

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

2017

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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 economic and institutional situation in the euro area and on the ability of the Czech economy to operate without an independent monetary policy. This ability will be affected by the similarity of 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 for the Czech Republic. The ability of the Czech economy to adjust to asymmetric shocks will also be of key importance.

The analyses of the Czech Republic's economic alignment with the euro area in 2017 have been drawn up in line with the Czech Republic's Updated Euro-area Accession Strategy of 2007 and are based on the documents of the same name published by the CNB in previous years. They assess the current state of economic alignment in terms of long-term economic trends, the medium-term evolution of economic activity and the structural similarity of the Czech economy to the euro area economy. They also analyse the Czech economy's ability to absorb and adjust flexibly to asymmetric shocks. As in previous years, the document also contains a section on the economic alignment and public finance situation of the euro area countries. It also briefly describes changes in the economic and political framework of the euro area which alter the view on the economic costs and benefits of adopting the single currency.

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 titled "Cyclical and Structural Alignment" provides an assessment of differences in economic developments in the Czech Republic compared to the euro area in order to evaluate the risk of the single monetary policy being highly suboptimal for the Czech economy. The section titled "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 given 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 (AT), Belgium (BE), Cyprus (CY), Estonia (EE), Finland (FI), France (FR), Germany (DE), Greece (EL), Ireland (IE), Italy (IT), Latvia (LV), Lithuania (LT), Luxembourg (LU), Malta (MT), the Netherlands (NL), Portugal (PT), Slovakia (SK), Slovenia (SI) and Spain (ES). 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, i.e. unless indicated otherwise in a note, this refers to the EA19.

B SUMMARY

Future adoption of the single European currency should further increase the benefits accruing to the Czech Republic from its intense involvement in international economic relations, as it will lead to the elimination of exchange rate risk vis-à-vis the euro area and to a related reduction in trade and investment costs. Besides these benefits, however, euro adoption simultaneously entails costs and risks arising from the loss of independent monetary policy and exchange rate flexibility and costs arising from new institutional commitments. The factors that will influence whether adoption of the euro by the Czech Republic will lead to an increase in the country's economic stability and performance thus include not only developments in the Czech economy, but also developments in the euro area and changes in its institutional set-up.

In the **euro area**, many indicators remain misaligned within the monetary union itself. Aided by still very accommodative ECB monetary policy, the euro area has nonetheless recently seen fairly synchronised economic growth, with unemployment falling and inflation returning to positive, though still very low, levels. The responses to the crisis have led to gradual changes in the institutional architecture of the euro area aimed at enhancing its stability. These changes also have some bearing on the non-euro area countries. The functioning of the new institutions and rules, which have fundamentally changed the form of the euro area and hence also the content of the obligation to adopt the euro which the Czech Republic assumed on joining the EU, will therefore have to be assessed in future decision-making on the timing of the Czech Republic's entry into the monetary union.

The two key factors for the **Czech economy** as regards the costs and benefits of euro adoption will be its economic and structural similarity to the euro area and its ability to absorb potential asymmetric shocks after euro adoption. The analyses presented in this document therefore assess the similarity of the Czech Republic's long-term economic trends, medium-term development of economic activity and economic structure to the euro area, including the similarity of the functioning of monetary policy transmission. The ability of the economy to adjust by means of autonomous fiscal policy and flexible labour and product markets is also examined. 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. The strong trade and ownership integration also reduces the potential costs associated with adopting the single monetary policy, among other things by fostering a high observed degree of alignment between the Czech and euro area business cycles. It has therefore long been one of the most significant arguments for joining 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 the transmission of monetary policy through it is similar to that in the euro area.

The second group contains **areas where trends were disrupted by the global crisis but which currently represent no barrier to euro adoption**. These include gradual stabilisation of financial markets and renewal of their alignment with the euro area. An improvement has also been recorded for general government finance, which showed a structural surplus last year. The medium-term budgetary objective (MTO) is also expected to be met in the next two years. As a result, the general government debt-to-GDP ratio is falling towards pre-crisis levels in an environment of buoyant economic growth. This is improving the ability of fiscal policy to fulfil its macroeconomic stabilisation role.

The third group consists of **areas where positive trends were disrupted by the crisis, convergence was later renewed, but the distance from the euro area remains large.** This is particularly true of the real economic convergence of the Czech Republic to the euro area. GDP per capita based on purchasing power parity has increased slightly in recent years and exceeds 80% of the euro area average, but there is still considerable room for long-term economic convergence to advanced euro area countries. This applies even more to the long-term convergence of the price level to the euro area, which stands at a mere 63%. Although the price level in the Czech Republic has also started to converge towards the euro area in recent years, it is currently only slightly above the pre-crisis level. The difference between the average wage levels in the Czech Republic and the euro area is much bigger still. A continued process of convergence of economic activity and the price and wage level, accompanied by real appreciation, can be expected. This could imply higher inflation in the event of euro adoption.

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 remains a risk to the sustainability of public finances, and the health care system. Some problems also persist on the labour market, which has recorded an increase in flexibility in recent years but still has its weak points, including relatively high overall labour taxation and low labour mobility. The flexibility of the Czech product market has worsened slightly relative to other countries and is still being hampered by some administrative barriers. According to an international assessment, quality of institutions, including enforceability of law, a still weak pace of innovation and some labour market efficiency parameters remain weaknesses of the Czech economy in terms of its international competitiveness. 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. Together with a different 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 C examines the economic convergence and government financial positions of euro area countries. Changes in the institutional architecture of the Economic and Monetary Union are described in part D. Detailed results of the analyses of developments in the Czech Republic are presented in part E.

Situation in the euro area

Economic alignment of business cycles is important for the monetary union to function smoothly, because in the event of adverse asymmetric shocks individual countries cannot use autonomous monetary policy to reduce their cyclical swings and there is limited scope for fiscal policy. Such alignment should be fostered by convergence in the levels of development of the countries of the monetary union, i.e. less advanced countries should grow faster than wealthier ones and the differences in performance should thus level out. Nevertheless, such convergence is occurring only partially in the euro area and different levels of wealth as expressed by GDP per capita thus persist across the euro area countries. This is due in part to the restrictive fiscal policy that the governments of the southern periphery countries had to pursue despite a cyclical contraction or stagnation of their economies. Fiscal indiscipline of individual members of the monetary union is a long-running problem in the euro area. Although the situation in this area has improved in recent years due to fiscal consolidation and renewed economic growth, only six euro area countries were compliant with the debt and deficit criteria in 2016. Continued economic growth is being reflected in increasing business cycle alignment and is also having a positive effect on the labour market. The ECB's unconventional measures have helped improve the functioning of the interest rate channel of monetary policy transmission and have contributed to a decline in long-term government bond yields accompanied by

a narrowing of cross-country differences in yields. However, the degree of interest rate convergence seen before the crisis has not been renewed. Despite the highly accommodative monetary conditions, euro area inflation remains below the ECB's definition of price stability. However, it has returned to slightly positive levels in most countries.

The work of the EU and particularly of the euro area on **deepening integration**, especially in the economic and fiscal policy area, has been profoundly affected in 2017 by the result of the Brexit referendum and by ongoing security and social challenges. In the interests of deepening EMU in the financial union area, there was a continuing discussion about establishing additional pillars of the **banking union** to complement the Single Supervisory Mechanism (SSM), the Single Resolution Mechanism (SRM) and the Single Rulebook. Given the uncertainty surrounding the final shape of the banking union and the related costs, the Czech government reaffirms its decision not to join the banking union in the current situation. Participation in the banking union will be reviewed on the basis of a further update of the *Impact Study of Participation or Non-participation of the Czech Republic in the Banking Union* prepared under the leadership of the Ministry of Finance, which will be submitted in 2018. No specific conclusions were reached in the technical negotiations on the form of publicly financed backstops at national and European level. Technical negotiations also continued on a proposal to amend the SRM regulation in order to establish a **European Deposit Insurance Scheme** (EDIS). A package of legislative proposals to reduce risks in the EU banking sector, published by the European Commission in November 2016, was also discussed.

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 global financial and subsequently economic crisis. It resumed in 2013, and in 2016 the level of Czech GDP per capita reached 82.5% of the euro area average. The price level did not start to converge towards the euro area again until 2015 and was only slightly above the pre-crisis period a year later (63.4% of the euro area average). In 2016, the wage level in the Czech Republic was only around 40% of the euro area average when converted using the exchange rate and was virtually unchanged compared with the onset of the global crisis. At purchasing power parity, it was just above 62% of the monetary union average and was somewhat higher than in the pre-crisis period. Continued convergence in economic activity and the price and wage level can be expected. The corresponding real appreciation would imply higher inflation compared to the monetary union average in the event of euro adoption. The related low or even negative real interest rates could simultaneously increase the risk of macro-financial imbalances.

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 over the business cycle, even when adjusted for the strong common external shock in the form of the global financial and economic crisis.

Similarity of the **structure of the economy** with the euro area should reduce the risk of asymmetric economic shocks. However, 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. The shares of industry and services have been broadly stable

over the last ten years. This may lead to asymmetric shocks in the Czech economy, to which the single monetary policy would not be able to respond in full. Structural misalignment thus still poses a risk as regards euro adoption.

Smooth euro area entry should be preceded by gradual and fundamental-based **nominal interest rate convergence**, which will leave no room for a one-off shock associated with euro adoption. The difference between Czech and euro area market interest rates has long been very small. The risk of the said one-off shock upon euro adoption is thus low. Moreover, financial markets view the Czech Republic's government debt as sustainable.

The **exchange rate** of the koruna against the euro has been affected in recent years by the Czech National Bank's use of the exchange rate as an additional instrument for easing monetary policy from November 2013 until April 2017. The volatility of the koruna-euro rate showed temporary increases in the periods around the introduction of and the exit from the exchange rate commitment. However, it remains relatively low and stable in the long run, which is a favourable factor in terms of euro adoption. The correlation between the koruna-dollar and euro-dollar exchange rates is relatively high and stable. The Czech currency therefore reacts to changes in the environment outside the euro area similarly to the euro. This indicates a high degree of alignment. The outlook for the average rate of equilibrium real (and de facto nominal) appreciation of the Czech koruna for the following five years is estimated at 0.4%–2.7%.

The Czech economy's strong **trade and ownership links** with the euro area creates potential for large benefits stemming from the elimination of exchange rate risk and from transaction cost savings. The euro area is the destination for about two-thirds of Czech exports and the source of about 60% of Czech imports. The share of intra-industry trade is also relatively high. The intensity of the Czech Republic's foreign trade with the euro area has thus long been one of the most significant arguments for joining the euro area. The Czech economy's intensive ownership integration with the euro area, as represented by a high level of FDI from the euro area, also 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.

The **financial sector** in the Czech Republic is still significantly smaller than that in the euro area, and the gap widened further in 2016. However, the depth of financial intermediation in the euro area should not be regarded as a target, as an excessively large financial sector can represent a source of risks. The smaller depth of financial intermediation in the Czech Republic is due to lower private sector debt. However, given the loan growth in the domestic economy and ongoing private sector deleveraging in some euro area countries, convergence towards the euro area can be expected to renew in this area.

A similar **structure of the financial assets and liabilities of key 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 structure of the financial balance sheet of Czech non-financial corporations continues to differ somewhat from that of euro area firms, the main persisting difference being a lower loan-to-GDP ratio in the Czech Republic. The net creditor position of the Czech household sector is about half that in the euro area. There are also persisting differences in the structure of households' balance sheets. In particular, the debt ratio is half that in the euro area, and on the asset side there is a higher ratio of the liquid component of the portfolio at the expense of the investment component. There are also differences in the preferences of European and Czech households as regards the use of specific financial instruments as part of the investment component of assets. These differences may give rise to an asymmetric effect of monetary policy, as they may lead to weaker monetary policy transmission in the Czech Republic than 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. Client interest rates remain heterogeneous in the euro area itself. This represents one of the main challenges to ensuring that the single monetary policy has a symmetric effect. The spread between client rates on loans to non-financial corporations and the overnight interbank rate in the Czech Republic is slightly lower than that in the euro area and also differs in structure. 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, the fixation structure in the Czech Republic converged towards that in Germany and the euro area as a whole. 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.

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 is one of the lowest among the countries under comparison and thus poses no risk as regards future euro adoption.

The results of the analysis of **alignment of financial markets** (the money, foreign exchange, government bond and stock markets) still 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 has been gradually increasing since 2009.

The degree of **euroisation** in the Czech Republic is gradually rising, but remains relatively low. The use of the euro in the Czech economy is rising in non-financial corporations, while remaining very low in the household sector. The gradual growth in euroisation in the corporate sector is associated with the export orientation of Czech firms and the openness of the economy. This trend was intensified by a surge in demand for euro-denominated loans while the CNB's exchange rate commitment was in place (especially towards the end of the commitment). Firms took out such loans as an exchange rate hedge on expectations that the koruna would appreciate after the commitment ended.

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 shocks and deepening macroeconomic imbalances. 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 had the desirable countercyclical nature in 2009, when government anti-crisis measures were adopted. By contrast, the fiscal consolidation launched in 2010 significantly reduced the budget deficits, albeit at the cost of procyclical restrictive fiscal policy and an economic downturn in 2012 and 2013. In 2014–2015, it contributed to a recovery of the economy and to higher growth, mainly by means of investment co-financed by EU funds. Nevertheless, the domestic fiscal position has been improving again since 2014, to the point where a structural general government surplus was achieved in 2016. This 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 and to the euro area average. However, coping with population ageing, especially in

the pension system and the health and long-term care system, will be of key importance for sustainability. A risk is also posed by the relatively high share of mandatory expenditures, which are time-consuming and politically challenging to change and limit the room for discretionary policy measures. Although the Czech Republic's preparedness to enter the euro area has improved significantly in this respect, among other things through the enactment of budgetary responsibility laws, fiscal space and the effectiveness of adjustment mechanisms, especially in the long term, remain an area that needs attention.

The **labour market** is another important mechanism through which the economy can cope with asymmetric shocks in the absence of independent monetary policy. The flexibility of the Czech labour market has increased in response to the previous economic crisis, especially in the area of use of shorter working hours. Owing to greater use of shorter working hours and increases in the retirement age, the rate of economic activity has also been rising in recent years. The long-term unemployment rate is also showing a positive trend, being one of the lowest among the countries under comparison. Nevertheless, the Czech Republic constantly displays medium-high regional differences in unemployment rates. Minor problems persist in the areas of unemployment and internal labour market flexibility, especially as regards labour mobility, which remains significantly lower than in advanced European countries. This limits the ability of the economy to adjust flexibly to asymmetric shocks.

The functioning of the labour market as an adjustment mechanism is significantly affected by its **institutional rules**. One such rule is the minimum wage, whose ratio to the average wage has been rising gradually in the Czech Republic in recent years in line with the government's 2013 Programme Declaration. Until recently, the ratio of the minimum wage to the average wage was one of the lowest among the countries under comparison. However, it is currently converging to the other countries from below. A further sizeable increase in the minimum and guaranteed wage could start to disrupt labour market flexibility. Overall labour taxation in the Czech Republic is relatively high and has risen slightly further in the last year. Implicit labour taxation, which expresses the real tax burden as it includes health and social insurance, is also relatively high. The recent changes in the configuration of taxes and benefits are generally reducing the incentive to work. Last year, however, they were outweighed by growth in wages reflecting a marked expansion of the economy.

The Czech Republic's position in the area of **product market flexibility** worsened slightly compared to the previous year with respect to the number of administrative and regulatory barriers and is roughly in the middle of the countries under comparison. Its ranking as regards barriers to growth and competitiveness has improved slightly since 2007. Its score for basic factors affecting economic growth is relatively good, but quality of institutions, including enforceability of law, remains a weakness; the pace of innovation and labour market efficiency have not improved either. These shortcomings in the business environment reduce product market flexibility.

The **condition of the financial sector** of an economy plays an important role in its ability to absorb economic shocks. The resilience of the Czech banking sector to adverse shocks is high by international comparison. An excess of loans over deposits and low private sector indebtedness by international comparison preserve room for banks to further expand their lending while maintaining sufficiently high liquid assets. The link of domestic banks to the euro area banking sector is due mainly to the foreign ownership structure of the domestic banking sector. The biggest risk to the Czech banking sector at the moment is that of a continued spiral between property prices and property purchase loans.

C ECONOMIC ALIGNMENT OF EURO AREA COUNTRIES

Since the Czech Republic has committed to adopt the euro, it is vital for the country to monitor economic developments in the euro area. One of the major issues is whether the convergence of economic levels across the member states takes place. Monitoring business cycles alignment and individual countries' responses to asymmetric shocks is also important for a candidate country. As individual countries in the euro area cannot use autonomous monetary policy to mitigate cyclical contractions when negative asymmetric shocks occur, fiscal policy has to assume this function. However, the fiscal space is considerably restricted in the euro area.

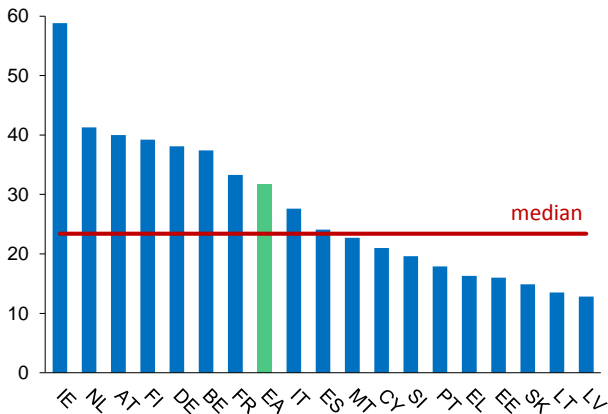
This part summarises the alignment of key macroeconomic variables by means of simple descriptive statistics. Emphasis is placed on cyclical indicators and indicators included in the Maastricht convergence criteria and the Stability and Growth Pact. Box 1 shows the indicators used in the Macroeconomic Imbalance Procedure to identify structural risks and macroeconomic imbalances.

Analysis of euro area economic cohesion

The wealth levels in the euro area countries, expressed by **GDP per capita**, are very diverse (see Chart 1). On the one hand, in most of the euro area founding members (EA-11) this indicator recorded similar levels in 2016, mostly exceeding EUR 30,000. On the other hand, GDP per capita in countries that have adopted the euro recently (Estonia, Lithuania, Latvia and Slovakia) hovered around EUR 15,000 in 2016.

In the optimum case, less advanced countries should grow faster than wealthier ones and the differences in performance should thus even out. However, Chart 2 shows that such "**beta-convergence**" is occurring only partially in the euro area. Although some of the new member states (Latvia, Lithuania, Malta and Slovakia) recorded the highest growth rates, the countries hit by the financial and debt crisis (Italy, Cyprus, Portugal, Greece and Spain) showed a decline in output and thus diverged from the wealthier countries.

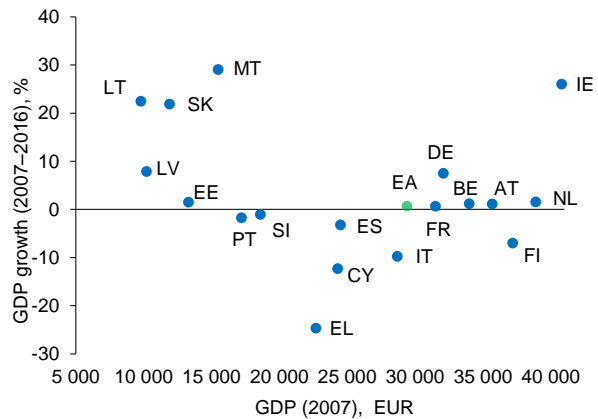
Chart 1: GDP per capita in euro area countries (2016, EUR thousands)



Note: GDP at current prices. The horizontal line shows the median value across euro area countries. Luxembourg is not included in the chart due to the specific structure of its economy (the high number of foreign workers in the country and the large number of high-value-added international corporations based there), which results in exceptionally high GDP per capita in the country.

Source: Eurostat.

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



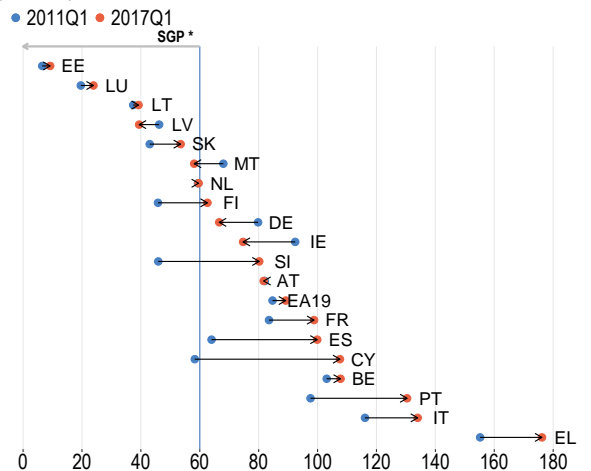
Note: The chart depicts the relation between GDP growth per capita in each country and its initial level (beta-convergence). X-axis – the GDP per capita of each country in 2007 at 2010 prices. Y-axis – real GDP growth in 2007–2016.

Source: Eurostat.

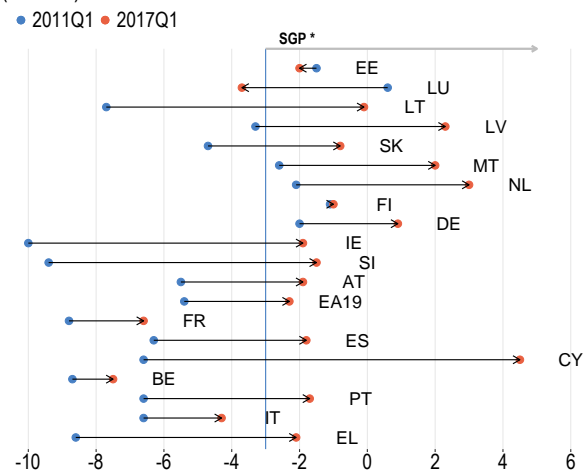
The decline in real GDP in the southern euro area countries was due in part to the restrictive **fiscal policy** that their governments had to pursue despite a cyclical contraction or stagnation of their economies. However, as Chart 3: Fiscal positions of euro area countries shows, even though government budget balances shifted more towards balanced budgets or surpluses between early 2011 and 2017, only Germany, Ireland, Latvia and Malta recorded decreases in debt.

Chart 3: Fiscal positions of euro area countries

Government debt (% GDP)



Government budget balance (% GDP)

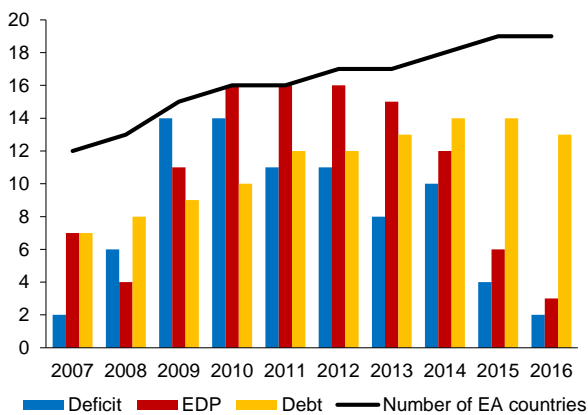


Note: Countries compliant with the Stability and Growth Pact (SGP) lie in the area labelled SGP*. The SGP sets limits on government deficits (3% of GDP) and debt (60% of GDP). The starting point (2011 Q1) was chosen to capture the negative fiscal effects of the financial crisis (such as rescue programmes in banking sectors financed from state budgets).

Source: Eurostat.

After a country joins the monetary union, it needs to maintain or create **fiscal space** for stimulating the national economy at times of crisis, especially in the absence of major fiscal transfers between countries. In this respect, fiscal indiscipline of individual EMU members is a long-running problem in the euro area – several countries were not compliant with the Stability and Growth Pact even before the crisis (see Chart 4). The debt of some countries surged during the financial crisis due to bail-out operations in the banking sector. In recent years, however, the situation has stabilised or improved, especially in the case of the deficit criterion, due to fiscal consolidation and renewed economic growth in previous years. Despite this, only six countries were compliant with the debt and deficit criteria at the same time in 2016 (see Chart 5).

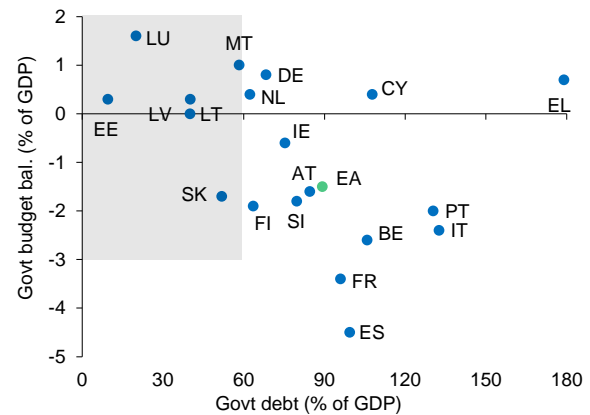
Chart 4: Non-compliance with the fiscal criteria



Note: The number of countries non-compliant with the Stability and Growth Pact. 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.

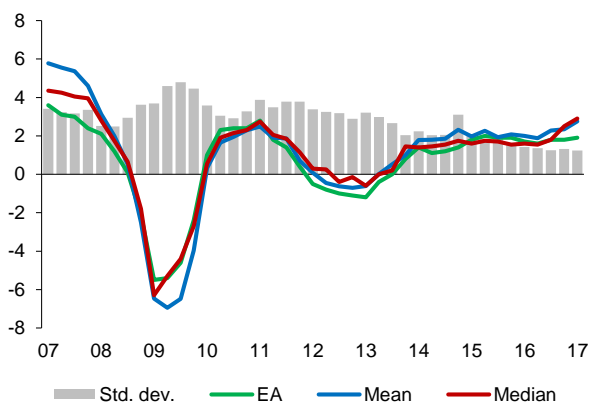
Chart 5: Fiscal positions of euro area countries



Note: 2016 data. Countries compliant with the Stability and Growth Pact lie in the grey area.

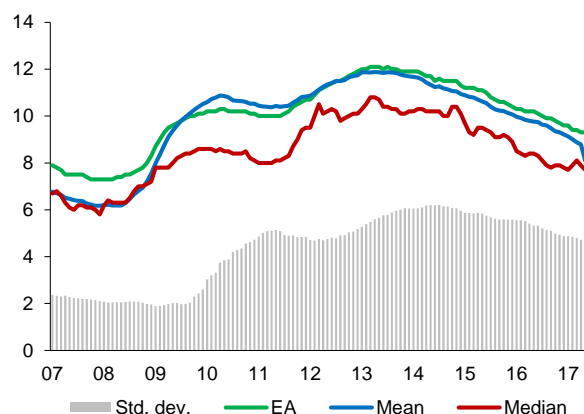
Source: Eurostat.

Besides fiscal consolidation, the improvement in the public finance situation is being supported by the economic recovery, which has started in the second half of 2013, gradually broadened to all countries over the last year and accelerated in this year. In addition, **business cycles** in the euro area became more aligned, as indicated, for example, by a decrease in the standard deviation of real GDP growth across countries (see Chart 6). Low growth in large economies (Germany, France and Italy) relative to smaller countries has resulted in the rate of growth of the euro area as a whole being lower than the average and median rates across all countries in recent quarters.

Chart 6: 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 due to exceptionally high growth in 2015, which exceeded 20% owing to the relocation of the headquarters of several international corporations to Ireland. The source series are seasonally adjusted.

Source: Eurostat, CNB calculations.

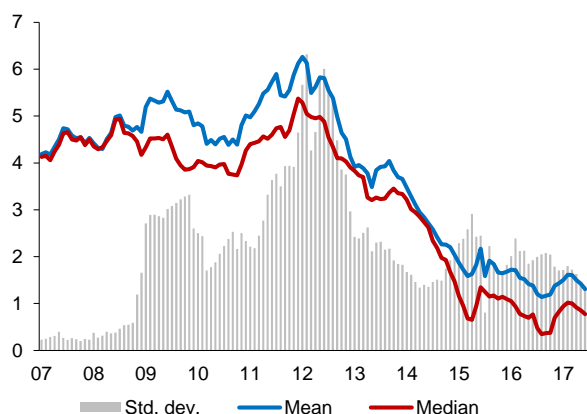
Chart 7: Unemployment in euro area countries (%)

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.

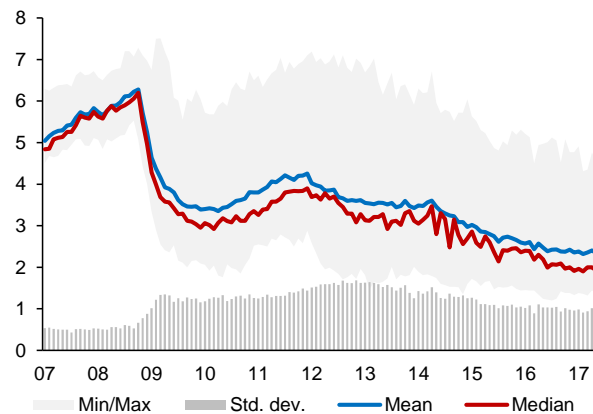
The upswing in the business cycle is also apparent in the **labour market**, where the unemployment rate is decreasing and the cross-country dispersion of its levels is also going down (see Chart 7). The labour market, where, after the onset of the financial crisis, unemployment rates had increased in all countries and rates in the hardest hit countries (Estonia, Greece, Italy, Lithuania, Slovakia and Spain) had diverged upwards from the rest of the euro area, recorded a turnaround approximately in 2013. Last year, unemployment in the euro area dropped to the 2009 level (i.e. below 9.5%) and the differences between countries narrowed further. Nevertheless, high unemployment, especially among people aged 16-24, remains a key macroeconomic and social problem in some countries (in particular Greece, Italy and Spain). By contrast, the unemployment rate in Germany fell to historical lows (below 4%).

These positive developments in the euro area have been supported by the ECB's very accommodative monetary policy, which has also contributed significantly to a decline in **long-term government bond yields** since 2012 (see Chart 8). It has thus reversed the trend that started during the financial crisis when government bond yields in some euro area countries started to rise and increased further during the sovereign debt crisis. Cross-country differences in yields narrowed significantly at the end of 2012 when the ECB announced its Outright Monetary Transactions (OMT) programme, which led to a stabilisation of the euro area government bond markets. Bond yields declined sharply further at the end of 2013 on the back of expectations and the subsequent announcement of the Public Sector Purchase Programme (PSPP) by the ECB. Yields in euro area countries went up temporarily at the end of 2016 (due, among other things, to the presidential elections in the USA and the monetary policy tightening by the Federal Reserve), but declined again this year. Cross-country differences in yields are thus close to the lows recorded after the financial crisis, but the degree of interest rate convergence seen between the onset of the euro area and the crisis has not resumed.

Chart 8: Long-term government bond yields 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 9: Funding costs of non-financial corporations (%)

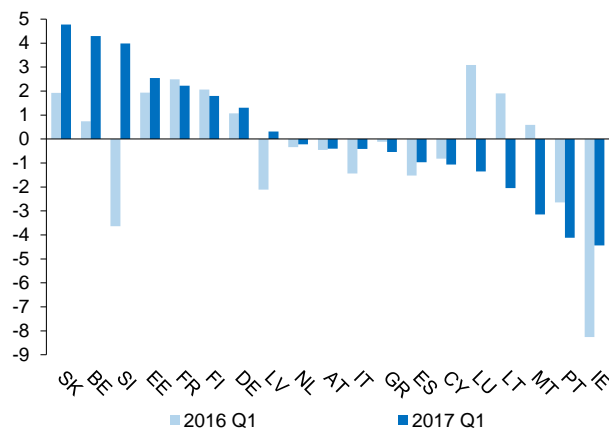
Note: The composite indicator comprises a weighted average of short-term and long-term loans to non-financial corporations.

Source: ECB (MIR database), CNB calculations.

The ECB's unconventional policy measures have also helped improve the functioning of the **interest rate channel of monetary policy transmission**. The channel was disrupted during the financial crisis and the subsequent sovereign debt crisis by a rise in government bond yields in the southern euro area countries and the fragmentation of the euro area banking sector. Interest rates on loans to non-financial corporations thus increased in some countries after 2010, although the ECB's base rates remained unchanged. The difference between the lowest and highest client loan rates in the euro area also increased significantly. Chart 9 shows an initial increase and subsequent decline in the misalignment of the funding costs of non-financial corporations. The decline started at the end of 2012 and accelerated after the ECB started its bond purchases. Along with the decline in misalignment, the average and median costs have decreased, the largest drop having been recorded for countries hit by the debt crisis.³

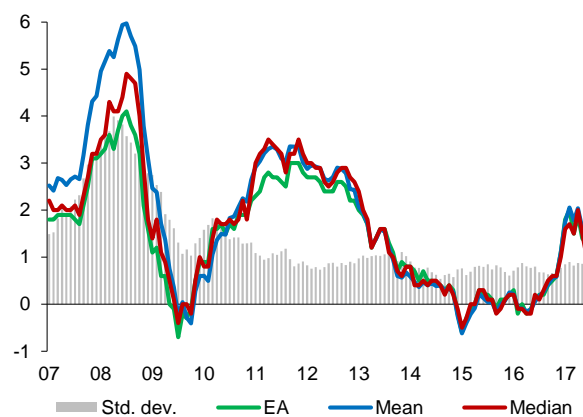
Although bank lending rates have decreased across the euro area countries in recent years, the trends in the **volume of bank loans** remain mixed. Chart 10 illustrates annual growth rates in bank loans to non-financial corporations, which are an important factor behind private investment growth. Although monetary policy has fostered a decrease in loan financing costs in this sector, loan volumes are still declining in several countries, including those in the southern part of the euro area. This is due to a combination of factors, most notably private sector deleveraging in some countries (see Box 1), banking sector problems in some countries and insufficient investment opportunities in an environment of low economic growth.

³ It should be noted that the series are calculated on the basis of actual loans provided. It is thus not possible to capture the credit constraints faced by small and medium-sized enterprises in the southern euro area countries, which have eased significantly in recent years.

Chart 10: Growth in bank loans to domestic non-financial corporations (y-o-y, %)

Note: Annual growth in outstanding volumes provided by monetary financial institutions.

Source: ECB (BSI database).

Chart 11: Inflation in euro area countries

Note: The mean series depicts the unweighted arithmetic mean of inflation in the given year across euro area countries.

Source: Eurostat, CNB calculations.

