Globální ekonomický výhled - říjen 2015

Česká národní banka; Sekce měnová; Odbor vnějších ekonomických vztahů
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GLOBAL ECONOMIC OUTLOOK - OCTOBER

Monetary Department
External Economic Relations Division

2015

CNB CZECH
NATIONAL BANK

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The October issue of Global Economic Outlook presents its regular overview of recent and expected developments in selected territories, focusing on key economic variables: inflation, GDP growth, leading indicators, interest rates, exchange rates and commodity prices. In this issue, we also apply the concept of shadow rates to quantify the effect of the unconventional monetary policy instruments of the ECB and the Fed and thereby indicate the degree of monetary policy easing achieved in terms of interest rates.

In October, the economic growth outlooks for the main economies were mostly increased for this year (except for Japan) and almost unanimously lowered for next year. Despite these revisions, the US economy should maintain its growth rate, staying about 1 pp above the current outlooks for the euro area. As the strongest European economy, Germany remains the engine of European growth, although its growth is weakening. Ireland is still the fastest growing euro area economy. The growth rate of the Japanese economy is expected to rise next year, slightly exceeding 1%. New figures on inflation in the main world economies reveal that consumer price inflation will be even lower this year than expected a month ago, reaching only a few tenths of a percent in positive territory. Next year, consumer price inflation is expected go up in the monitored advanced countries, but none of these countries is expected to reach the 2% level generally perceived as price stability.

Compared to the previous month, the GDP growth outlooks for the emerging BRIC economies were almost unanimously revised downwards for both 2015 and 2016. The Indian economy remains the leader of this heterogeneous group. Its growth outlooks for this period declined slightly again, but are still close to 8% at the end of 2016, i.e. more than 1 pp above the projected performance of the Chinese economy. China's slowdown is one of the main risks to the world economy (see also the leading indicators below). Consumer price inflation in China will gradually approach 2%. Visibly higher inflation is expected in India, slightly exceeding 5% at the end of 2016. In contrast to these two dynamically developing economies, Brazil and very probably also Russia will be in recession this year and the next. Moreover, the two countries will face high inflation, which is expected to reach double figures this year and fluctuate around 8% (Russia) and 6% (Brazil) next year.

The euro area interest rate outlook remains at zero at the one-year horizon, mainly because of the ECB's quantitative easing and a rising probability of asset purchases being extended. The Fed can be expected to raise interest rates, but it is increasingly likely that it will not take this step until the start of next year. The dollar is expected to appreciate slightly against all the monitored currencies at the one-year horizon.

The oil price outlook remains very slightly rising, but its path decreased compared to the previous month and oil prices are expected to be slightly below USD 60 a barrel at the end of 2016. Natural gas prices based on long-term contracts normally lag behind oil prices and are therefore expected to decrease further in the next few months and then stabilise close to USD 200 per 1000 m³. The non-energy commodity price index will edge up at the one-year horizon owing to modest growth in both its sub-indices, i.e. food commodities and industrial metals.

## Leading indicators for countries monitored in the GEO

PMI in manufacturing - advanced countries

OECD CLI - BRIC countries
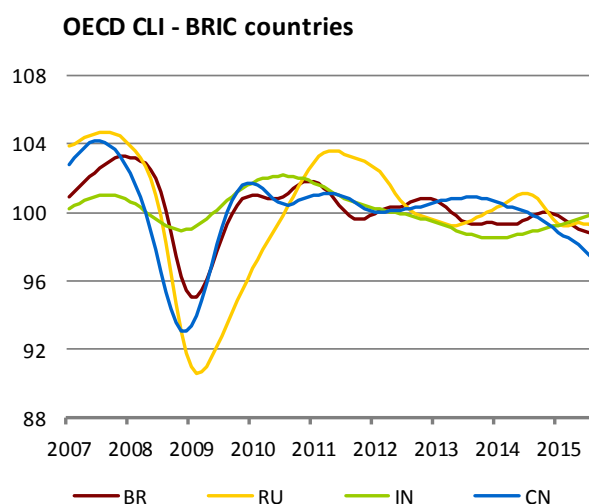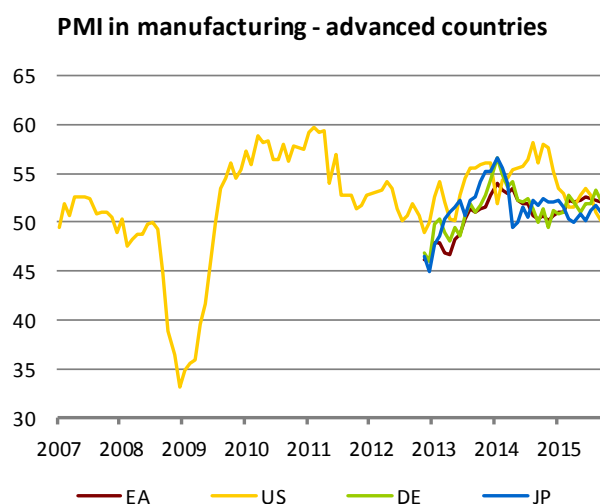
Zdroj: Bloomberg, Datastream

II.1 Eurozone

The forecasts of the monitored institutions all predict that euro area GDP will grow by 1.5% this year and accelerate slightly further in 2016. In the first half of this year, annual GDP growth in the euro area reached 1.7%. In Q2 alone it rose to 1.9%, the highest annual growth rate since 2011. The growth was again fostered mainly by household consumption. Except for change in inventories, the contributions of the other GDP components were also positive. The economy is being favourably affected by low oil prices and the ECB's easy monetary policy. In quarter-on-quarter terms, however, GDP slowed marginally to 0.4% in Q2.

Despite signs of an economic recovery, the consumer price inflation outlooks for this year remain close to zero. Inflation is expected to rise to around 1% only next year. Following five months of subdued growth, consumer prices fell by 0.1% in September, solely because of low prices of energy (and oil). Inflation excluding energy and food prices stood at 0.9%. A return to deflation could be a further stimulus for the ECB to extend its current bond purchase programme and thereby further ease monetary policy.

In addition, the ZEW economic sentiment indicator fell again in October. As in previous months, the PMI in manufacturing was in the expansionary band in September, whereas in the summer months industrial production had been unconvincing. The 3M Euribor is slightly negative, as is its outlook at the one-year horizon. The outlook for the 10Y German government bond fell slightly compared to the previous month.

GDP growth, %
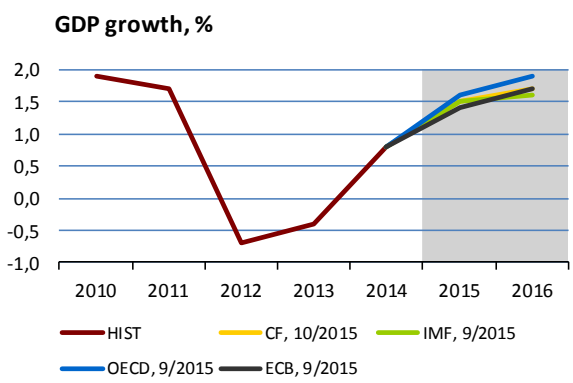
	CF		IMF		OECD		ECB	
2015	1,5	↗	1,5	➡	1,6	↗	1,4	↘
2016	1,7	➡	1,6	↘	1,9	↘	1,7	↘

Inflation, %
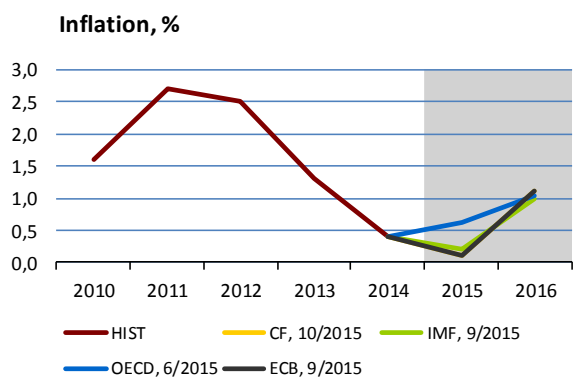
	CF		IMF		OECD		ECB	
2015	0,1	↘	0,2	↗	0,6	↘	0,1	↘
2016	1,1	↘	1,0	↘	1,0	➡	1,1	↘

Leading indicators
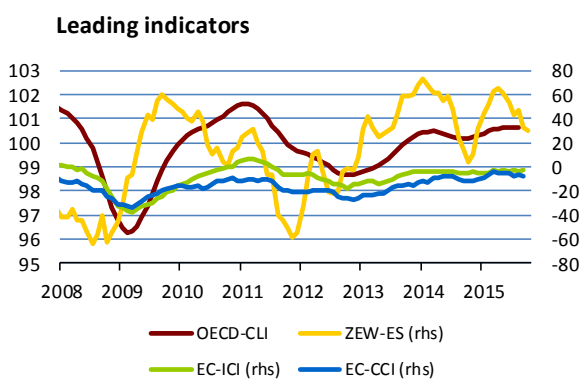
	OECD-CLI	EC-ICI	EC-CCI	ZEW-ES
8/15	100,7	-3,7	-6,9	47,6
9/15		-2,2	-7,1	33,3
10/15				30,1

Interest Rates
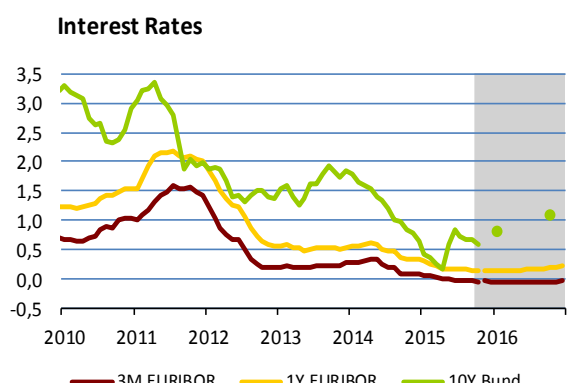
	09/15	10/15	01/16	10/16
3M EURIBOR	-0,04	-0,05	-0,06	-0,05
1Y EURIBOR	0,15	0,14	0,14	0,19
10Y Bund	0,68	0,59	0,80	1,10

II.2 United States

The final quarterly growth figure for the US economy even exceeded the revised one, reaching 3.9% in annualised terms (the first estimate had been 2.3%). The contribution of domestic demand was stronger, with private consumption rising by 3.6% and corporate investment by 4.1% (annualised quarter-on-quarter data). However, the published data on new jobs in the non-agricultural sector (seasonally adjusted) were disappointing, reaching just 142,000 (compared to an estimate of 173,000). Moreover, the August data were revised from 173,000 to 136,000. In September, unemployment was unchanged from August (5.1%), as was the average hourly wage. Consumer confidence and retail sales rose slightly, whereas the PMI fell for the third consecutive month. Industrial production fell by 0.4% month on month in August. The energy and manufacturing sectors seem to have been hit by the current drop in commodity prices and the appreciation of the dollar, as well as by financial market volatility.

