

# GLOBAL ECONOMIC OUTLOOK - APRIL

Monetary Department  
External Economic Relations Division

2016



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**Cut-off date for data**

15 April 2016

**CF survey date**

11 April 2016

**GEO publication date**

22 April 2016

**Notes to charts**

ECB and Fed: midpoint of the range of forecasts.

The arrows in the GDP and inflation outlooks indicate the direction of revisions compared to the last GEO. If no arrow is shown, no new forecast is available. Asterisks indicate first published forecasts for given year. Historical data are taken from CF.

Forecasts for EURIBOR and LIBOR rates are based on implied rates from interbank market yield curve (FRA rates are used from 4M to 15M and adjusted IRS rates for longer horizons). Forecasts for German and US government bond yields (10Y Bund and 10Y Treasury) are taken from CF.

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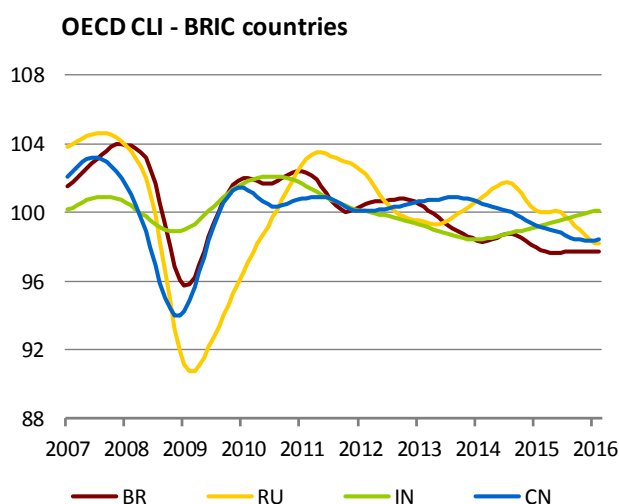
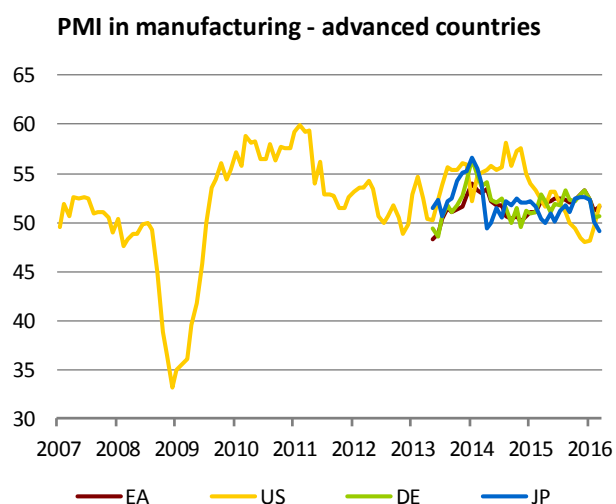
The April issue of Global Economic Outlook presents the regular monthly overview of recent and expected developments in selected territories, focusing on key economic variables: inflation, GDP growth, leading indicators, interest rates, exchange rates and commodity prices. In this issue we also look at how global inventory levels affect commodity prices, focusing, among other things, on fundamental factors (production, consumption and inventories), which should be the main drivers of both current and future commodity prices. Using simple statistics, we then deduce the effect of these fundamentals, as well as other possible factors, on the prices of individual commodities.

The economic growth outlooks for the world's major advanced economies declined again to varying extents in April. Despite these continued adjustments, the USA will maintain its position as the fastest-growing economy. The latest data also confirm that economic growth in the euro area is no longer being driven by Germany, which should in fact record the same rate of growth as the euro area this year and even slightly lower growth next year. The growth of the euro area economy should thus be close to that of the US economy this year, but will diverge from it again next year, with the US economy accelerating ahead by 0.8 pp. Japan is still expecting growth of only just above 0.5% this year, with slightly declining outlooks. New data on inflation in the main global economies also mostly saw downward revisions compared to the previous month. For the euro area and especially Japan, consumer price inflation is expected to remain only just at non-negative levels. Of the economies under review, only the US economy might thus record inflation above the "magic" level of 2% at the end of 2017.

The GDP growth outlooks for emerging BRIC countries except China were mostly lowered slightly compared to the previous month. Despite a slight increase in its growth outlooks, China lags behind India – the leader of the group – by more than 1 pp. The inflation outlooks for both countries shifted in the "right" direction, rising slightly to just below the 2% level in the case of China and falling slightly to 5% in the case of India, in line with the high rate of growth of the Indian economy. Both these economies are in a completely different situation than Brazil and Russia, which will be dogged by slumpflation this year. In the case of Russia, the situation will depend strongly on global oil prices. Brazil's situation will depend on whether its political and economic elites succeed in initiating greater use of the potential of the Brazilian economy.

The outlooks for euro area interest rates remain very low, with a falling outlook for 2016 and de facto no sign of growth until the end of 2017. For the USA, no further interest rate hike is expected at the upcoming Fed meeting, this step being expected to be taken only twice at the one-year horizon. According to CF, the US dollar will appreciate against all the monitored currencies at the one-year horizon – moderately against the euro, the Indian rupee and the Chinese renminbi and to a greater extent against the Japanese yen and particularly the Brazilian real. The market outlook for the oil price moved upwards again compared to the previous month and remains slightly rising along its entire path. The Brent crude oil price is expected to reach approximately USD 42 a barrel at the one-year horizon. Natural gas prices based on long-term contracts, which are indexed to oil prices usually with a lag of 6 to 9 months, are not expected to rise until the final quarter of this year. The industrial metals and food commodity indices are still close to seven- and six-year lows respectively, with the market outlooks remaining only slightly rising over the entire horizon.

## Leading indicators for countries monitored in the GEO

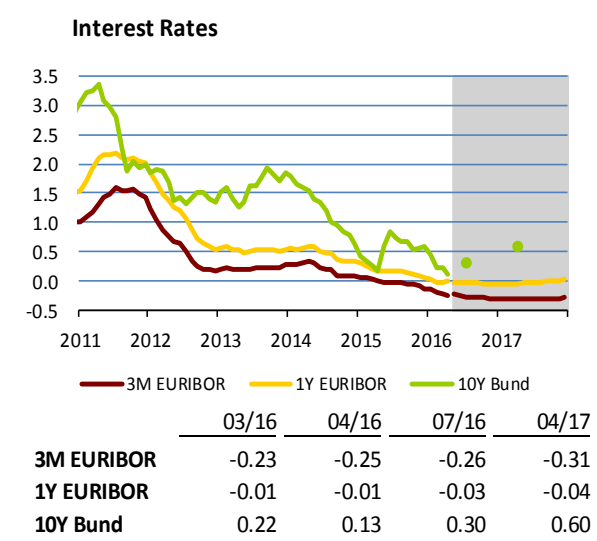
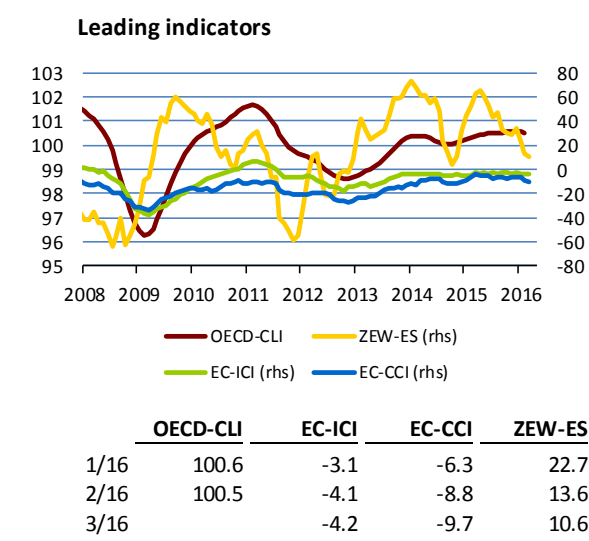
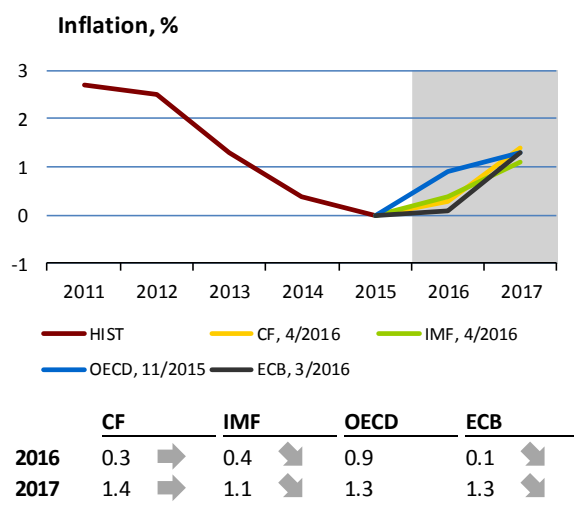
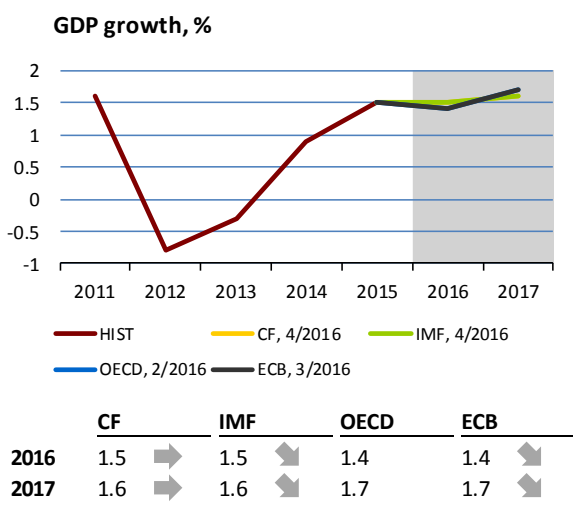


Zdroj: Bloomberg, Datastream

II.1 Euro area

The outlooks for euro area GDP growth for this year are roughly at last year's level (1.5%). Economic growth is expected to accelerate slightly in 2017. GDP grew by 1.6% year on year and 0.3% quarter on quarter in 2015 Q4, the year-on-year growth being driven mainly by household consumption again and also more significantly by investment than in previous quarters. By contrast, the contribution of net exports was negative. Economic growth in the euro area thus remains subdued, with considerable uncertainties. The PMI in manufacturing was flat in March at approximately the same level as a month ago, i.e. slightly in the expansionary band. Nonetheless, in spite of the higher levels of this indicator last year, annual growth in industrial production slowed sharply in February (and production decreased month-on-month terms), despite a positive supply shock from low oil prices. The other leading indicators were also broadly flat and the ZEW indicator declined further. Real retail sales growth in February was in line with previous months at 2.4% year on year.