Despite the highly accommodative monetary policy stance, euro area **inflation** remains below the ECB's definition of price stability (see Chart 11). Although headline inflation rose above 2% at the start of this year due to base effects and a rise in energy prices, it has gone down again in recent months. Core inflation remains stable just above 1%, reflecting among other things low wage growth, which persists despite a decline in the unemployment rate across the euro area countries. The cross-country alignment of the inflation rate, as captured by the standard deviation, showed no major changes.⁴

Box 1: Cohesion of euro area countries from the perspective of the indicators used in the Macroeconomic Imbalance Procedure

For several years, Section C of the Alignment Analyses has summarised the cyclical indicators used to assess the similarity of business cycles in euro area countries. An alternative analysis can be performed based on the indicators used to identify macroeconomic risks in the **Macroeconomic Imbalance Procedure** (MIP). The MIP was introduced in 2011 in response to the financial crisis and is included in the "Six-Pack" legislation. The indicators are used by the European Commission to identify countries for which a subsequent in-depth review is conducted and possible further actions taken in accordance with EU legislation.

⁴ Similarly as in last year's Alignment Analyses, a cluster analysis was performed for seven key macroeconomic indicators (unemployment, GDP growth, inflation, long-term interest rates, government debt, government deficit and growth in loans to non-financial corporations). Its results for 2016 confirm persisting (albeit decreasing) misalignment as regards the cyclical and fiscal position (growth in loans to non-financial corporations). Given the similarity of the results with those obtained last year, we do not present them in graphical form. The countries of the southern periphery (Greece, Spain and Cyprus) are still facing high unemployment and lower economic growth, while economies such as Germany and the Netherlands are showing more aligned indicators.

Table B1: Scoreboard for the early detection of macroeconomic imbalances

	AT	BE	CY	DE	EE	EL	ES	FI	FR	IE	IT	LT	LU	LV	MT	NL	PT	SI	SK
External imbalances and competitiveness																			
Current account balance (3Y average)	2.1	-0.2	-4.1	7.6	0.9	-1.2	1.3	-1.2	-0.7	4.6	1.4	0.9	5.2	-1.8	5.9	9.2	0.6	4.9	1.1
Net international investment position (% of GDP)	2.9	61.2	-130.3	49.7	-40.9	-134.6	-91.3	0.5	-15.7	-203.1	-23.5	-44.7	35.0	-62.5	52.1	56.1	-112.0	-40.0	-60.5
Real effective exchange rate (3Y change in %)	1.8	-1.3	-6.3	-1.5	6.4	-5.5	-2.9	2.2	-2.7	-6.0	-2.2	3.9	-0.5	3.0	-0.2	-0.6	-2.9	0.5	-0.7
Export market share (5Y change in %)	-9.5	-11.2	-16.7	-2.2	8.7	-20.5	-3.4	-20.4	-5.3	37.3	-8.8	15.6	23.1	10.6	-1.3	-8.2	2.6	-3.5	6.9
Nominal unit labour costs (3Y change in %)	6.1	1.5	-10.0	5.6	13.5	-11.1	-0.7	3.9	2.2	-19.5	1.7	11.6	0.0	16.3	-0.2	-0.4	0.0	-0.4	2.2
Internal imbalances																			
Deflated house prices (1Y change in %)	3.5	1.4	0.2	4.1	6.9	-3.5	3.8	-0.3	-1.8	8.3	-2.6	4.6	5.9	-2.8	5.1	3.4	2.3	1.5	5.5
Private sector credit flow (% of GDP)	2.1	10.0	4.4	2.8	3.3	-3.1	-1.9	6.9	4.4	-6.5	-1.7	2.2	23.7	0.7	5.0	-0.8	-1.9	-5.1	8.2
Private sector debt (% of GDP)	126.4	178.9	353.7	98.2	116.0	126.4	155.5	152.9	143.4	296.2	116.8	55.0	335.8	88.7	129.2	225.1	180.3	86.7	81.4
General government sector debt (% of GDP)	85.5	106.0	107.5	71.2	10.1	177.4	99.8	63.7	95.6	78.7	132.1	42.7	21.6	36.5	60.6	65.2	129.0	83.1	52.5
Unemployment rate (3Y average)	5.6	8.5	15.7	4.9	7.4	26.3	24.2	8.8	10.3	11.3	12.2	10.5	6.1	10.9	5.9	7.2	14.4	9.6	13.0
Total financial sector liabilities (1Y change in %)	0.6	0.0	2.8	2.8	8.1	15.7	-1.0	1.3	1.8	9.5	1.7	6.7	15.5	12.2	1.2	3.6	-1.8	-3.7	4.5
New employment indicators																			
Activity rate (3Y change in pp)	0.4	0.7	0.4	0.4	1.9	0.3	0.0	0.6	N/A	0.8	0.5	2.3	1.5	1.3	4.5	0.6	0.0	1.4	1.5
Long-term unemployment rate (3Y change in pp)	0.5	1.0	3.2	-0.4	-3.1	3.7	0.4	0.7	0.6	-3.7	1.3	-2.7	0.3	-3.3	-0.7	1.1	-0.5	0.4	-1.8
Youth unemployment rate (3Y change in pp)	1.2	2.3	5.1	-0.8	-7.8	-5.5	-4.6	3.4	0.3	-9.5	5.0	-10.4	-1.4	-12.2	-2.3	-0.4	-6.0	-4.3	-7.5

Note: Data for 2015 as used in the MIP commenced in November 2015, the results of which were published in 2017. Orange fields signal a warning that the indicator is above the threshold. The indicators and thresholds are described in the *Methodological Part*.

Source: Eurostat.

Among the euro area countries, the Commission detected – based on the scoreboard and other analyses – imbalances in Germany, Spain, Ireland, the Netherlands, Slovenia, Cyprus, France, Italy and Portugal in 2017. Excessive imbalances were identified for the last four. Table B1 scoreboard indicates that structural challenges in the euro area countries are mostly related to high indebtedness (both of the public and the private sector) and high unemployment rates. Although the levels of unemployment rate are partly of a cyclical nature, the fact that they have remained elevated for a long time may signal structural issues in the economy. Moreover, countries with low growth figures (Cyprus, Greece, Finland and Italy) are losing their export shares, which poses a drag on their timely recovery. On the other hand, the current account imbalances have improved in recent years in most countries with debt problems, so their external indebtedness is not further increasing.

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

The EU and the euro area experienced continued **economic growth** in 2017, although still mostly in the absence of major inflation pressures. Countries are still recovering from the impacts of the crisis, especially in the form of high private and public sector debt. They are suffering from insufficient implementation of necessary structural reforms and adverse demographic trends and the region remains generally vulnerable to external shocks.

No major changes were recorded in economic policy coordination in the EU compared to previous years. The seventh **European Semester** started in November 2016 with the publication of the 2017 Annual Growth Survey, in which the Commission reaffirmed the EU's main economic and social priorities set out a year earlier: (i) boosting investment, (ii) pursuing structural reforms and (iii) ensuring responsible fiscal policies. A draft recommendation for the economic policy for the euro area as a whole was published at the same time. The next step in the European Semester was the publication of country reports by the Commission in February 2017. This was followed in April by national reform programmes and convergence/stability programmes drawn up by the Member States and by a proposal for country-specific Council recommendations, which were endorsed in July. Nevertheless, the economic policy coordination system remains hindered by a low rate of compliance with the recommendations, which are not legally binding and thus not enforceable.⁵

Compliance with the fiscal rules laid down in the Stability and Growth Pact (SGP) is gradually improving. The excessive deficit procedures (EDPs) for Croatia and Portugal were closed in June 2017 and the Council also approved a decision to close the EDP for Greece in September and the UK in December; the number of countries subject to EDPs thus dropped from 24 in 2011 to just two (France and Spain). **Greece** and its debt situation were again a subject of complex negotiations in 2017.⁶ A compromise deal was reached between European creditors and the IMF in July 2017. On the basis of this deal, a third, EUR 8.5 billion tranche from the European Stabilisation Mechanism (ESM) was approved.⁷ Despite the continued absence of an agreement between European creditors and the IMF on the key issue of Greece's debt sustainability, a new IMF programme for Greece was approved in principle, although any payment of funds is conditional on debt sustainability. The European resolution mechanisms (the ESM and its predecessor the EFSF) thus became Greece's largest creditor with a total claim of EUR 182 billion, i.e. more than half of Greece's public debt.

The ESM's claims on Greece may be a crucial factor in the Czech Republic's euro area entry decision. Adoption of the single European currency is tied to **participation in the ESM**.⁸ This implies an obligation to contribute the ESM's capital and assume all the rights and duties of membership. In the hypothetical case of the Czech Republic participating in the ESM, its total capital commitment would be around CZK 415 billion, about CZK 48 billion of which it would be obliged to pay up within four years.⁹ In the hypothetical case of a write-off of the ESM's total current claim on Greece (EUR 40.2 billion), i.e. the maximum possible loss, its share as an

⁵ This problem is also mentioned in IMF (2017).

⁶ Nevertheless, Greece returned to the public bond market in July 2017 for the first time since 2014, selling five-year bonds amounting to EUR 3 billion on 25 July. The issue was judged a success, with demand from investors outstripping supply more than two times over.

⁷ ESM assistance paid to Greece under the third assistance programme has so far amounted to EUR 40.2 billion out of a possible EUR 86 billion.

⁸ The Czech Republic could theoretically adopt the euro without becoming a contracting party to the ESM, but the euro area members can de facto make their consent to euro adoption in the Czech Republic conditional on ESM entry.

⁹ The remainder is callable capital. The calculation is based on relevant Eurostat figures, the capital key calculation rules in the Treaty Establishing the European Stability Mechanism and on an exchange rate of CZK 25.5 to the euro.

ESM member would be around CZK 24 billion. The discussion between the IMF and Greece's European creditors on the need for and timing of measures to reduce Greece's debt is therefore very important purely in terms of the Czech Republic's financial interests. Although the ESM's claims on Greece will not start to mature until 2034, the risk of an earlier write-off of part of the debt cannot be ruled out. This fact must therefore be weighed carefully and efforts should be made to eliminate the uncertainty surrounding the potential need to extend the maturity of, or write off, Greece's debt before making any decision to join the euro area. From this perspective, the IMF's position is logically closer to the Czech interest.

Following the result of the **Brexit** referendum, formal negotiations on the UK's exit from the EU, the conditions for ending its EU membership and on future mutual relations were opened in June 2017. As envisioned by the EU27, the negotiations are to be divided into two stages. In the first stage, agreement is supposed to be reached on the principles for the settlement of mutual obligations arising from the UK's EU membership. If sufficient progress is made in that stage, an agreement on future relations should be reached in the second stage. Following the complicated negotiations in early December, the European Council may on 15 December note that this sufficient progress in the negotiations on the first phase has been made, thus opening the door for negotiations on the second stage. Progress with the highly complex negotiations is being further complicated by the fragile internal political situation in the UK itself following the June 2017 general election. The absence of a specific and coherent British political vision for future relations between the UK and the EU after Brexit, including possible temporary customs union membership or a free trade agreement, is a problem.

Brexit and the future of the EU27 raises many new legal, institutional and political issues for all EU states and institutions. It can be assumed that Brexit will also affect the position of non-euro area EU Member States, as the relative strength of this group 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. 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.

In 2017, as in 2016, the **debate about deepening economic and monetary union (EMU)** went on against a background of more pressing issues relating to the persisting inflow of migrants from countries close to the EU, terrorist risks and Brexit negotiations. It was also affected by a continued lack of consensus among euro area member states and the EU as a whole on the speed and degree of integration in various areas of European policy. Nevertheless, the Commission in March 2017 presented a **White Paper on the Future of Europe** as an input into the debate on the future direction of the EU. The White Paper was launched at an EU summit commemorating the 60th anniversary of the signing of the Treaties of Rome. In it, the Commission presented five hypothetical scenarios for how the EU as a whole could evolve in the future. These scenarios differ in terms of the form of cooperation between the Member States (for example in the areas of defence, justice, social issues and the internal market). The Commission's follow-up **reflection paper on the deepening of the EMU** focused in more detail on the reform of the EMU architecture in 2017–2025.¹⁰

In most cases, however, the reflection paper merely reiterated proposals that had previously been presented in various forms and discussed in various European forums without the

¹⁰ The *White Paper on the Future of Europe* was followed up by a series of Commission reflection papers, including one on the future of EU finances, which analysed the possible future financing of EU policies from the EU budget, primarily with regard to the amount of common resources and changes in the structure of EU budget expenditure and revenues, and one on the social dimension of Europe, which set out three possible scenarios for future cooperation between EU Member States in the social area.

Member States having reached agreement on them. These included proposals to introduce sovereign bond-backed securities, measures to coordinate EU and euro area economic policies and fiscal supervision (such as a possible macroeconomic stabilisation tool for the euro area, which could be used to absorb economic shocks, for example through unemployment benefit payments, or as a new investment instrument) and institutional changes envisaging greater formalisation of the functioning of the euro area and the establishment of a euro area “ministry of finance”. The Commission President’s speech on the State of the European Union in September injected new life into the debate. Jean-Claude Juncker announced, among other things, submission of specific proposals aimed at deepening the EMU in December 2017, including proposals to introduce a European Minister of Economy and Finance and to convert the European Stabilisation Mechanism into a European Monetary Fund. These ideas were further developed by the Commission in a policy package published on 6 December 2017, containing 4 legislative proposals and 3 communications on the deepening of EMU, including a proposal for a regulation establishing a European Monetary Fund that should take over the role of the ESM and also serve as a backstop for the Single Resolution Fund (SRF).

In the interests of deepening EMU in the financial union area, there was a continuing discussion about establishing additional pillars of the **banking union** to complement the Single Supervisory Mechanism (SSM), the Single Resolution Mechanism (SRM) and the Single Rulebook. The first bank resolution cases involving practical application of the decision-making mechanisms of the newly established banking union institutions, most notably the Single Resolution Board (SRB), occurred in Spain and Italy in the course of 2017.¹¹ Following these cases, discussions were held in the EU to assess the course and success of the measures taken. Although the EU resolution legislation does not contain any provisions on the use of public support in bank liquidation under national insolvency law, and the Italian procedure was thus compliant with EU law (the public support rules), the use of taxpayers’ money in this case runs contrary to the concept of the banking union, a declared aim of which is to sever the links between governments and the banking sector.

The SRM also includes the SRF, which is financed from contributions of credit institutions and should reach full capacity by the end of 2023. During the transition period, bridge financing for national sub-funds is ensured from the national sources of the states participating in the SRM in the form of bilateral national credit line agreements with the SRB.¹² However, given the planned amount of SRF resources relative to the size of the EU banking sector, a need for additional funds for resolving systemically important banks can be expected even after the transition period ends.¹³ These resources should take the form of publicly financed **backstops** at national and EU level, which will be fiscally neutral in the medium term. Further to the June 2016 Council conclusions on a roadmap to complete the banking union,¹⁴ which reaffirmed the existing approach to a common backstop for the SRF to be created during the transition period, technical negotiations on the common backstop were opened in autumn 2016.¹⁵ Given

¹¹ Spain’s Banco Popular Español was restructured in accordance with the resolution rules, whereas in the case of Italy’s Banca Popolare di Vicenza and Veneto Banca the SRB decided that there was no public interest for restructuring and the standard insolvency procedure under national insolvency legislation was applied. Given the regional importance of both banks, the Italian authorities found a public interest for the provision of public support from the Italian state budget (capital injections of EUR 4.785 billion and a state guarantee of up to EUR 12 billion) to facilitate liquidation. This was approved by the European Commission.

¹² If the Czech Republic were to become a member of the SSM/SRM during the transition period before the SRF reaches full capacity, it would also conclude a loan facility agreement.

¹³ 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.

¹⁴ Council of the EU (2016).

¹⁵ The proposals under discussion included a credit line from the ESM, the creation of national credit lines or guarantees from the state budgets of the Member States, the use of the EU budget, and credit lines provided by a newly established institution.

the high political sensitivity and complexity of the issue, however, the negotiations did not reach any final conclusions.

In 2017, technical negotiations also continued on a proposal to amend the SRM regulation in order to establish a **European Deposit Insurance Scheme (EDIS)**.¹⁶ A package of legislative proposals to reduce risks in the EU banking sector, published by the European Commission on 23 November 2016, was also discussed. This involves amending the EU legislation governing the pursuit of business of credit institutions and investment companies and the prudential rules and rules on recovery plans and resolution applying to them. The proposals to establish the EDIS and the proposed measures to reduce risks in the EU banking sector are closely interrelated, as the June 2016 Council conclusions state that the establishment of risk-sharing instruments should be preceded by a reduction of risks in the European banking sector. The political discussion about the EDIS is conditional on sufficient progress being made on risk reduction. However, owing to the technical complexity of the negotiations and the different positions of the Member States, no major progress has been achieved on this issue so far.

Given the current non-completion of the banking union project and the uncertainty surrounding its final shape and the related costs, the Czech government on 30 May 2016 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 of Participation or Non-participation of the Czech Republic in the Banking Union**. Due to the small progress made in 2017, a decision was made to postpone the submission of the updated study to 2018.

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 profoundly affected in 2017 by the result of the Brexit referendum and the related negotiations and by ongoing security and social challenges. 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 properly assess the functioning of the new institutions and regulations created in response to the economic and financial crisis. **They 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 of the future set-up of, and institutional changes to, the euro area itself and of the fiscal costs associated with any fiscal problems in euro area member states and their financial sectors. In this regard, the first cases of resolution of credit institutions in the banking union have revealed some shortcomings and a need to make further changes to ensure that the declared principle of severing the links between public budgets and banking sectors is fulfilled. In light of the above, it should be noted that not all the potential obligations associated with euro adoption for the Czech Republic in the future are known at present.

¹⁶ European Commission (2015a).

E RESULTS OF THE ANALYSES FOR THE CZECH REPUBLIC

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 analyses 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

A fundamental indicator of the similarity of two economies indirectly indicating their ability to share a common currency is a comparison of their **GDP per capita at purchasing power parity**. The process of convergence of this indicator towards the euro area has resumed in the Czech Republic since 2013 (see Table 1). Its level reached 82.5% of the euro area average in 2016. Among the countries under comparison, the Czech Republic has been in third position in recent years, but it still lags well behind Austria and Germany. However, it is ahead of the less advanced euro area states and the Central European non-euro area countries.

Table 1: GDP per capita at purchasing power parity

(EA = 100)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
CZ	75.1	77.1	78.6	76.4	77.0	76.8	78.3	81.0	81.8	82.5
AT	113.3	114.4	116.2	116.4	118.4	122.5	122.7	121.4	119.8	119.2
DE	107.0	107.7	107.9	110.9	114.2	115.4	116.1	117.7	116.2	115.9
PT	74.4	73.9	75.6	76.0	71.6	70.2	71.7	72.1	72.1	72.7
HU	54.7	57.4	58.6	59.6	60.6	61.1	62.6	63.6	64.0	63.3
PL	48.4	51.1	54.9	57.8	60.3	62.5	62.6	63.3	64.3	65.3
SI	79.6	82.4	78.6	77.1	77.0	76.5	75.9	77.6	77.6	78.2
SK	61.1	65.5	65.4	69.1	69.1	70.5	71.7	72.4	72.4	72.7

Source: Eurostat, CNB calculations.

Another key long-term parameter, important for domestic inflation after euro adoption, is the **price level of GDP** relative to the euro area. In the case of the Czech Republic, it is only slightly above the 2007 pre-crisis level (see Table 2). Its process of convergence to the monetary union average resumed in 2015, i.e. roughly two years later than the convergence of

GDP per capita. This lag reflected a temporary real depreciation of the koruna related to the introduction of the exchange rate commitment by the Czech National Bank in 2013. However, similarly subdued price convergence towards the euro area was recorded by other Central European countries (Hungary, Poland and Slovakia) in previous years, so it was evidently a more general regional phenomenon. In 2016, the Czech price level was 63.4% of the euro area average, substantially lower than in Austria and Germany. It was also lower than in Portugal, Slovenia and, to a much lesser extent, Slovakia.

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

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
CZ	62.7	69.2	64.9	68.2	69.6	68.3	65.1	61.3	62.5	63.4
AT	105.8	106.0	106.1	106.3	106.5	105.1	105.4	106.2	106.2	106.2
DE	102.1	101.8	102.0	101.5	101.1	101.7	102.5	102.4	103.1	103.7
PT	78.8	78.9	78.9	78.6	79.8	78.1	77.3	77.1	77.8	78.0
HU	65.1	64.6	57.3	57.9	57.0	56.1	55.7	55.6	56.2	57.2
PL	59.7	65.1	54.4	57.0	56.0	55.4	55.6	56.1	56.2	53.6
SI	76.8	78.6	81.1	80.5	79.9	78.3	78.1	78.0	77.9	78.1
SK	60.2	64.2	64.9	63.3	64.8	65.2	65.0	64.4	64.7	64.9

Source: Eurostat, CNB calculations.

The Czech price level in 2016 thus remained well – by more than 20 pp – below the level corresponding to the **empirical relationship between price levels and GDP per capita at purchasing power parity** (Model I).¹⁷ However, an alternative fixed-effects empirical estimate (Model II)¹⁸ reveals that the relatively low price level in the Czech Republic can be attributed largely to structural (but unspecified) characteristics.¹⁹

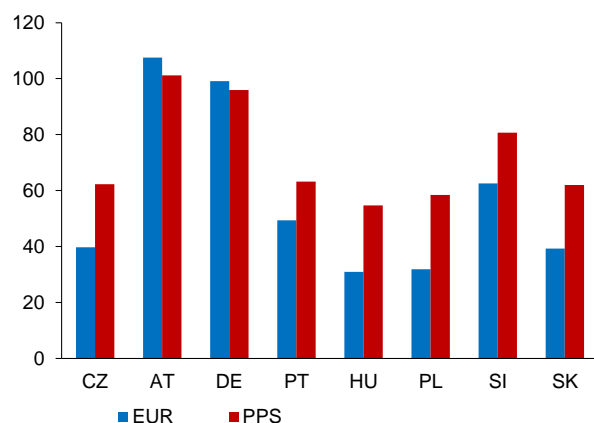
The relative **wage level** is also closely linked with GDP per capital and the price level relative to the euro area average. All the above variables simultaneously mirror the trend in labour productivity and wages in the tradables sector, which also affects unit labour costs in the non-tradables (mainly services) sector, and hence also their prices (the Balassa-Samuelson effect). Chart 12 compares the average annual wage in 2016 with the figure for the euro area. The figure in euro reveals the external purchasing power and wage competitiveness of the economy, while the purchasing power parity indicator describes the purchasing power of wages on the domestic market. 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. In 2016, the wage level in the Czech Republic expressed in euro was around 40% of the euro area average and was virtually unchanged compared with the onset of the global crisis. At purchasing power parity, it was just above 62% of the monetary union average (compared to just under 59% in 2007). In comparison with the Czech Republic, wages were practically the same in Slovakia and slightly lower in Hungary and Poland.

¹⁷ See the *Methodological Part* and Čihák and Holub (2003; 2005).

¹⁸ See the *Methodological Part* for details on Model I and Model II.

¹⁹ The same applies to a similar extent to the other countries in the Central European region, i.e. Slovakia, Hungary and Poland.

Chart 12: Average annual wage in 2016
(EA = 100)



Source: European Commission, CNB calculations.

The mirror image of convergence of the price level towards the euro area is the evolution of the **real exchange rate** (see Table 3). Between 2007 and 2016, the real exchange rate of the koruna appreciated by 10%, i.e. by almost 1% a year on average. The real appreciation of the Czech currency was concentrated in the start of the above ten-year period. Since 2011, by contrast, the koruna-euro exchange rate has depreciated in real terms overall, reflecting the relatively adverse evolution of the Czech economy in 2012–2013 and the resulting use of the koruna-euro rate as an additional instrument for easing the monetary conditions from November 2013 until April 2017 (the CNB's exchange rate commitment). Even so, the real appreciation of the Czech currency over the past ten years has been stronger than in the other countries under review except Slovakia. Germany, Portugal and Poland even recorded slight depreciation of their real exchange rates.

Table 3: Real exchange rate against the euro

(HICP deflated; 2006 = 100; index growth = real appreciation; average annual rate in %)

	Basic index (2006=100)										Avg. annual rate		
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2007-2016	Outlook ^{a)}	
												Model I	Model II
CZ	103	118	111	116	119	117	113	107	108	110	0.9	2.7	0.4
AT	100	100	100	100	101	101	102	103	104	104	0.4	0.4	-0.6
DE	100	100	99	99	99	98	99	99	99	99	-0.1	0.5	0.1
PT	100	100	98	98	99	99	98	98	98	99	-0.1	0.4	0.5
HU	111	114	106	111	111	110	108	103	103	103	0.3	2.7	1.7
PL	103	112	94	103	101	101	100	100	99	95	-0.5	3.7	3.3
SI	102	104	104	105	104	104	105	105	104	104	0.4	0.9	0.4
SK	110	119	125	124	125	127	127	126	126	125	2.2	2.1	0.1

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. Outlooks for its pace over the next five years based on the two aforementioned alternative models of price convergence are given in the last two columns of Table 3. For the Czech Republic, the range of the estimates between the two models is quite

wide (0.4–2.7%)²⁰ and lies at a higher level than for all the current euro area members under comparison. 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 inflation differential vis-à-vis the euro area which could be expected in the next five years if the euro were to be adopted. Following the adoption of the euro, the option of a real strengthening of the domestic exchange rate through the nominal exchange rate will be closed and its only channel will be higher domestic inflation compared to the euro area. Assuming average euro area inflation at the level of the long-run forecasts,²¹ inflation in the Czech Republic could therefore rise to 2.1–4.4% during the initial years following euro area entry. It could thus increase visibly compared to the current 2% target of 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 the current euro area countries. Their short-term real rates could even be significantly negative for an extended period. In the Czech Republic, the real interest rate would be between -2.2% and 0.1% 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 global crisis and the related need for sustained easy monetary conditions, it can also be assumed that the Czech equilibrium real interest rate is well below those in Hungary and Poland.²² Euro adoption would thus not generate such a strong shock in the form of a decrease in real interest rates for the Czech Republic as for the other countries in the region.

Table 4: Three-month ex-post real interest rates

(%; HICP deflated)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	Average ^{a)}	Outlook ^{b)}
CZ	0.2	-2.1	1.6	0.1	-0.9	-2.4	-0.9	-0.1	0.0	-0.4	-0.5	(-2.2 ; 0.1)
AT	2.0	1.4	0.9	-0.9	-2.1	-1.9	-1.9	-1.2	-0.8	-1.2	-0.6	(0.1 ; 1.1)
DE	2.0	1.8	1.0	-0.3	-1.1	-1.5	-1.4	-0.6	-0.2	-0.6	-0.1	(0.0 ; 0.4)
PT	1.8	1.9	2.2	-0.6	-2.1	-2.1	-0.2	0.4	-0.5	-0.9	0.0	(0.0 ; 0.1)
HU	0.0	2.5	5.0	1.4	2.5	2.3	2.4	2.5	1.5	0.5	2.1	(-2.2 ; -1.2)
PL	2.1	2.1	0.4	1.2	0.6	1.2	2.2	2.5	2.5	1.9	1.7	(-3.2 ; -2.8)
SI	0.5	-0.8	0.4	-1.3	-0.7	-2.2	-1.7	-0.2	0.7	-0.1	-0.5	(-0.4 ; 0.1)
SK	2.4	0.2	0.3	0.1	-2.6	-3.1	-1.2	0.3	0.3	0.2	-0.3	(-1.6 ; 0.4)

Note: ^{a)} Average for 2007-2016; ^{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 and nominal interest rate in the euro area of 0.5% and 2.2% respectively.

Source: Eurostat, CNB calculations.

To sum up, the convergence in economic activity and the price and wage level in the Czech Republic towards the euro area has renewed and the convergence process will most probably continue. The corresponding equilibrium real exchange rate appreciation would 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 could simultaneously increase the risk of macro-financial imbalances.

²⁰ Starting with Inflation Report IV/2013, the CNB's forecasts work on the assumption of long-term equilibrium real appreciation of the koruna at a rate of 1.5% a year. However, this is vis-à-vis the "effective euro area", in which Germany and Slovakia have especially large weights.

²¹ The Consensus Forecasts long-term prediction of euro area inflation for the next five years is 1.7% on average.

²² The CNB forecasts assume an equilibrium real 3M PRIBOR rate of 1% in the long term.

Box 2: The real exchange rate and productivity before and after the recession

When entering the monetary union, it is vital to understand the factors that affect the real exchange rate, which is an important variable for external macroeconomic stability. Joining a monetary union in a situation where the real exchange rate is well away from its equilibrium level may cause persistent external macroeconomic imbalances, as the goods price level generally adjusts more slowly than the nominal exchange rate, which is no longer available as an adjustment mechanism after monetary union entry. In addition, changes in the real exchange rate trend in an economy participating in the monetary union will manifest themselves as a permanent inflation differential.

Real appreciation can be explained by various theoretical approaches, the best known being the Balassa-Samuelson model. It explains real exchange rate movements using differences in relative productivity growth and related changes in relative prices in the tradables and non-tradables sectors of the economy.²³

However, this model is difficult to apply directly to the converging economies of Central Europe. Before the global economic crisis (i.e. between 2001 and 2007), the real exchange rate of the Visegrad Four countries strengthened by about 2.6% a year and that of the other Central European countries by 1.3%. At the same time, however, the real exchange rate based on tradables prices²⁴ appreciated by 1.8% and 0.8% (see Table B2). The relative change in tradables prices thus accounted for large part of the overall appreciation of the real exchange rates of converging economies. The Balassa-Samuelson model cannot explain this.

To comprehensively understand the evolution of the real exchange rate, we must therefore apply another approach. In this box, we use a model²⁵ able to incorporate the relative appreciation of tradables prices into the overall appreciation of a converging economy's real exchange rate. Here, growth in the productivity of the domestic economy will be reflected in its ability to invest in raising the quality of goods sold. The growth in quality (even if only perceived) leads to higher external demand for these goods. This raises their international price, causing the real exchange rate to strengthen. This effect is bolstered by the Balassa-Samuelson effect,²⁶ according to which more productive companies can be expected to dominate exports. Less productive firms thus do not export and simultaneously have higher unit labour costs. This causes prices of non-tradable goods to go up.

Before the crisis, Central European countries showed high labour productivity growth relative to the EU average. At the same time, they recorded strong real appreciation both overall and based on tradables prices. After a temporary easing of the crisis in 2010, growth in relative labour productivity halted and the process of real appreciation also stopped (or, more precisely, a very slight correction in the opposite direction occurred, probably reflecting slight overvaluation of real exchange rates before and during the crisis). A return to real appreciation

²³ Faster productivity growth in the tradables sector relative to other countries in the first stage creates pressure for the emergence of a wage growth differential in this sector vis-à-vis neighbouring countries. Given free movement of labour between the tradables and non-tradables sectors within the country, this leads to a rise in the wage growth differential between the domestic and foreign economy in the non-tradables sector. Prices of tradable goods are set by international arbitrage (i.e. the law of one price applies to such goods), whereas producers of non-tradable goods do not face foreign competition. The wage growth differential will therefore give rise to an increase in the relative prices of domestic versus foreign goods in the non-tradables sector only. This reflects higher growth of costs in this sector relative to its foreign counterpart. The faster growth in non-tradable goods prices at home than abroad will result in a rise in the overall relative domestic price level, which will be reflected in a strengthening of the real exchange rate.

²⁴ It is analogous to the real exchange rate defined using the tradables price index instead of the overall price level. For the purposes of this box, we use the Eurostat "non-energy industrial goods" aggregate.

²⁵ Brůha and Podpiera (2010).

²⁶ Bergin et al. (2006).

can be expected when relative labour productivity in Central European countries starts to rise again relative to the EU average.

Table B2: Average real appreciation

	Average real appreciation		Average real appreciation: tradables		Average labour productivity growth relative to EU average	
	2001-2007	2011-2016	2001-2007	2011-2016	2001-2007	2011-2016
Central Europe	1.8	-0.2	1.3	-0.3	2.7	0.2
V4	2.6	-0.3	1.8	-0.3	2.2	0.2
Others	1.3	-0.1	0.8	-0.3	2.9	0.3
Southern periphery	0.7	-0.6	0.5	-0.6	-0.1	-0.4

Note: Central European countries comprise the Czech Republic, Slovakia, Poland, Hungary, Estonia, Latvia, Lithuania, Bulgaria, Romania and Slovenia. V4 countries comprise the Czech Republic, Slovakia, Poland and Hungary. The southern periphery comprises Portugal, Spain, Greece and Cyprus.

Before the crisis, the real exchange rate appreciated not only in the converging Central and Eastern European economies, but also in the economies on the southern periphery of the EU, i.e. Portugal, Greece, Spain and Cyprus. However, the growth in the relative productivity of these countries vis-à-vis the EU average was lower and even negative on average (i.e. relative labour productivity was falling compared to the EU average). It is clear that a model based on whole-economy labour productivity growth cannot explain the real appreciation in these countries and another explanation should be sought. The literature usually states that domestic demand rose due to a drop in real interest rates and elimination of the risk premium after these countries joined the monetary union.²⁷ The growth in domestic demand led to a rise in domestic prices and an inflow of foreign capital, mainly in the form of debt.

It is clear, then, that the causes of the real appreciation in Central European countries and southern EU countries differ. This led to the emergence of macroeconomic imbalances. The converging Central European economies recorded trade surpluses and rapid export growth, so for them the real appreciation was not a source of external macroeconomic imbalances. However, the situation on the southern periphery was different. These countries showed trade and current account deficits until the European debt crisis erupted in 2012, and this trend was changed only by a dramatic fall in domestic demand after 2012. The external balance of the southern economies then started to be gradually restored.

It is therefore important to identify the causes of movements in the real exchange rate, which may affect both the external macroeconomic balance and the persisting inflation differential in a monetary union. Real appreciation in converging Central European economies did not lead to macroeconomic imbalances, as it was supported by growth in aggregate labour productivity. If renewed growth in relative productivity remains the dominant source of real appreciation, there is no need to worry about external macroeconomic balance even after accession to the monetary union. However, entering the monetary union still implies a positive inflation differential vis-à-vis the euro area average if real appreciation continues.

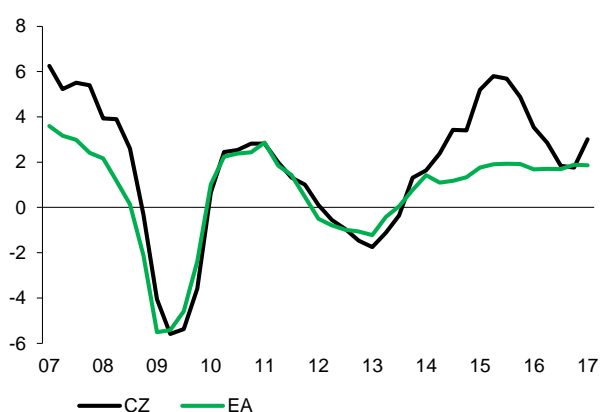
1.1.2 Correlation of economic activity

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 may not be optimal for a country that is in a different phase of the business cycle than the euro area average. Conversely, the loss of independent monetary policy is less costly for a country with a more correlated business cycle.

