GLOBAL ECONOMIC OUTLOOK – FEBRUARY

Monetary and Statistics Department
External Economic Relations Division

2011

CONTENTS

Authors:	Oxana Babecká	II.
	Milan Klíma	III.
	Filip Novotný	IV.
	Soňa Benecká	V.
	Martin Motl	VI.
	Filip Novotný	Focus…

| Editors: | Oxana Babecká |
| | Martin Motl |

| Editor-in-Chief: | Luboš Komárek |

The new outlooks indicate a slight economic recovery in the advanced economies under review and strong growth of the Chinese economy. Fiscal consolidation will probably temporarily curb economic growth in the euro area. Although **GDP** growth in the euro area has been revised upwards, the pace of economic recovery will remain the lowest among the monitored regions (1.4%–1.7%). The German economy will grow by around 2.3% this year. Annual GDP growth in the USA could be between 2.1% and 3.7% in 2011. Growth is expected to be the fastest in China, where GDP will rise by 9.0%–9.7%.

The **inflation** outlook for the euro area and Germany has been revised upwards. Inflation in the euro area could reach 2% in 2011. Inflation in Germany will remain just below this level. By contrast, lower inflation is expected in China. The outlook for inflation in the USA is between 0.9% and 1.9%.

The **leading indicators** in February are signalling a rise in economic growth in the USA, with a particularly strong improvement in the household consumption outlook. They are also indicating continued economic growth in the euro area, but at a lower level than in the USA. For China they are showing a slight downturn in its still strong GDP growth.

3M and 1Y EURIBOR **interest rates** have been relatively stable on average since October, at around 1.0% and 1.5% respectively. They edged up in February and the market outlooks have been revised accordingly. The revision is small in the short term, but increases as the horizon gets longer. The 10Y German government bond yield rose above 3.2% in February. CF expects it to remain flat in the three months ahead and then rise to 3.5% at the one-year horizon. USD LIBOR rates have been flat since September at 0.3% for 3M and 0.8% for 1Y. The market outlook for both rates has declined slightly in the short term, while increasing quite strongly in the long term. The 10Y US government bond yield rose to 3.6% in the first half of February. The CF outlook expects it to decline to 3.5% in the three months ahead and subsequently rise to 3.8% at the end of this year.

Uncertainty related to the euro area debt crisis continues to affect the **exchange rate** of the US dollar against the euro. On the other hand, the growth expected in the USA for 2011 increased, so the new CF expects the dollar to appreciate by 9% to the euro at the one-year horizon. A depreciation is expected vis-à-vis the pound sterling, and demand for Asian and Latin American currencies will also rise. However, the dollar should appreciate against the Japanese yen (by 9%) and the Swiss franc (by 8%) according to the latest forecasts.

The price of **Brent crude oil** broke through USD 100 a barrel on the last day of January. In February it has been fluctuating between USD 100 and USD 105 a barrel. According to the outlook based on currently traded futures, the price can be expected to stay broadly flat at the current levels, i.e. just above USD 100 a barrel, in the two years ahead. Additional upside risks can be seen in rising demand for oil as a result of faster economic growth in the USA and the euro area than originally expected, as well as further political developments in Africa and the Middle East. The price of **natural gas** is expected to rise throughout 2011. Following growth in prices of **industrial metals** since early 2011, the outlooks point to stagnation roughly at the current levels until the end of 2012. As for prices of **agricultural commodities**, their growth can be expected to slow in 2011 H1, followed by a gradual price decline over the rest of the outlook horizon.
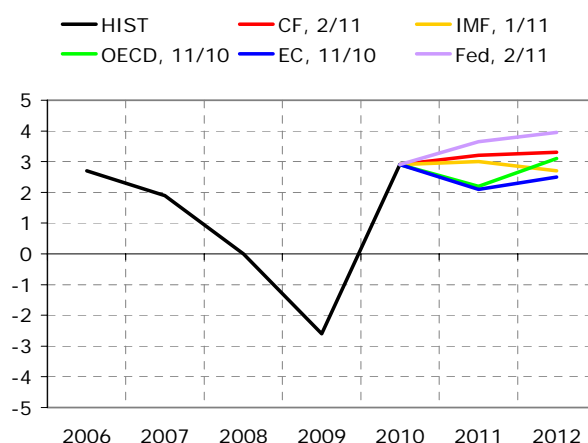
II.1 GDP

Euro area economic growth will not exceed 2% in the two years ahead and will remain the lowest among the monitored countries. The forecast for economic growth in Germany is only slightly more optimistic (1.5%–2.5%). However, it must be said that last year the German economy grew almost twice as fast as the euro area economy as a whole. Uncertainty persists regarding the economic recovery in the USA and China. The outlooks for GDP growth in the USA in 2011 range from 2.1% to 3.7%. Maximum GDP growth in the USA in the two years ahead could reach 4%. Expected economic growth in China remains below 10%.
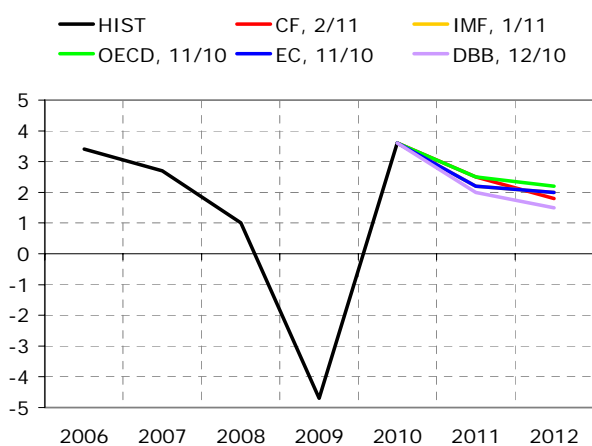
EURO AREA

Legend: HIST, CF, 2/11, IMF, 1/11, OECD, 11/10, EC, 11/10, ECB, 12/10
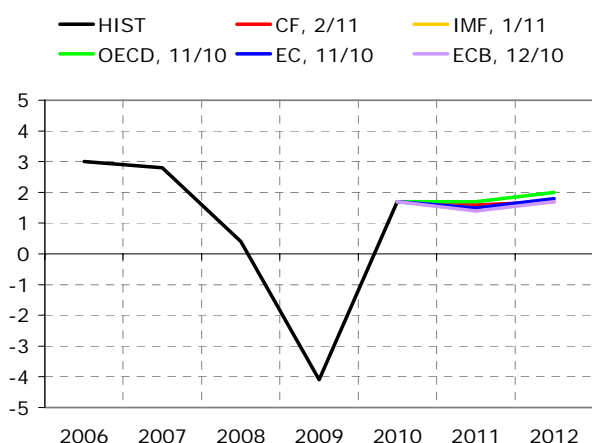
	HIST	CF	IMF	OECD	EC	ECB
2010	1.7					
2011		1.6	1.5	1.7	1.5	1.4
2012		1.7	1.7	2.0	1.8	1.7

USA

Legend: HIST, CF, 2/11, IMF, 1/11, OECD, 11/10, EC, 11/10, Fed, 2/11

	HIST	CF	IMF	OECD	EC	Fed
2010	2.9					
2011		3.2	3.0	2.2	2.1	3.7
2012		3.3	2.7	3.1	2.5	4.0

GERMANY

Legend: HIST, CF, 2/11, IMF, 1/11, OECD, 11/10, EC, 11/10, DBB, 12/10

	HIST	CF	IMF	OECD	EC	DBB
2010	3.6					
2011		2.5	2.2	2.5	2.2	2.0
2012		1.8	2.0	2.2	2.0	1.5

CHINA

Legend: HIST, CF, 2/11, IMF, 1/11, OECD, 11/10, EC, 11/10, BOFIT, 9/10
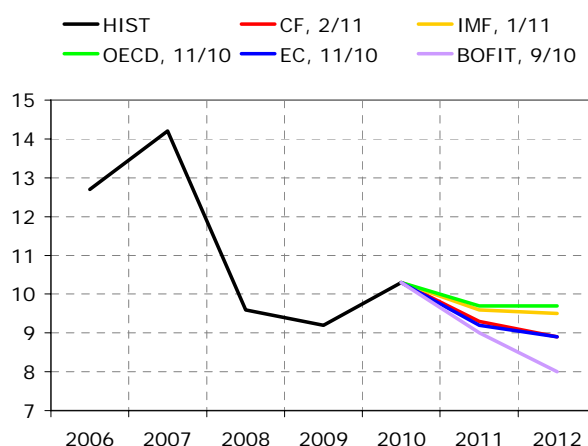
	HIST	CF	IMF	OECD	EC	BOFIT
2010	10.3					
2011		9.3	9.6	9.7	9.2	9.0
2012		8.9	9.5	9.7	8.9	8.0

Note: Legend shows latest forecast data in format "Source, month/year of forecast publication". HIST: historical value. ECB and Fed: midpoint of range. The 2010 figure is preliminary. [Cut-off date for data: 18 February 2011]

Source: CNB calculation using Eurostat, CF, IMF, OECD, EC, ECB, Fed, DBB and BOFIT databases.

