CNB‘s New Forecast

Inflation Report III/2008

Tomáš Holub

Monetary and Statistics Department

Meeting with analysts, Prague, 15 August 2008

CZECH CNB NATIONAL BANK

Outline

- Recent trends in inflation and the economy;
- External assumptions of the forecast;
- Fiscal policy;
- Inflation forecast and the interest rate trajectory;
- Regulated prices and tax changes;
- Overall inflationary pressures;
- Imported inflation;
- Domestic inflationary factors;
- Alternative forecast scenarios.

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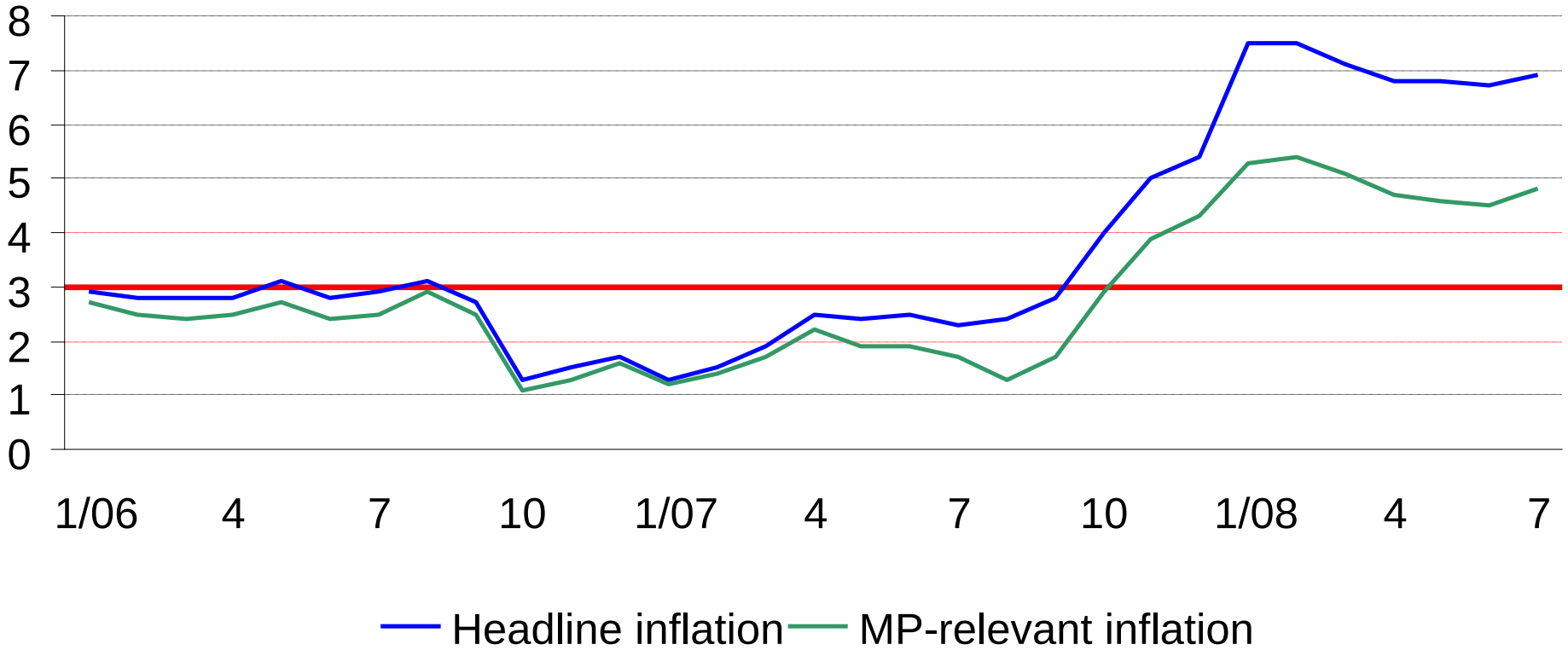
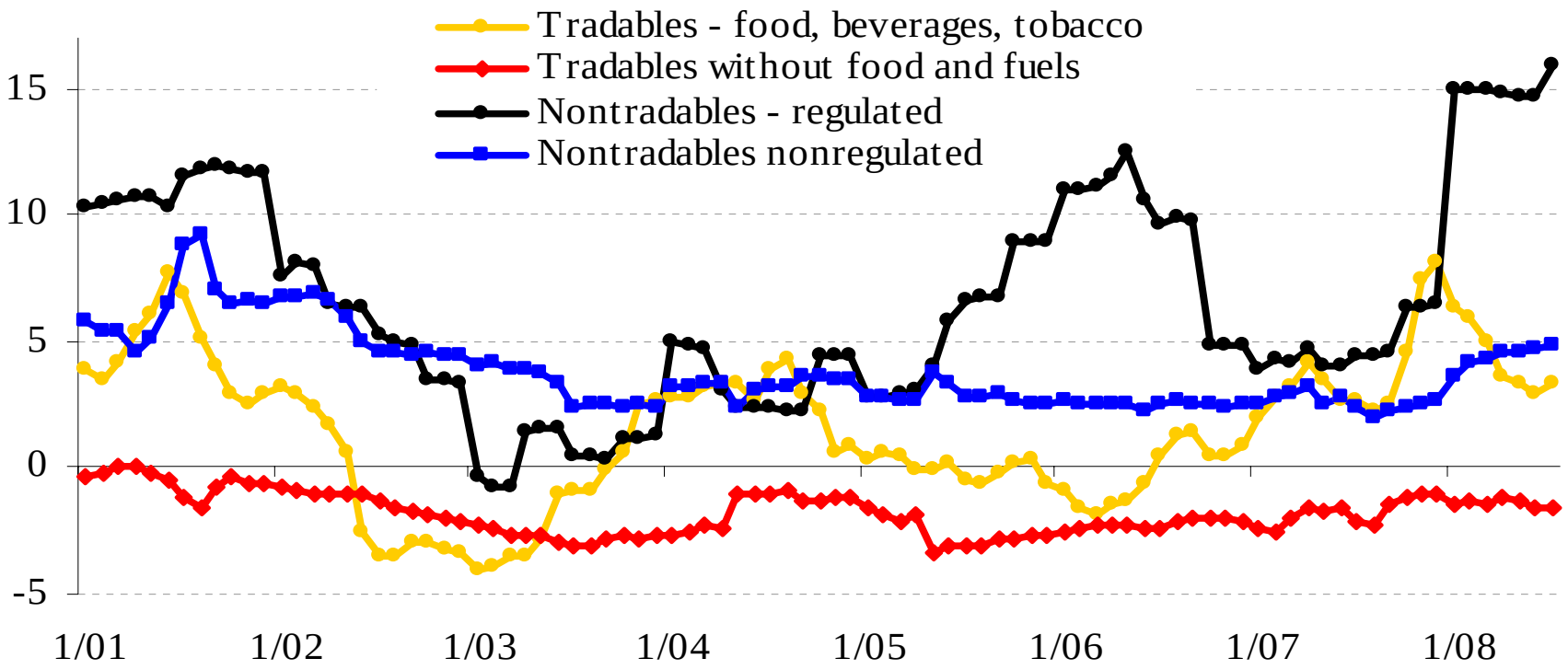
Inflation



- Inflation in Q2/08 only marginally above forecast;
- Both headline and MP inflation still far above the target;
- July 2008: headline inflation (6.9 %) and MP inflation (4.8 %), i.e. fully in line with the new forecast.

Structure of Inflation
(excluding taxes)



- Faster growth of non-tradable prices and in July also of regulated prices (natural gas price increase);
- Food, beverages and tobacco price growth excluding taxes has slowed down.