²⁷ Lin and Treichel (2012).

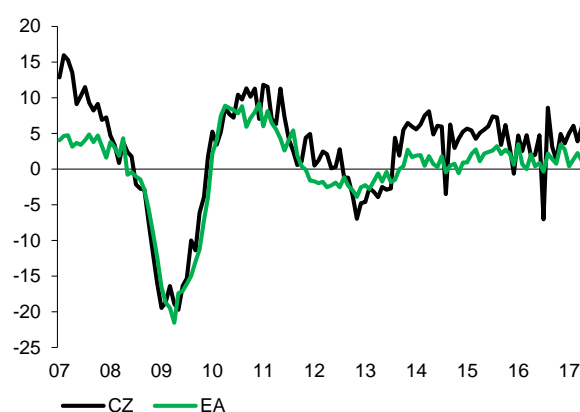
Economic activity in the Czech Republic can be compared with that in the euro area both overall using **annual real GDP growth** (see Chart 13) and specifically in industry using the **annual changes in the industrial production index (IPI)** (see Chart 14).²⁸ During the global financial crisis, the Czech economy recorded similar rates of growth of GDP and the IPI as the euro area. The Czech Republic accelerated markedly compared to the euro area in 2014, partly due to the adoption of the exchange rate commitment, and maintained a higher rate of growth until mid-2016. At present, the rates of growth of GDP and the IPI in the Czech economy are above those in the euro area again.

Chart 13: Year-on-year changes in real GDP (%)



Source: Eurostat, CNB calculations.

Chart 14: Year-on-year changes in the industrial production index (%)



Source: Eurostat, CNB calculations.

A **simple correlation analysis** calculated for various lags of the individual countries' GDP and IPI time series compared to the euro area time series can be used to assess whether and with what lag the economic activity of the euro area affects the individual countries' results (see Table 5).²⁹ 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.³⁰

The GDP correlations measured between the Czech Republic and the euro area can be evaluated as above average by comparison with the other countries. Only Germany³¹ displays a higher GDP correlation than the Czech Republic. By contrast, the Czech Republic ranks as one of the countries with low correlations measured using the IPI, even when adjusted for the

²⁸ The industrial production index responds to changes in the economic environment more flexibly than total GDP. The information obtained by comparing the correlation of industrial production is only complementary, as industry typically accounts for less than one-third of total output in the advanced economies, and, moreover, the economies of the countries under comparison differ in terms of structure (see section 1.1.3). Boone and Maurel (1999) criticise the use of the industrial production index for analysing the similarity of economies and business cycles, because of its high volatility.

²⁹ The calculation was performed for lags of 0–2 quarters for GDP and 0–3 months for the IPI.

³⁰ The two quarters in which the euro area recorded the highest quarterly growth volatility – 2008 Q4 and 2009 Q1 – are dropped from the correlation calculation.

³¹ The high correlation of economic activity between Germany and the euro area is natural, as Germany accounts for 28% of euro area GDP. 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 due to co-movement in the crisis quarters.

crisis. This is due to significantly higher industrial production growth in the Czech Republic since 2014.

Table 5: Correlation coefficients of economic activity with the euro area

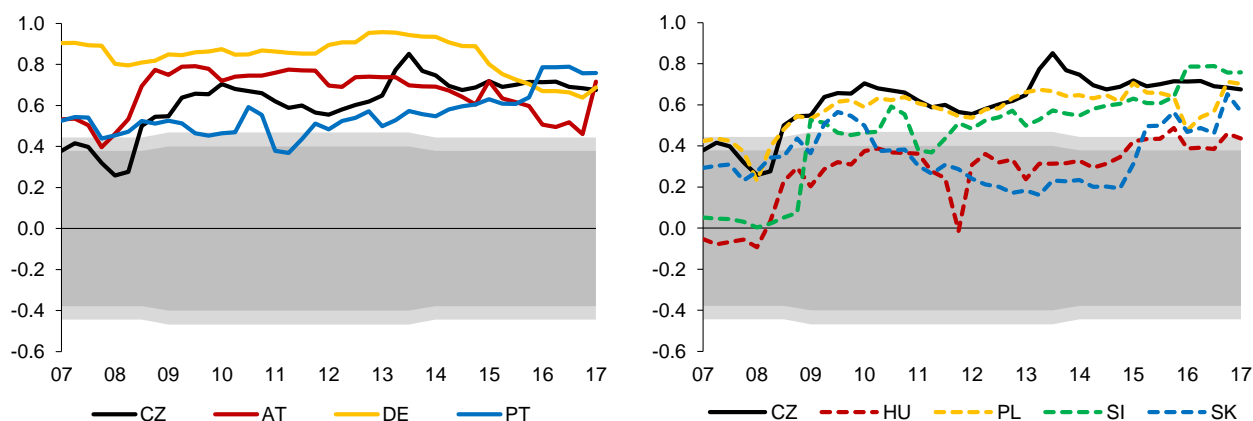
	GDP			GDP		
	2007Q1–2017Q1			Adjusted for crisis		
	t	t-1	t-2	t	t-1	t-2
CZ	0.85 **	0.71 **	0.42 **	0.61 **	0.62 **	0.42 **
AT	0.77 **	0.57 **	0.30 *	0.67 **	0.45 **	0.24
DE	0.93 **	0.53 **	0.23	0.77 **	0.30 *	0.13
PT	0.72 **	0.39 **	0.12	0.62 **	0.20	0.02
HU	0.75 **	0.45 **	0.23	0.24	0.19	0.13
PL	0.30 *	0.31 **	0.34 **	0.60 **	0.40 **	0.36 **
SI	0.72 **	0.39 **	0.12	0.62 **	0.20	0.02
SK	0.75 **	0.57 **	0.35 **	0.34 **	0.39 **	0.32 **

	IPI				IPI			
	2007M1–2017M5				Adjusted for crisis			
	t	t-1	t-2	t-3	t	t-1	t-2	t-3
CZ	0.41 **	0.01	0.24 **	0.08	0.32 **	-0.14	0.21 **	0.04
AT	0.45 **	0.10	0.23 **	0.24 **	0.37 **	-0.06	0.23 **	0.18 *
DE	0.86 **	0.08	0.38 **	0.27 **	0.80 **	-0.36 **	0.19 **	0.12
PT	0.42 **	-0.07	-0.01	0.15	0.42 **	-0.17 *	-0.05	0.17 *
HU	0.43 **	0.18 **	0.10	0.14	0.35 **	-0.01	0.02	0.13
PL	0.52 **	-0.01	0.07	0.04	0.53 **	-0.09	0.09	0.07
SI	0.36 **	0.25 **	0.12	0.11	0.27 **	0.06	0.03	0.06
SK	0.27 **	0.13	0.02	0.05	0.24 **	0.06	-0.03	0.06

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 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 correlation of economic activity over time is provided by an analysis of the **rolling correlations** of real GDP growth for moving five-year time periods. They indicate a gradual increase in alignment for most countries in the period under review (see Chart 15). The Czech Republic has long been one of the countries with the highest correlations in this comparison.

Chart 15: Rolling correlations of economic activity with the euro area

Note: The time data indicate the end of the rolling window 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 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. All the countries under comparison have a high **correlation of exports to the euro area with euro area GDP** (see Table 6), partly due to a common fall in 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					
	2007Q1–2017Q1			Adjusted for crisis		
	t	t-1	t-2	t	t-1	t-2
CZ	0.80 **	0.42 **	0.07	0.59 **	0.17	0.16
AT	0.72 **	0.41 **	0.11	0.49 **	0.10	0.19
DE	0.83 **	0.63 **	0.19	0.59 **	0.20	0.30
PT	0.79 **	0.37 **	-0.01	0.57 **	0.05	0.22
HU	0.83 **	0.47 **	0.13	0.58 **	0.13	0.23
PL	0.76 **	0.43 **	0.04	0.59 **	0.15	0.16
SI	0.76 **	0.45 **	0.13	0.54 **	0.07	0.13
SK	0.71 **	0.46 **	0.10	0.54 **	0.13	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.

The **dynamic correlation** method, which is based on spectral analysis of the time series of quarterly GDP changes, can be used to separate medium-term economic fluctuations, which correspond to the business cycle, from short-term (idiosyncratic) or, conversely, long-term (structural) movements. For the standard cycle length of 1.5–8 years, this analysis ranks the Czech Republic among the countries with a very high correlation.

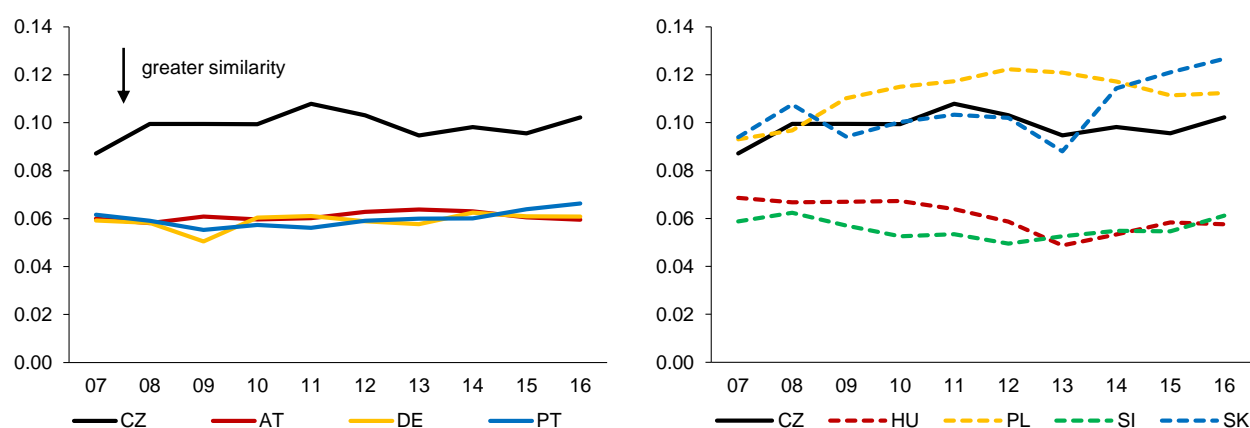
Overall, the Czech Republic has therefore been showing high correlations of economic activity with the euro area both in absolute terms and relative to the other countries under comparison over the last ten years. The correlations are high even when adjusted for the strong common external shock in the form of the global financial and economic crisis. These strong correlations imply a fast response of the Czech Republic's economic performance to fluctuations in economic activity 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 Structural similarity of the economies

The risk of asymmetric shocks decreases with increasing similarity of the structure of economic activity between the acceding economy and the monetary union. The structural similarity of the economies of the countries under comparison with the euro area can be measured using the **Landesmann index**, which compares the shares of the ten main sectors of the economy (according to the NACE classification) in total value added between the country under comparison and a reference country, in our case the euro area (see Chart 16).

Among the countries under review, the economies of the current euro area members (Austria, Germany and Slovenia) and, outside the euro area, of Hungary have displayed the greatest structural similarity (i.e. the lowest Landesmann index values, around 0.06) in the last few years.³² The index of similarity between the Czech economy and the euro area has been fluctuating around 0.10.³³

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



Note: 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 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 time series of the Landesmann index in its current form is not comparable with the data published in some past issues of this publication.

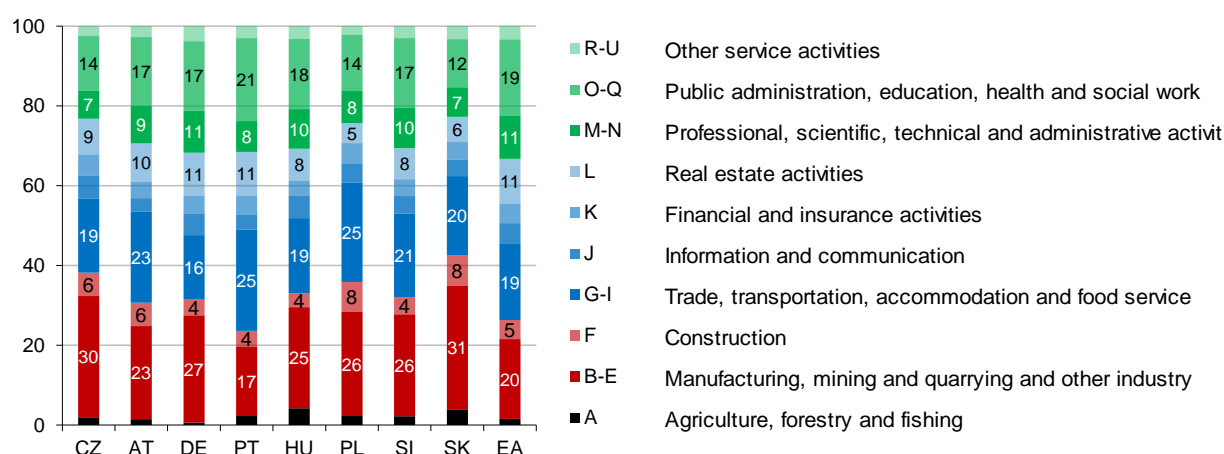
Source: Eurostat, CNB calculations.

³² 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 2016 was 17%, which is below the euro area average; 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 roughly the same Landesmann index.

³³ Until 2013, the structure of the economy of the Czech Republic was comparable with that of Slovakia. However, Slovakia's structural dissimilarity with the euro area then started to increase due to growth in the share of industry and a decline in the share of services, and also because of greater dissimilarities in the structure of services compared to the Czech Republic. Poland differs the most from the euro area average in the long term.

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 – along with Slovakia – is the highest of all the countries under comparison (see Chart 17); Germany also has a relatively high share of industry. The high share of industry (car manufacture in particular) and the lower share of services in the Czech economy compared to the euro area may lead to asymmetric shocks, to which the single monetary policy would 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.

Chart 17: Shares of economic sectors in GDP in 2016 (%)



Source: Eurostat, CNB calculations.

1.1.4 Interest rate convergence, analysis of exchange rate volatility and exchange rate alignment

Interest rate convergence

Previous nominal interest rate convergence – gradual and based on fundamentals – is better for smoother economic developments after accession to the euro area, as it will leave no room for a one-off asymmetric shock associated with euro adoption.³⁴ The probability of such a shock is indicated by a comparison of the **nominal interest rate differential** vis-à-vis the euro area/Germany.³⁵ 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 the lowest among the Central European countries under review, as Chart 18 shows. The moderate growth in the interest rate differential observed since the start of 2016 reflects a persistent decline in euro interest rates to negative levels and stable Czech short-term interest rates slightly above zero.³⁶ Turning to

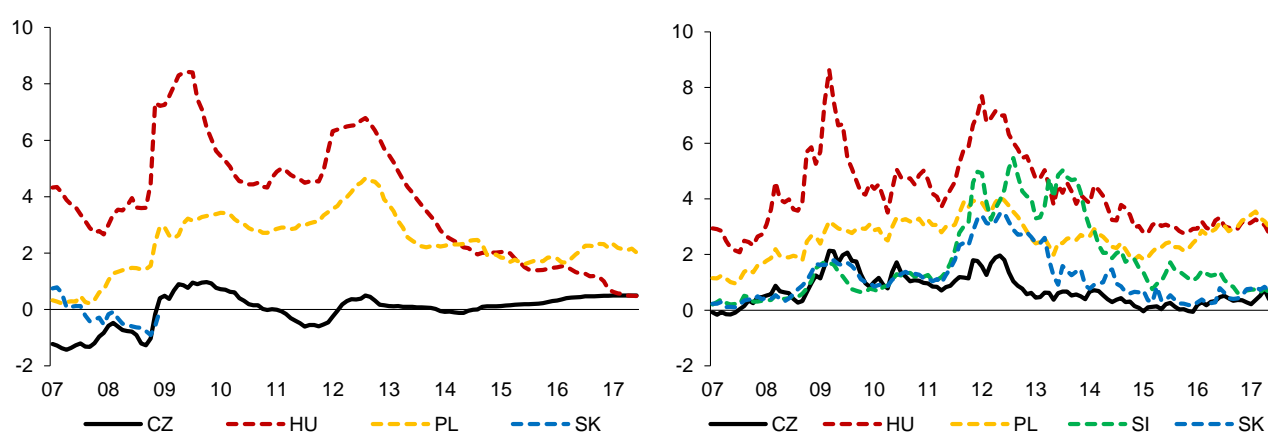
³⁴ Although real economic activity is affected primarily by real interest rates, nominal interest rates may also have a significant effect via credit or budgetary constraints (e.g. the loan repayment to financial income ratio). Following euro area entry, some countries faced fast nominal interest rate convergence 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. See also section 1.1.1.

³⁵ 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 showed extreme values in the past, so the euro area average influenced by such countries cannot be considered a suitable benchmark.

³⁶ In the case of Hungary, market rates have dropped in the last two years due mainly to new measures taken by the Hungarian central bank i.e. caps on sterilisation in the main monetary policy facility, a cut in the deposit rate to negative levels and the introduction of fine-tuning swap operations (forint vs. euro, maturities of one and three

ten-year government bonds, Czech yields remain closest to the reference level in Germany in comparison with the other countries under review (see Chart 19). The risk of an asymmetric shock upon euro adoption is thus low in the case of Czech rates. Moreover, it is evident from these developments that financial markets view the Czech Republic's government debt as sustainable.

Chart 18: Differences in three-month interest rates vis-à-vis the euro area (pp) **Chart 19: Differences in ten-year interest rates vis-à-vis Germany (pp)**



Source: Datastream, CNB calculations.

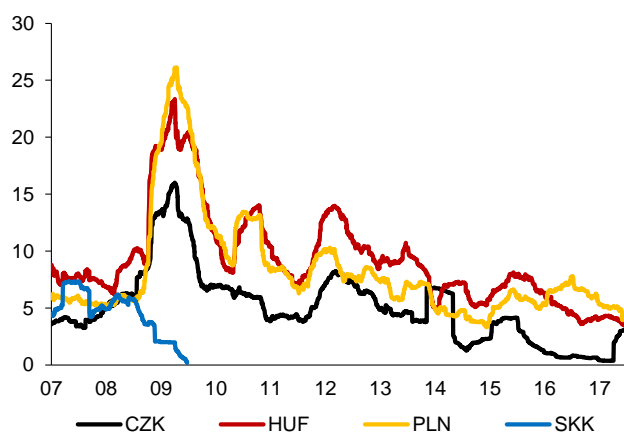
Source: Datastream, CNB calculations.

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**.³⁷ 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. A comparison of the historical volatility of selected countries' exchange rates vis-à-vis the euro (see Chart 20) reveals that the Czech koruna has shown the lowest volatility over the past ten years. The temporary rise in volatility in 2014 marks the period when the Czech National Bank decided to use the exchange rate as an additional instrument for easing monetary policy. The exit from the exchange rate commitment in April 2017 had a similar effect. The implied volatility, i.e. the expected volatility of the countries' exchange rates as reflected in the prices of options for the individual currencies, has also been showing a downward trend since 2012 (see Chart 21). The very similar patterns displayed by the selected economies' currencies suggest a volatility spillover effect across markets. However, except for one-off fluctuations, the volatility of the koruna-euro rate remains relatively low and stable, which is a favourable factor in terms of euro adoption.

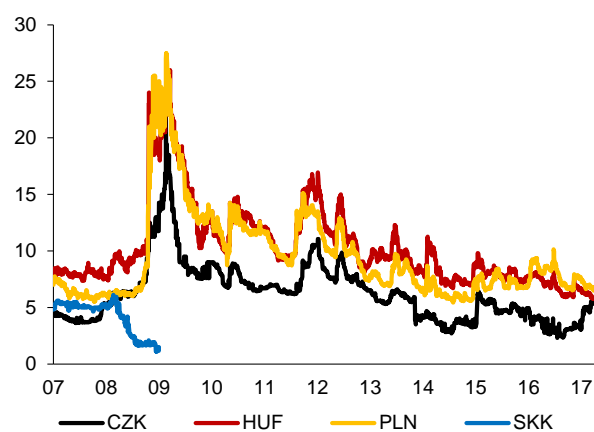
months). The decline in rates has also been due to the bank's repeated statements that it stands ready to further ease the monetary conditions in order to achieve the inflation target by means of targeted unconventional measures.

³⁷ 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 20: 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 21: Implied volatility of exchange rates vis-à-vis the euro (%)

Note: Six-month horizon.

Source: Datastream, CNB calculations.

Exchange rate alignment

A high correlation between the exchange rates of two currencies vis-à-vis a third, reference currency is a sign of high similarity of exchange rate dynamics, i.e. of the factors which affect those exchange rates. This 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 (see Table 7).³⁸

The correlation between the Czech koruna and the euro has been affected in recent years by the CNB's exchange rate commitment (see Box 3). After the commitment was discontinued, the correlation between the Czech koruna and the euro initially decreased sharply. However, it quickly returned to higher levels and in the first half of 2017 Q3 was, as in previous years, again the highest and the most stable among the Central European currencies under review.³⁹ We can thus sum up that the Czech currency reacts to changes in the environment outside the euro area similarly to the euro. This indicates a high degree of alignment.

³⁸ See Aguilar and Hördahl (1998). 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).

³⁹ Unlike in previous years, when the Hungarian forint was the most volatile, the Polish zloty has been displaying the largest fluctuations in correlation coefficient in recent years.

Table 7: Correlations of exchange rates against the US dollar

	2015				2016				2017		
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3
CZ	0.90 (0.04)	0.98 (0.01)	0.98 (0.01)	0.99 (0.01)	1.00 (0.00)	1.00 (0.00)	0.99 (0.00)	1.00 (0.00)	1.00 (0.00)	0.84 (0.08)	0.93 (0.02)
HU	0.78 (0.03)	0.83 (0.03)	0.85 (0.02)	0.86 (0.03)	0.81 (0.04)	0.87 (0.03)	0.89 (0.02)	0.87 (0.03)	0.91 (0.02)	0.90 (0.01)	0.91 (0.01)
PL	0.76 (0.06)	0.83 (0.04)	0.84 (0.03)	0.82 (0.03)	0.75 (0.07)	0.78 (0.06)	0.84 (0.03)	0.81 (0.05)	0.86 (0.05)	0.82 (0.04)	0.82 (0.03)

Note: Calculation using daily data; quarterly averages. Standard deviations in parentheses.

Box 3: Correlation between the koruna-dollar and euro-dollar exchange rates before and after the exchange rate commitment

From 7 November 2013 to 6 April 2017, the Czech National Bank used the exchange rate as an additional instrument for easing monetary policy by preventing the koruna from appreciating below CZK 27 to the euro. The correlation between the Czech koruna and the euro was relatively high while the exchange rate commitment was in place, although it was visibly relatively volatile until mid-2015. The brief falls in correlation observed in this period were due to the fact that the koruna exchange rate was more or less above the declared commitment level, moving freely according to supply and demand on the market. However, the subsequent economic recovery caused the Czech currency to strengthen to the intervention level of CZK 27 to the euro. A further strengthening of the rate was prevented by the exchange rate commitment and the koruna was essentially anchored at this level until April 2017. The correlation between the koruna-dollar and euro-dollar rates thus attained the highest possible values.

Following the exit from the exchange rate commitment, the koruna gradually strengthened to close to CZK 26 to the euro. Its correlation with the euro, which dropped temporarily to around 0.70 after the exit, steadily increased at the same time. However, the correlation rose again to 0.85 less than three weeks after the exit and has been above 0.90 since mid-June. In mid-August, the correlation was comparable to levels observed before the introduction of the exchange rate commitment and, in addition, was more stable over time.

Chart B1: Correlation between the koruna-dollar and euro-dollar exchange rates



Note: The grey area shows the period of the CNB's exchange rate commitment. A GARCH model estimated on daily data until 17 August 2017 was used to calculate the time-varying correlation.

Source: Datastream, CNB calculations.

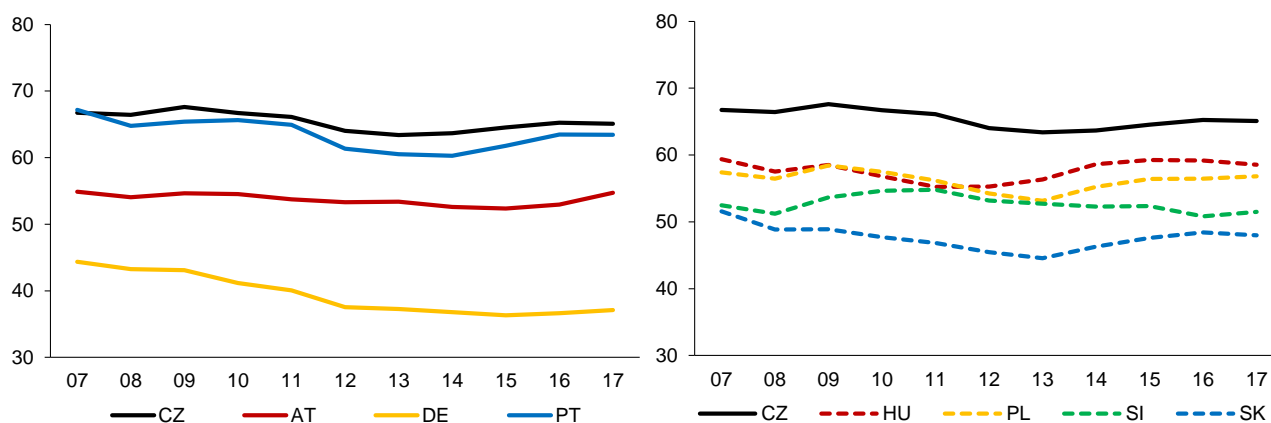
1.1.5 Integration of the economy with the euro area

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 of the Czech Republic 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.⁴⁰

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,⁴¹ higher than in any of the other countries under review (see Chart 22); only Portugal has a similar share. In the case of Czech imports (see Chart 23), 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 previous downward trend in those shares, when exporters were looking for opportunities on non-European markets which were less affected by the global economic crisis, has halted, suggesting that the euro area market is again of key importance for European exporters.

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

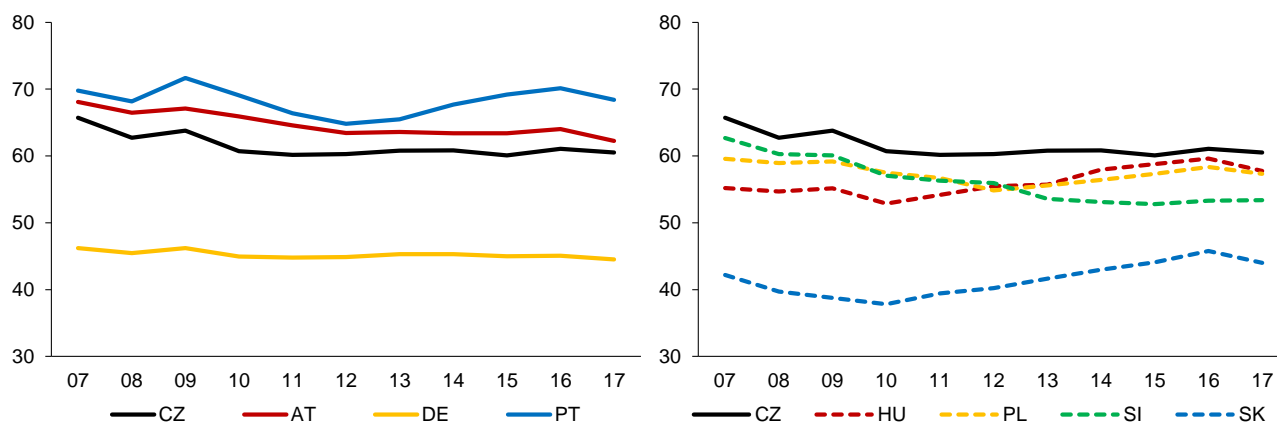


Note: The 2017 figure is for the first four months of the year.

Source: Eurostat, CNB calculations.

⁴⁰ 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).

⁴¹ Around half of Czech exports to the euro area go to Germany. The second-largest trading partner is Slovakia.

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

Note: The 2017 figure is for the first four months of the year.

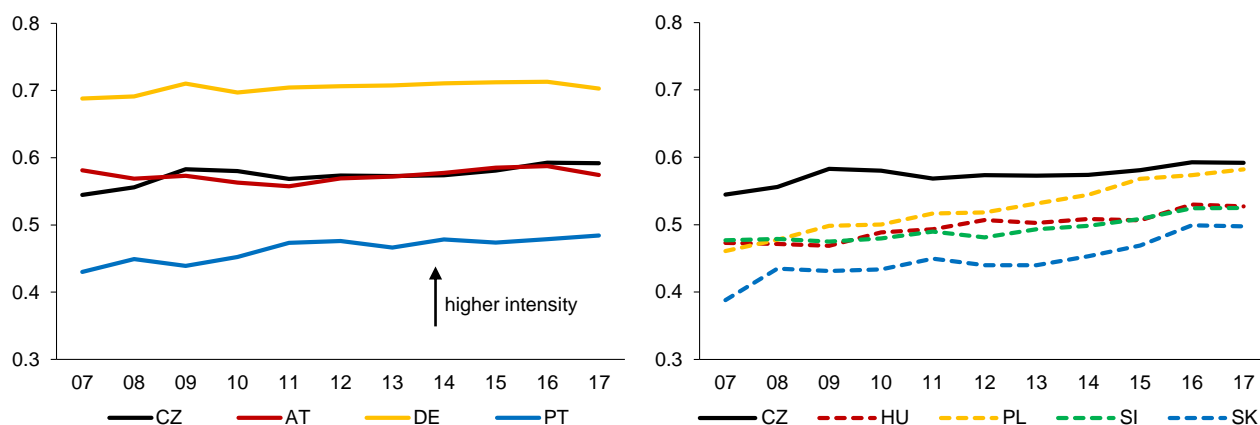
Source: Eurostat, CNB calculations.

The statistics on **intra-industry trade** gives a more detailed view of the nature of international trade. Intra-industry trade is usually particularly significant for technology-intensive products, which similarly advanced countries trade among themselves, and is thus another indicator of the structural similarity of economies. Strong intra-industry trade fosters cyclical convergence⁴² and can also favourably affect the economy's ability to absorb economic shocks.⁴³ The theory of intra-industry trade assumes that the intensity of intra-industry trade is greatest in capital- and research-intensive industries, i.e. industries with high market concentration, which can benefit most from economies of scale. On the other hand, the lowest level can be expected in industries associated with natural resources. To analyse intra-industry trade we used the Grubel-Lloyd index, which indicates the share of the absolute amount of intra-industry trade in total foreign trade turnover with the euro area.

The SITC5-based Grubel-Lloyd index (see Chart 24) 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. Compared to the other Central European countries, the Czech Republic has an above-average share of intra-industry trade with the euro area; only Poland has been converging towards the same level in recent years.

⁴² Frankel and Rose (1997). For more on the theory of intra-industry trade see Krugman (1981) and Hoekman and Djankov (1996).

⁴³ Among other things, intra-industry trade growth may have a positive effect on the costs and speed of restructuring, since the transfer of resources may be faster and less expensive if effected within an industry rather than between industries. An increase in the proportion of intra-industry trade (horizontal in particular) after accession to a monetary union may also indicate refutation of the specialisation hypothesis, which would predict an increase in inter-industry foreign trade.

Chart 24: Intensity of intra-industry trade with the euro area (under SITC5)

Note: The results were calculated using the five-digit SITC classification. The 2017 figure is for the first five months of the year.

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. Fluctuations in euro area demand have thus 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 elimination 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 to join 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.⁴⁴ In addition, capital integration between two countries can help to dampen a negative unilateral demand shock.

Ownership linkages are measured by the ratio of the **foreign direct investment** (FDI) stock to GDP. The ratio of FDI from the euro area to GDP (see Table 8) in the Czech Republic is the highest among the countries under comparison. High levels of ownership linkages are also recorded by Portugal and Hungary.⁴⁵

⁴⁴ Due 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 supporting convergence.

⁴⁵ In the case of Slovakia, by contrast, ownership linkages have been falling moderately since 2011. Slovakia's membership of the euro area has thus not yet had a significant positive effect on the inflow of FDI from the euro area.

Table 8: Ratios of FDI stock from the euro area to GDP
(%)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
CZ	49.5	46.8	54.9	57.9	53.8	60.6	59.3	61.7	62.4	60.9
AT	33.8	39.8	45.0	36.1	35.5	35.8	35.3	36.9	36.7	35.0
DE	21.9	21.0	23.0	23.4	23.5	25.7	26.8	26.3	26.2	26.6
PT	35.4	30.6	36.4	40.8	42.0	55.5	59.0	59.7	58.5	60.0
HU	-	42.6	49.3	50.4	48.4	57.6	55.5	55.4	57.0	48.9
PL	29.7	24.7	31.3	36.1	32.7	37.0	39.1	39.5	36.7	39.3
SI	17.5	17.8	18.6	18.8	20.1	20.8	19.9	22.1	23.9	26.0
SK	47.0	46.4	48.8	48.4	49.8	48.7	47.1	44.6	43.2	45.0

Source: Eurostat, Hungarian national bank, CNB calculations. Data are not available for Hungary for 2007.

In the case of the new EU members, by contrast, the ratios of direct investment from the countries under review in the euro area to their GDP are still low (see Table 9). 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.

Table 9: Ratios of DI stock in the euro area to GDP
(%)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
CZ	7.4	8.7	11.0	13.1	12.7	14.9	16.7	17.5	18.6	18.3
AT	18.2	19.2	22.1	24.4	25.2	25.1	26.3	29.2	29.0	29.6
DE	19.1	19.8	22.6	23.0	24.0	26.5	27.3	27.6	28.0	28.2
PT	16.2	16.4	17.2	17.4	23.7	28.7	30.2	28.6	29.8	31.8
HU	-	6.2	6.2	5.2	5.5	9.9	9.7	11.3	8.9	10.0
PL	3.0	3.0	4.3	7.5	7.9	8.8	8.6	8.5	8.7	9.1
SI	3.4	3.2	4.6	4.8	4.7	4.0	3.8	4.2	4.4	4.8
SK	5.3	5.2	6.2	6.0	8.1	6.6	7.1	6.7	7.7	11.4

Source: Eurostat, Hungarian national bank, CNB calculations. Data are not available for Hungary for 2007.

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 trade and ownership 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.