Annual consumer price inflation dropped to zero in September due to falling fuel prices, while core inflation edged up to 1.9%. Persisting anti-inflationary pressures, turbulence in foreign financial markets and labour market developments prompted the Fed not to increase rates yet. The CF panel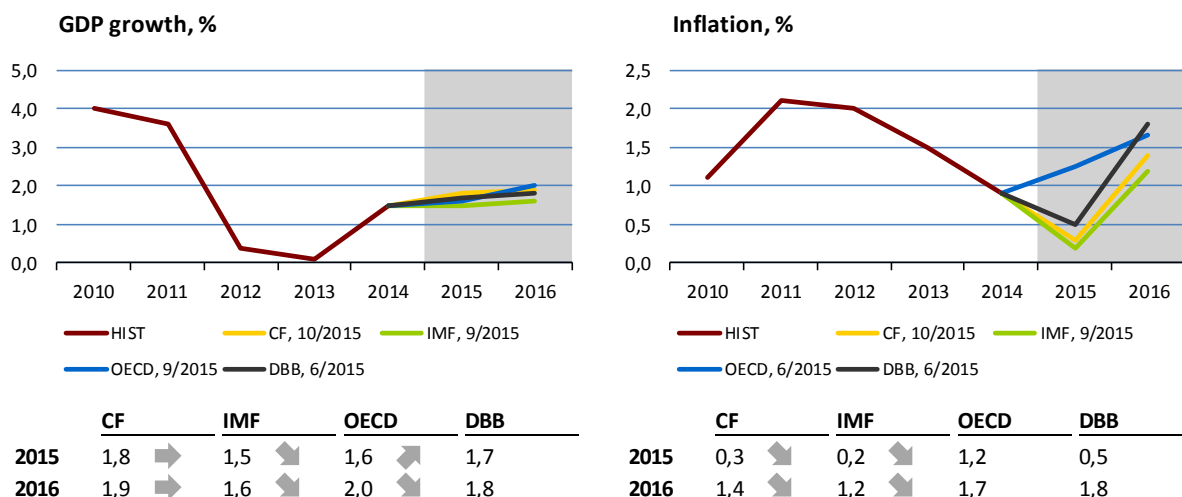lists expect rates not to be raised at the Fed's October meeting (with 88.6% probability). The expected interest rate path has also shifted downwards. The new Fed forecast expects stronger growth this year, while the growth outlook for 2016 has been lowered. Other institutions also likewise revised their forecasts, although they remain much more optimistic than the Fed. According to CF, the US economy should accelerate from 2.5% this year to 2.6% next year. The Fed's inflation outlook has shifted downwards, but remains above the path expected by the IMF. Compared to the Fed, CF expects slightly lower inflation this year (0.2%) and higher inflation in 2016 (1.8%).

GDP growth, %

	CF		IMF		OECD		Fed	
2015	2,5	→	2,6	↗	2,4	↗	2,1	↗
2016	2,6	↘	2,8	↘	2,6	→	2,3	↗

Inflation, %

	CF		IMF		OECD		Fed	
2015	0,2	→	0,1	↘	0,0	↘	0,4	↘
2016	1,8	↘	1,1	↘	1,8	→	1,7	↘

Leading indicators

	CB-LEII	OECD-CLI	UoM-CSI	CB-CCI
8/15	123,7	99,3	91,9	101,3
9/15			87,2	103,0
10/15				

Interest Rates

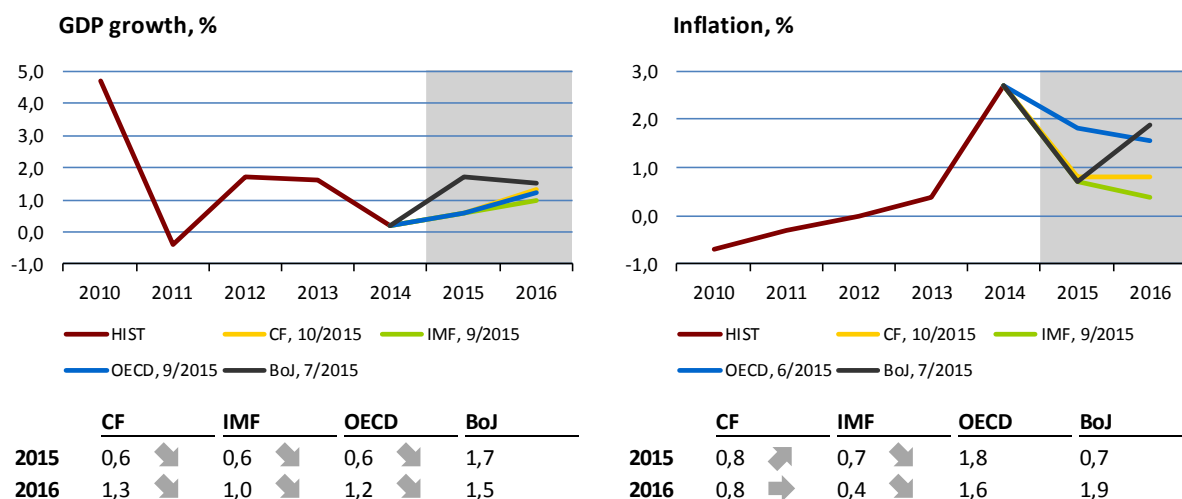|	09/15	10/15	01/16	10/16
USD LIBOR 3M	0,33	0,32	0,43	0,83
USD LIBOR 1R	0,85	0,85	0,98	1,41
Treasury 10R	2,17	2,07	2,30	2,70
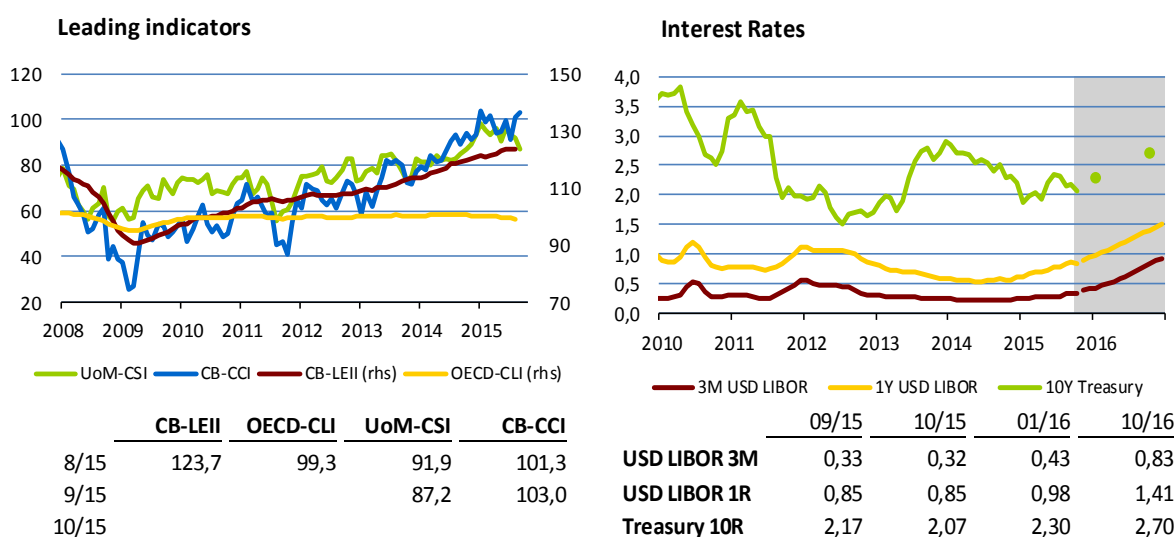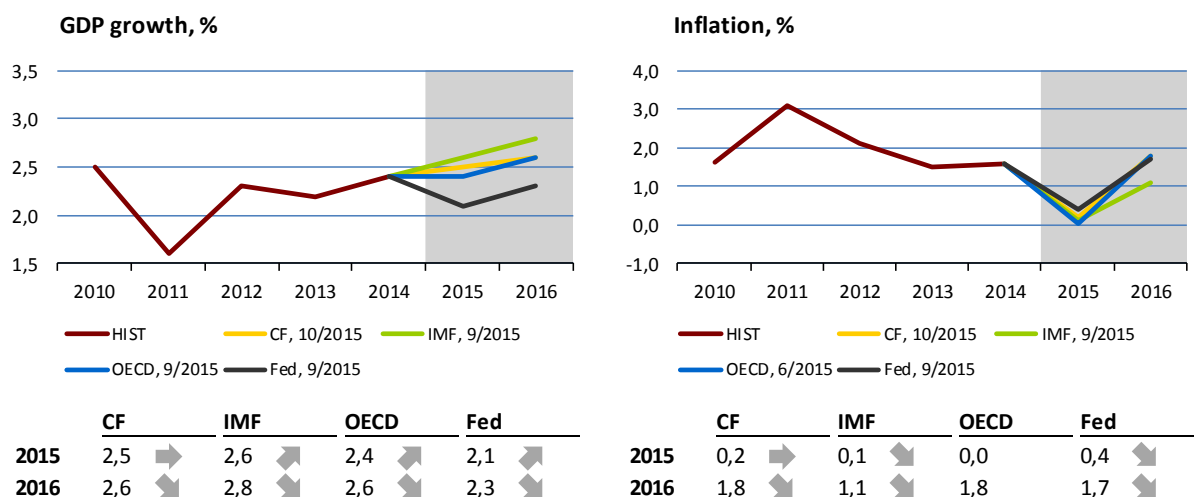
II.3 Germany

The annual and quarterly growth rates of the German economy increased in 2015 Q2, mainly as a result of higher net exports. Household consumption growth and its contribution to economic growth were lower than in the previous quarter. The quarterly GDP growth rate rose from 0.3% to 0.4% and the annual growth rate from 1.0% to 1.6%. The October CF expects economic growth to accelerate in Q3 (and H2 as a whole). However, leading indicators, which mostly decreased in September and October, do not point to any further acceleration of the economy. By contrast, stronger annual growth in industrial production and retail sales does indicate such a possibility. The October CF expects Germany's output to rise by 1.8% this year. Next year, the growth rate is expected to increase to 1.9%. Consumer prices were unchanged in September, following an increase of 0.2% in August. According to the October CF, inflation is expected to reach 0.3% in 2015 as a whole and pick up to 1.4% next year.

