regards compliance with the fiscal rules laid down in the Stability and Growth Pact, the Council decided, on the basis of a Commission recommendation of 12 July 2016, that **Portugal and Spain** had not taken effective action in response to its recommendations on measures to correct their excessive deficits and also found that the fiscal effort made had fallen significantly short of what it had recommended in both cases. Based on this decision, the option of applying sanctions of up to 0.2% of GDP to the states concerned in accordance with the Treaty on the Functioning of the EU opened up for the first time.²² However, the Council agreed with the Commission's proposal to forgive both countries the full amounts of the fines and set new deadlines for reducing their budget deficits below 3% of GDP (the end of 2016 for Portugal and the end of 2018 for Spain).²³ The Commission also initially postponed the making of a proposal to the Council to suspend part of the commitments for the programmes related to the European Structural and Investment Funds (which it is obliged to submit if the Council finds that a Member State has not taken effective action to correct its excessive deficit but for which no specific time limit is set)²⁴ and eventually decided not to introduce it at all. Although some of the reasons given for waiving the penalty for non-compliance with the Stability and Growth Pact rules are understandable, the decisions taken certainly do not enhance its credibility.

A three-year adjustment programme for **Cyprus**, consisting of financial assistance from the EU and the IMF, was successfully completed in March 2016. Due to a faster-than-expected economic recovery, only EUR 6.3 billion from the ESM and EUR 1 billion from the IMF were paid, as compared to the originally agreed EUR 10 billion. Following complicated domestic and international negotiations in summer 2015, **Greece** also agreed to the launch of a third assistance programme of up to EUR 86 billion under the ESM.²⁵ Two tranches totalling EUR 31.7 billion have been paid to Greece so far. The provision of these tranches is conditional on an assessment of a reform package which the Greek government has pledged to

²⁰ European Commission (2015b).

²¹ Council of the EU (2016a).

²² Article 126(8) of the Treaty on the Functioning of the European Union.

²³ Portugal is required to reduce its budget deficit to 2.5% of GDP in 2016 and Spain to reduce its to 2.2% of GDP by 2018. See Council Decisions Nos. 11552/16, 11553/16, 11554/16 and 11555/16.

²⁴ Article 23(9)(a) of Regulation of the European Parliament and of the Council (EU) No. 1303/2013.

²⁵ The second bailout programme of March 2016 totalling EUR 144.7 billion under the EFSF, of which EUR 13.9 billion had been paid to Greece, ended on 30 June 2015. The country was also in arrears with the IMF as of the same date. Greece subsequently paid two past-due instalments of around EUR 2.016 billion using a EUR 7.16 billion bridge loan provided by the EFSM in July 2015. It was granted as an emergency measure until a third ESM bailout programme was agreed, which occurred on 19 August. The EFSM bridge loan was later repaid using the first tranche from the ESM in August 2015.

implement. This process is very slow. The second bailout tranche amounting to EUR 10.1 billion was therefore not approved until June 2016, when Greece again ran into problems meeting its current government expenditure commitments. Although the IMF was initially expected to be involved, as was the case with the previous two bailout programmes, a decision on its participation has yet to be made, mainly because of uncertainty about the sustainability of Greek government debt, which is a condition for IMF involvement.

The result of the UK **Brexit** referendum on 23 June, in which a majority of UK citizens voted in favour of the country leaving the EU, is undoubtedly the main event of 2016 as regards the future form of the EU. It is now down to the UK to announce its intention to leave the EU under Article 50 of the Treaty on the EU and to launch the process of negotiations on the conditions for ending its EU membership and configuring future mutual relations. From that moment a two-year period will start to run, after which the UK's membership of the EU will automatically end unless it is extended unanimously by all the Member States. However, the UK must first define domestically its vision for future relations with the EU. This will then serve as a basis for further negotiations within the Union.

The UK referendum result raises many new legal, institutional and political issues for all EU states and institutions. It can also be assumed that Brexit will also affect the position of the non-euro area EU Member States. On the one hand, small non-euro area countries will gain – in relative terms – a stronger position upon the exit of a much larger player, but on the other hand the strength of the group as a whole within the EU will logically decrease. Euro area representatives in the EU Council have had a qualified majority since November 2014 due to the entry into effect of a new method for calculating that majority.²⁶ Moreover, the exit of the UK will reduce the influence of the group of countries – including the Czech Republic – that are pushing for trade liberalisation, a lower regulatory burden, and the removal of barriers in the internal market.

Besides the current challenges stemming from sluggish economic growth, banking sector problems, high public and private debt and still high unemployment, the EU is therefore now facing fundamental issues regarding its future course as a result of the UK referendum, the migration crisis and the threat of terrorism. There have been calls in many Member States for a review of the previous trend of further deepening of integration. An informal EU summit in Bratislava, organised by Slovak presidency in September 2016, discussed the future of European integration. As expected, though, it produced no landmark decisions and merely showed an effort to maintain the unity of the EU and find joint solutions. The European Council's role in the debate on key EU topics and issues thus continues to strengthen even in 2016.

The **debate about deepening Economic and Monetary Union (EMU)** and the future course of European integration was pushed somewhat into the background in 2016 due to the need to find solutions to more pressing issues relating, for example, to the inflow of immigrants and refugees from countries close to the EU, and also due to public sentiment. Growing scepticism about any further significant integration can be seen in numerous Member States, as reflected, for example, in the above-mentioned Brexit referendum. The originally expected broad European-wide public debate of the reform proposals contained in the June 2015 Five Presidents' Report *Completing Europe's Economic and Monetary Union* is thus not as intense as planned. The priority topics of the Slovak presidency as regards deepening of integration include the fiscal pillar of the EMU, specifically discussion of the establishment of a common "fiscal capacity" to perform a macroeconomic stabilising function for the euro area, and the social dimension of the EMU, including discussions on a common European unemployment

²⁶ In accordance with Protocol 36 on Transitional Provisions, however, each Member State may request voting in the original pre-2014 system until March 2017.

insurance.²⁷ A Commission expert group is due to issue a white paper next year setting out possible proposals for the second phase of completing the EMU.

The debate about **simplifying the Stability and Growth Pact fiscal rules** (e.g. the introduction of an adjusted expenditure rule in the corrective arm of the excessive deficit procedure and improved predictability and transparency of its rules), whose complexity has increased significantly due to post-crisis reforms, continued into 2016. On 1 November 2015, the Commission established an independent advisory **European Fiscal Board**²⁸ tasked with evaluating the implementation of the EU fiscal framework. The European Council also endorsed a recommendation on the establishment of independent national productivity boards in the euro area. As regards progress towards establishing a **unified representation of the euro area in the IMF**, discussed on the basis of an October 2015 Commission proposal,²⁹ a negative view prevails in most Member States.

In the interests of deepening EMU in the financial union area, steps continued to be taken to establish a **banking union**, whose pillars consist of a Single Supervisory Mechanism (SSM), a Single Resolution Mechanism (SRM) and a Single Rulebook. Under a 2013 EU Council agreement (reaffirmed in 2015), bridge financing will be secured for national sub-funds from the national sources of the states participating in the SRM during the transition period, i.e. until the Single Resolution Fund (SRF) reaches its expected full capacity in 2024.³⁰ To that end, the Member States will enter into bilateral national credit line agreements with the Single Resolution Board.³¹

However, given the planned amount of SRF resources³² relative to the size of the EU banking sector, a need for additional funds for resolving systemically important bank crises can be expected even after the transition period ends. These take the form of **backstops** financed from public sources at national and European level. However, due to their high political sensitivity and complexity, so far only technical discussions have started to be prepared. A joint statement issued by the EU finance ministers in December 2015 reaffirmed the approach to a permanent common backstop to the SRF to be developed during the transition period.³³

An ad hoc working group of the Council of the EU was also established in 2016 to strengthen the banking union. This group is currently discussing a proposal to amend the SRM regulation in order to establish a **European Deposit Insurance Scheme (EDIS)**³⁴ and related issues consisting in reducing risks in euro area banking sectors. The EU Member States have differing views on the specific conditions and form of the EDIS and the related sharing of financial responsibility for the resolution of risks in the banking sectors of euro area countries. The ongoing negotiations are therefore very complicated and the outcome cannot be foreseen at the moment. At the ECOFIN Council meeting in June, ministers of finance approved the Council conclusions on a roadmap to complete the banking union.³⁵ They specified further risk reduction measures and set a schedule of work for individual legislative proposals and announced an early start to technical discussions on the backstop for the SRF and continued work on the proposal for the EDIS. However, no real progress was made on risk reduction, mainly because of the absence of an EU-level agreement on the mitigation of risks stemming

²⁷ Slovak Presidency (2016).

²⁸ European Commission (2015c).

²⁹ European Commission (2015d).

³⁰ Council of the EU (2013, 2015).

³¹ These "Loan Facility Agreements" (LFAs) are bilateral private credit line agreements concluded under Luxembourg law with a maximum aggregate amount of EUR 55 billion. They will be used solely to cover the remaining costs of resolution transactions in the territory of the credit line-providing state of the banking union.

³² By the end of the eight-year transition period, the SRF should have reached its target amount of 1% of the total covered deposits of member banks in the banking union, i.e. around EUR 55 billion.

³³ Council of the EU (2015).

³⁴ European Commission (2015e). The European Deposit Insurance Scheme (EDIS) is intended as another pillar of the banking union.

³⁵ Council of the EU (2016b).

from sovereign exposures of banks and different interpretations of the risk of moral hazard. In line with the June Council conclusions on the completing of the banking union, on 23 November 2016 the Commission published a package of legislative proposals amending current legislation governing conduct and prudential requirements of credit institutions and investment companies, as well as rules on recovery plans and resolution of these entities.

The political debate on possible participation in the banking union, or, more precisely, the SSM/SRM, before euro adoption continued in the Czech Republic. The debate was based on an updated ***Impact Study of Participation of Non-participation of the Czech Republic in the Banking Union*** drawn up by the Ministry of Finance in partnership with the CNB, the Office of the Government and the Ministry of Foreign Affairs. On 30 May 2016, the government reaffirmed its decision not to join the banking union in the current situation and to review participation in the banking union on the basis of a further update of the impact study to be submitted by the Ministry of Finance by 31 December 2017.

To sum up, the work of the EU and particularly of the euro area on deepening integration, especially in the economic and fiscal policy area, has been greatly affected by the UK referendum and new security and social challenges in 2016. The impacts of these developments on the Czech Republic and other EU states, although they cannot be estimated well at the moment, will have to be considered in future decisions about the timing of entry into the monetary union. In addition, it is necessary to assess properly the functioning of the new institutions and regulations created in response to the economic and financial crisis, which have fundamentally changed the form of the euro area and hence the content of the obligation to adopt the euro, which the Czech Republic assumed upon its accession to the EU. Besides the direct costs arising from participation in the euro area's existing rescue mechanisms and the limits imposed on national powers in the supervision of credit institutions, account should also be taken of the implications stemming from the future set-up and institutional changes in the euro area itself and of the fiscal costs associated with any fiscal problems in euro area member states and their financial sectors.

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 following analysis monitor both 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).

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 the level of economic activity as well as in the price level foster a situation where similar long-term processes will take place 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 the single monetary policy will meet the needs of individual countries in the future. Sustainability of cyclical alignment is conditional in the longer run on similarity of economic structure and sufficient convergence in the interest rate level.

1.1.1 Real economic convergence

The degree of real economic convergence, as measured by GDP per capita at purchasing power parity and an international comparison of the price level of GDP, is a fundamental indicator of the similarity of two economies. A low degree of real economic convergence with the euro area may be a substantial disadvantage as regards euro adoption. Assuming that the difference in the 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 equilibrium real appreciation of the exchange rate vis-à-vis the euro may make fulfilment of the Maastricht convergence criteria more difficult.³⁶ 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 real convergence and lower public debt service costs. At the same time, however, they can contribute to creating serious macro-financial imbalances such as excessive lending, property market bubbles and high current account deficits.³⁷

³⁶ The simultaneous restriction placed by the Maastricht criteria 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 and by the option of revaluing the central rate in the ERM II system. Moreover, the increased emphasis laid for some time now 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. However, this approach leads to a temporary worsening of the country's price competitiveness.

³⁷ Ahrend et al. (2008); Taylor (2009); Martin (2010).

The process of convergence of the Czech Republic to the euro area in **GDP per capita at purchasing power parity** (see Table 1) has resumed since 2013. Czech economic activity slightly exceeded 80% of the euro area average for the first time in 2015. Among the countries under comparison, the Czech Republic has been in third position over the last five years, but it still lags well behind Austria and Germany, i.e. the advanced euro area countries. However, it is ahead of the less advanced euro area states³⁸ and the Central European non-euro area countries.

Table 1: GDP per capita at purchasing power parity

(EA = 100)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
CZ	74.4	76.9	75.1	76.8	74.9	76.6	76.1	77.6	79.2	80.3
AT	115.0	113.2	114.2	116.3	116.4	117.7	121.8	122.4	121.2	119.3
DE	107.9	107.8	108.5	108.0	112.0	114.9	115.8	116.1	117.7	117.7
PT	72.9	73.0	72.6	74.9	74.5	72.0	71.9	72.0	73.0	73.1
HU	57.1	55.9	58.0	59.7	60.0	60.6	60.4	61.9	63.5	63.9
PL	46.2	48.8	50.2	54.8	57.1	59.6	61.8	62.6	63.5	64.6
SI	78.9	80.1	82.2	78.7	76.7	76.2	75.4	75.2	77.1	77.7
SK	57.5	61.6	65.8	65.8	67.6	67.4	69.1	70.6	72.0	72.1

Source: Eurostat, CNB calculations.

The Czech **price level of GDP** relative to the euro area is slightly above the 2007 pre-crisis level (see Table 2). It reached a historical high in 2008, but decreased in relative terms in the years that followed. The real weakening of the koruna in 2013–2014 primarily reflected the Czech National Bank's use of the exchange rate as an additional instrument for easing the monetary conditions after technically zero nominal interest rates were reached.³⁹ In 2015, the Czech price level of GDP was 63% of the euro area average, substantially lower than in Austria and Germany. The Czech price level of GDP was also lower, albeit to a lesser extent, by comparison with Portugal, Slovenia and Slovakia. By contrast, it remains higher than in Hungary and Poland.

Table 2: Average price level of GDP

(EA = 100)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
CZ	59.9	61.2	71.1	66.3	69.8	69.8	68.7	65.4	62.1	63.0
AT	103.4	105.7	106.0	106.4	106.5	107.1	105.8	105.7	106.4	106.8
DE	101.2	101.3	101.0	102.0	100.8	100.5	101.4	102.3	102.2	102.5
PT	79.9	80.4	80.8	79.8	79.9	79.4	76.2	76.8	76.3	77.4
HU	58.7	63.7	64.0	56.5	57.6	57.3	56.7	56.1	55.5	56.3
PL	57.2	59.3	65.8	54.3	57.6	56.9	55.9	55.8	56.3	56.1
SI	73.5	76.8	78.9	81.2	81.2	80.9	79.2	78.9	78.4	78.2
SK	54.3	59.3	63.8	64.5	64.6	66.4	66.2	65.5	64.8	64.9

Source: Eurostat, CNB calculations.

³⁸ The lower GDP per capita at purchasing power parity in Portugal and Slovenia than in the Czech Republic largely reflects the problems these countries faced in previous years. Of the euro area countries not listed in Table 1, this applies even more so to Greece, which was clearly ahead of the Czech Republic until 2010 but now lags well behind it (66.6% of the euro area average). Likewise, the Czech Republic has also overtaken Cyprus (76.4%). Despite their rapid convergence, all three Baltic euro area countries are also still less advanced than the Czech Republic: Estonia (70.2%), Latvia (60.6%) and Lithuania (69.2%).

³⁹ Franta et al. (2014).

An **analysis of the empirical relationship between the price level of GDP and GDP per capita at purchasing power parity** for 36 European countries (Model I)⁴⁰ reveals that the Czech price level in 2015 continued to lie below the level corresponding to the performance of the economy in international terms. The estimated relationship would imply a Czech price level roughly 20 pp higher in relation to the euro area average, i.e. slightly above that in Portugal or Slovenia. On the other hand, the Czech Republic's main trading partner countries (Germany, Austria, Slovakia and Poland) also showed large downward deviations from the model-estimated price level (within a range of 11–14 pp). The Czech price level thus does not seem very low relative to these main trading partners. Moreover, an alternative fixed-effects panel estimate of the empirical relationship between the price level of GDP and GDP per capita at purchasing power parity (Model II) reveals that other characteristics (not captured individually by the model) of the Czech economy systematically reduce the Czech price level by more than 19 pp overall. According to this alternative model, which seems more realistic after the crisis, the Czech price level should be 63.7% of the euro area average. This suggests that the koruna's real exchange rate in 2015 was broadly at its equilibrium level.⁴¹

Table 3 presents the **evolution of the real exchange rate** against the euro. Between 2006 and 2015, the real exchange rate of the koruna appreciated by 14%, i.e. at an average rate of 1.3% a year. The real appreciation of the Czech currency was concentrated in the first few years of the above ten-year period. Since 2008, by contrast, the koruna-euro exchange rate has depreciated in real terms overall, reflecting the relatively adverse evolution of the Czech economy in 2009–2013 and since November 2013 the use of the nominal koruna-euro rate as an additional instrument for easing the monetary conditions. Looking at the ten-year period as a whole, however, the real appreciation of the Czech currency was still much stronger than in the other countries under comparison except Slovakia. Germany, Portugal and Hungary even recorded slight depreciation of their real exchange rates.

Table 3: Real exchange rate against the euro

(HICP deflated; 2005 = 100; average annual rate in %)

	Basic index (2005=100)										Avg. annual rate		
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2006–2015	Outlook ^{a)}	
												Model I	Model II
CZ	105	108	124	117	122	125	123	119	112	114	1.3	3.2	0.7
AT	99	100	99	99	100	100	100	101	102	103	0.3	0.6	-0.7
DE	100	100	99	99	99	98	98	98	99	99	-0.1	1.0	0.4
PT	101	101	100	99	99	100	100	99	99	99	-0.1	0.6	1.2
HU	96	106	109	101	106	106	105	103	99	98	-0.2	3.3	2.4
PL	102	106	115	97	106	104	103	102	102	102	0.2	4.2	4.1
SI	100	102	104	105	105	104	105	105	105	104	0.4	1.0	0.4
SK	106	116	126	132	131	132	134	134	133	133	2.9	2.4	0.4

Note: ^{a)} 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 have definitively faded away and the speed of renewed catch-up with the advanced economies has stabilised. Its pace, however, will probably be lower than before the crisis, when in the Czech Republic, for example, the equilibrium appreciation of the exchange rate against the euro reached 3–4% per

⁴⁰ See the *Methodological Part* and Čihák and Holub (2003; 2005).

⁴¹ IMF (2015a) assessed the real exchange rate of the koruna as being roughly in line with Czech economic fundamentals. The analyses of the CNB lead to the same conclusion (see Box 2 in Inflation Report III/2015).

year. It is so because the initially sizeable differences in the economic performance and price levels of converging countries compared to the euro area average narrowed visibly in the pre-crisis period, hence the room for further convergence is already smaller. Moreover, the real appreciation in converging countries in future years is likely to take place partly via a slightly positive inflation differential vis-à-vis the average in the euro area, where inflation is expected to return only slowly to 2%. Outlooks of equilibrium real appreciation for the next five years based on the two aforementioned alternative panel estimates of price convergence⁴² are given in the last two columns of Table 3. For the Czech Republic, the range of the estimates between both models is quite wide at 0.7–3.2%;⁴³ it evidently lies at a higher level than for all the existing euro area members. Conversely, for countries outside the euro area, i.e. Hungary and Poland, the equilibrium real appreciation estimates are similar or even higher than those for the Czech koruna. The above estimates correspond to the average inflation differential vis-à-vis the euro area which could be expected in the Czech Republic if the euro were to be adopted within the next five years. Assuming average euro area inflation at the level of the long-run forecasts,⁴⁴ inflation in the Czech Republic could therefore rise to 2.4–4.9% during the initial years following euro area entry. There could thus be a marked increase compared to the 2% targeted by the Czech National Bank

Owing to higher inflation, the Czech Republic, Hungary and Poland would have lower **real interest rates** (see Table 4) compared to the euro area average and to most of the euro area countries under comparison in the event of euro adoption. Their short-term real money market interest rates could even be significantly negative for an extended period. In the Czech Republic, the real three-month interest rate would be between -1.7% and 0.8% on average according to the above range of estimates. However, unlike Poland and Hungary, the Czech Republic has shown a slightly negative average real interest rate level over the past ten years. Although this has been due largely to the impacts of the global crisis and the related need for sustained easy monetary conditions, it can also be assumed that equilibrium real interest rates in the Czech Republic are well below those in Hungary and Poland.⁴⁵ Euro adoption would thus probably not generate such a strong shock in the form of a decrease in equilibrium real interest rates for the Czech Republic as for the other countries in the region.

⁴² Model I and Model II – see above and the *Methodological Part* for details.

⁴³ 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 (in particular Model I) 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 thus probably be lower vis-à-vis the effective indicator than vis-à-vis the euro area as a whole (the real exchange rate will probably appreciate vis-à-vis the latter partly via a positive inflation differential).

⁴⁴ The Consensus Forecasts long-term prediction of euro area inflation for the next five years is 1.7% on average.

⁴⁵ The CNB forecasts assume an equilibrium real 3M PRIBOR rate of 1% in the long term.

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

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Average ^{a)}	Outlook ^{b)}
CZ	0.2	0.2	-2.1	1.6	0.1	-0.9	-2.4	-0.9	-0.1	0.1	-0.4	(-1.7; 0.8)
AT	1.4	2.0	1.4	0.8	-0.9	-2.1	-2.0	-1.9	-1.2	-0.8	-0.3	(0.9; 2.2)
DE	1.3	2.0	1.8	1.0	-0.3	-1.1	-1.5	-1.4	-0.6	-0.1	0.1	(0.5; 1.1)
PT	0.0	1.8	1.9	2.1	-0.6	-2.1	-2.1	-0.2	0.4	-0.5	0.1	(0.3; 0.9)
HU	3.1	-0.1	2.6	4.9	1.4	2.5	2.3	2.4	2.5	1.4	2.3	(-1.8; -0.9)
PL	2.9	2.1	2.1	0.4	1.2	0.6	1.2	2.2	2.5	2.5	1.8	(-2.7; -2.6)
SI	1.0	0.5	-0.8	0.4	-1.3	-0.7	-2.2	-1.7	-0.2	0.7	-0.4	(0.5; 1.1)
SK	0.1	2.4	0.2	0.3	0.1	-2.6	-3.1	-1.2	0.3	0.3	-0.3	(-0.9; 1.1)

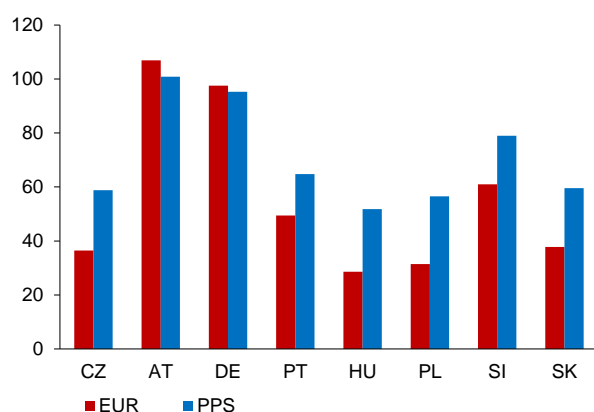
Note: ^{a)} Average for 2006-2015; ^{b)} Estimated equilibrium real average interest rate for the next five years derived from the range of estimates of the pace of equilibrium real exchange rate appreciation (see Table 3), assuming a zero money market risk premium and an equilibrium real interest rate in the euro area of 1.5%.

Source: Eurostat, CNB calculations.

Wages are another key 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 in total employment and GDP. Chart 11 compares the average annual wage with the figure for the euro area in 2015. The data converted into euro using the market exchange rate reveal the external purchasing power and wage competitiveness of the economy, while the purchasing power of wages on the domestic market is described by the purchasing power standard (PPS) indicator. 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. In 2015, the wage level in the Czech Republic was just under 37% of the euro area average when converted using the exchange rate (compared to 34% in 2006) and roughly 59% using PPP data (compared to 57% in 2006). In comparison with the Czech Republic, wages were slightly lower in Hungary and Poland and slightly higher in Slovakia in 2015.⁴⁶ Looking to the future, 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.

Chart 11: Average annual wage in 2015

(EA = 100)



Source: European Commission, CNB calculations.

⁴⁶ The Slovak wage level exceeded the Czech one not only after conversion at the current exchange rate, but also at PPP. The slightly higher wage level in Slovakia is therefore not due primarily to the weakening of the nominal exchange rate of the koruna by the Czech National Bank in November 2013, as the PPP parity figures are not directly affected by the exchange rate conversion.

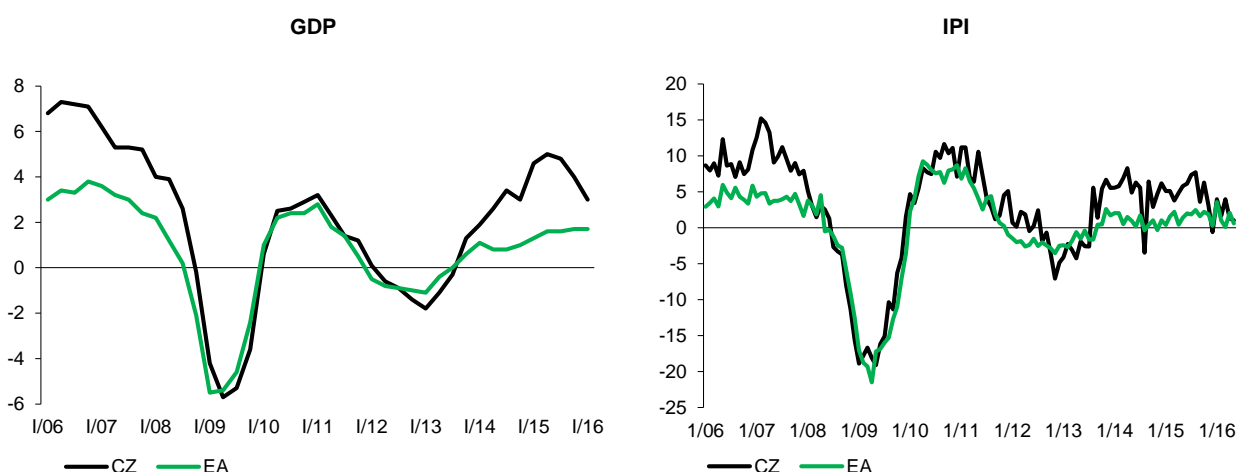
To sum up, the Czech Republic's convergence in economic activity towards the euro area has renewed. Going forward, this creates room for an increase in the Czech relative price level and wages. The equilibrium real appreciation of the exchange rate associated with this process may imply higher inflation compared to the monetary union average and thus an increase in inflation above the current 2% target in the event of euro adoption. The related low or even markedly negative real interest rates may simultaneously increase the risk of macrofinancial imbalances.

1.1.2 Correlation of economic activity

Upon euro area entry, a country's independent monetary policy decision-making is replaced by the single monetary policy of the European Central Bank, which responds 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 single monetary policy settings may be suboptimal and cause economic costs. Conversely, 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 is concerned with the degree to which the cycles of the Czech economy and the other countries under review are similar to that of the euro area.

Economic activity in the Czech Republic can be compared 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 (IPI, see Chart 12)**.⁴⁷ In the pre-crisis period, the Czech economy recorded roughly double the rate of growth of both GDP and the IPI compared to the euro area, whereas after the onset of the global financial crisis the growth rates equalised. The Czech Republic accelerated markedly again compared to the euro area at the end of 2013, partly due the adoption of the exchange rate commitment by the CNB. It has maintained a higher rate of growth to the present, largely due to drawdown of EU funds last year.

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



Source: Eurostat, CNB calculations.

⁴⁷ 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 1.1.5). 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.

A **simple correlation analysis** calculated for various lags of the individual countries' GDP and IPI time series compared to the euro area time series (lags of 0–2 quarters for GDP and 0–3 months for the IPI) can be used to assess the cyclical alignment of the economies under review with the euro area. Table 5 summarises the results of this analysis. For all the economies under analysis, the global financial and economic crisis represented a significant common external shock strongly affecting the measured correlations, so the correlations of the time series adjusted for crisis volatility are given in addition to the overall results.⁴⁸

By overall comparison with the other countries, the GDP correlations measured between the Czech Republic and the euro area can be evaluated as above average. Only Germany⁴⁹ and Slovenia display higher GDP correlation than the Czech Republic. By contrast, Poland has the lowest correlation. Unlike the other countries, Poland displays a stronger correlation adjusted for the crisis period, as it was one of the few European countries not to record a decline in economic activity. Conversely, the correlations between Hungary and Slovakia and the euro area are largely implied by co-movement in the crisis quarters.

The correlations of activity between the individual countries and the euro area measured using the IPI are generally smaller than the GDP correlations, but are also statistically significant. The Czech Republic ranks alongside Slovenia and Slovakia as one of the countries with the lowest coefficients, especially when adjusted for the crisis. This is due to significantly higher industrial production growth in the Czech Republic since 2013.

⁴⁸ The quarters in which the euro area recorded the highest quarterly growth volatility – 2008 Q4 and 2009 Q1 – are dropped from the correlation calculation.

⁴⁹ The high correlation of economic activity between Germany and the euro area is natural, as Germany accounts for 28% of euro area GDP.