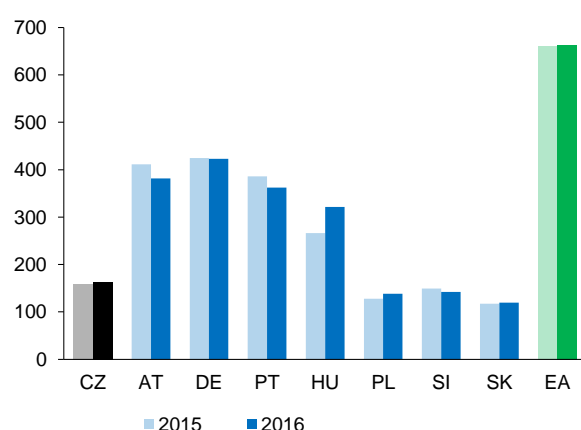
This section presents analyses of alignment in areas relating to monetary policy transmission. These areas include similarity of the financial system, the structure of assets and liabilities of

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 economy.

1.2.1 Financial system

The **depth of financial intermediation**⁴⁶ in the Czech Republic rose by 5.3 pp year on year to 163.3% in 2016. The main factor underlying this growth was a year-on-year increase in the banking sector's total assets of 3.5 pp. The depth of financial intermediation in the euro area went up by 2 pp year on year to 662.5% (see Chart 25). The difference in the extent of financial intermediation in the Czech Republic and the euro area thus remains large. However, the depth of financial intermediation in the euro area should not be regarded as a target towards which the Czech financial sector should converge, as an excessively large financial sector can represent a source of risks.

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



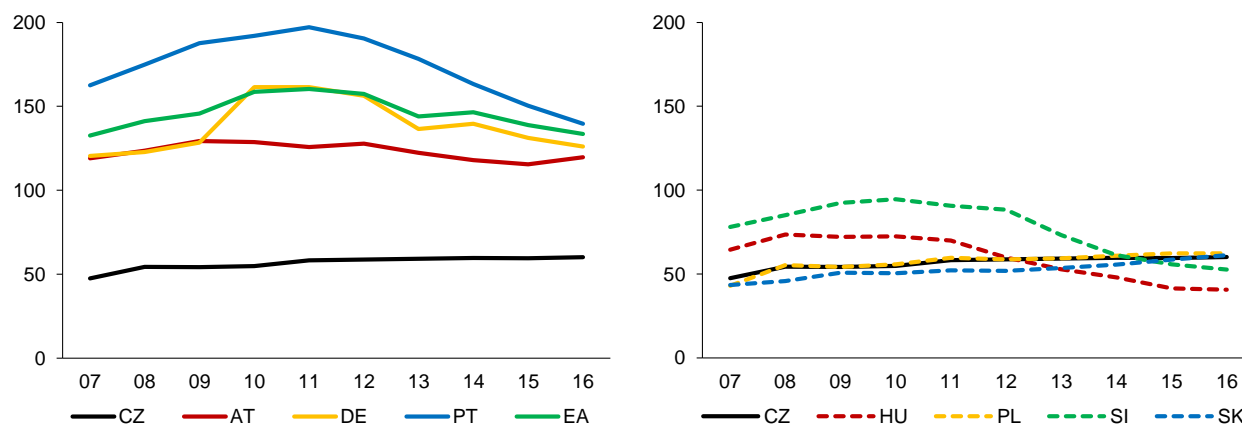
Note: The euro area value exceeds the other countries in the charts due to the large volume of assets of financial corporations in Luxembourg, Ireland, the Netherlands and France both as a percentage of their GDP and in comparison with the total financial assets of the euro area.

Source: CNB, ECB, Eurostat, central banks.

The depth of financial intermediation is closely linked to the **private sector debt ratio**.⁴⁷ Czech households and firms remain significantly less indebted than their euro area counterparts (see Chart 26). However, the private sector debt ratio in the euro area has been gradually declining. It fell from an all-time high of 160% of GDP in 2011 to 133% of GDP in 2016. In the Czech Republic, by contrast, the ratio increased slightly in this period, from 58% to 60% of GDP. However, given the loan growth in the domestic economy and ongoing private sector deleveraging in some euro area countries, convergence towards the euro area can be expected to renew in this area.

⁴⁶ The depth of financial intermediation is expressed as the ratio of financial institutions' assets to GDP. 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 due to certain methodological differences.

⁴⁷ In the euro area, a large component of the depth of financial intermediation consists of assets invested in pension and investment funds (117% of GDP) and assets of other financial corporations (189% of GDP). These components are less significant in the Czech financial system (15% and 21% of GDP respectively).

Chart 26: 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 the main institutional 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.

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 27.⁴⁸ The negative net position of the non-financial corporations sector,⁴⁹ which is due generally to a large proportion of non-financial assets in their balance sheets, decreased in all the countries under review except Germany compared to 2008.⁵⁰

In both years under comparison, the financial balance sheet structure of Czech non-financial corporations differs somewhat from that of euro area corporations, the main persisting difference being a lower loan-to-GDP ratio in the Czech Republic than in the euro area. Comparing 2008 and 2017, the ratio of net shares⁵¹ to GDP in the Czech Republic declined⁵² and is now comparable with the euro area level. The ratio of currency and deposits of non-financial corporations to GDP in the Czech Republic exceeds that in the other countries under

⁴⁸ Given the limited length of the time series due to the switch to ESA 2010, the analysis covers the period from 2008 Q1 to 2017 Q1.

⁴⁹ The net debtor position is the difference between financial assets and liabilities, including non-debt items such as shares.

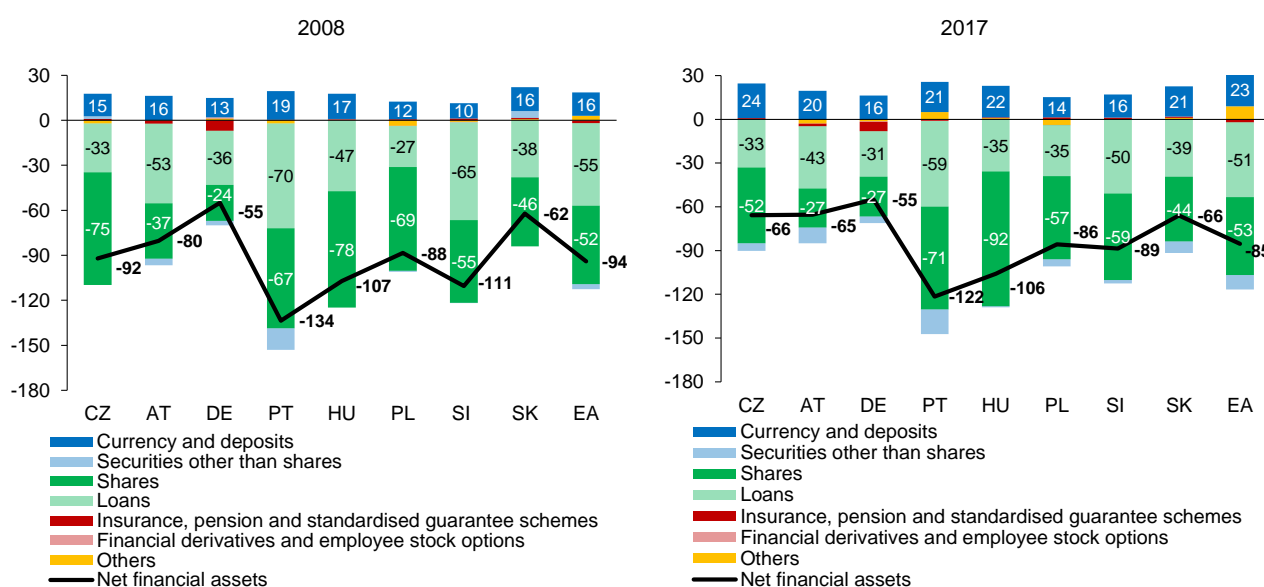
⁵⁰ 2008 was selected for comparison for several reasons. Data under the ESA 2010 methodology are available for the Czech Republic from that year onwards. It also falls in the pre-crisis period and is thus appropriate for monitoring changes in the structure of non-financial corporations' balance sheets.

⁵¹ Shares comprise quoted shares, unquoted shares and investment fund units.

⁵² Since 2008, shares have increased on the asset side of corporations' balance sheets while remaining broadly unchanged on the liability side.

comparison, as domestic corporations hold a larger liquidity buffer. Due to higher issuance of securities in previous years, the ratio of net liabilities in the form of securities other than shares to GDP has converged towards the euro area level.

Chart 27: Structure of the financial balance sheet and net financial assets of non-financial corporations (% of GDP)

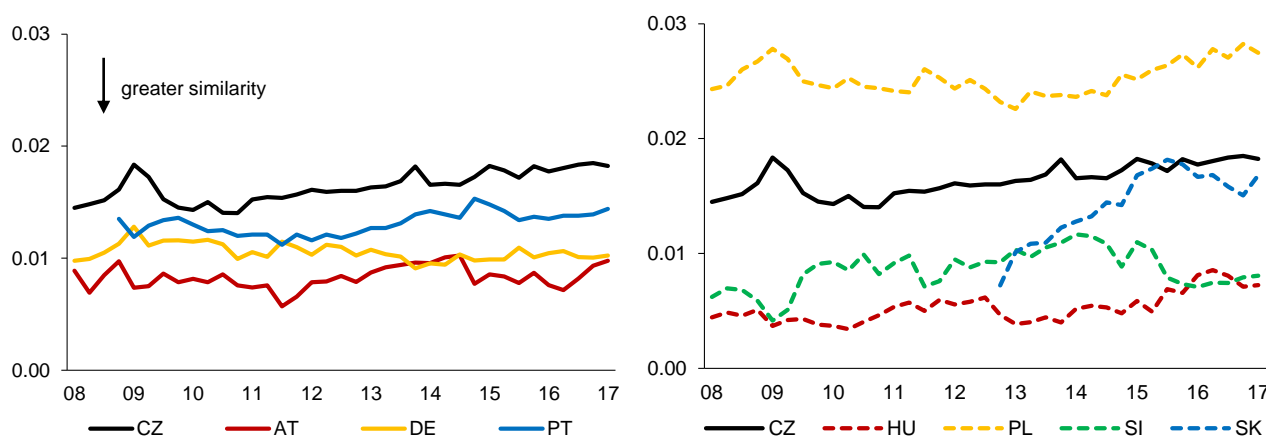


Note: The 2008 and 2017 data are as at the end of Q1 of the relevant year. The figure in the left-hand chart for Slovakia is for 2013 Q1 due to the unavailability of historical data under ESA 2010.

Source: ECB, CNB calculations.

The structural similarity of the balance sheets of the countries under review with the euro area can be measured using the **Landesmann index**, which here compares the shares of the main balance sheet items of a given sector in its total balance sheet between the country under comparison and a reference country (in our case the euro area; see Chart 28).

Chart 28: Structural similarity of non-financial corporations' balance sheets from the perspective of financial liabilities



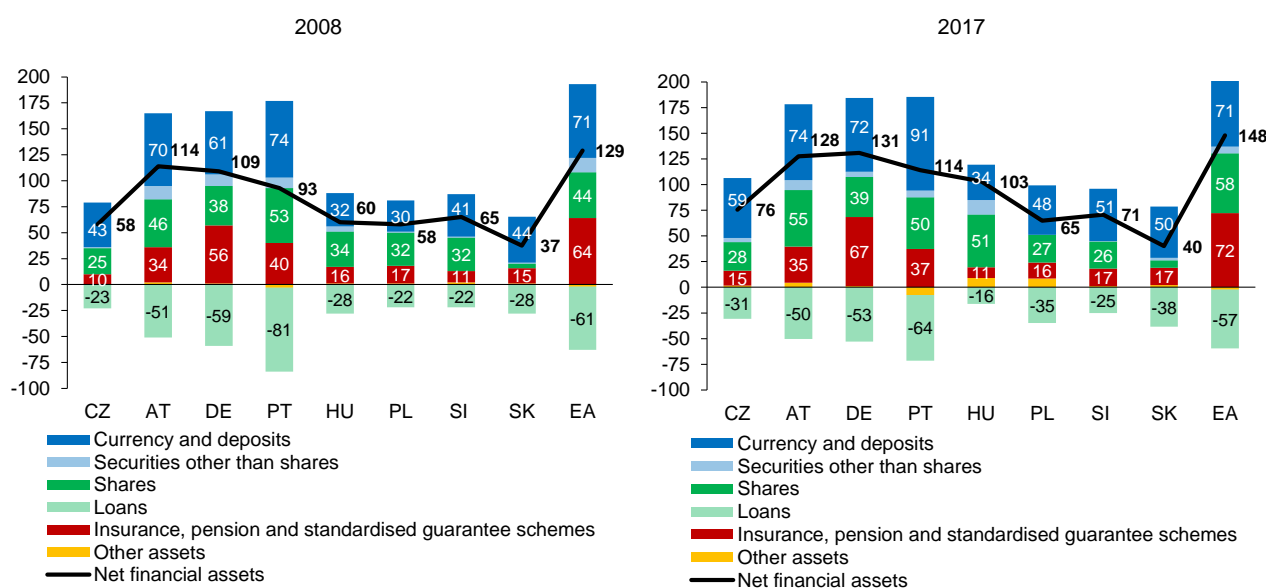
Note: The index takes values in the range [0, 1]. The closer the index is to zero, the more similar is the structure of the economies under comparison. The shares of the individual categories of liabilities in total liabilities were used for non-financial corporations.

Source: ECB, CNB calculations.

All the economies except Poland are showing greater similarity with the euro area from the perspective of the structure of non-financial corporations' liabilities than the Czech economy. The difference in the structure of corporate financial liabilities between the Czech Republic and the euro area was due mainly to shares, as they stagnated compared to the euro area. By contrast, corporate loans had the opposite effect, i.e. they fostered greater dissimilarity in structure. To sum up, the economies of the Czech Republic and the euro area continue to differ slightly in terms of the overall level and structure of non-financial corporations' liabilities.

Unlike non-financial corporations, the **household sector** is in a net creditor position (see Chart 29). The ratio of net household financial assets to GDP in the Czech Republic is 76%, which is about half the figure for the euro area. Compared to 2008, net financial assets increased in all countries, mostly due to growth in currency and deposits, insurance and pension schemes. Households thus still hold a large proportion of highly liquid assets in their portfolios. To some extent, this is due to Czech households' conservative approach to managing their financial portfolios, even at the cost of a making only a small return on these funds in an environment of low interest rates. By contrast, Czech households' share of insurance and pension schemes is substantially lower than in the euro area. However, Czech households invest in mutual funds (recorded under shares). Compared with 2008, the ratio of loans to GDP increased compared to the euro area. It is noticeably lower in the Czech Republic than in the euro area as a whole and in Austria, Germany, Portugal and Slovakia.

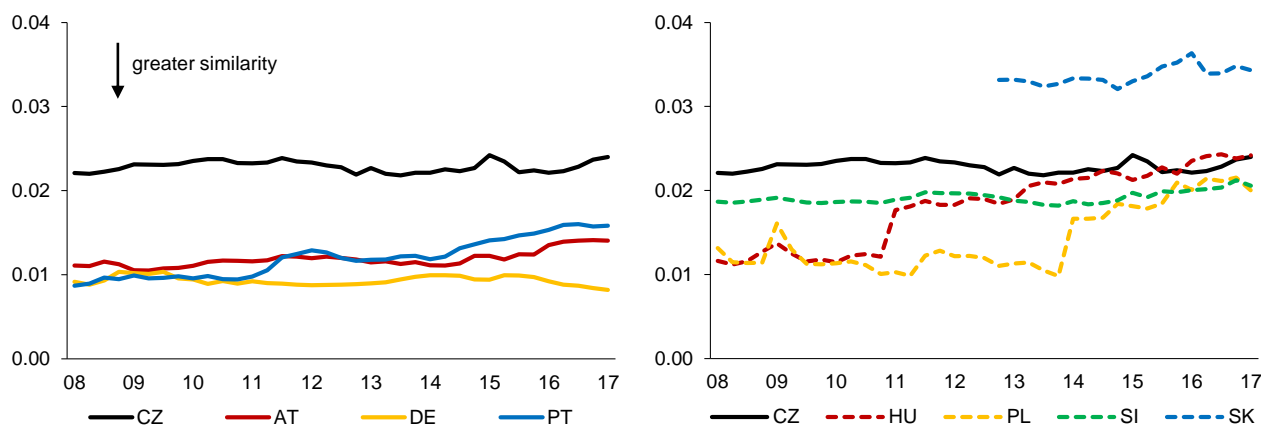
Chart 29: Structure of the financial balance sheet and net financial assets of households (% of GDP)



Note: The 2008 and 2017 data are for Q1 of the relevant year. 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.

As with non-financial corporations, the difference in the structure of households' balance sheet can be measured using the Landesmann index (see Chart 30). In the case of households, the individual categories of financial assets relative to total assets are used. The index of similarity of Czech households' balance sheets with the euro area has been fluctuating around 0.22 since 2008 and is higher than in all the other countries under comparison except Slovakia.

Chart 30: Structural similarity of households' balance sheets from the perspective of financial assets

Note: 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.

Source: ECB, CNB calculations.

The difference between the structure of household assets in the Czech Republic and the euro area consists mainly in a lower share of the insurance and pension scheme category and a higher share of the liquid component, i.e. in the shares of instruments yielding higher returns compared with instruments with lower ones. Households' sensitivity to a change in interest rates can thus be expected differ as well.

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 non-financial corporations, there are persisting differences in balance sheet structure. In particular, the debt ratio is half that in the euro area, and there is an inverse ratio of the liquid to the investment components 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 and the different structure of financial instruments may lead to somewhat weaker monetary policy transmission in the Czech Republic than in the euro area.

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. Before the financial crisis, the pass-through was full for both corporate loans and loans for house purchase, but after the onset of the crisis it weakened, except in the case of mortgage loans.⁵³ In the pre-crisis period, money market developments passed through the fastest to rates on large and small corporate loans with short fixation periods or floating rates, with around 60% of the transmission taking place within a month.⁵⁴ 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), which are linked more to long-term

⁵³ Havránek et al. (2016).

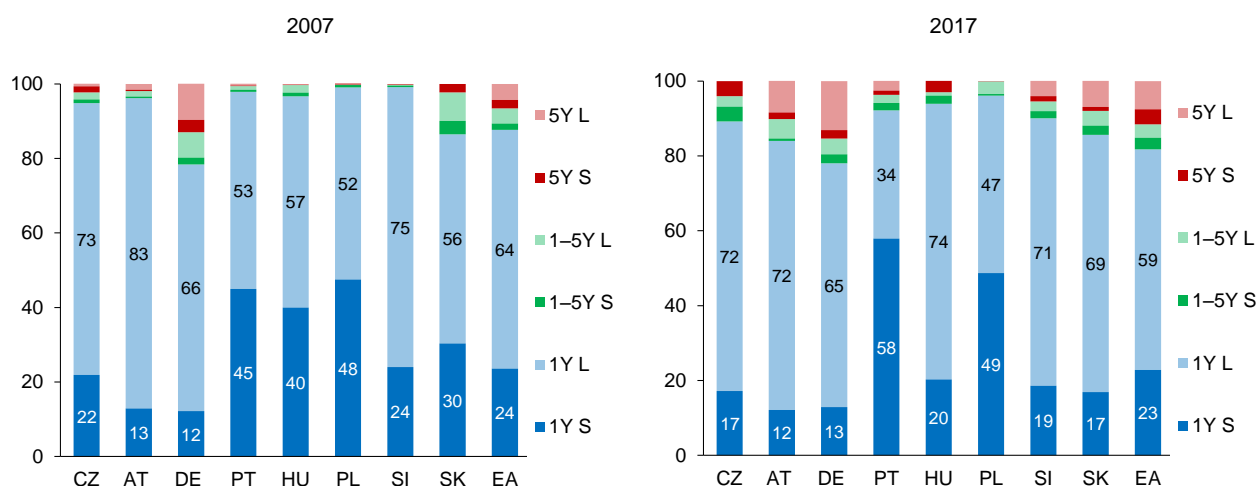
⁵⁴ Horváth and Podpiera (2009) and Babecká-Kucharčuková et al. (2013).

government bond yields, was around 2–3 months. A link to government bond rates was also observed for loans for house purchase, with a pass-through time of around three months. After the financial crisis, the relationship between government bond yields and the mortgage rate strengthened, but the extent of transmission of a change in rate decreased and the pass-through time increased.⁵⁵ In the case of loans to non-financial corporations, by contrast, the short-term response to a change in rate disappeared after the crisis and the transmission weakened overall; the length of transmission remained 1–3 months.

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. The strength of transmission differs substantially 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.⁵⁶

Chart 31 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 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. This enables relatively fast transmission of client interest rates to corporate balance sheets and a rapid impact on demand for loans. Of the countries under review, larger shares of loans with fixation periods longer than one year can be found in Austria, Germany, Slovakia and the euro area as a whole (above 15%) and to a lesser extent also in the Czech Republic (11%). However, these shares do not exceed 20% in any of the economies. Larger shares of large loans fixed for over five years can be observed in Austria, Germany, Slovakia and the euro area as a whole.

Chart 31: Structure of new loans to non-financial corporations by interest rate fixation period (%)



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 2017 data are as of June.

Source: ECB, CNB calculations.

⁵⁵ Havránek et al. (2016).

⁵⁶ Beckmann et al. (2013).

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. Table 10 shows the correlations between three-month money rates and rates on loans to non-financial corporations (fixed for up to one year) lagged by 0–2 months. For most countries, the correlations reach statistically significant levels with no lag, suggesting fast pass-through of changes in market rates to client rates. Austria, Germany and the euro area as a whole have the highest correlations for both small and large loans.⁵⁷ In the Czech Republic, the transmission is not lagged, but the relationship is weaker than in Austria and Germany. However, these results generally indicate strong links between client interest rates and the relevant interbank rates.

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

	loans up to EUR 1 million			loans over EUR 1 million		
	2004M1–2017M6			2004M1–2017M6		
	t	t-1	t-2	t	t-1	t-2
CZ	0.35 **	0.13	0.03	0.40 **	0.16	0.07
AT	0.83 **	0.70 **	0.57 **	0.74 **	0.55 **	0.46 **
DE	0.72 **	0.62 **	0.44 **	0.69 **	0.45 **	0.31 **
PT	0.48 **	0.61 **	0.38 **	0.22 **	0.32 **	0.21 *
HU	0.34 **	0.27 **	0.10	0.19 **	0.03	0.01
PL	0.69 **	0.58 **	0.38 **	0.16 **	0.08	0.08
SI	0.45 **	0.31 **	0.14 *	0.28 **	0.18	0.06
SK	0.33 **	0.11	0.08	0.12	0.23 *	0.09
EA	0.87 **	0.74 **	0.53 **	0.83 **	0.58 **	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 columns indicate the lag of rates on loans to non-financial corporations relative to the market rate. For example, t-1 denotes a lag of one month. The significance of the correlation coefficient is marked ** and * for the 5% and 10% significance levels respectively. The correlation analysis was performed on the first differences of the individual time series.

Source: ECB, CNB calculations.

Different risk premia may be a 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 overnight rate (O/N)** into three components (see Chart 32) it is possible to express various aspects of financial risk.

- (i) A growing difference between the three-month money market rate and the overnight interbank rate can be interpreted as a signal of tension or rising risk on the money market, often due to a lack of liquidity or increased risk aversion and resulting limits on mutual exposures between banks. This was particularly visible during the global financial crisis in both the euro area and the Czech Republic. In the euro area, the difference has also been affected in recent years by a change in the overall liquidity position of the banking system.⁵⁸ This has led, among other things, to the premium falling since 2012.

⁵⁷ The exception is Portugal, where there is a one-month 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 strong. 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.

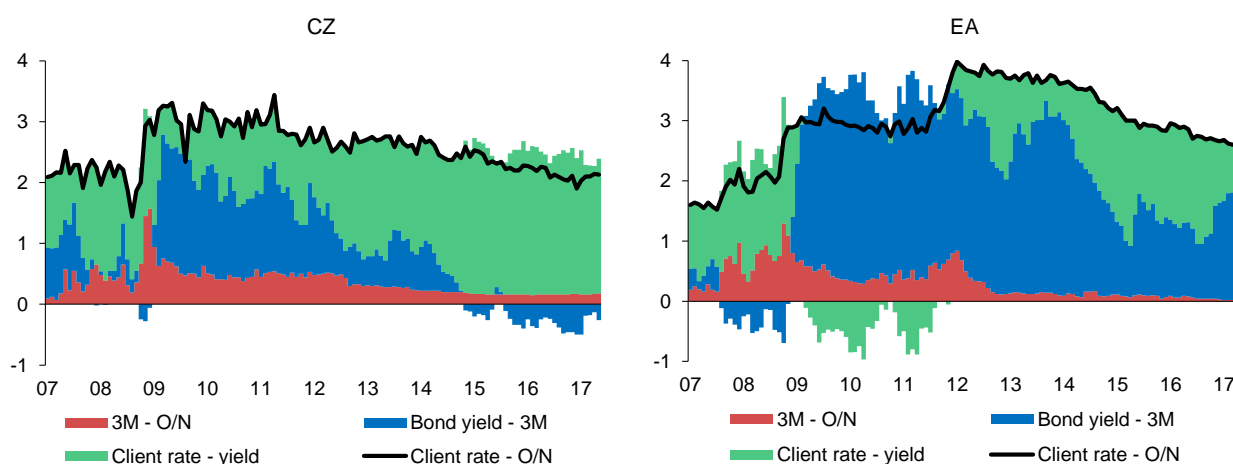
⁵⁸ A liquidity surplus has formed in the Eurosystem due to the ECB's fixed-rate refinancing operations with full allotment and other follow-up liquidity-providing operations, i.e. asset purchase programmes. The system has thus moved from a deficit to a surplus, with banks depositing this surplus liquidity on the deposit facility at the ECB at the relevant deposit rate. This rate has thus de facto (although not officially) become the ECB's main monetary policy rate.

Its drop to almost zero has also been enabled by the almost unlimited ability of commercial banks to obtain funds from the ECB. In the Czech Republic, the difference has stayed slightly positive at around 0.2 pp since the global financial crisis subsided.

- (ii) The difference between the government bond yield⁵⁹ and the three-month interbank rate indicates the term premium and the credit risk of government bonds. This difference surged in both the Czech Republic and the euro area at the beginning of the financial crisis, but in recent years it has been gradually shrinking. While it remains positive in the euro area due to the credit risk of euro area periphery countries, it has been slightly negative in the Czech Republic in recent years. This reflects – in addition to positive perceptions of Czech public finances, i.e. government bonds, by financial investors – a drop in the bond yield caused by the huge interest in this instrument over the last two or three years due to the exchange rate commitment coupled with a relatively sticky three-month interbank rate (when monetary policy rates were at technical zero).
- (iii) The difference between the client interest rate⁶⁰ and the government bond yield captures client credit risk changing over the financial and business cycle as perceived by banks and hence banks' willingness to assume the risk associated with lending to clients. 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 government bond yields falling to their current close-to-zero or negative figures. The aforementioned difference in the euro area is currently gradually narrowing and is roughly 1 pp lower than in the Czech Republic.

Overall, the spread between interest rates on loans to non-financial corporations and the overnight interbank rate in the Czech Republic has been lower than that in the euro area since 2011. However, the rates are gradually converging (the current difference being about 0.5 pp).

Chart 32: Decomposition of the spread between interest rates on loans to non-financial corporations and O/N interbank rates (pp)



Note: 3M - O/N is the difference between the three-month rate and the overnight interbank rate. Bond yield - 3M is the difference between the five-year government bond yield and the three-month interbank rate. Client rate - yield is the difference between the client rate on loans to non-financial corporations and the five-year government bond yield. The data are monthly averages.

Source: ECB, CNB, CNB calculations.

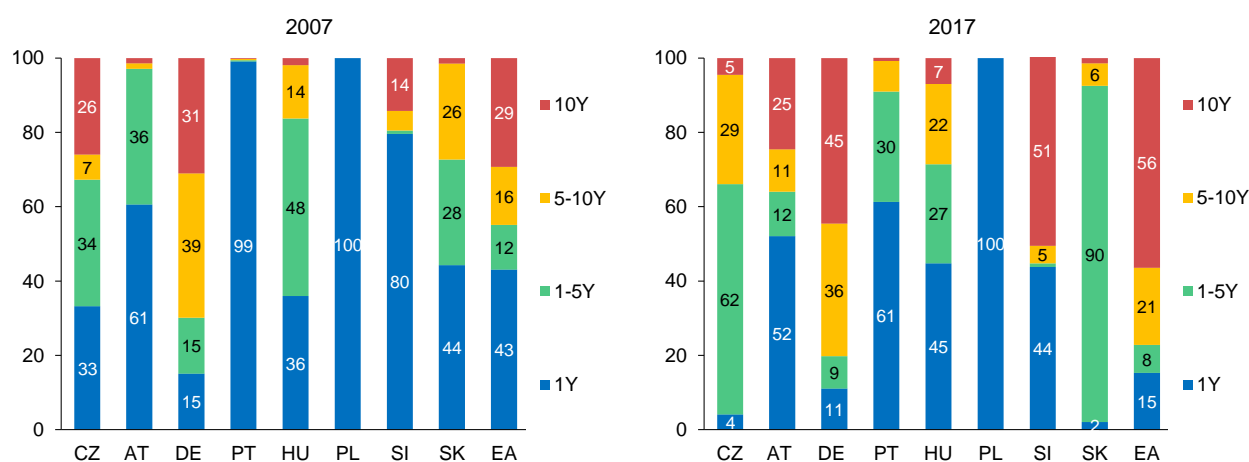
The negative deposit rate has simultaneously formed the limit on the drop in the implied yields on securities purchased by the ECB under its asset purchase programmes.

⁵⁹ Five-year government bonds were used.

⁶⁰ The weighted interest rate based on the amount of loans to non-financial corporations was used (for details of the fixation structure, see Chart 30).

Loans for house purchase make up the main segment of household debt. Chart 33 shows their structure by interest rate fixation period. In the Czech Republic, as in the euro area, households mostly take out loans with rates fixed for over one year. This contributes to similarity of monetary policy transmission to households' balance sheets. However, loans with fixation periods of over one year and up to five years are predominant in the Czech Republic, while in the euro area loans with even longer fixation periods have a high share. Besides historical factors, this is currently due to favourable market conditions, in particular very low interest rates throughout the financial market, and to a willingness of banks to fix rates for such long periods. Compared to last year's data, the share of longer fixation periods increased relative to fixation periods of up to one year in all the countries under review except Poland. This may lead to less sensitive transmission. The differences between countries are partly due to differences in financial products, market structure and regulatory measures.

Chart 33: Structure of new loans to households for house purchase by interest rate fixation period (%)



Note: The structure of the euro area total varies according to the increasing number of countries. The 2017 data are as of June.
Source: ECB, CNB calculations.

In all the countries under review, changes in rates on loans for house purchase with rates fixed for up to one year are correlated above all with changes in the relevant three-month market rates with a one-month lag.⁶¹ This suggests that **interest rate transmission** is fairly fast (see Table 11). 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 with rates fixed for over one year, the changes are statistically significantly correlated (with a one-month lag) with yields on ten-year government bonds in the Czech Republic, Germany and the euro area as a whole.⁶² At the same time, rates on most loans for house purchase are fixed for longer than one year in these countries. In the other countries under review, no significant correlation between loans with rates fixed for over one year and the relevant government bonds was identified.⁶³

⁶¹ There is no lag in the case of Poland due to a high volume of loans for house purchase with floating rates.

⁶² Correlations between client rates and government bond yields 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).

⁶³ 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 and subsequently during the debt crisis. In the case of Austria, no correlation was found between loans for house purchase with maturities of over one

Table 11: 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		
	2004M1–2017M6			2004M1–2017M6		
	t	t-1	t-2	t	t-1	t-2
CZ	0.12	0.21 *	0.16	0.04	0.27 **	0.26 **
AT	0.50 **	0.51 **	0.49 **	-0.02	-0.02	0.06
DE	0.57 **	0.61 **	0.42 **	0.39 **	0.72 **	0.56 **
PT	0.65 **	0.87 **	0.64 **	0.01	0.04	0.04
HU	0.19 **	0.28 **	0.21 *	0.08	-0.02	0.01
PL	0.63 **	0.62 **	0.41 **	-	-	-
SI	0.75 **	0.84 **	0.59 **	0.09	0.11	0.09
SK	0.10	0.34 **	0.19	-0.13 *	-0.07	0.08
EA	0.78 **	0.84 **	0.70 **	0.27 **	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 negligible. The columns indicate the lag of rates on loans for house purchase relative to the market rate. For example, t-1 denotes a lag of one month. The significance of the correlation coefficient is marked ** and * for the 5% and 10% significance levels respectively. The correlation analysis was performed on the first differences of the individual time series.

Source: ECB, CNB calculations.

The spread between client rates on loans to non-financial corporations and the overnight interbank rate in the Czech Republic is lower than that in the euro area and its structure is also slightly different, mainly reflecting the greater heterogeneity of the risk premia of euro area countries. 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. The shares of rate fixation periods of 1–5 years and over 10 years have increased, implying convergence towards the fixation structure in Germany and the euro area as a whole. The pass-through of changes in financial market interest rates to client rates in the Czech Republic thus does not differ greatly from that in the euro area and represents no barrier to future euro adoption.

1.2.4 Inflation persistence

The ability of the economy to absorb shocks effectively and the functioning of monetary policy transmission also depend on **price flexibility**. To examine price flexibility, we 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.⁶⁴

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 persistent is inflation.⁶⁵ Methods 2 and 3 are based on a model of

year and the ten-year bond, but the analysis revealed a correlation with the 3M EURIBOR with a one-month lag (0.37** correlation coefficient).

⁶⁴ According to Angeloni and Ehrmann (2004), the differences in inflation observed between euro area countries can largely be explained by different inflation persistence.

⁶⁵ The technique proposed in Marques (2004).

inflation as an autoregressive process, monitoring the sum of the coefficients of the autoregressive terms. Method 2 assumes a constant mean value of inflation and its results are largely dependent on this assumption.⁶⁶ If the inflation time series contains structural changes or breaks 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 and is the most relevant for comparing inflation persistence.

The persistence indicators in all three methods take values between 0 and 1. The closer they are to one, the more persistent is inflation. Table 12 summarises the inflation persistence estimates for 2007 Q1–2017 Q2. According to the non-parametric Method 1, inflation persistence in the Czech Republic is one of the highest among the countries under review. Estimated using the other two methods, by contrast, it is among the lowest. Inflation persistence in the Czech Republic thus poses no risk as regards future euro adoption.