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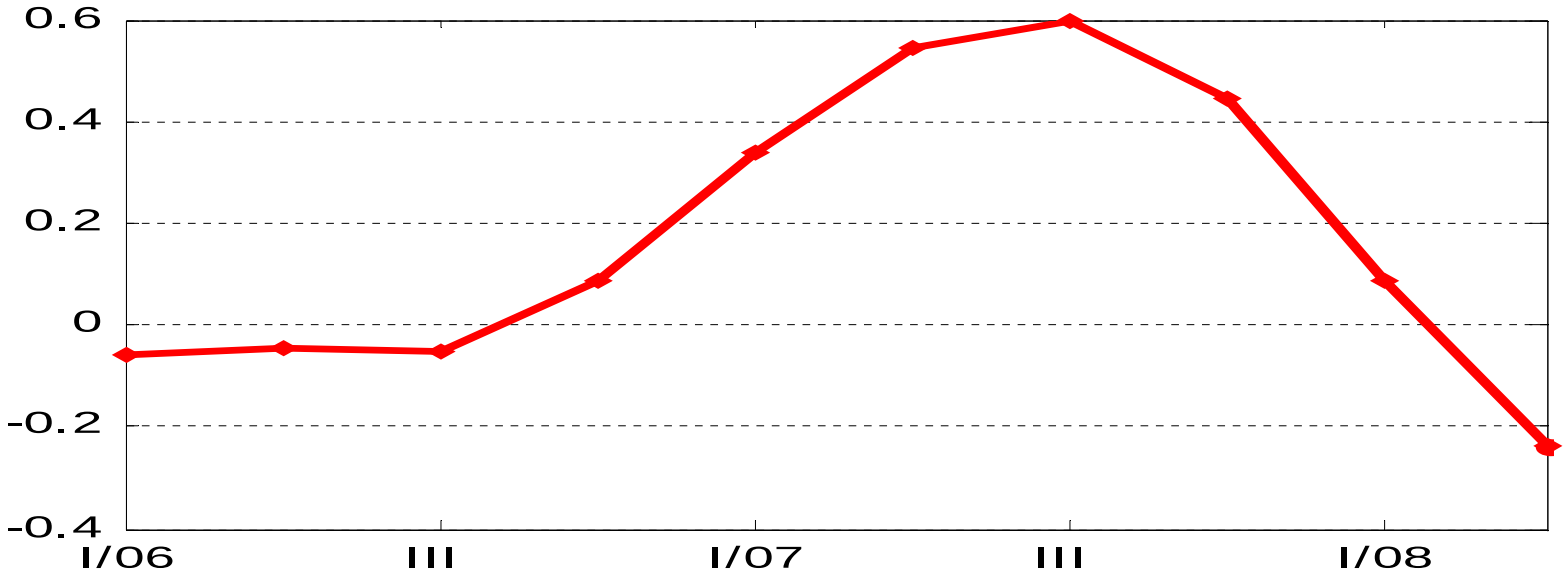
Overall Inflationary Pressures

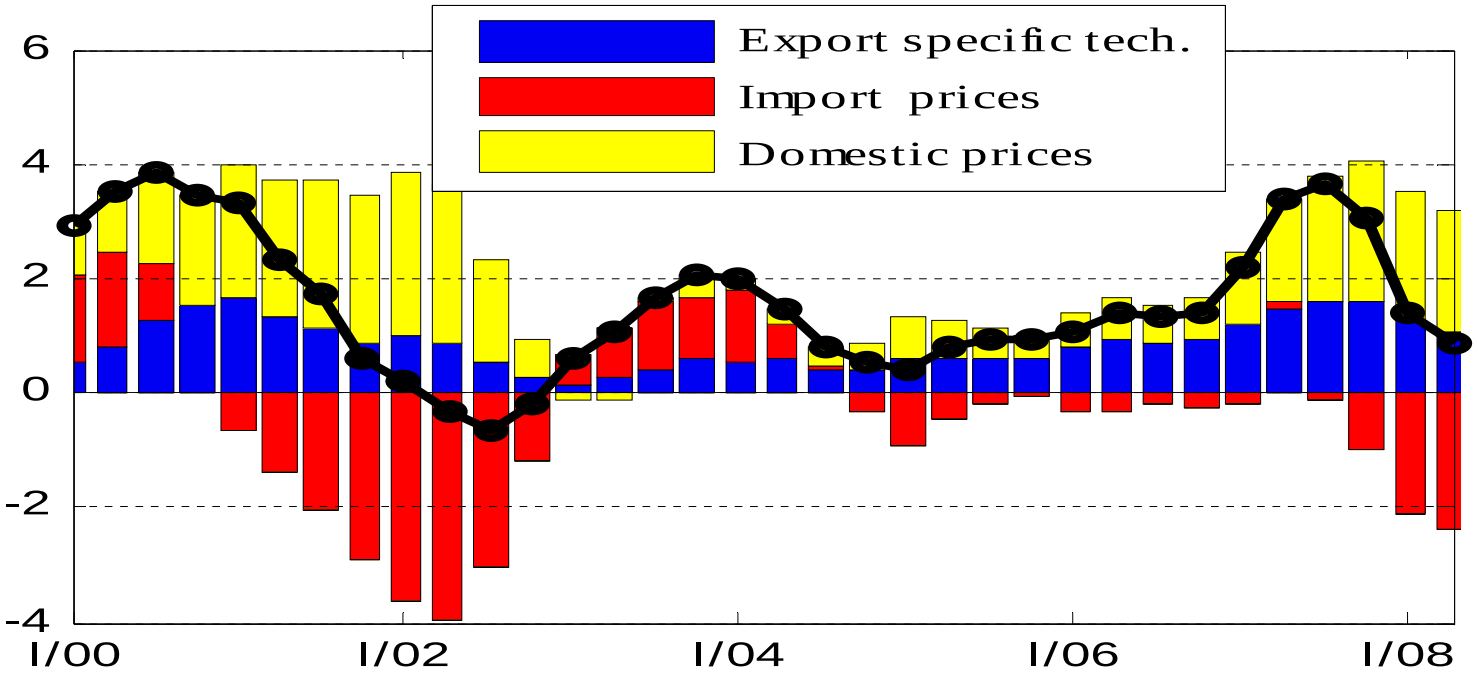
Real marginal cost gap, consumer goods sector (in %)



- The new g3 model: the overall inflationary pressures captured by the real marginal cost gap in the consumer goods sector;
- Overall pressures turned slightly anti-inflationary.

Domestic Pressures vs. Import Prices

Nominal Marginal Cost in Consumption Sector - Components (q/q in %, ann.)



- Domestic economy still generating pro-inflationary pressures, mainly due to the wage growth;
- Anti-inflationary impact of the exchange rate is increasing.

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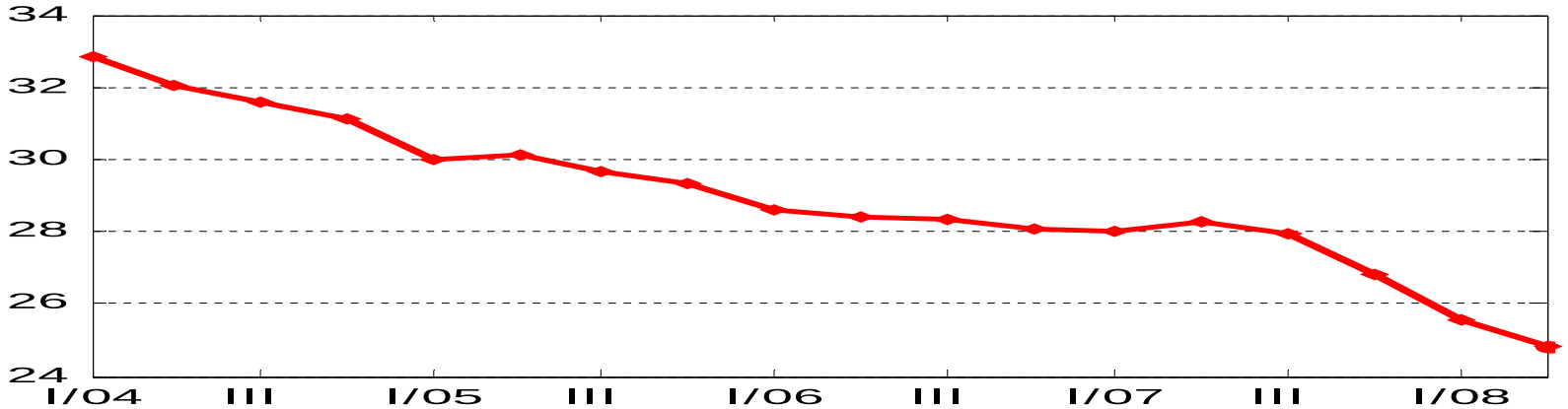
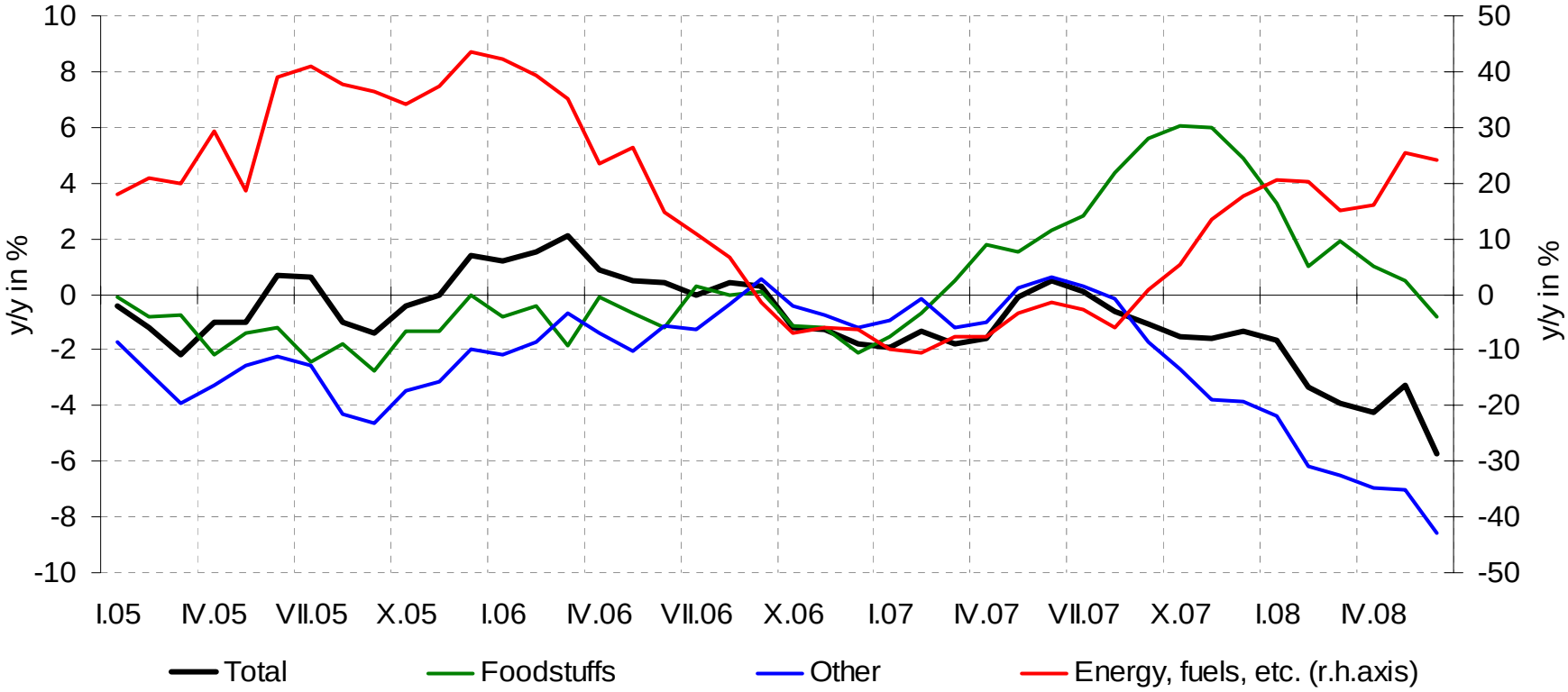
Exchange Rate