Table 5: Correlation coefficients of economic activity

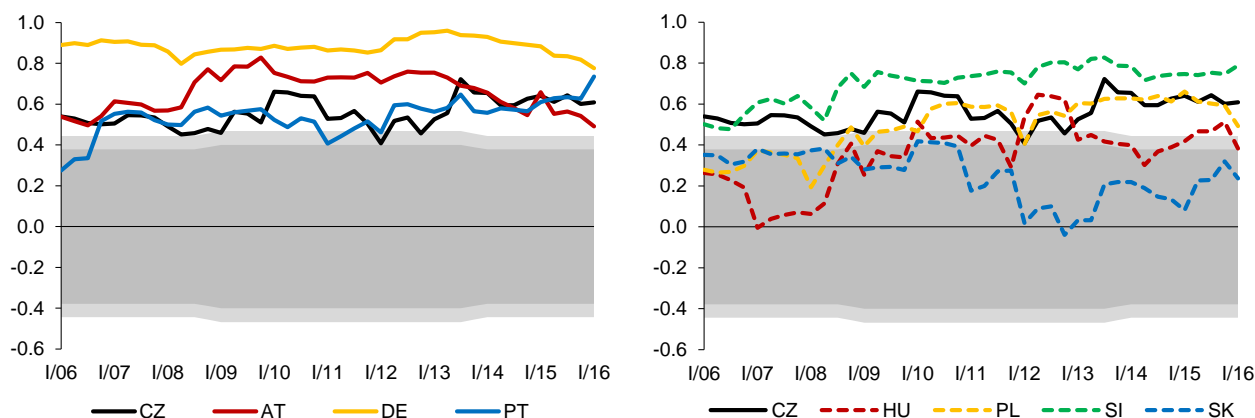
	GDP			GDP		
	2006Q1–2016Q1			Adjusted for crisis		
	t	t-1	t-2	t	t-1	t-2
CZ	0.82 **	0.59 **	0.35 **	0.66 **	0.42 **	0.30 *
AT	0.77 **	0.55 **	0.17	0.68 **	0.40 **	0.08
DE	0.94 **	0.51 **	0.27 *	0.85 **	0.26	0.16
PT	0.70 **	0.40 **	0.22	0.60 **	0.23	0.15
HU	0.70 **	0.49 **	0.32 **	0.37 **	0.25	0.26 *
PL	0.47 **	0.41 **	0.38 **	0.65 **	0.47 **	0.43 **
SI	0.86 **	0.63 **	0.44 **	0.75 **	0.49 **	0.42 **
SK	0.71 **	0.55 **	0.24	0.44 **	0.34 **	0.12

	IPI				IPI			
	2006M1–2016M5				Adjusted for crisis			
	t	t-1	t-2	t-3	t	t-1	t-2	t-3
CZ	0.35 **	0.12	0.26 **	0.15	0.21 **	-0.04	0.21 **	0.11
AT	0.41 **	0.11	0.25 **	0.20 **	0.32 **	-0.03	0.22 **	0.12
DE	0.86 **	0.12	0.36 **	0.32 **	0.79 **	-0.31 **	0.15	0.18 **
PT	0.45 **	-0.08	-0.01	0.15 *	0.47 **	-0.19 **	-0.05	0.18 *
HU	0.42 **	0.22 **	0.11	0.14	0.33 **	0.04	0.02	0.12
PL	0.51 **	0.03	0.06	0.07	0.51 **	-0.04	0.08	0.10
SI	0.36 **	0.23 **	0.18 **	0.07	0.26 **	0.02	0.14	0.00
SK	0.23 **	0.29 **	-0.03	0.14	0.13	0.23 **	-0.13	0.19 **

Note: The calculation is based on the quarter-on-quarter/month-on-month differences in the logarithms of the seasonally adjusted data. 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 correlations for the entire period analysed are presented in the left-hand panel, while the crisis quarters of 2008 Q4 and 2009 Q1 are dropped from the calculation in the right-hand panel. The highest statistically significant correlations for each country are highlighted in bold.

Source: Eurostat, CNB calculations.

Supplementary information on the alignment of economic activity over time is provided by an analysis of the correlation for moving five-year time periods (**rolling correlation**). The rolling correlations of real GDP growth indicate a gradual increase in alignment for most countries over the last ten years (see Chart 13). In some countries (Portugal, the Czech Republic and Slovenia) the correlation of economic activity rose after 2009 owing to the global financial crisis and the subsequent European debt crisis, whereas in others it stayed at low levels (Slovakia and Hungary). In the Czech Republic, the rolling GDP correlation has decreased slightly over the past two years. However, it has long been one of the highest among the countries under review.

Chart 13: Rolling correlations of economic activity with the euro area

Note: The time data indicate the end of the rolling period of five years (in periods containing the crisis quarters of 2008 Q4 and 2009 Q1, those quarters are dropped from the calculation, i.e. the periods are 4.5 years long). The calculation is based on the quarter-on-quarter differences in the logarithms of the seasonally adjusted data. The correlations are measured using real GDP. 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.

Exports are an important channel of transmission of euro area economic activity to small open economies such as the Czech Republic. With the exception of Hungary and Poland, all the countries under comparison recorded a high **correlation of exports to the euro area with euro area GDP** (see Table 6). In the case of Poland, this again primarily reflects the crisis period.

Table 6: Correlation coefficients of exports to the euro area with euro area GDP

	Exports to the euro area vs. euro area GDP					
	2006Q1–2016Q1			Adjusted for crisis		
	t	t-1	t-2	t	t-1	t-2
CZ	0.81 **	0.43 **	0.17	0.76 **	0.04	0.20
AT	0.76 **	0.38 **	0.15	0.60 **	0.11	0.08
DE	0.92 **	0.61 **	0.22	0.83 **	0.20	0.16
PT	0.81 **	0.38 **	-0.06	0.56 **	-0.01	0.10
HU	0.44 **	0.35 **	0.25	0.31 *	0.03	0.19
PL	0.08	0.08	0.07	0.43 **	-0.15	-0.01
SI	0.86 **	0.53 **	0.17	0.75 **	0.07	0.04
SK	0.78 **	0.45 **	0.12	0.64 **	0.08	0.15

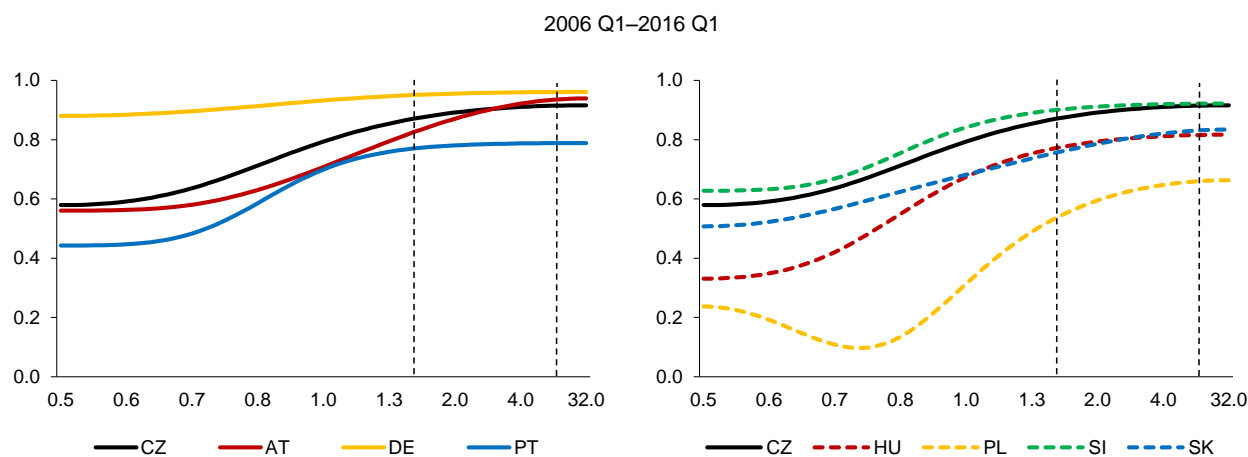
Note: The calculation is based on the quarter-on-quarter differences in the logarithms of the seasonally adjusted data. The significance of the correlation coefficient is marked ** and * for the 5% and 10% significance levels respectively. The columns indicate the lag of the given country's time series relative to the euro area time series. For example, t-1 denotes a lag of one quarter. The correlations for the entire period analysed are presented in the left-hand panel, while the crisis quarters of 2008 Q4 and 2009 Q1 are dropped from the calculation in the right-hand panel. The highest statistically significant correlations for each country are highlighted in bold.

Source: Eurostat, CNB calculations.

Using the **dynamic correlation** method (see Chart 14) based on spectral analysis of the time series of quarterly GDP changes, medium-term economic fluctuations, which correspond to the business cycle, can be separated from short-term (idiosyncratic) or, conversely, long-term (structural) movements of the monitored variable. The standard cycle length of 1.5–8 years is depicted in the chart by vertical dashed lines. For this cycle length, the results of the analysis

indicate a high correlation across the countries under review over the last ten years, the only exception being Poland, which has been at relatively low levels over the entire period 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 seasonally adjusted data.

Source: Eurostat, CNB calculations.

Over the last ten years the Czech Republic has therefore been showing high, statistically significant correlations of overall economic activity and exports with the euro area both in absolute terms and relative to the other countries under comparison. These high correlations were significantly affected by the temporary dominance of a strong common external shock in the form of the global financial and economic crisis. That said, even when adjusted for this factor, all the observed variables display strong immediate correlation of developments in the Czech Republic with those in the euro area. Overall, therefore, the cyclical alignment of economic activity in the Czech Republic and the euro area can be described as high in the long term.

1.1.3 Correlation of the cyclical component of unemployment

Correlation analysis of labour market data using the unemployment gap, defined as the difference between the general unemployment rate and the equilibrium employment rate estimated on the basis of the NAIRU,⁵⁰ offers another possible view of alignment between two economies alongside the measurement of correlations of economic activity using GDP or the industrial production index. If the unemployment gap is positive, the labour market is anti-inflationary. A negative gap conversely has an inflationary effect. Moreover, if Okun's law is applied, the unemployment gap can substitute for the output gap in the Taylor rule for determining the optimal level of monetary policy rates.⁵¹ In a single currency area, large fluctuations in the cycle and the size of unemployment gaps could lead to suboptimal monetary policy. In other words, the loss of independent monetary policy could be more costly for the acceding country.

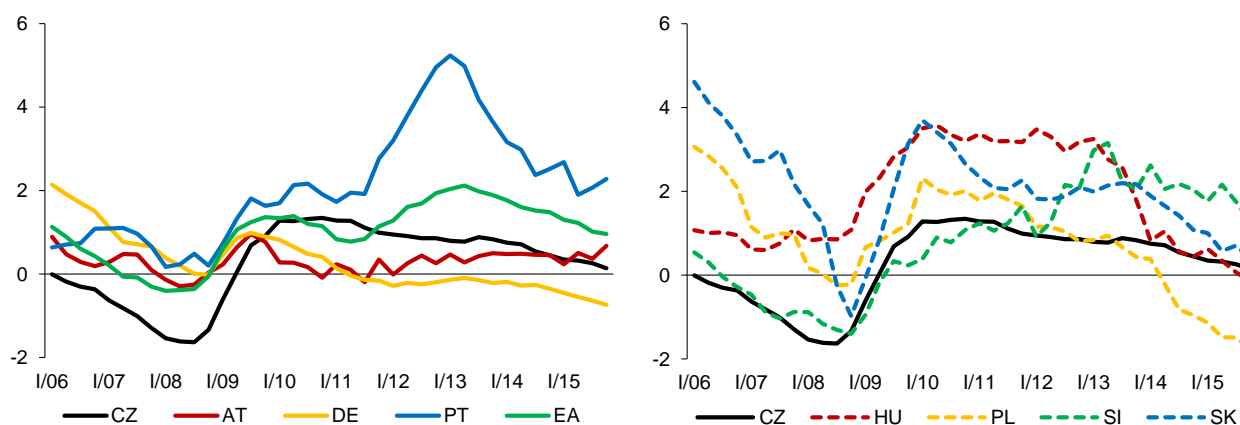
⁵⁰ The non-accelerating inflation rate of unemployment, i.e. the equilibrium rate towards which unemployment converges in the absence of temporary supply or demand shocks once the dynamic adjustment of inflation to previous shocks is completed. A semi-structural approach using the Kalman filter is applied for the estimates (see section 2.2.2 of the *Methodological Part*).

⁵¹ See, for example, Rudebusch (2010).

In the first third of the period under review, similar cyclical patterns are apparent for the unemployment gaps in all the countries under comparison and in the euro area as a whole, because the majority of countries saw a gradual narrowing of the positive unemployment gap (see Chart 15). However, the differences in the unemployment gaps were relatively large. In the Czech Republic, a negative unemployment gap was opening from 2006 onwards thanks to sustained robust growth in economic activity. With the onset of the economic crisis in 2009 and subsequent growth in the unemployment rate, however, the negative unemployment gap closed and turned positive. In the last three years, the unemployment gaps in the countries under comparison have started to close again (the Czech Republic, Slovakia, Portugal, Slovenia and the euro area), flattened out at low positive levels (Austria) or turned negative (Germany, Poland and Hungary). In the Czech Republic, the unemployment rate was close to the NAIRU at the end of 2015 and the unemployment gap was thus virtually closed.

Chart 15: Unemployment gaps

(percentage points)



Source: Eurostat, CNB calculations.

Our analysis of the correlation of unemployment gaps in 1998-2015⁵² reveals a relatively high correlation between the unemployment gap in the Czech Republic and that in the euro area and, among the individual countries under review, Slovenia. However, the correlation with Slovenia alone is of little relevance with regard to its economic size and the issue of euro adoption (see Table 7 and Chart 15). By contrast, the approximately zero unemployment gap correlation between the Czech Republic and Germany does not seem intuitive.⁵³ If, however, we split the data into two significantly shorter periods (2004-2009 and 2010-2015), the resultant correlation in these two periods is conversely high (0.6 and 0.9 respectively) and highly significant. Generally, it can be concluded that in terms of unemployment gap correlation, the Czech Republic is aligned with the euro area as a whole and, abstracting from the unconvincing results for the time period as a whole, also with Germany.

⁵² Given the length of NAIRU cycles, use of the standard 2006-2015 reference period in this report would distort the correlation analysis. For that reason, an extended period of 1998-2015 is used to calculate the NAIRUs and their gaps and statistical properties.

⁵³ This deviation is due to sizeable differences in the evolution of the two countries' unemployment gaps before 2004.

Table 7: Unemployment gap correlations

	CZ	AT	DE	PT	HU	PL	SI	SK	EA
CZ	1.00	0.12	-0.14	0,35 **	0.35 **	0.11	0.62 **	0.22 *	0.60 **
AT		1.00	0.45 **	0,32 **	0.08	-0.16	0.22 **	-0.05	0.42 **
DE			1.00	-0,44 **	-0.10	0.38 **	-0.32 **	0.43 **	0.18
PT				1.00	0.55 **	-0.58 **	0.64 **	-0.55 **	0.37 **
HU					1.00	-0.45 **	0.33 **	-0.48 **	0.39 **
PL						1.00	-0.28 **	0.93 **	-0.10
SI							1.00	-0.19	0.78 **
SK								1.00	0.00
EA									1.00

Note: The significance of the correlation coefficient is marked ** and * for the 5% and 10% significance levels respectively.

Source: Eurostat, CNB calculations.

Concordance statistics (see Table 8), which describe the length of time for which the unemployment gaps of two countries or groups of countries are in the same phase of the cycle, i.e. both gaps are positive or both gaps negative, are also important for optimally configuring a single monetary policy with regard to labour market developments. The Czech Republic displays average concordance with the euro area among the countries under review. As regards concordance with the individual countries under comparison, it displays the highest concordance with Slovenia, Hungary and Slovakia. By contrast, the Czech Republic's concordance with Germany – its biggest trading partner – is low. This is due mainly to the negative unemployment gap observed in Germany in the last four years, while the positive Czech unemployment gap was only gradually closing in this period. Moreover, an inverse relationship applied to the Czech Republic and Germany in 2006–2008. Overall, the concordance between individual countries is higher than 0.7 in around two-thirds of cases.

Table 8: Unemployment gap concordance

	CZ	AT	DE	PT	HU	PL	SI	SK	EA
CZ	1.00	0.61	0.40	0.61	0.70	0.60	0.80	0.68	0.74
AT		1.00	0.60	0.78	0.72	0.71	0.76	0.79	0.79
DE			1.00	0.49	0.60	0.81	0.56	0.70	0.64
PT				1.00	0.75	0.63	0.63	0.71	0.65
HU					1.00	0.74	0.68	0.79	0.74
PL						1.00	0.72	0.89	0.83
SI							1.00	0.83	0.89
SK								1.00	0.92
EA									1.00

Source: Eurostat, CNB calculations.

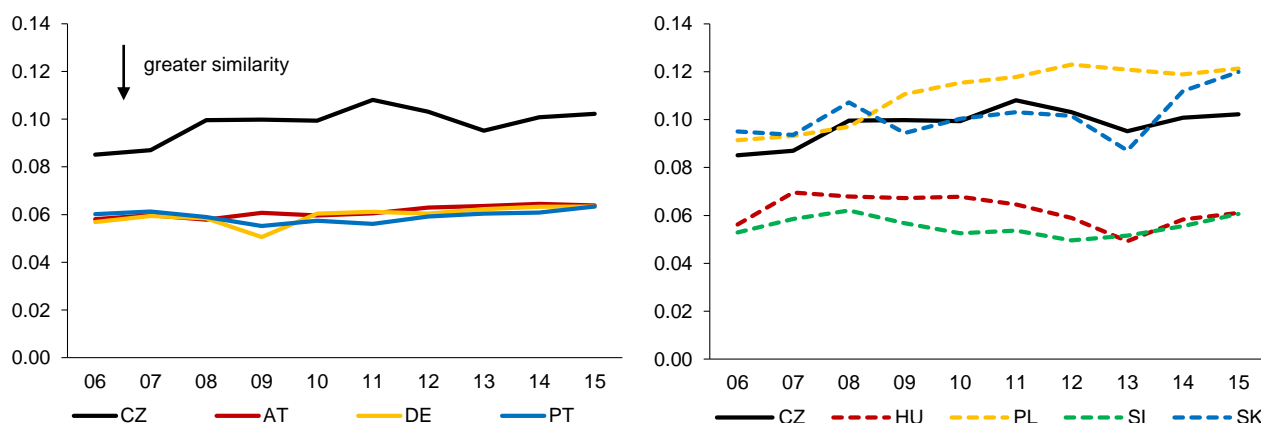
To sum up, labour market alignment in the countries under review can be assessed as mixed. However, the Czech Republic's alignment with the euro area as a whole is relatively high. Yet the question remains to what extent the alignment will be affected in the next few years by the strong economic growth currently being observed in some Central European countries and its subsequent pass-through to the labour market.

1.1.4 Structural similarity of the economies

The risk of asymmetric shocks decreases with increasing similarity of the structure of economic activity between an acceding economy and the monetary union. The structural similarity of the economies of the countries under review 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 country under comparison and a reference country, in our case the euro area (see Chart 16). 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.

The indices of structural similarity of the economies of Austria, Germany and Portugal with the euro area have been stable close to 0.06 over the past ten years.⁵⁴ The index of similarity of the Czech economy with the euro area has been fluctuating around 0.10 since 2008, recording a slight increase in 2011 and a decline in 2013. In 2008–2013, the structure of economic activity in the Czech Republic was comparable with that in Slovakia. In recent years, however, Slovakia's structural dissimilarity with the euro area has started to increase, while the dissimilarity of the Czech economy with the euro area has been unchanged.

Chart 16: Structural similarity vis-à-vis the euro area



Note: The methodology for the calculation of key national accounts indicators in EU countries was changed in September 2014. The previous ESA 95 System of National and Regional Accounts was replaced by ESA 2010. The time series were recalculated retroactively. According to Eurostat, the impact of the methodological change on the national accounts differs from country to country. For this reason, the Landesmann index published in past issues of this publication is not fully comparable with this year's results.

Source: Eurostat, CNB calculations.

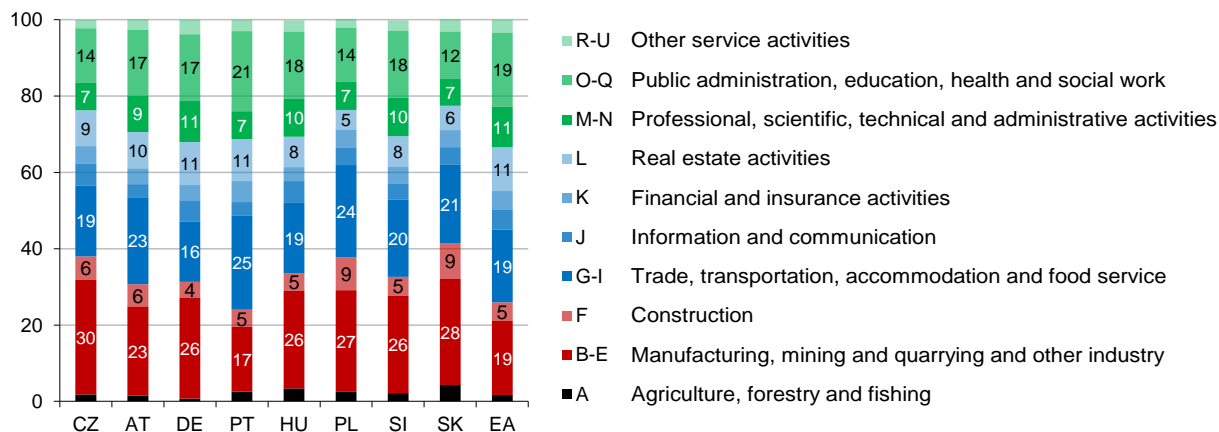
The difference in the structure of GDP between the Czech Republic and the euro area lies mainly in a still high share of industry (30%), which in the Czech Republic is the highest of all the countries under comparison (see Chart 17).⁵⁵ In the case of the Czech economy, such a high share of industry (car manufacture in particular) and a lower share of services compared to the euro area may lead to asymmetric shocks to which the single monetary policy would be not be able to respond in full. The relatively low structural similarity of the Czech economy to the euro area economy thus poses a potential risk as regards adopting the euro.

⁵⁴ However, the aggregate index does not always reveal fundamental differences in the economic structures of individual countries. In Portugal, for example, the share of industry (categories B–E) in 2015 was 17%, which is below the euro area average (see Chart 17); by contrast, the share of value added in the public sector (categories O–Q) in Portugal is above average (at 21%). In Austria, the shares of these sectors in value added are almost exactly the opposite, i.e. 23% and 17%, yet overall the two economies have the same Landesmann index.

⁵⁵ However, the Czech economy is similar to the German one, among others, in having a high share of industry in total value added.

Chart 17: Shares of economic sectors in GDP in 2015

(%)



Source: Eurostat, CNB calculations.

1.1.5 Interest rate convergence

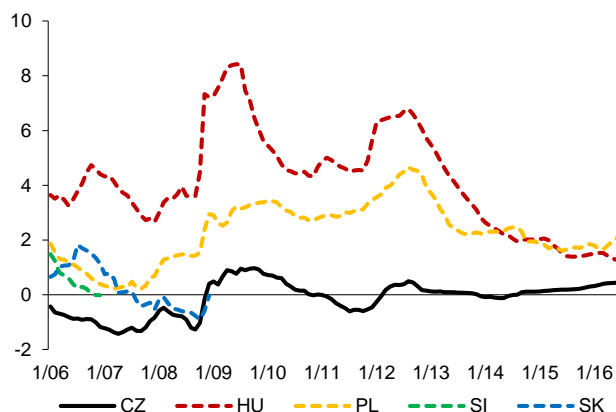
Following euro area entry, some countries faced fast nominal interest rate convergence⁵⁶ to the union level, which acted as an asymmetric shock manifesting itself, for example, in the emergence of property market bubbles or weaker fiscal discipline. Earlier nominal interest rate convergence – gradual and based on fundamentals – is thus better for smoother economic developments after 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.⁵⁷ The probability of this asymmetric shock is indicated by the **nominal interest rate differential** vis-à-vis the euro area/Germany.⁵⁸ 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.

⁵⁶ Although real economic activity is affected primarily by real interest rates, nominal interest rates may also have a significant effect via credit or budgetary constraints (e.g. the loan repayment to financial income ratio).

⁵⁷ See also section 1.1.1.

⁵⁸ EURIBOR is used as the reference rate for short-term rates. German government bond yields are used for long-term rates. The long-term rates in 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 18: Differences in three-month interest rates vis-à-vis the euro area
(percentage points)



Note: The values for Slovenia and Slovakia are only until the date of adoption of the euro in these countries.

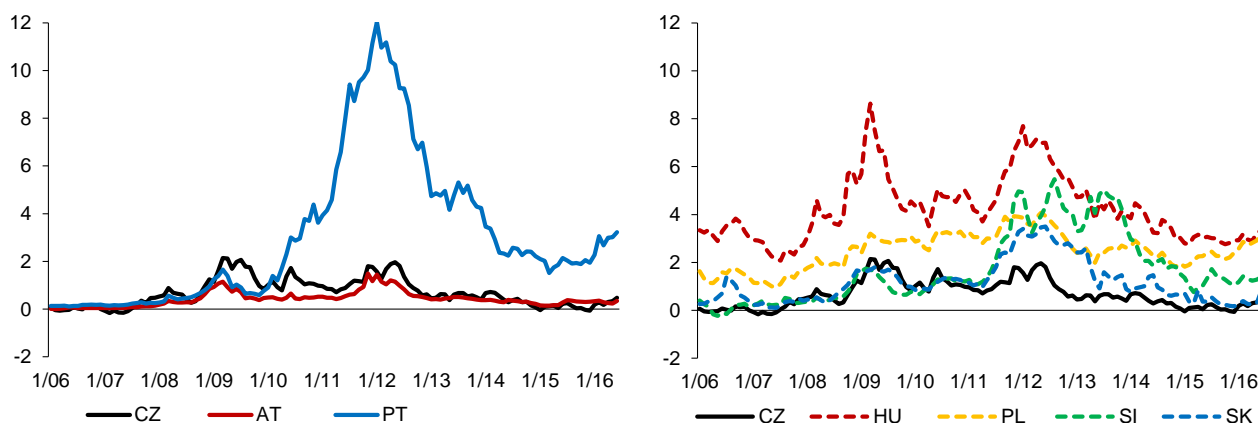
Source: Datastream, CNB calculations.

Chart 18 shows the nominal interest rate differential for short-term rates. In the case of the Czech Republic, the three-month interest rate differential vis-à-vis the euro area has long been very small and did not increase significantly even during the financial turbulence episode in 2009 or during the euro area debt crisis in 2012. Moderate growth in the differential has been observed since mid-2015, with the domestic rate staying slightly positive and the three-month EURIBOR turning increasingly negative. For a long time, Hungary had the largest interest rate differential among the countries under review. However, a drop in inflation led the Hungarian central bank to gradually ease monetary policy and cut its policy rate to a record low (0.9%) in May 2016. As a result, the three-month interest rate differential vis-à-vis the euro area fell to 1.3 pp. In the case of Poland, the differential has been stable since 2015 Q2, with developments in domestic markets copying those in the euro area. Monetary policy in Poland has seen no changes.

Turning to ten-year government bonds, Czech yields in comparison with the other countries remain closest to the level in Germany; since early 2015, the differential has even been below 0.5 pp (see Chart 19). The same goes for Austrian and, in the past year, Slovak rates, whereas the difference between Portuguese and German yields has increased to 3 pp since early 2016. Growth in risk aversion on financial markets has pushed down German bond yields into negative territory, while Portuguese yields have risen markedly. Portugal has the second lowest rating among euro area countries behind Greece, as well as high public debt and now also problems with financing its largest bank. Polish yields have also recorded growth in the last six months, in particular after the country's rating was downgraded in January 2016 due to the domestic political situation. The Polish yield differential has exceeded 3 pp and is currently the same as the Hungarian one. The differential of Slovenia, which has recovered from a major banking crisis, has been fluctuating between 1.5 pp and 2 pp since early 2015.

Chart 19: Differences in ten-year interest rates vis-à-vis Germany

(percentage points)



Source: Eurostat, CNB calculations.

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

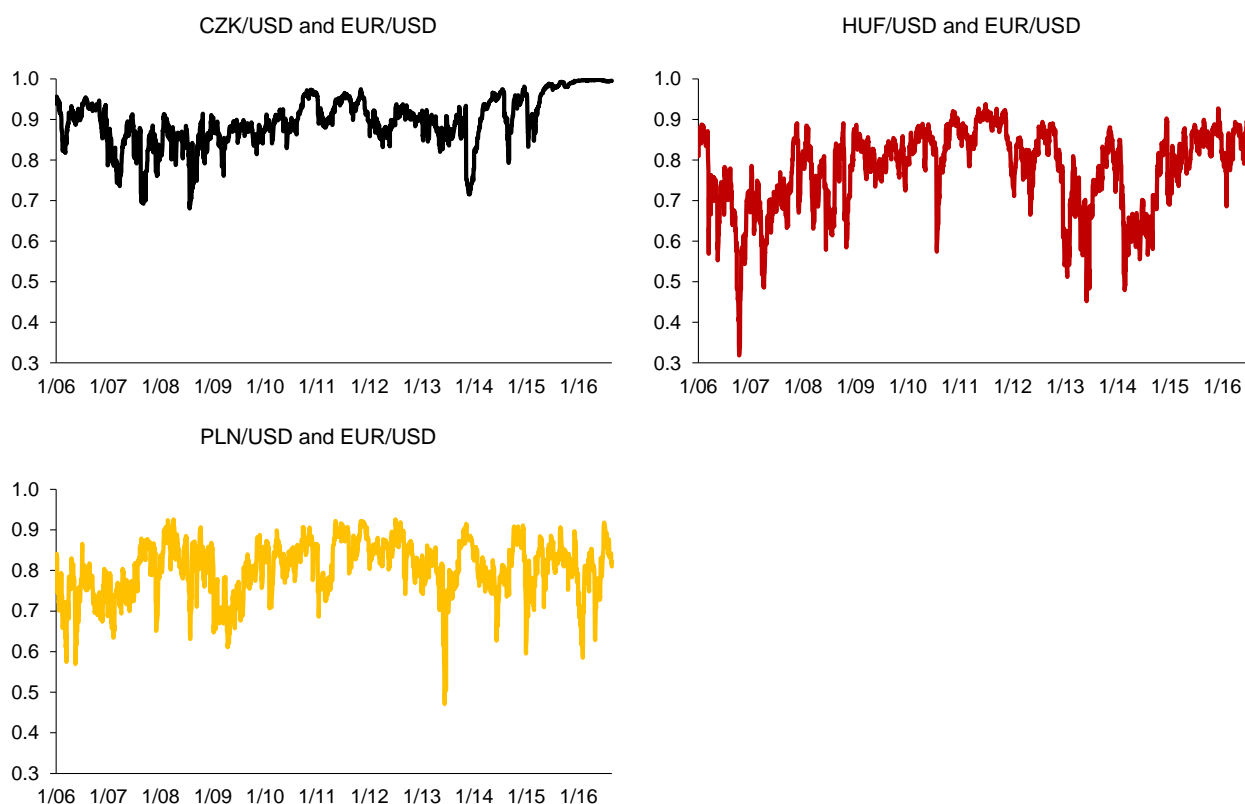
1.1.6 Exchange rate alignment

Long-term alignment of movements in the nominal 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 movements in the exchange rates** of two currencies vis-à-vis a reference currency is thus an indicator that the two countries could share a single currency.⁵⁹ 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.⁶⁰ A high degree of correlation reflects high similarity of exchange rate dynamics and less intense asymmetric pressures; the exchange rate correlation of currencies in a monetary union is one by definition.

Unlike in previous years, when the Hungarian forint was the most volatile, the Polish zloty is now displaying the largest fluctuations in correlation coefficient. The correlation of its exchange rate against the dollar with the cross rate saw the biggest drop in late January/early February, when it fell to 0.6; the correlation of the Hungarian forint also decreased in the same period – to around 0.7. These two Central European currencies were probably responding to the increased nervousness and uncertainty prevailing on markets at the time. This, in turn, was linked with the global macroeconomic situation, the main central banks' orientation towards further easing monetary policy and with a cut in Poland's rating due to political factors. The correlations of the forint and the zloty increased temporarily after the publication of the UK referendum result in late June 2016 and have been falling slightly ever since (see Chart 20).

⁵⁹ See Aguilar and Hördahl (1998).

⁶⁰ 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 (2005–2012).

Chart 20: Correlation coefficients of exchange rates against the US dollar

Source: Thomson Datastream, Eurostat, CNB calculations.