Table 12: Inflation persistence estimates

	Method 1	Method 2	Method 3
CZ	0.88	0.78	0.42
AT	0.88	0.85	0.53
DE	0.88	0.82	0.57
PT	0.85	0.81	0.62
HU	0.80	0.98	0.62
PL	0.83	1.00	0.75
SI	0.83	0.90	0.39
SK	0.88	0.92	0.58

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; for all three methods, the closer the values are to one, the more persistent is inflation.

Source: Eurostat, CNB calculations.

1.2.5 Financial market alignment

Financial markets can be identified as aligned if financial assets having comparable risk factors and yields are priced identically by the markets no matter which country they are traded in. The similarity in the behaviour of prices of comparable financial assets across markets thus illustrates the level of financial market alignment or synchronisation in the countries under review. 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.

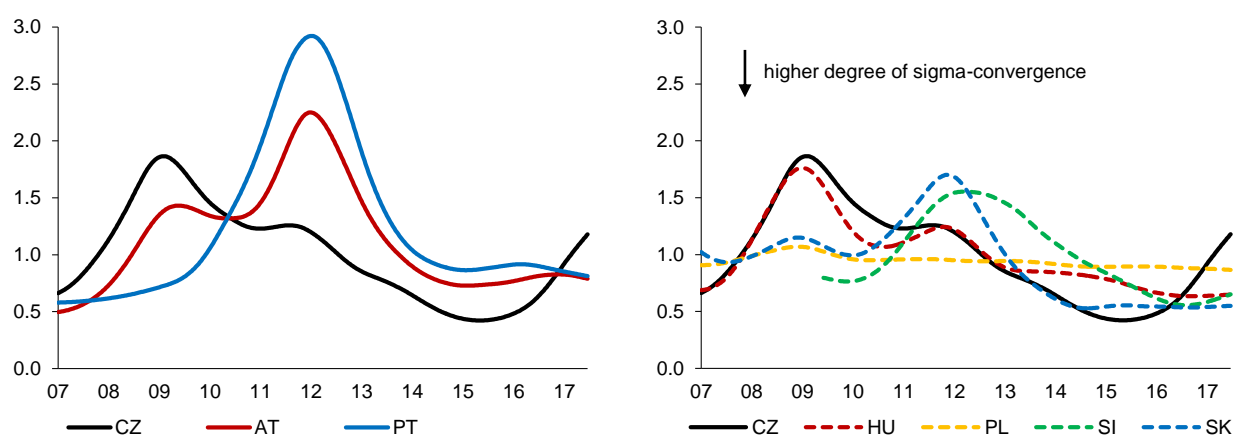
The law of one price was applied – with awareness of its limitations – to measure the alignment of selected countries' financial markets with the euro area. The degree of alignment of financial markets (money, foreign exchange, government bond and stock markets) is traditionally assessed using two methods: price-based measures and news-based measures.⁶⁷

⁶⁶ See Marques (2004) and Cecchetti and Debelle (2006).

⁶⁷ 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

The results of both measures are almost unchanged from last year, so they are not presented in full here. In the case of price-based measures, it still holds that 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 has been gradually increasing since the escalation of the financial crisis, reaching high levels (i.e. beta coefficients close to -1). Sigma-convergence has also been high across all the countries under comparison in the post-crisis period. The exception is persistent lower alignment of the Czech government bond market with the benchmark German market compared to the pre-crisis period. It probably reflects the effects of the Czech National Bank's exchange rate commitment and the ECB's unconventional monetary policy (see Chart 34).

Chart 34: Degree of convergence of the government bond market compared to Germany (sigma)



Note: Lower standard deviation values (y-axis) correspond to a higher degree of sigma-convergence. 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.

Like last year, the results of news-based measures indicate that global news has a significant effect on segments of the Czech financial market. The higher sensitivity of the stock and foreign exchange markets – as compared to the other financial market segments – to global shocks across countries can be explained by a stronger 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, particularly on the stock and bond markets.

Overall, the results of the analysis of the beta- and sigma-convergence of individual financial markets still rank the Czech Republic among the countries with a higher degree of alignment with the euro area. Moreover, the alignment of the segments of the Czech financial market with the euro area, including the significance of global news, has been gradually increasing since 2009.

1.2.6 Spontaneous euroisation

Rising euroisation is signalled by growth in the shares of foreign currency (i.e. euro-denominated) loans and deposits in the balance sheets of economic agents and increased use of the euro in financial transactions. Spontaneous euroisation is usually fostered by low trust in

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. For details, see the *Methodological Part*.

the domestic currency and high trade integration with the euro area.⁶⁸ A high degree of euroisation can limit the conduct of monetary policy and pose a risk to financial stability. The costs of entering the euro area may thus be lower for a highly euroised economy.

The **degree of euroisation** in the Czech Republic is gradually rising. The share of foreign currency loans in total loans to the private sector has increased to 15% in recent years due to a rise in euro-denominated corporate loans. The ratio of foreign currency loans to GDP is 8% overall. However, these figures are still among the lowest in the Central European region. The share of foreign currency loans in total bank assets, which indicates the extent of systemic risk in the banking sector, has risen to around 6% (compared to 4% in 2013), but also remains relatively low.⁶⁹

The share of **foreign currency loans of non-financial corporations** in the Czech Republic has increased due to greater trade integration with the euro area and the weakening of the koruna at the close of 2013. Foreign currency loans consist mainly of euro-denominated loans. Demand for these loans rose sharply before the expected exit from the CNB's exchange rate commitment (i.e. in 2016 and early 2017). In April 2017, the share of foreign currency loans increased to a historical high of 31% (see Chart 35). By contrast, the share of corporate foreign currency deposits (also mostly euro-denominated) dropped to around 20% in this period (see Chart 36). In Poland these shares remain at a similar level, while in Hungary they continue to be higher despite showing a downward trend.

Chart 35: Foreign currency loans of non-financial corporations

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

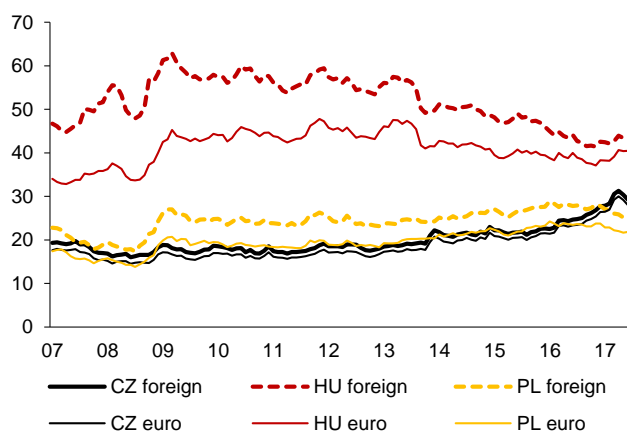
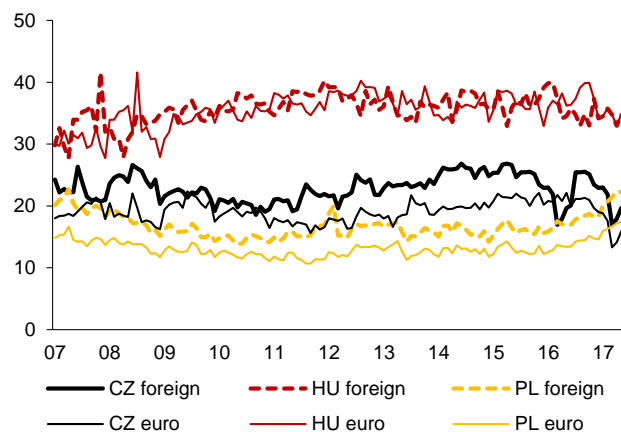


Chart 36: Foreign currency overnight deposits of non-financial corporations

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



Source: ECB, CNB calculations.

From a sectoral perspective, the highest growth in the Czech Republic was recorded for **euro-denominated loans in industry and real estate activities**.⁷⁰ Borrowing in euro in manufacturing is being accompanied by rising openness of the economy (the share of exports

⁶⁸ Emerging economies tend to display a high degree of euroisation, among other things as a result of higher interest rates compared with advanced countries and due to a large share of foreign currency funds of banks.

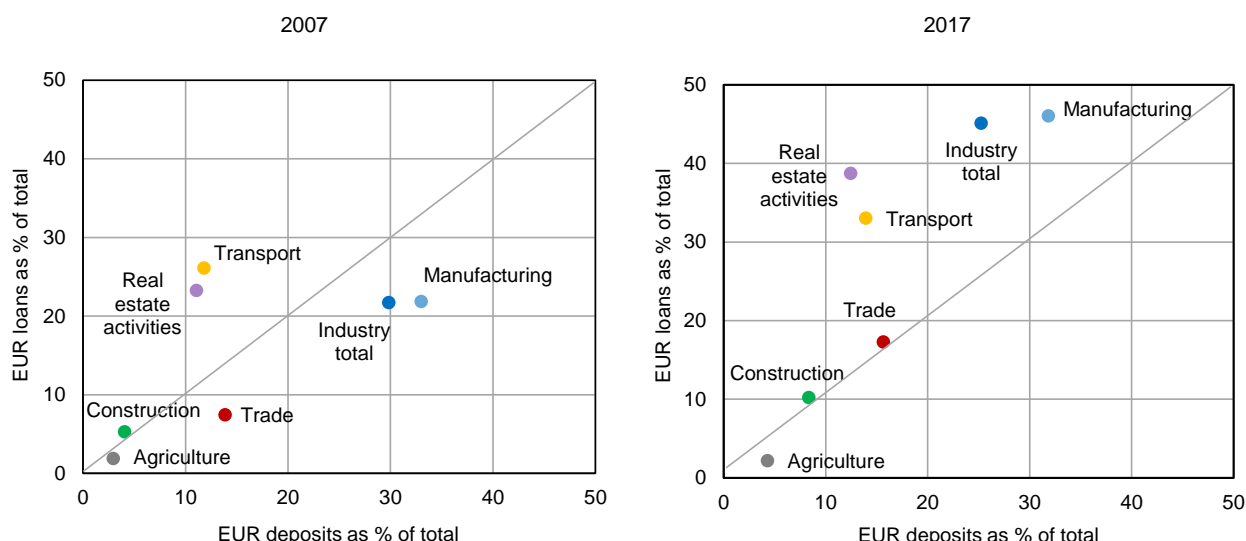
⁶⁹ The analogous indicator for non-euro area member states with high shares of foreign currency loans ranges between 40% and 50%. In Poland and Hungary it is 14% and 7% respectively, whereas in euro area countries (such as Germany) it is mostly below 1% (Yesin, 2013).

⁷⁰ The rise in the share of foreign currency loans among developers is linked with growth of the property market. The construction of commercial development projects is usually funded by euro-denominated loans so that rents can be set in euro.

in GDP has increased from 66% in 2007 to around 80%). The share of euro-denominated loans provided to domestic industrial firms by domestic banks is thus showing a long-term upward trend and is now fairly high at 46%. This is related to the high proportion of exporters in this sector and their natural hedging against exchange rate risk, which rose sharply before the expected exit from the CNB's exchange rate commitment. By contrast, hedging of firms' exports by financial instruments, which is usually more costly, fell to around 30% of exports in this period according to a survey of non-financial corporations conducted by the CNB and the Confederation of Industry. Euro-denominated loans also went up in other sectors except construction. The demand for loans in other sectors was also probably related to the expected movement of the exchange rate after the end of the CNB's exchange rate commitment.

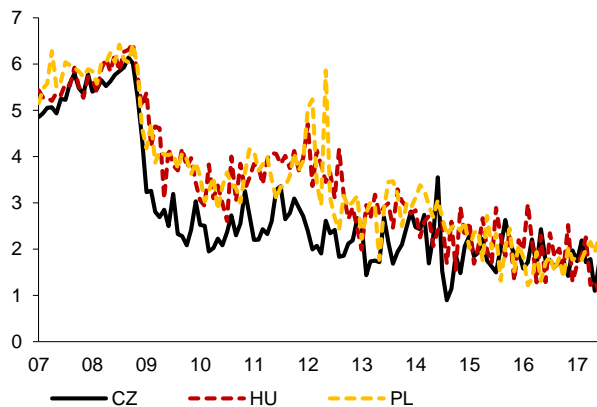
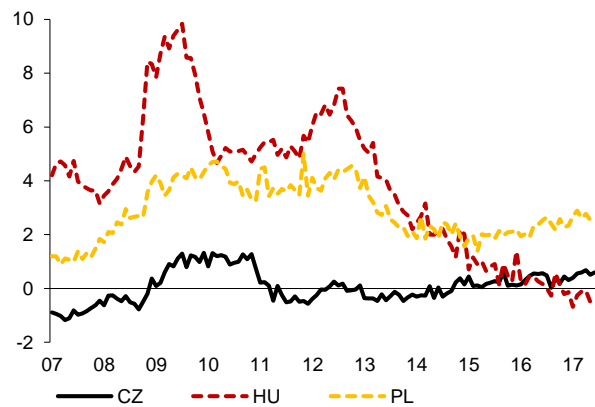
The **euroisation of the Czech economy is asymmetric in terms of corporate loans and deposits** (see Chart 37). While the share of euro-denominated loans has increased in most major sectors over the last ten years (albeit at different rates), the share of euro-denominated deposits has been broadly flat or has even dropped in some sectors. This may indicate increased sensitivity of the balance sheets of smaller firms with lower euro revenues to future exchange rate movements.

Chart 37: Euro-denominated loans and deposits of non-financial corporations in selected sectors
(shares in total loans and deposits of non-financial corporations in given sector with domestic banks, %)



Gradual euroisation of the Czech economy is also occurring in domestic payments – the **use of the euro in domestic payments by Czech firms** has gradually increased to roughly 20% according to the above survey of non-financial corporations. Large, export-oriented industrial firms are thus evidently preferring to pay domestic suppliers in euro in order to reduce exchange rate risk.

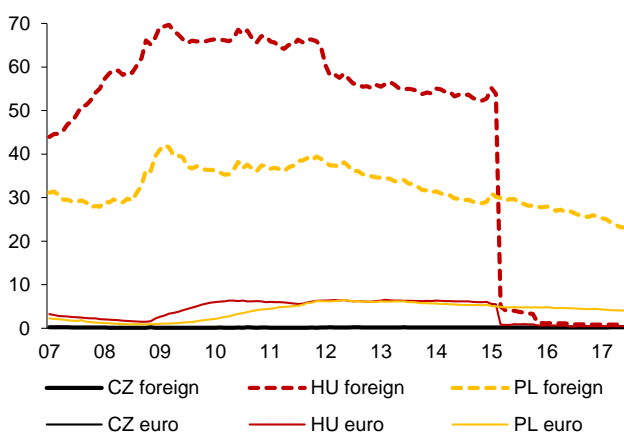
Interest rates on euro-denominated loans, which may be a major factor of the increased demand for loans in this currency, are showing a downward trend in the Central European countries under review (see Chart 38). The **differential between domestic and foreign currency (euro) loan rates**, higher levels of which can encourage growth in euro-denominated loans, has risen slightly in the Czech Republic recently but remains close to zero (see Chart 39).

Chart 38: Interest rates on euro-denominated loans of non-financial corporations (%)**Chart 39: Interest rate differentials on domestic and foreign currency loans of non-financial corporations (pp)**

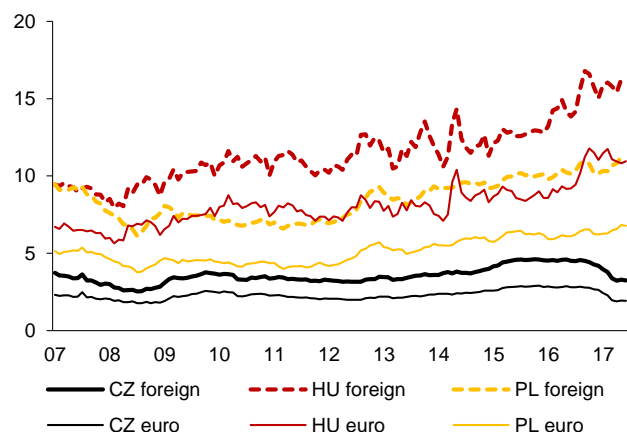
Note: The data refer to large loans of over EUR 1 million with floating rates and rates fixed for up to one year.

Source: ECB, CNB calculations.

Unlike in the case of firms, **households' demand for foreign currency loans and deposits** has long been very low in the Czech Republic, mainly due to strong confidence in the domestic currency and in the macroeconomic and institutional environment (see Chart 40).⁷¹ The share of foreign currency (euro) overnight deposits is negligible in the Czech Republic (see Chart 41). The share of euro banknotes and coins is also low and is moreover showing a downward trend – less than 5% of households surveyed in the Czech Republic, Poland and Hungary use the euro in domestic payments according to a survey conducted by the Austrian National Bank.⁷²

Chart 40: Foreign currency loans of households
(shares in total loans of households with domestic banks, %)**Chart 41: Foreign currency overnight deposits of households**

(shares in total overnight deposits of households with domestic banks, %)



Source: ECB, CNB calculations.

⁷¹ The share of foreign currency loans in Hungary has fallen to zero after previous administrative measures. In Poland, it is about 20% despite having shown a gradual decline. It consists mainly of loans denominated in Swiss francs.

⁷² Scheiber and Stern (2016).

To sum up, the use of the euro in the Czech economy is increasing in non-financial corporations, while the degree of euroisation in the household sector remains very low. The gradual growth in euroisation in the corporate sector is associated with the increasing export orientation of Czech firms and the generally growing openness of the economy and is likely to continue in the future. This long-term fundamental factor was intensified by a surge in demand for euro-denominated loans while the CNB's exchange rate commitment was in place (especially towards the end of the commitment). Firms took out such loans as a natural exchange rate hedge on expectations that the koruna would appreciate after the commitment ended.

2 ADJUSTMENT MECHANISMS

The adoption of the single currency and the related loss of independent monetary policy 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

The stabilising effect of fiscal policy can to some extent substitute for the missing monetary adjustment mechanisms in the event of asymmetric shocks. However, inappropriate fiscal policy itself may become a source of asymmetric shocks, as the European debt crisis showed. 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,⁷³ or indirectly, by creating conditions for optimal functioning of automatic fiscal stabilisers.

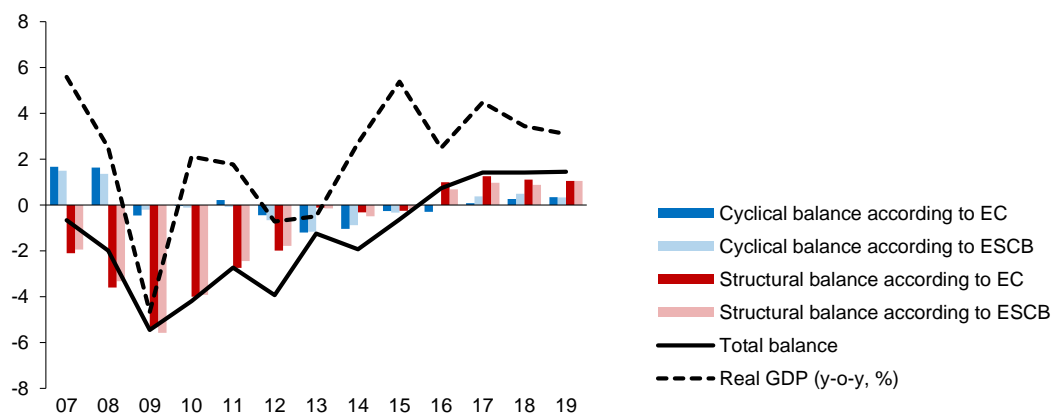
The EU fiscal rules recommend a broadly balanced **government budget policy over the business cycle**. This should allow automatic fiscal stabilisers, which can absorb shocks without the need for ad hoc discretionary fiscal measures, to operate freely. In a period of recession, public finances should 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 breaches of the maximum agreed deficits, public finance must be balanced or, preferably, in surplus during a growth phase of the business cycle.

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. This is adjusted not only for fluctuations caused by the economic cycle, but also for the impacts of extraordinary one-off, or temporary, fiscal measures.⁷⁴ Chart 42 shows the current estimates of the cyclical and structural components of the Czech Republic's general government balance based on the CNB's analyses.

⁷³ The negative experience in the advanced countries in the 1970s is an argument against the wider application of discretionary measures. 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.

⁷⁴ 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).

Chart 42: 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 2017–2019 figures come from the CNB's forecast published in Inflation Report IV/2017).

The **structural balance**⁷⁵ indicates that the Czech government's fiscal policy was persistently in deficit until 2012 and procyclical for most of this period. 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 being one of the reasons for the economic downturn in 2012 and 2013. In 2014–2016, a fiscal policy easing, including accelerated drawdown of EU funds, contributed to a recovery of the Czech economy and subsequently to higher growth; domestic fiscal policy was therefore slightly procyclical. In 2017–2018, when, according to the CNB's current forecast,⁷⁶ the general government balance will record a structural surplus exceeding 1% of GDP amid rapid economic growth, fiscal policy will be again slightly procyclical due to a positive fiscal impulse stemming in 2017 from renewed growth in government investment co-financed from EU funds and in 2018 mainly from household consumption growth.⁷⁷

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 more 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. The cyclical component returned to neutral levels in 2015 and the CNB's current forecast expects the phase of the cycle to contribute to budget surpluses over the outlook horizon.

⁷⁵ 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.

⁷⁶ CNB (2017a) Inflation Report IV/2017 (Table 13, last line).

⁷⁷ Fiscal policy remains slightly procyclical in the said years even when the fiscal impulse is adjusted for government investment financed from EU funds.

The fall of the economy into recession in 2012–2013 led the government to reassess the pace of previous fiscal consolidation and withdraw from the previously declared fulfilment of the **medium-term objective (MTO)**⁷⁸ of a structural deficit of 1% of GDP in 2015.⁷⁹ Nevertheless, better-than-expected evolution of the general government budget led to the structural deficit falling below the set limit already in 2014. The medium-term objective has been met by a considerable margin in the last two years and is also fulfilled in the outlook to 2018.^{80,81}

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 comply with the MTO) so that sufficient room is left for stabilising fiscal policy in bad times.

Table 13 summarises the forecast for the **general government balance** of the countries under review as published by the European Commission in autumn 2017 (the last line in the table gives the current estimate according to the CNB forecast). The European Commission's forecast for the overall general government balance in 2017 and 2018 does not expect the deficit to exceed the reference value of 3% in any of the countries under review. However, the structural deficits of most of the countries under review remain relatively high and exceed their specific MTOs. The only exceptions are Germany, which is recording structural surpluses regularly since 2013, and the Czech Republic, where the general government budget will be in surplus also in the years ahead after having attained a structural surplus in 2016. This European Commission outlook for the Czech Republic is less favourable than the current CNB forecast, which expects higher values of the structural surplus.

Table 13: General government balance (European Commission estimate)

(% of GDP)

	Total balance						Structural balance					
	2007	2014	2015	2016	2017	2018	2007	2014	2015	2016	2017	2018
CZ	-0.7	-1.9	-0.6	0.7	1.2	0.8	-3.2	-0.8	-0.6	0.8	0.8	0.4
AT	-1.4	-2.7	-1.0	-1.6	-1.0	-0.9	-2.7	-2.2	-0.6	-1.1	-0.9	-1.0
DE	0.2	0.3	0.6	0.8	0.9	1.0	-0.8	0.5	0.8	0.9	0.9	0.9
PT	-3.0	-7.2	-4.4	-2.0	-1.4	-1.4	-3.7	-5.5	-3.5	-1.5	-1.7	-2.0
HU	-5.0	-2.7	-2.0	-1.9	-2.1	-2.6	-6.3	-2.4	-2.1	-2.1	-2.8	-3.6
PL	-1.9	-3.6	-2.6	-2.5	-1.7	-1.7	-3.3	-3.0	-2.4	-2.2	-2.1	-2.3
SI	-0.1	-5.3	-2.9	-1.9	-0.8	0.0	-3.4	-3.4	-1.6	-1.5	-1.7	-1.6
SK	-1.9	-2.7	-2.7	-2.2	-1.6	-1.0	-4.7	-1.9	-2.3	-2.0	-1.6	-1.2
EA	-0.6	-2.6	-2.1	-1.5	-1.1	-0.9	-2.1	-1.2	-1.1	-0.9	-0.9	-1.1
CZ^{a)}	-0.7	-1.9	-0.6	0.7	1.4	1.4	-2.1	-0.3	-0.2	1.0	1.3	1.1

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 2017) until 2016, and the CNB's forecast from Inflation Report IV/2017 for 2017 and 2018. The structural balance is calculated under EC methodology. The difference from the European Commission's data for the Czech Republic stems mainly from a time mismatch between the EC's spring forecast and

⁷⁸ Convergence Programme of the Czech Republic, April 2013.

⁷⁹ The country-specific medium-term objective for the Czech Republic was set at 1% of GDP in line with the fact that the Czech Republic is a fast growing economy with a low general government debt level.

⁸⁰ European Commission (2017b).

⁸¹ Inflation Report III/2017.

the CNB's current forecast and also from differences in the forecast for GDP and related public budget revenues and expenditures.

Source: European Commission (2017a, 2017b), 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.⁸² 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.⁸³

The share of mandatory expenditures in total state budget expenditure and revenues has long been relatively high in the Czech Republic (see Table 14). Following a short-term decline in 2007, this share rose again in connection with the adverse cyclical developments in 2008–2009. The share of mandatory expenditures increased further in 2010–2013 as a result of the impact of government austerity measures on non-mandatory expenditures. Although the economic recovery and an enormous inflow of EU funds in 2014–2016 were reflected in a decline in the share of mandatory expenditure in total state budget expenditure and revenues in this period, the figures return to the relatively high level of previous years in the years ahead and in the outlook to 2018.

Table 14: Shares of mandatory state budget expenditure

(%)

	2007	2011	2012	2013	2014	2015	2016	2017	2018
Shares of mandatory expenditure in total SB expenditure	50.8	56.5	56.7	57.2	56.5	53.0	56.6	55.3	56.4
Shares of mandatory expenditure in total SB revenue	54.1	64.4	62.1	61.5	60.4	55.7	53.8	58.0	58.5

Note: Data until 2016 are actual figures; data for 2017 and 2018 are based on the government's August 2017 draft state budget (state budget compilation methodology).

Source: Ministry of Finance of the Czech Republic (2008, 2017), 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 15).⁸⁴ For all indicators as a percentage of GDP, the Czech Republic ranked among the countries with lower figures in 2016, 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. The Czech Republic's low debt service expenditure ratio is a consequence of its still relatively low government debt and exceptionally low interest rates. The ratio of compensation of employees (salaries in budgetary and subsidised organisations) to

⁸² The definition of mandatory expenditures used in this analysis is given in the *Methodological Part*.

⁸³ This risk materialised fully in the Czech Republic after the outbreak of the financial crisis, when the high share of mandatory expenditures contributed to a sharp rise in the public finance deficit.

⁸⁴ "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.

GDP is comparable with that in Germany and Slovakia and lower than in the other countries and the euro area average.

Table 15: Public revenues and expenditures relative to GDP in 2016

(%)

	CZ	AT	DE	PT	HU	PL	SI	SK	EA
Total revenues	40.1	49.1	45.0	43.0	44.8	38.7	43.3	39.3	46.1
- taxes	19.9	27.4	23.2	25.1	25.6	20.5	22.0	17.9	25.6
- social contributions	14.7	15.5	16.7	11.7	13.6	13.8	15.0	14.3	15.3
Total expenditures	39.4	50.7	44.2	45.0	46.7	41.2	45.1	41.5	47.6
- compensation of employees	8.8	10.7	7.5	11.3	10.9	10.3	11.3	9.1	10.0
- intermediate consumption	6.1	6.4	4.8	5.6	7.0	5.7	6.4	5.5	5.2
- social payments	15.3	23.1	24.0	18.9	14.8	17.2	17.5	19.1	22.8
- gross fixed capital formation	3.3	3.0	2.1	1.5	3.1	3.3	3.2	3.2	2.5
- interest expenditure	0.9	2.1	1.3	4.2	3.2	1.7	3.0	1.6	2.2

Source: European Commission (2017a).

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. Fiscal policy will have to take into account the fact that in the most recent reform of the Stability and Growth Pact the debt criterion gained much greater weight than before. Table 16 provides a comparison of the ratios of government debt to GDP.

Table 16: General government debt (European Commission estimate)

(% of GDP)

	2007	2011	2012	2013	2014	2015	2016	2017	2018
CZ	27.5	39.8	44.5	44.9	42.2	40.0	36.8	34.6	33.3
AT	64.7	82.2	81.7	81.0	83.8	84.3	83.6	78.6	76.2
DE	63.7	78.6	79.8	77.4	74.6	70.9	68.1	64.8	61.2
PT	68.4	111.4	126.2	129.0	130.6	128.8	130.1	126.4	124.1
HU	65.0	79.9	77.6	76.0	75.2	74.7	73.9	72.6	71.5
PL	44.2	54.1	53.7	55.7	50.2	51.1	54.1	53.2	53.0
SI	22.8	46.6	53.8	70.4	80.3	82.6	78.5	76.4	74.1
SK	30.1	43.7	52.2	54.7	53.6	52.3	51.8	50.6	49.9
EA	64.9	86.8	91.4	93.7	94.2	92.1	91.1	89.3	87.2
CZ^{a)}	27.5	39.8	44.5	44.9	42.2	40.0	36.8	33.8	31.5

Note: ^{a)} Data according to the CZSO's statistics and notifications (autumn 2017) until 2016, and the CNB's estimate from Inflation Report IV/2017 for 2017 and 2018. 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 (2017a), CZSO, CNB calculations.

Like the other fiscal indicators, debt was affected in 2008–2010 by dramatic changes in the economic situation, which gave rise to more or less sharp increases in debt as a result of growth in deficits and other extraordinary fiscal measures taken by individual countries to dampen the impacts of the financial and economic crisis. Nonetheless, Czech government debt has long been well below the reference value of 60% of GDP and has been declining steadily since 2014. Compared to the other countries under review and the euro area average for the entire period (except for Slovenia in 2007), the Czech Republic is by some way the least

indebted country. However, unresolved structural problems in the Czech economy and the impacts of population ageing remain a potential risk to the sustainability of the low debt level.

Table 17: Debt service (European Commission estimate)

(% of GDP)

	2007	2011	2012	2013	2014	2015	2016	2017	2018
CZ	1.1	1.3	1.4	1.3	1.3	1.1	0.9	0.8	0.8
AT	3.1	2.8	2.7	2.6	2.4	2.3	2.1	1.9	1.7
DE	2.7	2.5	2.3	2.0	1.7	1.5	1.3	1.2	1.1
PT	2.9	4.3	4.9	4.9	4.9	4.6	4.2	3.9	3.6
HU	4.0	4.1	4.6	4.5	4.0	3.5	3.2	2.8	2.6
PL	2.2	2.5	2.7	2.5	1.9	1.8	1.7	1.5	1.5
SI	1.2	1.9	2.0	2.6	3.2	3.2	3.0	2.6	1.9
SK	1.4	1.5	1.8	1.9	1.9	1.7	1.6	1.3	1.3
EA	2.9	3.0	3.0	2.8	2.6	2.4	2.2	2.0	1.9

Source: European Commission (2017a).

In this context, it should be taken into account that the level of debt is being reflected in mandatory expenditure connected with **debt service**. Owing to exceptionally low interest rates, it has yet to increase in many countries as a result of the growth in debt, but that is only a temporary factor. Nevertheless, the Czech Republic is succeeding in maintaining a low debt service expenditure level compared to the other countries under review, well below the euro area average. This is due to the above-mentioned low level of Czech government debt and to low debt servicing costs, reflecting, among other things, solid domestic economic fundamentals (see Table 17).

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. Virtually all EU countries will be exposed to the problem of **population ageing** and related growth in pension, social and health expenditure in the future. This may be a source of future instability. The long-term forecast for age-related expenditures (see Table 18) indicates that the Czech Republic is in a good position relative to the other countries under review. However, the expected rise in age-related expenditures is still marked.

Table 18: 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	8.7	5.9	7.9	1.4	1.9	15.5	18.5

Note: ^{a)} CNB calculations.

Source: European Commission (2015b).

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, had an immediate and positive long-term effect on public finances, but was not a 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 and was subsequently abolished at the end of 2015. The currently valid amendment to the pension law reforming the first pay-as-you-go pillar (establishing a retirement age ceiling of 65 years in combination with a revision mechanism for periodically testing that ceiling) will, however, lead to a deterioration in the sustainability of the pension system after 2030 in the absence of further parametric changes. Other measures amending the pension law also imply an adverse impact on the sustainability of the pension system.⁸⁵ 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 fiscal consolidation, the structural budget reaches a balanced level or a slight surplus in the government’s outlook contained in the Convergence Programme⁸⁶ (the CNB’s prediction is even more optimistic in this respect). The high share of mandatory expenditures, which are time-consuming and politically challenging to change, remains 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 country’s preparedness to enter the euro area has improved significantly in this respect, the effectiveness of fiscal adjustment

⁸⁵ For example, an amendment 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, along with an adjustment to the indexation equation whereby pensions will go up by one-half of real wage growth plus the pensioners’ costs of living index or the general consumer price inflation index (whichever is higher), as compared to only one-third of real wage growth plus the general consumer price index under the previous legislation.

⁸⁶ Convergence Programme of the Czech Republic, April 2017.

mechanisms remains an area that needs attention in terms of the Czech Republic's ability to adopt the euro.

2.2 LABOUR MARKET FLEXIBILITY

Labour market flexibility is one of the most important adjustment mechanisms for 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 therefore dealt with from the perspective of international competitiveness using the Global Competitiveness Index (GCI; 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 in the Czech Republic is one of the lowest among the countries under comparison (see Table 19). Like in most of the countries under review, it increased in 2010 as the impacts of the recession hit the labour market with the usual lag. It subsequently stagnated at around 3%, and since 2013 it has been declining as a result of growing economic activity. In 2016 it reached the same level as in Germany, which (along with Austria) has long had one of the lowest rates.