Nominal exchange rate (CZK/EUR)



External forecasts of CZK/EUR			
Date of forecast	**Next quarter**	**1Y horizon**	
	CF	CNB‘s survey	CF
7/07	28.5	27.4	27.9
10/07	27.6	26.9	27.6
1/08	26.2	25.8	26.2
4/08	25.4	25.2	25.5
7/08	24.0	24.6	24.3

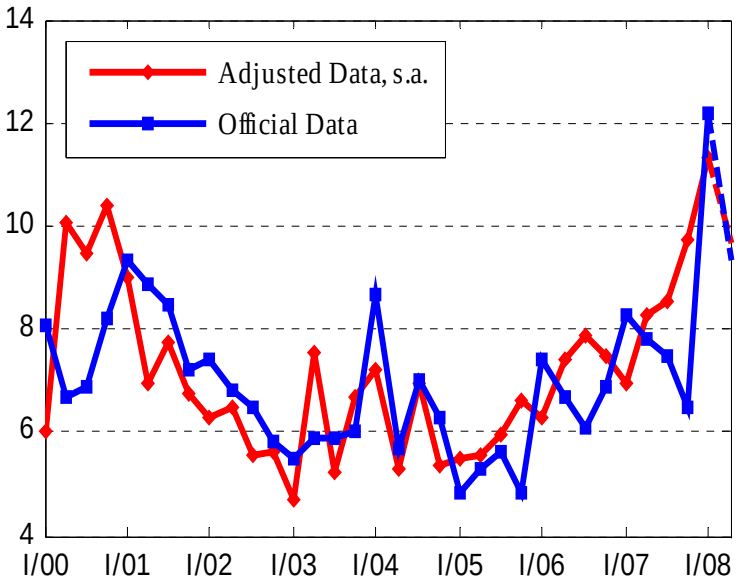
Import Prices



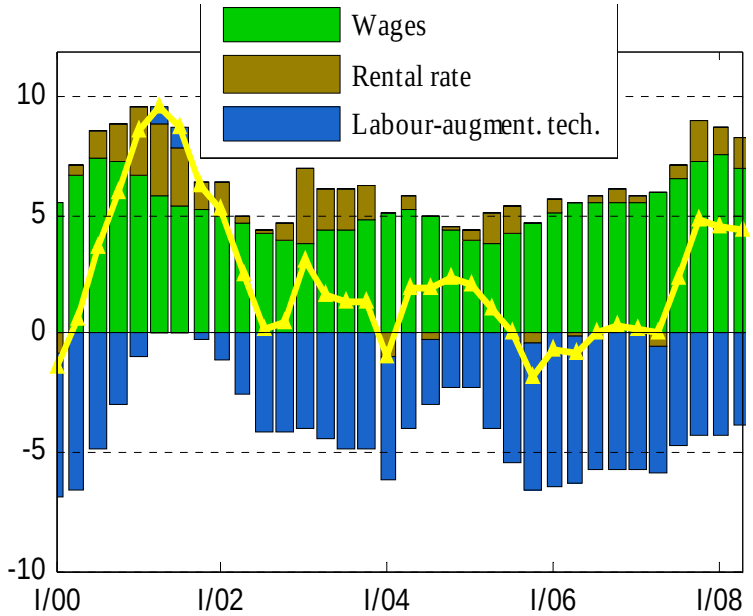
- Import prices ex food and energy declining substantially;
- Moderating growth of import food prices;
- High growth of fuel and energy prices.

Domestic Pressures

Nominal Wages (y/y in %)



Nominal Marginal Cost in Domestic Production – Components (q/q in % ann.)



- Acceleration in the nominal wage growth (even though partly due to one of factors);
- Slowdown in the productivity growth.

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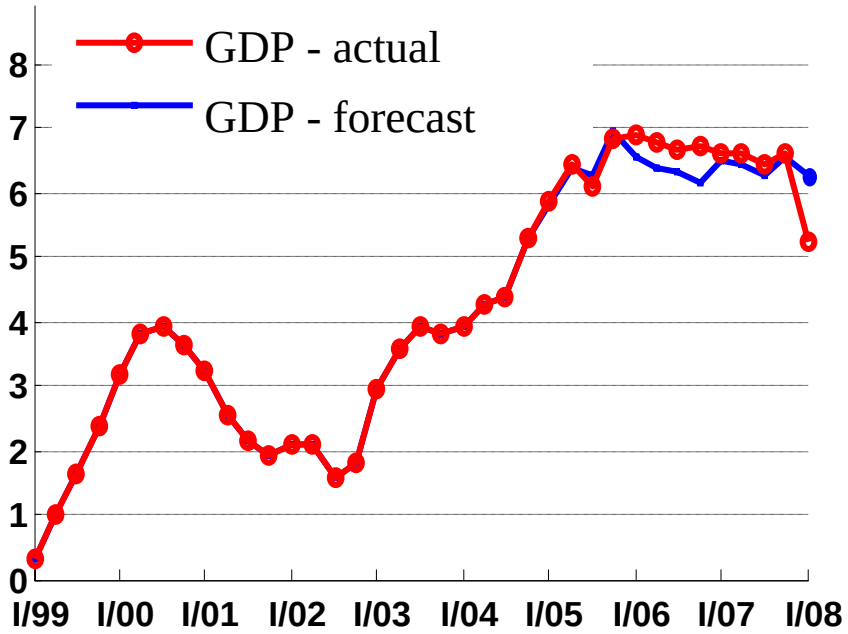
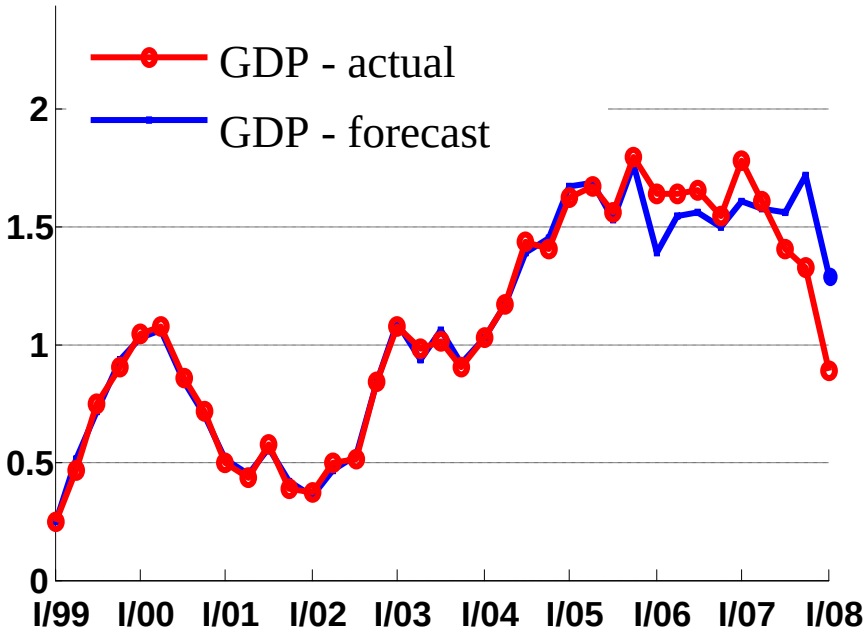
GDP Growth

GDP growth (y/y in %)



GDP growth (s.a., q/q in %)



- The economy has passed its cyclical peak;
- Slowdown in household consumption and investments;
- Flash estimate for Q2/08: 4.5 % y/y (vs. 4.7 % in the new forecast) and 0.9 % q/q (fully in line with the forecast).