II.2 GDP forecast comparison and change from the previous forecast

Compared to the previous forecast, the CF and IMF outlooks for this year indicate either a slight upward revision of GDP growth or no change. The new IMF estimate is the exception, pointing to faster growth in US GDP in 2011 than the previous forecast expected. The Fed also made an upward revision to the US GDP growth outlook in its latest forecast, which remains the highest among all the reviewed institutions monitoring the US economy.
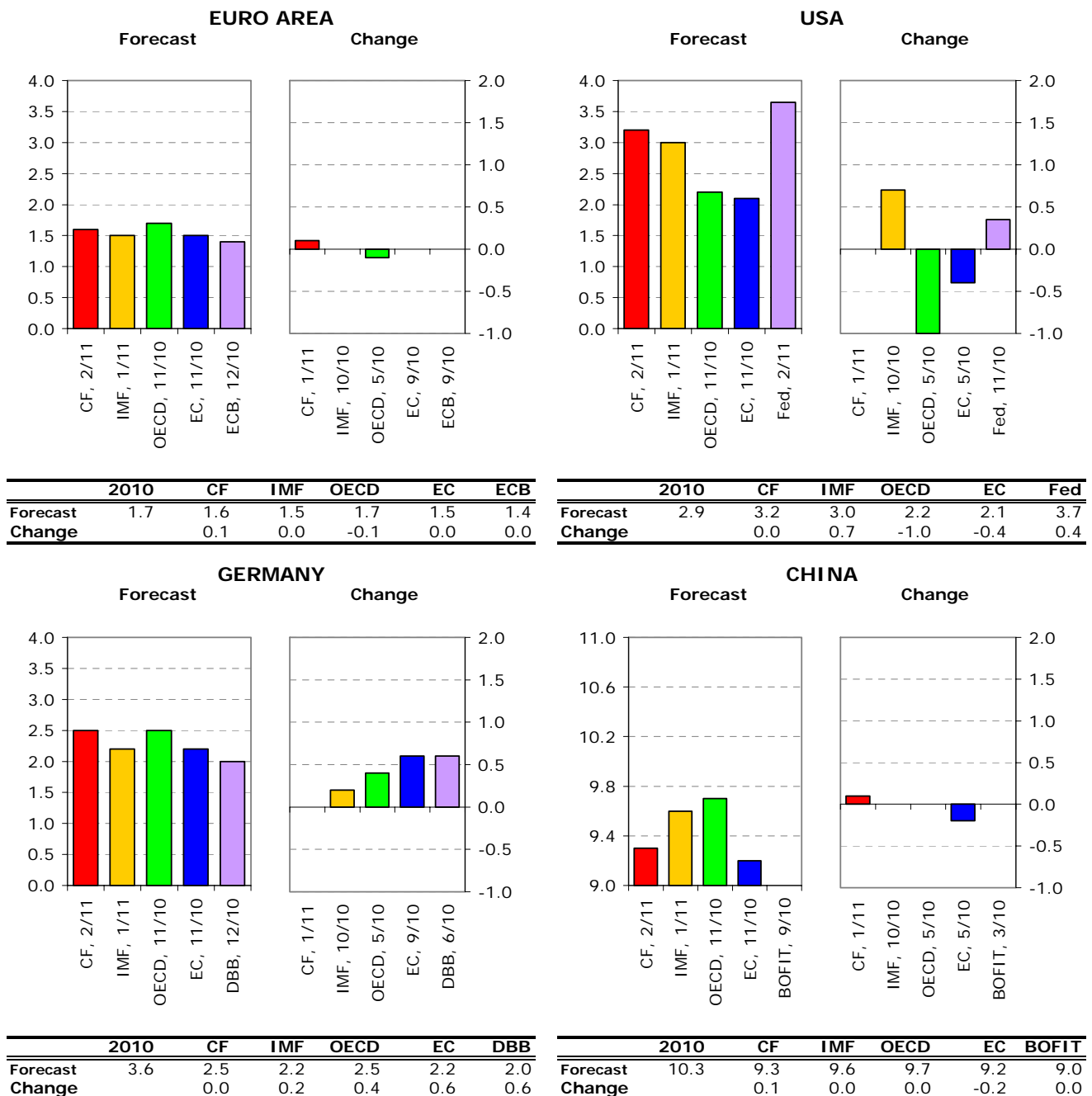
EURO AREA

	2010	CF	IMF	OECD	EC	ECB
Forecast	1.7	1.6	1.5	1.7	1.5	1.4
Change		0.1	0.0	-0.1	0.0	0.0

USA

	2010	CF	IMF	OECD	EC	Fed
Forecast	2.9	3.2	3.0	2.2	2.1	3.7
Change		0.0	0.7	-1.0	-0.4	0.4

GERMANY

	2010	CF	IMF	OECD	EC	DBB
Forecast	3.6	2.5	2.2	2.5	2.2	2.0
Change		0.0	0.2	0.4	0.6	0.6

CHINA

|	2010	CF	IMF	OECD	EC	BOFIT
Forecast	10.3	9.3	9.6	9.7	9.2	9.0
Change		0.1	0.0	0.0	-0.2	0.0

Note: Horizontal axis of left-hand (right-hand) chart shows latest (previous) forecast data in format "Source, month/year of forecast publication". HIST: historical value. ECB and Fed: midpoint of range. The 2010 figure is preliminary. [Cut-off date for data: 18 February 2011]

Source: CNB calculation using Eurostat, CF, IMF, OECD, EC, ECB, Fed, DBB and BOFIT databases.
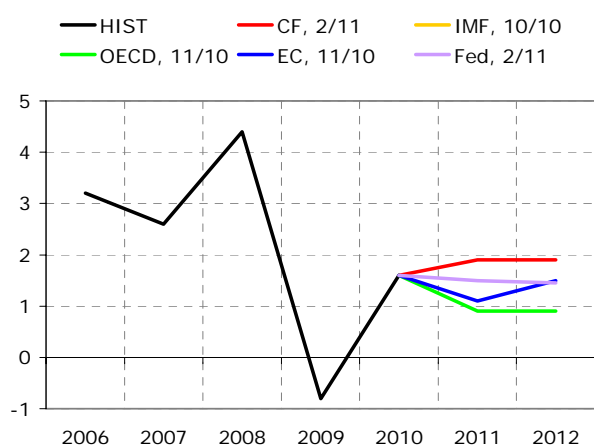
II.3 Inflation

The forecast for euro area inflation in 2011 increased further in February, reaching 2%. All the monitored institutions expect inflation to return below 2% in 2012. In the USA, prices will rise by at least 0.9% over the next two years and the maximum inflation rate could be just below 2%. In China, inflation can be expected to fall according to the latest forecasts.
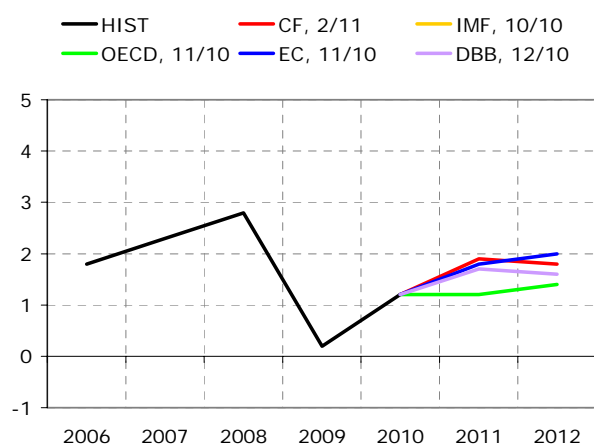
EURO AREA

HIST — CF, 2/11 — IMF, 10/10
OECD, 11/10 — EC, 11/10 — ECB, 12/10
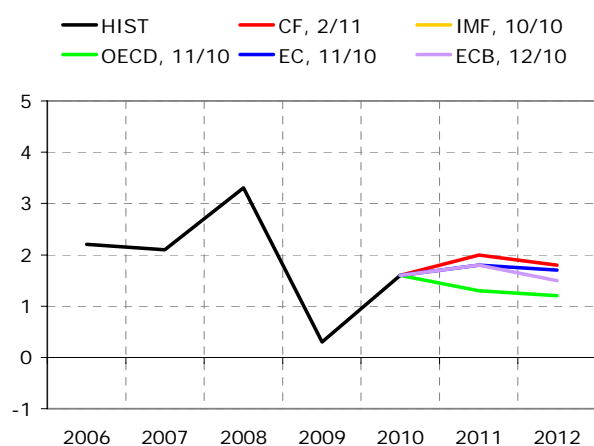
	HIST	CF	IMF	OECD	EC	ECB
2010	1.6					
2011		2.0	1.5	1.3	1.8	1.8
2012		1.8		1.2	1.7	1.5

USA

HIST — CF, 2/11 — IMF, 10/10
OECD, 11/10 — EC, 11/10 — Fed, 2/11

	HIST	CF	IMF	OECD	EC	Fed
2010	1.6					
2011		1.9	1.0	0.9	1.1	1.5
2012		1.9		0.9	1.5	1.5

GERMANY

HIST — CF, 2/11 — IMF, 10/10
OECD, 11/10 — EC, 11/10 — DBB, 12/10

	HIST	CF	IMF	OECD	EC	DBB
2010	1.2					
2011		1.9	1.4	1.2	1.8	1.7
2012		1.8		1.4	2.0	1.6

CHINA

HIST — CF, 2/11 — IMF, 10/10
OECD, 11/10 — EC, 11/10 — BOFIT, N/A
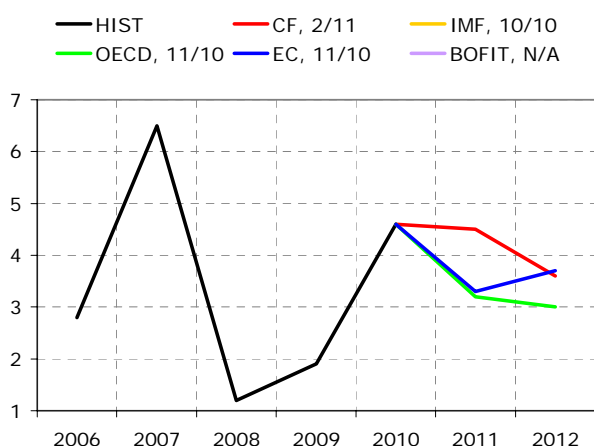
	HIST	CF	IMF	OECD	EC	BOFIT
2010	4.6					
2011		4.5	2.7	3.2	3.3	
2012		3.6		3.0	3.7	

Note: Legend shows latest forecast data in format "Source, month/year of forecast publication". HIST: historical value. ECB and Fed: midpoint of range. The 2010 figure is preliminary. [Cut-off date for data: 18 February 2011]

Source: CNB calculation using Eurostat, CF, IMF, OECD, EC, ECB, Fed, DBB and BOFIT databases.