Table 19: Long-term unemployment rate

(%)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
CZ	2.8	2.2	2.0	3.0	2.7	3.0	3.0	2.7	2.4	1.7
AT	1.3	1.0	1.2	1.2	1.2	1.2	1.3	1.5	1.7	1.9
DE	4.9	3.9	3.5	3.3	2.8	2.4	2.3	2.2	2.0	1.7
PT	3.8	3.6	4.2	5.7	6.2	7.7	9.3	8.4	7.2	6.2
HU	3.5	3.6	4.2	5.5	5.2	5.0	4.9	3.7	3.1	2.4
PL	5.1	2.5	2.6	3.0	3.6	4.1	4.4	3.8	3.0	2.2
SI	2.2	1.9	1.8	3.2	3.6	4.3	5.2	5.3	4.7	4.3
SK	8.4	6.7	6.6	9.3	9.3	9.4	10.0	9.3	7.6	5.8

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

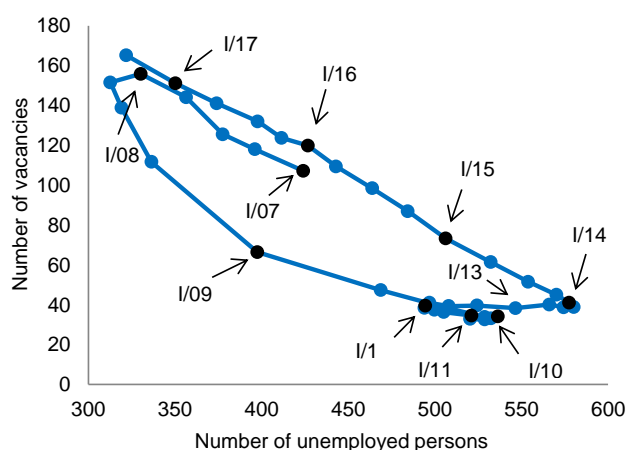
Source: Eurostat.

Cyclical and structural unemployment⁸⁷ can be analysed by means of the Beveridge curve, which plots the number of vacancies against the number of unemployed persons (see Chart

⁸⁷ 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.

43).⁸⁸ In the period under review (i.e. since 2007), the movements of the Beveridge curve have reflected developments in the Czech economy (and are described in detail in the previous issue of the Alignment Analyses, for example). Since 2014, the number of unemployed persons has been falling and the number of job vacancies has been rising in line with the renewed growth in economic activity. Overall, cyclical effects⁸⁹ have dominated structural ones in the Beveridge curve in recent years, so labour market flexibility is not likely to have changed significantly.

Chart 43: Beveridge curve (thousands)



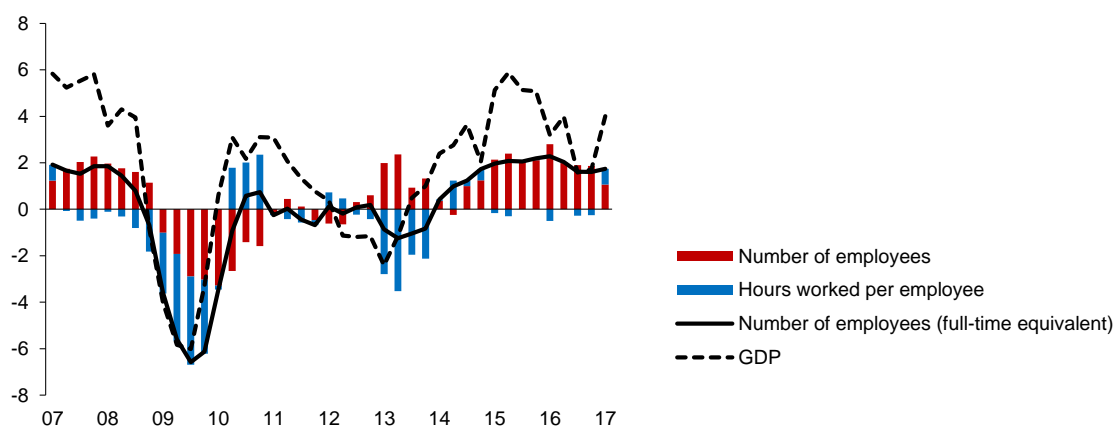
Note: Seasonally adjusted quarterly data.

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

The evolution of employment in the period under review has been significantly influenced by the use of alternative forms of employment, especially **shorter working hours**. In the past, for example in 2009 and 2013, employers cut working hours to adjust to falling demand and uncertainty about its future evolution and thereby streamline their labour costs (see Chart 44). The use of short working hours halted as economic activity rebounded in the first half of 2014. The 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. However, the rising occurrence of shorter working hours also reflects structural changes resulting from convergence towards labour market standards typical of advanced countries, where the use of shorter working hours, such as by women returning to work from parental leave and by employees of retirement age, continues to be far more widespread than in the Czech Republic.

⁸⁸ 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. 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).

⁸⁹ A decline in the unemployment rate coupled with growth in employment and the number of vacancies has recently led to rising tightness in the Czech labour market, reflected, among other things, in faster nominal wage growth.

Chart 44: 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**, i.e. the share of economically active persons in the population, has risen noticeably in most of the countries under comparison (see Table 20). This has been due, among other things, to increases in the retirement age and to greater use of shorter working hours, which has enabled people who often used to stay outside the labour force (e.g. parents of small children) to work. In terms of this parameter, the Czech Republic has thus converged towards the advanced countries of the euro area.

Table 20: Rate of economic activity in the 15–64 age category

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
CZ	69.9	69.7	70.1	70.2	70.5	71.6	72.9	73.5	74.0	75.0
AT	73.5	73.9	74.3	74.4	74.6	75.1	75.5	75.4	75.5	76.2
DE	75.6	75.9	76.3	76.7	77.3	77.2	77.6	77.7	77.6	77.9
PT	73.9	73.9	73.4	73.7	73.6	73.4	73.0	73.2	73.4	73.7
HU	61.6	61.2	61.2	61.9	62.4	63.7	64.7	67.0	68.6	70.1
PL	63.2	63.8	64.7	65.3	65.7	66.5	67.0	67.9	68.1	68.8
SI	71.3	71.8	71.8	71.5	70.3	70.4	70.5	70.9	71.8	71.6
SK	68.3	68.8	68.4	68.7	68.7	69.4	69.9	70.3	70.9	71.9

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), which reflects the level of mismatch between the regional supply of and demand for labour. This coefficient had been gradually decreasing in the Czech Republic since 2007 (see Table 21), but it started to rise again in 2012, when, in an adverse labour market situation, growth in unemployment was observed especially in regions with traditionally the highest unemployment rates. Since then, the coefficient of variation of the unemployment rate has been broadly flat. The regional differences in unemployment rates in the Czech Republic are medium-high compared to the other countries under review and are roughly the same as in Germany and Slovakia.

Table 21: Coefficient of variation of the unemployment rate
(%)

	NUTS II regions										NUTS III regions									
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2007	2008	2009	2010	2011	2012	2013	2014	2015	
CZ	42	44	34	31	28	33	31	30	33	33	43	46	35	32	29	34	32	30	33	
AT	45	39	34	37	40	43	39	43	45	46	46	41	36	39	42	45	41	45	47	
DE	43	45	37	36	41	40	39	39	37	32	49	51	43	42	48	47	46	-	-	
PT	21	19	18	20	13	14	16	13	14	14	23	-	-	-	-	-	-	-	-	
HU	40	43	31	23	26	23	21	31	34	41	45	49	36	28	30	27	25	36	37	
PL	14	18	20	14	14	15	16	18	19	23	37	27	29	26	26	27	26	27	29	
SI	-	-	-	-	-	-	-	-	-	-	-	-	-	22	28	21	19	22	21	
SK	38	41	32	27	32	31	29	28	26	29	46	51	38	29	33	33	31	30	31	

Note: The coefficient of variation is the ratio of the standard deviation weighted by region size to the average unemployment rate in per cent. Data for Slovenia are only available for the NUTS III level. With the exception of 2007, NUTS III level data are not available for Portugal.

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 22). This indicator is almost constant over time in the Czech Republic and has long been higher than in Poland and Slovakia. However, it is below the levels observed in Austria, Germany and Slovenia.

Table 22: Internal migration
(per 1,000 inhabitants)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
CZ	25	24	22	23	22	22	22	23	23	-
AT	37	38	37	37	38	39	39	4	43	44
DE	44	44	44	44	47	47	48	49	53	-
HU	25	24	21	20	20	19	19	22	22	26
PL	13	11	11	11	11	10	10	11	10	-
SI	19	53	48	52	53	55	55	55	53	54
SK	17	17	15	16	16	15	16	17	17	18

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. Data are not available for CZ, DE and PL for 2016.

Source: Statistical yearbooks, Eurostat, CNB calculations.

To sum up, the flexibility of the Czech labour market has increased markedly in response to the economic crisis in 2012–2013, especially in the area of use of shorter working hours. The rate of economic activity among the working age population has also been rising in recent years. The Czech Republic constantly 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. Minor problems persist in the areas of unemployment and internal labour market flexibility, especially as regards internal labour mobility, which remains significantly lower than in advanced European countries. This limits the ability of the economy to adjust flexibly to asymmetric shocks.

Box 4: Estimate of structural unemployment using the NAIRU and correlation of the cyclical component of unemployment

High **structural unemployment** in the economy is a sign of labour market inflexibility. However, structural unemployment is not directly observable and its rate is 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.⁹⁰ Changes in the NAIRU are estimated by filtering time series using an economic model.⁹¹

There are sizeable differences in the evolution and level of the NAIRU across the major European economies (see Chart B2). The NAIRU is high in France and Italy and especially so in Spain, i.e. countries with traditionally higher unemployment rates. The high level of structural unemployment in Spain reflects the very low flexibility of its labour market. Moreover, the Spanish NAIRU started to rise again last year.

By contrast, the NAIRU in the Czech Republic has been following a downward trend, with some fluctuations, since 2009. In recent years, the downward trend has probably been aided by the increased use of shorter working hours, especially during economic contractions (see section 2.2.1), which increases labour market flexibility and, in turn, lowers the NAIRU. The current estimated NAIRU in the Czech Republic is just below 5% and ranks among the lowest structural unemployment rates in the countries under comparison along with Germany. In France the estimated NAIRU is relatively stable over time, while in Italy structural problems have gradually been building up in the labour market over the last three years.

Chart B2: NAIRU
(%)

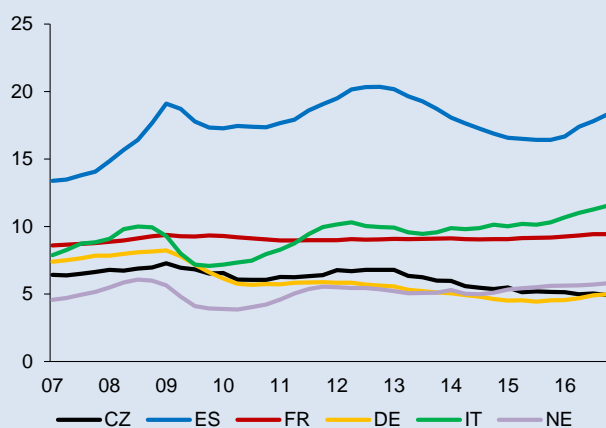
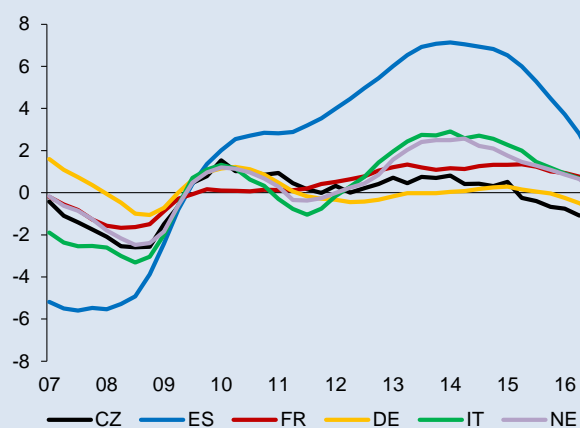


Chart B3: Unemployment gaps
(pp)



Source: Eurostat, CNB calculations using the model by Hlédik and Vlček (2017).

⁹⁰ NAIRU stands for 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.

⁹¹ The NAIRU estimate is based on the small structural model by Hlédik and Vlček (2017). A basic description of the model is available in the *Methodological Part*.

Correlation of the cyclical component of unemployment

The **cyclical component of unemployment**, as indicated by the difference between the measured general unemployment rate and the equilibrium unemployment rate estimated using the NAIRU, is sometimes also referred to as the unemployment gap.⁹² Alongside the correlation of changes in GDP or the industrial production index, for example (see section 1.1.2), the cyclical alignment of two economies can be measured using the **correlation of the unemployment gap**, which offers an alternative view of the correlation between two countries' economies. 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 costly for the acceding country.

In the first part of the period under review, the unemployment gaps of all the countries under comparison showed a similar pattern, reflecting a cyclically improving situation in individual labour markets, which manifested itself in the opening up of a negative unemployment gap (see Chart B3). With the onset of the economic crisis in 2009 and subsequent growth in the unemployment rate, the negative unemployment gap turned positive quite fast. This is particularly apparent in Spain, where the substantial growth in unemployment was primarily cyclical and structural unemployment rose noticeably less (see Chart B2). Over the last three years or so, the positive unemployment gaps in the countries under comparison have started to close again. In the Czech Republic and Germany, the unemployment rates were well below the NAIRU last year and the continued rise in labour demand thus resulted in the opening up of a negative unemployment gap.

Our analysis of the correlation of unemployment gaps in the major euro area economies and the Czech Republic in 2001–2016⁹³ reveals a high correlation between the Czech Republic and Germany and between the Czech Republic and the Netherlands (see Table B3, left-hand part). The correlation between the Czech Republic and the other euro area countries under comparison is weak, and with respect to Spain the time series are not correlated at all. However, when we analyse the data for a substantially shorter time period (2008–2016), the correlation between the Czech Republic and the other countries is high (0.6–0.8) and highly significant. Overall, the Czech Republic is aligned with the key euro area countries in terms of unemployment gap correlation.

Table B3: Unemployment gap correlations and concordance

	Correlation						Concordance					
	CZ	DE	NL	FR	IT	ES	CZ	DE	NL	FR	IT	ES
CZ	1.00	0.72 **	0.56 **	0.34 **	0.33 **	-0.01	1.00	0.77	0.71	0.62	0.46	0.51
DE		1.00	0.20	-0.10	-0.10 *	-0.57 **		1.00	0.60	0.45	0.35	0.34
NL			1.00	0.87 **	0.83 **	0.64 **			1.00	0.82	0.75	0.71
FR				1.00	0.87 **	0.80 **				1.00	0.75	0.83
IT					1.00	0.86 **					1.00	0.92
ES						1.00						1.00

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

Source: Eurostat, CNB calculations.

⁹² If the unemployment gap is positive, the labour market is anti-inflationary. By contrast, a negative gap 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; see, for example, Rudebusch (2010).

⁹³ Given the length of NAIRU cycles, the use of the standard 2007–2016 reference period in this report would distort the correlation analysis. For that reason, an extended period of 2001–2016 is used to calculate the NAIRUs and their gaps and statistical properties.

Concordance statistics, which describe how long the unemployment gaps of two countries or groups of countries have been in the same phase of the cycle, i.e. both positive or both negative, are also important for optimally configuring a single monetary policy with regard to labour market developments. The Czech Republic again showed high concordance with Germany and the Netherlands in 2001–2016. Its concordance with the other countries under review was low (see Table B3, right-hand part). As in the correlation analysis, shortening the time period results in the levels rising to 0.7–0.8.

To sum up, the labour market cycle in the Czech Republic can be assessed as substantially aligned with that in Germany, its most significant trading partner and a dominant euro area member state. However, the degree of alignment with the other countries under review has also been high in recent years. The relatively low NAIRU estimates, which are close to the German level, also indicate that the Czech labour market is not suffering from major structural problems.

2.2.2 International labour mobility

International labour mobility within a currency area is one of the most important mechanisms through which the individual member economies of a currency area 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 23) is one of the important indicators of international labour mobility.⁹⁴ 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%. Since 2014 the number has been growing, but it is still less than one-half of the ratio in Germany and less than one-third of that in Austria. This is partly because the shares of foreign nationals in Germany and Austria have been growing substantially in recent years.⁹⁵

Table 23: Share of foreign nationals in the population

(%)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
CZ	2.9	3.3	3.9	4.0	4.0	4.0	4.0	4.1	4.3	4.5
AT	9.6	9.9	10.2	10.5	10.8	11.2	11.8	12.4	13.2	14.4
DE	8.8	8.8	8.8	8.7	7.6	7.9	8.3	8.7	9.3	10.5
PT	4.1	4.2	4.2	4.3	4.2	4.1	4.0	3.8	3.8	3.8
HU	1.7	1.8	1.9	2.0	2.1	1.4	1.4	1.4	1.5	1.6
PL	0.1	0.2	-	0.2	0.2	0.2	0.2	0.3	0.3	0.4
SI	2.7	3.4	3.5	4.0	4.0	4.2	4.4	4.7	4.9	5.2
SK	0.6	0.8	1.1	1.2	1.3	1.3	1.3	1.1	1.1	1.2

Source: Eurostat, CNB calculations.

⁹⁴ Over the last three 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 Germany and Austria) recorded any significant rise in the numbers of foreign nationals from non-EU countries either. However, the previously published data are subject to the risk of revision.

⁹⁵ The share of foreign nationals from non-EU countries in the Czech population was 2.7% in 2016. Markedly higher shares of non-EU foreign nationals are observed in Germany and Austria (5.9% and 7.2% respectively), whereas in the other Central European countries the shares are almost negligible. The share of Slovak nationals in the Czech population was below 1% in 2016.

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. The strong reluctance to migrate is confirmed by a recent study⁹⁶ according to which the willingness of Czechs to relocate to other Member States has been the lowest in the EU in recent years. The outlook for the next decade is the same. In comparison to other countries, the Czech populace shows a much greater disproportion across professions in terms of cross-border mobility: the willingness to migrate in search of work is higher in technical and scientific professions than in other professions.

2.2.3 Institutional environment of the labour market

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.⁹⁷

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 24). In subsequent years, it rose modestly on account of increases in the minimum wage.⁹⁸ The ratio of the minimum wage to the average wage in the Czech Republic was among the lowest of the countries under review in previous years. From this perspective, therefore, the minimum wage probably did not have a stronger negative impact on the labour market in the Czech Republic than in the other countries. However, it is currently converging rapidly to the other countries from below and a further sizeable increase could start to disrupt labour market flexibility.

Table 24: Minimum wage

(% of the average wage)

	2008	2009	2010	2011	2012	2013	2014	2015	2016
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	42.7	44.1	43.7	45.8
HU	38.8	38.3	38.0	38.6	42.5	43.3	43.3	43.2	-
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	52.4
SK	33.6	35.7	36.0	36.1	35.6	36.0	35.4	36.9	-

Note: For 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

⁹⁶ Institute of Labor Economics (IZA) and Randstadt (2017).

⁹⁷ OECD (1998) and Gregg (2000).

⁹⁸ The minimum wage was increased from CZK 8,000 to CZK 8,500 in August 2013, CZK 9,200 in January 2015, CZK 9,900 in January 2016 and CZK 11,000 in January 2017 and will be increased to CZK 12,200 in January 2018.

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, Poland and Slovakia for 2016.

Source: Eurostat, CZSO, CNB calculations.

The minimum wage may have a particularly 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 and has increased rapidly in recent years (see Table 25).⁹⁹ Moreover, the ratio of the minimum wage to the wage in the first decile has also increased markedly on average in the business sector in recent years.

Table 25: Ratio of the minimum wage to the gross monthly wage in selected professions

(%)

Main employment class	Minimum wage / 1st decile									
	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Total for the Czech Republic (business sector)	67.2	63.2	63.9	63.5	72.9	69.9	70.5	71.6	77.3	79.7
- services and shop workers	88.8	85.0	85.9	86.5	91.4	85.2	84.1	86.3	91.1	91.9
- workers in agriculture, forestry and fishing	70.6	67.2	67.9	65.2	71.9	61.5	60.8	62.0	75.3	81.8
- elementary occupations	89.8	87.7	88.1	89.1	91.7	89.4	89.5	90.3	95.0	96.1

Note: The table lists data for the Czech Republic as a whole and for the three professions with the highest figures in 2016.

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

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, it increases the relative size of the grey economy.¹⁰⁰

Overall labour taxation in the Czech Republic was lower than in advanced neighbouring countries (Germany and Austria) in the period under review (see Table 26). Compared to the remaining countries, however, it ranked among the highest (behind Hungary) both at the average wage level and for low earners. Since 2007, overall taxation in the Czech Republic has been rising slightly. Portugal and Slovakia have recorded stronger growth (in the case of Slovakia the increase is due mainly to higher social and health insurance, while in the remaining countries it is also due to income tax). By contrast, overall taxation has declined in Germany, Poland and Hungary. In 2016, overall taxation increased slightly year on year in most of the countries under review, including the Czech Republic.

⁹⁹ For example, for the 10% of lowest-income persons employed in elementary occupations, the ratio of the minimum wage to their average earnings rose above 96% in 2016.

¹⁰⁰ Brandt et al. (2005).

Table 26: Overall labour taxation

	100% of average wage					67% of average wage				
	2007	2013	2014	2015	2016	2007	2013	2014	2015	2016
CZ	42.9	42.4	42.6	42.8	43.0	40.6	39.4	39.7	39.9	40.2
AT	48.8	49.2	49.4	49.6	47.1	44.2	44.6	44.8	45.1	42.8
DE	51.8	49.2	49.3	49.4	49.4	47.0	45.1	45.1	45.2	45.3
PT	37.3	41.4	41.2	42.1	41.5	32.5	35.2	34.9	36.2	36.3
HU	54.5	49.0	49.0	49.0	48.2	46.1	49.0	49.0	49.0	48.2
PL	38.2	35.6	35.7	35.7	35.8	37.1	34.8	34.9	35.0	35.1
SI	43.3	42.4	42.5	42.6	42.7	40.9	38.5	38.6	38.6	38.7
SK	38.4	41.1	41.3	41.4	41.5	35.5	38.5	38.6	38.8	39.0

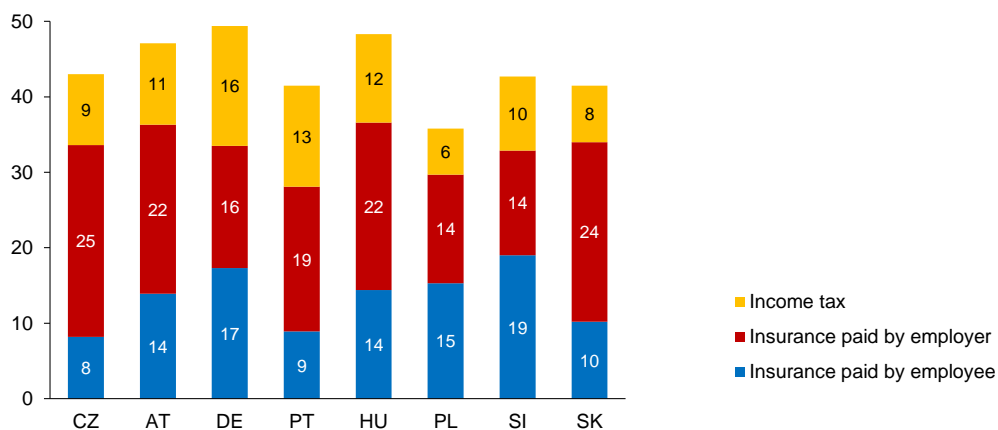
Note: Income tax and contributions paid by employees and employers as a percentage of total labour costs. Data for employees (individuals without children) earning 100% (left-hand part of the table) and 67% (right-hand part of the table) of the average wage.

Source: OECD (2017).

The data on the components of labour taxation (see Chart 45) show that health and social insurance affects overall labour taxation to a considerably greater extent than income tax in all the selected countries. The overall insurance level in the Czech Republic is similar to that in Austria and Hungary and slightly higher than that in Germany. By contrast, Poland and Slovenia have the lowest insurance burdens among the countries under review.

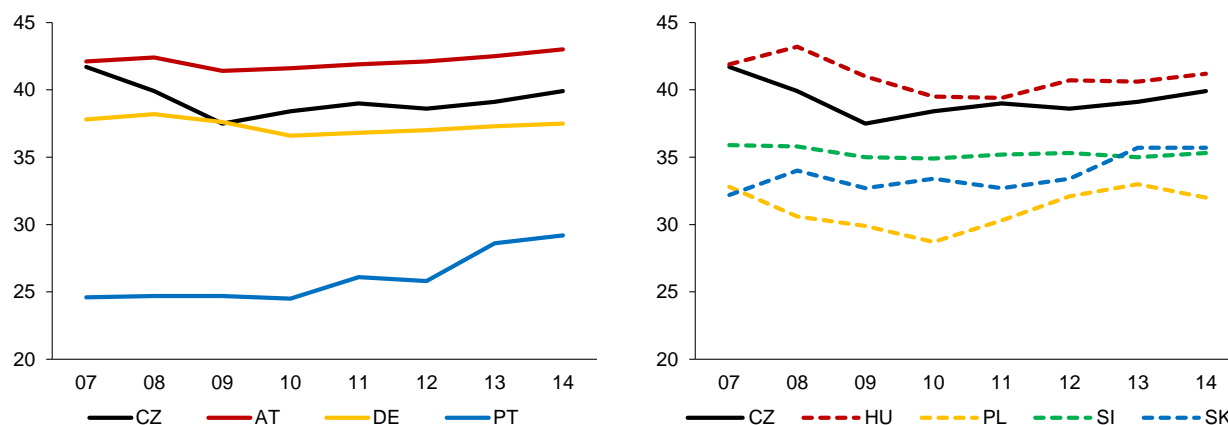
Chart 45: Components of labour taxation in 2016

(% of the average wage)



Source: OECD (2017).

The real tax burden, i.e. aggregate tax revenues (including social security and health insurance contributions) as a percentage of total compensation of employees, is described by **implicit tax rates** (see Chart 46). Until 2007, the implicit labour taxation rate in the Czech Republic was the highest of all the countries under review, but in 2008 and 2009 it decreased substantially to approximately the German level. This decrease was due to a change in the tax system (a shift to a flat income tax rate calculated from the "super-gross wage") in 2008 and to a reduction in health and social insurance rates and the introduction of a maximum assessment base for both types of insurance in 2009. Since 2010, however, the implicit tax burden has been increasing again (reaching almost 40% in 2014) and is thus higher than in most of the countries under review.

Chart 46: Implicit labour taxation rates (%)

Note: The implicit taxation rate expresses aggregate tax revenues including social security and health insurance contributions (related to the costs of the production factor of labour) as a percentage of total compensation of employees. More recent data are not available.

Source: Eurostat (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 seek or enter employment.

Several changes affecting the incentive to work were made in 2016. Unemployment benefit in the event of termination of an employment contract by an employee was increased to 65% of the previous net wage for the first two months, then for the next two months it is 50% of the net wage, and then 45% till the end of the support period.¹⁰¹ When an employment contract is terminated in agreement, the unemployment benefit remains at the 2015 level, i.e. 45% over the entire support period. Additional income, even from “non-clashing” employment, is still prohibited. This is aimed at increasing the incentive to seek “proper” work.

The tax discounts for dependent children were also revised in 2016. The discount remained unchanged for the first child, but was increased for the second, third and subsequent child.¹⁰² By contrast, no changes were made in 2016 to the minimum living level and the minimum subsistence level affecting claims for some other social benefits (child allowance, maternity allowance and social assistance benefits).

Looking at the labour market in 2016, however, the above changes, which are mostly reducing the incentive to work, have been overshadowed by a considerable expansion in economic activity, related growth in demand for labour by firms and attendant growth in wages.

To sum up, the ratio of the minimum wage to the average wage in the Czech Republic has increased in recent years 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. However, this could change if the rapid upward trend in the minimum wage were to continue. Overall labour taxation in the Czech Republic is among the highest in the countries under review and is

¹⁰¹ 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.

¹⁰² The tax discount for the first child is CZK 13,404; for the second child it rose from CZK 15,804 to CZK 17,004 and for the third and any subsequent child it went up from CZK 17,004 to CZK 20,604.

continuing to rise gradually, but is still substantially lower than in Germany and Austria. Implicit labour taxation in the Czech Republic is also relatively high. The changes in the configuration of taxes and benefits are generally reducing the incentive to work. Last year, however, they were outweighed by continued growth in demand for labour and attendant growth in wages in an upward phase of the business cycle.

Box 5: Wage rigidity 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 labour costs and in other ways, such as by changing employee numbers or working hours. Revised results from a survey European firms carried out in 2014¹⁰³ reveal that in 2013, 71.8% of euro area firms provided performance related 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). In the Czech Republic, performance related 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 the total wage bill of all firms). The use of flexible wage components by Czech firms was therefore above the euro area average, suggesting greater potential for labour cost adjustment if asymmetric shocks occur in a situation of rigid base wages.

Firms exposed to adverse shocks in 2010–2013, i.e. to a decline in demand for their products or services or in the ability of customers to pay and meet contractual terms, adjusted their total wage bill by cutting base wages, bonuses and benefits, employee numbers, working hours and other components (see Table B4). In most of the countries under review, firms most often responded to adverse shocks by reducing the number of permanent employees (45.9% of firms in the Czech Republic; euro area average 33.8%); cutting wages (base wages and flexible wage components) was used less frequently. This attests to overall downward rigidity.¹⁰⁴ The Czech Republic recorded an above-average decrease in base wages (12.9% of firms; euro area average 7.5%) and particularly in bonuses and benefits (32.4% of firms; euro area average 17.9%) in the period under review. This was aided by the aforementioned above-average share of flexible wage components in the total wage bill.

¹⁰³ 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. See also the 2015 and 2016 Alignment Analyses.

¹⁰⁴ Babecký, Galuščák and Žigraiová (2017) analyse the mechanisms of the state dependence of wage setting in more detail and find that due to wage rigidities, Czech firms relied more on reducing the number of employees than on cutting wages even during the strongest downturn in economic activity in 2010–2013. However, wage rigidity was lower in firms in good financial condition, large firms and foreign-owned firms.

Table B4: Use of labour cost adjustment channels in firms that experienced a decline in demand or in customers' ability to pay during 2010–2013

	Share of firms (%) having cut:						
	Base components of wages	Flexible components of wages	Permanent workers	Temporary workers	Agency workers	Working hours	Other components of labour costs
CZ	12,9	32,4	45,9	18,5	10,2	18,1	17,4
AT	1,7	6,1	26,2	33,9	12,5	41,1	3,5
DE	4,5	7,0	16,2	21,8	20,9	19,0	27,8
PT	11,4	26,5	39,7	27,7	15,4	11,2	-
HU	9,2	28,8	32,9	7,6	7,8	18,5	26,2
PL	7,3	11,4	27,4	39,6	13,0	22,2	30,8
SI	20,3	37,1	42,2	22,5	14,0	18,0	-
SK	6,1	20,6	44,6	15,6	7,2	23,8	26,7
EA	7,5	17,9	33,8	22,4	18,7	18,2	33,5

Note: The figures are weighted by the number of employees. Cutting of individual items: at least once in 2010–2013.

A follow-up regression analysis examined the extent to which European firms use flexible wage components as an adjustment channel in response to adverse shocks.¹⁰⁵ The main finding is that firms affected by wage rigidities that preclude adjustment of base wages rely to a larger extent on cutting flexible wage components when they need to reduce their total wage bill. Flexible wage components are thus used as way of overcoming base wage rigidity. Even in situations where firms are able to adjust base wages, flexible wage components respond faster and more strongly to adverse shocks than base wages. Flexible wage components thus contribute significantly to increasing overall wage flexibility.

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, lower product market flexibility has a negative impact on job creation and employment¹⁰⁶ and limits adjustment mechanisms in the event of an asymmetric shock.

In an assessment of the conditions for doing business compiled every year by the World Bank and published in *Doing Business*, the Czech Republic ranked 30th out of the total of 190 countries assessed in 2017, down three places compared to a year earlier. A deterioration was recorded above all in getting credit, protecting minority investors and enforcing contracts.¹⁰⁷ The process of issuing construction permits also remains problematic – the Czech Republic scored worst in this area out of all the areas under review.¹⁰⁸ The year-on-year deterioration in business conditions was also due to the duty to submit VAT control statements introduced last

¹⁰⁵ See Babecký et al. (2017).

¹⁰⁶ Nicoletti and Scarpetta (2004).

¹⁰⁷ However, the deterioration in getting credit is due mainly to an improvement in the other countries under review amid broadly unchanged conditions in the Czech Republic.

¹⁰⁸ The Czech Republic ranked 127th as regards the administrative difficulty and cost of dealing with construction permits. This has long been one of its worst-scored *Doing Business* areas. The complicated process of issuing construction permits also limits the supply of new projects on the property market, which, in turn, is increasing housing price growth given the current rapidly rising household demand.

year, which increased the administrative tax burden on businesses. In the area of starting a business, a decrease in the costs of starting a limited liability company received a positive assessment.¹⁰⁹ However, the resulting score in this area is lowered in particular by a need for a higher number of procedures and hours (at the Trade Licensing Office and the Commercial Register). Overall, the Czech Republic's position in terms of conditions for starting a business remains unchanged in the middle of the group of countries under review (see Table 27). The Czech Republic has long been in a considerably better position in its score for closing a business (comparable with Austria and Poland in 2017), surpassing some other Central European countries such as Slovakia and Hungary.

Table 27: Conditions for starting and closing a business

	Starting a business						Closing a business					
	2012	2013	2014	2015	2016	2017	2012	2013	2014	2015	2016	2017
CZ	140	110	90	88	81	81	35	20	20	22	26	25
AT	133	113	101	106	111	118	12	16	16	18	20	23
DE	104	103	110	107	114	113	19	3	3	3	3	4
PT	25	10	10	31	32	48	22	11	9	8	7	15
HU	54	24	56	55	75	79	69	64	64	63	63	62
PL	124	80	80	102	107	120	37	30	31	33	27	22
SI	33	14	14	45	49	46	41	39	41	12	12	10
SK	80	83	71	64	68	83	38	28	30	34	35	42

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 country rankings include subsequent data revisions (more information can be found at <http://www.doingbusiness.org/methodology/methodology-note>).

Source: World Bank (2017).

Another view of 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 that influence a country's competitiveness and hence also its productivity and economic level (the three categories are basic requirements, efficiency enhancers and innovation and sophistication factors). There is a clear correlation between a country's economic level (as measured by GDP) and the index value (a higher index value means higher competitiveness).¹¹⁰ The Czech Republic ranks 31st out of 137 countries in the most recent assessment for the period 2017–2018.¹¹¹

Looking at the category of basic requirements for growth for the sample of countries in the period 2017–2018 (see Chart 47), the Czech Republic is in a relatively good position in the health and macroeconomic environment pillars. As regards factors influencing efficiency, the Czech Republic has relatively good scores for education, technological readiness and financial market development. In innovation, it lags well behind Austria and Germany, which top the world rankings, and also just behind Portugal and Slovenia. Quality of institutions remains a weakness. It is close to the average for the sample of countries under review, but worldwide the Czech Republic ranked down in 52nd place for this parameter. Within this pillar, the Czech Republic scores particularly poorly in burden of government regulation, public trust in politicians, favouritism in decisions of government officials and diversion of public funds.