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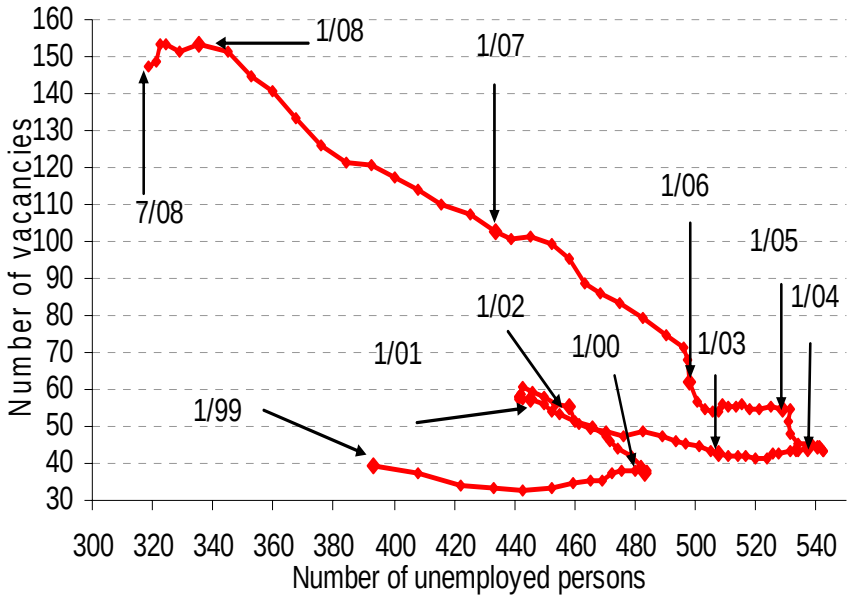
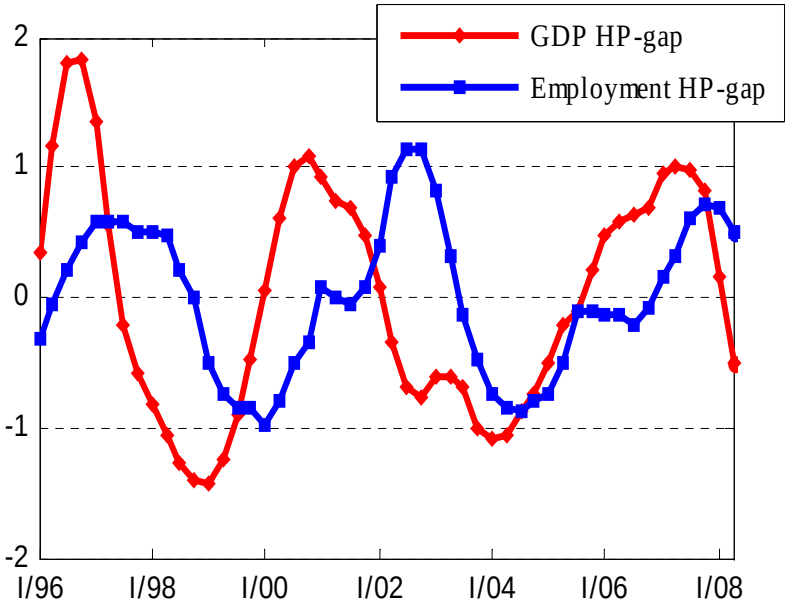
Employment Growth

Beveridge Curve (s.a., in thousands)



GDP and Employment (HP gap, in %)



- Employment growth (1.8 % y/y in Q2/08) typically lags behind the GDP growth by a few quarters;
- But first signs of a slowdown are apparent;
- Number of vacancies stopped increasing.

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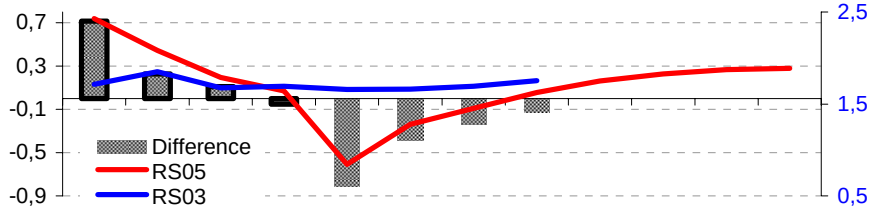
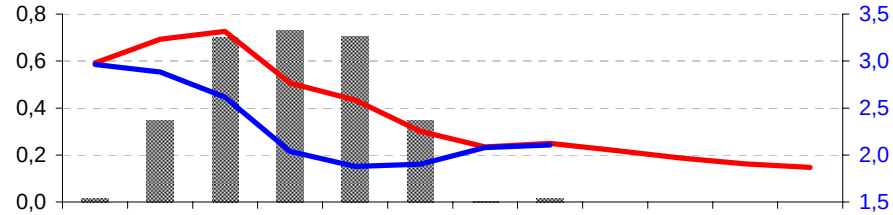
External Assumptions (CF07)

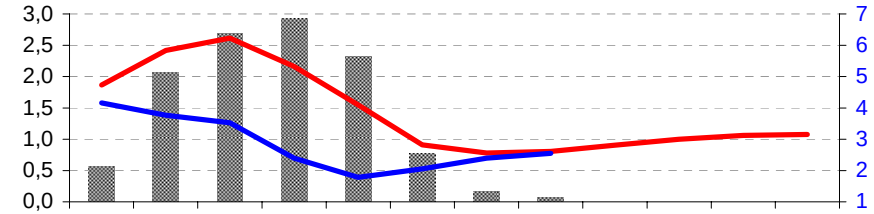
(difference in p.p.) **Eurozone effective GDP** (y/y in %)



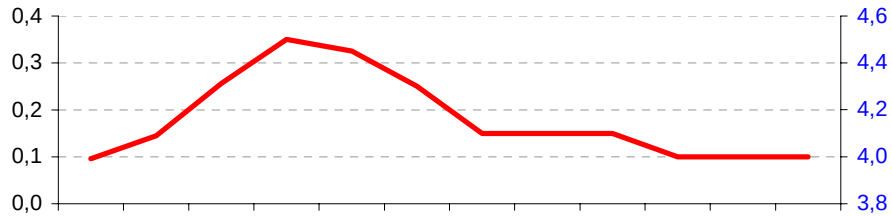
(difference in p.p.) **Eurozone effective CPI** (y/y in %)



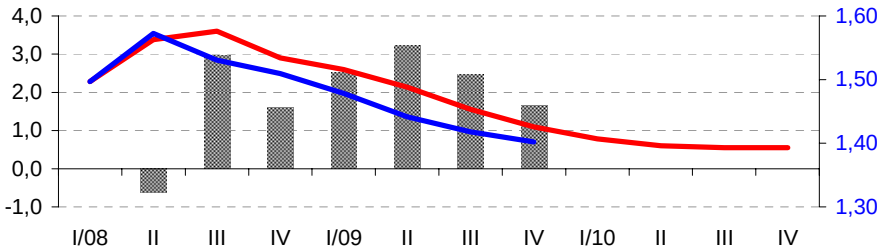
(difference in p.p.) **Eurozone effective PPI** (y/y in %)