The correlation between the Czech koruna and the euro has been fundamentally affected by the Czech National Bank's use of the exchange rate as an additional instrument for easing monetary policy since November 2013, when the exchange rate commitment was announced. This has been even more true since roughly mid-2015, when the exchange rate of the koruna against the euro came into close alignment with the exchange rate commitment, and the correlation between the koruna and the euro is thus staying only just below the maximum level. Even before that, however, the correlation between the Czech koruna and the euro was the highest and most stable by comparison with the currencies of the Central European region. As a result, we can sum up that from the long-term perspective the Czech currency reacts to changes in the external environment outside the euro area similarly to the euro itself. This indicates a high degree of alignment.

1.1.7 Analysis of exchange rate volatility

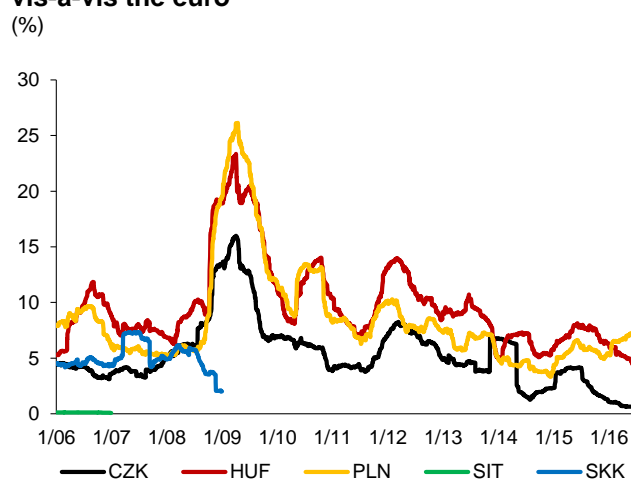
Another way of assessing the risk of asymmetric shocks in the Czech economy vis-à-vis the euro area is to analyse exchange rate volatility.⁶¹ Low volatility of the exchange rate between two countries may be regarded, under the floating exchange rate regime, as an indicator of their potential to share a single currency (see also section 1.1.6).

⁶¹ CNB (2009) estimates the fundamental-based (i.e. theoretically expected) exchange rate volatility. For Slovakia and Slovenia this refers to a purely hypothetical situation. It can be said that the lower the fundamental-based exchange rate volatility, the higher the ability of two countries to share a common currency (for details see, for example, Horváth, 2005).

Chart 21 illustrates 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 lower than that of the Hungarian forint and the Polish zloty over the past ten years, even at the time of sharp growth in volatility connected with the global financial and European debt crisis. The only exception is a one-off swing in the historical volatility of the Czech koruna in 2014, which was related to the Czech National Bank's decision in November 2013 to start using the exchange rate as an additional instrument for easing monetary policy.

Appreciation pressures on all three Central European currencies against the euro in the first half of 2015 temporarily increased their historical volatility. The exchange rates of the Czech koruna and the Hungarian forint then stabilised in mid-2015, which also brought about a drop in their historical volatility. In the case of the Czech koruna, this volatility has recently fallen almost to zero as a result of the stabilisation of the exchange rate close to the CNB's exchange rate commitment. By contrast, the volatility of the Polish zloty has increased, as the zloty has started weakening against the euro on concerns about the new government's steps to restrict the independence of key institutions (such as the Constitutional Court) and its plans to increase expenditure and reform pensions and health care.

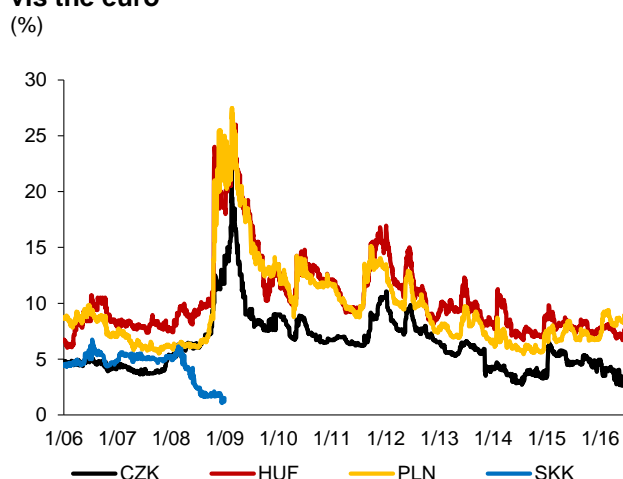
Chart 21: Historical volatility of exchange rates vis-à-vis the euro



Note: The historical volatility is described by the annualised standard deviation of daily returns in the past six months.

Source: Datastream, CNB calculations.

Chart 22: Implied volatility of exchange rates vis-à-vis the euro



Note: Six-month horizon.

Source: Datastream, CNB calculations.

An outlook for exchange rate volatility can be derived from financial market data. The **implied volatility**, i.e. the expected volatility of the exchange rates of the countries under comparison as reflected in the prices of options for the individual currencies (see Chart 22), displays a relatively similar pattern in the Czech Republic, Hungary and Poland over the entire period under review. This suggests a volatility spillover effect among Central European currency markets.⁶² The implied volatility of the Czech koruna against the euro fell to a historical low in 2014 in response to the adoption of the exchange rate commitment by the Czech National Bank. The implied volatility of all three Central European currencies rose in early 2015, due among other things to the Swiss central bank's decision to discontinue its exchange rate

⁶² 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 volatility spillover effects on this currency. An overall increase in the spillover effects is apparent in the post-crisis period.

commitment. In the case of the Czech koruna, the implied volatility then gradually fell back to the end-2014 level, while the outlook for the volatility of the Polish zloty increased further on higher uncertainty regarding domestic political developments.

To sum up, except during the financial crisis, the volatility of the Czech koruna's exchange rate against the euro has been 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 introduction of the exchange rate commitment by the Czech National Bank caused a one-off 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.

1.1.8 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 mutual trade. At the same time, greater intensity of international economic relations usually leads to greater synchronisation of economic shocks and cyclical alignment and hence to lower costs associated with the loss of independent monetary policy.⁶³

International trade with the euro area

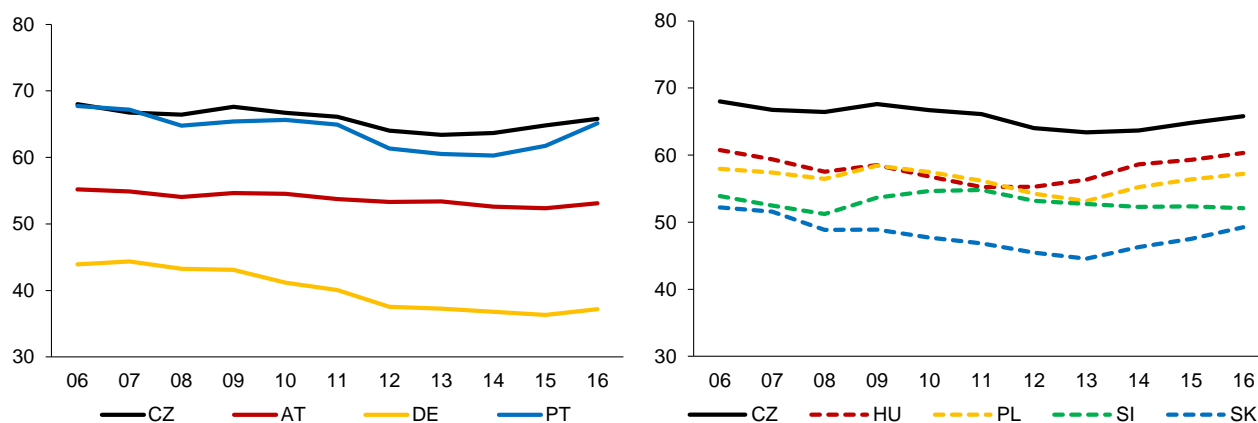
The **intensity of trade** of the countries under comparison with the euro area average can be assessed using export and import shares. The share of exports to the euro area in total exports is very high in the Czech Republic,⁶⁴ higher than in any of the other countries under review (see Chart 23). Only Portugal has a similar share. In the case of Czech imports (see Chart 24), the share of the euro area is similarly high – among the countries under review only Portugal and Austria have higher shares of imports from the euro area. The charts show that the previous downward trend in those shares has halted, suggesting that the euro area market is still of key importance for European exporters.

⁶³ Closer trade links increase the 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).

⁶⁴ Around half of Czech exports to the euro area go to Germany. Slovakia also has a share of greater than 10%.

Chart 23: Shares of exports to the euro area in total exports

(%)

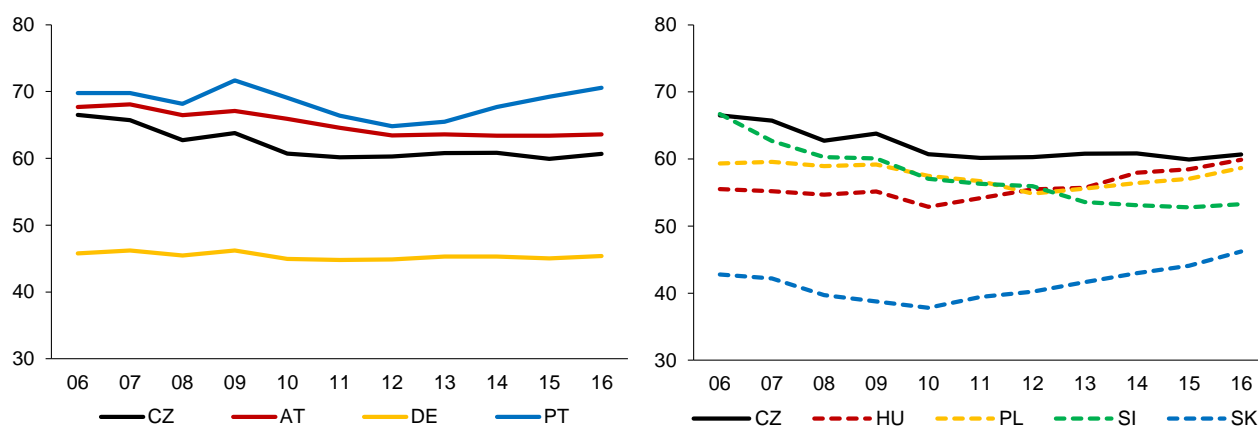


Note: The 2016 figure is for the first five months of the year.

Source: Eurostat, CNB calculations.

Chart 24: Shares of imports from the euro area in total imports

(%)



Note: The 2016 figure is for the first five months of the year.

Source: Eurostat, CNB calculations.

The statistics on **intra-industry trade** give a more detailed view of international 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 convergence⁶⁵ and can also affect the economy's ability to absorb economic shocks.⁶⁶ 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

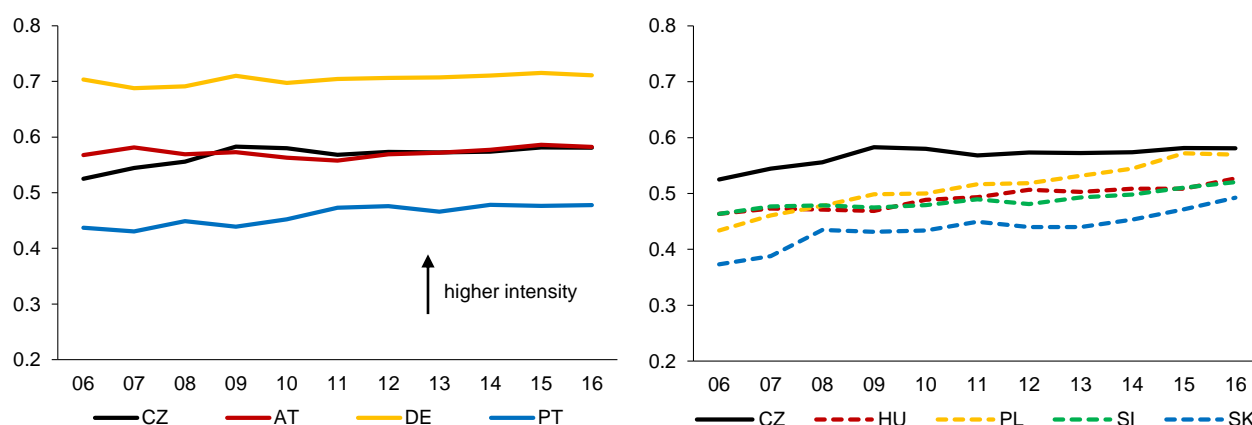
⁶⁵ Frankel and Rose (1997). For more on the theory of intra-industry trade see Krugman (1981) and Hoekman and Djankov (1996).

⁶⁶ 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.

Grubel-Lloyd index, which indicates the share of the absolute amount of intra-industry trade in total foreign trade turnover with the euro area.

Chart 25: Intensity of intra-industry trade with the euro area

(under SITC5)



Note: The presented results were calculated using the five-digit SITC classification. The 2016 figure is for the first four months of the year.

Source: Eurostat, CNB calculations.

The SITC5-based Grubel-Lloyd index (see Chart 25) shows relatively high and stable values for the Czech Republic in the long term, values comparable with those for Austria. Only Germany has a higher intensity of intra-industry trade with the euro area. Portugal has lower Grubel-Lloyd index values than the Czech Republic, similar to the Central European new EU Member States, which, however, show an upward trend in the period under review. Poland has had almost the same intensity of intra-industry trade with the euro area as the Czech Republic over the past two years. Overall, the Czech Republic has an above-average share of intra-industry trade with the euro area compared to the other Central European countries if we take into account the most detailed foreign trade classification (SITC 5), which best describes intra-industry trade (see Table 9).

Table 9: Grubel-Lloyd indices by degree of aggregation

(for 2015)

	SITC 1	SITC 2	SITC 3	SITC 5
CZ	0.82	0.75	0.68	0.58
AT	0.88	0.78	0.72	0.59
DE	0.92	0.86	0.81	0.72
PT	0.76	0.69	0.62	0.48
HU	0.87	0.76	0.68	0.51
PL	0.86	0.79	0.69	0.57
SI	0.85	0.77	0.65	0.51
SK	0.89	0.77	0.59	0.47

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

Source: Eurostat, CNB calculations.

Intensive foreign trade represents a significant 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.

Strong trade integration reduces the potential costs associated with adopting the single monetary policy. At the same time, it creates potential for large benefits stemming from the removal of exchange rate risk and from transaction cost savings upon euro adoption. It has therefore long been one of the most significant arguments for the Czech Republic joining the euro area.

Foreign direct investment

Alignment of economic activity is also fostered by a higher level of ownership linkages. If domestic companies are part of multinational groups, this helps to transmit economic impulses.⁶⁷ In addition, capital integration between two countries can help to dampen negative unilateral demand shocks. Ownership linkages with the euro area are measured by the ratio of the **foreign direct investment** (FDI) stock from the euro area in the countries under review to GDP (see Table 10) and by the ratio of the direct investment (DI) stock from the country under review in the euro area to GDP (see Table 11).

Table 10: Ratios of FDI stock from the euro area to GDP

(%)

	2008	2009	2010	2011	2012	2013	2014	2015
CZ	46.9	55.0	58.1	53.8	60.6	59.3	61.0	60.1
AT	39.8	45.0	36.1	35.5	35.8	35.3	36.9	36.6
DE	21.0	23.0	23.4	23.5	25.7	26.6	25.7	25.6
PT	30.6	36.4	40.8	42.0	55.5	59.3	59.1	56.9
HU	42.6	49.3	50.5	48.5	57.7	55.6	55.3	56.5
PL	24.7	31.3	36.1	32.7	37.0	39.1	39.1	36.6
SI	17.8	18.6	18.8	20.1	20.8	19.9	22.0	22.5
SK	46.6	49.0	48.6	50.0	48.9	47.4	46.3	46.9

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

The ratio of FDI from the euro area to GDP in the Czech Republic is the highest among the countries under comparison. High levels of ownership linkages were also recorded by Portugal and Hungary, with Slovakia a small distance behind.

⁶⁷ 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.

Table 11: Ratios of DI stock in the euro area to GDP
(%)

	2008	2009	2010	2011	2012	2013	2014	2015
CZ	8.7	11.0	13.1	12.7	14.9	16.7	17.2	18.1
AT	19.2	22.1	24.4	25.2	25.1	26.3	28.5	28.9
DE	19.8	22.6	23.0	24.0	26.6	27.2	27.5	28.0
PT	16.4	17.2	17.4	23.7	28.7	30.2	31.4	31.8
HU	6.2	6.2	5.2	5.5	10.0	9.7	10.7	9.3
PL	3.0	4.3	7.5	7.9	8.8	8.6	8.5	8.9
SI	3.2	4.6	4.8	4.7	4.0	3.8	4.2	4.3
SK	5.2	6.2	6.1	8.1	6.6	7.2	7.4	8.5

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

By contrast, ownership linkages 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 is characterised by much higher ownership linkages to the euro area, but those linkages are still much lower than 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.

1.2 SIMILARITY OF MONETARY POLICY TRANSMISSION

When assessing the Czech Republic's preparedness to join the monetary union, it is important to consider to what extent the settings and impacts of the single monetary policy will be appropriate for the Czech Republic. Given the similar course of the business cycle and strong links between the Czech economy and the euro area core, the European Central Bank's single monetary policy is likely to be quite often in line with the needs of the Czech economy. However, to take advantage of this possible benefit, the transmission of monetary policy in the Czech Republic from monetary policy rates (or other monetary policy instruments) to real economic activity and particularly 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

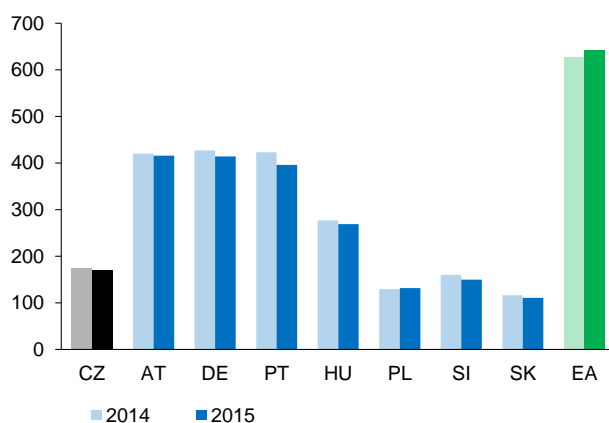
The **depth of financial intermediation**⁶⁸ in the Czech Republic in 2015, as expressed as the ratio of financial institutions' assets to GDP, was 170%. This ratio was 642% in the euro area and just over 400% in Germany and Austria (see Chart 26). The extent of financial intermediation thus remains considerably lower in the Czech Republic and is comparable more

⁶⁸ 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.

with that in Poland, Slovenia and Slovakia. The depth of financial intermediation in the Czech Republic in 2015 fell by 2 pp year on year, while that in the euro area rose by 16 pp.⁶⁹ However, the depth of financial intermediation in the euro area should not be regarded as a target to which the Czech financial sector should converge. The financial crisis highlighted the fact that an excessively large financial sector can represent a source of risks and limit the ability of economic policy makers to solve potential problems in the financial system.

Chart 26: Depth of financial intermediation

(assets of financial institutions as % of GDP)



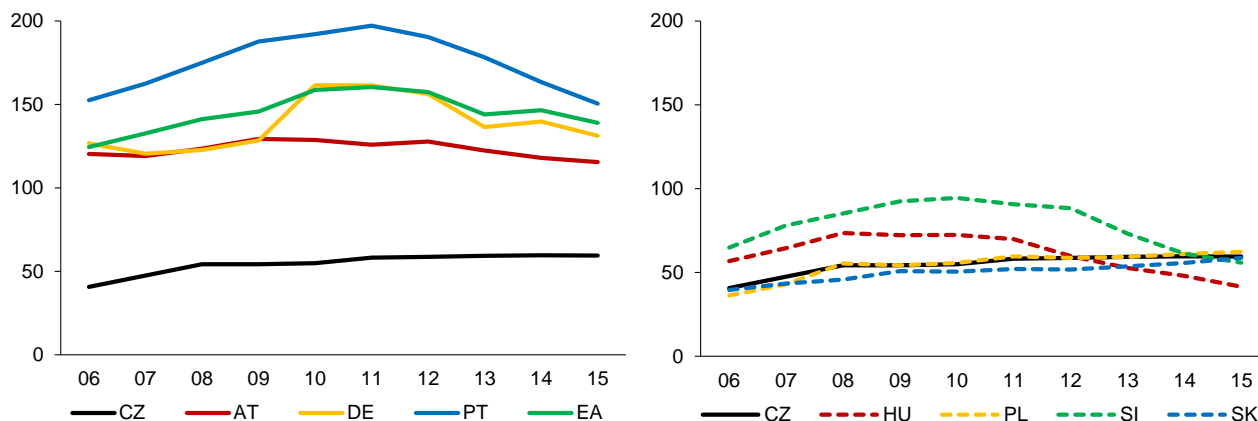
Note: The euro area value exceeds the other countries in the charts due to the large volume of assets of financial corporations in Luxembourg, Ireland, the Netherlands and France both as a percentage of their GDP and in comparison with the total financial assets of the euro area.

Source: CNB, ECB, Eurostat, central banks.

The depth of financial intermediation is closely linked to the **private sector debt ratio**. Czech households and firms remain significantly less indebted than their euro area counterparts and in this respect are comparable more with Central European countries such as Slovakia and Poland (see Chart 27). However, the euro area is experiencing a gradual decline in its debt ratio, with private sector debt falling from 160% of GDP in 2011 to 139% of GDP in 2015. By contrast, the Czech Republic saw a very slight increase from 58% of GDP to 59% of GDP in the same period. It can be assumed that convergence towards the euro area will continue in this area. This is due mainly to ongoing private sector deleveraging in some euro area countries.

⁶⁹ In absolute terms, financial institutions' assets rose at similar rates in the Czech Republic and the euro area (4.7% versus 5.9%). The different sign is due to different nominal GDP growth (5.6% in the Czech Republic versus 3.2% in the euro area). Assets rose more slowly than GDP in the Czech Republic and more quickly than GDP in the euro area.

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 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. The financial position, as expressed by net financial assets, can be used to compare to what extent the sectors of non-financial corporations and households in individual countries are able to finance other sectors and, conversely, to what extent they need funds from other sectors to finance their activities. 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 financial position. Moreover, a look at the structure of financial balance sheets of the corporate and household sectors provides information on the link of the real economy to the financial sector and especially the banking sector. The banking sector's exposure to other sectors is high in all the economies under comparison. This is because bank loans are historically the primary source of external financing of non-financial corporations and households. Bond financing remains a complement to bank loans despite favourable market conditions for issuing corporate bonds (low interest rates and demand for corporate bonds).

The **structure of the financial balance sheet and the net financial assets of non-financial corporations** as a percentage of GDP are shown in Chart 28.⁷⁰ The negative position of the non-financial corporations sector,⁷¹ which is due generally to a large proportion of non-financial assets in the balance sheet, decreased in all the countries under review compared to 2008.⁷²

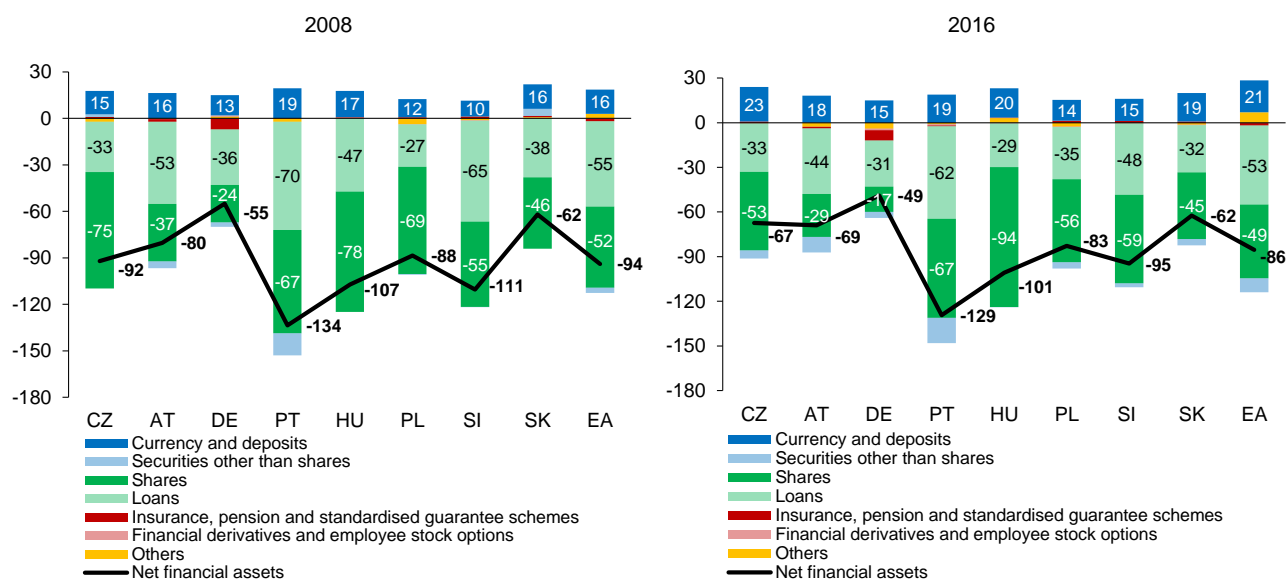
⁷⁰ Given the limited length of the time series due to the switch to ESA 2010, the analysis covers the period from 2008 Q1 to 2016 Q1.

⁷¹ The net debtor position is the difference between financial assets and liabilities, including non-debt items such as shares.

⁷² 2008 was selected for comparison for several reasons. Data under the ESA 2010 methodology are available for the Czech Republic from that year onwards. It also falls in the pre-crisis period and is thus appropriate for monitoring changes in the structure of non-financial corporations' balance sheets.

Chart 28: Structure of the financial balance sheet and net financial assets of non-financial corporations

(% of GDP)



Note: The 2008 and 2016 data are as at the end of Q1. The figure in the left-hand chart for Slovakia is for 2014 Q1 due to the unavailability of historical data under ESA 2010.

Source: ECB, CNB calculations.

In both years under comparison, the financial balance sheet structure of Czech non-financial corporations is similar to that of corporations in the euro area and the individual countries under comparison in terms of the prevailing debtor positions in loans and shares.⁷³ However, the relative importance of these two categories differs. The main difference is a substantially higher loan-to-GDP ratio in the euro area, which is the main reason for the more negative net position of corporations in the euro area compared to those in the Czech Republic.⁷⁴ Since 2008, however, the loan-to-GDP ratio has declined in all the countries under comparison except Poland and the Czech Republic. This testifies to low credit growth and a process of deleveraging. The current level of corporate loan debt in the Czech Republic is broadly comparable with that in Germany, Poland and Slovakia.

Compared to advanced euro area countries (Germany and Austria), shares have a higher weight in the net debtor position of corporations in the other countries under review, including the Czech Republic. This is due mainly to a far lower proportion of shares in financial assets, linked with a lower rate of corporate investment in other non-financial corporations in the domestic economy and, in particular, abroad. The net debtor position of corporations in the Czech Republic fell between 2008 and 2016 (see Chart 28), mainly reflecting subdued growth in liabilities and faster growth in financial assets in the form of currency, deposits, shares and other accounts receivable. The ratio of currency and deposits of non-financial corporations to GDP in the Czech Republic exceeds that in the other countries under comparison, as domestic corporations hold a larger liquidity buffer. Due to higher issuance of securities in previous

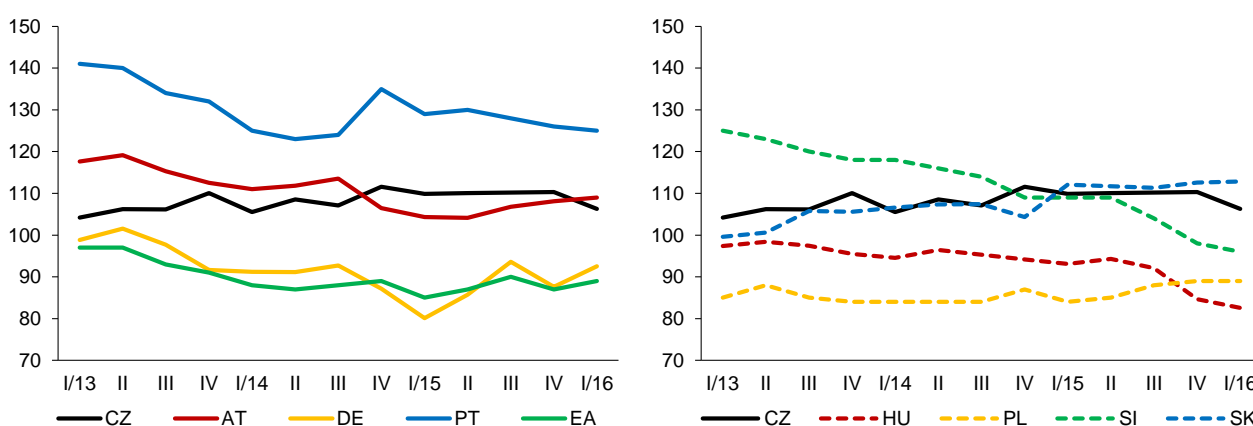
⁷³ Shares comprise quoted shares, unquoted shares and investment fund units.

⁷⁴ A higher loan ratio in the euro area is also seen when one takes a "non-consolidated" view of the balance sheet, i.e. a separate view of assets (i.e. loans provided by non-financial corporations) and liabilities (loans received by non-financial corporations). The ratio of loans received to GDP is 92% in the euro area compared to 50% in the Czech Republic, while the ratio of loans provided is 39% in the euro area compared to 17% in the Czech Republic. A similar situation holds for shares when one looks at shares issued compared to shares held. Shares issued by non-financial corporations in the Czech Republic amount to 88% of GDP compared to 144% of GDP in the euro area, while shares held amount to 35% of GDP in the Czech Republic compared to 95% of GDP in the euro area. In net terms, therefore, the Czech Republic slightly exceeds the euro area, whereas in non-consolidated terms the opposite is true.

years, the ratio of net liabilities in the form of securities other than shares to GDP is almost comparable with that in the euro area, though issuance activity in the Czech Republic has been broadly flat over the past few quarters.

The importance of debt financing of non-financial corporations is expressed by the **debt-to-equity ratio** (see Chart 29),⁷⁵ which can be used to assess the risk of overleveraging. In the Czech Republic, this ratio has been fluctuating above 100% since the beginning of 2013, attaining a level comparable to that of Austria. Throughout the period under review, it has been above that of Germany and the euro area and below that of Portugal; it is also higher than in Poland and Hungary. The dynamics of this ratio are slightly different, as in the Czech Republic it is not rising and has recently declined, whereas in Germany and the euro area it has been growing. The dynamics are thus more similar to the evolution of the debt-to-equity ratio in Hungary and Slovenia.

Chart 29: Debt-to-equity ratios of non-financial corporations



Source: ECB, CNB calculations.

The debt of non-financial corporations consists of bonds issued, loans accepted and trade credits. Trade credits account for a larger share of the debt structure in the Czech Republic and Slovakia than in the other countries. Their role in the financial management of corporations is thus more important and they may partially stand in for short-term loans from financial institutions. By comparison, the ratio in the euro area is roughly one-half. The ratio of securities to equity in the Czech Republic is slightly lower than that in the euro area, comparable to that in Germany and higher than that in Poland and Hungary. Overall, more than half of the debt of non-financial corporations traditionally consists of loans.