II.4 Inflation forecast comparison and change from the previous forecast

The higher inflation rates for 2011 in all the countries under review largely reflect the currently rising energy and commodity prices. The changes in the forecasts for the USA show no clear trend. According to this year's forecasts and last year's OECD outlook, inflation in China in 2011 has been revised upwards.
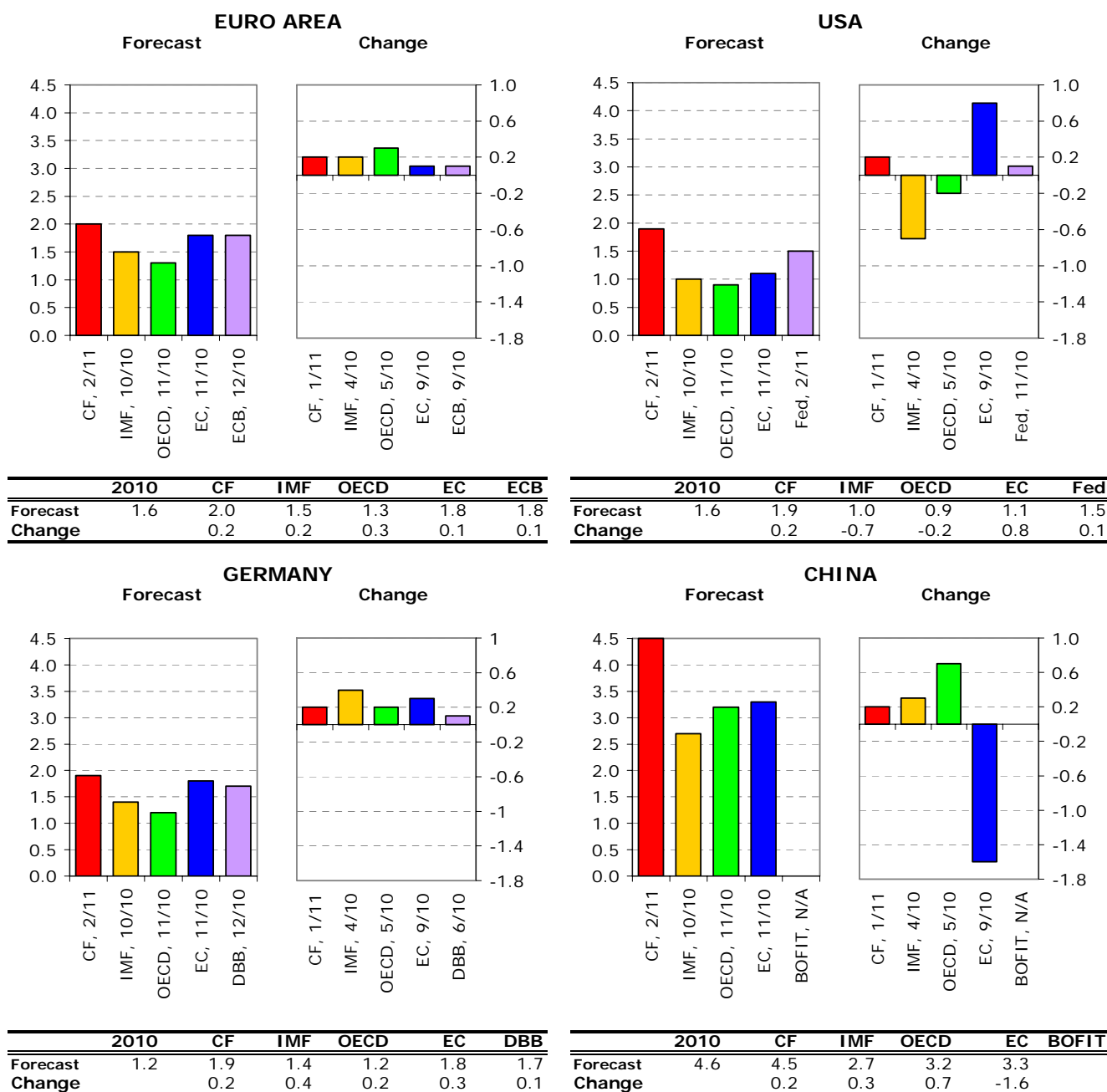
EURO AREA

Forecast | Change

	2010	CF	IMF	OECD	EC	ECB
Forecast	1.6	2.0	1.5	1.3	1.8	1.8
Change		0.2	0.2	0.3	0.1	0.1

USA

Forecast | Change

	2010	CF	IMF	OECD	EC	Fed
Forecast	1.6	1.9	1.0	0.9	1.1	1.5
Change		0.2	-0.7	-0.2	0.8	0.1

GERMANY

Forecast | Change

	2010	CF	IMF	OECD	EC	DBB
Forecast	1.2	1.9	1.4	1.2	1.8	1.7
Change		0.2	0.4	0.2	0.3	0.1

CHINA

Forecast | Change

|	2010	CF	IMF	OECD	EC	BOFIT
Forecast	4.6	4.5	2.7	3.2	3.3	
Change		0.2	0.3	0.7	-1.6	

Note: Horizontal axis of left-hand (right-hand) chart shows latest (previous) forecast data in format "Source, month/year of forecast publication". HIST: historical value. ECB and Fed: midpoint of range. The 2010 figure is preliminary. [Cut-off date for data: 18 February 2011]

Source: CNB calculation using Eurostat, CF, IMF, OECD, EC, ECB, Fed, DBB and BOFIT databases.

The PMI (Purchasing Managers' Index) leading indicators in February are signalling that industrial production growth will increase in the USA and slow (but stay high) in China at the start of this year. The other leading indicators (consumer confidence indicators in particular) also indicate improving estimates of economic growth in the USA and expectations that growth will be at least twice as high in the USA this year as in the euro area. Falling consumer sentiment in the euro area reflects poor prospects of higher growth in household consumption due mainly to government expenditure cuts. The leading indicators for Germany suggest that private consumption will hinder overall economic growth despite continued buoyant growth.
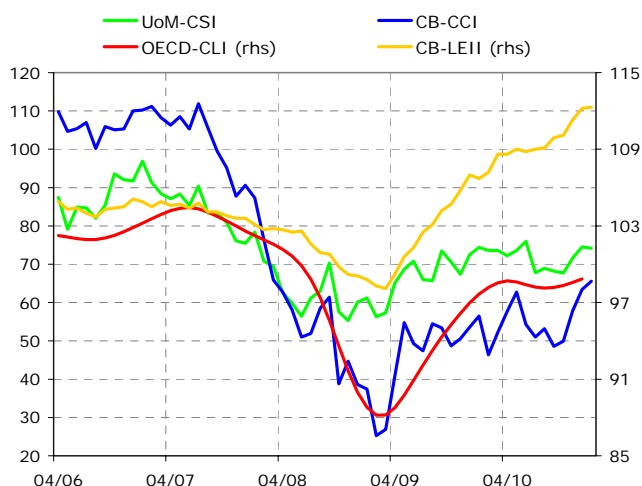
PMI IN MANUFACTURING
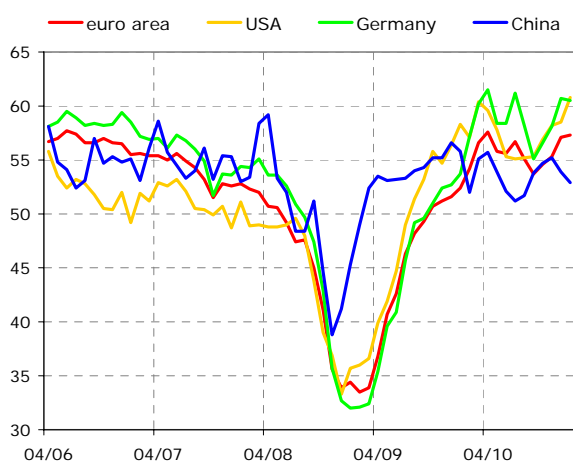
	EA	US	DE	CN
11/10	55.3	58.2	58.1	55.2
12/10	57.1	58.5	60.7	53.9
1/11	57.3	60.8	60.5	52.9

EURO AREA
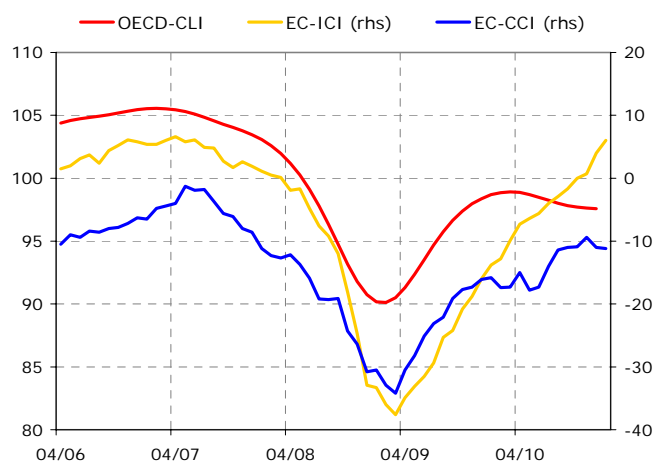
	OECD-CLI	EC-ICI	OECD-CCI
11/10	97.6	0.7	-9.4
12/10	97.6	4.0	-11.0
1/11		6.0	-11.2