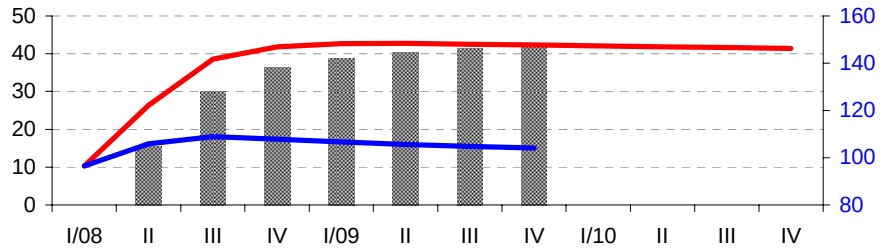
EONIA 3M swap (in %)



(difference in %) **USD/EUR** (USD/EUR)

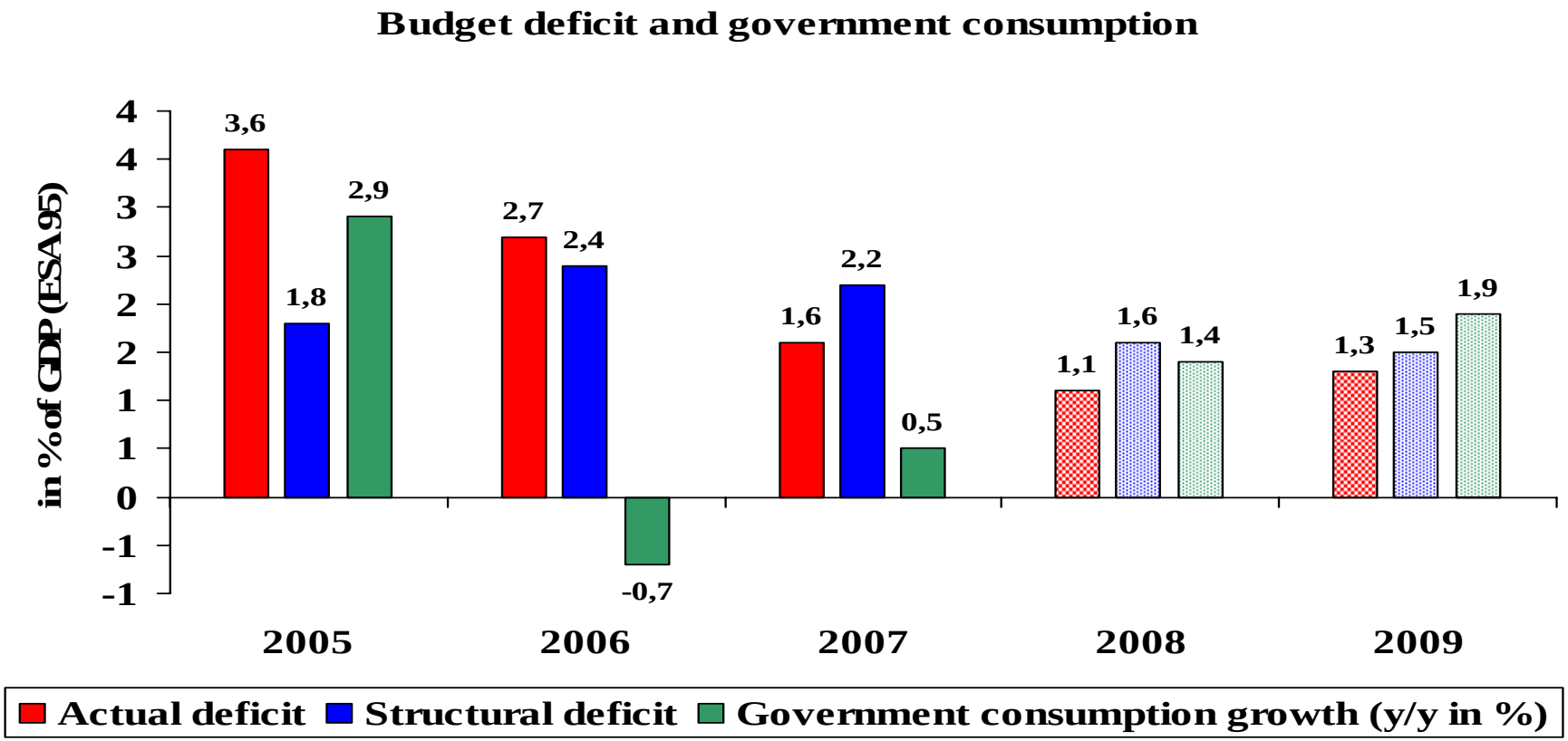


(difference in %) **Brent Oil** (USD/barrel)



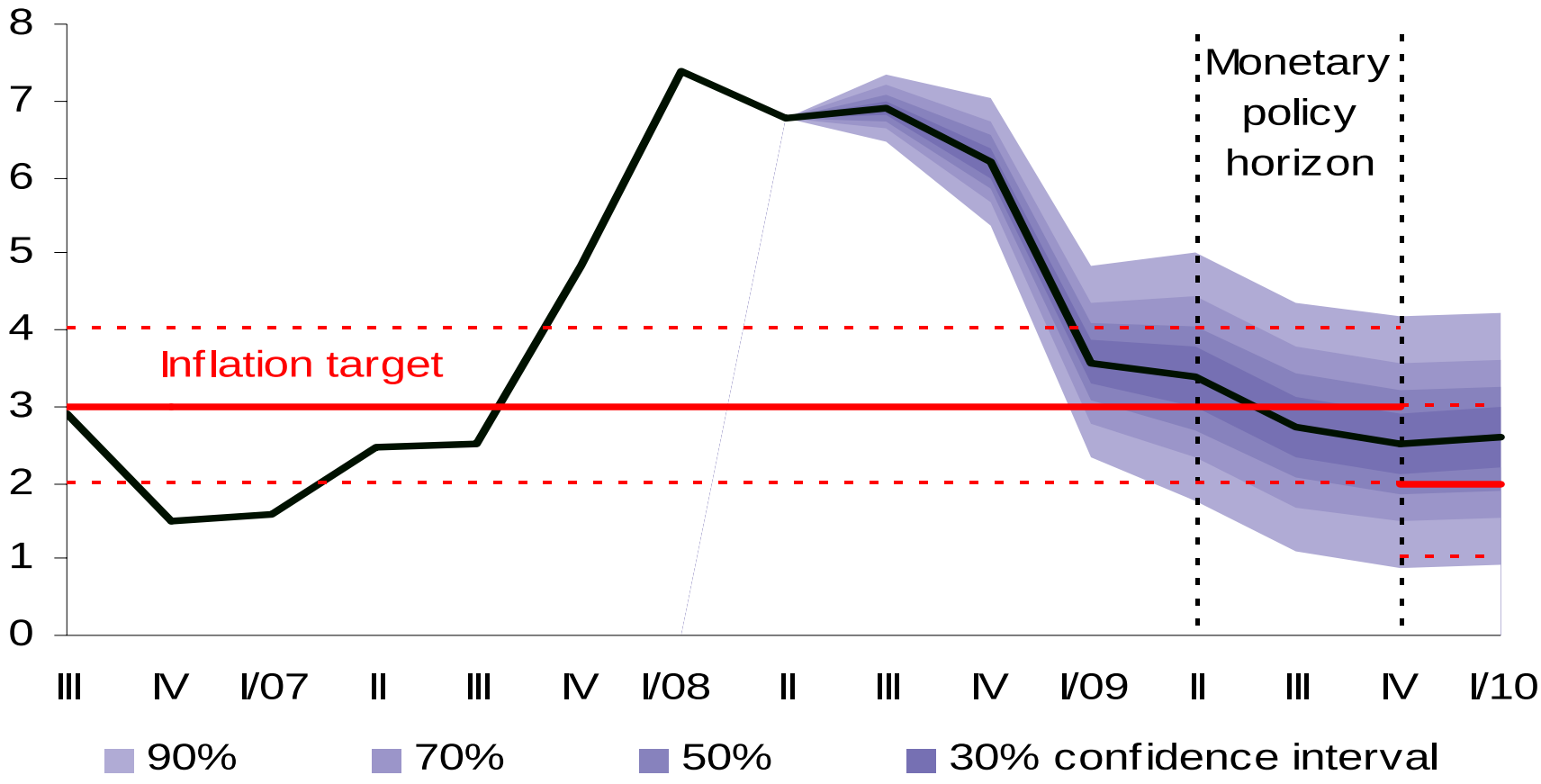
- Reduced growth outlook vs. higher inflation, energy prices and PPI outlook; MP dilemma.