To sum up, despite similar patterns in the financing of non-financial corporations in the Czech Republic and the euro area, these economies continue to differ in some respects in terms of the overall level and structure of corporate liabilities. This is due mainly to different pre-crisis leveraging levels, which were lower in the Czech Republic than in the euro area, and also to different post-crisis responses of debt.

Unlike non-financial corporations, the **household sector** is in a net creditor position (see Chart 30).⁷⁶ The ratio of net financial assets of households to GDP exceeds 100% in Austria, Germany, Portugal and the euro area as a whole, while in the Czech Republic it is 76%. The pre-crisis ratio of net financial assets to GDP was lower than at present in all of the countries under review. On the asset side, the liquid component of the household portfolio increased in

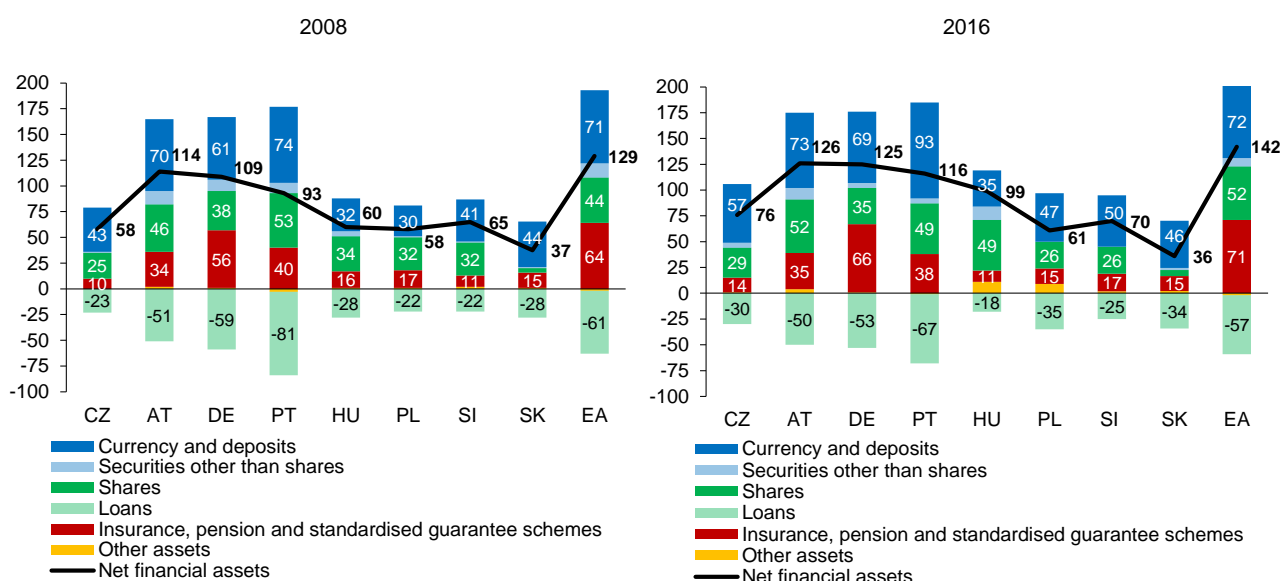
⁷⁵ Bonds issued + loans accepted + other liabilities/shares issued.

⁷⁶ Given the limited length of the time series due to the switch to ESA 2010, the analysis covers the period from 2008 Q1 to 2016 Q1.

all of the countries, i.e. the share of currency and deposits rose. To some extent, this is due to households' conservative approach to managing their financial portfolios (even at the cost of a small return on these funds in an environment of low interest rates) and also to the still abating liquidity preferences of households in the (post-)crisis financial environment. The response of the other components of households' balance sheet during the crisis differed from that after the crisis. In the Czech Republic, Austria, Germany, Slovenia and the euro area, the ratio of insurance and pension schemes to GDP increased. A higher relative level of insurance and pension schemes is generally typical of countries with developed financial sectors and a tradition of financial intermediation (Germany and Austria). In addition, households in these countries tend to hold a higher more shares and securities as a percentage of GDP compared to the other countries under review. This is due to an effort to diversify their portfolios. Households in the Czech Republic and Hungary hold a larger amount of securities relative to GDP than households in Poland, Slovakia and Slovenia. This is due to purchases of government bonds and investment in mutual funds (the share category) in recent years. On the liability side, the ratio of loans to GDP has risen only in the Czech Republic, Poland, Slovakia and Slovenia. The net financial position of Czech households is about half that in the euro area, corresponding to about half the level of their financial wealth.

Chart 30: Structure of the financial balance sheet and net financial assets of households

(% of GDP)



Note: The 2008 and 2016 data are for Q1. The figures in the left-hand chart for Slovakia and the euro area are for 2013 Q1 due to data unavailability.

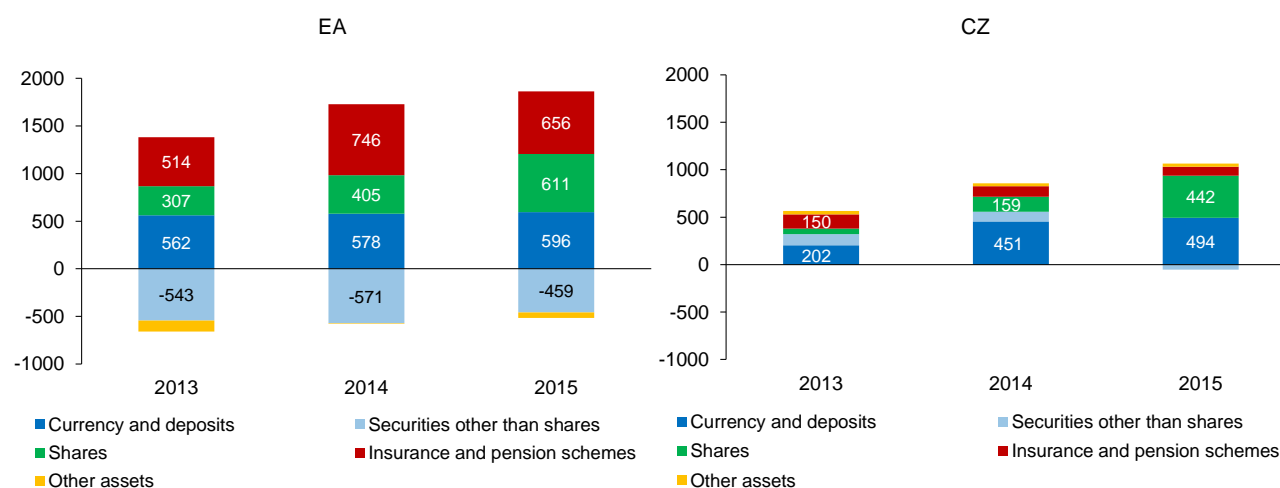
Source: ECB, CNB calculations.

Chart 31 gives an overview of the structure of households' transactions.⁷⁷ The annual sum of transactions in currency and deposits was flat in the euro area over the past three years, whereas transactions in the Czech Republic recorded dynamic growth, particularly between 2013 and 2014. In 2015, Czech households invested strongly in mutual funds, but growth in investment in mutual funds can be observed generally. Over the past three years, euro area households sold securities, while Czech households purchased securities at a time of issuance of government saving bonds (2012–2014). Regular and significant (in terms of volume) investment in insurance and pension schemes is another feature of the management of the

⁷⁷ Transactions, i.e. flows, can be defined as the difference between the stocks of two quarters net of revaluation and other changes in the amount of assets.

investment component of household portfolios⁷⁸ in the euro area. The amount of such investment by Czech households has decreased over time. Moreover, such investment does not account for a large share and is in fact almost the lowest compared to other assets as a percentage of GDP (see Chart 30). This is partly due to the institutional set-up and system of retirement savings in the Czech Republic.

Chart 31: Transaction structure in households' portfolios in the Czech Republic and the euro area
(four-quarter sum; transactions per capita, EUR)



Note: The figures are expressed as the sum of quarterly transactions in financial instruments in the given year.

Source: ECB.

To sum up, the net creditor position of the Czech household sector is about half that in the euro area as a whole. Moreover, as in the case of corporations, there are persisting differences in structure; in particular, the debt ratio is half that in the euro area and, despite some convergence, there is an inverse ratio of the liquid to the investment component of the asset portfolio. There are also differences in the preferences of European and Czech households as regards investment in specific instruments of the investment component. These differences may give rise to an asymmetric effect of monetary policy, as the lower ratios of household financial assets and liabilities to GDP may lead to weaker monetary policy transmission.

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 loans for house purchase. Money market developments pass through the fastest to rates on large and small loans with short fixation periods or floating rates, with around 60% of the transmission taking place within a month.⁷⁹ The pass-through time for client rates on corporate loans with a fixation period of over one year, whose weight, however, is low (see below) and which are linked more to long-term government bond yields, is around 2–3 months. A link to government

⁷⁸ The investment component of the portfolio contains, on the asset side, securities other than shares, shares and insurance and pension schemes. The liquid component of the portfolio contains currency and deposits.

⁷⁹ Horváth and Podpiera (2009) and Babecká-Kucharčuková et al. (2013).

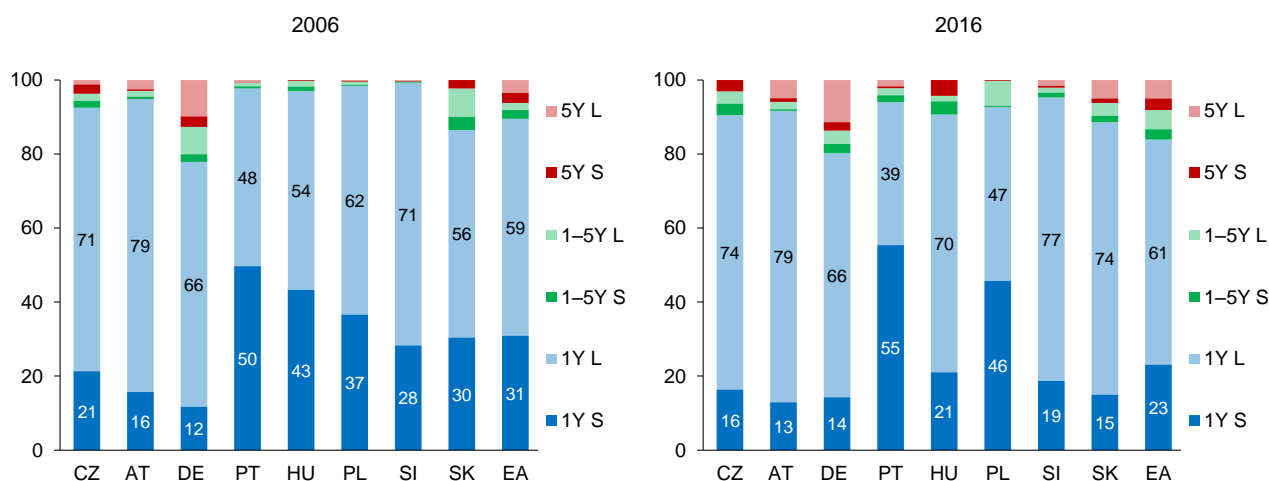
bond rates is also observed for loans for house purchase, with a pass-through time of around three months. The transmission of interest rates during the financial crisis was somewhat weakened as a result of an increase in client risk premia. This, however, is a traditional sign of cyclicity associated with more prudential behaviour by banks and tightening of credit conditions in response to the increasing level of risk associated with clients and their projects.

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 are rates on loans to households. This applied both in the period of the financial crisis (and hence higher volatility) and in the pre-crisis and post-crisis periods.⁸⁰ 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.⁸¹

Chart 32 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, corporations typically take out loans with floating rates or rates with a fixation period of up to one year. 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. Of the countries under review, larger shares of loans with longer fixations can be found in Slovakia, Germany and the euro area as a whole (above 12%), and to a lesser extent also in the Czech Republic. Large loans (i.e. those over EUR 1 million) have the largest share in all the countries except Portugal, and this share has generally increased since 2006.

Chart 32: 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 countries. The 2016 data are as of June.

Source: ECB, CNB calculations.

A simplified estimate of the strength and lag of the transmission from market to client rates can be obtained by conducting a correlation analysis of changes in these rates. The maximum

⁸⁰ Aristei and Gallo (2012).

⁸¹ Beckmann et al. (2013).

value of the coefficients of correlation between interest rates on client loans and the relevant market interest rate was determined for several possible lags for the countries under review. Table 12 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. For most countries, these correlations reach statistically significant levels with no lag, suggesting fast pass-through of changes in market rates to client rates. The exception is Portugal, where there is a one-month lag for both small and large loans. Austria, Germany and the euro area as a whole have the highest correlations with no lag for both small and large loans. In the case of Slovakia, a one-month lag occurs for large loans, and the relationship between the lending rate and market rate is less significant. A weaker relationship is also found for large loans in Poland and Hungary. This may stem from the fact that the client rate on large loans may also be affected by other factors, such as individual firm characteristics and the bank-firm relationship. In the Czech Republic, the transmission is not lagged and the correlation is statistically significant, but the relationship is weaker than in Austria and Germany. These results generally indicate strong links between client interest rates and the relevant interbank rates.

Table 12: 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			loans over EUR 1 million		
	2004M1–2016M6			2004M1–2016M6		
	t	t-1	t-2	t	t-1	t-2
CZ	0.36 **	0.13	0.03	0.42 **	0.17	0.07
AT	0.84 **	0.70 **	0.57 **	0.75 **	0.56 **	0.47 **
DE	0.73 **	0.62 **	0.44 **	0.71 **	0.46 **	0.31 **
PT	0.49 **	0.61 **	0.38 **	0.25 **	0.35 **	0.23 *
HU	0.35 **	0.27 **	0.11	0.21 **	0.09	0.02
PL	0.70 **	0.59 **	0.38 **	0.16 *	0.08	0.09
SI	0.47 **	0.32 **	0.15 *	0.33 **	0.20 *	0.07
SK	0.33 **	0.11	0.08	0.12	0.24 *	0.09
EA	0.87 **	0.75 **	0.53 **	0.84 **	0.59 **	0.45 **

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 asymmetry in client interest rates after entry into a monetary union. By decomposing the **spread between interest rates on new loans to non-financial corporations and the monetary policy rate** (RI-Rp) into three components (see Chart 33) it is possible to express the various aspects of financial risk⁸² and assess the primary channel of monetary policy transmission – the money market.

- (i) A growing difference between the overnight interbank rate (EONIA, CZEONIA) and the monetary policy rate (Rb-Rp) can generally be interpreted as a signal of tension or rising risk on the money market. In recent years, however, this difference has been affected – especially in the euro area – by a change in the overall liquidity position of the banking system. This change has led to the overnight interbank rate dropping below the monetary policy rate and converging towards the deposit rate since 2009. This was due to the creation of a liquidity surplus in the Eurosystem due to the ECB's fixed rate refinancing operations with full allotment and other follow-up liquidity-providing

⁸² Illes and Lombardi (2013).

operations. At present, the Rb-Rp difference is narrower, but it is still negative due to the zero main monetary policy rate and because the negative overnight rate is converging to the negative deposit rate.⁸³ The growing Rb-Rp difference in the Czech Republic initially suggested liquidity problems on the interbank market and subsequently a period of crisis of confidence among banks. The overnight rate is currently closely attached to the main monetary policy rate and is in fact following the discount rate.

- (ii) The difference between the government bond yield⁸⁴ and the overnight interbank rate (Rg-Rb) indicates the term premium and the credit risk of government bonds. This difference surged at the beginning of the financial crisis and remained strongly elevated in the euro area until last year. It then it shrank but still persists due to the credit risk of euro area periphery countries. By contrast, the difference is currently slightly negative in the Czech Republic due to the close-to-zero or even negative bond yield.
- (iii) The difference between the client interest rate⁸⁵ and the government bond yield (RI-Rg) captures the credit risk of the set of clients and banks' willingness to assume the risk associated with lending to them. Despite the current very low client rates on loans, this difference has shown a rising tendency over the past three years due to client rates stagnating at around 2% and bond yields falling to their current close-to-zero or negative figures.⁸⁶ The aforementioned difference in the euro area is gradually narrowing and is currently roughly 1 pp lower than in the Czech Republic.

Overall, the spread between interest rates on loans to non-financial corporations and the monetary policy rate (RI-Rp) in the Czech Republic is comparable with that in the euro area, averaging about 2 pp in the past twelve months.

⁸³ The main monetary policy rate in this decomposition will obviously not take into account any additional easing of the monetary conditions implemented through the ECB's unconventional monetary policy. In the current context of the large liquidity surplus in the euro area, the ECB's deposit rate has effectively become more important for the interbank market than the ECB's official monetary policy rate.

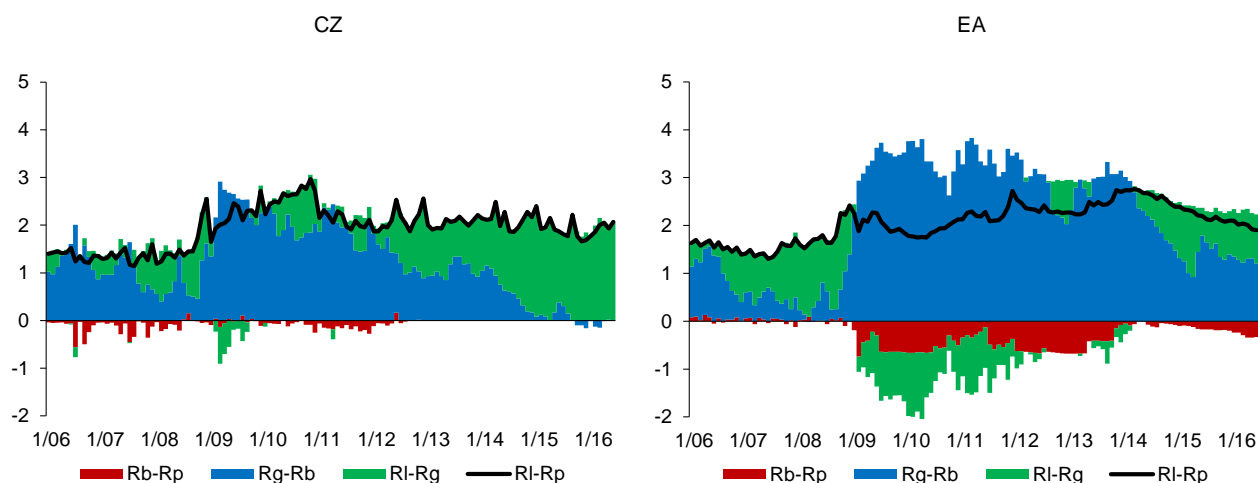
⁸⁴ Five-year government bonds are used.

⁸⁵ The weighted interest rate based on the amount of loans to non-financial corporations was used (for details of the fixation structure, see Chart 32).

⁸⁶ In the Czech Republic, bond yields with maturity up to five years are below zero. Five-year bond yields in the euro area remain at around 0.8% due to the varying levels of sovereign risk of its individual members.

Chart 33: Decomposition of the spread between interest rates on loans to non-financial corporations and monetary policy rates

(percentage points)



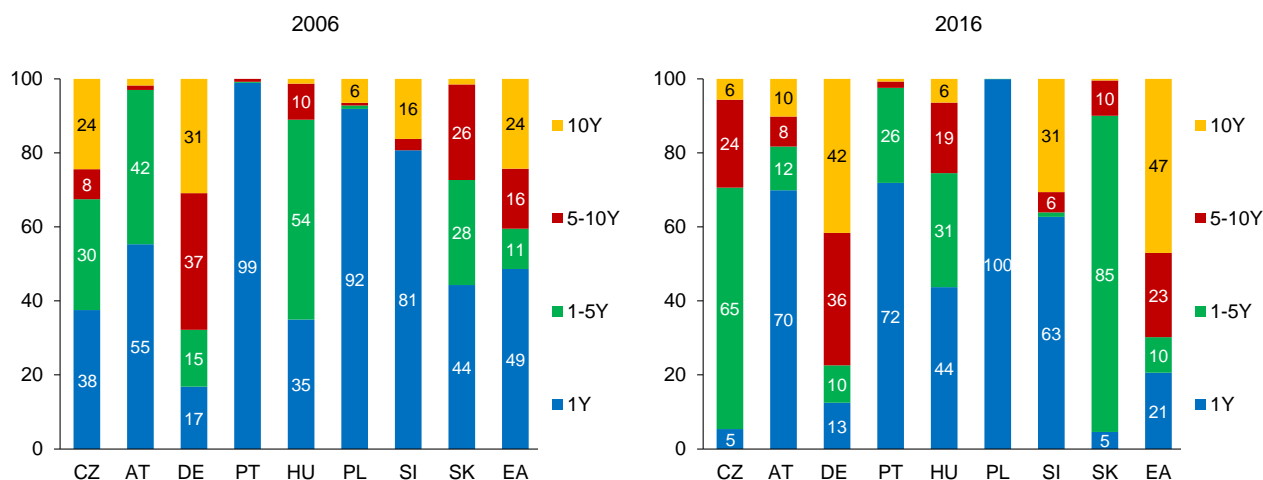
Note: RI-Rp is the difference between the interest rate on loans to non-financial corporations and the monetary policy rate; Rb-Rp is the difference between the overnight interbank rate and the monetary policy rate; Rg-Rb is the difference between the government bond yield and the overnight interbank rate; RI-Rg is the difference between the client interest rate and the government bond yield; the rates are calculated using a weighted rate on total corporate loans. End-of-month data were used for the key monetary policy rate. Five-year government bonds are used.

Source: ECB, CNB, CNB calculations.

Loans for house purchase make up the main segment of household debt. Chart 34 shows their structure by interest rate fixation. 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 meets the condition 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 (as in Slovakia), loans with even longer fixations (over ten years) prevail in Germany and the euro area as a whole. This is due to favourable market conditions, in particular very low client interest rates, and to a willingness of banks to fix interest rates for such long periods. However, fixing loans for house purchase for longer periods may result in less sensitive transmission. By contrast, a majority share of loans fixed for up to one year, and thus a higher sensitivity of transmission, can be observed in Austria, Portugal, Poland and Slovenia. The differences between countries are partly due to differences in financial products, market structure and some regulatory measures.⁸⁷

⁸⁷ In Poland, for example, standard loans for house purchase 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.

Chart 34: 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 increasing number of countries. The 2016 data are as of June.
Source: ECB, CNB calculations.

In all the countries under review, changes in rates on loans for house purchase fixed for up to one year are correlated most strongly with changes in the relevant three-month market rates with a one-month lag (no lag in the case of Poland due to a high volume of loans for house purchase with a floating rate). This suggests that **interest rate transmission** is fairly fast (see Table 13). This correlation is weaker in the Czech Republic than in the other countries under review, although the share of these mortgages with short fixation periods has been almost negligible in recent years. In the case of new loans fixed for over one year, the changes are correlated statistically significantly (with a one-month lag) with yields on ten-year government bonds only in the Czech Republic, Germany and the euro area as a whole.⁸⁸ At the same time, most loans for house purchase in these countries are fixed for a period of longer than one year (over one year and up to five years in the Czech Republic and over five years in Germany and the euro area). By contrast, no significant correlation between loans fixed for over one year and the relevant government bonds was identified in Austria, Hungary, Portugal, Slovenia and Slovakia.⁸⁹

⁸⁸ 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 loans for house purchase (Babecká Kucharčuková et al., 2013).

⁸⁹ In the cases of Hungary and Portugal, the absence of a correlation with government bonds may be due to an elevated and fairly volatile risk premium since the outbreak of the financial crisis. In the case of Austria, no correlation was found between loans for house purchase with maturities of over one year and the ten-year bond, but the analysis revealed a correlation with the 3M EURIBOR with a one-month lag (correlation coefficient: 0.35**).

Table 13: Correlation between changes in rates on loans for house purchase and changes in market rates

	rate fixed for up to one year			rate fixed for over one year		
	3M market interest rates			10Y government bonds		
	2004M1–2016M6			2004M1–2016M6		
	t	t-1	t-2	t	t-1	t-2
CZ	0.12	0.21 *	0.16	0.05	0.27 **	0.25 **
AT	0.50 **	0.51 **	0.49 **	0.01	-0.05	0.04
DE	0.58 **	0.63 **	0.43 **	0.40 **	0.73 **	0.55 **
PT	0.65 **	0.87 **	0.64 **	0.01	0.04	0.04
HU	0.20 **	0.30 **	0.22 *	0.07	-0.01	0.00
PL	0.65 **	0.65 **	0.42 **	-	-	-
SI	0.76 **	0.84 **	0.59 **	0.13	0.01	0.11
SK	0.10	0.36 **	0.20	0.09	0.18	0.22 *
EA	0.78 **	0.84 **	0.70 **	0.28 **	0.53 **	0.53 **

Note: The highest correlations over time between the interest rate on loans for house purchase 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, the share of loans for house purchase 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. In the Czech Republic, the spread between client rates on loans to non-financial corporations and the monetary policy rate is approximately the same as that in the euro area, though its structure is different. The correlation between client rates on loans to non-financial corporations and market rates in the Czech Republic is strong and comparable with that in the other countries under review. As regards loans for house purchase, 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 an economy to absorb shocks effectively also depends, among other things, 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. Substantial differences in inflation persistence in the countries of a monetary union can result in the single monetary policy having different impacts. The differences in inflation observed

between individual euro area countries can largely be explained by different inflation persistence.⁹⁰

Inflation persistence is measured by three different methods. The non-parametric method (Method 1) uses a procedure according to which the longer it takes actual inflation to return to its mean value, the more rigid is the inflation.⁹¹ This indicator takes values between 0 and 1. The closer it is to one, the more persistent is inflation.

Methods 2 and 3 are based on a model of inflation as an autoregressive process, monitoring the sum of the coefficients of the autoregressive terms. The values of the persistence indicators in these two methods (as in Method 1) increase with rising inflation persistence. Method 2 assumes a constant mean value of inflation. It has been demonstrated,⁹² however, that the results of modelling inflation persistence are largely dependent on the assumption regarding the mean to which inflation converges, and 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 14 summarises the inflation persistence estimates for 2006 Q1–2016 Q2. According to the estimate produced by the non-parametric Method 1, the inflation persistence in the Czech Republic is roughly in the middle of the group of countries under comparison. According to the estimates made using the other two methods, the Czech Republic ranks among countries with lower inflation persistence. However, the differences in the persistence estimates between the countries under comparison 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. The potential impacts of the single monetary policy on individual countries would thus be similar in this respect.

Table 14: Inflation persistence estimates

	Method 1	Method 2	Method 3
CZ	0.83	0.95	0.46
AT	0.80	1.00	0.56
DE	0.88	1.00	0.60
PT	0.80	0.87	0.60
HU	0.83	1.00	0.41
PL	0.88	1.01	0.65
SI	0.83	1.01	0.43
SK	0.85	1.00	0.53

Note: 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: Eurostat, CNB calculations.

⁹⁰ See Angeloni and Ehrmann (2004).

⁹¹ The technique proposed in Marques (2004).

⁹² See Marques (2004) and Cecchetti and Debelle (2006).

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 – 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.⁹³ 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.⁹⁴ 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 15: Speed of convergence of national financial markets to the euro area (beta)

	Money market		Forex market		Bond market		Stock market	
	1/02–7/07	8/07–6/16	1/02–7/07	8/07–6/16	1/02–7/07	8/07–6/16	1/02–7/07	8/07–6/16
CZ	-0.66	-0.39	-0.89	-0.88	-0.74	-0.74	-0.93	-0.81
AT	–	–	–	–	-1.09	-0.87	-1.03	-0.73
DE	–	–	–	–	B	B	-0.71	-0.84
PT	–	–	–	–	-0.68	-0.88	-1.05	-0.90
HU	-0.83	-0.77	-0.96	-0.90	-0.90	-0.70	-0.86	-1.01
PL	-0.48	-0.52	-0.82	-0.96	-0.81	-0.82	-0.93	-0.86
SI	–	–	–	–	–	-0.79 ^{°°}	-0.73 ^{°°°}	-0.85
SK	-0.79	–	-0.98	–	-0.99 [°]	-0.65	-0.78	-0.93
EA	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 (see the methodology). The first time interval is the period before the outbreak of the financial crisis (up to July 2007); the second is the period following the onset of the financial crisis. In the case of the bond market the convergence is vis-à-vis Germany. Other symbols: B = benchmark; ° from 22 June 2002; °° from 26 May 2009; °°° from 12 April 2003. All the estimates were statistically significant at the 1% level. Some data are not available.

Source: Thomson Datastream, CNB calculations.

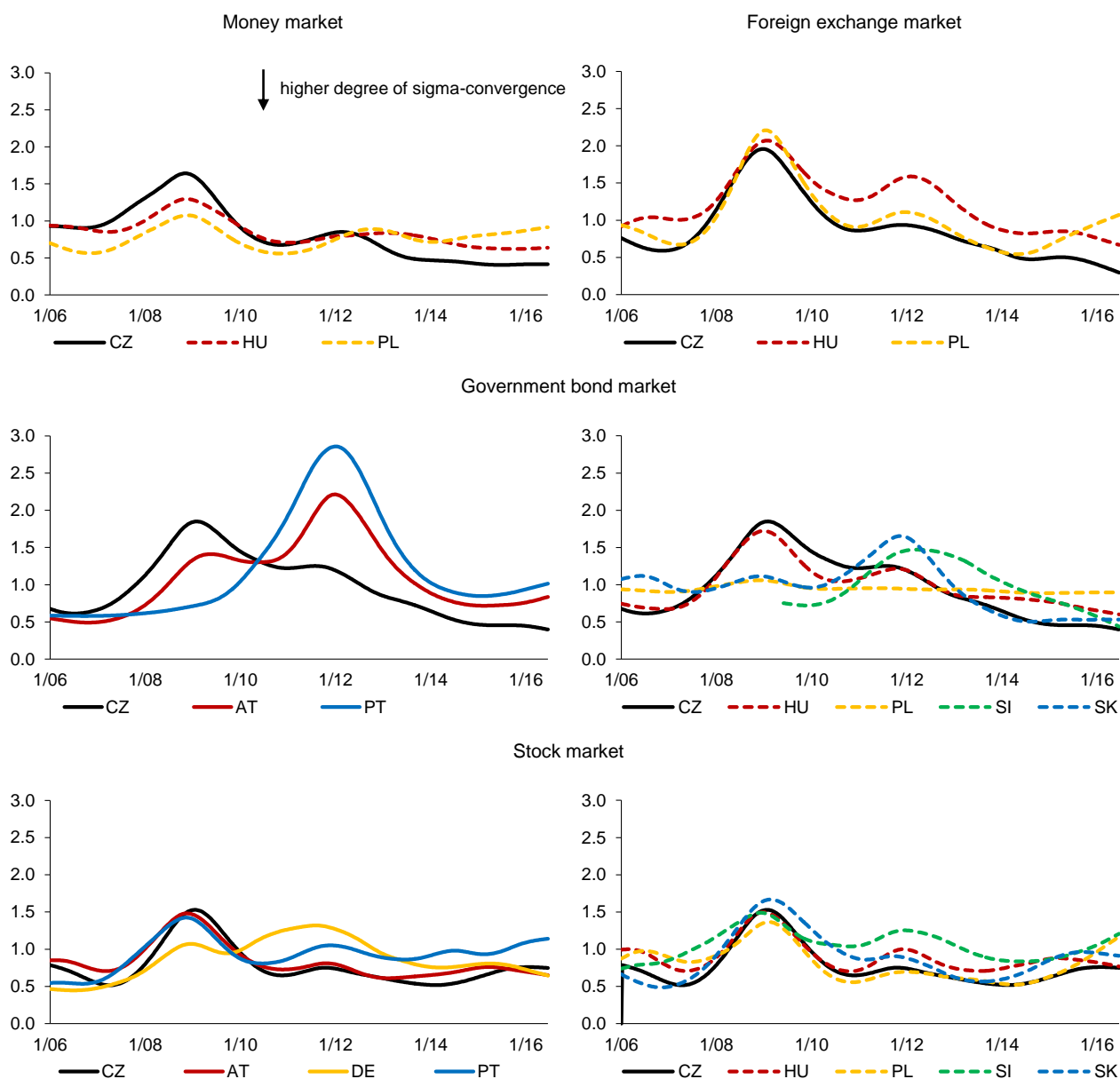
The results of **price-based measures** signal that in the pre-crisis period the speed of price beta-convergence on the stock, bond and foreign exchange markets of the countries under review vis-à-vis the euro area was relatively high (i.e. beta coefficients close to -1; see Table

⁹³ 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.