USA

	OECD-CLI	CB-LEII	UoM-CSI	CB-CCI
11/10	98.6	111.3	71.6	57.8
12/10	98.8	112.2	74.5	63.4
1/11			74.2	65.6

GERMANY
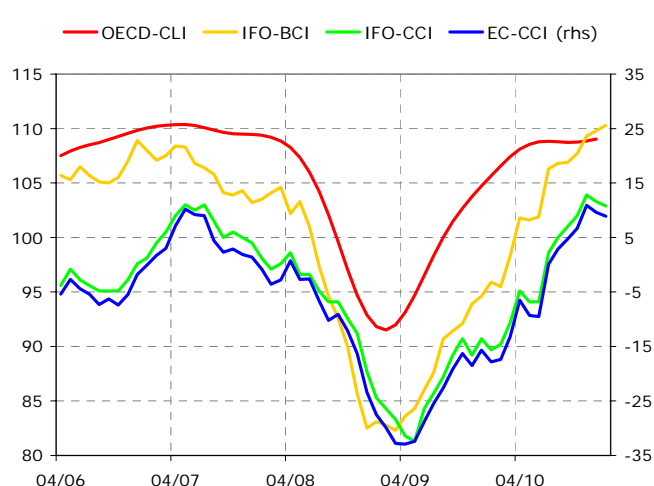
	OECD-CLI	IFO-BCI	IFO-CCI	EC-CCI
11/10	108.9	109.3	103.9	10.9
12/10	109.0	109.8	103.3	9.6
1/11		110.3	102.9	8.9

Note: OECD-CLI stands for OECD Composite Leading Indicator, EC-ICI (right-hand scale) for European Commission Industrial Confidence Indicator, EC-CCI (right-hand scale) for EC Consumer Confidence Indicator, CB-LEII for Conference Board Leading Economic Indicator Index, CB-CCI for CB Consumer Confidence Index, UoM-CSI for University of Michigan Consumer Sentiment Index, IFO-BCI for Institute for Economic Research – Business Climate Index, and IFO-CCI for IFO Consumer Confidence Index. [Cut-off date for data: 18 February 2011]

Source: CNB calculation using OECD, EC, IFO and UoM databases.

IV.1 Outlook for short-term and long-term interest rates: Euro area
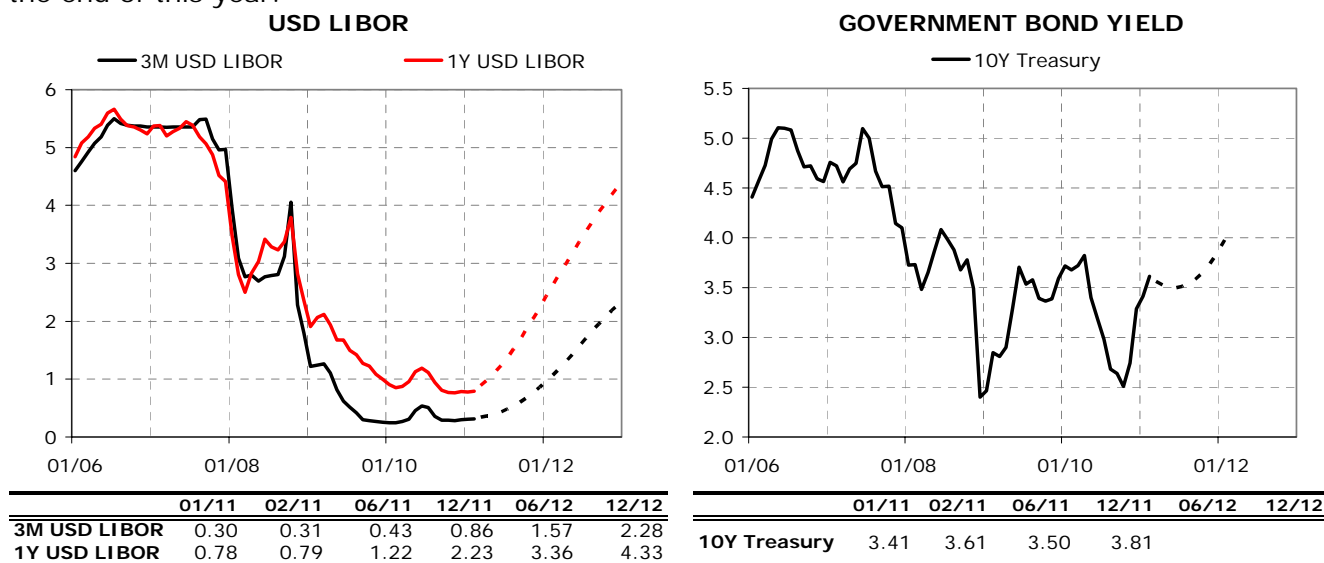
3M and 1Y EURIBOR rates have been relatively stable since October, at around 1.0% and 1.5% respectively. They edged up in February and the market outlooks have been revised accordingly. The revision is small in the short term, but increases as the horizon gets longer. The 10Y German government bond yield rose to 3.0% in November and exceeded 3.2% in February. CF expects it to remain flat in the three months ahead and then rise to 3.5% at the end of 2011.

EURIBOR

GOVERNMENT BOND YIELD

	01/11	02/11	06/11	12/11	06/12	12/12
3M EURIBOR	1.02	1.09	1.38	1.90	2.33	2.66
1Y EURIBOR	1.55	1.69	2.09	2.63	3.06	3.38

	01/11	02/11	06/11	12/11	06/12	12/12
10Y Bund	3.05	3.27	3.23	3.48		
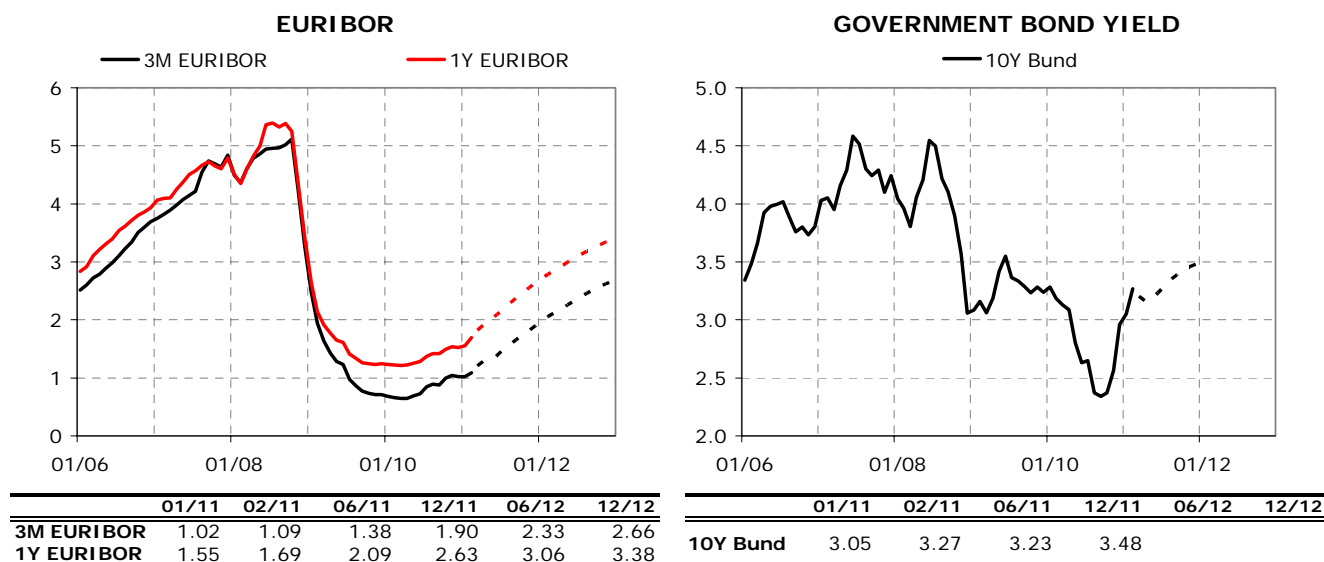
Note: Forecast for EURIBOR rates is based on rates implied by interbank market yield curve (FRA rates are used from 4M to 15M and adjusted IRS rates for longer horizon). Forecast for German government bond yield (10Y Bund) is derived from CF forecast. Dashed line represents outlook. [Cut-off date for data: 14 February 2011]
Sources: Thomson Reuters (Datastream), Bloomberg, CNB calculations.

## IV.2 Outlook for short-term and long-term interest rates: USA

LIBOR dollar rates have been flat since September at 0.3% for 3M and 0.8% for 1Y. The market outlook for both rates has declined slightly in the short term, while increasing quite strongly in the long term. The 10Y government bond yield rose to 3.6% in the first half of February. The CF outlook expects it to decline to 3.5% in the three months ahead and subsequently rise to 3.8% at the end of this year.