GDP growth, %

Inflation, %

	CF		IMF		OECD		DBB
2015	1,8	→	1,5	↘	1,6	↗	1,7
2016	1,9	→	1,6	↘	2,0	↗	1,8

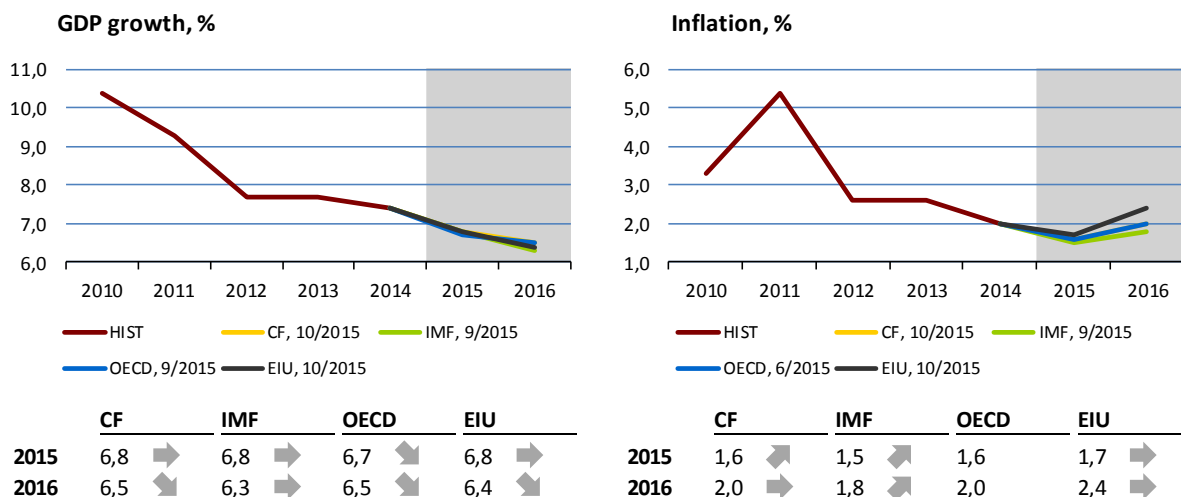|	CF		IMF		OECD		DBB
2015	0,3	↘	0,2	↘	1,2		0,5
2016	1,4	↘	1,2	↘	1,7		1,8

II.4 Japan

New data from Japan do not suggest any major economic improvement. Annual headline inflation fell further to 0.2%, while core inflation excluding food prices was almost flat at -0.1%. The PMI leading indicator declined in September, owing chiefly to a drop in export orders. Japan's exports decreased mainly as a result of the slowdown in China. The central bank has not taken any stimulus measures so far, but Prime Minister Abe introduced a new "three arrows" programme aimed at increasing nominal output by 20% over the next five years to JPY 600 trillion. In addition to the commitment to boost economic growth, the measures will focus on care for small children and the elderly. The unsatisfactory results and rising Japanese debt also led to a rating downgrade by Standard & Poor's from AA- to A+. Some of the institutions we monitor (CF, IMF, OECD) revised their economic growth outlooks downwards. As regards inflation, CF and the IMF do not expect the 2% inflation target to be hit by the end of 2016.

GDP growth, %

Inflation, %

	CF		IMF		OECD		BoJ
2015	0,6	↘	0,6	↘	0,6	↘	1,7
2016	1,3	↘	1,0	↘	1,2	↘	1,5

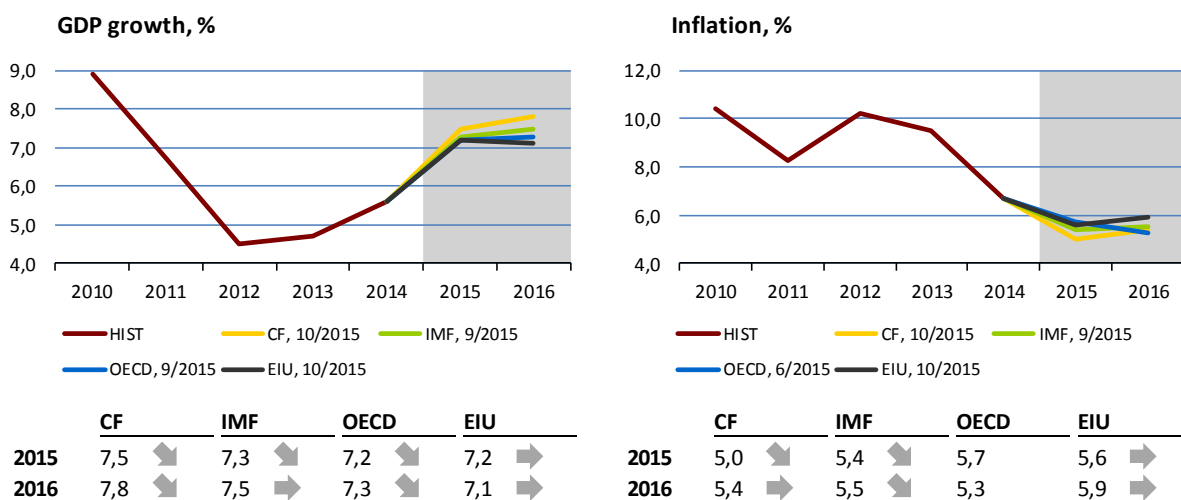|	CF		IMF		OECD		BoJ
2015	0,8	↗	0,7	↘	1,8		0,7
2016	0,8	→	0,4	↘	1,6		1,9

III.1 China

China's economic growth fell below 7% for the first time since 2009, to 6.9%. Although GDP growth was slightly above expectations (6.8%) and remains among the strongest in the world, the continuing slowdown of the Chinese economy is increasingly feeding concerns about global growth. The Chinese PMI fell for the seventh consecutive month to 47 points in October, the lowest figure since 2009. International trade also indicates that industry is going through a tougher period. Although the Chinese government has an official trade growth target of 6%, trade turnover fell by 8.1% year on year in the first nine months of this year. Exports fell by 3.7% in September, i.e. less markedly than expected (6%). By contrast, imports dropped much more sharply (by 20.4%, as against expectations of 16%). New outlooks expect a further slowdown in GDP growth from 6.7%–6.8% this year to 6.3%–6.5% next year. Consumer price inflation in China slowed by 0.4 pp compared to August, reaching 1.6% (0.2 pp lower than expected).

GDP growth, %

	CF		IMF		OECD		EIU	
2015	6,8	→	6,8	→	6,7	↘	6,8	→
2016	6,5	↘	6,3	→	6,5	↘	6,4	↘

Inflation, %

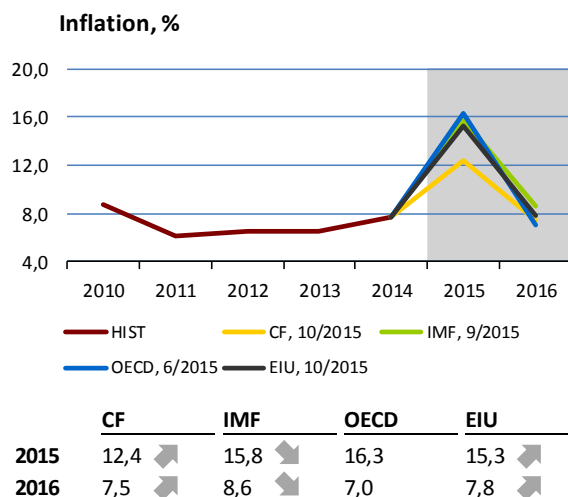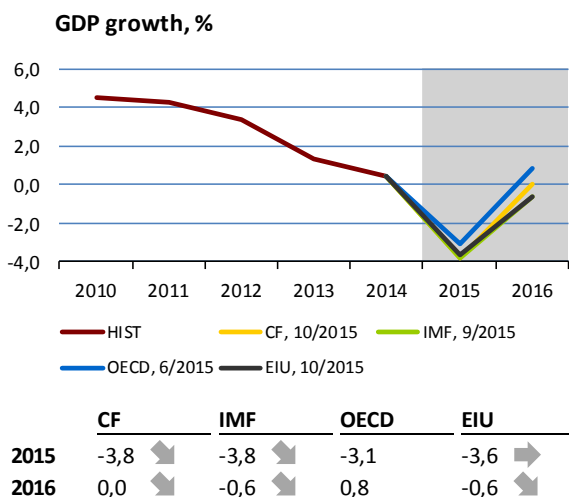|	CF		IMF		OECD		EIU	
2015	1,6	↗	1,5	↗	1,6	→	1,7	→
2016	2,0	→	1,8	↘	2,0	→	2,4	→

III.2 India

Industrial production in India keeps rising and its annual growth accelerated by more than 2 pp in August. However, the PMI in manufacturing declined owing to weakening external demand, which is reducing India's exports. The CF and OECD reduced their GDP growth predictions slightly – by 0.1 pp for both periods under review. The IMF lowered its growth outlook only for this fiscal period (by 0.2 pp). By contrast, the EIU left its growth estimate unchanged. The Indian central bank cut its policy rate by 0.5 pp to 6.75%. The rate cut will support the economy without jeopardising inflation. Inflation rose by 0.8 pp to 4.4% in September due to higher prices of food, especially cereals and vegetables, as a result of a weak monsoon. However, inflation is still being pushed down by falling commodity prices. CF and the IMF lowered their predictions by 0.2 pp and 0.7 pp respectively. Only the IMF decreased its outlook for the next fiscal year (by 0.2 pp).