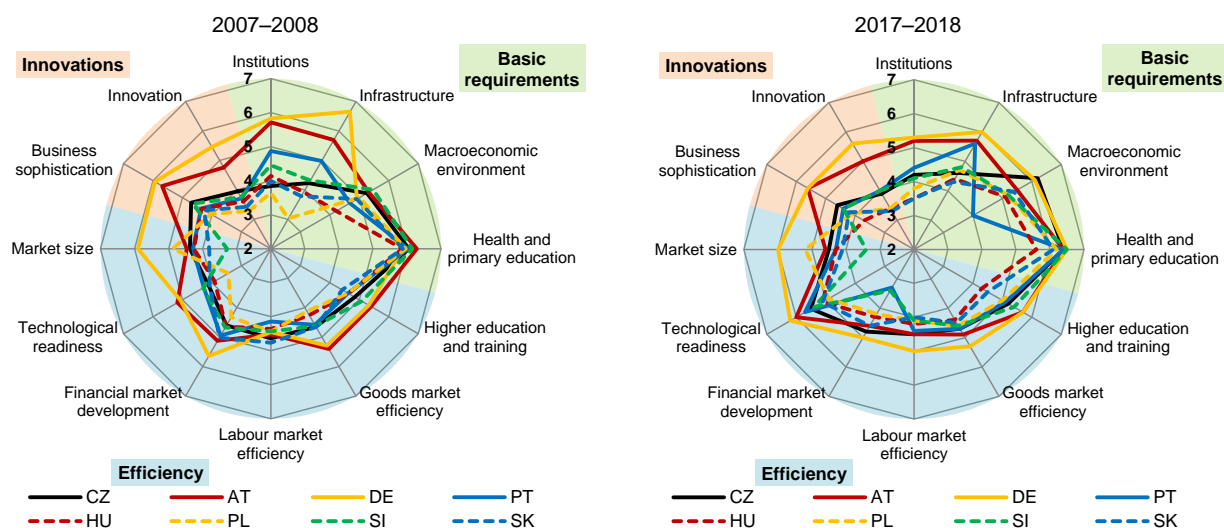
¹⁰⁹ In particular a decline in notarial and court fees.

¹¹⁰ The GCI takes values ranging from 1 to 7. The GCI calculation methodology is described in the current edition of the report at <https://www.weforum.org/reports/the-global-competitiveness-report-2017-2018> and briefly also in the *Methodological Part* of this document.

¹¹¹ In the period 2007–2008 the Czech Republic ranked 33rd out of 131 countries. Last year it ranked 31st out of 138.

Compared to the period 2007–2008, the Czech Republic's absolute ranking improved most of all in technological readiness and quality of the macroeconomic environment, but worsened in labour market efficiency, business sophistication and innovation. However, similar changes were recorded for other countries, so the Czech Republic's relative position was unchanged.

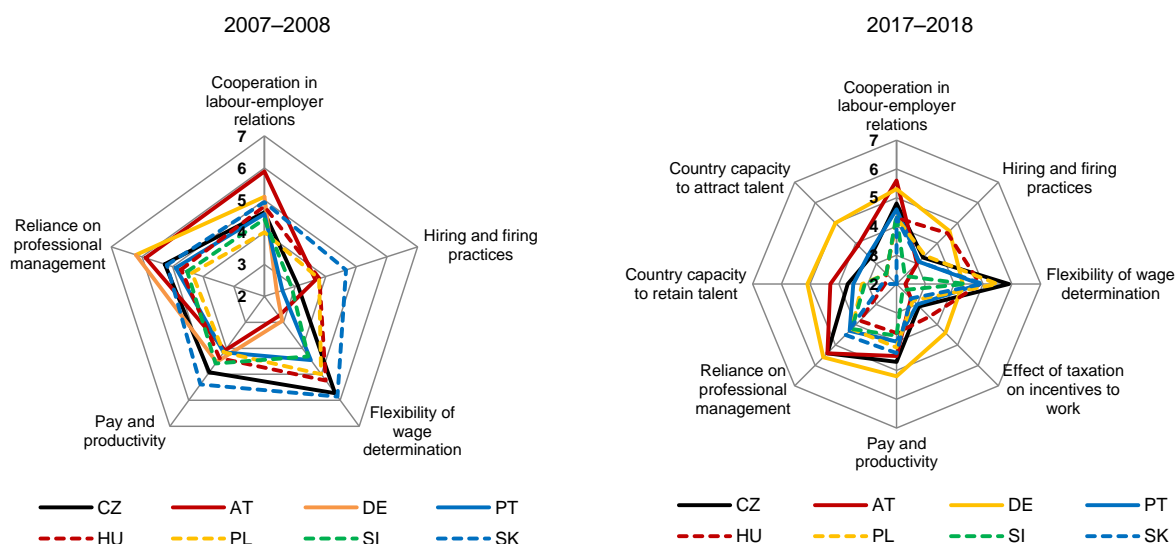
Chart 47: Global Competitiveness Index – scores by pillars and their categories



Note: The GCI takes values ranging from 1 to 7, where a higher index value means higher competitiveness in the relevant area.

Source: World Economic Forum (2007, 2017).

Chart 48: Global Competitiveness Index – labour market scores



Note: The GCI takes values ranging from 1 to 7, where a higher index value means higher competitiveness in the relevant area.

Source: World Economic Forum (2007, 2017).

International competitiveness on the labour market can be compared within the GCI by looking at the individual indicators in the **labour market pillar** (see Chart 48). Of the countries under comparison, the Czech Republic has long been among the most flexible in wage bargaining and pay and productivity. To a large extent the same is true for labour-employer relations. All

those categories are crucial as regards inflationary pressures and monetary policy implementation. 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 in the Czech Republic by relatively high redundancy costs and by a low score for female participation in the labour force – the second-lowest among the countries under comparison behind Slovakia.¹¹² Higher labour taxation, which leads to lower labour force motivation, is also a limiting factor.

2.4 THE BANKING SECTOR AND ITS SHOCK-ABSORBING CAPACITY

The **condition of the financial sector** of an economy plays an important role in its ability to absorb economic shocks. In particular, stability of the banking sector, which accounts for 77% of the total assets of Czech financial institutions (except the CNB), is of key importance in the Czech Republic. The Czech banking sector maintains high profitability, a good liquidity position and favourable capitalisation and hence a high level of resilience to potential adverse shocks. It could therefore perform its adjustment and stabilisation mechanism function in the event of euro adoption.

However, certain risks are linked with the implementation of the banking union project, which the Czech Republic would automatically join upon euro adoption. They consist in 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 also join the Single Resolution Mechanism (SRM) and contribute to the Single Resolution Fund (SRF),¹¹³ whose effectiveness will only be tested by a potential future financial crisis.

The Czech banking sector remains profitable even in the persisting environment of exceptionally low interest rates.¹¹⁴ Its **profitability**, as measured by return on capital and return on assets, has significantly exceeded the euro area average over a long time (see Chart 49 and Chart 50).¹¹⁵ The profit of the Czech banking sector consists mainly of stable components such as interest rate income and fee and commission income. It is favourably affected, among other factors, by high operational efficiency (in 2016 the cost-to-income ratio was 44.6% in the Czech Republic, as compared to 69.4% in the euro area).¹¹⁶

¹¹² These two indicators are not included in Chart 2 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).

¹¹³ Domestic 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.

¹¹⁴ Last year, the profit of domestic banks rose by 12.4% year on year, owing largely to profit from the sale of a share in VISA Europe. Adjusted for this one-off factor, the year-on-year growth in profit was 4%.

¹¹⁵ 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.

¹¹⁶ Source: EBA Risk Dashboard. The profitability of the Hungarian and Slovenian banking sectors rose sharply in 2016. This was linked with the fading of the acute phase of bank distress in those countries. In both cases, however, the state was heavily involved in the resolution process.

Chart 49: Return on equity (RoE) (%)

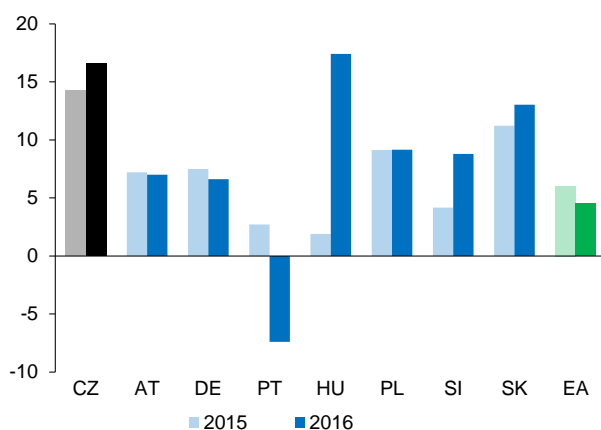
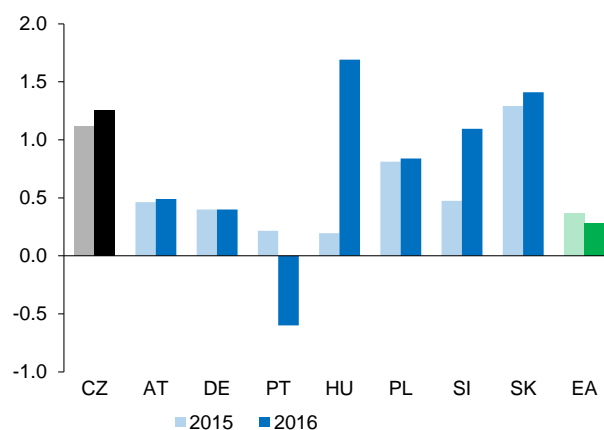


Chart 50: Return on assets (RoA) (%)



Note: EA represents the GDP-weighted average of the euro area member countries. The large increase in profitability indicators between 2015 and 2016 in the case of Hungary is due to non-performing loan write-offs in several significant institutions in the second half of 2015 and to the positive effect of one-off items in 2016. By contrast, the fall of the Portuguese banking sector into loss in 2016 is due to the identification of bad loans and subsequent provisioning and to one-off effects.

Source: IMF FSI, Deutsche Bundesbank.

In 2016, the quality of the Czech banking sector's credit portfolio improved and **credit risk**, as expressed by the ratio of non-performing loans (NPLs) to total loans, fell to 4.6%, i.e. towards record-low values. A decline in NPL ratios is also observed in most of the other countries under review (see Table 28).¹¹⁷

The resilience of the Czech banking sector to adverse shocks is based on strong **capitalisation** (see Chart 51), consisting mainly of retained earnings. The capital ratio of the Czech banking sector on a consolidated basis was flat at 16.7% in 2016, while the euro area capital ratio rose by 0.5 pp year on year to 17.5%. However, the leverage ratio¹¹⁸ of the Czech banking sector (7.6%) is above the euro area average (6.5%). In addition, Czech banks hold a larger part of their capital in the form of Common Equity Tier 1, i.e. the highest-quality component, by comparison with the euro area (16.2% in the Czech Republic compared to 15.0% in the euro area).¹¹⁹ Thanks to their sufficient capitalisation and operating profits, Czech banks should be able to withstand potential large credit losses, as also evidenced by the latest banking sector macro stress tests published in Financial Stability Report 2016/2017.

¹¹⁷ Only in Portugal is this share increasing further. [ESRB \(2017\)](#) discusses macroprudential risks associated with a high NPL ratio and ways of resolving NPLs.

¹¹⁸ The leverage ratio is the ratio of capital to non-risk-weighted exposures. The figures in the text illustrate capital relative to total assets only, i.e. excluding selected off-balance-sheet items.

¹¹⁹ The dominant components of Tier 1 are equity capital, retained earnings and mandatory reserve funds.

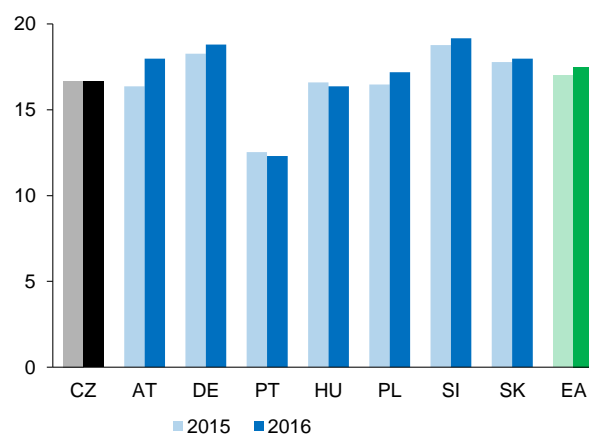
Table 28: Non-performing loans
(% of total bank loans)

	2014	2015	2016
CZ	5.6	5.5	4.6
AT	3.5	3.4	2.7
DE	2.3	2.0	1.7
PT	11.9	11.9	17.2
HU	15.6	11.7	7.4
PL	4.8	4.3	4.0
SI	11.7	10.0	5.1
SK	5.3	4.9	4.4
EA	7.3	6.8	6.5

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

Source: IMF FSI, CNB, Deutsche Bundesbank.

Chart 51: Capital ratios (%)

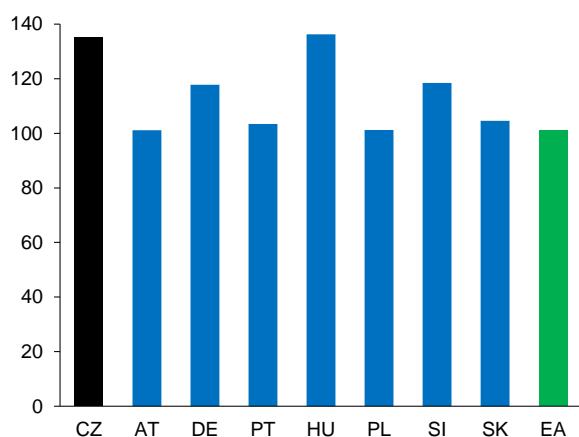


Note: The capital ratio is the ratio of a bank's capital to its risk-weighted assets. EA represents the GDP-weighted average of the euro area member countries.

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 135%, which, despite a year-on-year drop of 3 pp, is the highest figure among all the countries under review together with Hungary (see Chart 52). Deposits by residents in the domestic currency account for 86% of total deposits; loans to residents in the domestic currency make up roughly 78% of total loans.

The **net external position** of the Czech banking sector has declined by 7.6 pp year on year to -7.5% of GDP (see Chart 53). This was due mainly to a rise in koruna deposits of non-residents at domestic banks linked with expected appreciation of the koruna following the exit from the exchange rate commitment, which led to an inflow of capital from abroad. Domestic banks then deposited the funds obtained from the conversion of this capital into koruna at the CNB, so this phenomenon does not imply increased risks.

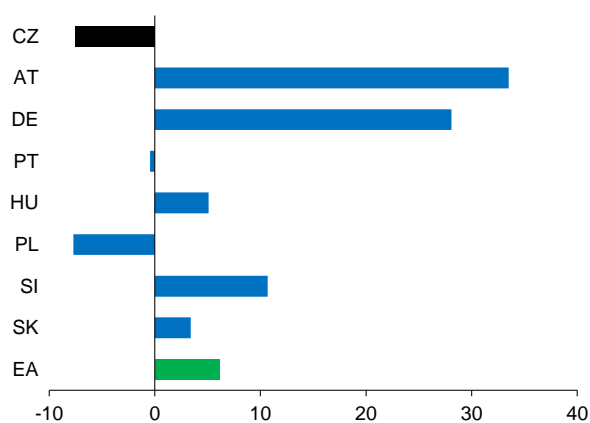
Chart 52: Ratios of deposits to loans in selected EU countries (%)

Note: Data as at the end of 2016; deposits/loans to residents. EA represents the euro area.

Source: ECB, national central banks.

Chart 53: Net external positions of banking sectors

(net external assets in % of GDP, 2016)



Source: IMF IFS, central banks.

To sum up, the resilience of the Czech banking sector to adverse shocks is high by international comparison. An excess of loans over deposits and low private sector indebtedness by international comparison preserve room for banks to further expand their lending while maintaining sufficiently high liquid assets. The link of domestic banks to the euro area banking sector is due mainly to the foreign ownership structure of the domestic banking sector.¹²⁰ The risks to the Czech banking sector are linked mainly with a further upward shift of the domestic economy in the growth phase of the financial cycle. The biggest risk to the Czech banking sector is that of a continued spiral between property prices and property purchase loans. For the European banking sector, there are persisting risks related to credit portfolio quality and to the environment of exceptionally low interest rates, which are squeezing the profitability of financial institutions.¹²¹

¹²⁰ At the end of 2016, foreign owners directly or indirectly controlled 93.1% of the Czech banking sector's assets.

¹²¹ [ESRB \(2016\)](#) discusses the impacts of low interest rates on financial stability and gives a series of policy options to mitigate the risks that have been identified.

F THEORETICAL FOUNDATIONS OF THE ANALYSES

This section briefly summarises the foundations of the analyses contained in this document and updates the detailed description of those theoretical foundations published in previous issues of the Alignment Analyses. The basic theoretical starting point is the **theory of optimum currency areas**,¹²² 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.¹²³ 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.

Economists agree on the general set of fundamental **costs and benefits of introducing a single currency**, but the significance of the individual arguments may change over time or depending on the specific features of the economies concerned. The benefits include reduced international trade costs, 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. The costs include non-recurring ones stemming from the change of legal tender and long-term ones due to the risk of greater volatility in economic activity and consumption as a result of the loss of independent monetary policy and to a reduction in the effectiveness of domestic macroeconomic policy. The size of these costs depends, among other things, 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.¹²⁴

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. The latest empirical studies confirm that the introduction of the single currency has a positive effect on international trade.¹²⁵

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**.¹²⁶ The traditional optimum currency area criteria therefore also include similar economic structure and economic shocks, a similar inflation rate, stable terms

¹²² 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).

¹²³ In addition to economic arguments, the decision to adopt the euro is motivated by political and social demand, as analysed, for example, in Eichengreen (2008) and Spolaore (2013).

¹²⁴ For EU members planning to join the euro area, another possible cost is fulfilment of the Maastricht criteria, especially the price stability criterion. Another potential cost for converging countries is a persisting inflation differential (Brůha and Podpiera, 2007), which may be reflected in a fall in real rates and thus have a temporary destabilising effect on the economy. Examples for individual countries can be found in Martin (2010), Hampl and Skořepa (2011) and Lin and Treichel (2012).

¹²⁵ 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. However, later studies – 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%. By contrast, the latest studies return to positive but somewhat lower estimates – see, for example, Glick and Rose (2016) and Rose (2016). Furthermore, Bergin and Lin (2012) present evidence that the effects of the single currency on trade may be visible before euro adoption and the effect of the single currency on trade is underestimated if this effect is not taken into account in empirical studies.

¹²⁶ De Grauwe and Mongelli (2005).

of trade, mobility of labour and other production factors, price and wage flexibility, and fiscal and political integration.¹²⁷

An important – albeit not generally accepted – role in the theory of optimum currency areas is played by the **endogeneity hypothesis**,¹²⁸ which holds that changes leading to an optimum currency area will be an automatic result of the very introduction of the single currency. However, 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.¹²⁹ 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. Stronger trade integration may result in greater alignment of business cycles.¹³⁰

Business cycle alignment and similarity of shocks have been the subject of many empirical studies. Most studies analysing the pre-crisis period have found that the similarity of shocks was increasing in the euro area and that business cycles were becoming more aligned.¹³¹ Some studies covering the period 2008–2012 find divergence in the alignment of business cycles between the core and the periphery of the euro area, while the alignment of the core increased even during the crisis.¹³² The latest studies again confirm a continued trend of business cycle convergence even for the period covering the crisis and find that the euro area has shifted to a new equilibrium with less misalignment of business cycles compared to both historical data and other OECD countries.¹³³

Existing research of the **determinants of business cycle alignment** in the euro area supports the conclusion that trade aligns business cycles while differences in labour market regulation act in the opposite direction¹³⁴ and that trade increases the synchronisation of cycles and differences in fiscal and structural policies conversely reduce their alignment.¹³⁵ A further deepening of coordination of structural policies across countries is therefore important for greater alignment of business cycles in the euro area.¹³⁶

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.¹³⁷ 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 increases. For example, a simulation of the costs of euro adoption in Central European countries using a DSGE model 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

¹²⁷ Some papers add to the traditional criteria democratic legitimacy and economic agents' trust in central institutions and their policies – see Mongelli (2013).

¹²⁸ Frankel and Rose (1998).

¹²⁹ Krugman (1993) and Kalemli-Ozcan et al. (2003).

¹³⁰ Frankel and Rose (1997). De Grauwe and Ji (2016) describe this effect in a structural macroeconomic model.

¹³¹ See, for example, Babetskii (2005) and Stavrev (2008).

¹³² For example, Campos and Macchiarelli (2016).

¹³³ For example, Crespo-Cuaresma and Fernandez-Amador (2013), Gächter and Riedl (2014) and Bandrés et al. (2017).

¹³⁴ Duran and Ferreira-Lopes (2015).

¹³⁵ Inklaar et al. (2008).

¹³⁶ Lukmanova and Tondl (2017).

¹³⁷ For example, 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.

large significance of domestic demand shocks (e.g. government consumption).¹³⁸ An ex-post empirical study confirms the general conclusions of structural models.¹³⁹

The **impacts of euro adoption in the transition phase**, which 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, are also important.¹⁴⁰

A significant body of literature critically examines the experience of the euro area during the crisis with regard to the importance of the **efficient operation of institutions**.¹⁴¹ Studies point out that the main problem in the euro area during the crisis was weak political integration.¹⁴² In addition, studies show that fiscal rules can only be effective if there is an institution to enforce them, even though that institution does not have to be a full fiscal union.¹⁴³ Differences in indebtedness across countries and ineffective fiscal coordination are reflected in government bond yields, which may lead to differences in credit conditions across euro area countries.¹⁴⁴ On the other hand, some studies argue that the euro area may be functioning and beneficial to all members even without a fiscal union, but only provided that rescue mechanisms are introduced within the banking union.¹⁴⁵ However, 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.¹⁴⁶

¹³⁸ Ferreira-Lopes (2014).

¹³⁹ Gomis-Porqueras and Puzello (2015).

¹⁴⁰ 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, Ireland and Portugal by El-Shagi et al. (2016), 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.

¹⁴¹ For example, De Grauwe 2010a,b.

¹⁴² Razin and Rosefield (2012).

¹⁴³ Wyplosz (2015).

¹⁴⁴ Arnold and van Ewijk (2014).

¹⁴⁵ Mongelli (2013). 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.

¹⁴⁶ Podpiera et al. (2015).

G METHODOLOGICAL PART

C Economic alignment of euro area countries

The economic alignment of the euro area countries was analysed using simple descriptive statistics of macroeconomic fundamentals. The individual descriptive statistics were calculated across countries, i.e. with no weight adjustment for the size of the given economy or the population of the given country. In addition to unweighted values, the charts show values for the euro area as a whole.

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

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

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

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

Box 1: Structural cohesion of euro area countries from the perspective of the indicators used in the Macroeconomic Imbalance Procedure

List of main indicators used in the Macroeconomic Imbalance Procedure

		Threshold
External imbalances and competitiveness		
Current account balance	Three-year average, % of GDP	-4/6%
Net international investment position	% of GDP	-35%
Real effective exchange rate	42 trading partners, GDP deflator (three-year % change)	±5%
Export market share	% of world exports, five-year % change	-6%
Nominal unit labour cost index	2010=100, three-year % change	9%
Internal imbalances		
House price index	2010=100, deflated, one-year % change	6%
Private sector credit flow	Consolidated, % of GDP	25%
Private sector debt	Consolidated, % of GDP	133%
General government gross debt	% of GDP	60%
Unemployment rate	Three-year average	10%
Total financial sector liabilities	Non-consolidated, one-year % change	16.5%

New employment indicators		
Activity rate	% of total population aged 15–64 (three-year change in pp)	-0.2%
Long-term unemployment rate	% of active population aged 15–74 (three-year change in pp)	0.5%
Youth unemployment rate	% of active population aged 15–24 (three-year change in pp)	0.2%

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 wage level data are taken from the European Commission’s AMECO database (indicator “Nominal compensation per employee: total economy”) in both euro and PPS. 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 2007–2016.

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:

$$P_{C,it} = 22.58 + 0.79 GDP_{PPS,it} + 0.92 AR(1)_{it}$$

where $P_{C,it}$ is the price level of final consumption of households in country i in year t , $GDP_{PPS,it}$ is its gross domestic product at purchasing power parity per capita (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 cross-sectional fixed effects, which enable us to account for price level differences due to other structural country-specific characteristics not directly specified by the model. The estimate is as follows:

$$P_{C,it} = 61.39 + FE_i + 0.31 GDP_{PPS,it} + 0.69 AR(1)_{it}$$

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 equilibrium pace of real exchange rate movements for individual countries take as their starting point the estimates of GDP and the price level for 2017. These are based on European Commission and Eurostat forecasts for real GDP growth, inflation and, as appropriate, the nominal exchange rates of their national currencies against the euro 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 2016. It is therefore assumed for converging economies that their other, unspecified characteristics will converge towards the advanced euro area countries in parallel with convergence of GDP.¹⁴⁷

Real interest rates are derived from three-month money market interest rates. The average annual level of nominal 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 0.5%.¹⁴⁸ 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.

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:

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

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 a half and eight years long are considered most frequently. **Dynamic correlation**,¹⁴⁹ 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

¹⁴⁷ Convergence of GDP per capita at purchasing power parity of 1 pp will increase the estimated fixed effect of the country by 0.47 pp (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 pp is 0.78 (0.31 + 0.47) pp, i.e. it is similar as in Model I.

¹⁴⁸ Compared to previous issues of the Alignment Analyses (as well as the assumptions of the CNB's forecasts), this assumption has been lowered by one percentage point owing to increasing empirical evidence of a marked decline in the euro area equilibrium real interest rate.

¹⁴⁹ Croux, Forni and Reichlin (2001).

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 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.¹⁵⁰

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

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

¹⁵⁰ 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:

$$SL = \sum_{i=1}^n \sqrt{(sh_A^i - sh_B^i)^2 \cdot \left(\frac{sh_B^i}{100}\right)}. \text{ A similar approach is used, for example, in Landesmann (2000).}$$

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 $SL/100$.¹⁵¹ The modified coefficient takes values in the range $[0, 1]$. The closer the coefficient is to zero, the more similar in structure are the economies.

1.1.4 Interest rate convergence, analysis of exchange rate volatility and exchange rate alignment

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.¹⁵² Datastream data based on central bank data (three-month interbank market rates) and Eurostat data (ten-year government bonds) were used to measure the interest rate differentials between three-month and ten-year rates in the euro area and these countries.

The time series start in January 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.

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.¹⁵³ 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.

$$^{151} SL = \sum_{i=1}^n \sqrt{\left(I_{sh_A^i} \cdot 100 - I_{sh_B^i} \cdot 100 \right)^2 \cdot \left(\frac{I_{sh_A^i} \cdot 100}{100} \right)} = 100 \sum_{i=1}^n \sqrt{\left(I_{sh_A^i} - I_{sh_B^i} \right)^2 \cdot I_{sh_A^i}} = 100 \cdot I_{SL}$$

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

¹⁵² 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.

¹⁵³ The same method is used in Castrén and Mazzotta (2005).

The correlation coefficient is based on a covariance matrix obtained using a GARCH estimate¹⁵⁴ 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.

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 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.

1.1.5 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

¹⁵⁴ The bivariate BEKK GARCH specification is used; see Engle and Kroner (1995).

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,¹⁵⁵ 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.¹⁵⁶

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.

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 2010 methodology. In line with national accounting, a unified

¹⁵⁵ This is particularly so in SITC 7 (Machinery and transport equipment).

¹⁵⁶ The simplest calculation of the Gruber-Lloyd index, using SITC 1, is based on ten categories.

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 six 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.

The **Landesmann structural coefficient** method is used to assess the structural similarity of the balance sheets of individual sectors (see section 1.1.4 for more methodological details). The coefficient is calculated by comparing the shares of individual financial instruments on the asset side of the household balance sheet in the total assets of this sector. In the case of non-financial corporations, assets are replaced by liabilities. The side of the balance sheet that better characterises the sector's activity and is more important to it is therefore used for each sector. Country A (i.e. all the countries in the sample except the euro area) is compared to country B (i.e. the EA). The coefficient takes values in the range $[0, 1]$. The closer the coefficient is to zero, the more similar in structure are the economies.

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 period. 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 2007 Q1 to 2017 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

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

where π_t is inflation observed at time t . The sum of autoregression coefficients is defined as

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

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).¹⁵⁷ The concept of beta-convergence enables identification of the speed at which differences in yields are eliminated on individual financial markets (selected against the benchmark). A negative beta coefficient signals the existence of convergence. The closer the value of the beta coefficient is to -1, the higher is the speed of convergence. To quantify beta-convergence, common regression analysis or the panel estimation method is applied (as in Babetskii et. al., 2007), in the form of the equation:

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

where $R_{i,t} = Y_{i,t} - Y_{i,t}^B$ is the difference between the asset yields of country i ¹⁵⁸ and a selected reference territory (a benchmark, B) at time t , Δ is the difference operator, α_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.¹⁵⁹ 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,¹⁶⁰ 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 $\lambda = 270,400$.

¹⁵⁷ 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).

¹⁵⁸ $Y_{i,t} = [\ln(A_{i,t}) - \ln(A_{i,t-1})]$ 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.

¹⁵⁹ For pairs of countries, the calculated values in each period are essentially equal to half the square of the yield differential.

¹⁶⁰ This occurs on the money and foreign exchange markets for countries entering the euro area on a given date.

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 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 2017. 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.

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.

Box 4: Estimate of structural unemployment using the NAIRU and correlation of the cyclical component of unemployment

The NAIRU analysis presented in the main part of the text focuses on the medium-term NAIRU concept,¹⁶¹ which defines the NAIRU as the equilibrium unemployment rate consistent with a position of the real economy in the business cycle that creates no inflation or deflation pressures. A small semi-structural gap model¹⁶² is used to estimate the NAIRU, and unobserved variables are identified using the Kalman filter.¹⁶³

¹⁶¹ 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.

¹⁶² The model consists of the Phillips curve for several price categories, Okun's law, the IS curve, uncovered interest parity and a forward-looking Taylor-type interest rate rule. It uses forward-looking model-consistent expectations of economic agents.

¹⁶³ Richardson et al., 2000; Szeto and Guy, 2004.

The NAIRU estimate is based on Okun's law, which is described by the following equation:

$$u_t^{gap} = \alpha \cdot u_{t-1}^{gap} + \beta \cdot y_t^{gap} + \varepsilon_t \quad \varepsilon_t \sim N(0, \sigma_\varepsilon^2)$$

$$\varepsilon_t \sim N(0, \sigma_\varepsilon^2)$$

where:

$$u_t^{gap} = u_t - u_t^*$$

$$y_t^{gap} = y_t - y_t^*$$

Okun's law is based on the empirically observed link between the unemployment gap u_t^{gap} (the percentage gap between the observed unemployment rate u_t and the NAIRU u_t^*) and the output gap y_t^{gap} (the percentage gap between observed output y_t and potential output y_t^*). The unemployment gap shows a high degree of persistence in many countries. This is taken into account by including the lagged member u_{t-1}^{gap} in the Okun's law equation.

The NAIRU, u_t^* , is modelled as an AR(1) process with a mean estimated using historical data and a structural shock to the NAIRU, $\varepsilon_t^{u^*}$:

$$u_t^* = \gamma u_{t-1}^* + (1 - \gamma)\sigma + \varepsilon_t^{u^*}$$

where σ is the steady-state NAIRU, i.e. the average for 2011–2016.

The equation parameters for the unemployment gap and the NAIRU are estimated by Bayesian estimation, as is the size of the standard errors of the structural shocks in these equations.

The output gap y_t^{gap} plays a key role in identifying the unemployment gap and the NAIRU. The output gap estimate is based on the link to inflation described by the Phillips curve. Inflation pressures are divided into three main determinants: pressures from the domestic economy (described by the output gap), import prices and cost shocks. The general form of the Phillips curve is as follows:

$$\pi_t = \gamma \cdot E_t \pi_{t+1} + (1 - \gamma) \cdot \pi_{t-1} + \delta \cdot y_t^{gap} + \tau \cdot q_t^{gap} + \omega_t \quad \omega_t \sim N(0, \sigma_\omega^2)$$

$$\omega_t \sim N(0, \sigma_\omega^2)$$

where:

π_t is inflation at time t , $E_t \pi_{t+1}$ is expected inflation and q_t^{gap} is the deviation of relative import prices versus the domestic price level from the equilibrium level and γ, δ and τ are parameters. After taking into account expected and past inflation, import prices (proxied by q_t^{gap}) and supply shocks ω_t to inflation, the "missing" inflation pressures in the KF are identical to the domestic demand pressures. Hence, if the model parameters are calibrated correctly, the potential output estimate is determined so that the resulting output gap "fills in" the demand-inflation pressures not taken into account so far.

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 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):

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

2.2.2 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.

2.2.3 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.