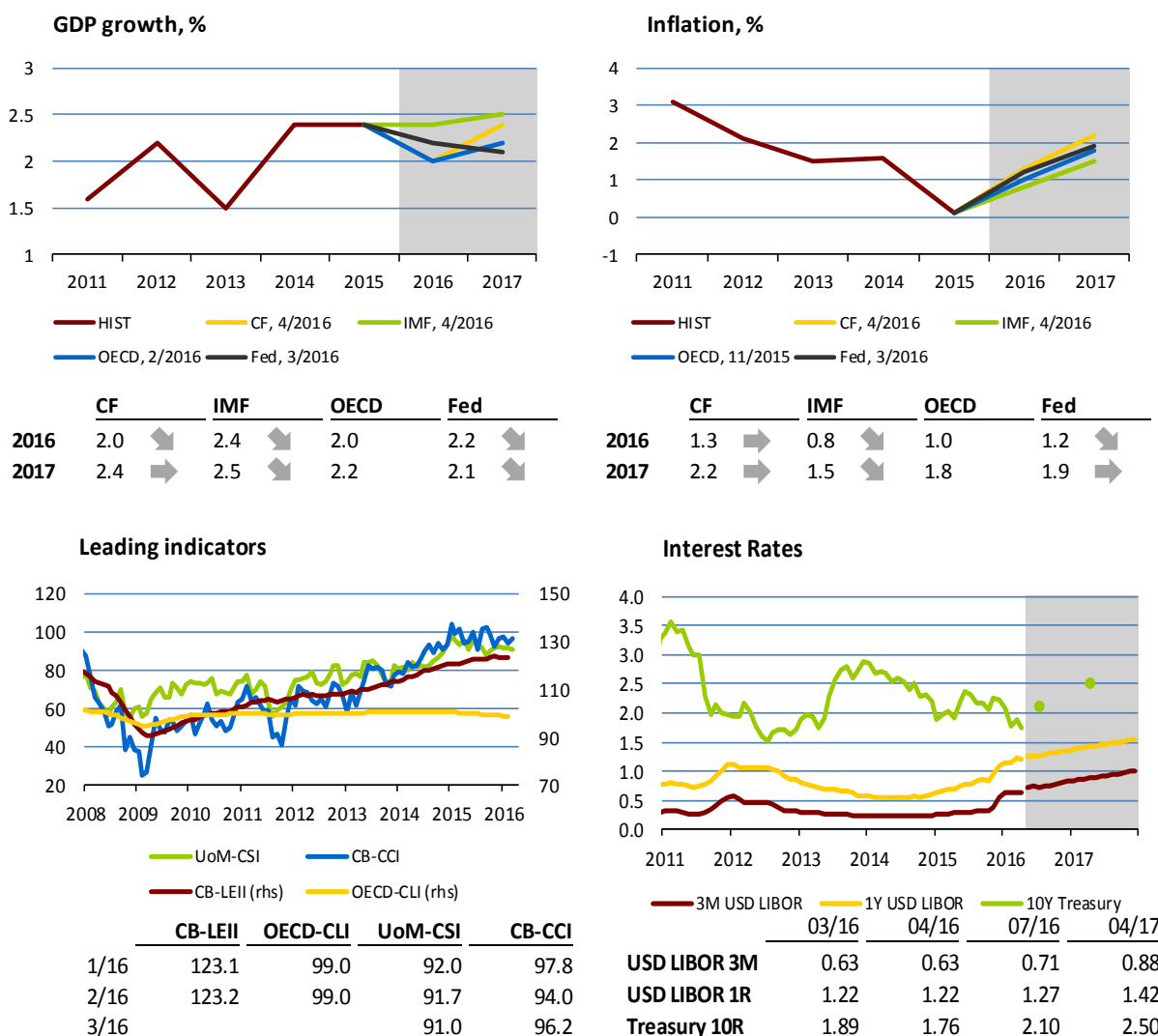
Consumer prices stagnated in March after a previous moderate decline. The main reason for the flat prices was a year-on-year decrease in energy prices. In March, the ECB revised downwards its GDP growth and inflation outlooks for this year and the next and eased monetary policy. Overall, inflation is expected to be close to zero this year and to increase above 1% in 2017. According to market outlooks, short-term interest rates will remain at slightly negative levels until the end of 2017. According to CF, the German ten-year government bond yield will rise to 0.6% at the one-year horizon, slightly below the rate expected a month ago. Annual M3 growth was 5% in February, the same as in the previous month.



## II.2 United States

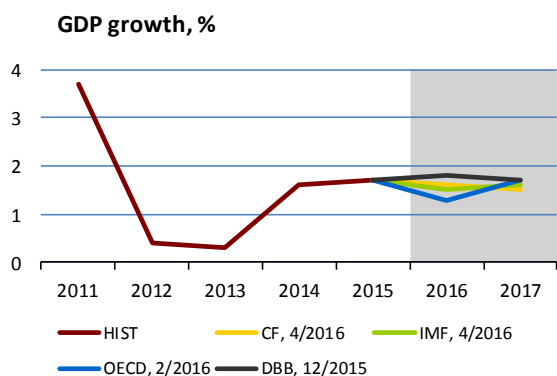
The US economy grew faster at the end of the year than suggested by the second GDP estimate. GDP growth reached 1.4% in 2015 Q4 (quarter-on-quarter, annualised), driven mainly by growth in private consumption (of 2.4% quarter-on-quarter, annualised). By contrast, the drop in corporate investment was deeper than expected, mainly because of markedly lower corporate profits. The situation of US companies, in particular those in manufacturing, did not improve significantly in 2016 Q1 either. Decreases were recorded for orders and for corporate investment and inventories. As in February, industrial production recorded a month-on-month decline (of 0.6%) in March, mainly in the mining and car industries. By contrast, the labour market situation improved further. A total of 215,000 new jobs were created in the non-agricultural sector in March, while the figures for January and February were revised upwards by 30,000. The unemployment rate was flat at 5% and the participation rate rose slightly again to 63%. The slump in retail sales in March was particularly significant for cars segment and consumer confidence fell slightly. Leading indicators thus suggest a further slowdown of the US economy in Q1.

Annual consumer price inflation slowed to 1.0% in February, while core inflation remained at higher levels. Producer prices fell in year-on-year terms. According to Fed Chair Janet Yellen, persisting risks in the global economy led to a revision of the pace of interest rate growth. The Fed is expected to increase the range of the key interbank rate only twice this year, each time by a quarter of a percentage point, instead of the four 25 bp increases expected earlier. As a result, the implied interest rate path has dropped. In the April survey, more than 91% of CF panellists believed that rates would not be raised at the April meeting. The April CF only revised its GDP growth forecast for 2016 (down by 0.1 pp to 2%).

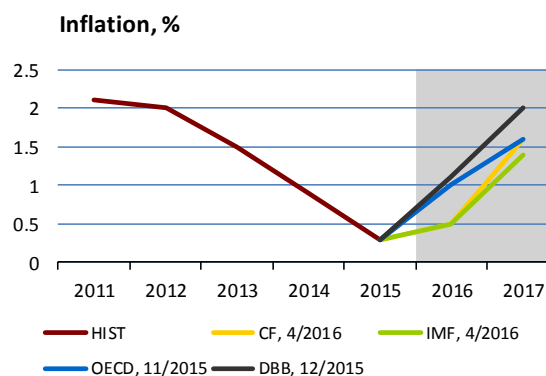


### II.3 Germany

The quarterly GDP growth rate in Germany stayed at 0.3% in 2015 Q4, but the annual growth rate fell to 1.3%. For 2016 Q1, the April CF expects both quarterly and annual growth to accelerate slightly. This is also suggested by leading indicators, which mostly increased in March after declining in January and February. The positive outlook is also supported by industrial production growth in January and February, which strengthened considerably compared with the previous quarter. For this year as a whole, CF predicts GDP to rise by 1.6% and a new IMF outlook by 1.5%, in line with the estimates of major German economic institutes (1.6%) and the council of economic advisers to the German government (1.5%). Annual consumer price inflation returned to year-on-year growth in March (rising by 0.3% after a stagnation in February), owing to growth in services prices, which outweighed a further drop in energy prices. CF as well as IMF predict inflation at 0.5% in 2015 as a whole, accelerating to 1.6% next year.