GDP growth, %

	CF		IMF		OECD		EIU	
2015	7,5	↘	7,3	↘	7,2	↘	7,2	→
2016	7,8	↘	7,5	→	7,3	↘	7,1	→

Inflation, %

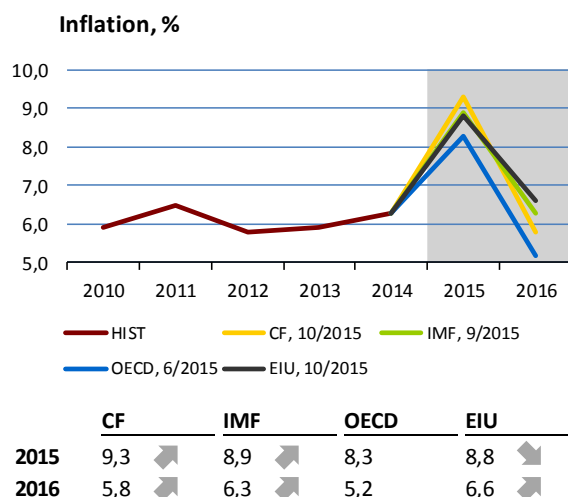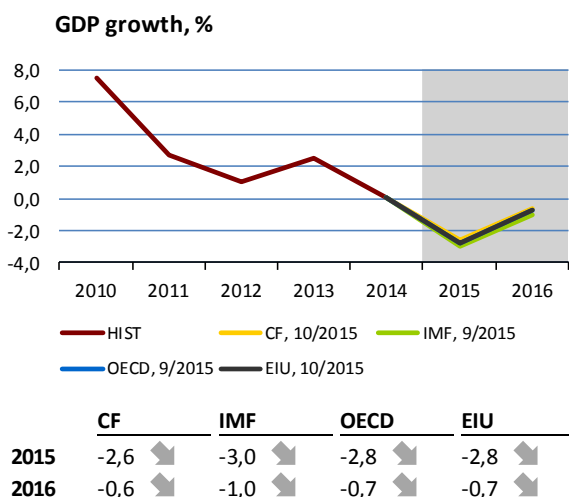|	CF		IMF		OECD		EIU	
2015	5,0	↘	5,4	↘	5,7		5,6	→
2016	5,4	→	5,5	↘	5,3		5,9	→

III.3 Russia

The year-on-year decline in Russian industrial production reached 3.7% in September. In Q3 as a whole, industry fell by 4.2%. Oil extraction and exports increased slightly in July (by 2.4% and 3.5% respectively), but the oil export price fell by 18% year on year in the same month, contributing to an overall decrease in exports, of which oil accounts for almost one-third. The consumer confidence index fell slightly in Q3 and remains well below the levels observed in the last five years. Inflation accelerated further, reaching 15.7% in September. Prices also rose significantly compared to August, although some foodstuffs recorded seasonal decreases. With the exception of CF, the new outlooks for the first time revised Russia's economic growth in 2016 from near zero to negative. The new World Bank and EBRD outlooks also expect a contraction in economic activity. The Russian central bank lowered its growth outlook for next year to between -0.5% and -1% (assuming a Ural crude oil price of USD 50 a barrel).

GDP growth, %

Inflation, %

	CF		IMF		OECD		EIU	
2015	-3,8		-3,8		-3,1		-3,6	
2016	0,0		-0,6		0,8		-0,6	

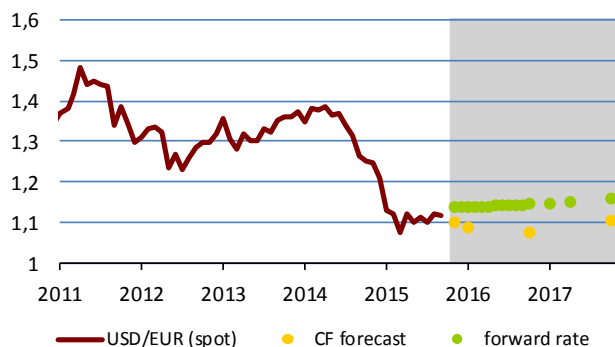|	CF		IMF		OECD		EIU	
2015	12,4		15,8		16,3		15,3	
2016	7,5		8,6		7,0		7,8	

III.4 Brazil

The Brazilian economy continued to decline. Unemployment rose further in August and industrial production and retail sales fell. The PMI in manufacturing rose slightly but remains in the contractionary band. The GDP growth predictions keep going down. A contraction of roughly 2.8% is now predicted for this year. Next year, the monitored institutions expect the economy to contract by 0.7% (the IMF even predicts 1%). Moreover, Fitch downgraded Brazil's rating by one notch (to BBB-) with a negative outlook, due to weak government finances and the deepening recession. Inflation in Brazil fell slightly for the second month in a row. Inflation pressures weakened after the central bank hinted at a further policy rate hike. The rate was eventually left unchanged but is expected to rise further in reaction to government austerity measures. CF and the IMF increased their inflation outlooks, as did the EIU for 2016. Inflation is expected to reach about 9% this year. The inflation target of 4.5%, with a tolerance band of ±2%, is expected to be hit next year.

GDP growth, %

Inflation, %

	CF		IMF		OECD		EIU	
2015	-2,6		-3,0		-2,8		-2,8	
2016	-0,6		-1,0		-0,7		-0,7	

	CF		IMF		OECD		EIU	
2015	9,3		8,9		8,3		8,8	
2016	5,8		6,3		5,2		6,6	

IV. Outlook of exchange rates vis-à-vis the US dollar

The euro

	12/10/15	11/15	01/16	10/16	10/17
spot rate	1,136				
CF forecast		1,102	1,088	1,074	1,103
forward rate		1,136	1,138	1,145	1,161

The Japanese yen
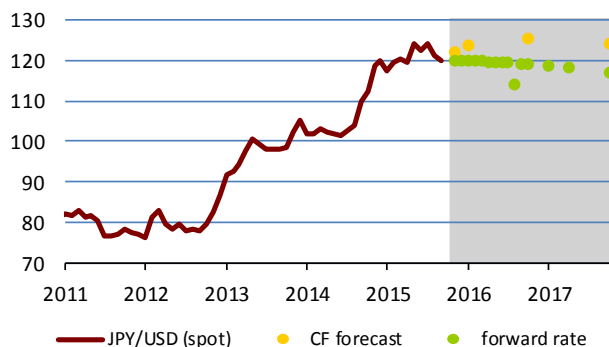
	12/10/15	11/15	01/16	10/16	10/17
spot rate	120,0				
CF forecast		122,1	123,7	125,2	124,0
forward rate		120,0	119,8	118,9	117,0

The Brazilian real
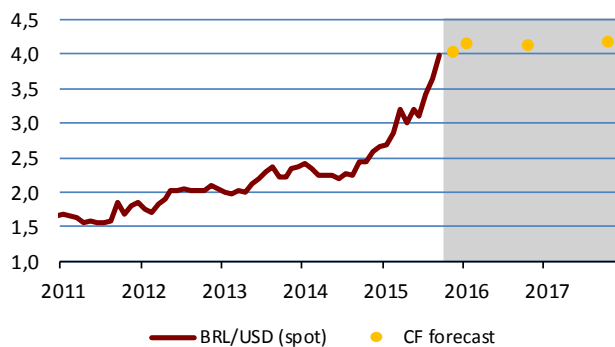
	12/10/15	11/15	01/16	10/16	10/17
spot rate	3,727				
CF forecast		4,024	4,144	4,137	4,186

The Russian rouble
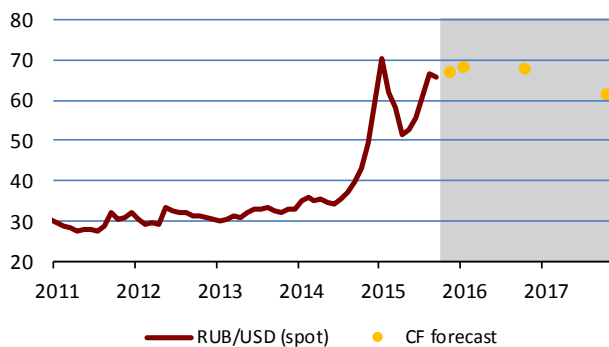
	12/10/15	11/15	01/16	10/16	10/17
spot rate	61,94				
CF forecast		67,14	68,05	67,95	61,35

The Indian rupie
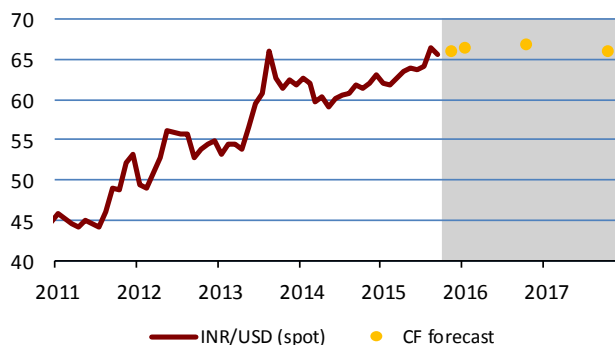
	12/10/15	11/15	01/16	10/16	10/17
spot rate	64,78				
CF forecast		66,07	66,37	66,87	66,04

The Chinese renminbi
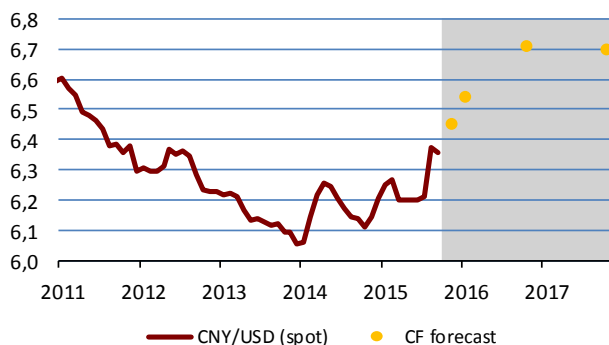
	12/10/15	11/15	01/16	10/16	10/17
spot rate	6,323				
CF forecast		6,454	6,541	6,707	6,701

Exchange rates as of last day of month. Forward rate does not represent outlook; it is based on covered interest parity, i.e. currency of country with higher interest rate is depreciating. Forward rate represents current (as of cut-off date) possibility of hedging future exchange rate.