⁹⁴ Asset prices are monitored at an aggregate level and it is assumed that euro area assets respond primarily to global news.

15), but then fell due to escalation of the financial crisis. As the effects of the financial crisis abated, it rose again to almost the pre-crisis levels. The level of sigma-convergence across the countries under review also differed little in markets in the post-crisis period (see Chart 35). One exception is a decrease in alignment on the Polish foreign exchange market manifesting itself in higher volatility of the Polish zloty, which was associated with local political developments. The results of the analysis of the beta- and sigma-convergence of individual financial markets rank the Czech Republic among the countries with a higher degree of alignment with the euro area. Moreover, the alignment of the individual segments of the Czech financial market with the euro area has been increasing since 2009.⁹⁵ However, in the case of the foreign exchange market this is due to the use of the exchange rate as an additional monetary policy instrument, which is temporary by definition.

⁹⁵ 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. The 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 UK.

Chart 35: Degree of convergence of national financial markets to the euro area (sigma)

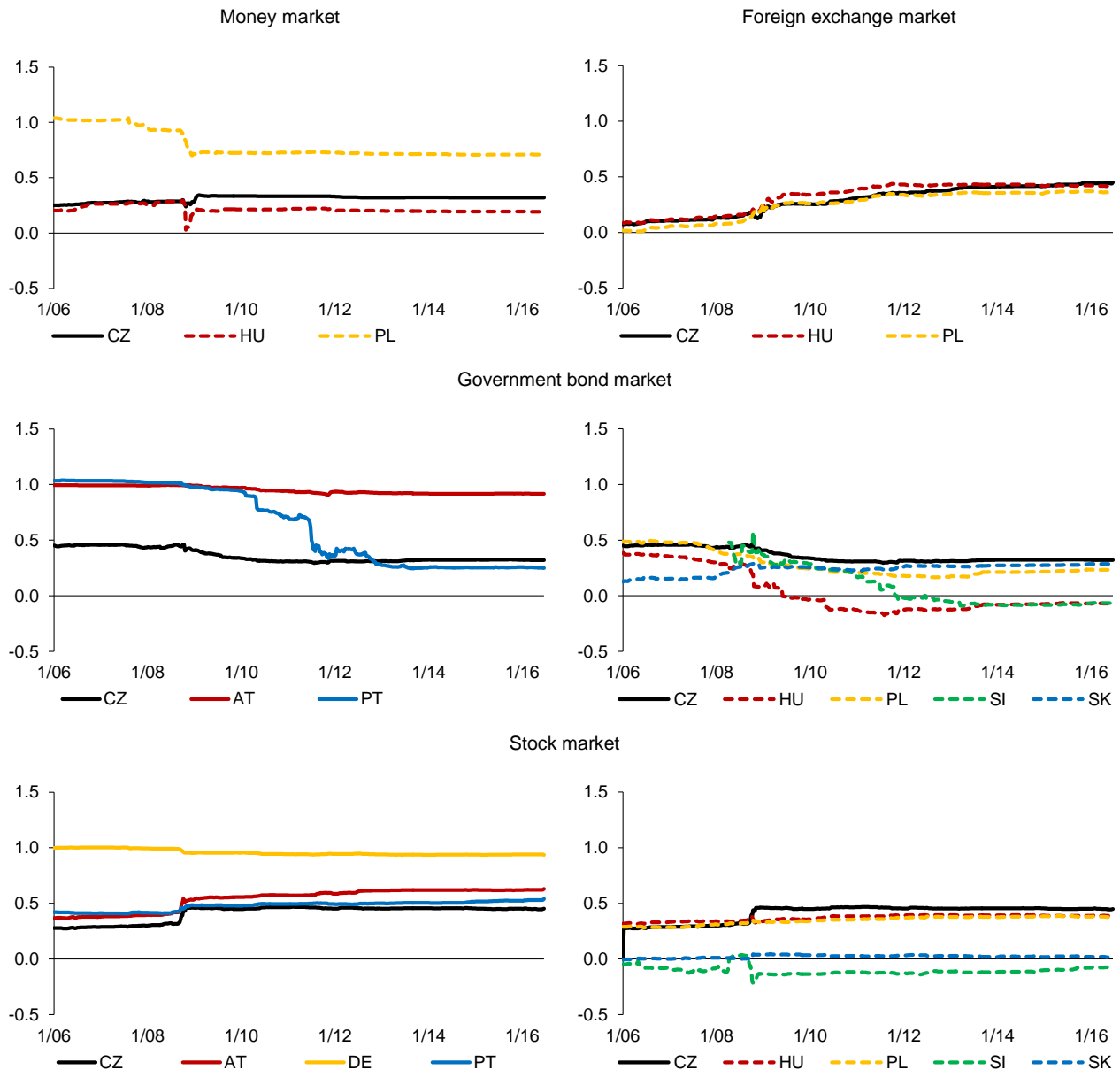
Note: Lower standard deviation values (y-axis) correspond to a higher degree of sigma-convergence. In the case of the bond market the convergence is vis-à-vis Germany. The differences in the standard deviations in individual markets are not statistically significant, except for the Slovenian and Slovakian foreign exchange markets, where volatility dropped to zero due to euro adoption.

Source: Thomson Datastream, CNB calculations.

The results of **news-based measures** (see Chart 36) 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 in the Czech Republic. The higher sensitivity of stock and foreign exchange markets to global shocks can be explained by a more significant influence of foreign investors. The reaction of markets 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 new EU Member States under review, especially on the stock and bond markets.

Chart 36: Sensitivity of asset prices to global news by comparison with the euro area (gamma)



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.

Source: Thomson Datastream, CNB calculations.

Both methods signal a visible stabilisation and a renewed process of alignment of financial markets in all the countries under review with the euro area after the escalation of the **euro area financial and debt crisis**. However, this stabilisation remains conditional on active central bank policy and measures, including unconventional ones. As Chart 35 shows, the start of the debt crisis brought about divergent movements in financial markets and increased price

volatility.⁹⁶ This was particularly observable in the Portuguese government bond market and to a lesser extent also in Austria (see Chart 36).⁹⁷ Renewed convergence can currently be seen in most markets and countries, with asset prices being greatly affected by the ECB's unconventional policy. These 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, visible 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 owing to the persisting uncertainty, and on the other hand are trying to find financial returns on assets in an environment of sustained low and often even negative rates.

To sum up, the process of financial alignment of the individual segments of the Czech financial market with the euro area, which was temporarily halted by the crisis, has now stabilised and in some areas has exceeded the pre-crisis alignment level. However, the assessment of alignment must still be viewed in the light of the measures taken by central banks.

1.2.6 Spontaneous euroisation

A high degree of euroisation limits the conduct of independent monetary policy and 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 has been gradually rising but remains relatively low due mainly to high confidence in the macroeconomic and institutional environment.⁹⁸ Foreign currency is used in transactions mainly by firms because of their high trade integration with the euro area. Rising euroisation was also recorded in response to the weakening of the koruna at the close of 2013. The share of total resident foreign currency deposits and loans in banks' balance sheets is around 10% in both categories and is the lowest in the Central European region.

The share of foreign currency loans of **non-financial corporations** in the Czech Republic has recently been gradually rising and is now at about 25% – the same as the share of foreign currency deposits (see Chart 37). Growth in foreign currency loans was recorded mainly in response to the weakening of the koruna at the close of 2013 (associated with the announcement of the CNB's exchange rate commitment), and since then it has been fluctuating slightly above its long-term average.⁹⁹ Firms in services and industry are showing the strongest interest in foreign currency loans (especially euro-denominated loans with longer maturities). In services, growth in foreign currency loans is concentrated in real estate activities, since the construction of commercial development projects is usually funded by euro-denominated loans so that rents can be set in euro, and those loans thus provide a natural hedge against exchange rate risk. However, foreign currency loans have also increased in some other services as well as in insurance, financial intermediation and transport. The use of such loans in the manufacturing sector is associated mainly with trade integration of firms with the euro area. Their share in total loans from domestic banks is showing a long-term upward trend in this sector, reaching about 45%, and is symmetrical with the development of deposits. Hedging of exports against exchange rate risk using financial instruments decreased

⁹⁶ Only the Slovak forex market recorded "artificial" convergence at the beginning of the crisis, owing to euro adoption.

⁹⁷ While the response of assets in Portugal stems from domestic factors such as adverse macroeconomic developments and widening structural imbalances, that in Austria stems more from financial sector developments.

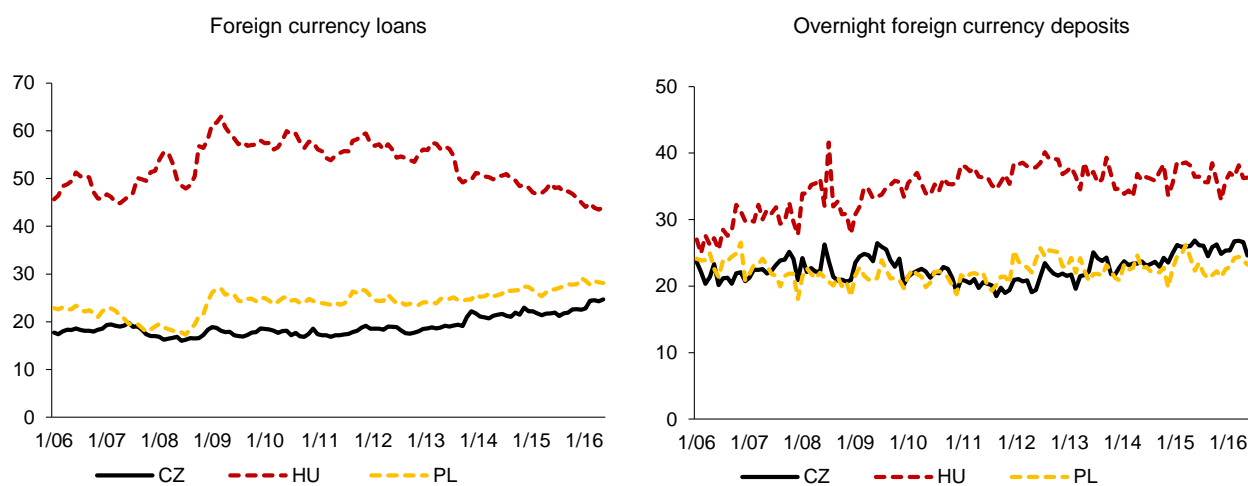
⁹⁸ Tkalec, 2012

⁹⁹ Demand for foreign currency loans is generally affected among other things by the interest rate on domestic and foreign currency loans. Interest rates on euro and koruna loans are currently similar in the Czech Republic and are close to 2%. Compared to the euro area, however, the rates are slightly higher this year.

slightly following the introduction of the CNB's exchange rate commitment and currently covers about 30% of exports.¹⁰⁰ In addition, exporters are continuing to use natural hedging through foreign currency loans and other liabilities directly with their parent companies abroad (as part of direct investment). In Poland, the shares of foreign currency deposits and loans of non-financial corporations with domestic banks remain similar to those in the Czech Republic, with loans also gradually increasing. By contrast, these shares in Hungary continue to be noticeably higher despite showing a downward trend.

Chart 37: Foreign currency loans and overnight deposits of non-financial corporations

(shares in total loans and overnight deposits of non-financial corporations with domestic banks, %)



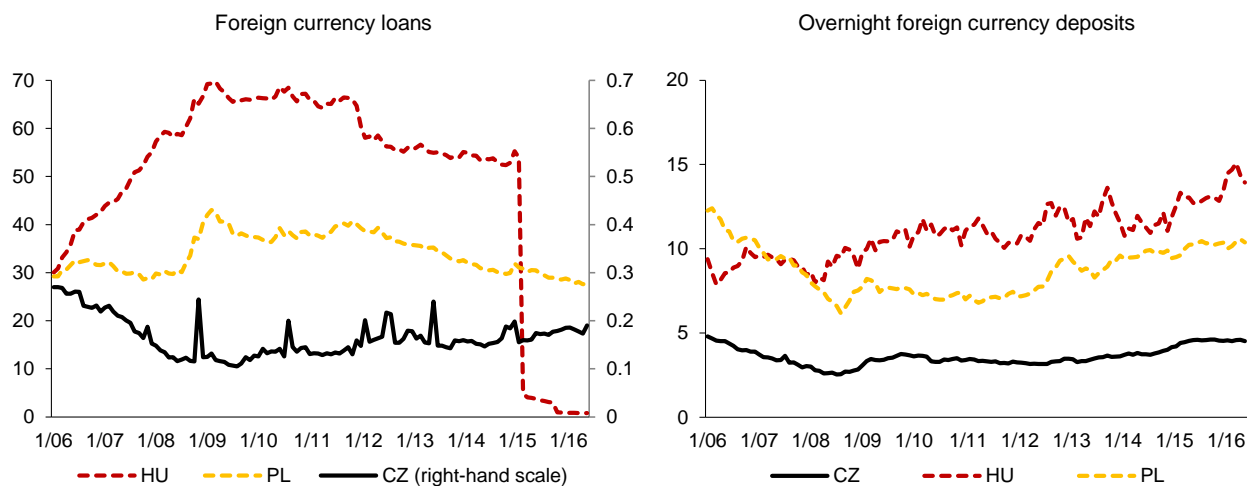
Source: Central banks, CNB calculations.

The demand of **households** for foreign currency loans and deposits has long been very low in the Czech Republic. The demand of households for foreign currency loans remains almost zero. By contrast, foreign currency loans in Poland have a share of almost 30% despite showing a gradual decline. In Hungary, the share of foreign currency loans to households has fallen dramatically from around 54% in February 2015 to less than 1% in June 2016, due to their conversion into the domestic currency under an agreement between the Hungarian government and the central bank (see Chart 38). In the Czech Republic, foreign currency overnight deposits continue to account for less than 5% of total overnight deposits of households with banks, although this ratio has risen modestly, mainly due to the weakening of the koruna in late 2013, and is thus slightly above its long-term average. In Hungary and Poland, the share of foreign currency deposits is also rising steadily and is still above the level observed in the Czech Republic. The share of foreign currency deposits has long been negligible thanks to households' confidence in the domestic currency and the macroeconomic and institutional environment.

¹⁰⁰ Source: Survey of non-financial corporations conducted by the CNB and the Confederation of Industry of the Czech Republic.

Chart 38: 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, the use of foreign currency in the Czech Republic naturally reflects the high degree of global integration of firms. In the household sector, the degree of euroisation is low and the amount of foreign currency loans is negligible. Demand for foreign currency is associated mainly with the natural export orientation of Czech firms, reflecting the high openness of the economy and recently to some extent the weakening of the koruna at the close of 2013.

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. An important role is also played by product market flexibility and the ability of the financial sector to absorb shocks.

2.1 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, Czech public finances are therefore important measures of the preparedness of the Czech economy to join the euro area.

2.1.1 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.¹⁰¹ This was also reflected in a paradigm shift in economic theory, 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 and 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 political representations considered automatic stabilisers to be insufficient on their own.¹⁰² In addition to 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, which was subsequently reflected in the response of the financial markets. Stabilisation of public budgets therefore became a fiscal policy priority in the countries under review in 2010–2012. 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 the following period of 2014–2015, which was characterised by a stronger economic recovery, fiscal policy in the countries under review and in the euro area as a whole turned slightly restrictive again.

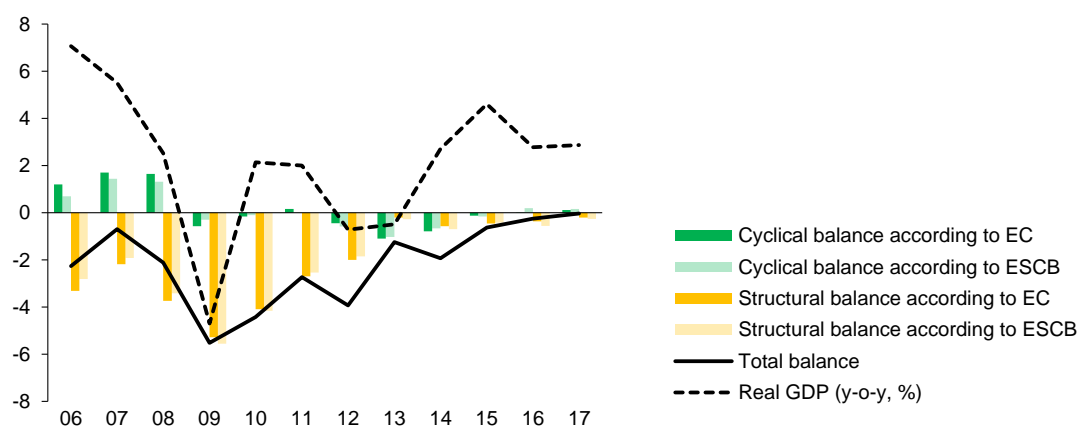
¹⁰¹ The long lags that arise between the identification of shocks, the implementation of fiscal measures and the effects of those measures, the existence of institutional constraints and the inertia of fiscal decisions are generally regarded as the main causes. A typical example of this problem is the risk of “procyclical fiscal policy”, i.e. fiscal policy that tries to smooth the business cycle but in reality – owing to the aforementioned lags – may amplify it.

¹⁰² 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).

The EU fiscal rules recommend a broadly balanced **government budget policy over the business cycle**. This should allow 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 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 39 shows the current estimates of the cyclical and structural components of the Czech Republic’s general government balance based on the CNB’s analyses.

Chart 39: General government balance and its cyclical and structural components
(% 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. The estimates are carried out using both the European Commission method and the ESCB approach (see the *Methodological Part*).

Source: CZSO, CNB calculations (the 2016 and 2017 figures come from the CNB’s forecast published in Inflation Report IV/2016).

The **structural balance**¹⁰³ indicates that the Czech government’s fiscal policy in the past was persistently in deficit and procyclical for most of the period under review. Fiscal policy was countercyclical in 2009, 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 1–2% of GDP year on year depending on the methodology

¹⁰³ 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.

selected) being one of the reasons for the economic downturn in 2012 and 2013. In 2014–2015, a fiscal policy easing, including accelerated drawdown of EU funds, contributed to a recovery of the Czech economy and subsequently to higher growth, and hence also to a closing of the negative output gap; fiscal policy was therefore slightly procyclical. According to the CNB's current forecast,¹⁰⁴ the general government structural deficit will decrease moderately in 2016–2017, with the general government budget being structurally balanced or in a slight surplus at the end of the period. The European Commission's outlook and the Fiscal Outlook of the Ministry of Finance published in autumn 2016 differ from the CNB's forecast. However, these outlooks are also consistent with compliance with the medium-term budgetary objective.

The **cyclical component** of the total budget balance for the most part played a less important role in the period under review, since the action of automatic stabilisers, which smooth the business cycle, was limited and the total balance was therefore 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 component returned to levels close to zero. It was negative in 2012–2014, when the contribution of the cyclical component to the overall general government deficit was apparent again as a result of the renewed recession in the Czech economy. In 2015 the cyclical component returned to neutral levels and the CNB's forecast expects it to stay there in the coming years.

The fall of the economy into recession in 2012–2013 resulted in a reassessment of the pace of previous fiscal consolidation and a withdrawal from the previously declared fulfilment of the **medium-term objective (MTO)**¹⁰⁵ in the form of a structural deficit of 1% of GDP in 2015.¹⁰⁶ This objective was initially postponed until the confidence of economic agents is restored and sustainable growth has been started up again.¹⁰⁷ A deadline of 2018 was subsequently set for convergence to the MTO.¹⁰⁸ However, the subsequent favourable evolution of the general government budget¹⁰⁹ led to the structural deficit falling below the set limit in 2015, i.e. as originally planned. Nevertheless, the current Convergence Programme expects the structural balance to gradually deteriorate¹¹⁰ to the MTO level, i.e. 1% of GDP, in the years ahead as a result of growth in expenditure on investment from national sources.¹¹¹

2.1.2 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.

¹⁰⁴ CNB (2016b) Inflation Report IV/2016 and the final row of Table 16.

¹⁰⁵ Convergence Programme of the Czech Republic, April 2012.

¹⁰⁶ 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.

¹⁰⁷ Convergence Programme of the Czech Republic, April 2013.

¹⁰⁸ Convergence Programme of the Czech Republic, April 2015.

¹⁰⁹ This was fostered by a drop in debt service costs, among other things, on the expenditure side and an increase in excise duty on cigarettes on the revenue side.

¹¹⁰ Convergence Programme of the Czech Republic, May 2016.

¹¹¹ However, according to the current CNB forecast published in Inflation Report IV/2016, the general government structural balance will approach zero in 2016 and 2017, so the MTO for the Czech Republic will be met for the fifth consecutive year.

Table 16 summarises the forecast for the **general government balance** of the countries under review as published by the European Commission in spring 2016. 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. The European Commission's forecast for the overall general government balance in 2016 and 2017 does not expect the deficit to exceed the reference value of 3% in any of the countries under review (except for Poland in 2017). However, the structural balances of most of the countries (except for Germany, and partly the Czech Republic as well) remain relatively high and exceed their specific MTOs. In the case of the Czech Republic, the structural deficit returns to the set level (-1% of GDP) after the drop observed in 2015 and further diminution in 2016. However, the European Commission's outlook for the Czech Republic is less favourable than the CNB's prediction, which indicates swifter approaching to a zero structural balance.

Table 16: General government balance (European Commission estimate)
(% of GDP)

	Total balance						Structural balance					
	2006	2013	2014	2015	2016	2017	2006	2013	2014	2015	2016	2017
CZ	-2.3	-1.2	-1.9	-0.6	-0.2	-0.6	-4.3	0.1	-1.0	-0.7	-0.3	-0.8
AT	-2.6	-1.4	-2.7	-1.0	-1.5	-1.3	-2.9	-1.0	-2.2	-0.5	-1.1	-1.1
DE	-1.7	-0.2	0.3	0.7	0.6	0.4	-1.7	0.1	0.5	0.8	0.6	0.6
PT	-4.3	-4.8	-7.2	-4.4	-2.7	-2.2	-4.2	-2.7	-5.7	-3.6	-2.3	-2.2
HU	-9.3	-2.6	-2.1	-1.6	-1.5	-2.3	-11.4	-1.3	-1.9	-1.9	-1.9	-2.9
PL	-3.6	-4.1	-3.4	-2.6	-2.4	-3.0	-3.5	-3.3	-2.8	-2.4	-2.4	-3.1
SI	-1.2	-15.0	-5.0	-2.7	-2.4	-2.0	-2.9	-12.4	-3.6	-1.9	-2.2	-2.4
SK	-3.6	-2.7	-2.7	-2.7	-2.2	-1.5	-4.6	-1.7	-1.9	-2.3	-2.0	-1.4
EA	-1.5	-3.0	-2.6	-2.1	-1.8	-1.5	-2.3	-1.4	-1.3	-1.2	-1.2	-1.2
CZ^{a)}	-2.3	-1.2	-1.9	-0.6	-0.3	0.0	-3.3	-0.2	-0.6	-0.4	-0.4	-0.2

Note: The general government balance is calculated according to ESA 2010 methodology and the "Excessive Deficit Procedure" definition. ^{a)} Total balance: data according to the CZSO's statistics and notifications (autumn 2016) until 2015, and the CNB's forecast from Inflation Report IV/2016 for 2016 and 2017. The structural balance is calculated under EC methodology. The difference from the European Commission's data for the Czech Republic stems from differences in the forecast for GDP and related public budget revenues and expenditures.

Source: European Commission (2016a, 2016b), CNB.

In addition to other factors, the government's room for manoeuvre for the application of discretionary budgetary policy measures is determined by the nature of fiscal expenditure, with **mandatory expenditures** being the least flexible.¹¹² 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. 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 and the initial state of the public budgets does not provide enough room for problem-free operation of automatic stabilisers.¹¹³

¹¹² 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. The definition of mandatory expenditures used in this analysis is given in the *Methodological Part*.

¹¹³ 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 in total expenditures and total revenues of the state budget has long been rising in the Czech Republic (see Table 17). Following a short-term decline in 2007, this share rose again in connection with the adverse cyclical developments in 2008–2009. Thereafter, this share increased further as a result of the impact of the government's austerity measures on non-mandatory expenditures. The share of mandatory expenditures in state budget revenues and expenditures remains relatively high even after the economic recovery in 2014–2015.

Table 17: Shares of mandatory state budget expenditure

(%)

	2006	2010	2011	2012	2013	2014	2015	2016	2017
Shares of mandatory expenditure in total SB expenditure	53.0	54.3	56.5	56.7	57.2	56.5	53.0	56.6	55.4
Shares of mandatory expenditure in total SB revenue	58.6	62.8	64.4	62.1	61.5	60.4	55.7	60.0	58.1

Note: Data until 2015 are actual figures; data for 2016 and 2017 are based on the government's August 2016 draft state budget (state budget compilation methodology).

Source: Ministry of Finance of the Czech Republic (2008, 2016), 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 18).¹¹⁴ For all indicators as a percentage of GDP, the Czech Republic ranked among the countries with lower figures in 2015, below the euro area average to a larger or smaller extent, with the exception of gross capital formation and intermediate consumption. This overall assessment of the Czech Republic's position is also in line with the share of social expenditure payments, which are the main component of mandatory expenditures (as in the other countries under review). The Czech Republic's low debt service expenditure ratio is a consequence of its still relatively low government debt and exceptionally low interest rates reflecting, among other things, the confidence of investors in Czech public finance. 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.

¹¹⁴ "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. 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.

Table 18: Public revenues and expenditures relative to GDP in 2015
(%)

	CZ	AT	DE	PT	HU	PL	SI	SK	EA
Total revenues	41.3	50.6	44.7	44.0	48.5	38.9	45.1	42.9	46.5
- taxes	19.6	28.9	23.1	25.3	25.8	19.8	22.2	18.2	25.7
- social contributions	14.6	15.4	16.5	11.6	13.2	13.5	14.8	14.0	15.3
Total expenditures	42.0	51.6	44.0	48.4	50.0	41.5	47.8	45.6	48.5
employees	8.7	10.8	7.5	11.3	10.6	10.2	11.2	9.0	10.1
- intermediate consumption	6.2	6.4	4.6	5.8	7.3	5.9	6.7	5.9	5.2
- social payments	15.9	23.5	23.8	19.5	15.4	16.3	18.4	19.0	23.1
formation	5.1	2.9	2.1	2.3	6.6	4.4	4.7	6.3	2.7
- interest expenditure	1.1	2.4	1.6	4.6	3.5	1.8	2.9	1.8	2.4

Source: European Commission (2016a).

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 maturing government debt. This may have serious macroeconomic impacts.¹¹⁵ Moreover, fiscal policy will have to take into account the fact that in the recent reform of the Stability and Growth Pact the debt criterion gained much greater weight than before. Table 19 provides a comparison of the ratios of government debt to GDP

Table 19: General government debt (European Commission estimate)
(% of GDP)

	2006	2010	2011	2012	2013	2014	2015	2016	2017
CZ	27.9	38.2	39.8	44.5	44.9	42.2	40.3	39.7	39.1
AT	67.0	82.4	82.2	82.0	81.3	84.4	85.5	83.5	81.1
DE	66.3	81.0	78.3	79.9	77.5	74.9	71.2	68.1	65.7
PT	69.2	96.2	111.4	126.2	129.0	130.6	129.0	130.3	129.5
HU	64.6	80.5	80.7	78.2	76.6	75.7	74.7	73.4	72.5
PL	46.9	53.3	54.4	53.7	55.7	50.2	51.1	53.4	55.0
SI	26.0	38.4	46.6	53.9	71.0	80.9	83.1	80.2	78.3
SK	30.7	40.7	43.2	52.2	54.7	53.6	52.5	53.3	52.7
EA	67.3	84.0	86.7	91.4	93.7	94.4	92.6	91.6	90.6
CZ^{a)}	27.9	38.2	39.8	44.5	44.9	42.2	40.3	39.0	37.9

Note: ^{a)} Data according to the CZSO's statistics and notifications (autumn 2016) until 2015, and the CNB's estimate from Inflation Report IV/2016 for 2016 and 2017. The creation of a government debt financing reserve (issuance of bonds going beyond the need to cover budget deficits) contributed to the increase of several percentage points in the debt-to-GDP ratio in 2011–2013. A decrease in this reserve then contributed to a decline in the debt-to-GDP ratio in 2014–2015.

Source: European Commission (2016a), 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 as a result of the growth in deficits and other extraordinary fiscal measures

¹¹⁵ As debt crisis in the euro area – and above all in Greece – 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.

taken by individual countries to dampen the impacts of the financial and economic crisis. Although Czech government debt has long been well below the reference value of 60% of GDP, and the debt-to-GDP ratio has even shown a slight decrease since 2014, its sustainability remains a major risk due to unresolved structural problems in the Czech economy and the impacts of population ageing.

Table 20: Debt service (European Commission estimate)

(% of GDP)

	2006	2010	2011	2012	2013	2014	2015	2016	2017
CZ	1.0	1.3	1.3	1.4	1.3	1.3	1.1	1.0	0.9
AT	3.1	2.9	2.8	2.7	2.6	2.5	2.4	2.2	2.2
DE	2.7	2.5	2.5	2.3	2.0	1.8	1.6	1.4	1.2
PT	2.8	2.9	4.3	4.9	4.9	4.9	4.6	4.3	4.4
HU	3.9	4.1	4.2	4.6	4.5	4.0	3.5	3.1	2.9
PL	2.4	2.5	2.5	2.7	2.5	1.9	1.8	1.7	1.6
SI	1.4	1.6	1.9	2.0	2.6	3.2	2.9	2.8	2.6
SK	1.4	1.3	1.5	1.8	1.9	1.9	1.8	1.5	1.4
EA	2.8	2.7	3.0	3.0	2.8	2.7	2.4	2.2	2.1

Source: European Commission (2016a).

At the same time, it should be taken into account that the level of debt is also being reflected in mandatory expenditure connected with **debt service**. In many countries it has not increased yet owing to the exceptionally low interest rates, but that is only a temporary factor. Nevertheless, the Czech Republic is succeeding in maintaining low debt service expenditure level compared to the other countries under review, even well below the euro area average, according to the outlook up to 2017. This is due to the low level of Czech government debt and low debt servicing costs, reflecting, among other things, solid domestic economic fundamentals (see Table 20).¹¹⁶

2.1.3 Government finance sustainability

Sustainability of government 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, 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.