USD LIBOR

GOVERNMENT BOND YIELD

	01/11	02/11	06/11	12/11	06/12	12/12
3M USD LIBOR	0.30	0.31	0.43	0.86	1.57	2.28
1Y USD LIBOR	0.78	0.79	1.22	2.23	3.36	4.33

	01/11	02/11	06/11	12/11	06/12	12/12
10Y Treasury	3.41	3.61	3.50	3.81		

Note: Forecast for 3M and 1Y USD LIBOR rates is based on rates implied by London interbank market yield curve (USD LIBOR rates are used up to 3M, 3M FRA rates up to 15M, and adjusted IRS rates for longer horizon). Forecast for US government bond yield (10Y Treasury) is derived from CF forecast. Dashed line represents outlook. [Cut-off date for data: 14 February 2011]
Sources: Thomson Reuters (Datastream), Bloomberg, CNB calculations.

The February CF outlook expects the dollar-euro exchange rate to be stable at around USD 1.32 to the euro in the short term and to return to the end-2010 level at the two-year horizon. A more pronounced depreciation of the dollar than in the previous CF is expected against the pound sterling; the dollar is expected to be 2% weaker at the start of 2013. The outlook for the dollar's exchange rate against the Japanese yen and the Swiss franc was unchanged. Although concerns about developments in the euro area are increasing investors' interest in "safe currencies", these currencies are likely to depreciate in the longer term. The downgrading of Standard and Poor's rating for Japan's long-term liabilities only confirmed the not-too-optimistic economic outlook. Similarly, the Swiss central bank must face pressure on the domestic currency given its near-zero rates and low growth and inflation. By contrast, owing to the positive interest rate differential of USD vis-à-vis JPY and CHF, the forward rate is indicating a depreciation of the dollar.
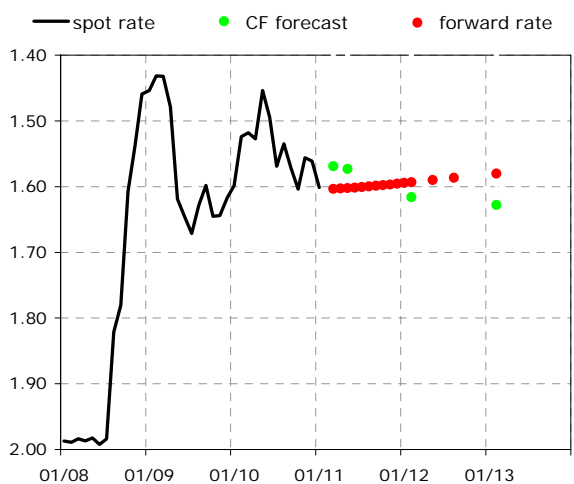
US$ per Euro
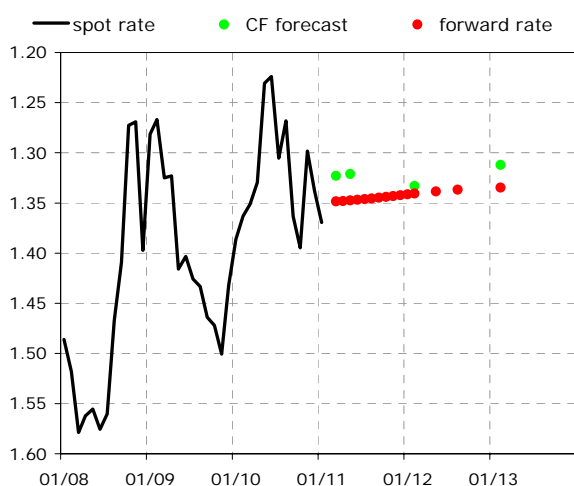
	14/2/11	03/11	05/11	02/12	02/13
spot rate	1.349				
CF forecast		1.323	1.321	1.333	1.312
forward rate		1.348	1.347	1.341	1.335

Yen per US$
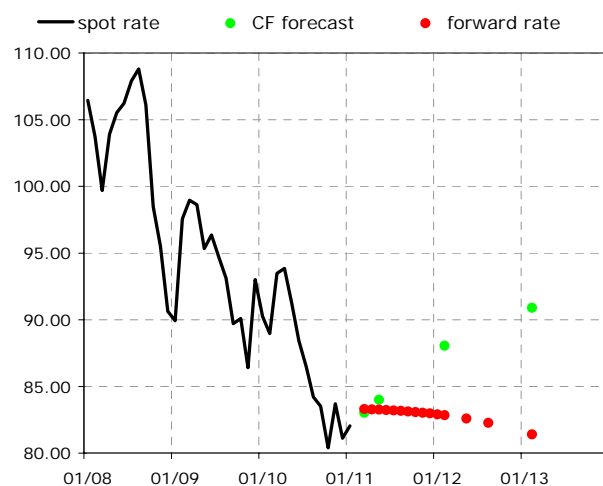
	14/2/11	03/11	05/11	02/12	02/13
spot rate	83.32				
CF forecast		83.03	84.01	88.05	90.90
forward rate		83.30	83.26	82.84	81.41

US$ per UK£

	14/2/11	03/11	05/11	02/12	02/13
spot rate	1.604				
CF forecast		1.569	1.573	1.616	1.628
forward rate		1.604	1.602	1.593	1.580

Swfr per US$
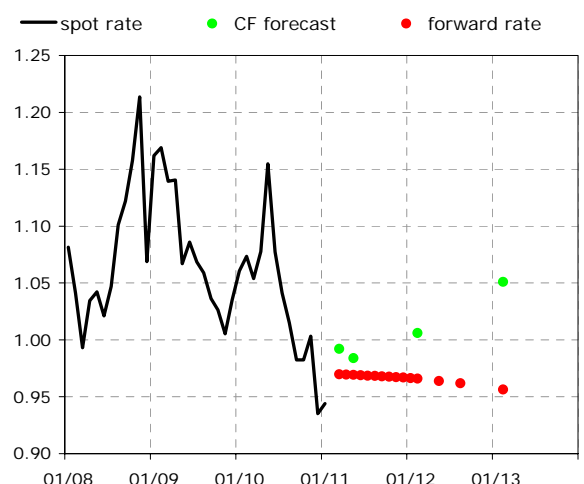
	14/2/11	03/11	05/11	02/12	02/13
spot rate	0.970				
CF forecast		0.992	0.984	1.006	1.051
forward rate		0.970	0.969	0.966	0.956

Note: Increase in currency pair represents appreciation of US dollar; data as of the last day of the 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) possibilities for securing future exchange rate. [Cut-off date for data: 14 February 2011]

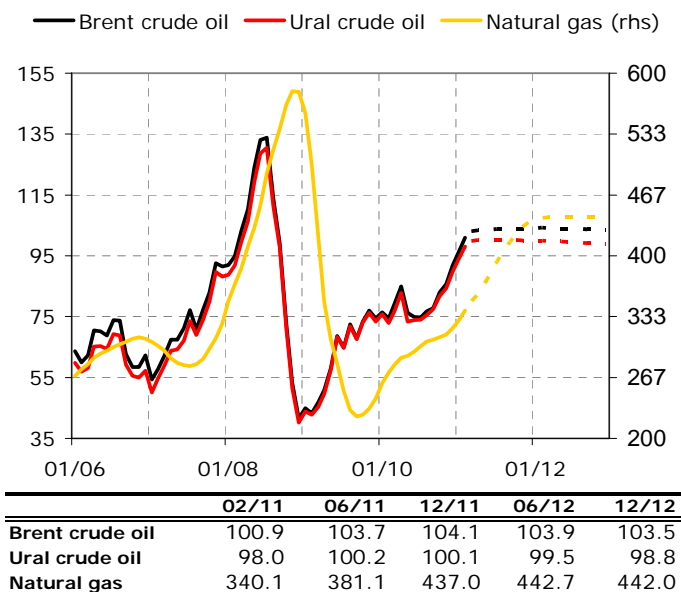Source: CNB calculation using Bloomberg and Consensus Forecasts databases.

VI.1 Oil and natural gas

The price of Brent crude oil has continued to rise sharply since the start of 2011. This trend is due in part to the depreciation of the dollar. The price of Brent crude oil broke through USD 100 a barrel on the last day of January. Since then, Brent crude has been trading at USD 100–105 a barrel. The current rise in oil prices mainly reflects the upward revision to US economic growth and also the spreading wave of anti-government protests in countries of Africa and the Middle East. However, the market outlooks based on futures do not expect further pronounced growth in the oil price, instead expecting it to remain flat at the current levels, i.e. just above USD 100 a barrel, until the end of 2012. The rising price of oil is subsequently reflected in the price of natural gas, which is expected to rise throughout 2011.

OUTLOOK FOR PRICES OF OIL AND NATURAL GAS

	02/11	06/11	12/11	06/12	12/12
Brent crude oil	100.9	103.7	104.1	103.9	103.5
Ural crude oil	98.0	100.2	100.1	99.5	98.8
Natural gas	340.1	381.1	437.0	442.7	442.0

Note: Oil prices in USD/barrel are taken from listings on London-based ICE Futures Europe international exchange. Prices of Russian natural gas at border with Germany in USD/1000 cubic m are calculated using IMF data. Future oil prices are derived from oil futures. Dashed line represents outlook. [Cut-off date for data: 18 February 2011].
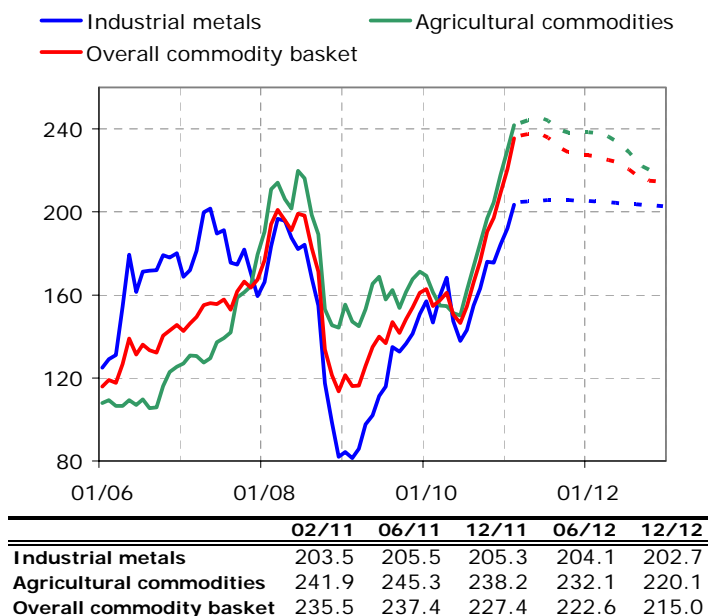
Source: Bloomberg, IMF, CNB calculations.