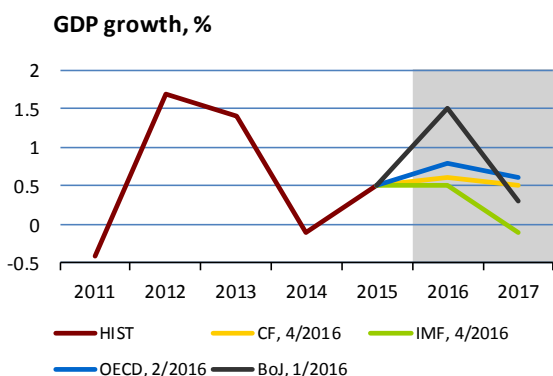
	CF	IMF	OECD	DBB
2016	1.6 →	1.5 ⇐	1.3	1.8
2017	1.5 →	1.6 ⇐	1.7	1.7



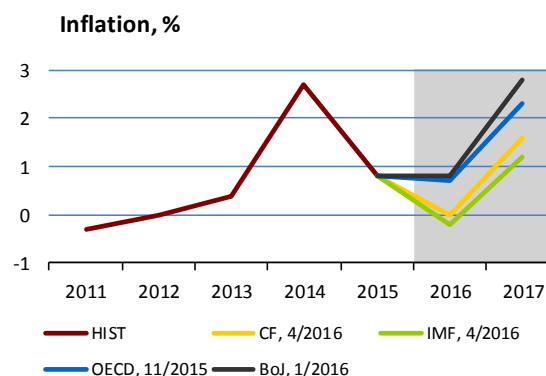
	CF	IMF	OECD	DBB
2016	0.5 →	0.5 ⇐	1.0	1.1
2017	1.6 →	1.4 ⇐	1.6	2.0

### II.4 Japan

Japan's economic performance continues to lag behind expectations, with financial markets not even ruling out the possibility of negative annual GDP growth in 2016 Q1. Industrial production dropped by 5.2% month on month in February. The PMI in manufacturing even dropped into the contraction band (49.1) in March, mainly due to the new export orders item. Japan's export performance continues to worsen. Total exports fell again (by 4%) year on year in February. A particular source of concern is the appreciation of the Japanese yen against the dollar, which reached an 18-month high. Inflation pressures remain subdued, with annual headline inflation at 0.3% in March and core inflation excluding food prices again at zero. The April CF as well as the new IMF prediction lowered their economic growth outlooks for both 2016 and 2017. The CF inflation outlook was left unchanged, the IMF expects deflation this year.



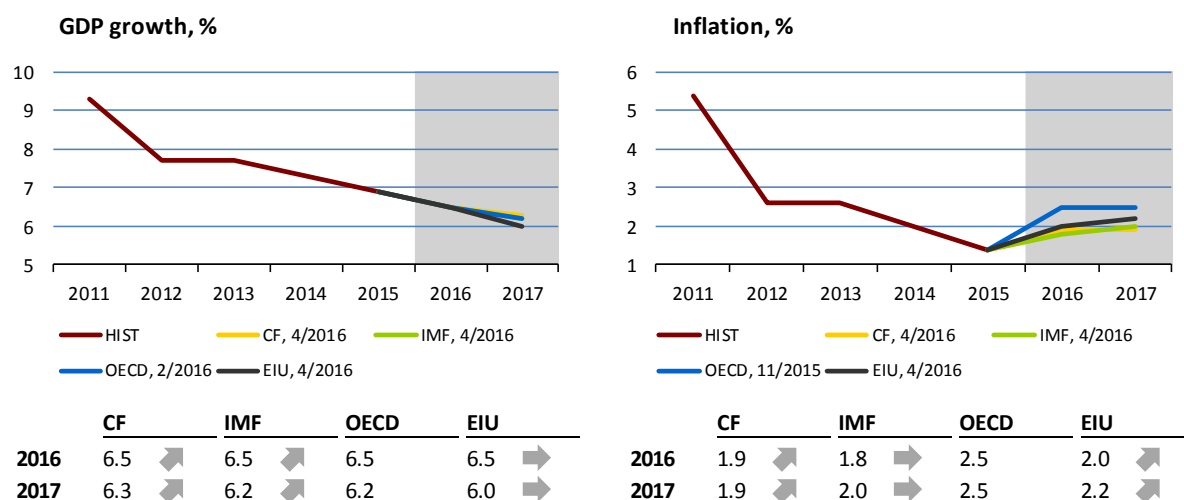
	CF	IMF	OECD	BoJ
2016	0.6 ⇐	0.5 ⇐	0.8	1.5
2017	0.5 ⇐	-0.1 ⇐	0.6	0.3



	CF	IMF	OECD	BoJ
2016	0.0 →	-0.2 ⇐	0.7	0.8
2017	1.6 →	1.2 ⇐	2.3	2.8

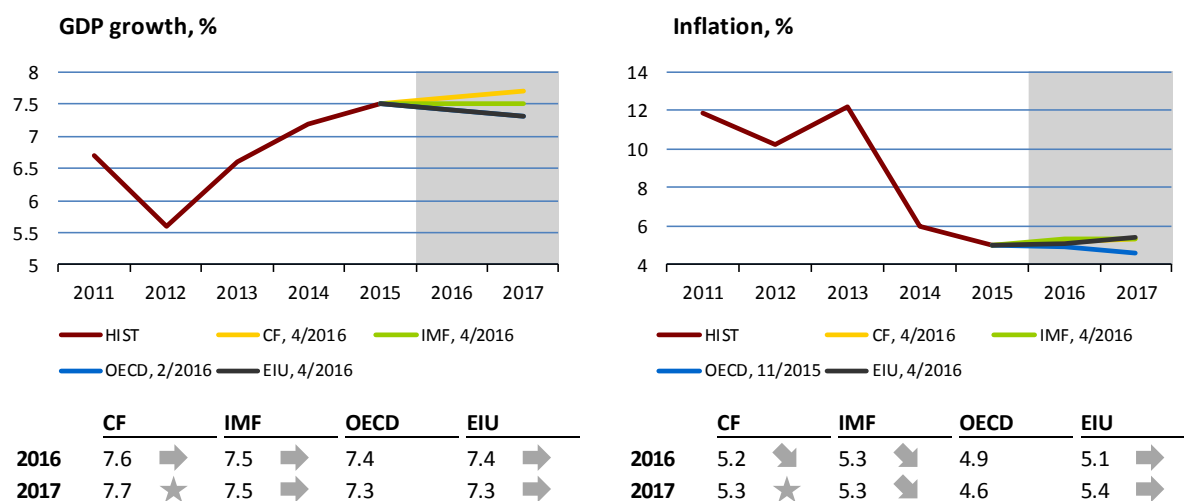
### III.1 China

GDP growth in Q1 (6.7% year on year) points to a persisting slowdown of the Chinese economy, but the latest short-term macroeconomic indicators are mostly optimistic. The annual growth rate of industrial production rose to 6.8% in March and the PMI also suggests a potential improvement in the macroeconomic situation. The seasonally adjusted PMI in manufacturing (CAIXIN) rose to 49.7. Exports in value terms showed an 11.5% year-on-year increase in March after a previous significant year-on-year decline, returning to growth for the first time in nine months. The drop in imports slowed almost two-fold compared to the previous month, to 7.6%. However, the results were significantly affected in both months by the floating date of the start of the new lunar year. The April CF revised both GDP and inflation upwards, expecting GDP growth of 6.5% and consumer price inflation of 1.9% this year, similarly as the IMF outlook.



### III.2 India

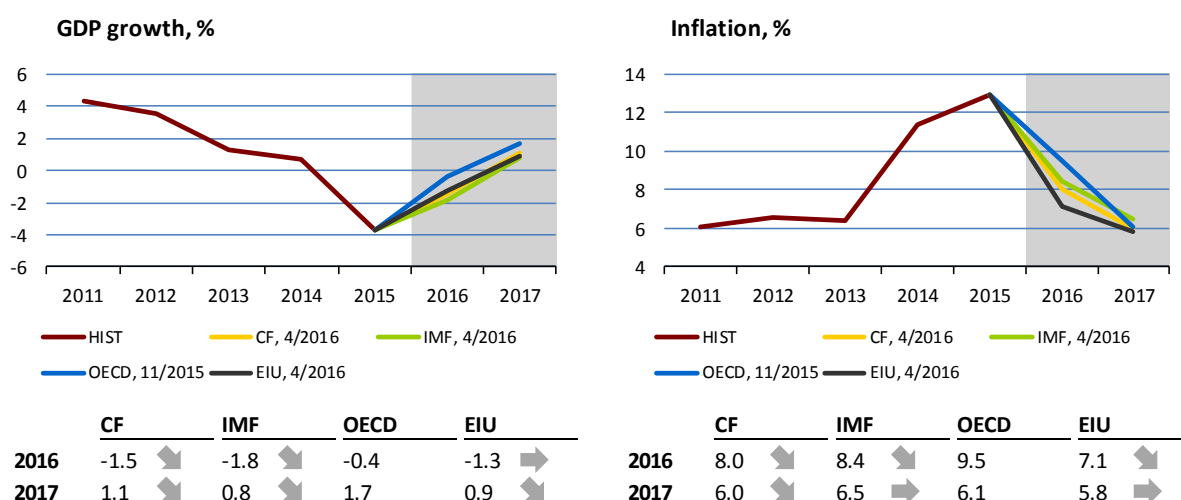
After three months of decline, Indian industrial output recorded year-on-year growth of 2%, mainly due to growth in mining and electricity supply. The PMI in manufacturing rose to 52.4 points in March, thanks mainly to growth in new export orders and improved domestic demand. The GDP growth forecasts for fiscal year 2016/2017 starting in April were unchanged. For fiscal year 2017/2018, the CF foresees GDP growth of 7.7% in its first prediction. Inflation slowed for the second time in a row in March, to 4.8%, thanks to a slower rise in food prices. The Indian central bank cut its key rate by 0.25 pp to 6.5% at its April meeting on expectations of strengthening economic growth this year and also of a normal monsoon season, which should thus not foster higher inflation. Both CF and the IMF revised their inflation outlooks. For both the fiscal years they predict now inflation to be in the range of 5.2%–5.3%.