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

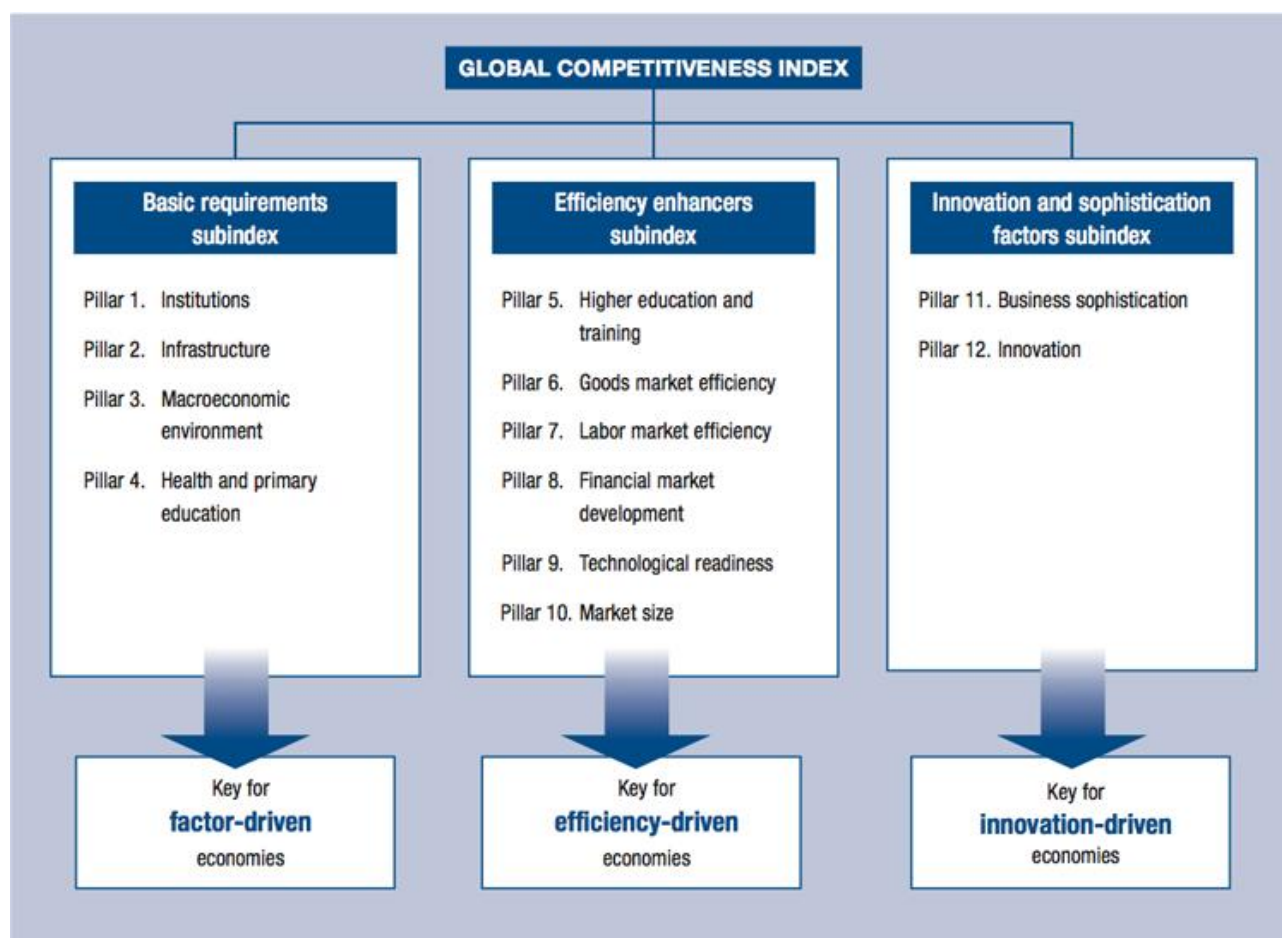
In the context of the Global Competitiveness Index (GCI), competitiveness is defined as the set of institutions, policies and factors that determine the level of productivity of a country. The productivity level determines the rates of return obtained by investments in an economy, which in turn are the fundamental drivers of its growth rates. The assessment of the importance of the GCI is based on a methodology¹⁶⁴ 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 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 capita 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.¹⁶⁵

¹⁶⁴ Robert E. Hall, Charles I. Jones, *The Productivity of Nations*, NBER (1996).

¹⁶⁵ 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/>.

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 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).

2.4 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.

The **capital ratio (%)** is the ratio of an institution's capital to its total risk exposure and indicates its ability to cover potential future losses with capital. The capital 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.

H REFERENCES

- Adam, K., Japelli, T., Menichini, A., Padula, M., Pagano, M. (2002): "Study to Analyze, Compare, and Apply Alternative Indicators and Monitoring Methodologies to Measure the Evolution of Capital Market Integration in the European Union", *European Commission*, pp. 1–5.
- Aguilar, J., Hördahl, P. (1998): "Exchange Rates and Currency Options as EMU Indicators", *Sveriges Riksbank Quarterly Review*, 2, pp. 58–81.
- Ahrend, R., Cournède, B., Price, R. (2008): "Monetary Policy, Market Excesses and Financial Turmoil", OECD, Economics Department Working Paper No. 597.
- Alexius, A., Post, E. (2008): "Exchange Rates and Asymmetric Shocks in Small Open Economies", *Empirical Economics*, 35(3), pp. 527–541.
- Ambriško, R., Augusta, V., Hájková, D., Král, P., Netušilová, P., Říkovský, M., Soukup, P. (2012): "Fiscal Discretion in the Czech Republic in 2001–2011: Has It Been Stabilizing?", CNB Research and Policy Note No. 1/2012.
- Anderton, R. et al. (2015): "Comparisons and Contrasts of the Impact of the Crisis on Euro Area Labour Markets", ECB Occasional Paper Series, No. 159.
- Angeloni, I., Ehrmann, M. (2004): "Euro Area Inflation Differentials", ECB Working Paper No. 388.
- Aristei, D., Gallo, M. (2012): "Interest Rate Pass-Through in the Euro Area during the Financial Crisis: A Multivariate Regime-Switching Approach", *Quaderni Del Dipartimento Di Economia, Finanza E Statistica* No. 107, University of Perugia.
- Arnold, I., Van Ewijk, S. (2014): "A State Space Approach to Measuring the Impact of Sovereign and Credit Risk on Interest Rate Convergence in the Euro Area", *Journal of International Money and Finance*, 49(PB), pp. 340–357.
- Audzei, V., Brazdik, F. (2015a): "Monetary Policy and Exchange Rate Dynamics: The Exchange Rate as a Shock Absorber", *Czech Journal of Economics and Finance*, 65(5), pp. 391–410.
- Audzei, V., Brazdik, F. (2015b): "Exchange Rate Dynamics and its Effect on Macroeconomic Volatility in Selected CEE Countries", CNB Working Paper No. 7/2015.
- Babecká Kucharčuková, O., Franta, M., Hájková, D., Král, P., Kubicová, I., Podpiera, A., Saxa, B. (2013): "What We Know About Monetary Policy Transmission in the Czech Republic: Collection of Empirical Results", CNB Research and Policy Note No. 1/2013.
- Babecký, J., Berson, C., Fadejeva, L., Lamo, A., Marotzke, P., Martins, F., Strzelecki, P. (2017): "Flexible Wage Components as a Source of Wage Adaptability to Shocks: Evidence from European Firms, 2010–2013", *WDN3 research project, mimeo*.
- Babecký, J., Galuščák, K., Žigraiová, D. (2015): "Labour Market Adjustment since the Global Financial Crisis: Evidence from a Survey of Czech Firms", CNB Research and Policy Note No. 1/2015.
- Babecký, J., Galuščák, K., Žigraiová, D. (2017): "Mechanisms of the State Dependence of Wage Setting: Evidence from a Survey of Czech Firms", *Eastern European Economics*, 55, pp. 342–356.
- Babetskii, I. (2005): "Trade Integration and Synchronization of Shocks: Implications for EU Enlargement", *Economics of Transition*, 13(1), pp. 105–138.
- Babetskii, I., Komárek, L., Komárková, Z. (2007): "Financial Integration of Stock Markets among New EU Member States and the Euro Area", CNB Working Paper No. 7/2007.
- Baele, L., Ferrando, A., Hördahl, P., Krylova, E., Monnet, C. (2004): "Measuring Financial Integration in the Euro Area", ECB Occasional Paper Series, No. 14.

- Baldwin, R. (2006): "In or Out: Does It Matter? An Evidence-Based Analysis of the Euro's Trade Effects", Centre for Economic Policy Research.
- Ball, L. M., D. Leigh, P. Loungani (2013): "Okun's Law: Fit at Fifty?", NBER Working Paper No. 18668, National Bureau of Economic Research.
- Bandrés, E., Gadea-Rivas, M. D., Gómez-Loicos, A. (2017): "Regional Business Cycles Across Europe", Banco de España Occasional Papers, No. 1702.
- Barigozzi, M., Conti, A. M., Luciani, M. (2014): "Do Euro Area Countries Respond Asymmetrically to the Common Monetary Policy?", *Oxford Bulletin of Economics and Statistics*, 76(5), pp. 693–714.
- Barro, R. J., Sala-I-Martin, X. (1992): "Convergence", *Journal of Political Economy*, 100, pp. 223–251.
- Barro, R. J., Sala-I-Martin, X. (1995): "Technological Diffusion, Convergence, and Growth", NBER Working Paper No. 5151, National Bureau of Economic Research.
- Bassanini, A., Duval, R. (2006): "Employment Patterns in OECD Countries: Reassessing the Role of Policies", OECD Economics Department Working Paper No. 486.
- Baum, A., Cecherita-Westphal, C., Rother, P. (2013): "Debt and Growth: New Evidence for the Euro Area", *Journal of International Money and Finance*, 32(C), pp. 809–821.
- Beckmann, J., Belke, A., Verheyen, F. (2013): "Interest Rate Pass-Through in the EMU: New Evidence from Nonlinear Cointegration Techniques for Fully Harmonized Data", *Journal of International Money and Finance*, 37(C), pp. 1–24.
- Beetsma, R., Giuliodori, M. (2010): "The Macroeconomic Costs and Benefits of the EMU and Other Monetary Unions: An Overview of Recent Research", *Journal of Economic Literature*, 48(3), pp. 603–641.
- Bergin, P. R., Glick, R., Taylor, A. M. (2006): "Productivity, Tradability, and the Long-run Price Puzzle", *Journal of Monetary Economics*, 53(8), pp. 2041–2066.
- Bergin, P. R., Lin, C.-Y. (2012): "The Dynamic Effects of a Currency Union on Trade", *Journal of International Economics*, 87(2), pp. 191–204.
- Boone, L., Maurel, M. (1999): "An Optimal Currency Area Perspective of the EU Enlargement to the CEECs", CEPR Discussion Paper No. 2119.
- Brandt, N., Burniaux, J. M., Duval, R. (2005): "Assessing the OECD Jobs Strategy: Past Developments and Reforms", OECD Economics Department Working Paper No. 429.
- Brůha, J., Podpiera, J. (2007): "Transition Economy Convergence in a Two-Country Model: Implications for Monetary Integration", ECB Working Paper No. 0740.
- Brůha, J., Podpiera, J. (2010): "Real Exchange Rates in Emerging Economies", *Economics of Transition*, 18(3), pp. 599–628.
- Brůha, J., Podpiera, J. (2011): "The Dynamics of Economic Convergence: The Role of Alternative Investment Decisions", *Journal of Economic Dynamics and Control*, 35(7), pp. 1032–1044.
- Brůha, J., Polanský, J. (2015): "Empirical Analysis of Labor Markets over Business Cycles: An International Comparison", CNB Working Paper No. 15/2015.
- Brůha, J., Tonner, J. (2016): "An Exchange Rate Floor as an Instrument of Monetary Policy: An Ex-post Assessment of the Czech Experience", CNB Working Paper No. 4/2017.
- Bubák, V., Kočenda, E., Žikeš, F. (2011): "Volatility Transmission in Emerging European Foreign Exchange Markets", *Journal of Banking & Finance*, 35(11), pp. 2829–2841.
- Campos, N. F., Macchiarelli, C. (2016): "Core and Periphery in the European Monetary Union: Bayoumi and Eichengreen 25 Years Later", *Economic Letters*, 147, pp. 127–130.

- Castrén, O., Mazzotta, S. (2005): "Foreign Exchange Rate Option and Returns Based Correlation Forecasts Evaluation and Two Applications", ECB Working Paper No. 447.
- Cavallo, A., Ribba, A. (2015): "Common Macroeconomic Shocks and Business Cycle Fluctuations in Euro Area Countries", *International Review of Economics & Finance*, 38(C), pp. 377–392.
- Cecchetti, S. G., Debelle, G. (2006): "Has the Inflation Process Changed?", *Economic Policy*, 21(46), pp. 311–352.
- Čihák, M., Holub, T. (2003): "Price Convergence to the EU: What Do the 1999 ICP Data Tell Us?", CNB Working Paper No. 2/2003.
- Čihák, M., Holub, T. (2005): "Price Convergence in EU-Accession Countries: Evidence from the International Comparison", *Économie Internationale*, 102, pp. 61–84.
- Claeys, P., Vašíček, B. (2012): "Measuring Sovereign Bond Spillover in Europe and the Impact of Rating News", CNB Working Paper No. 7/2012.
- Corsetti, G., Kuester, K., Meier, A., Müller, G. J. (2013): "Sovereign Risk, Fiscal Policy, and Macroeconomic Stability", *Economic Journal*, 0, pp. F99-F132, 02.
- Council of the EU (2013): *Statement of Eurogroup and ECOFIN Ministers of 18 December 2013*, <http://www.consilium.europa.eu/press/press-releases/2013/12/pdf/Statement-of-Eurogroup-and-ECOFIN-Ministers-on-the-SRM-backstop>.
- Council of the EU (2015): *Statement on Banking Union and Bridge Financing Arrangements for the Single Resolution Fund, 8 December 2015*, <http://www.consilium.europa.eu/en/press/press-releases/2015/12/08-statement-by-28-ministers-on-banking-union-and-bridge-financing-arrangements-to-srf/>.
- Council of the EU (2016): *Council Conclusions on a Roadmap to Complete the Banking Union, 17 June 2016*, <http://www.consilium.europa.eu/cs/press/press-releases/2016/06/17-conclusions-on-banking-union/>.
- Council of the EU (2016a): *Council Recommendation of 12 July 2016 on the 2016 National Reform Programme of the Czech Republic and Delivering a Council Opinion on the 2016 Convergence Programme of the Czech Republic*, ST 9194/16.
- Council of the EU (2016b): *Council Conclusions on a Roadmap to Complete the Banking Union, 17 June 2016*, http://www.consilium.europa.eu/press-releases-pdf/2016/6/47244642837_en.pdf.
- Crespo-Cuaresma, J., Fernández-Amador, O. (2013): "Business Cycle Convergence in EMU: A Second Look at the Second Moment", *Journal of International Money and Finance*, 37, pp. 239–259.
- Croux, C., Forni, M., Reichlin, L. (2001): "A Measure Of Comovement For Economic Variables: Theory And Empirics", *Review of Economics and Statistics*, 83(2), pp. 232–241.
- Czech National Bank (2006): *Analyses of the Czech Republic's Current Economic Alignment with the Euro Area*, December 2006.
- Czech National Bank (2009): *Analyses of the Czech Republic's Current Economic Alignment with the Euro Area*, December 2009.
- Czech National Bank (2010): *Analyses of the Czech Republic's Current Economic Alignment with the Euro Area*, December 2010.
- Czech National Bank (2011): *Analyses of the Czech Republic's Current Economic Alignment with the Euro Area*, December 2011.
- Czech National Bank (2012): *Analyses of the Czech Republic's Current Economic Alignment with the Euro Area*, December 2012.
- Czech National Bank (2013): *Analyses of the Czech Republic's Current Economic Alignment with the Euro Area*, December 2013.

- Czech National Bank (2014): *Analyses of the Czech Republic's Current Economic Alignment with the Euro Area*, December 2014.
- Czech National Bank (2015): *Analyses of the Czech Republic's Current Economic Alignment with the Euro Area*, December 2015.
- Czech National Bank (2016): *Analyses of the Czech Republic's Current Economic Alignment with the Euro Area*, December 2016.
- Czech National Bank (2017a): *Financial Stability Report 2016/2017*.
- Czech National Bank (2017b): *Inflation Report IV/2017*.
- De Grauwe, P. (2010a): "Crisis in the Eurozone and How To Deal With It", CEPS Policy Brief No. 204, Centre for European Policy Studies, Brussels.
- De Grauwe, P. (2010b): "The Financial Crisis and the Future of the Eurozone", Bruges European Economic Policy Briefings, No. 21.
- De Grauwe, P. (2013): *Economics of Monetary Union*, Ninth Edition, Oxford University Press, New York.
- De Grauwe, P., Ji, Y. (2016): "International Correlation of Business Cycles in a Behavioral Macroeconomic Model", CEPR Discussion Paper No. 11257.
- De Grauwe, P., Mongelli, P. F. (2005): "Endogeneities of Optimum Currency Areas: What Brings Countries Sharing a Single Currency Closer Together?", ECB Working Paper No. 0468.
- Dellas, H., Tavlas, G. S. (2009): "An Optimum-Currency-Area Odyssey", *Journal of International Money and Finance*, 28(7), pp. 1117–1137.
- Duran, H. E., Ferreira-Lopes, A. (2015): "Determinants of Co-movement and of Lead and Lag Behavior of Business Cycles in the Eurozone", Working Papers Series 2 15-02, ISCTE-IUL, Business Research Unit (BRU-IUL).
- Eichengreen, B. (2008): "Sui Generis EMU", *European Economy – Economic Papers* 303, Directorate General Economic and Monetary Affairs, European Commission.
- Eichengreen, B. (2009): "The Crisis and the Euro", Working Paper 23/2009, Elcano Royal Institute, Madrid.
- El-Shagi, M., Lindner, A., von Schweinitz, G. (2016): "Real Effective Exchange Rate Misalignment in the Euro Area: A Counterfactual Analysis", *Review of International Economics*, 24(1), pp. 37–66.
- Enders, Z., Jung, P., Müller, G. J., (2013): "Has the Euro Changed the Business Cycle?", *European Economic Review*, 59(C), pp. 189–211.
- Engle, R. F., Kroner, K. F. (1995): "Multivariate Simultaneous Generalized ARCH", *Econometric Theory*, 11(01), pp. 122–150.
- ESRB (2016): *Report on the Macroprudential Policy Issues Arising from Low Interest Rates and Structural Changes in the EU Financial System*, https://www.esrb.europa.eu/news/pr/date/2016/html/pr161128_1.en.html>
- ESRB (2017): *Resolving Non-performing Loans in Europe*, https://www.esrb.europa.eu/pub/pdf/reports/20170711_resolving_npl_report.en.pdf?e4c478e9cabf35b6dec49a064f01c6ed.
- European Commission (2006): *The European Economy: 2006 Review – Adjustment Dynamics in the Euro Area*, http://ec.europa.eu/economy_finance/publications/publication425_en.pdf.
- European Commission (2015a): *Proposal for a Regulation of the European Parliament and of the Council Amending Regulation (EU) 806/2014 in Order to Establish a European Deposit Insurance Scheme*, COM(2015) 586 final.
- European Commission (2015b): *The 2015 Ageing Report: Economic and Budgetary Projections for the 28 EU Member States (2013–2060)*, *European Economy* 3/2015.

- European Commission (2017a): *Statistical Annex to European Economy*, Autumn 2017.
- European Commission (2017b): *Cyclical Adjustment of Budget Balances*, Autumn 2017, Table 9A.
- Farrant, K., Peersman, G. (2006): "Is the Exchange Rate a Shock Absorber or a Source of Shocks? New Empirical Evidence", *Journal of Money, Credit and Banking*, 38(4), pp. 939–961.
- Ferreira-Lopes, A. (2010): "In or Out? The Welfare Costs of EMU Membership", *Economic Modelling*, 27(2), pp. 585–594.
- Ferreira-Lopes, A. (2014): "The Welfare Costs of the EMU for Transition Countries", *Prague Economic Papers*, 4, pp. 446–473.
- Ferroni, F., Klaus, B. (2014): "Euro Area Business Cycles in Turbulent Times: Convergence or Decoupling?", Working Paper No. 522, Banque de France.
- Flek, V., Hájek, M., Hurník, J., Prokop, L., Racková, L., Soukupová, E. (2001): "Výkonnost a struktura nabídkové strany" (Supply Side Performance and Structure), CNB Research Paper No. 27.
- Frankel, J. (2008): "Should Eastern European Countries Join the Euro? A Review and Update of Trade Estimates and Consideration of Endogenous OCA Criteria", Working Paper Series 08-059, Harvard University.
- Frankel, J. A., Rose, A. K. (1997): "Is EMU More Justifiable Ex Post Than Ex Ante?", *European Economic Review*, 41, pp. 753–760.
- Frankel, J. A., Rose, A. K. (1998): "The Endogeneity of the Optimum Currency Area Criteria", *Economic Journal*, 108(449), pp. 1009–1025.
- Franta, M., Saxa, B., Šmídková, K. (2007): "Inflation Persistence: Euro Area and New EU Member States", ECB Working Paper No. 810.
- Gächter, M., Riedl, A. (2014): "One Money, One Cycle? The EMU Experience," *Journal of Macroeconomics*, 42(C), pp. 141–155.
- Gavin M., Siedschlag, I. (2011): "Has the Euro Boosted Intra-Euro Area Exports? Evidence from Industry Data", *Review of Economics and Institutions*, 2(3).
- Georgiadis, G. (2015): "Examining Asymmetries in the Transmission of Monetary Policy in the Euro Area: Evidence from a Mixed Cross-Section Global VAR Model", *European Economic Review*, 75(C), pp. 195–215.
- Giannone, D., Lenza M., Reichlin L. (2009): "Business Cycles in the Euro Area", ECB Working Paper No. 1010.
- Giannone, D., Reichlin, L. (2006): "Trends and Cycles in the Euro Area: How Much Heterogeneity and Should We Worry About It?", ECB Working Paper No. 595.
- Glick, R., Rose, A. K. (2015): "Currency Unions and Trade: A Post-EMU Mea Culpa", NBER Working Paper No. 21535, National Bureau of Economic Research.
- Glick, R., Rose, A. K. (2016): "Currency Unions and Trade: A Post-EMU Reassessment", *European Economic Review*, 87(C), pp. 78–91.
- Gnocchi, S., Lagerborg, A., Pappa, E. (2015): "Do Labor Market Institutions Matter for Business Cycles?", *Journal of Economic Dynamics and Control*, 51(C), pp. 299–317.
- Gomis-Porqueras, P., Puzzello, L. (2015). "Winners and Losers from the Euro", Economics Series 2015_2, Deakin University, Faculty of Business and Law, School of Accounting, Economics and Finance.
- Gregg, P. (2000): "The Use of Wage Floors as Policy Tools", OECD Economic Studies No. 31.
- Hampl, M., Skořepa, M. (2011): "Long-run Equilibrium Exchange Rate Notions in Monetary Policy Strategies: The Case of the Czech National Bank", in *The Influence of External Factors*

- on *Monetary Policy Frameworks and Operations*, BIS Paper 57, pp. 155–162, Bank for International Settlements.
- Hansen, B. E. (1999): "The Grid Bootstrap and the Autoregressive Model", *Review of Economics and Statistics*, 81(4), pp. 594–607.
- Havránek, T. (2010): "Rose Effect and the Euro: Is the Magic Gone?", *Review of World Economics*, 146(2), pp. 241–261.
- Havránek, T., Iršová, Z. (2010): "Which Foreigners Are Worth Wooing? A Meta-Analysis of Vertical Spillovers from FDI", CNB Working Paper No. 3/2010.
- Havránek, T., Iršová, Z., Lešánovská, J. (2016): "Bank Efficiency and Interest Rate Pass-through: Evidence from Czech Loan Products", *Economic Modelling*, 54(C), pp. 153–169.
- Havránek, T., Rusnák, M. (2012): "Transmission Lags of Monetary Policy: A Meta-Analysis", CNB Working Paper No. 10/2012.
- Hlédik, T., Vlček, J. (2017): "The Natural Rate of Interest – The Czech Case", forthcoming Czech National Bank Working Paper .
- Hoekman, B., Djankov, S. (1996): "Intra-industry Trade, Foreign Direct Investment and Reorientation of East European Exports", CEPR Discussion Paper No. 1377.
- Horváth, R. (2005): "Exchange Rate Variability, Pressures and Optimum Currency Area Criteria: Implications for the Central and Eastern European Countries", CNB Working Paper No. 8/2005.
- Horváth, R., Podpiera A. M. (2009): "Heterogeneity in Bank Pricing Policies: The Czech Evidence", CNB Working Paper No. 8/2009.
- Hughes-Hallett, A., Piscitelli, L. (2002): "Does Trade Integration Cause Convergence?", *Economic Letters*, 75(2), pp. 165–170.
- Illes, A., Lombardi, M. (2013): "Interest Rate Pass-through since the Financial Crisis", *BIS Quarterly Review*, September 2013.
- IMF (2015a): *Czech Republic – Staff Report for the 2015 Article IV Consultation*, International Monetary Fund, July 2015.
- IMF (2017): *Euro Area Policies. Staff Report for the 2017 Article IV Consultation with Member states. July 6, 2017.*
- IMF FSI: *IMF Financial Soundness Indicators*, 2017.
- IMF IFS: *IMF International Financial Statistics*, 2017.
- Inklaar, R., Jong-A-Pin, R., de Haan, J. (2008): "Trade and Business Cycle Synchronisation in OECD Countries – A Re-examination", *European Economic Review*, 52(4), pp. 646–666.
- Institute of Labor Economics (IZA) and Randstadt (2017): *People to Jobs, Jobs to People. Global Mobility and Labour Migration*, <https://workforceinsights.randstad.com/hr-research-reports-iza-research-2017>.
- Jackman, R., Roper, S. (1987): "Structural Unemployment", *Oxford Bulletin of Economics and Statistics*, 49(1), pp. 9–36.
- Jarocinski, M. (2010): "Responses to Monetary Policy Shocks in the East and the West of Europe: A Comparison", *Journal of Applied Econometrics*, 25(5), pp. 833–868.
- Javorcik, B. S. (2004): "Does Foreign Direct Investment Increase the Productivity of Domestic Firms? In Search of Spillovers Through Backward Linkages", *American Economic Review*, 94(3), pp. 605–627.
- Kalemli-Ozcan, S., Sorensen, B. E., Yosha, O. (2003): "Risk Sharing and Industrial Specialization: Regional and International Evidence", *American Economic Review*, 93(3), pp. 903–918.

- Kaufmann, D., Kraay, A., Mastruzzi, M. (2010): "The Worldwide Governance Indicators: A Summary of Methodology, Data and Analytical Issues", World Bank Policy Research Working Paper No. 5430.
- Kenen, P. B. (1969): "The Theory of Optimum Currency Areas: An Eclectic View", in Mundell and Swoboda (eds.), *Monetary Problems in the International Economy*, University of Chicago Press.
- Kočenda, E. (2001): "Macroeconomic Convergence in Transition Countries", *Journal of Comparative Economics*, 29, pp. 1–23.
- Krugman, P. (1981): "Intraindustry Specialization and the Gains from Trade", *Journal of Political Economy*, 89(5), pp. 959–973.
- Krugman, P. (1993): "Lessons of Massachusetts for EMU", in Torres, F., Giavazzi, F. (eds.), *Adjustment and Growth in the European Monetary Union*, Cambridge, Cambridge University Press, pp. 241–261.
- Lafourcade, P., Gerali, A., Brůha, J., Bursian, D., Buss, G., Corbo, V., Haavio, M., Håkanson, C., Hledik, T., Katay, G., Kulikov, D., Lozej, M., Micallef, B., Papageorgiou, D., Vanhala, J., Zeleznik, M. (2016): "Labour Market Modelling in the Light of the Financial Crisis", ECB Occasional Paper Series, No. 175.
- Landesmann, M. (2000): "Chapter 4. Structural Change in the Transition Economies, 1989–1999", *Economic Survey of Europe*, 2/3, pp. 95–123.
- Landesmann, S. (1995): *Industrial Restructuring and Trade Reorientation in Eastern Europe*, Cambridge, Cambridge University Press.
- Lee, H. Y., Wu, J. L. (2004): "Convergence of Interest Rates Around the Pacific Rim", *Applied Economics*, 36, pp. 1281–1288.
- Lin, J. Y., Treichel, V. (2012): "The Crisis in the Euro Zone: Did the Euro Contribute to the Evolution of the Crisis?", World Bank Policy Research Working Paper Series No. 6127.
- Lukmanova, E., Tondl, G. (2017): "Macroeconomic Imbalances and Business Cycle Synchronization. Why Common Economic Governance Is Imperative for the Eurozone", *Economic Modelling*, 62(C), pp. 130–144.
- Marques, C. R. (2004): "Inflation Persistence: Facts or Artefacts?", ECB Working Paper No. 371.
- Martin, R. (2010): "Boom and Bust in the Baltic Countries – Lessons to be Learnt", *Review of European Economic Policy*, 45(4), pp. 220–226.
- McKinnon, R. I. (1963): "Optimum Currency Areas", *American Economic Review*, 53(4), pp. 717–725.
- Messina, J., Strozzi, C., Turunen, J. (2015): "Real Wages over the Business Cycle: OECD Evidence from the Time and Frequency Domains", *Journal of Economic Dynamics and Control*, 33(6), pp. 1183–1200.
- Micco, A., Stein E., Ordonez G. (2003): "The Currency Union Effect on Trade: Early Evidence from EMU", *Economic Policy*, 18, pp. 315–343.
- Ministry of Finance of the Czech Republic (2008): *Státní závěrečný účet České republiky za rok 2007 (State Final Account of the Czech Republic for 2007)*, April 2008.
- Ministry of Finance of the Czech Republic (2008): *Státní závěrečný účet České republiky za rok 2007 (State Final Account of the Czech Republic for 2007)*, April 2008.
- Ministry of Finance of the Czech Republic (2015): *Impact Study of Participation or Non-participation of the Czech Republic in the Banking Union*, p. 120.
- Ministry of Finance of the Czech Republic (2017a): *The Convergence Programme of the Czech Republic*, May 2017.

- Ministry of Finance of the Czech Republic (2017b): *Návrh zákona o státním rozpočtu České republiky na rok 2018 včetně rozpočtové dokumentace (Draft Act on the State Budget of the Czech Republic for 2018 including Budget Documentation)*, August 2017.
- Mongelli, P. F. (2002): "'New' Views on the Optimum Currency Area Theory: What is EMU Telling Us?", ECB Working Paper No. 138.
- Mongelli, P. F. (2013): "The Mutating Euro Area Crisis: Is the Balance Between Sceptics and Advocates Shifting?", ECB Occasional Paper Series, No. 144.
- Mundell, R. A. (1961): "A Theory of Optimum Currency Areas", *American Economic Review*, 51(4), pp. 657–665.
- Neri, S., Ropele, T. (2015): "The Macroeconomic Effects of the Sovereign Debt Crisis in the Euro Area", Economic Working Paper No. 1007, Bank of Italy.
- Nicoletti, G., Scarpetta, S. (2004): "Do Regulatory Reforms in Product and Labor Markets Promote Employment? Evidence from OECD Countries", paper presented at the ECB/CEPR Conference on "What Helps or Hinders Labour Market Adjustments in Europe", Frankfurt, 28–29 June.
- OECD (1998, 2004, 2010): *Employment Outlook*, Paris, OECD.
- OECD (2012): *Economic Policy Reforms: Going for Growth*, Paris, OECD.
- OECD (2017): *Taxing Wages 2017*, OECD.
- Opatrný, M. (2016): "Quantifying the Effects of the CNB's Exchange Rate Commitment: A Synthetic Control Method Approach", IES Working Paper No. 17/2016.
- Podpiera, J., Wiegand, J., Yoo, J. (2015): "Euro Adoption in NMS: Macroeconomic Benefits and Challenges", IMF Staff Report.
- Punzo, A., McNicholas, P. D. (2016): "Parsimonious Mixtures of Multivariate Contaminated Normal Distributions", *Biometrical Journal*, 58(6), pp. 1506–1537.
- Razin, A., Rosefield, S. (2012): "A Tale of Politically-Failing Single-Currency Area", NBER Working Paper No. 18352, National Bureau of Economic Research.
- Richardson, P., Boone, L., Giorno, C., Macci, M., Rae, D., Turner, D. (2000): "The Concept, Policy Use and Measurement of Structural Unemployment: Estimating a Time Varying NAIRU Across 21 OECD Countries", OECD Economic Department Working Paper No. 250.
- Rose, A. (2000): "One Money, One Market: Estimating the Effect of Common Currencies on Trade", *Economic Policy*, 15, pp. 7–45.
- Rose, A. K. (2016): "Why Do Estimates of the EMU Effect on Trade Vary So Much?", NBER Working Paper No. 22678, National Bureau of Economic Research.
- Rudebusch, G. D. (2010): "The Fed's Exit Strategy for Monetary Policy", Federal Reserve Bank of San Francisco Economic Letter, June 14.
- Scheiber, T., Stern, C. (2016): "Currency Substitution in CESEE: Why Do Households Prefer Euro Payments?", *Focus on European Economic Integration*, 4, pp. 73–98, OeNB.
- Shimer, R. (2009): "Convergence in Macroeconomics: The Labor Wedge", *American Economic Journal: Macroeconomics*, 1(1), pp. 280–297.
- Skořepa, M., Komárek, L. (2015): "Sources of Asymmetric Shocks: The Exchange Rate or Other Culprits?", *Economic Systems*, 39(4), pp. 654–674.
- Slovak Presidency (2016): *Programme of the Slovak Presidency of the Council of the European Union, 1 July – 31 December 2016*, <http://www.consilium.europa.eu/en/council-eu/pdf/presidency-programme-eng-3-korektura.pdf>.
- Spolaore, E. (2013): "What Is European Integration Really About? A Political Guide for Economists", *Journal of Economic Perspectives*, 27(3), pp. 125–144.

- Statistical Survey of the CNB and CI CR in Non-financial Companies, https://www.cnb.cz/cnb/STAT.ARADY_PKG.STROM_SESTAVY?p_strid=ACAA&p_sestuid=&p_lang=EN.
- Stavrev, E. (2008): "What Explains Growth and Inflation Dispersion in EMU?", *Czech Journal of Economics and Finance*, 58(1-2), pp. 57-67.
- Szeto, K. L., Guy, M., (2004): "Estimating a New Zealand NAIRU", New Zealand Treasury Working Paper No. 04/10.
- Van Leuvensteijn, M., Sorensen, C. K., Bikker, J. A., Van Rixtel, A. (2013): "Impact of Bank Competition on the Interest Rate Pass-Through in the Euro Area", *Applied Economics*, 45(11), pp. 1359-1380.
- Venn, D. (2009): "Legislation, Collective Bargaining and Enforcement: Updating the OECD Employment Protection Indicators", OECD Social, Employment and Migration Working Paper No. 89.
- World Bank (2017): *Doing Business 2018*.
- World Economic Forum (2007): *The Global Competitiveness Report 2007-2008*.
- World Economic Forum (2017): *The Global Competitiveness Report 2017-2018*.
- Wyplosz, C. (2012): "Fiscal Rules: Theoretical Issues and Historical Experiences", NBER Working Paper No. 17884, National Bureau of Economic Research.
- Wyplosz, C. (2015): "Fiscal Rules: Theoretical Issues and Historical Experiences", in Alesina, A. Giavazzi, F. (eds.), *Fiscal Policy after the Financial Crisis*, NBER Books, National Bureau of Economic Research, NBER Chapter No. 12656, pp. 495-525.
- Yesin, P. (2013): "Foreign Currency Loans and Systemic Risk in Europe", *Federal Reserve Bank of St. Louis Review*, 95(3), pp. 219-235.
- Ziemann, V. (2013): "Do Structural Policies Affect Macroeconomic Stability?", OECD Economics Department Working Paper No. 1075.