VI.2 Other commodities

Prices of agricultural commodities have been very high since the start of the year. Falling demand has been offset by the depreciating dollar since the beginning of 2011, but a sharper price decline can still be observed for some commodities (wheat, soya, sugar, rice). By contrast, the fastest growing agricultural commodity is cotton, followed by cocoa and coffee, whose prices have risen by almost 20% and 10% respectively since the start of February. The long-term outlook suggests a gradual fall in agricultural commodity prices as from mid-2011. Prices of industrial metals have risen by around 10% since January 2011, with nickel showing the highest growth (more than 20% since January 2011). However, no major increase is expected for prices of industrial metals over the entire outlook horizon up to the end of 2012.

OUTLOOK FOR OTHER COMMODITY PRICES

	02/11	06/11	12/11	06/12	12/12
Industrial metals	203.5	205.5	205.3	204.1	202.7
Agricultural commodities	241.9	245.3	238.2	232.1	220.1
Overall commodity basket	235.5	237.4	227.4	222.6	215.0

Note: Chart shows indices, year 2005 = 100. Dashed line represents outlook. [Cut-off date for data: 18 February 2011].

Source: Bloomberg, outlooks based on futures.

**THE LINK BETWEEN THE BRENT CRUDE OIL PRICE AND THE US DOLLAR
EXCHANGE RATE**

*Growth in the intensity of the inverse relationship between the US dollar exchange rate
and the Brent crude oil price has been observed over the last decade. A similar inverse
relationship with the dollar exchange rate is visible for other commodities as well. This
may be linked, among other things, with the growing role of commodities as an
alternative investment instrument at times of excess liquidity and low interest rates on
global markets. This analysis examines monthly data from January 1982 to September
2010. Since 2002, the direction of the relationship in the Granger causality sense has
been from the dollar exchange rate to the oil price. The statistically significant effect of
the nominal exchange rate of the US dollar on the oil price since 2005 was estimated
using a regression equation of the Brent oil price. A weakening of the dollar of 1%
causes the Brent oil price to rise by 2.1%. The contrary movements in the Brent oil price
and the dollar exchange rate are a factor dampening the impact of sharp fluctuations in
the dollar price of oil on "non-dollar" economies, including the Czech Republic. This
dampening effect was clearly visible in the period of sharp oil price growth in 2007 and
2008.*

1 Introduction

The link between the oil price and the US dollar exchange rate, which can be observed
since the 1990s, is attracting the interest of many economists. The fact that commodity
prices are mostly denominated in US dollars[1] naturally leads to a question regarding the
relationship between commodity prices and the dollar exchange rate.

There are essentially two approaches examining the links between the oil price and
exchange rates in the literature. The first approach examines the real effective exchange
rates of specific currencies and uses the real price of oil as a proxy for changes in the
terms of trade (Amano and van Norden, 1998a,b; Chaudhuri and Daniel, 1998;
Bénassy-Quéré et al., 2005; Habib and Kalamova, 2007). This approach usually finds a
strong interdependence of the two variables, with the real price of oil affecting the real
effective exchange rates of the countries under review. Given the high share of oil in the
total imports of most industrial countries, this conclusion is in line with economic
intuition.

This analysis, however, uses the second approach, which examines the relationship
between the price of oil and the exchange rate of the currency in which oil is traded, i.e.
the US dollar. According to Muñoz and Dickey (2009), fluctuations of the US dollar affect
oil prices simply because commodity prices are quoted in US dollars. The results of this
approach essentially confirm contrary movements of the two variables, i.e. a weakening
dollar causes prices of oil and other commodities to rise and a strengthening dollar
conversely causes them to fall (Cuaresma and Breitenfellner, 2008; Brown et al., 2008;
European Commission, 2008; Schulmeister, 2009; Hošek et al., 2011).

There are several explanations for the inverse relationship between the oil price and the
US dollar exchange rate. One of them involves the growing role of investors in
commodity markets, related to falling financial asset returns in advanced countries. In
this case, oil is a recognised investment asset used as a means of diversifying the risk of
inflation, the risk of US dollar depreciation or the risk of a stock market decline.
Furthermore, a depreciation of the US dollar or an easing of monetary policy in the USA
implies an easing of the monetary conditions in countries whose exchange rate is tied to
the dollar. Oil-exporting countries and China are typical examples.

---

[1] Commodities are traded in a single currency for reasons of transparency, cost and risk (Mileva and Siegfried, 2007).

Demand in these countries, including demand for oil products, then increases, reinforcing the effect of US monetary policy on commodity market prices. In addition, a weakening of the dollar against the currencies of countries with floating exchange rates means that the oil price in local currency becomes lower. This can cause a rise in demand for oil in these countries as well (for details, see, for example, Cuaresma and Breitenfellner, 2008, p. 7).

This article first analyses the intensity and direction of the relationship between the nominal effective exchange rate of the US dollar and the price of Brent crude oil and other commodities (gold, industrial metals and agricultural commodities) in 1982–2010. A regression equation of the Brent oil price is then estimated, with one of the explanatory variables being the nominal effective exchange rate of the US dollar. The final part summarises the main findings, including the implications of the inverse relationship between the value of the dollar and the price of oil for "non-dollar" net importers of oil.

2 Analysis of the intensity and direction of the relationship

The intensity of the relationship between the Brent crude oil price and the US dollar exchange rate has been elevated since 2002 (see Figure 1), with the gradually rising price of Brent oil being accompanied by depreciation of the US dollar. This trend peaked in 2008, when the effective dollar exchange rate[2] weakened to a historical low in March and the average monthly price of Brent oil then reached an all-time high of $134 a barrel in July.

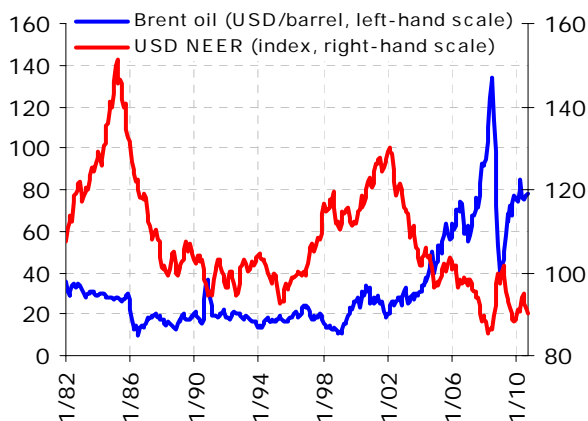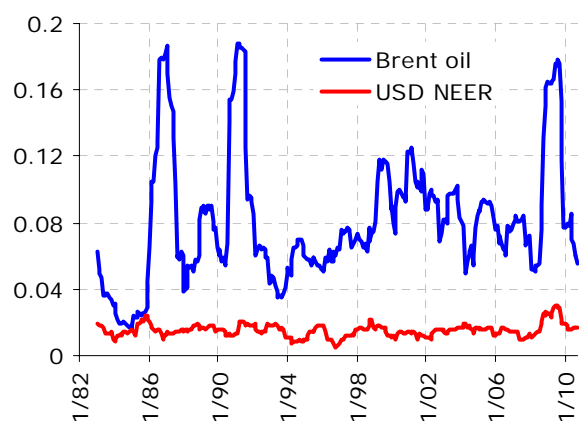**Figure 1** Evolution of the Brent crude oil price and the US dollar exchange rate

Figure 2 Historical volatility of monthly returns

Note: Monthly averages between January 1982 and September 2010 (345 observations).
Brent oil price (USD/barrel) – minimum/average/maximum: 9.5/32.2/133.6
USD NEER – minimum/average/maximum: 85.5/108.1/151.1
An increase in the USD NEER index represents appreciation of the US dollar. Historical volatility (Figure 2) is calculated as the annual moving standard deviation of the logarithmic monthly returns.
Source: Thomson Reuters (Datastream) and International Monetary Fund (IMF-IFS)

Monthly frequency is used because we are interested mainly in long-term fundamental factors between the two variables. Given the much higher efficiency of the foreign exchange market compared to the oil market, the average volatility of the dollar was more than five times lower than that of the Brent oil price in the period under review

---

[2] The source of the data on the nominal effective exchange rate (NEER) of the US dollar is the database of the International Monetary Fund (IMF-IFS). The correlation between month-on-month changes in NEER and the EUR/USD bilateral exchange rate was 0.9 in that period (synthetic euro used before 1999).