¹¹⁶ The current low debt service costs in the Czech Republic, and the “negative yields” on some issues, are related to the CNB’s interventions and non-residents’ increased interest in government koruna bonds. They can therefore be expected to rise after the exit from the CNB’s exchange rate commitment or as a result of changes in the monetary policies of the CNB and the ECB.

Table 21: Age-related government expenditures
(% of GDP)

	Pensions		Health care		Long-term care		Total	
	2013	2060	2013	2060	2013	2060	2013	2060
CZ	9.0	9.7	5.7	6.7	0.7	1.4	15.4	17.8
AT	13.6	13.9	6.9	8.2	1.4	2.7	21.9	24.8
DE	10.0	12.7	7.6	8.2	1.4	2.9	19.0	23.8
PT	12.1	11.1	6.0	8.5	0.5	0.9	18.6	20.5
HU	11.5	11.4	4.7	5.4	0.8	1.2	17.0	18.0
PL	10.4	10.5	4.2	5.5	0.8	1.7	15.4	17.7
SI	11.8	15.3	5.7	6.8	1.4	2.9	18.9	25.0
SK	8.0	10.0	5.7	7.7	0.2	0.6	13.9	18.3
EA	12.0	11.9	7.0	7.7	1.7	3.0	20.7	22.6
CZ^{a)}	8.2	8.8	5.9	8.1	1.4	1.8	15.5	18.7

Note: ^{a)} CNB calculations (see the *Methodological Part* for the public finance sustainability model). The decline in pension expenditure in 2060 is due to expected increases in the retirement age.

Source: European Commission (2015f).

Among the countries under comparison, the Czech Republic (together with Slovakia) had the lowest initial level of **age-related expenditure** in 2013 (see Table 21). It maintains this good relative position in international comparison at the long-term forecast horizon as well. However, the expected rise in age-related expenditures is still marked.

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 in effect since 2011, which introduced several parametric changes, the most significant being a gradual increase in the retirement age, had an immediate and positive long-term effect on public finances. However, this reform 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” met with little interest from the general public, not least because it was not communicated consensually by the political representation, and it was subsequently abolished at the end of 2015. The reform of the first pay-as-you-go pillar currently being prepared by the government (establishing a retirement age ceiling of 65 years in combination with a revision mechanism for periodically testing that ceiling) would, however, lead to a deterioration in the sustainability of the pension system after 2030 in the absence of further parametric changes. An amendment to the pension law scheduled to take effect in January next year, enabling the government to increase old-age pensions by up to 2.7% on average if such growth is not achieved by applying the indexation equation, implies an immediate adverse impact on the sustainability of the pension system.¹¹⁷ Another critical factor for public finance sustainability in the Czech Republic is healthcare expenditure, which, according to long-term projections, is increasing even faster than pension expenditure.

To sum up, fiscal policy in the Czech Republic grappled with elevated structural deficits 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

¹¹⁷ The indexation equation for adjusting old-age pensions takes into account the full extent of the growth in consumer prices and one-third of the growth in the real wage in the reference period.

a slightly rising path in the government's outlook contained in the Convergence Programme (while the CNB's prediction is more optimistic in this respect). 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 the forecast expects compliance with the fiscal convergence criteria 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.

2.2 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. In addition to the analyses in this section, the labour market is dealt with from the perspective of international competitiveness using the Global Competitiveness Index (GCI) in the pillar assessing labour market efficiency (see section 2.3.1 for details).

2.2.1 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.

The **long-term unemployment** rate increased in most countries in 2010 as the impacts of the recession hit the labour market with the usual lag (see Table 22). The exception is Germany, where the long-term unemployment rate decreased gradually over the entire period under review. The long-term unemployment rate in the Czech Republic is one of the lowest among the countries under comparison. It increased in 2010 and then stagnated at around 3%, but since 2013 it has been declining as a result of growing economic activity. The long-term unemployment rate in the Czech Republic has thus been converging towards the levels observed in Austria and Germany, which have the lowest rates. By contrast, Slovakia, Portugal and Slovenia have much higher levels.

Table 22: Long-term unemployment rate
(%)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
CZ	3.9	2.8	2.2	2.0	3.0	2.7	3.0	3.0	2.7	2.4
AT	1.5	1.3	1.0	1.2	1.2	1.2	1.2	1.3	1.5	1.7
DE	5.7	4.9	3.9	3.5	3.3	2.8	2.4	2.3	2.2	2.0
PT	3.9	3.8	3.6	4.2	5.7	6.2	7.7	9.3	8.4	7.2
HU	3.4	3.5	3.6	4.2	5.5	5.2	5.0	4.9	3.7	3.1
PL	7.9	5.1	2.5	2.6	3.0	3.6	4.1	4.4	3.8	3.0
SI	2.9	2.2	1.9	1.8	3.2	3.6	4.3	5.2	5.3	4.7
SK	10.3	8.4	6.7	6.6	9.3	9.3	9.4	10.0	9.3	7.6

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

Source: Eurostat.

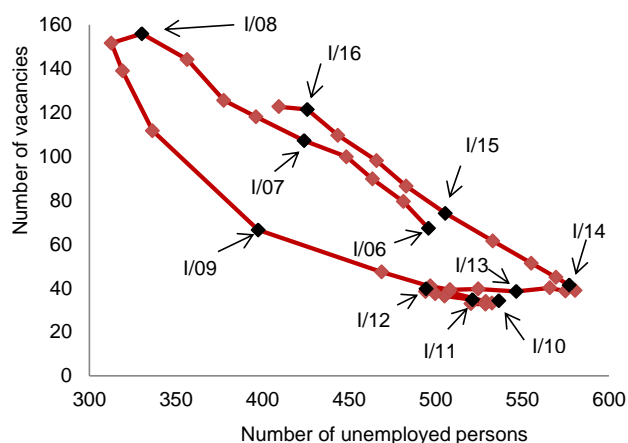
Cyclical and structural unemployment can be analysed by means of the Beveridge curve,¹¹⁸ which plots the number of vacancies against the number of unemployed persons (see Chart 40). Decreasing (increasing) unemployment amid a rising (falling) number of vacancies is associated with cyclical changes on 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.¹¹⁹ There was a cyclical decline in unemployment in the Czech Republic from 2006 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. An opposite shift, i.e. a fall in the number of unemployed persons amid a rise in job vacancies, has been occurring in the last two years as the economy has expanded. 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.

¹¹⁸ 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 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.

¹¹⁹ In addition to changes in structural unemployment, horizontal or vertical shifts of the Beveridge curve may often reflect 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 (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).

Chart 40: Beveridge curve

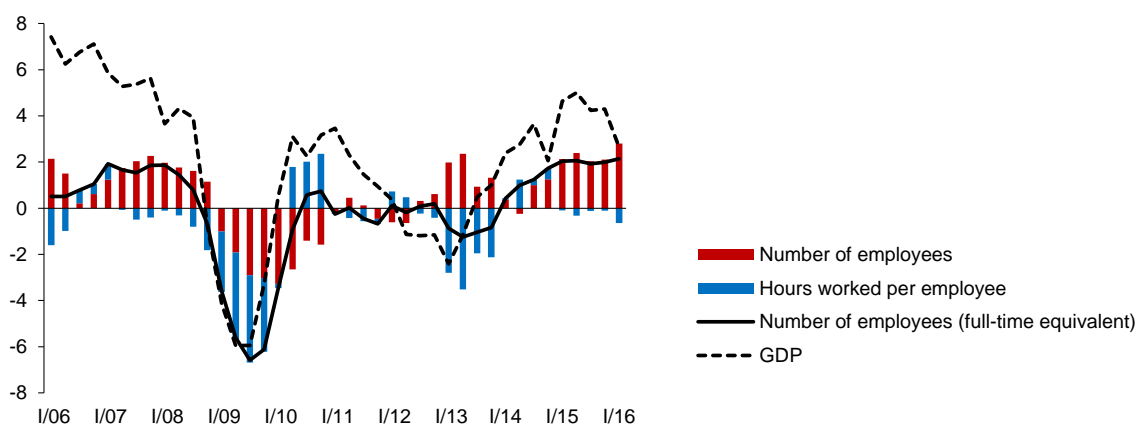
(thousands)



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, thus streamlining their labour costs. This is well illustrated by the situation in 2013 (and before that in 2009), when average hours worked per employee declined substantially amid falling GDP (see Chart 41). The decrease in hours worked per employee halted as year-on-year growth in economic activity was renewed in 2014 H1. This cyclical pattern in the use of shorter working hours is an element of greater labour market flexibility and is therefore favourable from the viewpoint of future euro adoption. In addition to these cyclical causes, however, the rising occurrence of shorter working hours and part-time employment is due to structural factors, reflecting convergence towards labour market standards in more advanced countries, such as greater use of part-time employment by women after returning to work from parental leave and by employees of retirement age.

Chart 41: Average hours worked per employee

Note: Annual percentage changes, contributions in percentage points.

Source: LFS, CNB calculations.

Over the past ten years, the **rate of economic activity** rose noticeably in most countries under comparison, including the Czech Republic. The largest increases – of more than 5 pp – were recorded in Hungary and Poland (see Table 23). The rise was due, among other things, to increases in the retirement age and to greater use of shorter working hours. By contrast, the rates of economic activity in Portugal and Slovenia were flat over the last ten years.

Table 23: Rate of economic activity in the 15–64 age category

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
CZ	70.3	69.9	69.7	70.1	70.2	70.5	71.6	72.9	73.5	74.0
AT	72.4	73.5	73.9	74.3	74.4	74.6	75.1	75.5	75.4	75.5
DE	74.9	75.6	75.9	76.3	76.7	77.3	77.2	77.6	77.7	77.6
PT	73.6	73.9	73.9	73.4	73.7	73.6	73.4	73.0	73.2	73.4
HU	62.0	61.6	61.2	61.2	61.9	62.4	63.7	64.7	67.0	68.6
PL	63.4	63.2	63.8	64.7	65.3	65.7	66.5	67.0	67.9	68.1
SI	70.9	71.3	71.8	71.8	71.5	70.3	70.4	70.5	70.9	71.8
SK	68.6	68.3	68.8	68.4	68.7	68.7	69.4	69.9	70.3	70.9

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

Source: Eurostat (LFS).

Regional differences in unemployment can be monitored using the coefficient of variation of the unemployment rate for areas (NUTS II) and regions (NUTS III). This coefficient had been gradually decreasing since 2006 (see Table 24). A rebound, suggesting a slight increase in the mismatch between the regional supply of and demand for labour, was recorded in 2012, when, in an adverse labour market situation, growth in unemployment was observed especially in regions with traditionally the highest unemployment rates. The coefficient of variation also increased in Austria in 2012, while remaining broadly flat in the other countries. Since 2013, the coefficient of variation of the unemployment rate in the Czech Republic has been falling gradually again in the context of an improving labour market situation. In Hungary, by contrast, the coefficient of variation rose significantly in 2014, exceeding the level recorded for the Czech Republic. The regional differences in unemployment rates in the Czech Republic are medium-high compared to the other countries under review and are traditionally lower than in the core euro area countries, i.e. Germany and Austria.

Table 24: Coefficient of variation of the unemployment rate

(%)

	NUTS II regions									NUTS III regions								
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2006	2007	2008	2009	2010	2011	2012	2013	2014
CZ	45	42	44	34	31	28	33	31	30	46	43	46	35	32	28	34	32	30
AT	44	45	39	34	37	40	43	39	43	45	46	41	36	39	42	45	41	45
DE	41	45	46	37	38	44	40	39	39	45	50	51	43	44	50	48	46	-
PT	21	21	19	18	20	13	14	16	13	29	28	-	-	-	-	-	-	-
HU	31	40	43	31	23	26	23	21	31	36	45	49	36	28	30	27	25	36
PL	12	14	18	20	14	14	15	16	18	28	39	30	32	28	27	27	26	27
SI	-	-	-	-	-	-	-	-	-	26	25	28	30	23	28	21	20	22
SK	38	38	41	32	27	32	31	29	28	43	46	51	38	29	33	33	31	30

Note: The coefficient of variation is the ratio of the standard deviation weighted by region size to the average unemployment rate in per cent. Data for Slovenia are only available for the NUTS III level.

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 25). This indicator has long been

higher in the Czech Republic than in Poland and Slovakia and is more or less constant over time. However, it attains significantly higher levels in Austria, Germany and Slovenia.

Table 25: Internal migration

(per 1,000 inhabitants)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
CZ	22	25	24	22	23	22	22	22	23	21
AT	36	37	38	37	37	38	39	39	40	43
DE	43	44	44	44	44	47	47	48	49	-
HU	25	25	24	21	20	20	19	19	22	22
PL	12	13	11	11	11	11	10	12	11	-
SI	19	19	53	48	52	53	55	55	55	53
SK	17	17	17	15	16	16	15	16	17	17

Note: Migration between municipalities (HU, PL and SI – all changes in permanent residence); SI – only Slovenian nationals until 2007. Data are not available for Portugal. The calculations do not take into account differences in the sizes of territorial units in the chosen countries.

Source: Statistical yearbooks, Eurostat, CNB calculations.

To sum up, the Czech labour market has been showing signs of greater flexibility in recent years in response to the economic crisis, particularly through stronger growth in the number of employees working shorter hours during the recession. The rate of economic activity among the working age population has also gone up. The Czech Republic displays medium-high regional differences in unemployment rates. In recent years, the long-term unemployment trends in the Czech Republic have been qualitatively similar to those in the other countries under comparison, although its rate is among the lowest. However, structural problems persist in the areas of unemployment and internal labour market flexibility. In particular, internal geographical labour mobility remains significantly lower than in advanced European countries, limiting the ability to adjust to asymmetric shocks.

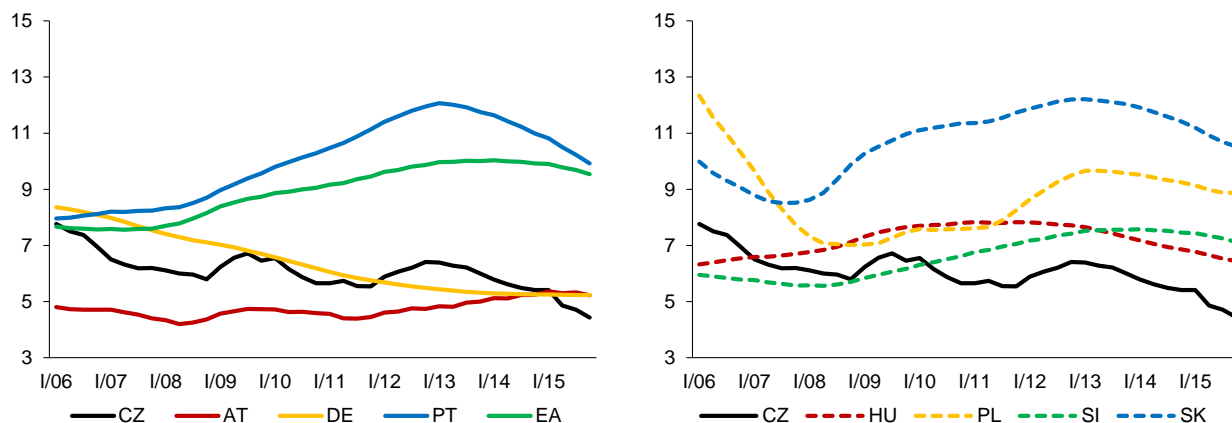
2.2.2 Estimate of structural unemployment using the NAIRU

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, structural unemployment is not directly observable and is estimated by filtering time series using an economic model.¹²⁰

There are sizeable differences in the evolution and level of the NAIRU between the countries under comparison (see Chart 42). The NAIRU is high in Slovakia and Poland, i.e. countries with traditionally higher unemployment rates, and also in Portugal. In the Czech Republic, the NAIRU has long been falling with some fluctuations around the downward trend, which accelerated further last year. It is reasonable to assume that the downward trend in recent years has been partly due to the increased use of shorter working hours (see above), especially during economic downturns, which increases labour market flexibility and, in turn, lowers the NAIRU. The current estimated level of the NAIRU in the Czech Republic – slightly above 4% – is the lowest among the countries under comparison and almost one percentage point lower than the NAIRU estimates for Austria and Germany. Austria's NAIRU is traditionally low, but has increased gradually over the last three years. Conversely, labour market reforms in Germany over the last ten years have helped significantly reduce German structural unemployment.

¹²⁰ For details, see the *Methodological Part*.

Chart 42: NAIRU
(%)



Source: Eurostat, CNB calculations.

2.2.3 International labour mobility

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

The share of foreign nationals in the population (see Table 26) is one of the important indicators of international labour mobility.¹²¹ In the Czech Republic, it more than doubled in the initial years after EU accession compared to the pre-accession period, but it later flattened out at around 4%. Last year it increased somewhat, but it was still less than one-half of the ratio in Germany and one-third of that in Austria. Moreover, the share of foreign nationals in Austria has risen markedly in recent years.¹²² Of the other countries under comparison, only Slovenia recorded a similar trend as the Czech Republic, but its share of foreigners has been rising at a slightly faster pace in recent years. The shares of foreign nationals in the population have long been significantly lower and almost constant in Hungary, Slovakia and Poland.¹²³

¹²¹ Over the last two years, the EU has been experiencing a massive wave of immigration caused above all by the poor security situation in some non-European areas. This is a different sort of immigration compared to the economically motivated labour mobility within the monetary union and its neighbours. In the case of the Czech Republic, however, this sort of immigration occurs to a negligible degree, and none of the other countries under comparison (with the exception of Austria) recorded any significant rise in the numbers of foreign nationals either. However, data revisions can be expected in this area in the future.

¹²² The share of foreign nationals from non-EU countries in the Czech population was 2.6% in 2015. Markedly higher shares of non-EU foreign nationals are observed in Germany and Austria (5% and 6.6% respectively), whereas in the other Central European countries the shares are almost negligible. The share of Slovak nationals in the Czech population was 0.9% in 2015.

¹²³ 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.

Table 26: Share of foreign nationals in the population
(%)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
CZ	2.5	2.9	3.3	3.9	4.0	4.0	4.0	4.0	4.1	4.3
AT	9.7	9.7	9.9	10.2	10.5	10.8	11.2	11.8	12.4	13.2
DE	8.8	8.8	8.8	8.8	8.7	8.8	9.1	9.4	8.7	9.3
PT	2.6	4.1	4.2	4.2	4.3	4.2	4.1	4.0	3.8	3.8
HU	1.5	1.7	1.8	1.9	2.0	2.1	1.4	1.4	1.4	1.5
PL	0.1	0.1	0.2	0.1	0.2	0.2	0.2	0.2	0.3	0.3
SI	2.4	2.7	3.4	3.5	4.0	4.0	4.2	4.4	4.7	4.9
SK	0.5	0.6	0.8	1.0	1.2	1.3	1.3	1.3	1.1	1.1

Source: Eurostat, CNB calculations.

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

2.2.4 Institutional environment

The institutional set-up of the labour market has a fundamental influence on its functioning 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.¹²⁴

The ratio of the **minimum wage** to the average wage in the Czech Republic decreased gradually in 2005–2012 owing to stagnation of the minimum wage (see Table 27). The ratio then rose modestly on account of an increase in the minimum wage from CZK 8,000 to CZK 8,500 in August 2013. During 2014, the minimum wage remained at CZK 8,500.¹²⁵ It was increased further (to CZK 9,200) in January 2015.¹²⁶ The ratio of the minimum wage to the average wage in the Czech Republic is among the lowest of 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.

¹²⁴ OECD (1998) and Gregg (2000).

¹²⁵ The whole-year average of the minimum wage was therefore higher in 2014 than in 2013.

¹²⁶ The minimum wage was increased to CZK 9,900 in January 2016 and will be raised further to CZK 11,000 in January 2017.

Table 27: Minimum wage
(% of the average wage)

	2008	2009	2010	2011	2012	2013	2014	2015
CZ	35.2	34.3	33.3	32.4	31.6	32.6	32.8	34.6
PT	44.2	42.8	42.4	42.2	42.9	42.9	44.1	43.4
HU	38.8	38.3	38.0	38.6	42.5	43.3	43.3	-
PL	39.1	42.2	42.0	41.7	43.5	44.6	45.3	45.5
SI	43.4	44.2	50.5	51.7	52.2	53.2	52.9	52.8
SK	33.6	35.7	36.0	36.1	35.6	36.0	35.4	36.9

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 was defined at the national level in Germany until 2014; a minimum wage was introduced in January 2015 and is around 40% of the average wage. In Austria the minimum wage is only defined for some specific occupations and represents around 30% of the average wage. Data are not available for Hungary for 2015.

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 occupations (see Table 28). Moreover, this ratio has increased in recent years. For example, for the 10% of lowest-income persons employed in elementary occupations, the ratio of the minimum wage to their average earnings rose to 95% in 2015. The ratio of the minimum wage to the wage in the first decile also increased markedly on average in the business sector in 2015, owing chiefly to a rise in the minimum wage valid from January 2015.

Table 28: Ratio of the minimum wage to the gross monthly wage in selected professions

(%)

Main employment class	Minimum wage / 1st decile									
	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
Total for the Czech Republic (business sector)	70.4	67.2	63.2	63.9	63.5	72.9	69.9	70.5	71.6	77.3
- services and shop workers	91.1	88.8	85.0	85.9	86.5	91.4	85.2	84.1	86.3	91.1
- lower administrative workers	69.4	63.8	60.9	60.4	60.2	68.6	65.3	68.1	69.3	77.7
- elementary occupations	90.7	89.8	87.7	88.1	89.1	91.7	89.4	89.5	90.3	95.0

Note: The table lists data for the Czech Republic as a whole and for the three professions with the highest figures in 2015.

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** contribute to a decrease in labour market flexibility and an increase in long-term unemployment.¹²⁷ The labour market is also affected by 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.

¹²⁷ OECD (2004) and OECD (2010). By contrast, Bassanini and Duval (2006) and others assert that employment protection, as measured by the EPL index (Employment Protection Legislation), has no clear impact on the overall unemployment rate. However, higher EPL values, according to these authors, adversely affect the entry of young people onto the labour market and are also associated with substitution of part-time contracts with full-time contracts for women.

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 29). Protection against collective dismissal has long been stable. By international comparison, however, protection of regular employment was still among the highest, while temporary jobs were generally still protected less than in the other countries. As regards collective dismissal, the conditions in the Czech Republic are among the weakest of the countries under comparison, while in Hungary and Germany they are not sufficiently flexible. 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 29: Employment protection legislation (EPL) index^{a)}

	Regular employment ^{b)}			Temporary employment ^{c)}			Collective dismissals ^{d)}		
	2006	2011	2013	2006	2011	2013	2006	2011	2013
CZ	3.3	3.1	2.9	1.1	1.3	1.4	2.1	2.1	2.1
AT	2.4	2.4	2.4	1.3	1.3	1.3	3.3	3.3	3.3
DE	2.7	2.7	2.7	1.0	1.0	1.1	3.6	3.6	3.6
PT	4.4	4.1	3.2	2.6	1.9	1.8	2.9	1.9	1.9
HU	2.0	2.0	1.6	1.1	1.1	1.3	3.4	3.4	3.6
PL	2.2	2.2	2.2	1.8	1.8	1.8	2.9	2.9	2.9
SI	-	2.6	2.6	-	1.8	1.8	-	3.4	3.4
SK	2.2	2.2	1.8	0.6	1.8	1.8	3.8	3.8	3.4

Note: ^{a)} The indices take values ranging from 1 to 6, a higher value meaning greater employment protection. ^{b)} Protection against individual dismissal. ^{c)} Fixed-term contracts, temporary work agencies. ^{d)} 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 2012¹²⁸ 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 economy¹²⁹ and can significantly increase unemployment if the minimum wage is high, as an excessively high minimum wage may reduce demand for less skilled labour.¹³⁰ The taxation of high earners also plays a role from the perspective of international competition and labour mobility, 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 2015 and throughout the period under review was higher than in Portugal, Poland, Slovakia and Slovenia both at the average wage level and for low earners (see Table 30). By contrast, it is markedly lower than in advanced

¹²⁸ See the 2012 Alignment Analyses.

¹²⁹ Brandt et al. (2005).

¹³⁰ See the section on the minimum wage above, and Bassanini and Duval (2006).

neighbouring countries – Germany and Austria – and also Hungary. Last year, overall labour taxation increased slightly year on year in most of the countries under review, including the Czech Republic.¹³¹

Table 30: Overall labour taxation

	100% of average wage					67% of average wage				
	2006	2012	2013	2014	2015	2006	2012	2013	2014	2015
CZ	42.5	42.5	42.4	42.6	42.8	40.1	39.4	39.4	39.6	39.9
AT	48.5	48.8	49.2	49.4	49.5	43.8	44.2	44.6	44.9	45.0
DE	52.3	49.6	49.2	49.3	49.4	47.5	45.5	45.1	45.1	45.3
PT	37.5	37.6	41.4	41.2	42.1	32.8	32.6	35.2	34.9	36.2
HU	51.9	49.5	49.0	49.0	49.0	43.3	47.9	49.0	49.0	49.0
PL	37.4	34.3	34.4	34.6	34.7	35.5	32.9	33.1	33.3	33.4
SI	-	42.3	42.3	42.5	42.6	-	38.5	38.5	38.5	38.6
SK	38.3	39.6	41.1	41.2	41.3	35.3	36.9	38.5	38.6	38.8

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. Data are not available for Slovenia for 2006.

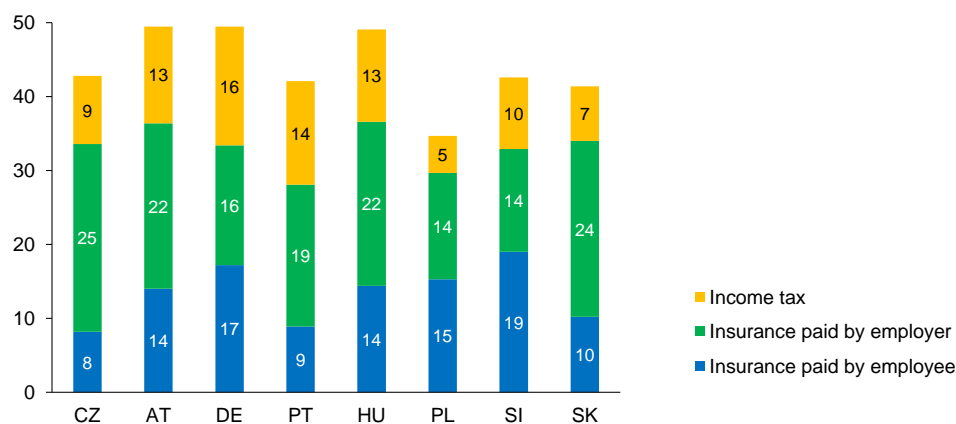
Source: OECD (2016).

The data on the **components of labour taxation** (see Chart 43) show that in all the selected countries health and social insurance affects overall labour taxation to a considerably greater extent than income tax. The level of insurance in the Czech Republic is similar to that in Germany and slightly lower than in Hungary and Austria. By contrast, Portugal and Poland have the lowest insurance burdens among the countries under comparison. Since 2006, overall taxation has increased markedly in Portugal and Slovakia and risen slightly in Austria and the Czech Republic. In Slovakia, this increase has been implemented mainly through insurance, whereas in the other countries income tax has also gone up. By contrast, overall taxation has declined in Germany, Poland and Hungary.

¹³¹ The real tax burden, i.e. aggregate tax revenues as a percentage of total compensation of employees, is described by implicit tax rates. They increased in the Czech Republic in 2008 and 2009 owing to legislative changes, but from 2010 they increased again, reaching around 39% in 2012. While lower than in Austria, the tax burden in the Czech Republic is still considerably higher than in Portugal, Poland, Slovenia and Slovakia and slightly higher than in Germany. A more detailed analysis of implicit tax rates is available in previous issues of the Alignment Analyses. Data are only available up to 2012 for the countries under comparison.

Chart 43: Components of labour taxation in 2015

(% of the average wage)



Source: OECD (2016).

Work-incentive indicators

Taxes affect not only labour demand, but also labour supply. This is because they influence, in combination with social benefits, the net income of households and thereby the motivation of unemployed or inactive persons to enter employment. 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. It thus indirectly measures the financial incentive for the unemployed to seek work. **Net replacement rates** can be compared for short-term and long-term unemployment and for different types of households (see Table 31).

As in previous years, the financial incentives to accept a job in the initial phase of unemployment among childless individuals in 2014 were highest in Austria (the lowest replacement rate), followed by Germany and Slovakia. In the Czech Republic, by contrast, the incentives to find a job were again the lowest. The incentives to seek work were also rather low in the case of long-term unemployment of childless individuals in the Czech Republic, as the replacement rate was almost one-half of potential employment income and was among the highest of the countries under comparison. In Portugal, by contrast, long-term unemployed childless individuals received only 23% of their potential employment income, and in Hungary this ratio was only slightly higher.

There are also marked differences in the support provided to families with small children in the event of long-term unemployment. The support provided to such families is highest in Austria, where the net replacement rate has been close to 100% for several years. In the Czech Republic, the net replacement rate for this category of families in 2014 was about 75% of income, slightly lower than in Germany. However, it was markedly higher than in Hungary, Portugal and Slovakia.

Table 31: Net replacement rates

	Initial phase of unemployment ^{a)}								Long-term unemployment ^{b)}							
	Individuals w/out children				Family (2 children) ^{c)}				Individuals w/out children				Family (2 children) ^{c)}			
	2006	2012	2013	2014	2006	2012	2013	2014	2006	2012	2013	2014	2006	2012	2013	2014
CZ	55	77	77	77	76	74	74	74	42	49	49	49	76	76	76	75
AT	55	55	55	55	82	98	98	98	53	54	54	54	82	98	98	98
DE	61	59	59	59	88	92	92	91	51	48	49	48	78	79	80	81
PT	78	75	75	75	84	76	78	78	24	24	23	23	71	52	49	49
HU	71	69	68	67	80	76	78	80	32	26	25	24	77	39	38	37
PL	75	70	70	69	69	66	66	65	41	32	32	32	88	59	73	71
SI	75	85	86	86	89	90	90	90	50	47	47	47	89	81	81	82
SK	61	62	62	62	56	57	57	63	29	27	26	39	55	56	56	63

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. ^{a)} Unemployed persons entitled to unemployment benefits. ^{b)} Unemployed persons after five years. ^{c)} The other adult is economically inactive, children of four and six years of age.

Source: OECD tax benefit models.

There were no pronounced legislative changes affecting the incentive to work in 2015. In the event of termination of an employment contract by the employee or by agreement with the employer, the unemployment benefit stayed at 45% of the previous net wage over the entire support period.¹³² Additional income, even from “non-clashing” employment, is still prohibited. This is aimed at increasing the incentive to seek “proper” work.¹³³ No changes were made in 2015 to the tax discount for children, the minimum living level and the minimum subsistence level affecting claims for some other social benefits (child allowance, maternity allowance and social assistance benefits).