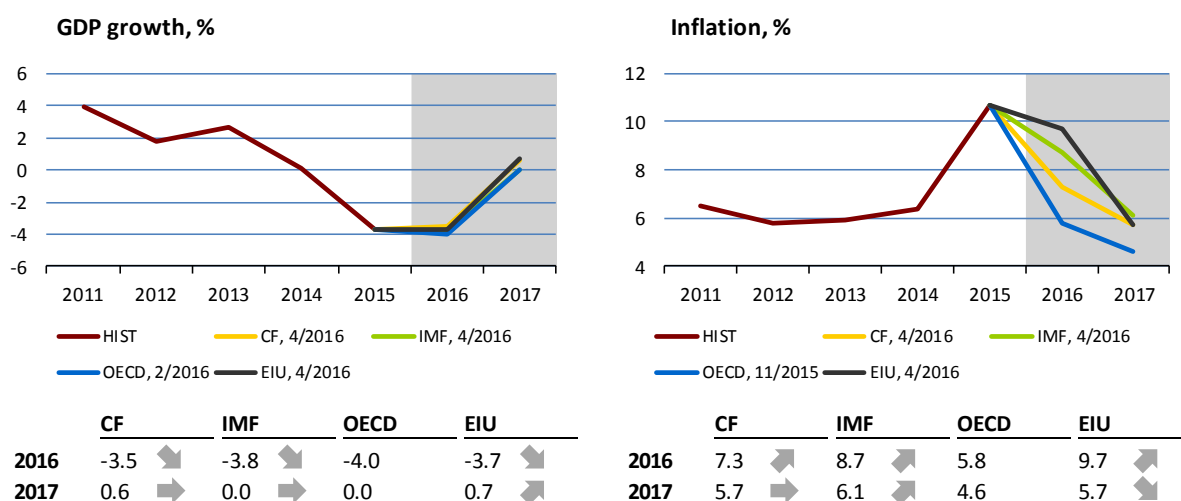
### III.3 Russia

The decline in Russian GDP deepened to 3.8% in 2015 Q4, but industrial production growth in the first months of 2016 suggests an improvement on 2015 Q4. Russian oil output is currently rising. Oil extraction grew by 0.3% to 10.91 million barrels a day in March, the highest level since 1987, the largest contributions coming from “small producers” (1.5% growth) and joint ventures (11.9% growth). By contrast, production by large oil companies has now slowed by 0.1% on average and is moreover uncoordinated. The rouble continued to appreciate gradually due to oil price growth and the weakening of the US dollar, approaching RUB 65 to the dollar in mid-April. The new CF, IMF and EIU outlooks expect GDP to fall by 1.3%–1.8% this year, with CF and the IMF lowering their outlooks. By contrast, all three institutions lowered their inflation outlooks significantly, the forecast range for this year now being 7.1%–8.4%.



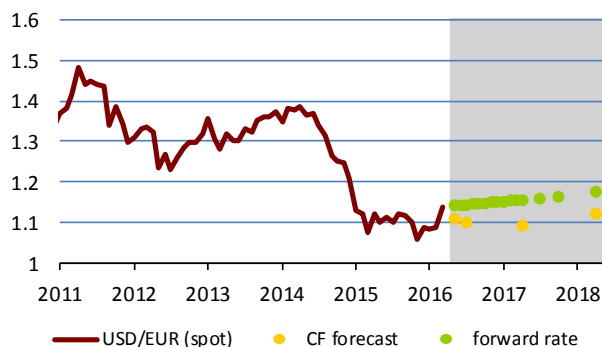
### III.4 Brazil

Expectations of a further worsening of household income and uncertainty about unemployment are undermining consumer confidence in Brazil. The current decision of the Congress to start the impeachment process of President Dilma Rousseff over fiscal irresponsibility is not improving the situation in the country either. Unemployment went up again in February to a seven-year high. Industrial production has been falling for two years now, but its decline, like that in retail sales, slowed in February. The PMI in manufacturing increased in March, but the manufacturing sector remains in contraction for the thirteenth consecutive month despite positive growth in new contracts abroad. CF, IMF and the EIU lowered their GDP growth outlooks for this year. The EIU raised its forecast for next year slightly (by 0.2 pp). Inflation was 9.4% in March, down by 1 pp from February thanks mainly to a drop in electricity and transport prices. However, CF and IMF increased their inflation estimates for 2016 to 7.3% and 8.7% respectively. Inflation of 5.7%–6.1% is expected for 2017.



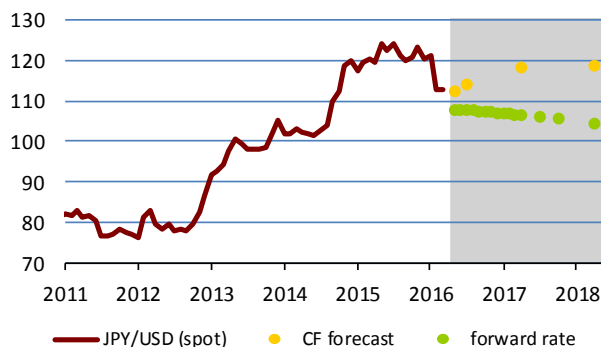
## IV. Outlook of exchange rates

The US dollar (USD/EUR)



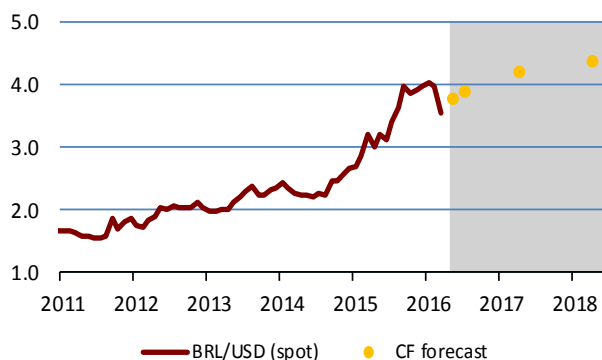
	11/4/16	05/16	07/16	04/17	04/18
spot rate	1.141				
CF forecast		1.109	1.099	1.091	1.121
forward rate		1.142	1.144	1.156	1.175

The Japanese yen (JPY/USD)



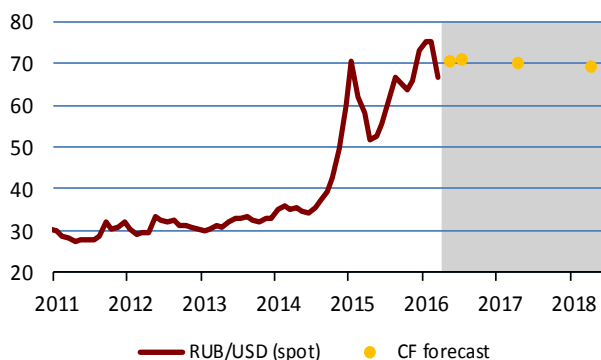
	11/4/16	05/16	07/16	04/17	04/18
spot rate	107.9				
CF forecast		112.3	114.2	118.1	118.6
forward rate		107.8	107.6	106.4	104.3

The Brazilian real (BRL/USD)



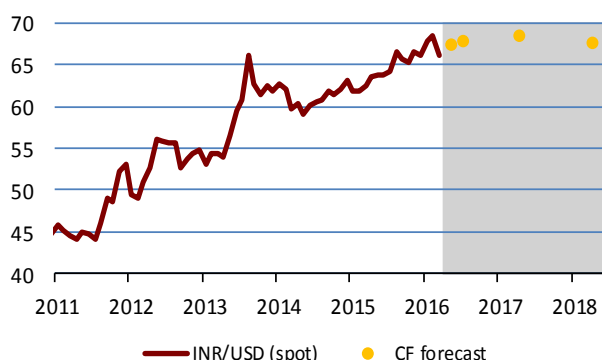
	11/4/16	05/16	07/16	04/17	04/18
spot rate	3.529				
CF forecast		3.774	3.896	4.198	4.375

The Russian rouble (RUB/USD)



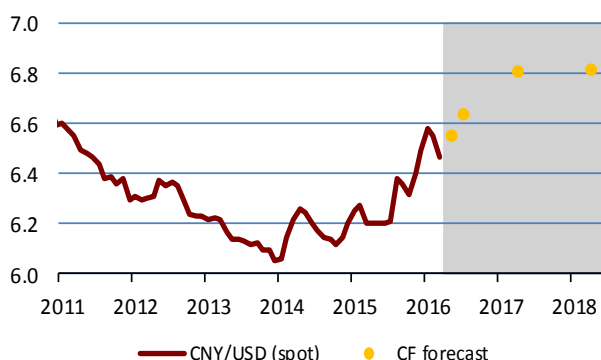
	11/4/16	05/16	07/16	04/17	04/18
spot rate	66.65				
CF forecast		70.42	71.02	70.16	69.21

The Indian rupee (INR/USD)



	11/4/16	05/16	07/16	04/17	04/18
spot rate	66.45				
CF forecast		67.35	67.79	68.54	67.60

The Chinese renminbi (CNY/USD)



	11/4/16	05/16	07/16	04/17	04/18
spot rate	6.470				
CF forecast		6.551	6.633	6.809	6.813

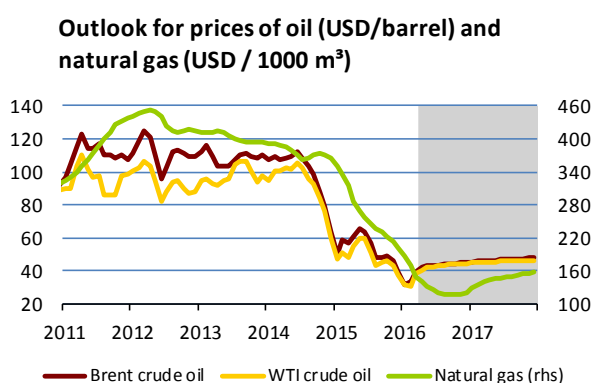
Exchange rates as of last day of month. Forward rate does not represent outlook; it is based on covered interest parity, i.e. currency of country with higher interest rate is depreciating. Forward rate represents current (as of cut-off date) possibility of hedging future exchange rate.