(see Figure 2). Moreover, the oil market is characterised by low price elasticity of demand and supply. Therefore, greater price fluctuations are necessary to achieve equilibrium on the oil market. Oil supply is affected above all by limited reserve capacity, which is concentrated largely in just one country (Saudi Arabia) and by the long time – often between five and ten years – it takes to establish new oil fields for commercial use.

Figure 2 also shows that the recent increase in oil market volatility accompanied by sharp growth in oil prices was by no means unusual from the historical perspective. However, the most recent upswing in oil price volatility was also accompanied by increased foreign exchange market volatility; this contrasted with the previous two episodes of increased volatility in 1986 and 1990, which were linked in the first case with a marked drop in oil demand and with excess oil production (a sharp fall in the price of oil) and in the second case with Iraq's invasion of Kuwait, which, on the contrary, was connected with a steep rise in the price of oil. From this we can also indirectly infer an increase in the intensity of the relationship between the two variables.

As both time series – the Brent oil price as well as the nominal effective exchange rate of the dollar – are non-stationary, we examine the interdependence between their monthly logarithmic returns, which fulfil the condition of stationarity. The monthly logarithmic returns are expressed by the equation:

$$v_{\log} = \ln\left(\frac{p_t}{p_{t-1}}\right), \tag{1}$$

where *p* is the average monthly value of the variable at time *t* or *t-1*.

This approach differs from that of previous authors, who examined the interdependence between the absolute values of these variables. According to Deutsche Bank Research (2009) and Hošek et al. (2011), the coefficient of correlation between the two variables in the period 2000–2009 was relatively high (-0.9). Similarly, Cuaresma and Breitenfellner (2008) report high coefficients of correlation between the price of oil and the USD/EUR exchange rate in 1998–2006 (-0.73).

The evolution of the calculated annual moving coefficient of correlation between monthly returns on the price of Brent oil and the nominal effective exchange rate of the US dollar, as well as the correlation coefficients for the three selected periods (below the figure) are shown in Figure 3. For comparison, corresponding correlation coefficients were also calculated between the dollar exchange rate and agricultural commodity prices (S&P GSCI Agricultural), the price of gold and prices of industrial metals (S&P GSCI Industrial Metals) (see Figures 4–6).

In line with the previous literature, the rolling correlation coefficients were in most cases negative (depreciation of the dollar was associated with higher commodity prices and appreciation with lower prices), while the intensity of the correlation has recently increased for oil as well as for industrial metals and agricultural commodities. The intensity of the inverse relationship declined only for gold in 2009/10. Despite that, gold has long been characterised by a relatively high negative correlation with the exchange rate of the dollar. From a historical perspective, gold has therefore traditionally been a safe alternative investment to dollar financial assets.

A very similar inverse relationship between monthly returns on gold holdings and the nominal effective exchange rate of the dollar is also obtained on the basis of a state-space model by Frait and Komárek (2006), who state that an inverse relationship arises in periods when the dollar is not stable and investors try to find a more durable asset, hence gold (along with other precious metals) becomes more attractive.

In addition to industrial metals, which have long been showing a gradually increasing inverse relationship with the dollar exchange rate, Brent crude oil and agricultural commodities have recorded sharp growth in their inverse correlation in recent years. This correlation is more pronounced for Brent oil. In line with our assumptions, it therefore really does seem that investors probably seek alternative investment returns on commodity markets in an environment of low real interest rates and excess liquidity.

Figures 3–6 Annual moving coefficient of correlation between monthly returns on the nominal effective exchange rate of the US dollar and selected commodities
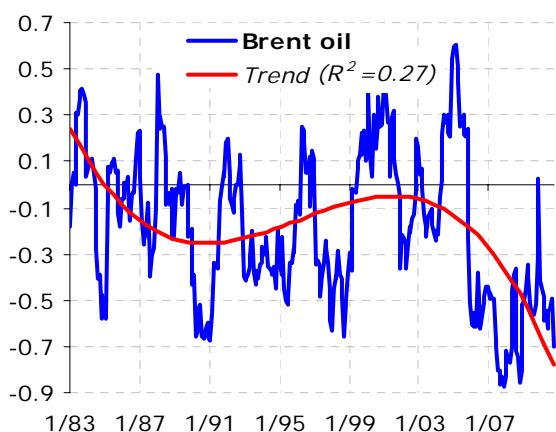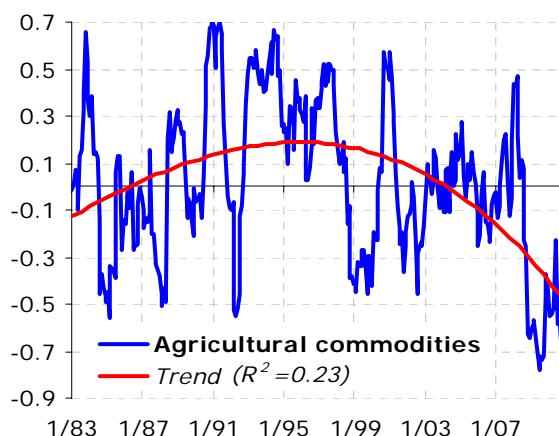

Correlation coefficient 1982:1–2010:9 = -0.2
Correlation coefficient 2002:1–2010:9 = -0.36
Correlation coefficient 2007:1–2010:9 = -0.58
Granger causality: USD→Brent (since 2002)
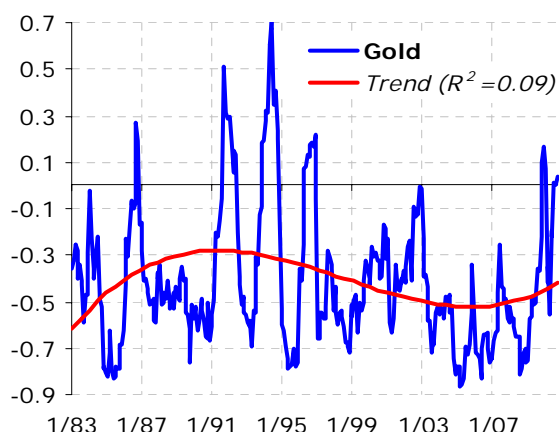
Correlation coefficient 1982:1–2010:9 = -0.4
Correlation coefficient 2002:1–2010:9 = -0.47
Correlation coefficient 2007:1–2010:9 = -0.44
Granger causality: impossible to determine definitely
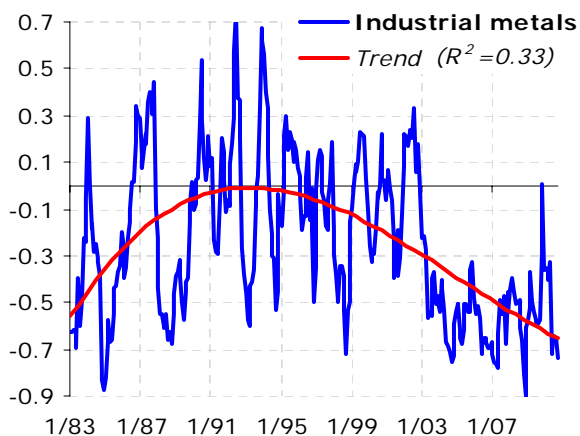
Correlation coefficient 1982:1-2010:9 = -0.36
Correlation coefficient 2002:1-2010:9 = -0.53
Correlation coefficient 2007:1-2010:9 = -0.6
Granger causality: impossible to determine definitely

Correlation coefficient 1982:1-2010:9 = -0.13
Correlation coefficient 2002:1-2010:9 = -0.33
Correlation coefficient 2007:1-2010:9 = -0.53
Granger causality: impossible to determine definitely

Note: Correlation coefficients for the three selected periods are shown under the figures. Granger causality was confirmed only for Brent oil (from the exchange rate to the Brent oil price). The trend is expressed by a third-degree polynomial. The corresponding coefficients of determination are shown in brackets.
Source: Thomson Reuters (Datastream), International Monetary Fund (IMF-IFS), monthly data, authors' calculations.

Three-month rates on the US dollar money market have averaged only 2.0% since 2002, compared to 6.0% in 1982–2001. In real terms, interest rates were 2.6% in 1982–2001 and have declined to an average of -0.4% since 2002. Above and beyond traditional fundamental factors, additional speculative demand has therefore probably been driving up commodity prices in recent years.

3 Factors affecting the price of oil

In the next step we quantify potential factors affecting the price of Brent oil, including the nominal effective exchange rate of the dollar.