Fiscal Situation



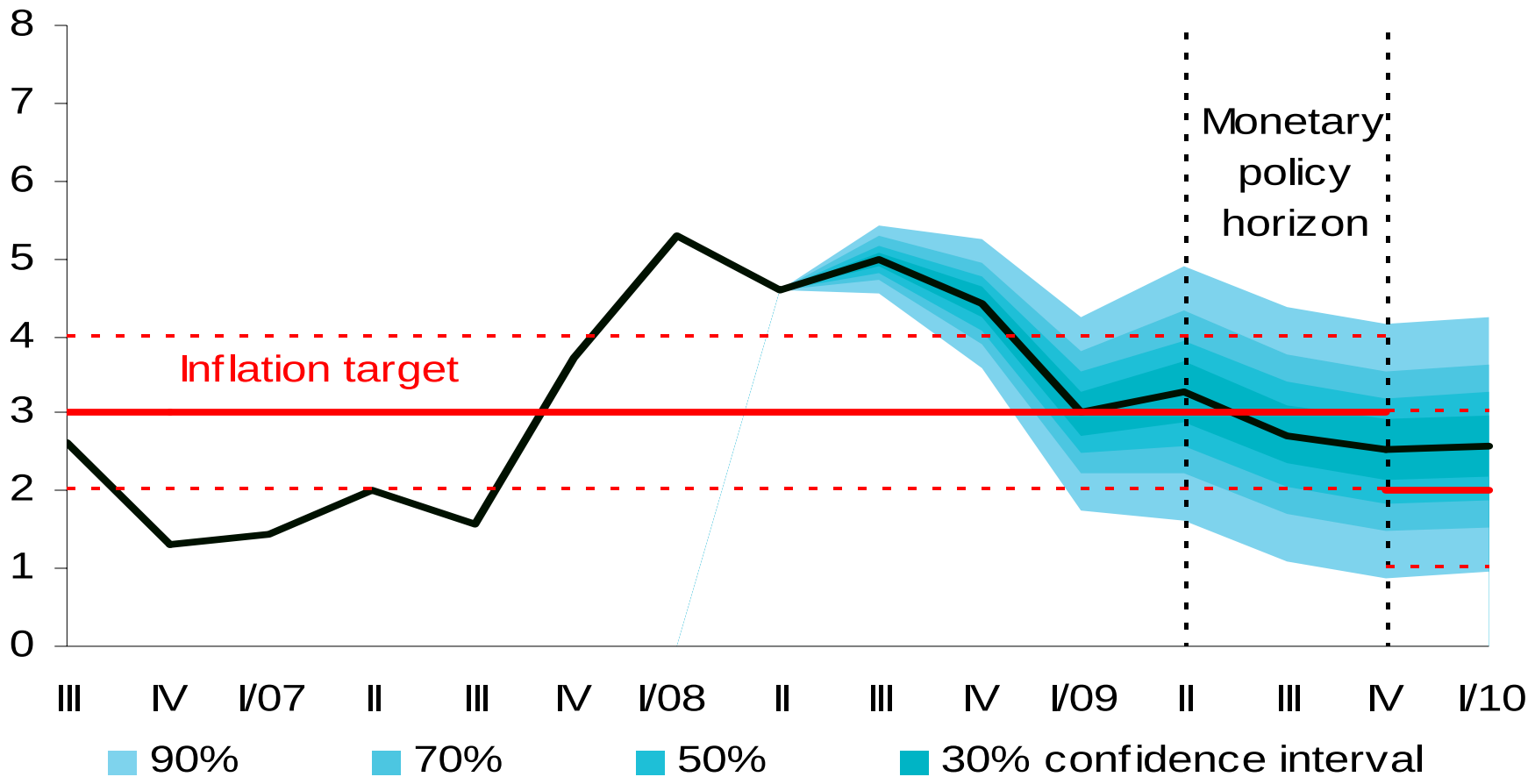
- Decline in the deficit in 2008 due to reform measures;
- Structural deficit around 1.5 % of the GDP;
- Assumed modest acceleration in public consumption.

Headline Inflation Forecast



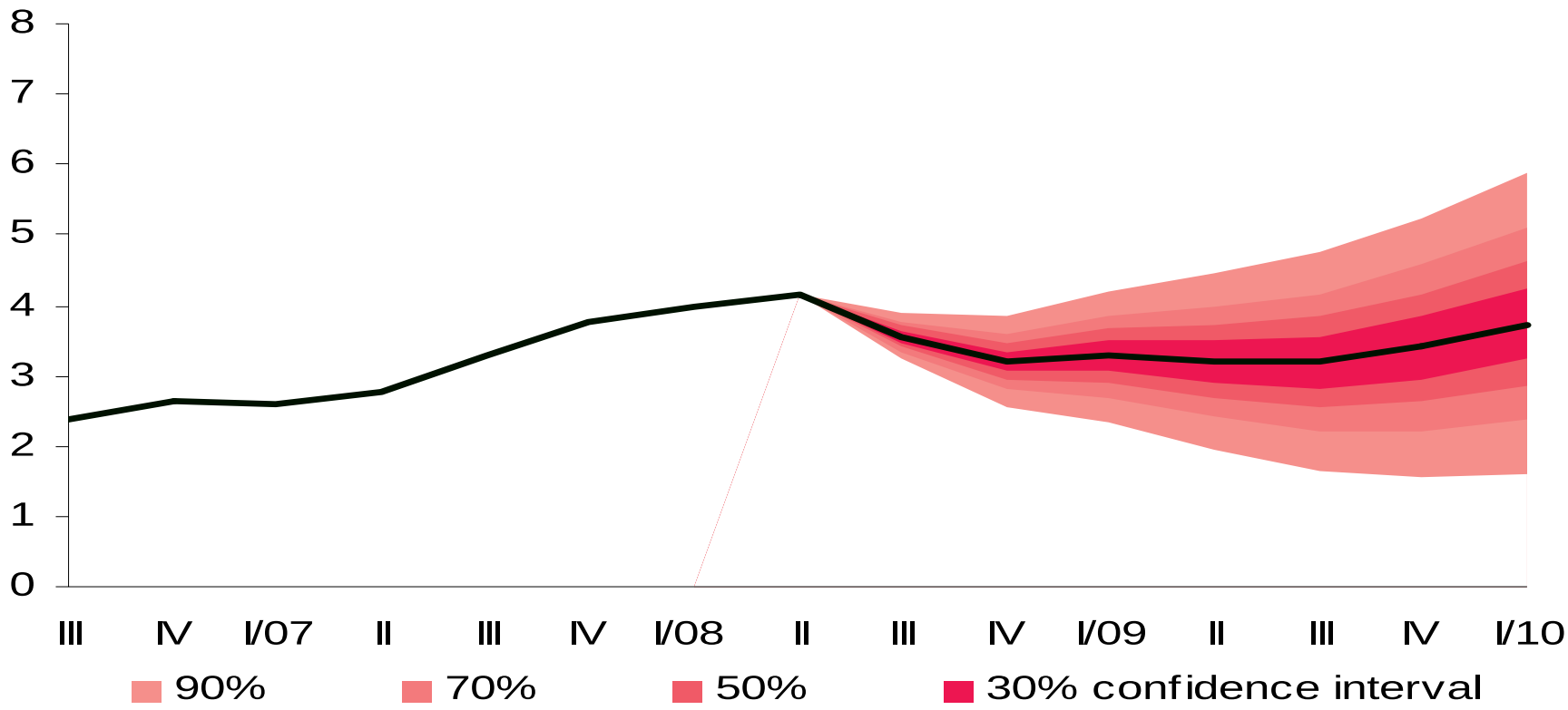
- The forecast has been increased;
- But inflation still heading below 3% on the MP horizon.

MP Inflation Forecast



- The impact of tax changes will fully fade away in 2009.