### V.1 Oil and natural gas

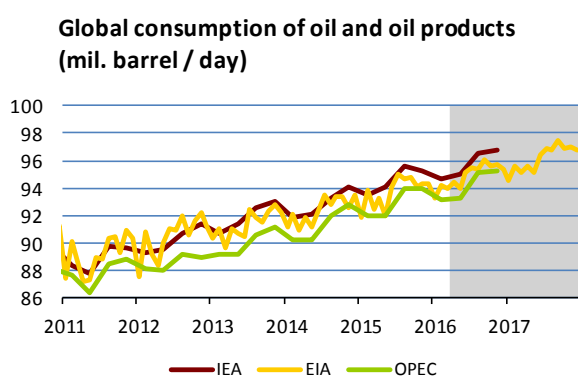
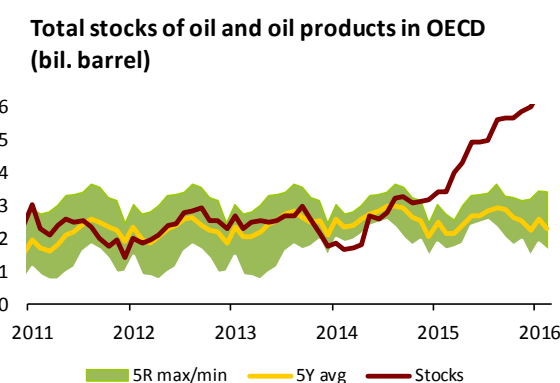
The Brent crude oil price started to surge shortly before mid-February, rising from USD 30/bbl to USD 40/bbl in one month, and stayed around this level with only minor swings for almost a month. The price growth was driven mainly by optimism that large oil producers would agree to freeze production growth at their April meeting and by a continued decline in the number of drilling rigs and falling shale oil extraction in the USA. The oil price dropped by about USD 2/bbl in early April as concerns about a further rise in global stocks predominated on the market again, but it then rose strongly again until the middle of the month. The Brent crude oil price reached a more than four-month high of over USD 44/bbl following news that Russia and Saudi Arabia had tentatively agreed to freeze production even before the meeting in Doha, where no agreement was reached at the end. The oil price was also supported by a weaker dollar and increased activity of financial investors, who reduced short positions and increased long positions in oil.

In its April forecast, the EIA predicts an average Brent (and WTI) crude oil price of USD 35/bbl and USD 41/bbl this year and the next respectively, with the price not expected to accelerate until 2017 H2. The April CF expects a markedly higher Brent price (USD 46.3/bbl) at the one-year horizon, virtually in line with the forecast based on the market futures curve of 11 April 2016, which comes to USD 41.7/bbl and USD 46.9/bbl on average respectively for the two years.

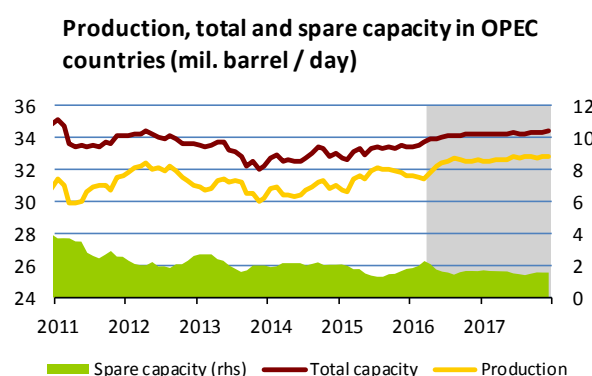
Average prices of natural gas fell in both the USA and Europe in March due to unusually warm weather and above-average inventories. Prices of long-term contracts dropped due to the previous fall in oil prices, which they usually follow with a lag of 6 to 9 months.



	Brent	WTI	Natural gas
2015	53.64 ↗	48.80 ↗	263.24 ↗
2016	41.71 ↘	40.74 ↘	134.63 ↘



	IEA	EIA	OPEC
2015	94.58 ↗	93.71 ↗	92.98 ↗
2016	95.75 ↗	94.86 ↗	



	Production	Total capacity	Spare capacity
2015	31.60 ↘	33.22 ↘	1.62 ↗
2016	32.20 ↘	33.96 ↘	1.76 ↘

Note: Oil price in USD/barrel, price of Russian natural gas at German border in USD / 1,000 m<sup>3</sup> (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

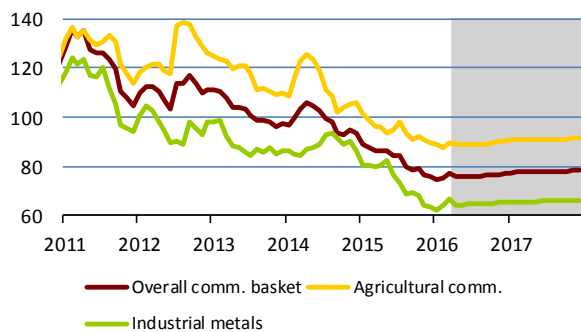
## V.2 Other commodities

Prices of non-energy commodities strongly reflected the positive sentiment in the oil market in March. The average monthly price index thus rose by 2.8% compared to February. However, it fell back slightly in the first half of April, with the industrial metals and food commodity price sub-indices showing a similar pattern.

Industrial metals prices mirrored the rising oil prices and the favourable economic data from China, where the PMI in manufacturing grew from 48.0 to 49.7 in March and the local property market also improved, leading to growth in copper and steel prices. This was reflected in a further rise in iron ore prices. Outlooks for the manufacturing sector also improved in the USA, where the PMI grew from 49.5 to 51.8 in March. The growth in commodity prices was also fostered by the US dollar exchange rate, which started to weaken in early March on expectations of slower monetary policy tightening in the USA, thereby increasing the purchasing power of the Chinese currency.

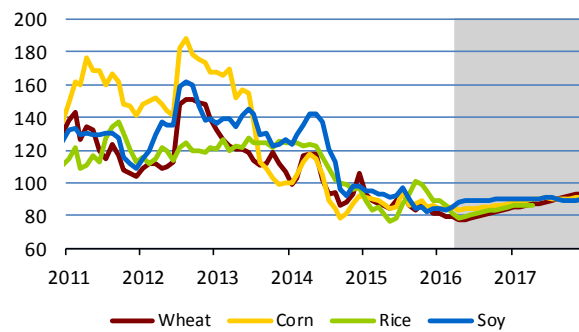
As regards food commodities, sugar prices rose in early March as a result of appreciation of the Brazilian real and an expected 20% year-on-year drop in exports from Thailand this year due to drought. The appreciation of the Brazilian currency also led to a rise in coffee prices. However, prices of both commodities were falling again in late March and early April. Cereal prices are still under pressure, as the USDA estimates for this year's harvest remain high. Only the soy price has risen sharply since early March. The seasonal growth in lean hog prices halted in mid-March, but the forecast expects prices to be rising until June. Prices of live cattle were broadly flat but are expected to fall sharply.

**Non-energy commodities price indices**



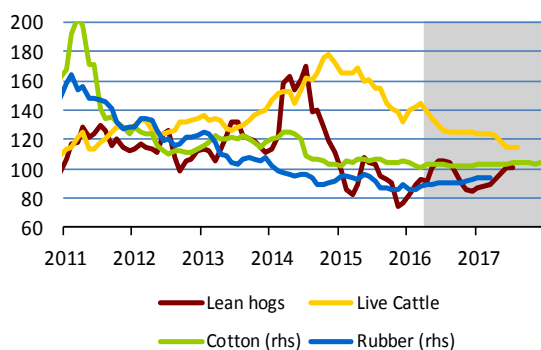
	Overall	Agricultural	Industrial
2015	82.8 →	94.7 →	74.0 →
2016	76.1 ↘	89.2 ↗	64.7 ↘

**Food commodities**



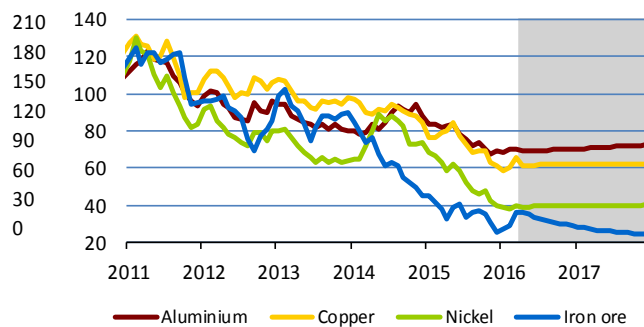
	Wheat	Corn	Rice	Soy
2015	87.4 →	88.1 →	88.3 →	90.2 →
2016	80.4 ↘	85.2 ↘	83.2 ↘	88.2 ↗

**Meat, non-food agricultural commodities**



	Lean hogs	Live Cattle	Cotton	Rubber
2015	91.8 →	154.3 →	67.5 →	46.7 →
2016	94.3 ↗	131.6 ↘	63.8 ↗	

**Basic metals and iron ore**



	Aluminium	Copper	Nickel	Iron ore
2015	76.6 →	73.0 →	54.4 →	36.0 →
2016	69.5 ↘	61.7 ↘	39.2 ↘	31.6 ↘

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.

## How global inventory levels affect commodity prices <sup>1</sup>

In *Global Economic Outlook* we regularly monitor the prices of major industrial and agricultural commodities and derive their expected future paths from their market futures curves. Because a drop in prices, accompanied by a marked increase in global inventories, has been observed for most of the commodities we monitor in the past few years, we will focus in this article on fundamental factors (production, consumption and inventories), which should be the main drivers of both current and future commodity prices. Using simple statistics, we will then attempt to deduce whether they are indeed the main drivers and whether it is possible to identify other factors that significantly affect the prices of individual commodities.

### Fundamental factors affecting food commodities

Global stocks<sup>2</sup> of most agricultural commodities are currently at their highest levels in many years or even at historical highs. Excess supply has led to a constant decline in prices over the past few years, although the reasons may differ from commodity to commodity. The most stable fundamental, particularly for food commodities, is consumption, which shows relatively even growth. By contrast, production is more volatile along its upward trend, as, in addition to hard-to-predict exogenous factors (such as the weather), it is affected by changes in acreage, through which farmers respond with the necessary lag to the current price and level of inventories. Production, inventories and the price are thus endogenous variables affecting one another in a dynamic system. Special attention should be paid to energy crops, i.e. maize and soy, which are used to produce biofuels (bioethanol and biodiesel) as well as food, and may thus also respond to movements in oil prices and biofuel production. In the case of sugar, the exchange rate of the Brazilian currency is often also a price-determining factor. Charts 1 to 6 compare the evolution of fundamentals with prices for selected food commodities. By just looking at the charts we can see that periods of rising (falling) prices are usually accompanied by a fall (rise) in global inventories. We will focus on this phenomenon in more detail in section 4.