V.1 Oil and natural gas

The price of Brent crude oil has been fluctuating around a horizontal trend just below USD 50 a barrel (bbl) since early August. However, it has been alternating between peri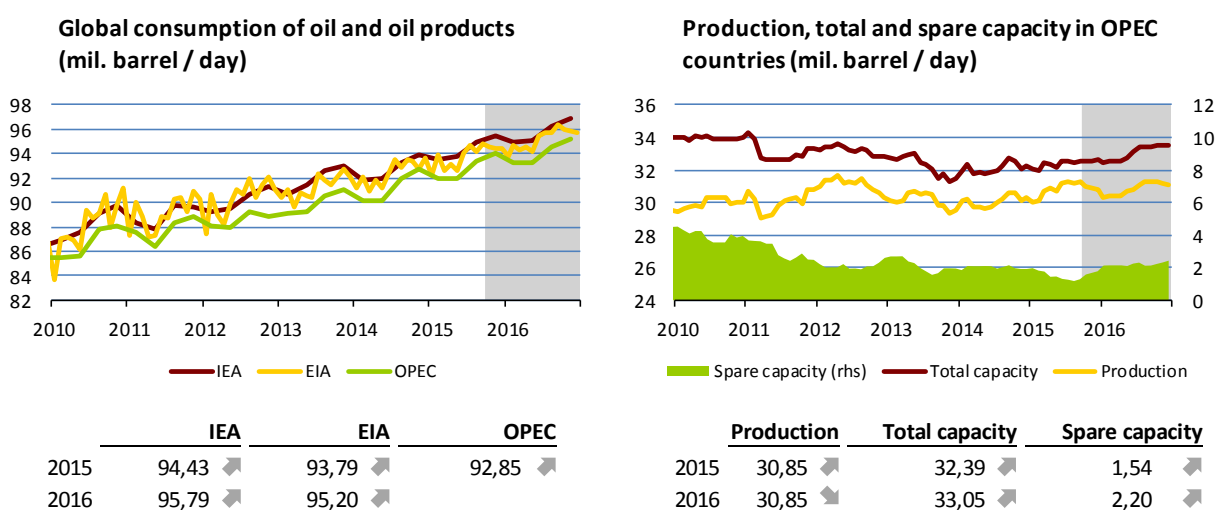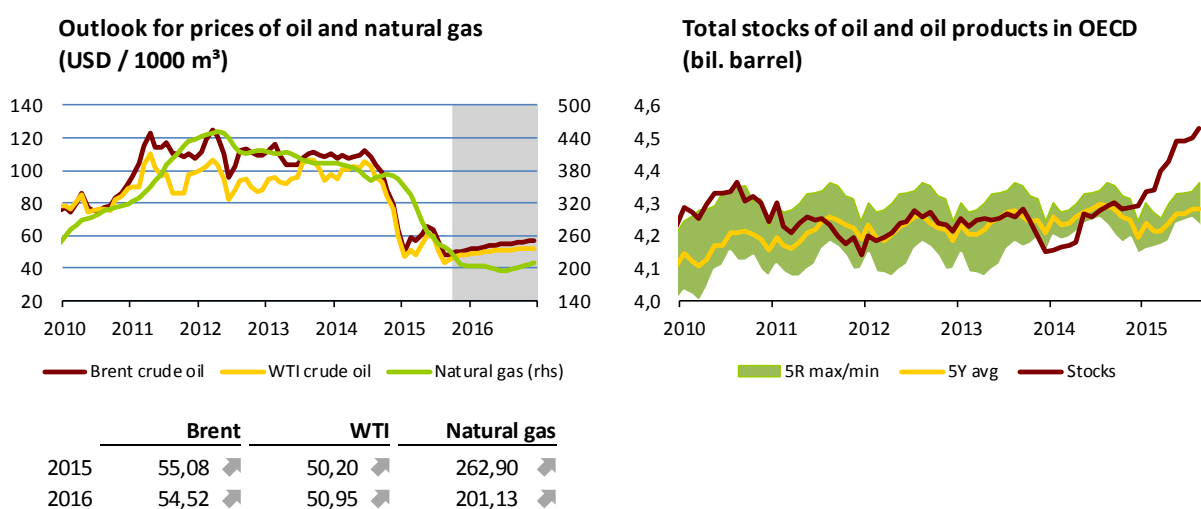ods of relative stability and extreme volatility. For most of September it stayed within a relatively narrow band of USD 47–50/bbl before rising rapidly again to USD 53/bbl in the second week of October. However, it returned equally quickly to the previous trend by mid-October. The fundamental excess of oil in the market persists, but according to OPEC representatives it now is starting to shrink slowly (as a result of solid growth in global demand and falling extraction in non-OPEC countries). By the end of 2016, demand for OPEC oil could be in line with its current production. However, global stocks of oil and oil products, which are currently at record highs, will continue to rise, albeit at a falling pace compared to this year.

The market forecast based on the futures curve from 12 October shifted slightly upwards for this year (for which it implies an average price of USD 55.1/bbl). The implied average price for 2016 saw only a slightly larger increase to USD 54.5/bbl, representing gradual growth from current levels. The EIA left its forecast unchanged and still expects faster price growth in 2016 from an average of USD 54/bbl this year to USD 59/bbl next year. The WTI price is expected to be lower by USD 4/bbl and USD 5/bbl in 2015 and 2016 respectively. The October CF also lowered its outlook only negligibly and expects a Brent price of USD 58/bbl one year ahead. However, great uncertainty persists regarding future supply and demand.

Natural gas prices decreased over the past month. Prices of long-term contracts went down as a result of the previous oil price decline, while spot contract prices fell on account of rising stocks in the USA and Europe. LNG prices are also declining and will remain under pressure due to falling demand in Asia and growing supply in the USA and above all Australia.

Outlook for prices of oil and natural gas (USD / 1000 m³)

	Brent	WTI	Natural gas
2015	55,08	50,20	262,90
2016	54,52	50,95	201,13

Total stocks of oil and oil products in OECD (bil. barrel)

Global consumption of oil and oil products (mil. barrel / day)

	IEA	EIA	OPEC
2015	94,43	93,79	92,85
2016	95,79	95,20	

Production, total and spare capacity in OPEC countries (mil. barrel / day)

	Production	Total capacity	Spare capacity
2015	30,85	32,39	1,54
2016	30,85	33,05	2,20

Note: Oil price in USD/barrel, price of Russian natural gas at German border in USD/1,000 m3 (IMF data, smoothed by the HP filter). Future oil prices (grey area) are derived from futures and future gas prices are derived from oil prices using model. Total oil stocks (commercial and strategic) in OECD countries including average, maximum and minimum in past five years in billions of barrels. Global consumption of oil and oil products in millions of barrels a day. Production and extraction capacity of OPEC in million barrels a day (EIA estimate).
Source: Bloomberg, IEA, EIA, OPEC, CNB calculation

V.2 Other commodities

The average monthly non-energy commodity price index fell slightly further in September, but returned roughly to the August level in the first half of October. The food commodity price sub-index showed a similar pattern. By contrast, the industrial metals sub-index edged up in September and was broadly flat in mid-October. The outlooks for all three indices are modestly rising.

Prices of wheat, corn and especially soy declined in August and early September. The USDA increased its forecast for global wheat stocks thanks to a strong harvest in Europe in particular. The estimates for corn and soy stocks remained very high despite a slight decrease. During September, however, wheat and corn prices switched to relatively strong growth, while soy prices stagnated close to a six-year low. Rice prices continued to show an upward trend. Following previous declines, sugar prices rose sharply in September on concerns about drought in India and a lower harvest in Brazil, where part of the harvest could, moreover, be used to produce ethanol instead of sugar. Beef prices fell sharply in September, but recovered partially in early October. Pork prices increased slightly. Rubber prices were flat close to their lowest levels in many years as a result of continued growth in stocks and low oil prices.

Prices of most basic metals stopped falling in September as some producers announced cuts in production. However, prices remain under pressure from the weakening manufacturing sector in China, where the PMI fell only slightly in September but remains deep in the contractionary band. The PMI also fell in the USA, the euro area and Japan. Following previous growth, prices of iron ore were flat in September and remain under pressure from low steel production.