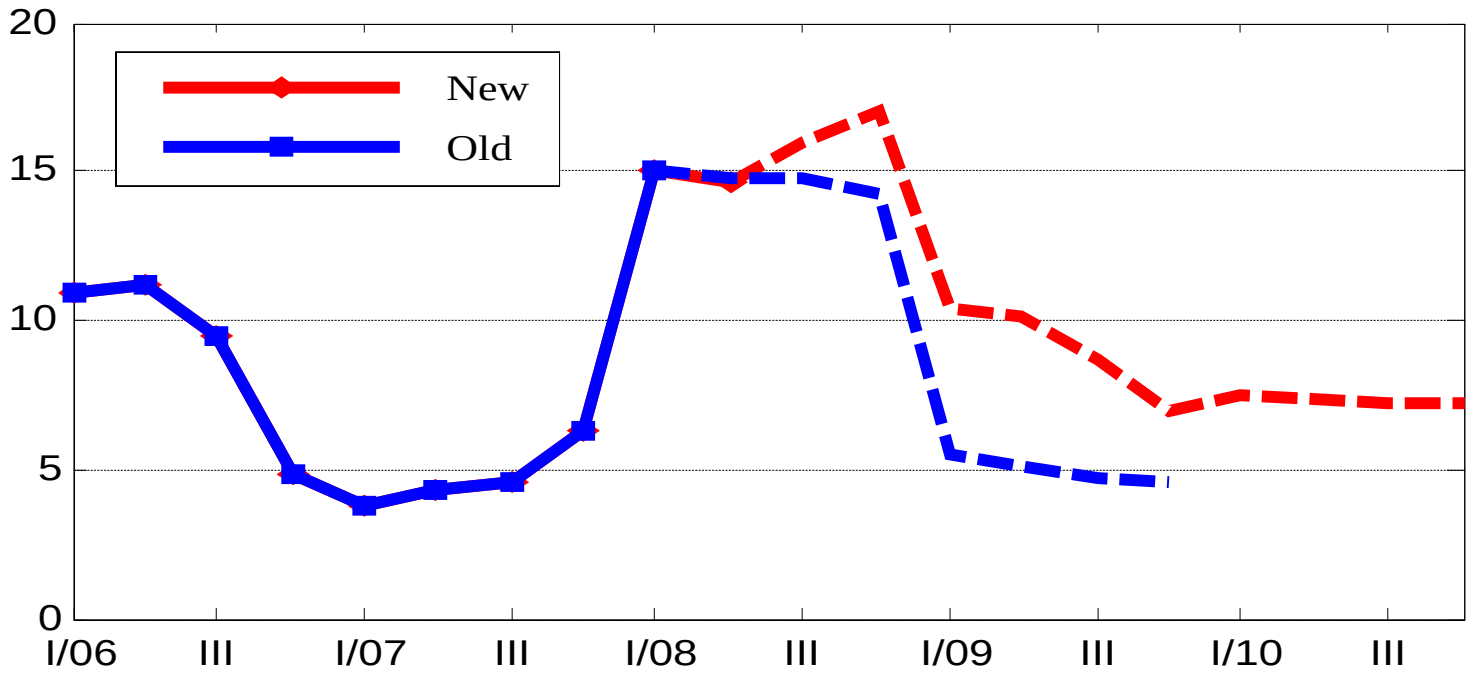
Interest Rate Forecast



- Consistent with the forecast and its assumptions is a declining interest rate path for the rest of 2008 and broad interest rate stability for most of 2009.

Regulated Prices

Growth of regulated prices (y/y in %)



- Forecast increased due to faster growth of energy prices and regulated rents;
- Regulated rents: lagged impact of real estate prices.

Administrative Measures
(selected items and total impact)

	2008		2009		2010	
	Y/Y growth	Impact in p.p.	Y/Y growth	Impact in p.p.	Y/Y growth	Impact in p.p.
Regulated prices - total	16,9	2,90	7,0	1,32	7,2	1,42
of which (selected items):						
Regulated rents	23,0	0,40	27,0	0,54	37,0	0,92
Electricity	9,5	0,37	10,0	0,40	7,0	0,30
Natural gas	37,3	0,83	4,1	0,12	0,0	0,00
Heating	11,0	0,33	4,0	0,13	2,0	0,06
Healthcare	42,0	0,57	2,0	0,04	2,0	0,04
Primary impact of tax changes on non-regulated prices		1,43		0,00		0,00

- Overall impact of administrative measure will drop from 4.3 p.p. at the end of 2008 to 1.3-1.4 p.p. in 2009-2010.

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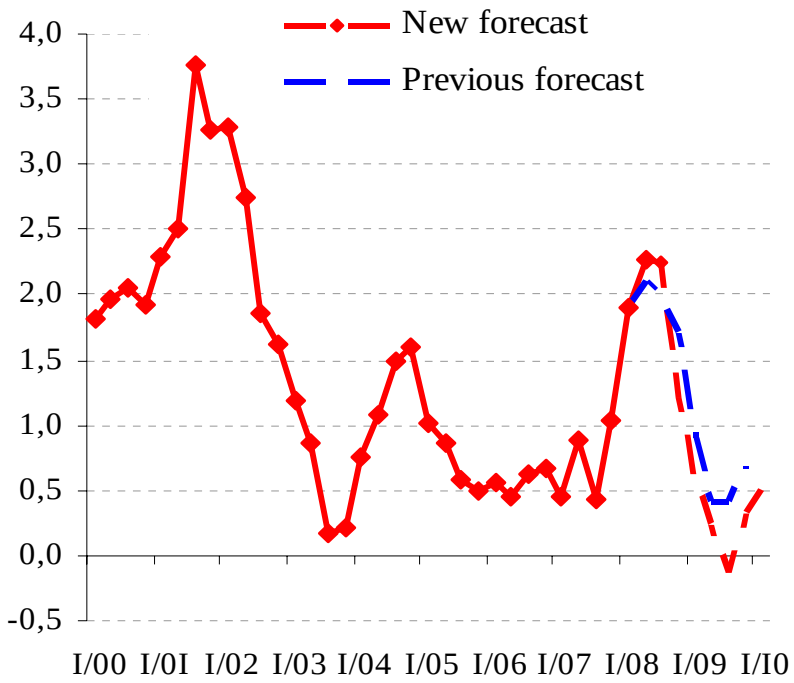
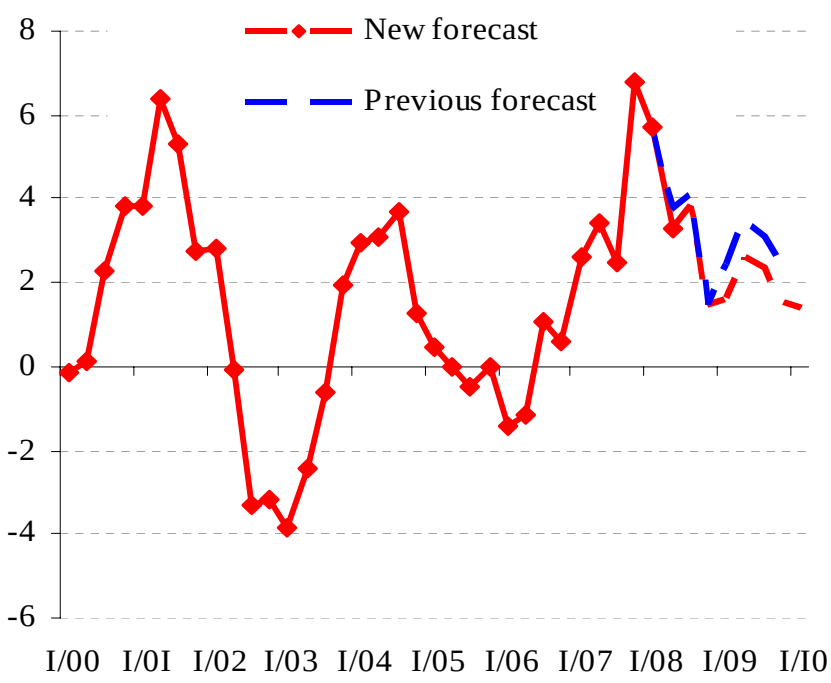
Core Inflation and Food Prices

"Core" inflation (in %, excl. tax changes)



Food price growth (in %, excl. tax changes)



- Forecast lowered due to more anti-inflationary exchange rate developments and domestic factors;
- Downside risks to the food price forecast in the near-term.

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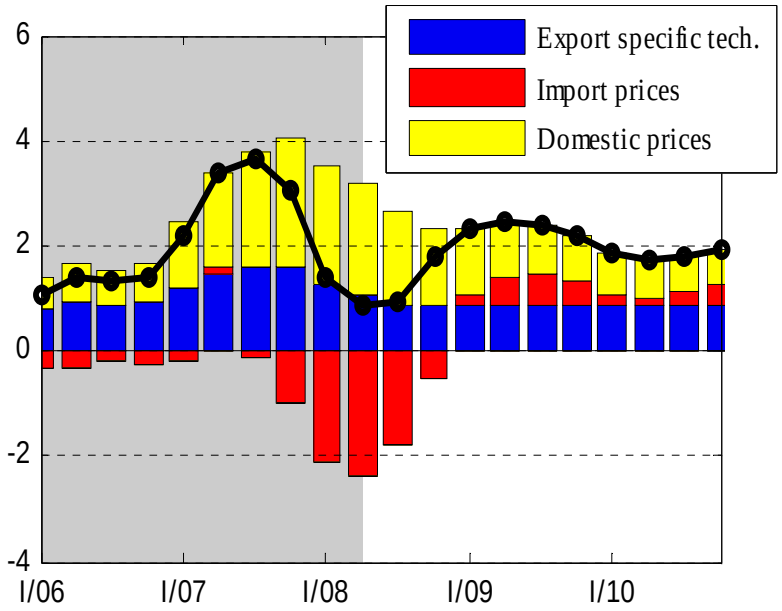
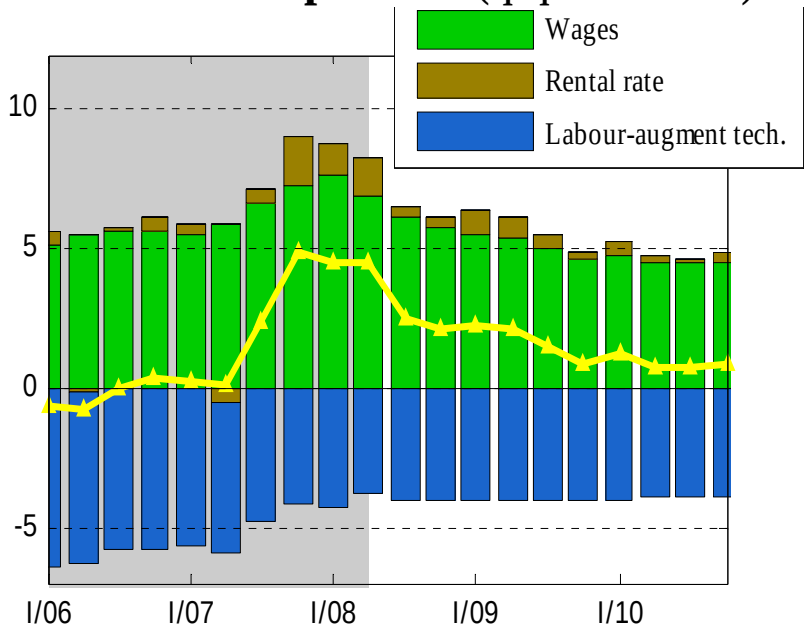
Inflationary Pressures