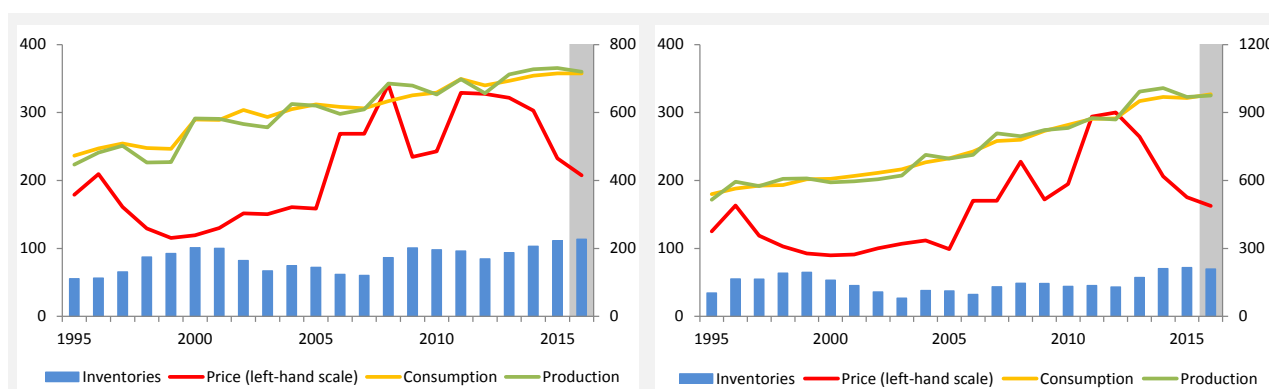


Chart 1 Wheat

Chart 2 Maize

Source: Economist Intelligence Unit (EIU)

Note: Price in USD/tonne; consumption, production and stocks in million tonnes. The grey shaded area is the EIU forecast.

<sup>1</sup> Author: Jan Hošek (jan2461.hosek@cnb.cz). The views expressed in this article are those of the author and do not necessarily reflect the official position of the Czech National Bank.

<sup>2</sup> Statistical assessment of global supply, demand and inventories is particularly tricky in the case of agricultural commodities, as the harvest season varies depending on crop variety and geographical location. The data are taken from the Economist Intelligence Unit (EIU) database, where they are processed using data from the International Grains Council (IGC), the US Department of Agriculture (USDA), the Food and Agriculture Organisation (FAO), the International Cocoa Organisation (ICCO) and the International Sugar Association (ISA).

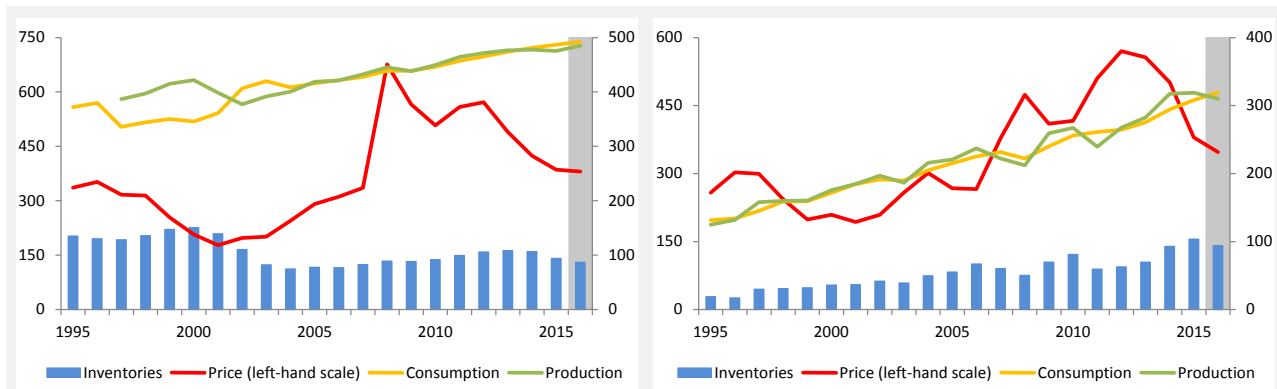


Chart 3 Rice

Chart 4 Soybeans

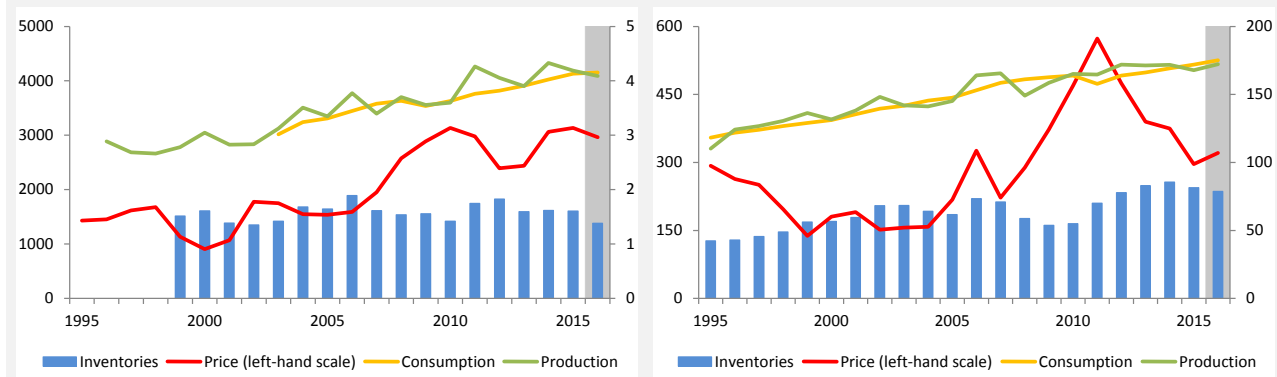


Chart 5 Cocoa

Chart 6 Sugar

Source: EIU

Note: Price in USD/tonne; consumption, production and stocks in million tonnes. The grey shaded area is the EIU forecast.

## Fundamental factors affecting basic metals and other industrial commodities

Compared to food commodities, industrial commodities are not affected by the weather so much on the supply side, whereas consumption shows greater business-cycle-related volatility (see Charts 7 to 12). As the processing of basic metals is very energy-intensive, their prices can be expected to be affected to a considerable extent by prices of oil and other energy commodities as well. Stocks at the LME, statistics for which are available at high frequency in real time,<sup>3,4</sup> are often used as a proxy for global stocks of industrial metals. Besides industrial metals, we will also look at the fundamental factors affecting cotton and natural rubber stocks in this section. This section should logically also cover other major industrial commodities such as coal, natural gas and iron ore. Unfortunately, regular statistics on the inventories of these commodities are not available so they will not be included in this study.

<sup>3</sup> In this section we will again use EIU data, in this case based on data from the London Metal Exchange (LME), the World Bureau of Metal Statistics (WBMS), the International Primary Aluminium Institute (IPAI), Metallgesellschaft, the International Nickel Study Group (INSG), the International Lead and Zinc Study Group (ILZSG) and the International Rubber Study Group (IRSG). The data for oil are compiled using statistics from the International Energy Agency (IEA).

<sup>4</sup> In the case of industrial commodities, a distinction must be made between extracted stocks (used in this article) and estimates of mineable reserves. The latter are located underground and geological surveys are used to estimate what quantity of them is economically mineable given the current price and the available technologies. These reserves represent a completely different concept which will not be dealt with in this publication.