Non-energy commodities price indicies
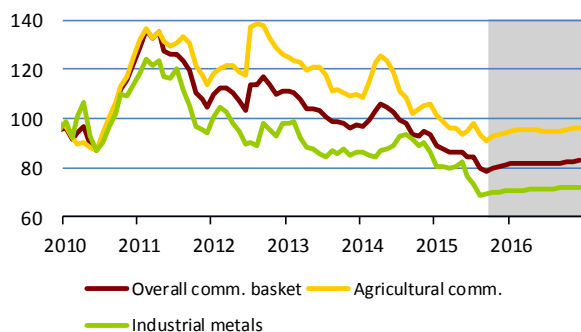
	Overall	Agricultural	Industrial
2015	83,7 ↗	95,4 ↗	75,3 ↗
2016	82,1 ↗	95,3 ↗	71,5 ↗

Food commodities
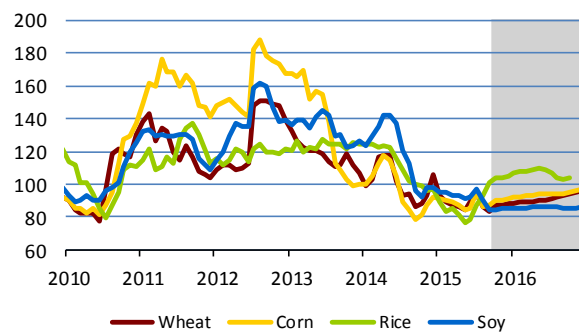
	Wheat	Corn	Rice	Soy
2015	88,2 ↗	88,9 ↗	90,8 ↗	90,5 ↗
2016	91,5 ↗	94,1 ↗	106,7 ↗	85,9 ↗

Meat, non-food agricultural commodities
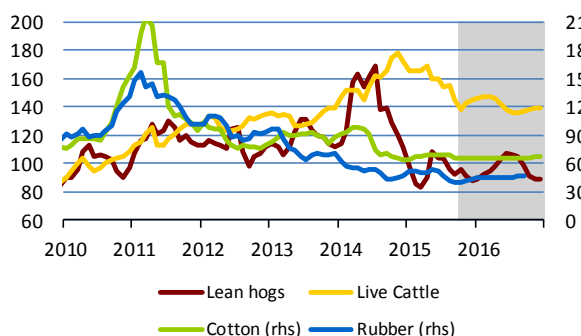
	Lean hogs	Live Cattle	Cotton	Rubber
2015	94,7 ↗	155,4 ↘	67,3 ↘	47,0 ↗
2016	97,0 ↗	141,1 ↘	66,5 ↗	

Basic metals and iron ore
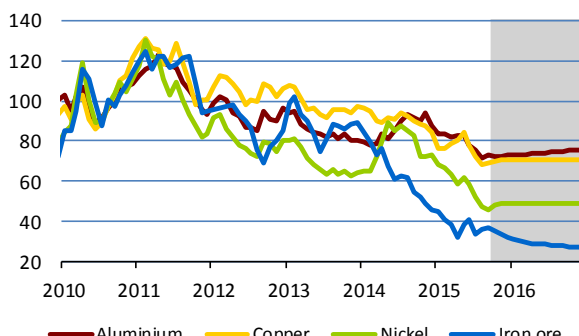
	Aluminium	Copper	Nickel	Iron ore
2015	77,5 ↘	74,5 ↗	55,7 ↗	36,8 ↗
2016	74,4 ↘	70,8 ↗	48,9 ↗	28,6 ↘

Note: Structure of non-energy commodity price indices corresponds to composition of The Economist commodity indices. All prices are given as indices, 2010 = 100 (charts) and percentage changes (tables).
Source: Bloomberg, CNB calculations.

Shadow policy rates – alternative quantification of unconventional monetary policy[1]

This article sets out to quantify the unconventional monetary policy easing pursued by the world's two most important central banks – the Federal Reserve (Fed) and the European Central Bank (ECB) – using a hypothetical interest rate equivalent. By applying the concept of "shadow policy rates" the article quantifies the effect of the unconventional instruments recently introduced by the said central banks and indicates the degree of monetary policy easing achieved in terms of policy rates. The measures taken by the Fed and the ECB are analysed because of their global impacts, which reflect the economic power and position of the dollar and the euro as the two most frequently used global reserve currencies.

1 Unconventional monetary policy

In response to the recent financial and subsequent economic crisis, central banks – being unable to use their standard instruments (primarily the setting of monetary policy rates via open market operations) – had to seek other ways to fulfil their statutory mandates (usually price and financial stability or currency stability). Unconventional monetary policy (MP) instruments were implemented in a situation where the scope for conducting monetary policy using policy rates had been exhausted, as central banks had cut rates to zero and could not lower them any further using conventional measures.[2]

Several types of central bank behaviour can be classed as unconventional monetary policy. They include: (i) quantitative easing – action by the monetary authority that causes its balance sheet to expand while keeping the liquidity and riskiness of its balance sheet asset portfolio unchanged on average; (ii) qualitative easing – the central bank conducts operations that hold the size of its balance sheet constant but change the composition of its balance sheet away from government debt securities towards riskier and less liquid assets; (iii) credit easing – a combination of quantitative and qualitative easing where the central bank expands its balance sheet in such a way that liquidity decreases and the riskiness of its assets increases; (iv) forward guidance[3] – the central bank makes an explicit commitment regarding the future path of a variable, such as undertaking to maintain interest rates at zero for at least a year or until the inflation rate rises; (v) foreign exchange interventions – the central bank conducts operations in the forex market to weaken the domestic currency, thereby easing real interest rates via higher inflation due to higher import prices and stimulating the real economy via the indirect exchange rate channel.

The financial crisis induced numerous central banks of advanced economies, in particular the Fed and the ECB, to apply various unconventional measures. While the ways in which the unconventional policies were implemented by the ECB and the Fed differed, in both cases they considerably affected their balance sheets. As shown in Chart 1, central banks' balance sheets gradually expanded to around 20–30% of GDP, the exceptions being those of the Bank of Japan and the Swiss National Bank, which rose to more than 60% and 85% of GDP respectively.

The methods of expanding balance sheets differ across countries and over time. While in Japan and the UK quantitative easing consists mainly of
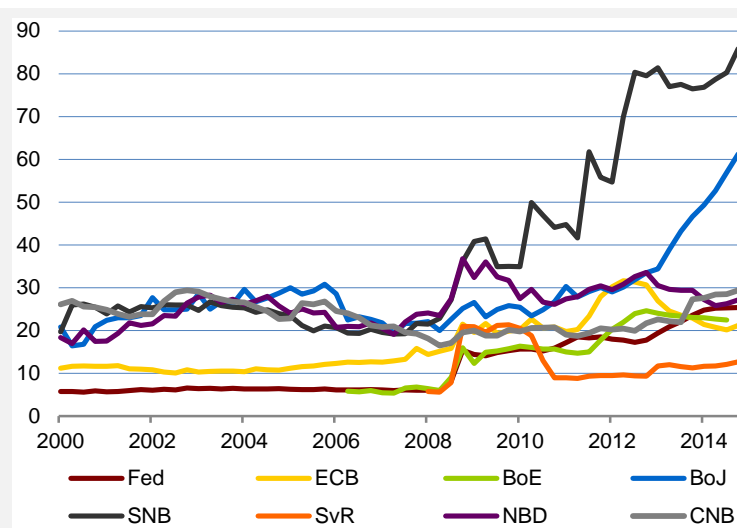
Chart 1 Ratio of total assets of selected central banks to GDP
Source: Bloomberg.
Note: Fed (USA), ECB (euro area), BoE (UK), SNB (Switzerland), SvR (Sweden), NBD (Denmark), CNB (Czech Republic).

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[2] Reducing rates to negative values ranks among unconventional instruments and has its obvious limits (for example the risk of cash substituting for cashless money and other financial assets, and disruption of the natural relationship between debtors and creditors).

[3] See the January 2014 issue of *Global Economic Outlook*.

government bond purchases, the Fed and the ECB have pursued a broader approach. Small open economies either apply negative interest rates (Sweden) or use the exchange rate as an additional MP instrument (the Czech Republic).

In the first phase, the Fed's quantitative (credit) easing was aimed at injecting necessary liquidity into the financial sector. In subsequent phases, the Fed focused on lowering long-term interest rates as an additional MP instrument. Short-term rates were then cut to zero at the end of 2008. The Fed's asset purchases increased the prices of government bonds and reciprocally lowered their yields, causing borrowing costs to go down for firms and households. The low interest rates were aimed at reviving the stock market, the mortgage loan market and business investment.

The unconventional MP tools of the ECB (i.e. the entire Eurosystem) gradually changed as the global financial crisis and later the economic and debt crisis intensified. To some extent, they also reflected the greater heterogeneity across euro area countries than in the USA. Longer-term refinancing operations (LTROs, i.e. secured loans with fixed maturities),[4] which temporarily affect banks' funds, became the key instrument. The ECB started purchasing bonds (government and secured) on a large scale as late as March 2015.

Table 1: Assessment of the effects of the ECB's and Fed's unconventional monetary policies

	ECB	**Fed**
Strengths	- Multiple targets (stabilisation of money and debt markets) pursued in single programme - Contains automatic mechanisms (LTROs have fixed maturity – exit strategy; costs derived from policy rate)	- QE can be used to stabilise financial system (QE1) - QE can be effective instrument in environment of zero rates and risk of deflation (QE2) - Clear signal of central bank's position, high level of transparency
Weaknesses	- Stabilisation of banking sector but no microprudential function - Liquidity supplied to banks as needed, no direct influence of ECB; option of early redemption by banks (LTROs[5]) turned out to be problematic - Higher financial imbalance in euro area (potentially risky if euro area disintegrates) - Addresses liquidity but not solvency; lacks measures to support interbank transactions (e.g. safe collateral)	- Interest rate risk – rise in rates will result in loss which may (but need not) influence central bank's decisions - Liquidity supplied to financial market mainly spills over to rising commodity prices (cost-push inflation pressures) and to faster-growing emerging economies (appreciation of currencies and potential overheating) - Assumption of strong effect on behaviour of households and firms within transmission mechanism does not hold
Options in event of another crisis, exit strategies	- Exit strategy has been postponed; LTROs were complemented by fully fledged quantitative easing in March 2015 - As result of austerity on periphery, ECB has very limited options to respond to another debt crisis (only expansion of SMP[6]); lack of high-quality collateral	- Fed has very limited options to reduce its balance sheet (reverse sale of bonds) - Option of introducing new instruments for withdrawing short-term liquidity from financial markets seems far more realistic (size of influence on growth in short-term interest rates is an issue)

Comparing the Fed's and ECB's policies – even when they only applied conventional instruments – is not a trivial exercise, as those policies reflect different economic environments (different levels of price rigidity),[7] different regulations and different histories of shocks in the given period, shocks to which these central banks responded with different degrees of aggressiveness.[8] Stronger real rigidities can be seen in

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[4] Marginal refinancing operations (the ECB's standard instrument) are used for routine liquidity supply purposes.