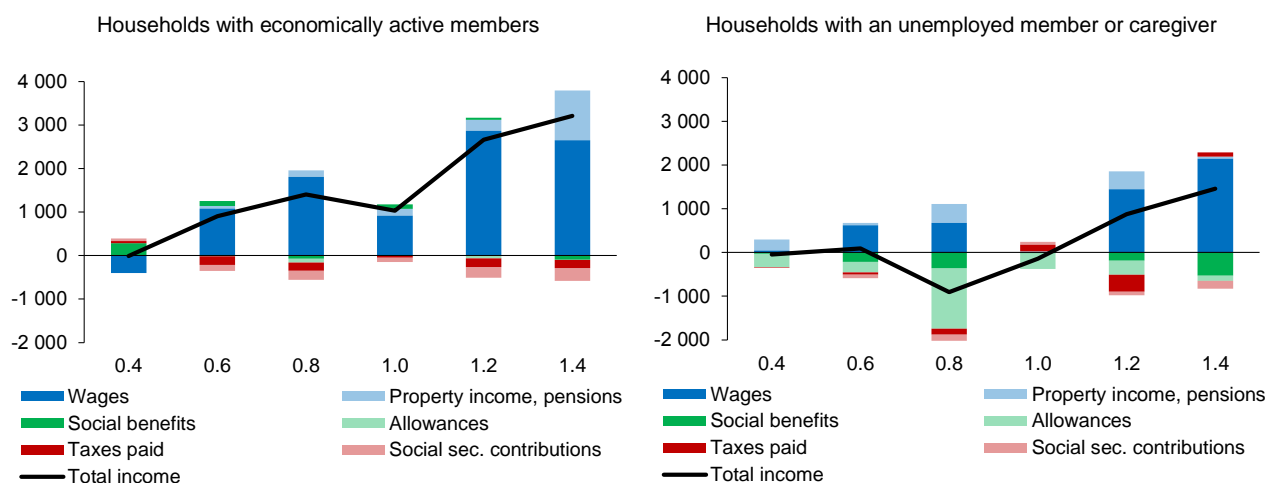
An analysis of individual data from the household budget surveys in 2014 and 2015 revealed a marked difference in the change in the nominal income of a household with economically active persons compared to a household with an unemployed person or a caregiver. In the case of households with economically active members, nominal income increased noticeably between 2014 and 2015, mainly on account of growth in nominal wages observed across the entire wage distribution with the exception of the lowest-income households (see Chart 44). In the case of households with an unemployed person, a person receiving parental allowance or a person caring for a disabled person, nominal income increased less and solely in the right-hand part of the wage distribution calculated per economically active person. In addition, the nominal wage growth in this segment was partly offset by a drop in both allowances (parental allowance and child allowances) and benefits. Households with below-average income recorded a stagnation or slight decrease in income.

¹³² The support period depends on the employee’s age: five months up to 50 years of age, eight months between 50 and 55 years of age, and eleven months over 55 years of age.

¹³³ 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. However, since 2011 it has not been possible to combine unemployment benefits with “non-clashing” employment.

Chart 44: Change in household income by type of household and total income per economically active household member

(2015 compared to 2014, CZK)



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 2014. The vertical axis shows the absolute change in household income from 2014 to 2015.

Source: Household budget survey, CNB calculations.

The stagnation or decrease in income for the lowest-income households with an unemployed member or a caregiver by comparison with the noticeable increase in the income of households with economically active members is increasing the incentive to work, i.e. to move into the category of households with economically active members. The incentive to work probably also increased for households with above-average income despite the observed rise in the income of households with an unemployed member or a caregiver, as the increase in the income of households with economically active members was much more pronounced.

To sum up, the ratio of the minimum wage to the average wage increased slightly but is still one of the lowest among the countries under comparison and probably has not had a significant negative impact on the labour market so far. Labour market regulation in the Czech Republic is comparable to that in European countries, which are, however, among the least flexible by international comparison. Protection of regular employment is still relatively high, while temporary jobs are protected slightly less than in the other countries. Overall labour taxation in the Czech Republic rose slightly, but is still substantially lower than in Austria and Germany. The incentives to work arising from the configuration of taxes and benefits remain relatively low by international comparison, especially for the initial phase of unemployment of childless individuals. However, the return to economic growth in recent years and the related availability of work and wage growth are now increasing the incentive to work among households with an unemployed member or a caregiver.

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

The flexibility with which wages respond to the business cycle is viewed as an indicator of an economy's ability to adjust to asymmetric shocks. In countries with weaker or slower real wage adjustment, asymmetric shocks can have a stronger impact on the real economy in the absence of independent monetary policy. One can therefore hypothesise that countries where the response of real wages is less sensitive to the business cycle will show higher sensitivity of unemployment. The following analysis examines the sensitivity (elasticity) of the unemployment gap and wages to the business cycle.

The results (see Table 32) confirm that the labour markets of the individual countries are partly able to absorb asymmetric shocks, as the cyclical relationships between variables are statistically significant and run in the expected direction. Among the countries under comparison, the Czech Republic is one of those where both sensitivities are relatively high.

However, the results do not support the hypothesis that economies in which wages are more sensitive to the business cycle are better able to absorb shocks thanks to a flexible labour market response and thereby reduce the impact of those shocks on unemployment. On the contrary, countries characterised by greater sensitivity of real wages to the output gap usually also have greater sensitivity of the unemployment gap to the output gap.

An explanation can be found in the literature, which shows that the regulation and institutional set-up of the labour market has a relatively weak effect on the cyclicalities of wages (explaining less than one-third of the cross-country variability).¹³⁴ Other factors affecting the cyclicalities of wages, such as the degree of openness of the economy, have a stronger quantitative effect. The cross-country heterogeneity of wage cyclicalities therefore does not necessarily reflect differences in labour market regulation and the response of labour markets to shocks, but is rather an indicator of country heterogeneity or another aspect of the differences between them (the degree of openness of the economy or the predominant type of shock affecting the economy).¹³⁵

Table 32: Sensitivity of the cyclical components of wages and unemployment to the business cycle

	Wage elasticity	Unemployment elasticity
CZ	0.64 ***	-1.90 ***
AT	0.70 ***	-2.93 ***
DE	0.42 ***	-2.25 ***
PT	0.05 ***	-1.24 ***
HU	0.29 **	-1.84 ***
PL	0.34 **	-0.42 ***
SI	0.45 **	-3.12 ***
SK	0.45 ***	-1.45 ***
EA	0.37 ***	-2.00 ***

Note: Statistical significance: *** significance at 1%, ** significance at 5%, * significance at 10%. Data for 2006–2015.

Source: Eurostat, CNB calculations.

Box 1: Rigidity of base wages and the use of flexible wage components in 2010–2013: European firm-level survey evidence

Firms can influence total labour costs by adjusting base wages (which, however, show significant downward rigidity), by changing the more flexible components of the wage bill and in other ways. Information on the use of these components of the wage bill is provided by a survey of European firms carried out in 2014.¹³⁶

In 2013, 71.9% of euro area firms provided bonuses and benefits, which on average made up 8.3% of their total wage bill (or 6.0% of the total wage bill of all firms; see Table B1). In the

¹³⁴ Brůha and Polanský (2015), Gnocchi et al. (2015).

¹³⁵ These conclusions are robust to the method used to estimate the cyclical components (the Christiano-Fitzgerald filter instead of the Hodrick-Prescott filter). The qualitative conclusions remain valid even if correlation is used instead of sensitivity.

¹³⁶ The detailed results of the survey for the Czech Republic are described in Babecký, Galuščák and Žigraiová (2015). The results for other countries are available at https://www.ecb.europa.eu/pub/economic-research/research-networks/html/researcher_wdn.en.html.

Czech Republic, bonuses and benefits were provided by 84.1% of firms and those flexible wage components accounted for 12.0% of their total wage bill (or 10.1% of total wage bill of all firms). The use of flexible wage components by Czech firms was therefore above the euro area average, but was lower, for example, than in Portugal, where bonuses and benefits were provided by 99% of firms and those flexible components accounted for about 24% of the total wage bill.

Table B1: Bonuses and benefits in 2013

(% of firms)

	Share of firms paying bonuses and benefits	Share of bonuses and benefits in total wage bill	
		Among firms paying bonuses and benefits	Among all firms
CZ	84.1	12.0	10.1
AT	79.3	6.3	5.0
DE	69.1	7.1	4.9
PT	99.0	24.0	23.7
HU	69.2	13.4	9.2
PL	84.6	15.1	12.8
SI	85.3	12.2	10.4
SK	93.2	16.2	15.1
EA	71.9	8.3	6.0

Note: The figures are weighted by the number of employees.

Table B2 provides a comparison of how firms adjust their wage bill by freezing or cutting base wages or by reducing bonuses and benefits. In 2010–2013, the Czech Republic recorded above-average use of base wage freezes (28.8% of all firms; euro area average: 21.4%) and cuts (6.8% of all firms; euro area average: 4.3%), and in particular of reduction of bonuses and benefits (21.6% of all firms; euro area average: 12.8%). The fact that the share of flexible wage components in the total wage bill in the Czech Republic is also above-average (see Table B1) suggests greater potential for wage bill adjustment in a situation of rigid base wages and the occurrence of asymmetric shocks such as a drop in demand.

Table B2: Share of firms that froze/cut base wages or reduced bonuses and benefits during 2010–2013

(% of firms)

	Base wage freezes		Base wage indexing		Reducing of bonuses and benefits	
	All firms	Firms affected by decline in demand	All firms	Firms affected by decline in demand	All firms	Firms affected by decline in demand
CZ	23.9	33.4	5.8	9.1	21.6	37.7
AT	7.8	3.8	3.0	2.2	6.1	8.8
DE	13.7	20.9	3.7	4.0	3.9	8.4
PT	43.7	52.1	8.6	10.1	21.5	29.0
HU	6.8	14.6	1.2	2.5	20.0	32.7
PL	10.5	13.9	2.7	2.8	11.8	15.6
SI	8.4	10.4	13.0	17.0	30.3	44.6
SK	34.0	27.4	6.2	12.0	17.4	25.5
EA	19.3	26.6	4.3	5.9	12.5	21.1

Note: The figures are weighted by the number of employees. Freezing/cutting of base wages: at least once in 2010–2013.

In most countries, the use of all three wage bill adjustment channels was higher among firms that recorded a decline in demand for their goods or services during the period under review (see Table B2). Among such firms in the euro area, the use of base wage freezes/cuts was one-third higher (29.2%/6.7%, as against 21.4%/4.3% of all firms) and the use of reduced bonuses and benefits was two-thirds higher (21.5%, as against 12.8% of all firms).

Czech firms hit by a decline in demand also resorted much more frequently to adjusting flexible wage components (37.7%) or freezing or cutting base wages (38.5% and 10.6% respectively). Reducing bonuses was used more often in the Czech Republic than in the other countries under comparison (except Slovenia) and thus represented an important wage bill adjustment tool.

A regression analysis reveals that bonuses and benefits are more likely reduced by firms with rigid base wages.¹³⁷ This result indicates the possibility of some substitution between base wage and flexible wage component flexibility at the firm level, which can be viewed as positive.

Box 2: Comparing the dynamics of GDP, unemployment and wages for EU countries since the start of the recession in 2008

After 2008, the EU countries recorded an economic downturn that resulted in a deterioration of the labour market conditions. However, the depth of the downturn and its repercussions in the area of unemployment and wages differed substantially across countries. The heterogeneity of the initial downturn in economic activity was affected by a range of exogenous factors, such as external demand and sectoral composition,¹³⁸ but the subsequent economic developments and the responses on the labour market were undoubtedly also affected by domestic conditions, especially economic policy and the quality of institutions.

This box analyses the differences in labour market developments in the EU countries using **non-hierarchical cluster analysis**.¹³⁹ This method is used to allocate countries into groups (clusters) such that the countries in the same group are more similar than the rest in terms of selected criteria. GDP, the unemployment rate, wages and salaries, and the gap between the average wage and whole-economy labour productivity were used as the main criteria.¹⁴⁰ Cluster analysis identified the following four groups of countries.

The **first group** contains Germany, the Czech Republic, Slovakia, the United Kingdom, Malta and Hungary. These countries recorded an initial decline in GDP between 2008 and 2010 of 4.5% on average, associated with a rise in the unemployment rate of 3 pp on average. Over time, GDP growth resumed and unemployment, which was lower in all these countries after the crisis ended in 2016 than when it started in 2008, subsequently started to fall. Wage growth in this group of countries was subdued, broadly reflecting the usual cyclical pattern. At the start of the period under review, the average wage rose faster than whole-economy labour productivity, a phenomenon typical of advanced economies (a countercyclical labour share).¹⁴¹ In the period that followed, labour productivity started rising again and caught up with (or slightly overtook) wage growth.

¹³⁷ See Babecký et al. (2016).

¹³⁸ See Anderton et al. (2015).

¹³⁹ This box thus continues in the informal tradition of boxes in previous Alignment Analyses examining the similarity between the Czech economy and other EU economies from various perspectives using cluster analysis (see, for example Box 1 in the 2015 and 2014 Alignment Analyses as well as section D.1 in this year's Analyses).

¹⁴⁰ The percentage changes in these variables between 2008 Q1 and 2010 Q1 and between 2008 Q1 and 2016 Q1 were used. The only exception is the unemployment rate, for which absolute changes were used.

¹⁴¹ See Shimer (2009) and Brůha and Polanský (2015).

The **second group** of countries comprises Ireland, Lithuania, Latvia and Estonia, i.e. countries that were hit by a severe adverse shock in 2008–2010 and recorded a significant initial drop in GDP accompanied by a rapidly rising unemployment rate. The economic situation of these countries started to improve after 2011. This was reflected in a decline in unemployment, which, however, had still not fallen below the 2008 level by the start of 2016. Since 2010, labour productivity in this group of countries has been rising much faster than the average wage (which has been recording weakly positive or even negative growth). This is another characteristic in which these economies differ from the rest. We can therefore conclude that these countries overcame the crisis thanks to subdued growth in wages, which rose more slowly than labour productivity and even declined at the start of the period under review.¹⁴² This helped reduce the unemployment rate from its initial high levels.

The **third group** consists of “stressed countries” (Spain, Greece, Italy, Cyprus, Finland and Denmark), where the unemployment rate was higher at the start of 2016 than in 2008 (by more than 2 pp) and the GDP level was lower. In contrast to the previous group, therefore, their labour markets did not start to improve after 2011. In addition, these countries recorded rapid wage growth, which significantly outpaced labour productivity growth on average.

Lastly, the **fourth group** comprises France, Belgium, Austria and Sweden. In these countries, GDP has now reached the pre-crisis level, but unemployment is higher in 2016 than in 2008, albeit by less than 2 pp.

However, not all countries can be categorised so clearly. For example, Slovenia and Portugal lie between the second and third group. They are connected with the third group by a more gradual onset of the downturn in GDP and by the fact that they did not succeed in quickly returning to the initial economic level. On the other hand, in the second phase of the crisis (after 2011) they recorded higher labour productivity growth than wage growth and an improving labour market situation. Developments in the other countries (Poland and Bulgaria) were so different that they cannot be simply compared to the other groups.

Table B3 shows the change in selected variables in 2010 and 2016 relative to the onset of the crisis in 2008. The first three variables were used to classify the countries into groups, but it is clear that there are also differences between the groups of countries in terms of hours worked (according to the national accounts) and the unemployment rate in the age category of up to 25 years: the first group is the only one where the number of hours worked was higher in 2016 than in 2008 and the youth unemployment rate did not rise markedly. In the second group, by contrast, the total number of hours worked is much lower in 2016 than in 2008. Unlike in the third group, however, the situation is improving. The same goes for youth unemployment.

¹⁴² The only exception was Ireland, where wage growth remained positive, although considerably lower than labour productivity growth.

Table B3: Change in selected variables since the onset of the crisis

(median for each group; change compared to 2008)

	Unemployment rate		GDP		Gap between productivity and average wage		Hours worked		Youth unemployment rate	
	abs. diff. (pp)		%		%		%		abs. diff. (pp)	
	2010	2016	2010	2016	2010	2016	2010	2016	2010	2016
Group I	3.00	-0.70	-4.26	6.92	0.90	0.84	-1.69	2.09	7.25	-1.60
Group II	13.50	3.35	-17.25	4.33	-1.33	-1.01	-20.95	-11.92	28.40	6.00
Group III	3.05	7.05	-6.55	-7.11	2.47	1.13	-3.04	-10.98	7.30	17.55
Group IV	1.60	1.80	-3.34	3.99	1.42	1.80	-3.26	-1.07	5.70	2.90
All countries	3.94	2.81	-6.03	3.19	1.22	0.47	-6.47	-4.72	9.10	5.86

Note: Change in selected variables between the first quarter of the given year and the onset of the crisis (2008 Q1).

From the perspective of the impacts on the labour market, the countries in the first group handled the crisis best. Independent monetary policy may have helped the non-euro area countries in this group to overcome the crisis.¹⁴³ However, the selected method also quite clearly allocated some euro area countries – which do not have independent monetary policy – to this group.

Labour market regulation and institution quality affect not only the levels of macroeconomic variables, but also the economy's ability to absorb shocks.¹⁴⁴ Table B4, which shows the employment protection legislation (EPL) index (the higher the value of the index, the more regulated the labour market) and two indices of the quality of state administration (the higher the index, the higher the quality),¹⁴⁵ clearly illustrates that there are differences in these characteristics between the groups of countries identified above. In particular, a decrease in the EPL index and an improvement in the quality of state administration are apparent in the second group, i.e. in countries which had to overcome a strong adverse shock to economic activity. At the same time, it can be seen that the countries in the third and fourth groups (i.e. countries not experienced worse labour market developments) have higher EPL index values on average than the other countries.

Table B4: Quality of institutions by country group

(median for group)

	Employment protection legislation index (EPL)		Index of regulatory quality		Index of government effectiveness	
	2008	2013	2008	2013	2008	2013
Group I	2.24	2.03	1.32	1.22	1.18	1.13
Group II	2.01	1.60	1.37	1.45	0.96	1.15
Group III	2.44	2.24	1.33	1.08	1.27	1.15
Group IV	2.44	2.42	1.54	1.47	1.67	1.60
All countries	2.44	2.23	1.26	1.17	1.12	1.13

Source: OECD, World Bank, CNB calculations.

¹⁴³ In the case of the Czech Republic, we should mention the unconventional instrument taking the form of the CNB's exchange rate commitment, which according to available estimates contributed to a decrease in unemployment. See, for example, Opatrný (2016) and Brůha and Tonner (2016).

¹⁴⁴ Ziemann (2013).

¹⁴⁵ For the construction of the indices, see Kaufman et al. (2010).

To sum up, the above cluster analysis reveals that EU countries recorded different labour market responses to the initial downturn in GDP. Such heterogeneity is also visible across the euro area, probably reflecting differences in the quality of institutions and the macroeconomic environment. Therefore, adoption of the single currency need not be a threat to macroeconomic stability, but it cannot be expected to resolve domestic problems. Quality of institutions may be crucial to macroeconomic stability.

The dynamics of the labour market relative to GDP in the Czech Republic were close to those in neighbouring countries. Central Europe therefore seems to form a relatively homogeneous region with similar institutional and macroeconomic environments.

2.3 PRODUCT MARKET FLEXIBILITY

2.3.1 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.¹⁴⁶ At the same time, lower product market flexibility limits adjustment mechanisms in the event of an asymmetric shock.

In a World Bank assessment forming part of a regular survey of conditions for doing business, the Czech Republic ranked 27th out of the total of 190 countries assessed in 2016, down one place compared to revised data for 2015.¹⁴⁷ A deterioration was recorded in getting credit, protecting minority investors and enforcing contracts. The process of issuing construction permits also remains problematic – the Czech Republic scored worst in this area out of all the areas under review.¹⁴⁸ By contrast, it made improvements in the areas of starting a business and getting electricity, with the number of days required to deal with applications decreasing in both cases.¹⁴⁹ However, as regards the ease of starting a business, the Czech Republic remains one of the poorer performers among the countries under review (see Table 33), mainly because starting a business involves a significantly higher number of procedures and hours (at the Trade Licensing Office and the Commercial Register) and above-average costs. Despite a slight deterioration, the Czech Republic remains in a considerably better position in its score for closing a business, surpassing all the new EU Member States under comparison except Slovenia. Germany and Portugal have much better scores for closing a business.

¹⁴⁶ Nicoletti and Scarpetta (2004).

¹⁴⁷ This year's edition of *Doing Business* published revised rankings for 2015, in which the Czech Republic ranked 26th.

¹⁴⁸ The Czech Republic ranked 130th as regards the administrative difficulty and cost of dealing with construction permits. This area has long been one of its worst-scored Doing Business areas.

¹⁴⁹ The number of days required to start a business dropped by a sizeable six days between 2015 and 2016. This was facilitated by the adoption of the Act on Public Registers of Legal Entities and Individuals, which allows for entry in public registers directly through a notary. This law also reduced the costs of starting a business.

Table 33: Conditions for starting and closing a business

	Starting a business						Closing a business					
	2011	2012	2013	2014	2015	2016	2011	2012	2013	2014	2015	2016
CZ	138	140	110	90	88	81	33	35	20	20	22	26
AT	134	133	113	101	106	111	21	12	16	16	18	20
DE	98	104	103	110	107	114	36	19	3	3	3	3
PT	26	25	10	10	31	32	22	22	11	9	8	7
HU	39	54	24	56	55	75	66	69	64	64	63	63
PL	126	124	80	80	102	107	87	37	30	31	33	27
SI	28	33	14	14	45	49	39	41	39	41	12	12
SK	76	80	83	71	64	68	35	38	28	30	34	35

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 2011 and 2012 are based on the Doing Business methodology valid until 2013, the ranking for 2013 on the methodology valid in 2014 and the ranking for 2014 on the methodology valid since 2015. The figures for 2015 were recalculated to reflect methodological changes and revisions to the data and are consistent with 2016. More information can be found at <http://www.doingbusiness.org/methodology/methodology-note>.

Source: World Bank (2016).

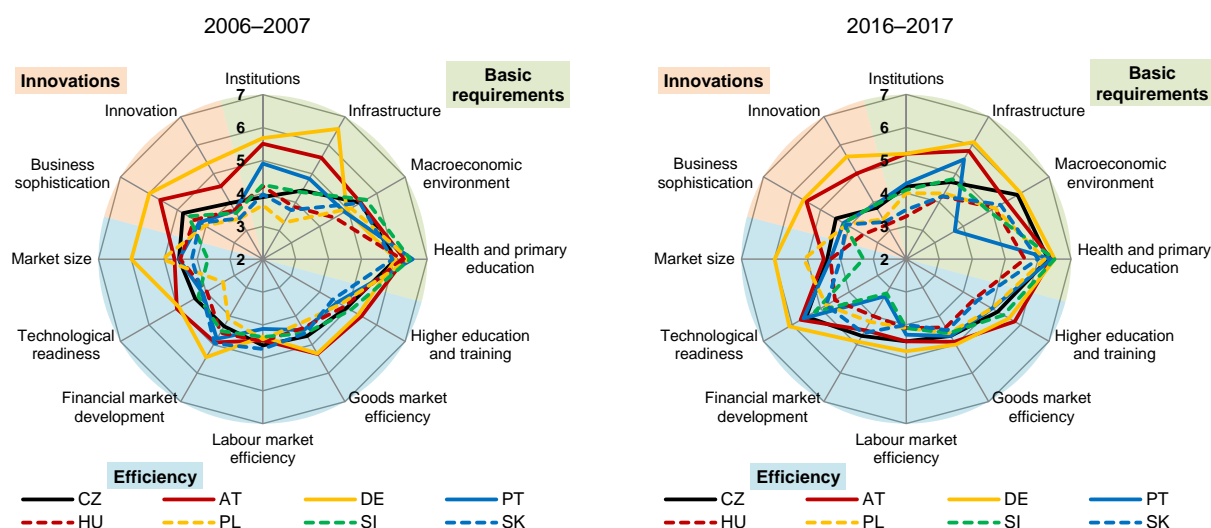
Another view of barriers to growth and competitiveness is offered by the Global Competitiveness Report published by the World Economic Forum (WEF). It assesses competitiveness on a large sample of countries using the Global Competitiveness Index (GCI). The GCI is composed of 12 main pillars grouped into three main categories (basic requirements, efficiency enhancers and innovation and sophistication factors) that influence a country's competitiveness and hence also its productivity and economic levels. The Czech Republic ranks 31st out of 138 countries in the period 2016–2017.¹⁵⁰ As with the full GCI dataset, for the following sample of countries under comparison there is a marked correlation between a country's economic level (as measured by GDP) and the index value (on a scale of 1 to 7, where a higher index value means higher competitiveness).¹⁵¹

Looking at the overall index and its categories and pillars for the sample of countries in the period 2016–2017 (see Chart 45), the Czech Republic is in a relatively good position in the basic requirements for growth category, especially in the health, macroeconomic environment and education pillars. Compared to Slovakia, Hungary and Poland, it also has a better infrastructure score. By contrast, its weakness is the quality of institutions, which, however, is close to the average of the countries under comparison; worldwide, the Czech Republic ranked down in 54th place for this parameter. This, however, is a considerable improvement on previous years. Within this sub-pillar, the Czech Republic scored particularly low in government regulation, public trust in politicians, favouritism in decisions of government officials and diversion of public funds. As regards the pillars influencing economic efficiency, the Czech Republic has a relatively good position in technological readiness, financial market development, labour market efficiency and goods market efficiency among the countries under review. In contrast, it lags well behind Austria and especially Germany in innovation.¹⁵² Compared to the period 2006–2007, the Czech Republic's ranking improved most of all in technological readiness and quality of the macroeconomic environment, but worsened in innovation and labour market efficiency. However, similar changes were also recorded for other countries, so the Czech Republic's relative position was unchanged.

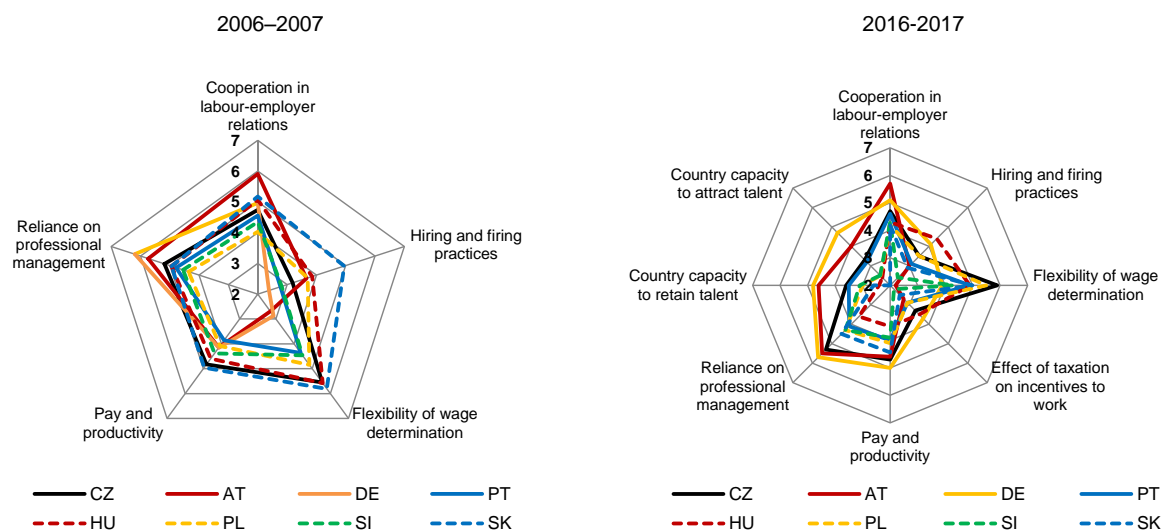
¹⁵⁰ In the period 2006–2007 the Czech Republic ranked 31st out of 122 countries. Last year it ranked 31st out of 140 countries.

¹⁵¹ The GCI calculation methodology is described in the current edition of the report at <https://www.weforum.org/reports/the-global-competitiveness-report-2016-2017-1/> and briefly also in the *Methodological Part* of this document.

¹⁵² These two countries, however, are at the top of the world ranking for innovation.

Chart 45: Global Competitiveness Index – scores by pillars and their categories

Source: World Economic Forum (2016).

Chart 46: Global Competitiveness Index – labour market scores

Source: World Economic Forum (2016).

International competitiveness on the labour market can be measured within the GCI by looking at the **structure of the labour market pillar** (see Chart 46). Of the countries under comparison, the Czech Republic has long been among the most flexible in wage bargaining, pay and productivity and to a large extent also labour-employer relations. All those categories are crucial as regards inflationary pressures and monetary policy implementation. In these categories, the Czech Republic is on average more competitive than Germany, which is the largest and – for the Czech Republic – the most important euro area economy. By contrast, the Czech Republic's weakness is its low scores for attracting and retaining talent, although the same goes for the other countries under comparison except Germany and Austria.

Competitiveness is also hindered by relatively high redundancy costs and by the lowest score for female participation in the labour force among the countries under comparison.¹⁵³

2.3.2 Tax burden on businesses

The tax burden on businesses significantly affects product market flexibility, since, given the high international mobility of capital, it 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.

The Czech Republic has been applying a **corporate income tax rate** of 19% since 2010. Together with Slovenia and Poland, this is one of the lowest figures among the countries under comparison (see Table 34). The tax burden on businesses has been flat in most of the countries under comparison over the last six years. Germany and Portugal have the highest statutory corporate taxation among the countries under comparison. Taxes were increased sharply in Slovakia in 2013.

Table 34: Highest statutory corporate income tax rates
(%)

	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Change (pp)
CZ	24.0	24.0	21.0	20.0	19.0	19.0	19.0	19.0	19.0	19.0	-5.0
AT	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	25.0	0.0
DE	38.7	38.7	30.2	30.2	30.2	30.2	30.2	30.2	30.2	30.2	-8.5
PT	27.5	26.5	26.5	26.5	29.0	29.0	31.5	31.5	31.5	29.5	2.0
HU	17.5	21.3	21.3	21.3	20.6	20.6	20.6	20.6	20.6	20.6	3.1
PL	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	19.0	0.0
SI	25.0	23.0	22.0	21.0	20.0	20.0	18.0	17.0	17.0	17.0	-8.0
SK	19.0	19.0	19.0	19.0	19.0	19.0	19.0	23.0	22.0	22.0	3.0

Note: Changes in pp for 2006–2015.

Source: Eurostat (2015).

2.4 THE BANKING SECTOR AND ITS SHOCK-ABSORBING CAPACITY

The **condition of the financial sector** plays an important role in the economy's ability to absorb economic shocks. In particular, stability of the banking sector, which accounts for 77% of total assets of Czech financial institutions (except the CNB), is of key importance in the Czech Republic. The banking sector maintains high profitability, a good liquidity position and favourable capitalisation and hence an overall resilience to potential adverse shocks. It could therefore perform its adjustment and stabilisation mechanism function in the event of euro adoption. Experience from the euro area shows that the resilience of the banking sectors of some countries weakened rapidly following euro adoption. Risks are also linked with the implementation of the banking union project, which the Czech Republic would automatically join upon euro adoption. These risks are due to the transfer of some powers to the EU level, especially direct supervision of key banks, without transfer of responsibility for the overall condition of the national financial sector. On entering the euro area, the Czech Republic would

¹⁵³ These two indicators are not included in Chart 46 because they use measurement units other than the 1–7 scale (redundancy costs are measured in weeks of salary and female participation is measured as the ratio of women to men in the labour force).

also join the Single Resolution Mechanism (SRM) and contribute to the Single Resolution Fund (SRF),¹⁵⁴ whose effectiveness, however, will only be tested by a future financial crisis.