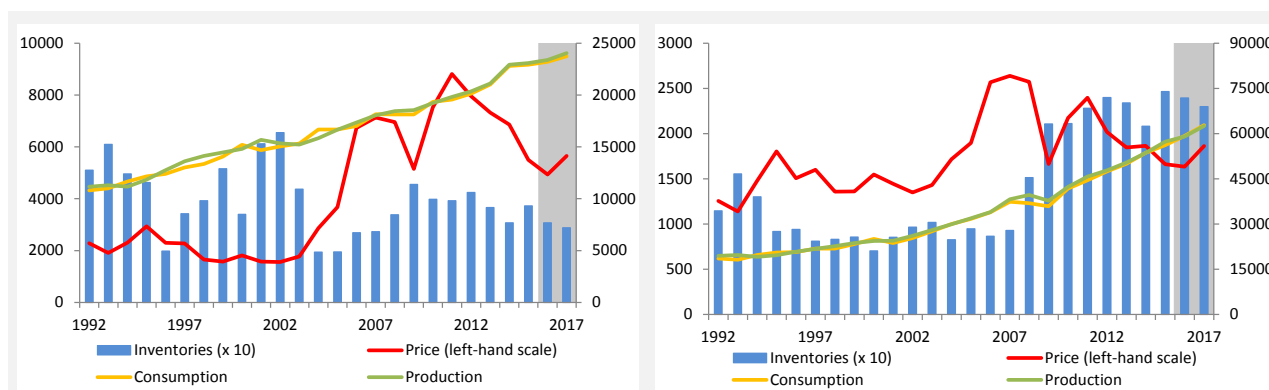


Chart 7 Copper

Chart 8 Aluminium

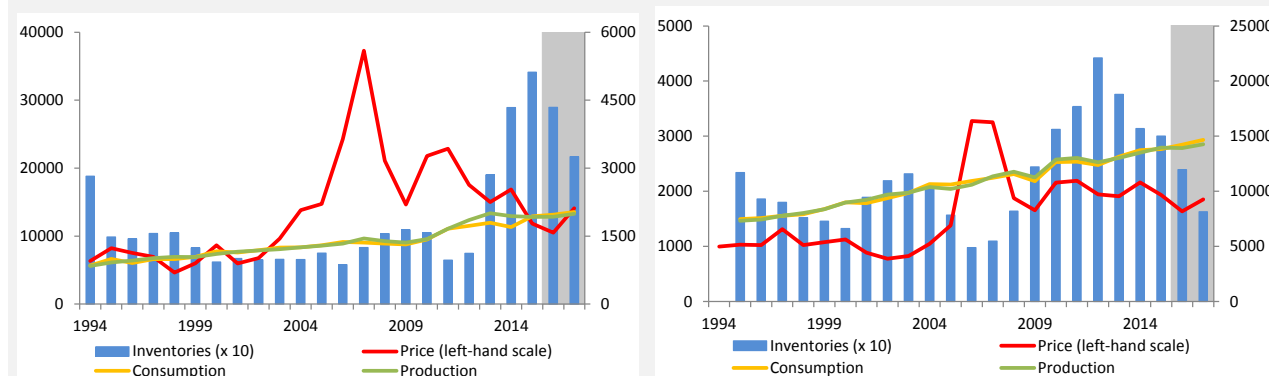


Chart 9 Nickel

Chart 10 Zinc

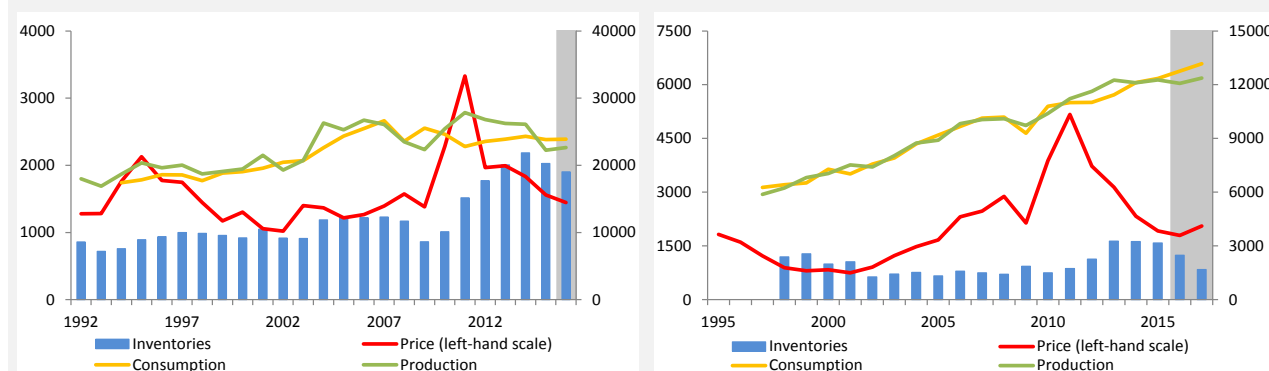


Chart 11 Cotton

Chart 12 Natural rubber

Source: EIU.

Note: Price in USD/tonne; consumption, production and stocks in thousand tonnes. The grey shaded area is the EIU forecast. Stocks are multiplied by ten to make them more visible.

## Relative inventories

The previous sections presented absolute inventory levels in chart form. In the period under review, most of the commodities reached their highest absolute inventory levels in 2015. In absolute terms, cotton and sugar stocks peaked in 2014, rubber in 2013 and zinc in 2012. Only in the case of rice (2000), cocoa (2006) and copper (2002) did stocks not peak in the past four years. However, the information value of absolute stocks may be limited given that both commodity consumption and commodity production are showing an upward trend. In this section, therefore, we will look at relative inventories, i.e. the ratio of absolute stocks to consumption in a given year (see Charts 13 and 14). In relative terms, most commodity inventories have not been extreme from a historical perspective in the past few years. The exceptions are soy, sugar, nickel, zinc and cotton stocks. At the same time, the charts show that the ratio of stocks to total consumption differs considerably across commodities. In general, it is lowest for basic metals, although this is probably due partly to the fact that we only use stocks at the LME, which are certainly lower than real global stocks. The highest stocks-to-consumption ratios are recorded for cotton, sugar and cocoa.

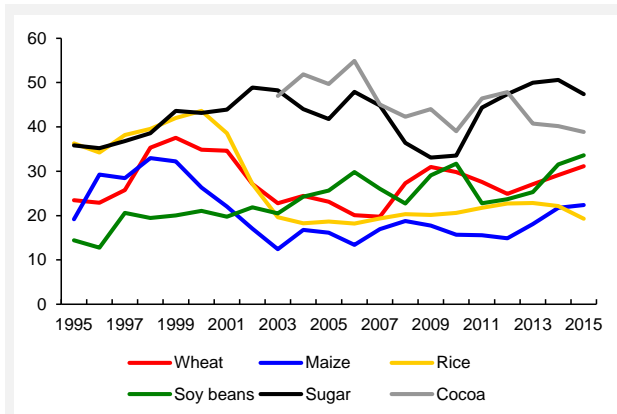


Chart 13 Relative inventories of food commodities

Source: EIU, CNB calculations.

Note: Ratio of stocks to current consumption in %.

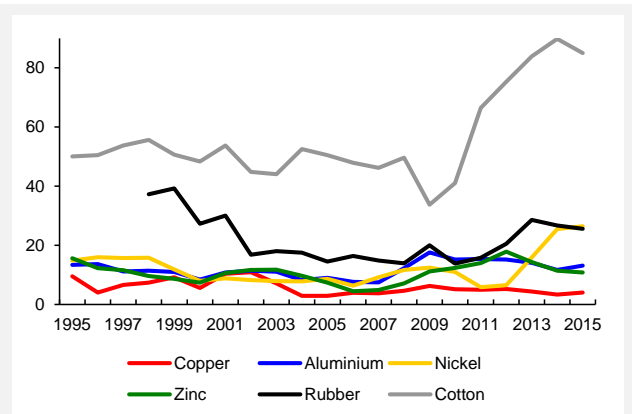


Chart 14 Relative inventories of non-food commodities

## Correlation between prices and stocks from a simple statistical perspective

An imbalance between supply and demand for a commodity on the global market leads immediately, by definition, to a change in global stocks and to a change in its price due to the functioning of market mechanisms. In response to the price change, market mechanisms should, with a lag, also steer demand and supply back towards market equilibrium. The length of the lag differs for different commodities. For annual crops it should be relatively short because farmers can respond quickly by changing acreages and state institutions can also react by buying surpluses into state reserves (or by releasing reserves where necessary). The equilibrium of the system is disturbed by weather changes. In the case of industrial commodities it can take longer to establish market equilibrium. Investment in projects commences in periods of growth or high prices. When those projects start up several years later, they must be productive to generate cash to cover loan instalments even when supply exceeds demand, as it does for most industrial commodities at present. As noted previously, the change in stocks accompanying excess supply or demand for a commodity should in theory be negatively correlated with the change in its price. This is visually evident in Charts 1 to 12. Table 1 documents the same fact in figures. The vast majority of the correlation coefficients<sup>5</sup> have the expected (negative) sign and differ only in value. The "Coefficient 1" column shows the correlation between the price of the commodity and the relative inventory level. In the case of a negative sign, this correlation can be interpreted as meaning that a higher (lower) commodity price predominates in periods when the relative inventory level is lower (higher). The "Coefficient 2" column shows the correlation between the change in price and the change in relative inventories. In the case of a negative sign, it tells us that the commodity price can be expected to rise (fall) in periods when relative inventories are falling (rising). However, the existence of a negative correlation says nothing about the causal relationship between stocks and prices, as both are a result of third variables which affect fundamental factors (supply, demand or both) and can also have a short-term effect on market psychology and speculative financial flows.

	Coeff. 1	Coeff. 2
Wheat	-0.36	-0.36
Maize	-0.39	-0.06
Rice	-0.44	0.04
Soy	0.44	-0.41
Sugar	-0.06	-0.06
Cocoa	-0.82	-0.48
Copper	-0.60	-0.22
Aluminium	-0.37	-0.55
Nickel	-0.30	-0.27
Zinc	-0.31	-0.59
Rubber	-0.48	-0.48
Cotton	0.35	0.45

Table 1 Correlation coefficients for prices and inventories

Note: Coefficient 1 captures the correlation between the price and the relative inventory level and coefficient 2 the correlation between changes in those variables.

## Other factors affecting commodity prices

Besides inventories, analysts' comments on price developments in commodity markets also often mention, for example, data on Chinese GDP growth (or Chinese industry) and oil prices, which are linked with energy costs in the production of most commodities, in the role of explanatory variables. We will now therefore try to estimate and quantify these potential relationships using linear regression. The calculations are performed on annual data (source: EIU) for the period shown in Charts 1 to 12 (excluding the forecast). We will analyse two possible specifications. In equation 1, the commodity price is expressed as a linear function of the Brent crude oil price, annual GDP growth in China and the relative inventory level. Given that the estimate based on level data may suffer from data non-stationarity, we will then estimate a similar

<sup>5</sup> The correlation coefficients are calculated from annual data (source: EIU) for the entire period shown in Charts 1 to 12 (excluding the forecast).



relationship on changes in the variables. In equation 2, the annual percentage change in the commodity price will thus depend on the percentage change in the Brent price and the changes in Chinese GDP growth and the relative inventory level (both in percentage points). The results are presented in the following tables. In the first specification (see Table 2), the value of the regression coefficients has virtually no information value given the different levels of the variables, hence we only examine the sign of the coefficient and its statistical significance. In the second specification, the coefficient values may be interesting and can be interpreted as follows: how many per cent the dependent variable (price) will change by if the explanatory variable changes by 1% (for the oil price) or 1 pp (for Chinese GDP growth and relative inventories).

	Oil prices	Chinese growth	Relative inventories
Wheat	+ ***		
Maize	+ ***		
Rice	+ ***	- *	
Soy	+ ***	- *	
Sugar	+ ***		+ *
Cocoa			- **
Copper	+ ***	+ *	
Aluminium	+ ***	+ ***	- ***
Nickel	+ ***	+ ***	
Zinc	+ ***	+	- *
Rubber	+ ***		
Cotton	+		

Table 2 Signs and regression coefficient significance in equation 1

Note: Level of statistical significance of regression coefficients: 90% ( ), 95% (\*), 99% (\*\*), 99.9% (\*\*\*).