[5] Longer-Term Refinancing Operations.

[6] The SMP (Securities Markets Programme) is and may remain controversial, as there is a real possibility that the bonds purchased will stay in the ECB's balance sheet even after they mature. On the other hand, the ECB has so far made much smaller purchases than the Fed.

[7] Microeconomic survey results by Dhyne at al. (2009) show that prices in the euro area change at less than half the frequency of those in the USA. When prices do change in the euro area, the changes are larger.

[8] According to Christiano, Motto and Rostagno (2007), the ECB's response function is characterised by a greater emphasis on smoothing the interest rate path and by a lower coefficient on the inflation gap
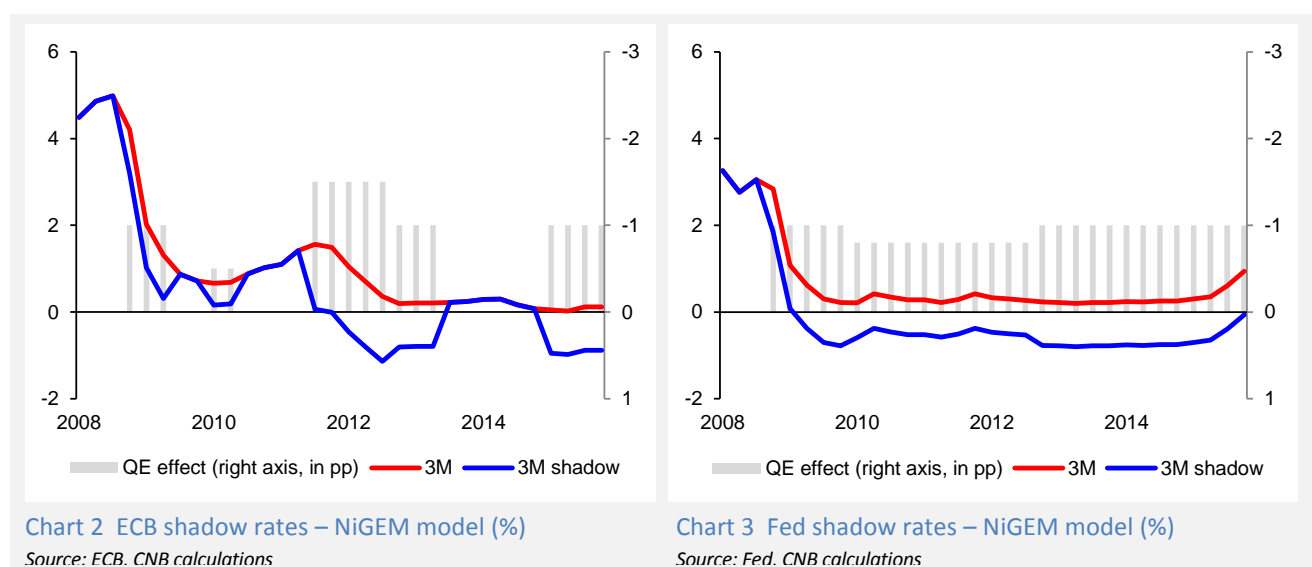
the euro area than in the USA. These call for larger changes in nominal variables and hence in interest rates. The degree of homogeneity of the two economic zones[9] also plays a major role. Even in the pre-crisis period, the ECB and the Fed showed different degrees of aggressiveness. Moreover, the euro area and the USA have different legal frameworks – the ECB, unlike the Fed, is subject to a strict prohibition of monetary financing. This has major implications for unconventional policies. The differences between the ECB's and Fed's unconventional policies are summarised in Table 1.

2 Estimation of shadow policy rates – NiGEM model

It is hard to determine the degree to which monetary conditions have been eased by central banks' unconventional instruments (more narrowly defined as quantitative easing, QE). One option is to attempt to convert the degree of unconventional monetary policy easing into an interest rate equivalent and to compare that directly with the conventional shift in central banks' MP rates when they still have scope for such a shift. A possible solution is to apply a model simulation of the theoretical effects of QE policies on 3-month money market rates. This was done for the two most important central banks, i.e. the Fed and the ECB.

The starting point for the analysis was a summary of previous estimates of the effects of non-standard instruments on the GDP of the countries under review (Fic, 2013). We then used those estimated effects on the GDP of the euro area countries and the USA in NiGEM model simulations.[10] More specifically, we attempted to achieve the same positive effect on GDP by gradually lowering policy rates to negative values. At the same time, we took into account the evolution of the total assets of the central banks under review in the form of changes in their balance sheets. Moreover, to estimate interest rates in 2015 we used NiGEM forecasts for the whole year.[11]

Charts 2 and 3 plot the 3-month interbank reference rates for the USA and the euro area along with the NiGEM-derived shadow rates, which incorporate the effect of QE. The grey columns represent the difference between the two rates, i.e. the effect of unconventional MP instruments.

Chart 2 ECB shadow rates – NiGEM model (%)
Source: ECB, CNB calculations

Chart 3 Fed shadow rates – NiGEM model (%)
Source: Fed, CNB calculations

These effects are observed from 2008 onwards. A relatively evenly distributed effect of the additional MP easing is apparent over the entire period under review for the USA, where QE has an additional effect equivalent to cutting rates by just under 1 pp on average. In the euro area, the effects of the additional MP easing are unevenly distributed across the period. Effects are apparent in late 2008, moderately in the first

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compared to the Fed. However, this is offset by the inclusion of M3 growth, which, by contrast, the Fed does not take into account at all.

[9] While the USA has only one government bond yield curve, the euro area consists of independent fiscal units, and segmentation is apparent on both financial and real markets. The different process of finding a political compromise among countries should also not be ignored.

[10] NiGEM is a quarterly global macroeconomic model that comprises more than 50 countries and regions using over 5,000 variables (see http://nimodel.niesr.ac.uk/).

[11] In order to simulate the effects of QE, the NiGEM model normally uses the term premium on interest rates or nominal GDP targeted via an auxiliary variable, which is used when various MP rule settings are simulated. In order to simulate the effect of QE, however, we would need to know its quantitative impact on these variables, and we cannot do this without using expert judgement.

half of 2010, in 2011–2013 (LTROs) and from the beginning of 2015 onwards (QE). The effect of the additional MP easing over the entire period is about 0.6 pp lower on average than in the USA.

3   Estimation of shadow policy rates – alternative model approaches

There are two alternative approaches to estimating shadow rates as an indicator of the monetary policy stance. The first approach is based on bond prices (option-based model). It assumes that nominal rates cannot turn negative because in such case cash is preferred as a risk-free investment. Black (1995) offered a method of calculating the value of a call option on cash holdings at the zero lower bound (ZLB) that can then be deducted from bond yields. Numerous studies have used option-pricing models to estimate the price of a call option on cash holdings. This effect is then subtracted from the yield curve, i.e. a hypothetical yield curve is constructed as if no physical cash existed. After the ZLB is reached, the yield curve is then used to derive rates as a measure of the monetary policy stance. Examples include Krippner (2012) and Wu and Xia (2014). Charts 4 and 5 show these authors' estimates of the ECB's and Fed's shadow rates.

The second approach is based on estimating the unobservable shadow rate using data on other financial variables and central bank operations. Using a dynamic factor model, common components are extracted and the missing shadow rate is reconstructed – see, for example, Lombardi and Zhu (2014). The auxiliary variables include selected central bank asset and liability items that are representative of unconventional measures, as well as monetary aggregates and various money market and bond market rates. In the case of the approach applied by Lombardi and Zhu (2014), estimates are only available for the USA (see Chart 5). For comparison, we applied the same methodology to euro area data, presented in Chart 4 as the authors' estimate based on Lombardi and Zhu (2014).[12] Besides the rate on main refinancing operations, the analysis included other policy rates (the marginal lending facility rate and the deposit facility rate), EURIBOR market rates with maturities of 3, 6 and 12 months, bond market rates with maturities of 2, 3, 5, 7 and 10 years and monetary aggregates (M1, M2, M3). As to the unconventional measures, we used asset-side volume data (total assets, main and long-term refinancing operations, purchase programmes such as CBPP[13] and SMP) and Eurosystem liability-side data (currency, MROs[14]+LTROs+CBPP+SMP - deposit facility, MROs+LTROs+CBPP+SMP - deposit facility – fixed-term liabilities).