The Czech banking sector remains profitable even in the low interest rate environment. Its **profitability**, as measured by return on capital and return on assets, significantly exceeds the euro area average¹⁵⁵ (see Chart 47 and Chart 48). The profit of the Czech banking sector consists mainly of stable components such as interest rate income and fee and commission income. The Polish and Slovak banking sectors are also showing above-average profitability by international comparison.

Chart 47: Return on equity (RoE)

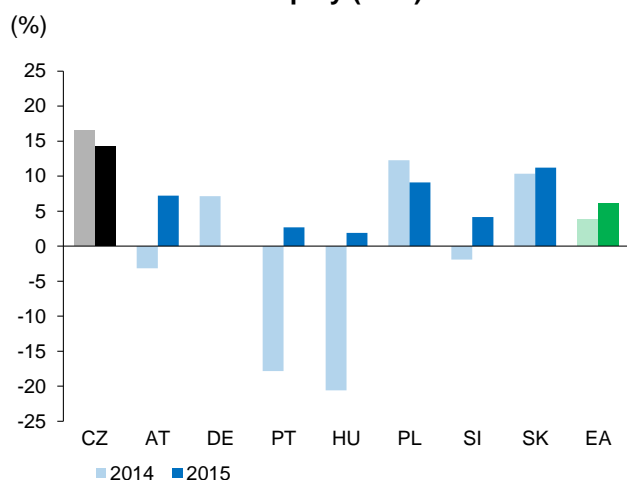
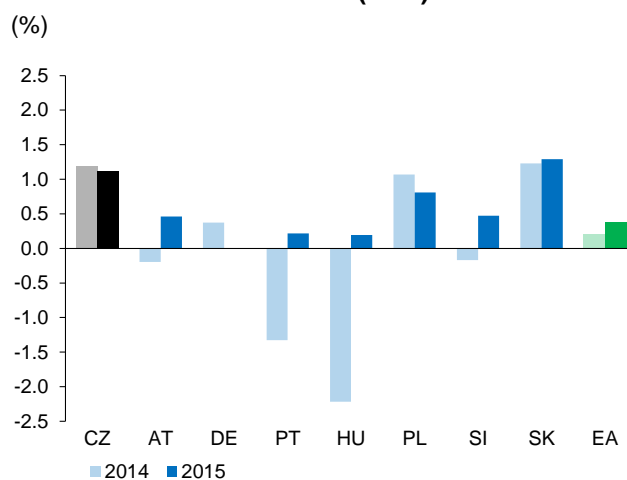


Chart 48: Return on assets (RoA)



Note: EA represents the GDP-weighted average of the euro area member countries. The chart does not contain the figure for Germany in 2015 owing to data unavailability. To calculate the euro area (EA) average for 2015, the 2014 figure was used for Germany.

Source: IMF FSI.

Credit risk in the Czech banking sector, as expressed by the ratio of non-performing loans (NPLs) to total loans, has been fluctuating around 6% for the past several years (see Table 35) and is below the euro area average. As economic growth has accelerated, credit risk has declined slightly and the quality of the credit portfolio has improved. Although credit risk continues to grow for non-resident loans, this trend poses no major systemic risk due to their low volume. The evolution of credit quality differs across the countries under comparison. While the NPL ratio has started to decline in most countries, in Portugal it stays on high level.¹⁵⁶

The resilience of the Czech banking sector to adverse shocks is based on strong **capitalisation** (see Chart 49), consisting mainly of retained earnings. The capital ratio of the Czech banking sector on a consolidated basis decreased by 0.3 pp to 16.7%, while the euro area capital ratio rose by 0.8 pp year on year to 17.3%. Among the countries under review, the biggest year-on-year increase in the total capital ratio in 2015 – of 1.3 pp to 16.0% – was recorded by Poland. The Czech banking sector also displays high capital quality, as Czech banks hold a larger part of their capital in the form of Common Equity Tier 1 by comparison

¹⁵⁴ Czech banks currently contribute to the Resolution Fund, which is part of the national Financial Market Guarantee System. Problems in the banking sector would be resolved in accordance with national legislation, i.e. using the mechanism based on Act No. 374/2015 Coll., on recovery and resolution in the financial market.

¹⁵⁵ 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.

¹⁵⁶ In the euro area, the steadily rising NPL ratio in Italy, which reached 18% in 2015, is giving rise to concerns.

with the euro area banking sector. 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 published in Financial Stability Report 2015/2016.

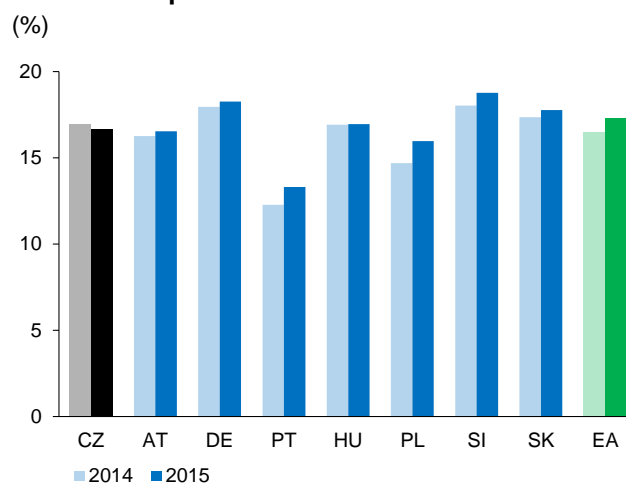
Table 35: Non-performing loans
(% of total bank loans)

	2013	2014	2015
CZ	5.9	6.1	5.8
AT	2.9	3.5	3.4
DE	2.7	2.3	-
PT	10.6	11.9	11.9
HU	16.8	15.6	11.7
PL	5.0	4.8	4.3
SI	13.3	11.7	10.0
SK	5.1	5.3	4.9
EA	7.3	7.1	6.7

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

Source: IMF FSI, CNB.

Chart 49: Capital ratios



Note: The capital ratio is the ratio of a bank's capital to its risk-weighted assets. EA represents the GDP-weighted average of the euro area member countries.

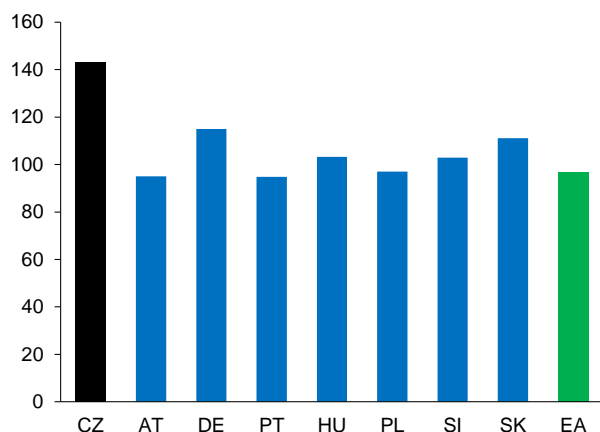
Source: IMF FSI.

Most domestic banks focus on a conservative business model that involves accepting deposits and providing loans to households and non-financial corporations. The **ratio of deposits to loans** to residents in the Czech banking sector is 138%, which, despite a year-on-year drop of 5 pp, is the highest figure among all the countries under review (see Chart 50). Deposits by residents in the domestic currency account for almost 85% of total deposits, and roughly 79% of total loans are to residents in the domestic currency.

The Czech banking sector is not dependent on funds from abroad and, despite a year-on-year decrease, its **net external position** is approximately balanced, reaching 0.1% of GDP at the end of 2015 (see Chart 51). Of the countries under comparison, Austria and Germany have the highest positive net external banking sector positions. Czech banks' exposure to highly indebted euro area countries (not only to governments, but also to private sectors) is low.

Chart 50: Ratios of deposits to loans in selected EU countries

(%)

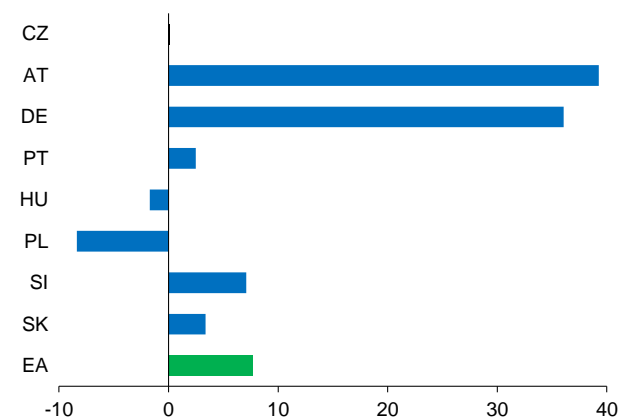


Note: Data as at the end of 2015; deposits/loans to residents.
EA represents the euro area.

Source: ECB.

Chart 51: Net external position of banking sectors

(net external assets in % of GDP, 2015)



Source: IMF IFS, central banks.

To sum up, the resilience of the Czech banking sector to adverse shocks is high, even by international comparison. The excess of loans over deposits and the low indebtedness of the private sector preserve room for banks to further expand their lending while maintaining sufficiently high liquid assets. Thus, the link of domestic banks to the euro area banking sector is due mainly to the foreign ownership structure of the domestic banking sector.¹⁵⁷ The risks to the Czech banking sector include the long-running low interest rate environment, a further easing of credit standards and the risk of feedback between property price growth and growth in mortgage loans. For the European banking sector, there are persisting risks related to the quality of the credit portfolio, to the uncertainty regarding the continuation of the economic recovery and to the environment of exceptionally low interest rates, which are squeezing the profitability of financial institutions.

¹⁵⁷ At the end of 2015, foreign owners directly or indirectly controlled 94.1% of the Czech banking sector's assets (i.e. foreign owners holding directly or indirectly at least 50% of the ownership rights in the bank).

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

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

$$\bar{x}_t = \frac{\sum_{i=1}^n x_{i,t}}{n}$$

is the arithmetic (unweighted) mean of the variable across countries at time t 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.

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 exchange rate changes in 2006–2015.

The outlook for future real appreciation for the next five years is based on two alternative panel estimates which link the price level of final consumption of households with GDP at purchasing power parity per capita for 36 European countries between 1995 and 2015 (see also Čihák and Holub, 2003 and 2005).

Model I was estimated using a two-stage least-squares panel method with no fixed or random effects:

$$P_{C,it} = 19.06 + 0.83 GDP_{PPS,it} + 0.90 AR(1)_{it}$$

where $P_{C,it}$ is the price level of final consumption of households in country i in year t , $GDP_{PPS,it}$ is the gross domestic product of country i at purchasing power parity per capita in year t (in both cases $EA=100$) and $AR(1)_{it}$ is the first-order autoregressive term.

Model II was estimated using the same method, but with fixed effects, which enable us to account for price level differences due to other country-specific characteristics not individually captured by the model. The estimate is as follows:

$$P_{C,it} = 51.35 + FE_i + 0.44 GDP_{PPS,it} + 0.68 AR(1)_{it},$$

where FE_i is the fixed effect for country i and the other symbols are the same as in the previous equation.

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 2016 based on European Commission and Eurostat forecasts for real GDP growth, as well as 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 at a rate of 2.5% a year. In the case of Model II, the simulations also account for the statistically significant positive relationship between the individual countries' fixed effects and their GDP per capita at purchasing power parity in 2015. It is therefore assumed for converging economies that their other specific – but not individually captured – characteristics will converge towards the advanced euro area countries in parallel with convergence of GDP.¹⁵⁸

Real interest rates are derived from three-month money market interest rates. 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. To identify the impact of the onset of the economic crisis on the size of the correlation coefficient, correlation coefficients are given both for the entire period under review from 2005 Q1 to 2015 Q1 (January 2005 to May 2015 for IPIs) and for the same period excluding 2008 Q4 and 2009 Q1 (October 2008 to March 2009 for IPIs).

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

¹⁵⁸ Convergence of GDP per capita at purchasing power parity of 1 percentage point will increase the estimated fixed effect of the country by 0.36 percentage point (i.e. it will reduce the negative fixed effect in the case of less advanced countries). The overall impact of convergence of GDP per capita of 1 percentage point is 0.80 (0.44 + 0.36) percentage point, i.e. it is similar as in Model I.

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

where s_{xy} is the estimate of covariance and σ_x and σ_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 (five years). The rolling correlation should help 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 half and eight years long are considered most frequently. **Dynamic correlation**,¹⁵⁹ 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 λ 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.

1.1.3 Correlation of the cyclical component of unemployment

Concordance is a statistical method used, for example, in situations where simple correlation may not provide a complete picture or is unsuitable. Concordance measures the agreement between certain monitored characteristics. In the case of the NAIRU gap, it shows the part of

¹⁵⁹ Croux, Forni and Reichlin (2001).

the period under review for which two time series are in the same phase of the cycle (i.e. both have a positive or negative gap). Let time series $S_{i,t}$ and $S_{j,t}$ be defined by the value 1 when their gap is positive and 0 in the opposite case. The concordance statistic then takes values between 0 and 1 and is calculated using the following formula (McDermott and Scott, 2000):

$$C_{ij} = T^{-1} \left\{ \sum_{t=1}^T (S_{i,t} * S_{j,t}) + (1 - S_{i,t}) * (1 - S_{j,t}) \right\}$$

1.1.4 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). The difference between the shares is weighted by the share of the sector in country A in the total. The weighted shares are then summed.¹⁶⁰

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 $SL/100$.¹⁶¹ 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.

1.1.5 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.¹⁶² Datastream data based on central bank data (three-month interbank market rates) and Eurostat data (ten-year government bonds) were used to measure the

¹⁶⁰ The index calculated in this way shows the importance of differences in economic structure from the perspective of the converging country. Another way of calculating the Landesmann index is to weight using the given sector of the reference country, i.e. the euro area:

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

. A similar approach is used, for example, in Landesmann (2000).

¹⁶¹ $SL = \sum_{i=1}^n \sqrt{\left(I_{sh_A^i} \cdot 100 - I_{sh_B^i} \cdot 100 \right)^2 \cdot \left(\frac{I_{sh_A^i} \cdot 100}{100} \right)} = 100 \sum_{i=1}^n \sqrt{\left(I_{sh_A^i} - I_{sh_B^i} \right)^2 \cdot I_{sh_A^i}} = 100 \cdot I_{SL}$

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

¹⁶² 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.

interest rate differentials between three-month and ten-year rates in the euro area and these countries.

The time series start in January and end in June of the relevant years 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 series are based on the gross yield on government bonds on the secondary market with approximately ten years to maturity.

1.1.6 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.¹⁶³ 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 and Poland are to adopting the euro.

The correlation coefficient is based on a covariance matrix obtained using a GARCH estimate¹⁶⁴ and is calculated according to the following formula:

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

Unlike simple covariance, which is the same for the entire formula, covariance based on a GARCH model changes over time. It thus enables one to calculate a correlation coefficient which also changes over time and hence provides more information than a simple correlation coefficient of the exchange rate of the national currency against the euro. Moreover, the GARCH technique allows for better use of the information contained in the data. A higher correlation means similar developments in exchange rate volatility (change), which can be interpreted as synchronisation of exchange rate shocks in the countries under review.

Daily data from Thomson Datastream were used.

1.1.7 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 σ 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

¹⁶³ The same method is used in Castrén and Mazzotta (2005).

¹⁶⁴ The bivariate BEKK GARCH specification is used; see Engle and Kroner (1995).

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.

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.

1.1.8 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:

$$GL_t = 1 - \frac{\sum_i |X_t^i - M_t^i|}{\sum_i (X_t^i + M_t^i)}$$

GL_t is the ratio of the absolute value of net intra-industry trade to foreign trade turnover. X_t^i and M_t^i denote the exports and imports of the country under review from/to the euro area 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. 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,¹⁶⁵ 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.¹⁶⁶

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 (monthly data).

The source of data for the analysis of the euro area's share in direct investment is the Eurostat database and for Hungary the national central bank. 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.

¹⁶⁵ This is particularly so in SITC 7 (Machinery and transport equipment).

¹⁶⁶ The simplest calculation of the Gruber-Lloyd index, using SITC 1, is based on 10 categories.

1.2 SIMILARITY OF MONETARY POLICY TRANSMISSION

1.2.1 Financial system

Depth of financial intermediation (the ratio 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 include:

$$\text{Debt/equity} = (\text{bonds issued} + \text{loans accepted} + \text{other liabilities}) / \text{equity issued}$$

...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.

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 2006 Q1 to 2016 Q2 are used for the calculation. The source of the data is Eurostat.

Method 1

Method 1 uses the non-parametric technique proposed by Marques (2004) to estimate inflation persistence. This approach defines inflation persistence, γ , 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 $\lambda = 1,600$.

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 π_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 π_t^T is medium-term inflation (or the central bank’s implicit inflation target), π_t^P is the inflation target perceived by the public, η_{1t} and ε_{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 π_t is the observed variable and medium-term inflation π_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).¹⁶⁷ 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:

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

¹⁶⁷ 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).

where $R_{i,t} = Y_{i,t} - Y_{i,t}^B$ is the difference between the asset yields of country i ¹⁶⁸ and a selected reference territory (a benchmark, B) at time t , Δ is the difference operator, a_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 β may be interpreted as a direct measure of the convergence speed. A negative beta coefficient indicates the occurrence of convergence. The β coefficient can take values ranging from -2 to 0. The closer the value of the β coefficient to 1, the higher the speed of convergence. If $\beta = -2$ or $\beta = 0$, no convergence is observed. β 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 (σ), according to the formula:

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

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.¹⁶⁹ In theory, σ takes only positive values. The lower is σ , the higher is the level of convergence. In theory, full integration is achieved when the standard deviation is zero,¹⁷⁰ while high (several digit) values of σ 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, Δ denotes the difference operator and $\varphi_{i,t}$ is a random term. An increase in this type of integration requires α to converge to zero, γ to converge to

¹⁶⁸ $Y_{i,t} = [\ln(A_{i,t}) - \ln(A_{i,t-1})]$ 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.

¹⁶⁹ For pairs of countries, the calculated values in each period are essentially equal to half the square of the yield differential.

¹⁷⁰ This occurs on the money and foreign exchange markets for countries entering the euro area on a given date.

one and the ratio of the variances of coefficients γ (for benchmark and national assets) to be close to one. The time-varying parameters γ 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 γ 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 2002 to June 2016. Three-month interbank rates were used for the money market, national currencies quoted against the US dollar for the foreign exchange market, five-year government bonds for the bond market and national stock indices for the stock market. The relevant time series were adjusted for exchange rate effects.

Thomson Datastream codes for the data sources used:

	Money market	Forex market	Bond market	Stock market
CZ	PRIBK3M	PRUSDSP	BMCZ05Y-(RY)	CZPXIDX
AT	–	–	BMOE05Y-(RY)	ATXINDX
DE	–	–	BMBD05Y-(RY) ^{B)}	DAXINDX
PT	–	–	BMPT05Y-(RY)	POPSI20
HU	HNIBK3M	HNUSDNB	BMHN05Y-(RY)	BUXINDX
PL	POIBK3M	POUSDSP	BMPOZ05Y-(RY)	POLWIGI
SI	–	–	TRSI5YT	SLOETOP
SK	SXIBK3M	SXUSDSP	SXGOVT1	SXSAX16
EA	BBEUR3M ^{B)}	USECBSP ^{B)}	–	DJES50I ^{B),a)}

Note: ^{B)} benchmark; ^{a)} 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

Euroisation is the process of substitution of a domestic currency with a foreign one (the euro) to ensure the necessary functions of money as a medium of exchange and a store of value. Generally, official and unofficial (spontaneous) euroisation can be distinguished. This analysis is concerned with spontaneous euroisation, which is important for assessing the efficiency and effectiveness of independent monetary policy, and compares the level of euroisation in the Czech Republic and selected Central European countries, namely Poland and Hungary.

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 2010 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 CNB's calculations are based on a **model of the sustainability of Czech public finances** developed for the CNB's internal needs. The model aims to show the main trends in government debt in relation to the demographic forecast, population ageing costs and other selected 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 financial market developments.

The model consists of several interconnected blocks describing the individual parts of the economy that affect the government deficit/surplus and government debt. The **GDP growth projection** 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 CZSO demographic projection by age and gender and reflect current trends in the economic activity of Czech households (such as length of education and maternity and parental leave-taking) and legislative parameters (such as the replacement rate, the retirement age and health and social insurance contributions).

The **government sector balance** is modelled on the basis of the individual items of government revenues and expenditures. On the government revenue side, personal income taxes and social security and health insurance contributions reflect wage growth and the proportion of working-age people. Other revenues (such as corporate income taxes, indirect and capital taxes and other current revenues) are assumed to have constant shares in GDP according to the historical data. On the expenditure side, spending on old-age pensions, health care and interest payments is modelled. Old-age pension expenditure is a function of the expected number of future pensioners and the amount of their pensions, calculated assuming the current pension indexation scheme for pensions already awarded and a constant replacement rate for newly awarded pensions. Health care expenditure is based on the cost profiles of individual groups of the population according to age and gender. Interest payments are based on the debt portfolio structure and reflect expected financial market developments. Other government expenditure (such as compensation of public employees, intermediate consumption, other current expenditure and capital expenditure) is projected in the current version of the model on the basis of constant percentages of GDP.

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. The yield on new government debt is projected using a statistical model in which the explanatory variables are the main macro-financial and fiscal variables: total government debt, money market interest

rates, expected inflation and the dollar yield curve. The model is estimated by the panel regression method on a sample of historical data for 35 advanced countries over the last 24 years. The maturity structure of newly issued government bonds depends on the maturity structure of government debt in the previous period and the total amount of government debt relative to GDP and the position of the yield curve in the period under review.

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** expresses the relationship between vacancies and the number of unemployed persons. It is used as a tool to differentiate between cyclical and structural unemployment: 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,¹⁷¹ 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.¹⁷²

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

¹⁷¹ 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.

¹⁷² Richardson et al., 2000; Szeto and Guy, 2004.

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. Household consumption represents short-term demand pressures in the equation.

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

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

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

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.

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 2010 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.

2.2.5 Rate of adjustment of wage growth to the business cycle

The rate of adjustment of real wage growth and the unemployment rate to the business cycle is analysed using the cyclical components of the relevant variables. For the purposes of this section, the cyclical components are estimated using the Hodrick-Prescott filter with the smoothness parameter $\lambda = 1,600$. The Christiano-Fitzgerald filter was also used to test the robustness of the cycle estimates (the cyclical component corresponds to 6–32 quarters).

The elasticities 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 elasticity is defined as $\text{cov}(Y_t, U_{t+k})/\text{var}(Y_t)$ for k such that the absolute value of the expression is the highest for $k \in \{0, \dots, 6\}$. Analogously, we report the highest absolute value for the sensitivity of the cyclical component of wages to the output gap.

Box 2: Comparing the dynamics of GDP, unemployment and wages for EU countries since the start of the recession in 2008

There are a number of non-hierarchical cluster analysis methods, but all of them divide objects into mutually disjoint sets, or clusters. The objects in each individual cluster are similar to each other. Box 2 uses a method based on a mixture of Gaussian distributions in a variant which

allows for atypical observations in each group. Formally, if we assume the existence of K clusters, the distribution of objects (countries) within a single cluster can be expressed as:

$$f(x) = \alpha_K \varphi(x|m_K, \Sigma_K) + (1 - \alpha_K) \varphi(x|m_K, \eta \Sigma_K),$$

where φ is the distribution function of the multivariate Gaussian distribution, m_K is the vector of its mean, which in fact describes the “centre” of the cluster (where the data of the given country are typically found), Σ_K is a covariance matrix, $1 - \alpha_K$ is the number of atypical observations in the cluster and η is the scaling factor for those atypical observations.

The probability of country j belonging to a specific cluster is then given by the expression:

$$Prob(j \in K) = \frac{\alpha_K \varphi(x_j|m_K, \Sigma_K) + (1 - \alpha_K) \varphi(x_j|m_K, \eta \Sigma_K)}{\sum_l [\alpha_l \varphi(x_j|m_l, \Sigma_l) + (1 - \alpha_l) \varphi(x_j|m_l, \eta \Sigma_l)]}$$

The country is classified into the cluster for which the above expression is the highest.

The estimation of the parameters of such a model (in particular the mean m_K , the covariance matrix Σ_K , the ratios α_K and the factor η) is described, for example, in Punzo and McNicholas (2016). The Bayesian approach then enables us to place *a priori* information on the membership of individual countries in various clusters and on the model parameters, and especially on the location of the centres of individual clusters.

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.

Methodology of the Global Competitiveness Index

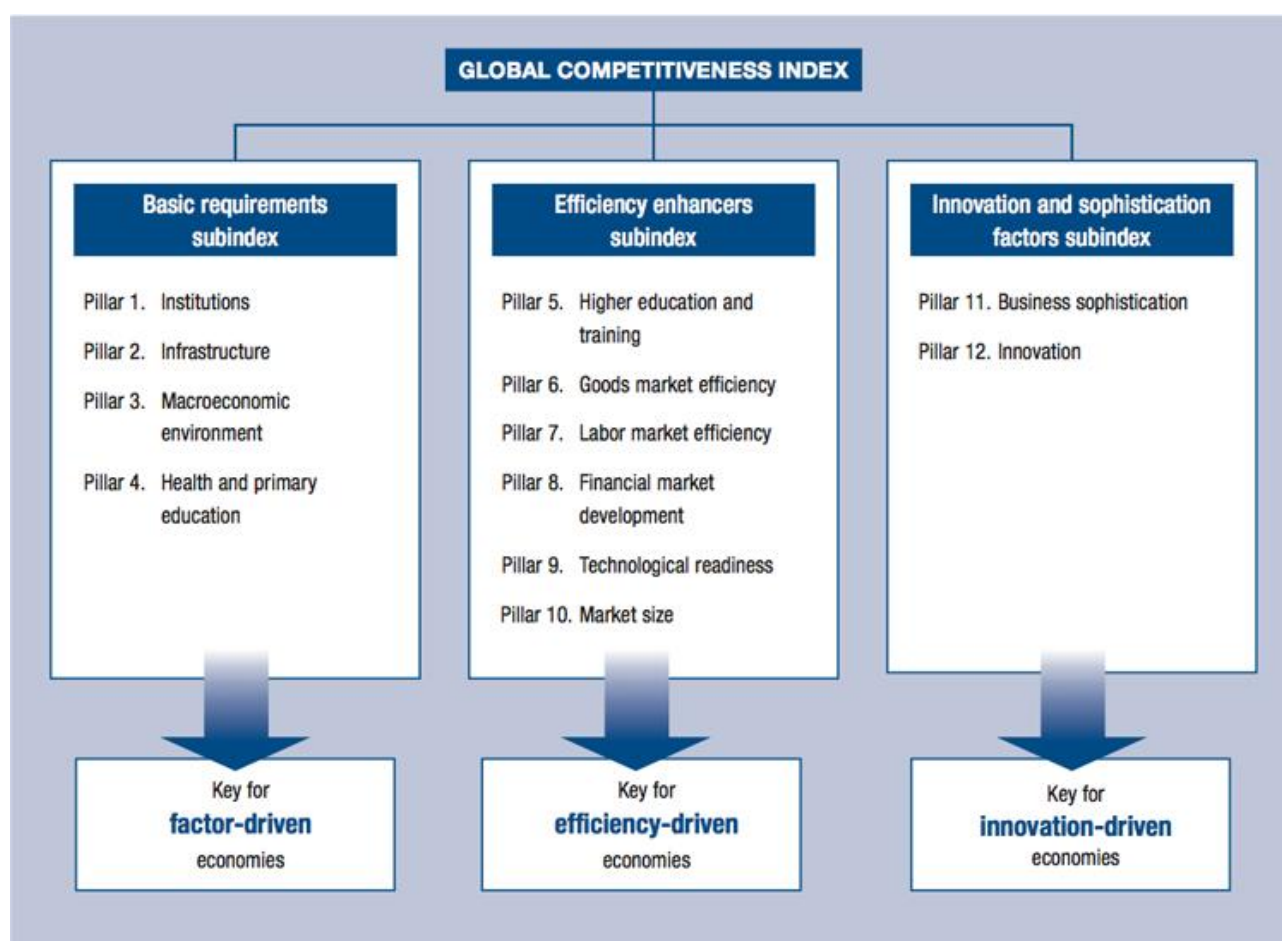
In the context of the Global Competitiveness Index (GCI), competitiveness is defined as the set of institutions, policies and factors that determine the level of productivity of a country. The productivity level determines the rates of return obtained by investments in an economy, which in turn are the fundamental drivers of its growth rates. The assessment of the importance of the GCI is based on a methodology¹⁷³ that explains approximately 89% of the change in GDP per capita by differences in the level of productivity. A positive and relatively close correlation between the economic level as measured by GDP per capita and the GCI was

¹⁷³ Robert E. Hall, Charles I. Jones, The Productivity of Nations, NBER (1996).

demonstrated using a sample of 138 countries (in 2016). The process of convergence of economies can be described by a similarly close relationship, as the growth rate of GDP per capita is positively correlated with the GCI and negatively correlated with GDP per capital at any given time. These relationships also apply to the substantially smaller sample of eight countries selected for comparison in this document.

The indicators monitored and assessed for the GCI (114 in total) are divided into three sub-indices and further broken down into twelve pillars. These twelve pillars are assessed separately, but the indicators explaining the evolution of the various pillars affect one another (for example, it will be difficult for a country to achieve a good score in the innovation pillar without a healthy, well-educated and trained workforce). The computation of the GCI is based on successive aggregations of scores from the lowest indicator level up to the overall index for the country. An arithmetic mean is generally used for the lower categories and weighting is applied to the higher aggregation levels. The weights put on the three main sub-indices are not the same for all countries but depend on each country's stage of development.¹⁷⁴

The pillars are assigned to the sub-indices as shown in the following flowchart:



In line with the economic theory of stages of development, the GCI assumes that, in the first stage, economic growth is based on unskilled labour and natural resources. The country competes on the basis of price and sells basic products or commodities, with its low

¹⁷⁴ A detailed description of the calculation of the Global Competitiveness Index can be found in the latest Global Competitiveness Report at <https://www.weforum.org/reports/the-global-competitiveness-report-2016-2017-1/>.

productivity reflected in low wages. Maintaining competitiveness at this stage of development hinges primarily on well-functioning public and private institutions (Pillar 1), a well-developed infrastructure (Pillar 2), a stable macroeconomic environment (Pillar 3) and a healthy workforce that has received at least a basic education (Pillar 4). As the economy becomes more competitive, productivity will increase and wages will rise and the country will move into the efficiency-driven stage of development, when it must begin to develop more efficient production processes and increase product quality. Competitiveness is therefore increasingly driven by higher education and training (Pillar 5), goods market efficiency (Pillar 6), labour market efficiency (Pillar 7), financial market development (Pillar 8), technological readiness (Pillar 9) and the size of the domestic and foreign markets (Pillar 10). As the country moves into the innovation-driven stage, wages will have risen by so much that it is able to sustain its competitiveness only by producing new and different goods using the most sophisticated production processes (Pillar 11) and by innovating new ones (Pillar 12).

2.3.2 Tax burden on businesses

The highest **statutory tax rates** 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 profitability of the 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 ratio (%) – 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. The capital adequacy ratio 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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