	Oil prices	Chinese growth	Relative inventories
Wheat	0.36		
Maize	0.43 *		
Rice	0.50 *	-0.09 *	
Soy			-1.80
Sugar	0.37		
Cocoa			
Copper	0.39	0.07 *	
Aluminium	0.18	0.03 *	-2.94 ***
Nickel	0.30	0.13 ***	-1.87 *
Zinc		0.10 *	
Rubber		0.08 *	
Cotton			

Table 3 Regression coefficients and their significance in equation 2

Although in practice we often observe a reaction of commodity prices to announced changes in stocks, our regressions were virtually unaffected by this dependence. The explanation probably lies in the fact that prices react immediately after new inventory levels are announced (i.e. on a daily basis, for example), but this dependence is not so significant for data at annual frequency. It is also likely that simple linear regression cannot capture the effect of stocks because the relationship between stocks and the price may be non-linear or discontinuous and only begins to manifest itself after reaching a critical (threshold) level. By contrast, most of the mentioned commodities are fundamentally affected by oil prices and most industrial commodities also by economic growth in China.<sup>6</sup> Similar conclusions apply to other major commodities such as coal, iron ore and natural gas, for which, however, information about global stocks is difficult to obtain.

At a time of sharp growth in food commodity prices, this growth was in part attributed to rapidly increasing biofuel production, for which maize and soy were partly used as input commodities (for the production of bioethanol and biodiesel in the USA). We can test this hypothesis by adding production of the relevant biofuel (or the change thereof) to the above-mentioned regression equations for the given crops as another explanatory variable. In neither case did the new variable in the regression equations turn out to be significant, so the link between maize and soy prices and growth in biofuel production cannot be proven by these methods.

### The effect of inventory levels on future commodity prices

Besides current (spot) prices, current inventory levels are theoretically also influenced by futures prices and hence by the slope of the futures curve. An inventory owner must generally reckon with the costs of physical storage of a commodity and with financing costs connected with the real interest rate. These costs should in theory increase the price of a commodity with a later delivery date. However, this is counteracted by the "convenience yield", i.e. the (subjective) benefit accruing from physical ownership of the commodity over the purchase of a futures contract. Generally, if inventories are (relatively) high, the futures curve will be in contango, i.e. the spot price is the lowest and futures prices increase as the delivery date moves further into the future (at least for the few nearest contracts). Conversely, if the market perceives stocks as low, the futures curve will be in backwardation, with the prompt (spot) price high and futures prices decreasing as the delivery date gets more distant. A distinction must be made between permanent or long-term shocks to supply or demand, which tend to shift the futures curve over the entire horizon, and

<sup>6</sup> It should be noted here that oil price growth and Chinese GDP growth may be correlated and that this may partly distort the coefficients for the given variables.

temporary short-term shocks, which usually lead to a change in the slope of the futures curve – see, for example, Roache and Erbil (2010).

The shape of the futures curve then affects the behaviour of market participants – producers, processors, consumers and financial investors. High spot prices (and hence a perceived shortage of commodities in the market) motivate producers to increase current production, whereas processors and consumers in such circumstances prefer to restrict demand and draw on their own stocks, temporarily further worsening the perceived shortage of inventories. The significance of the convenience yield relative to storage costs increases. However, we are currently seeing the opposite phenomenon in most commodity markets: commodity stocks are high and the benefits accruing to physical ownership are thus relatively small. The spot price is low (and often insufficient even to cover operating costs, so the market perceives this phenomenon as temporary), which stimulates current demand. Suppliers should naturally react by curbing in production, but this is happening to only a limited extent at present.<sup>7</sup> The futures curve is upward sloping (contango). This makes it possible to cover storage costs, resulting in a further rise in stocks. The current situation does not benefit speculators much, as rolling over futures contracts when commodity prices are stagnating is a loss-making exercise.

## Conclusion

Stocks of many food and industrial commodities are currently at historical highs in absolute terms. In relative terms, the situation is not so dramatic for most commodities, but their growth is being accompanied by a marked drop in prices. One of the factors behind these developments is the recent fall in energy prices, which is reducing the cost of producing energy-intensive industrial commodities and of growing agricultural commodities. Another factor is slowing GDP growth in China and other emerging countries, due to which past investment in commodity extraction and production has turned out to be excessively large. By contrast, the effect of increasing biofuel production on the previous growth in maize and soy prices cannot be proven. Excess production capacity and growth in inventories is also affecting the futures market, which is in contango. The market thus perceives the current inventory levels as relatively high but only temporary. This is making commodity storage profitable and encouraging further growth in stocks. Constantly rising consumption (albeit at a slower pace) should gradually catch up again with supply, whose growth has now exhausted its potential owing to dramatically reduced investment. After that, stocks will start to decrease again and the commodity market will begin to approach equilibrium. The fact that the current drop in investment in production capacity could tilt the commodity market imbalance in the opposite direction in the future if supply growth does not catch up with demand growth in time represents a potential risk.

## References

Roache and Erbil (2010): How Commodity Price Curves and Inventories React to a Short-Run Scarcity Shock, IMF Working Paper WP/10/222, September 2010

<https://www.imf.org/external/pubs/ft/wp/2010/wp10222.pdf>.

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<sup>7</sup> This is due to a “commodity supercycle” associated with fast growth in commodity consumption in China and other emerging economies since the end of the 1990s. Huge sums were gradually invested in commodity production because of soaring prices of most commodities. As Chinese growth has slowed, however, the new extraction and processing capacity has turned out to be surplus to requirement. The new projects are nonetheless forced to maintain excess production even in the current circumstances to generate cash to service previous investment loans.

## A1. Change in GDP predictions for 2016

	CF		IMF		OECD		CB / EIU	
EA	0	2016/4	-0.2	2016/4	-0.4	2016/2	-0.3	2016/3
		2016/3		2016/1		2015/11		2015/12
US	-0.1	2016/4	-0.2	2016/4	-0.5	2016/2	-0.2	2016/3
		2016/3		2016/1		2015/11		2015/12
DE	0	2016/4	-0.2	2016/4	-0.5	2016/2	0	2015/12
		2016/3		2016/1		2015/11		2015/6
JP	-0.1	2016/4	-0.5	2016/4	-0.2	2016/2	+0.1	2016/1
		2016/3		2016/1		2015/11		2015/10
BR	-0.4	2016/4	-0.3	2016/4	-2.8	2016/2	-0.6	2016/4
		2016/3		2016/1		2015/11		2016/3
RU	-0.1	2016/4	-0.8	2016/4	-1.2	2015/11	0	2016/4
		2016/3		2016/1		2015/6		2016/3
IN	0	2016/4	0	2016/4	+0.1	2016/2	0	2016/4
		2016/3		2016/1		2015/11		2016/3
CN	+0.1	2016/4	+0.2	2016/4	0	2016/2	0	2016/4
		2016/3		2016/1		2015/11		2016/3

## A2. Change in inflation predictions for 2016

	CF		IMF		OECD		CB / EIU	
EA	0	2016/4	-0.6	2016/4	-0.1	2015/11	-0.9	2016/3
		2016/3		2015/9		2015/6		2015/12
US	0	2016/4	-0.3	2016/4	-0.8	2015/11	-0.4	2016/3
		2016/3		2015/9		2015/6		2015/12
DE	0	2016/4	-0.7	2016/4	-0.7	2015/11	-0.7	2015/12
		2016/3		2015/9		2015/6		2015/6
JP	0	2016/4	-0.6	2016/4	-0.9	2015/11	-0.6	2016/1
		2016/3		2015/9		2015/6		2015/10
BR	+0.1	2016/4	+2.4	2016/4	+0.6	2015/11	+0.8	2016/4
		2016/3		2015/9		2015/6		2016/3
RU	-0.4	2016/4	-0.2	2016/4	+2.5	2015/11	-0.4	2016/4
		2016/3		2015/9		2015/6		2016/3
IN	-0.1	2016/4	-0.2	2016/4	-0.4	2015/11	0	2016/4
		2016/3		2015/9		2015/6		2016/3
CN	+0.4	2016/4	0	2016/4	+0.5	2015/11	+0.1	2016/4
		2016/3		2015/9		2015/6		2016/3

### A3. List of abbreviations

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

**A4. List of thematic articles published in the GEO****2016**

	<b>Issue</b>
How global inventory levels affect commodity prices (Jan Hošek)	2016-4
The Europe 2020 strategy: Will it be fulfilled? (Pavla Břízová)	2016-3
Changes in global imbalances in the world economy (Luboš Komárek and Vladimír Žďárský)	2016-2
The FDI life cycle on the example of the Czech Republic (Filip Novotný)	2016-1

**2015**

	<b>Issue</b>
The role of China in the slowdown in international trade (Oxana Babecká Kucharčuková)	2015-12
Central banks' gold reserves (Iveta Polášková)	2015-11
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
The Chinese renminbi in the SDR basket: A realistic prospect? (Soňa Benecká)	2015-8
Annual assessment of the forecasts included in GEO (Filip Novotný)	2015-7
Seasonal price movements in the commodity markets (Martin Motl)	2015-6
Assessment of the effects of quantitative easing in the USA (Filip Novotný)	2015-5
How consensus has evolved in Consensus Forecasts (Tomáš Adam and Jan Hošek)	2015-4
The US dollar's position in the global financial system	2015-3
The crisis and post-crisis experience with Swiss franc loans outside Switzerland (Alexis Derviz)	2015-2
The effect of oil prices on inflation from a GVAR model perspective (Soňa Benecká and Jan Hošek)	2015-1

**2014**

	<b>Issue</b>
Applicability of Okun's law to OECD countries and other economies (Oxana Babecká Kucharčuková and Luboš Komárek)	2014-12
Monetary policy normalisation in the USA (Soňa Benecká)	2014-11
Changes in FDI inflows and FDI returns in the Czech Republic and Central European countries (Vladimír Žďárský)	2014-10
Competitiveness and export growth in selected Central European countries (Oxana Babecká Kucharčuková)	2014-9
Developments and the structure of part-time employment by European comparison (Eva Hromádková)	2014-8
The future of natural gas (Jan Hošek)	2014-7

	<b>Issue</b>
Annual assessment of the forecasts included in GEO (Filip Novotný)	2014-6
How far the V4 countries are from Austria: A detailed look using CPLs (Václav Žďárek)	2014-5
Heterogeneity of financial conditions in euro area countries (Tomáš Adam)	2014-4
The impacts of the financial crisis on price levels in Visegrad Group countries (Václav Žďárek)	2014-3
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

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