Differences are apparent when we compare the estimates of shadow policy rates for the USA and the euro area based on the above approaches. While the option-based approach is sensitive to the choice of yield curve model, the dynamic factor model naturally mainly reflects the evolution of the central bank's balance sheet. The substantial decline in the ECB's shadow rates based on the bond-pricing model at the close of the period under review was probably due partly to bond market rates turning negative in some euro area countries (such as Germany). However, a similar trend can be expected for the estimates based on the dynamic factor model as the Eurosystem's balance sheet gradually expands.
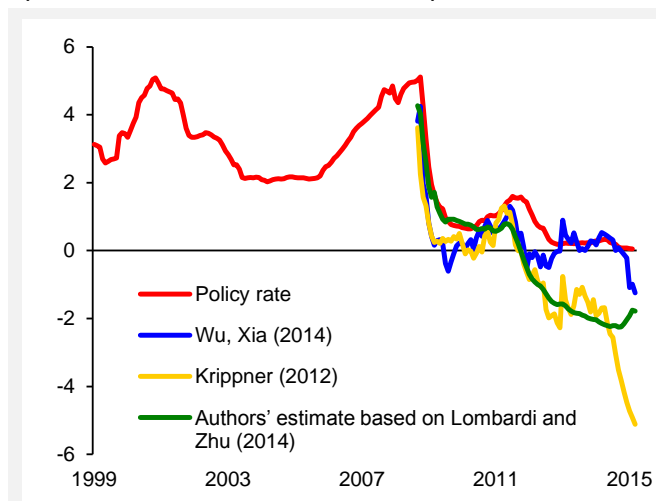
Chart 4 ECB shadow rates – alternative calculations (%)
Source: ECB, Bloomberg, CNB calculations
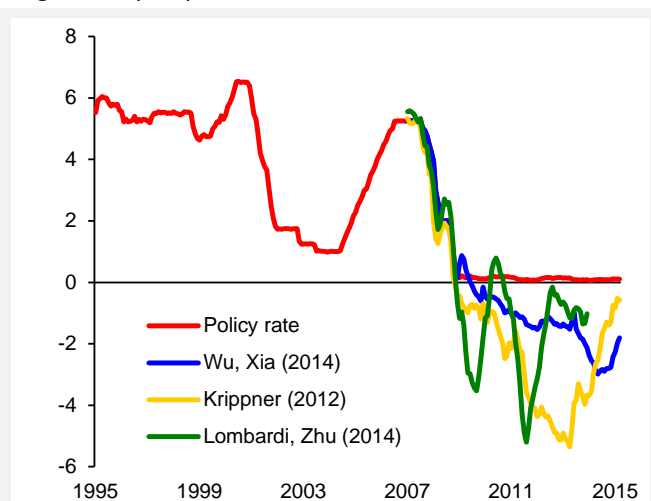*Note: ECB policy rate – minimum bid rate on main refinancing operations*

Chart 5 Fed shadow rates – alternative calculations (%)
Source: Fed, Bloomberg, CNB calculations
Note: Fed policy rate – federal funds rate

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[12] For an alternative estimate for the euro area see Babecká Kucharčuková at al. (2014).

[13] Covered Bond Purchase Programme.

[14] Main Refinancing Operation.

4   Conclusion

From the simulations described above we can see clear differences between the individual approaches (NiGEM, alternative calculations). While, for example, the option-based approach is sensitive to the choice of yield curve model, the dynamic factor model primarily reflects the evolution of the central bank's balance sheet. When we compare the estimates obtained using the NiGEM model with the aforementioned alternative calculations, we observe that the alternative estimates indicate a stronger impact of QE. Two of the three approaches indicate a decline in the key policy rate below -2% for the euro area in 2013. For the USA, the monetary policy easing would correspond to an interest rate reduction of 5 pp. These differences probably stem from the objective and timing of the unconventional measures applied. Many of the interventions by central banks have been aimed at stabilising the financial sector (liquidity measures) in order to prevent a major economic slowdown. The macroeconomic effects identified in the literature are therefore relatively small and our estimates based on the stimulated effect on GDP are lower than those that primarily take into account the impacts on financial markets and central banks' balance sheets.

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A1. Change in GDP predictions for 2015

	CF		IMF		OECD		CB / EIU	
EA	+0,1	2015/10 2015/9	0	2015/9 2015/7	+0,2	2015/9 2015/6	-0,1	2015/9 2015/6
US	0	2015/10 2015/9	+0,1	2015/9 2015/7	+0,4	2015/9 2015/6	+0,2	2015/9 2015/6
DE	0	2015/10 2015/9	-0,1	2015/9 2015/7	+0,0	2015/9 2015/6	+0,7	2015/6 2014/12
JP	-0,1	2015/10 2015/9	-0,2	2015/9 2015/7	-0,1	2015/9 2015/6	-0,3	2015/7 2015/5
BR	-0,7	2015/10 2015/9	-1,5	2015/9 2015/7	-2,0	2015/9 2015/6	-0,2	2015/10 2015/9
RU	-0,2	2015/10 2015/9	-0,4	2015/9 2015/7	-3,1	2015/6 2014/11	0	2015/10 2015/9
IN	-0,1	2015/10 2015/9	-0,2	2015/9 2015/7	-0,1	2015/9 2015/6	0	2015/10 2015/9
CN	0	2015/10 2015/9	0	2015/9 2015/7	-0,1	2015/9 2015/6	0	2015/10 2015/9

A2. Change in inflation predictions for 2015

	CF		IMF		OECD		CB/EIU	
EA	-0,1	2015/10 2015/9	+0,1	2015/9 2015/4	+0,0	2015/6 2014/11	-0,2	2015/9 2015/6
US	0	2015/10 2015/9	-0,0	2015/9 2015/4	-1,4	2015/6 2014/11	-0,3	2015/9 2015/6
DE	-0,1	2015/10 2015/9	-0,0	2015/9 2015/4	+0,0	2015/6 2014/11	-0,6	2015/6 2014/12
JP	+0,1	2015/10 2015/9	-0,3	2015/9 2015/4	+0,0	2015/6 2014/11	-0,1	2015/7 2015/5
BR	+0,1	2015/10 2015/9	+1,1	2015/9 2015/4	+2,9	2015/6 2014/11	-0,1	2015/10 2015/9
RU	+0,1	2015/10 2015/9	-2,1	2015/9 2015/4	+8,6	2015/6 2014/11	+0,8	2015/10 2015/9
IN	-0,2	2015/10 2015/9	-0,7	2015/9 2015/4	-0,7	2015/6 2014/11	0	2015/10 2015/9
CN	+0,1	2015/10 2015/9	+0,3	2015/9 2015/4	-1,0	2015/6 2014/11	0	2015/10 2015/9

A3. List of abbreviations

ABS	asset-backed securities		**GDP**	gross domestic product
bbl	barrel		**HICP**	harmonised index of consumer prices
BoJ	Bank of Japan		**CHF**	Swiss franc
BR	Brazil		**ICE**	Intercontinental Exchange
BRIC	countries of Brazil, Russia, India and China		**IFO**	Institute for Economic Research
			IFO-BE	IFO Business Expectations
BRL	Brazilian real		**IMF**	International Monetary Fund
CB-CCI	Conference Board Consumer Confidence Index		**IN**	India
			INR	Indian rupee
CB-LEII	Conference Board Leading Economic Indicator Index		**IRS**	Interest Rate swap
			JP	Japan
CBOT	Chicago Board of Trade		**JPY**	Japanese yen
CBR	Central Bank of Russia		**LI**	leading indicators
CF	Consensus Forecasts		**LIBOR**	London Interbank Offered Rate
CN	China		**MER**	Ministry of Economic Development (of Russia)
CNB	Czech National Bank			
CNY	Chinese renminbi		**OECD**	Organisation for Economic Co-operation and Development
DBB	Deutsche Bundesbank			
DE	Germany		**OECD-CLI**	OECD Composite Leading Indicator
EA	euro area			
EBRD	European Bank for Reconstruction and Development		**PMI**	Purchasing Managers' Index
			PPI	producer price index
EC	European Commission		**RU**	Russia
ECB	European Central Bank		**RUB**	Russian rouble
EC-CCI	European Commission Consumer Confidence Indicator		**TLTRO**	targeted longer-term refinancing operations
EC-ICI	European Commission Industrial Confidence Indicator		**UoM**	University of Michigan
			UoM-CSI	University of Michigan Consumer Sentiment Index
EIA	Energy Information Administration			
EIU	Economist Intelligence Unit		**US**	United States
EU	European Union		**USD**	US dollar
EUR	euro		**USDA**	United States Department of Agriculture
EURIBOR	Euro Interbank Offered Rate			
Fed	Federal Reserve System (the US central bank)		**WEO**	World Economic Outlook
			WTI	West Texas Intermediate (crude oil used as a benchmark in oil pricing)
FRA	forward rate agreement			
GBP	pound sterling		**ZEW-ES**	ZEW Economic Sentiment

A4. List of thematic articles published in the GEO

2015

	Issue
Shadow policy rates – alternative quantification of unconventional monetary policy (Soňa Benecká, Luboš Komárek and Filip Novotný)	2015-10
The economic reforms of Indian Prime Minister Narendra Modi (Pavla Břízová)	2015-9
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Is the threat of deflation real? (Soňa Benecká and Luboš Komárek)	2014-2
Forward guidance – another central bank instrument? (Milan Klíma and Luboš Komárek)	2014-1

2013

	Issue
Financialisation of commodities and the structure of participants on commodity futures markets (Martin Motl)	2013-12
The internationalisation of the renminbi (Soňa Benecká)	2013-11
Unemployment during the crisis (Oxana Babecká and Luboš Komárek)	2013-10
Drought and its impact on food prices and headline inflation (Viktor Zeisel)	2013-9

	Issue
The effect of globalisation on deviations between GDP and GNP in selected countries over the last two decades (Vladimír Žďárský)	2013-8
Competitiveness and determinants of travel and tourism (Oxana Babecká)	2013-7
Annual assessment of the forecasts included in GEO (Filip Novotný)	2013-6
Apartment price trends in selected CESEE countries and cities (Michal Hlaváček and Luboš Komárek)	2013-5
Selected leading indicators for the euro area, Germany and the United States (Filip Novotný)	2013-4
Financial stress in advanced economies (Tomáš Adam and Soňa Benecká)	2013-3
Natural gas market developments (Jan Hošek)	2013-2
Economic potential of the BRIC countries (Luboš Komárek and Viktor Zeisel)	2013-1

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	Issue
Global trends in the services balance 2005–2011 (Ladislav Prokop)	2012-12
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US holdings of foreign securities versus foreign holdings of securities in the US: What is the trend? (Narcisa Kadlčáková)	2012-9
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