In contrast to Cuaresma and Breitenfellner (2008), who assess the predictive power of the USD/EUR nominal exchange rate for estimating future oil prices using a VAR/VEC model incorporating the USD/EUR exchange rate, its determinants (the relative money supply, relative output and relative interest rates between the USA and the euro area) and the price of oil, we directly estimate an equation of the Brent oil price that contains other relevant variables in addition to the nominal effective exchange rate on the right-hand side of the equation:

$$
\Delta \ln\left(Brent_t\right) = \beta_1 \Delta \ln\left(NEER_t^{USD}\right) + \beta_2 \Delta \ln\left(IP_t^{OECD}\right) + \beta_3 \Delta r_t^{USD} + \beta_4 \Delta \ln\left(OIL\_INV_{t-1}^{USA}\right) \\
+ \beta_5 \Delta REFINERY_{t-2}^{USA} + \varepsilon_t
$$

(2)

where $Brent_t$ is the nominal price of Brent crude oil in US dollars per barrel; $NEER_t^{USD}$ is the nominal effective exchange rate of the dollar (growth in the index implies appreciation of the dollar); IP_t^{OECD} is the seasonally adjusted industrial production index in OECD countries; r_t^{USD} denotes three-month real interest rates in the USA; $OIL\_INV_{t-1}^{USA}$ are oil inventories in the USA excluding strategic reserves in barrels, adjusted for seasonal effects; $REFINERY_{t-2}^{USA}$ is the percentage rate of use of oil refineries in the USA, adjusted for seasonal effects; and t is time in months. The corresponding coefficients are expressed by β_1 through β_5, while ε_t is the i.i.d. term.[3]

3.1 Results of the estimate

Table 1 Estimate of variables affecting the price of Brent crude oil (Equation 2)

	1994:1–2004:12	2005:1–2010:9
$\Delta \ln\left(NEER_t^{USD}\right)$	-0.025 (0.453)	-2.125*** (0.545)
$\Delta \ln\left(IP_t^{OECD}\right)$	5.308*** (1.385)	3.263*** (0.979)
Δr_t^{USD}	-0.074*** (0.021)	-0.036** (0.015)
$\Delta \ln\left(OIL\_INV_{t-1}^{USA}\right)$	0.74** (0.283)	0.356 (0.406)
$\Delta REFINERY_{t-2}^{USA}$	0.008*** (0.003)	0.004 (0.003)
$\overline{R}^2$	0.18	0.45
D-W	1.94	1.71
Number of observations	132	69
Dependent variable (avg./std. dev.)	0.008/0.084	0.01/0.099

Note: *Estimated by the least squares method. Standard errors of the coefficient estimates are shown in brackets. Asterisks denote significance as follows: *** 1%, ** 5%.*

The equation was estimated using monthly data from January 1994 to September 2010. Within this period, we identified a structural break in December 2004 using the Chow test. For this reason the results are presented separately for two periods: up to December 2004 and from January 2005 onwards.

---

[3] The data are taken from the databases of IMF-IFS ($NEER_t^{USD}$), Thomson Reuters ($Brent_t$, r_t^{USD}), Bloomberg ($OIL\_INV_{t-1}^{USA}$, $REFINERY_{t-2}^{USA}$) and OECD (IP_t^{OECD}).

Until 2005 the effect of the dollar exchange rate on the Brent oil price is statistically insignificant with a very low coefficient. All the other explanatory variables are statistically significant, with industrial production in OECD countries having the largest effect. Growth in industrial production of 1% had an upward effect on the oil price of around 5.3%. This relationship confirms the inelasticity of demand for oil, with a small increase in demand for oil causing a several times higher increase in the oil price.[4] Growth in real interest rates causes the oil price to decline, confirming our hypothesis that investors seek investment returns on commodity markets if the return on financial assets is low. The remaining two variables capture the effects of oil inventories and the rate of use of refineries in the USA. Growth in oil inventories with a one-month lag and growth in the use of refineries with a two-month lag both result in an increase in the price of oil. The said model specification explains about one-fifth of the total oil price variability until 2005.

The model's explanatory power increased significantly from 2005 onwards (to about one-half). However, the nominal effective exchange rate of the dollar also ranked among the statistically significant variables. An appreciation of the dollar of 1% represents a fall in the Brent oil price of 2.1%. For comparison, Brown et al. (2008) estimate that the weakening of the dollar against the euro between 2003 and 2007 accounted for one-third of the oil price growth in the same period. This would mean that a depreciation of the dollar of 1% caused an increase in the oil price of around 2.4%. If we used the bilateral EUR/USD rate directly in the equation instead of the effective exchange rate of the dollar, we would get a smaller coefficient (-1.3).

Together with the dollar, industrial production in OECD countries remains another statistically significant variable affecting the oil price. Growth in this variable causes an increase in the oil price. The dollar exchange rate and industrial production therefore have contrary effects on the oil price.

As regards the remaining variables, only short-term real interest rates in the USA maintained a statistically significant effect, albeit with a lower coefficient. As in the period up to 2005, their growth causes the oil price to fall.

Equation 2 originally included variables expressing the OPEC oil supply and industrial production in China. However, neither variable was statistically significant.

4 Conclusion

The inverse relationship between the Brent crude oil price and the US dollar exchange rate dampens the impact of sharp fluctuations in the dollar price of Brent oil in "non-dollar" economies. We estimate that since 2005 a depreciation of the nominal effective exchange rate of the dollar of 1% has implied an increase in the oil price of 2.1%. The exchange rate thus absorbs the impact of high volatility in dollar prices of oil on both the euro area countries and other economies linked to the euro area, including the Czech Republic.

According to Babetskaia-Kukharchuk et al. (2008), the dynamic correlation coefficient between the koruna-dollar and euro-dollar currency pairs was 0.9 for the Czech Republic. The Czech koruna is therefore characterised by a high tendency to move similarly against the US dollar as the euro.[5] The impacts of fluctuations in dollar prices of oil on the Czech economy are therefore dampened similarly as in the euro area

---

[4] According to most estimates, a movement in the oil price of 10% requires a movement in demand for oil of only slightly more than 0.02%.
[5] Updated correlation coefficients (CNB, 2010, p. 42) confirm a high dependence in 2010 as well. The correlation decreased only in 2008 H2 and in 2009 Q1, when the koruna was exposed to depreciation pressures linked with increased volatility in global financial markets.

countries. Moreover, the dampening effect on the Czech Republic is increased by long-term nominal appreciation of the koruna against the euro, as the average annual appreciation of the koruna against the euro has been 3.1% since 2002.

Growth in the dollar price of oil was dampened mainly between August 2007 and September 2008, when the difference in annual growth between the dollar and koruna price of Brent oil was 20 percentage points (as against 11 percentage points relative to the euro price of oil).

References

Amano RA, van Norden S (1998a) Exchange Rates and Oil Prices. Review of International Economics 6(4): 683–694

Amano RA, van Norden S (1998b) Oil Prices and the Rise and Fall of the US Real Exchange Rate. Journal of International Money and Finance 17: 299–316

Babetskaia-Kukharchuk O, Babetskii I, Podpiera J (2008) Convergence in Exchange Rates: Market's View on CE-4 Joining EMU. Applied Economic Letters 15: 385–390

Bénassy-Quéré A, Mignon V, Penot A (2005) China and the Relationship between the Oil Price and the Dollar. CEPII Working Paper No. 2005-16

Brown SPA, Virmani R, Alm R (2008) Crude Awakening: Behind the Surge in Oil Prices. Economic Letter – Federal Reserve Bank of Dallas 5(3)

Chaudhuri K, Daniel BC (1998) Long-run Equilibrium Real Exchange Rates and Oil Prices. Economics Letters 58: 231–238

Cuaresma JC, Breitenfellner A (2008) Crude Oil Prices and the Euro-Dollar Exchange Rate: A Forecasting Exercise. University of Innsbruck – Working Papers in Economics and Statistics (08)

Czech National Bank (2010) Analyses of the Czech Republic's Current Economic Alignment with the Euro Area
http://www.cnb.cz/miranda2/export/sites/www.cnb.cz/en/monetary_policy/strategic_documents/download/analyses_of_alignment_2010.pdf

Deutsche Bank Research (2009) Exchange Rate Perspectives – Of Growth & Gaps: The Oil & Dollar Cycle Revisited. DB Global Markets Research

European Commission (2008) First Interim Report on Oil Price Developments and Measures to Mitigate the Impact of Increased Oil Prices. ECFIN/REP 54538-EN

Frait J, Komárek L (2006) Půlstoletí vývoje světových peněz (Half a Century of Global Money Developments). Politická ekonomie 3: 307–325

Habib MM, Kalamova M (2007) Are There Oil Currencies? The Real Exchange Rate of Oil Exporting Countries. Working Paper Series No. 839, European Central Bank

Hošek J, Komárek L, Motl M (2011) Měnová politika a cena ropy (Monetary Policy and the Price of Oil). Politická ekonomie, forthcoming

Mileva E, Siegfried, N (2007) Oil Market Structure, Network Effects and the Choice of Currency for Oil Invoicing. Occasional Paper Series No. 77, European Central Bank

Muñoz MP, Dickey DA (2009) Are Electricity Prices Affected by the US Dollar to Euro Exchange Rate? The Spanish Case. Energy Economics 31: 857–866

Schulmeister S (2009) Trading Practices and Price Dynamics in Commodity Markets and the Stabilizing Effects of a Transaction Tax. WIFO (Austrian Institute of Economic Research)

BOFIT	Bank of Finland Institute for Economies in Transition
CB-CCI	Conference Board Consumer Confidence Index
CB-LEII	Conference Board Leading Economic Indicator Index
CBOT	Chicago Board of Trade
CF	Consensus Forecasts
CN	China
CNB	Czech National Bank
DBB	Deutsche Bundesbank
DE	Germany
EA	euro area
EC	European Commission
ECB	European Central Bank
EC-CCI	European Commission Consumer Confidence Indicator
EC-ICI	European Commission Industrial Confidence Indicator
EIU	The Economist Intelligence Unit database
EU	European Union
EUR	euro
EURIBOR	Euro Interbank Offered Rate
Fed	Federal Reserve System (the US central bank)
FRA	forward rate agreement
GBP	pound sterling
GDP	gross domestic product
CHF	Swiss franc
IFO	Institute for Economic Research
IFO-BCI	IFO – Business Climate Index
IFO-CCI	IFO – Consumer Confidence Index
IMF	International Monetary Fund
IRS	Interest rate swap
JPY	Japanese yen
LIBOR	London Interbank Offered Rate
N/A	not available
OECD	Organisation for Economic Co-operation and Development
OECD-CLI	OECD Composite Leading Indicator
UoM	University of Michigan
UoM-CSI	University of Michigan Consumer Sentiment Index
US	United States
USD	US dollar