Nominal Marginal Cost in Consumption Sector - Components (q/q in %, ann.)



Nominal Marginal Cost in Domestic Production – Components (q/q in % ann.)



- The anti-inflationary impact of the CZK will peak in H2/08;
- Domestic inflationary pressure will be subsiding due to slower growth of real GDP and nominal wages.

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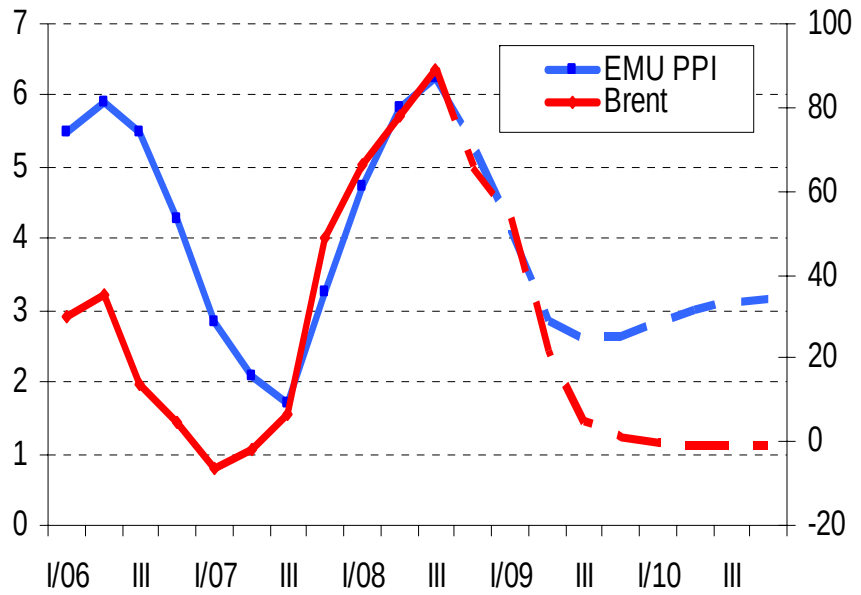
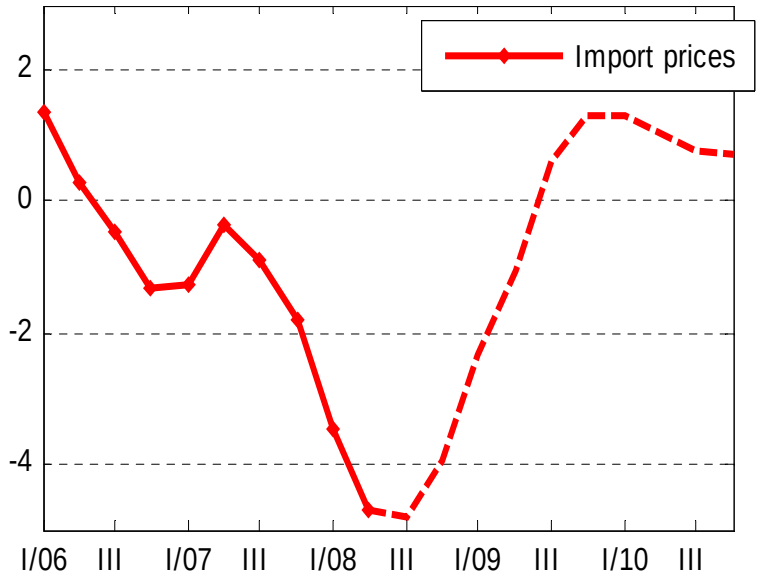
Import Prices

EMU PPI and Brent Oil (y/y in %)



Import Prices (y/y in %)



- The anti-inflationary impact of the strong exchange rate (despite its initial correction) will only partly be reduced by high oil prices and growing PPI in the eurozone.

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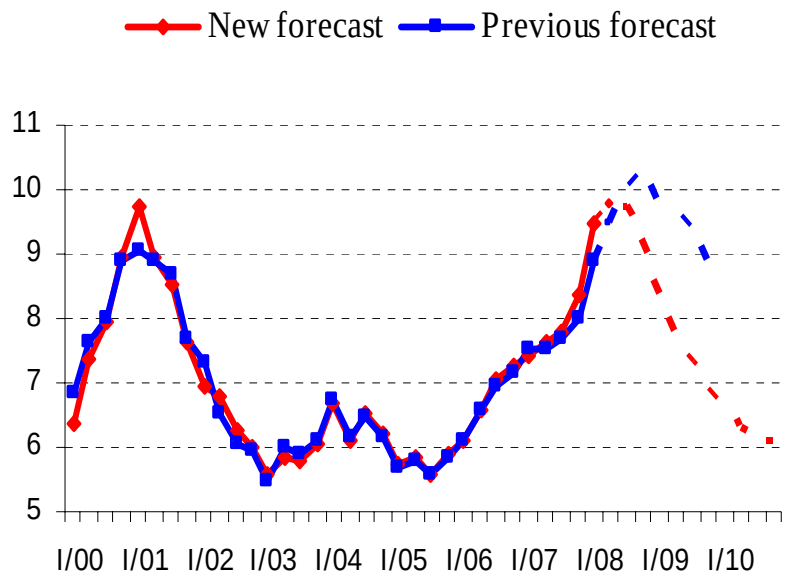
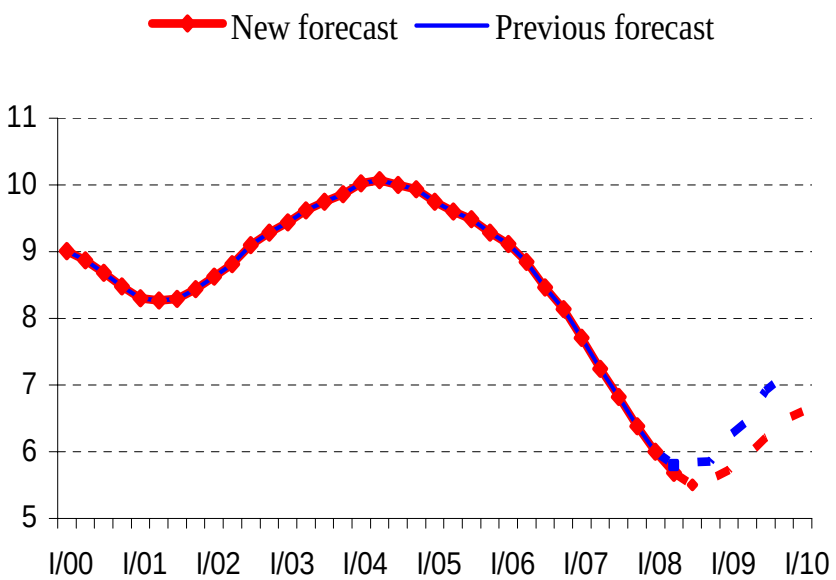
Nominal Wage Growth

Nominal wage growth in business sector
(y/y in %, seasonally adjusted)



Total registered unemployment
(in %, seasonally adjusted)



- Wage growth will slow down quickly (as in 2001-03);
- But there is an upward risk (tight wage negotiations?);
- Unemployment rate will start increasing.

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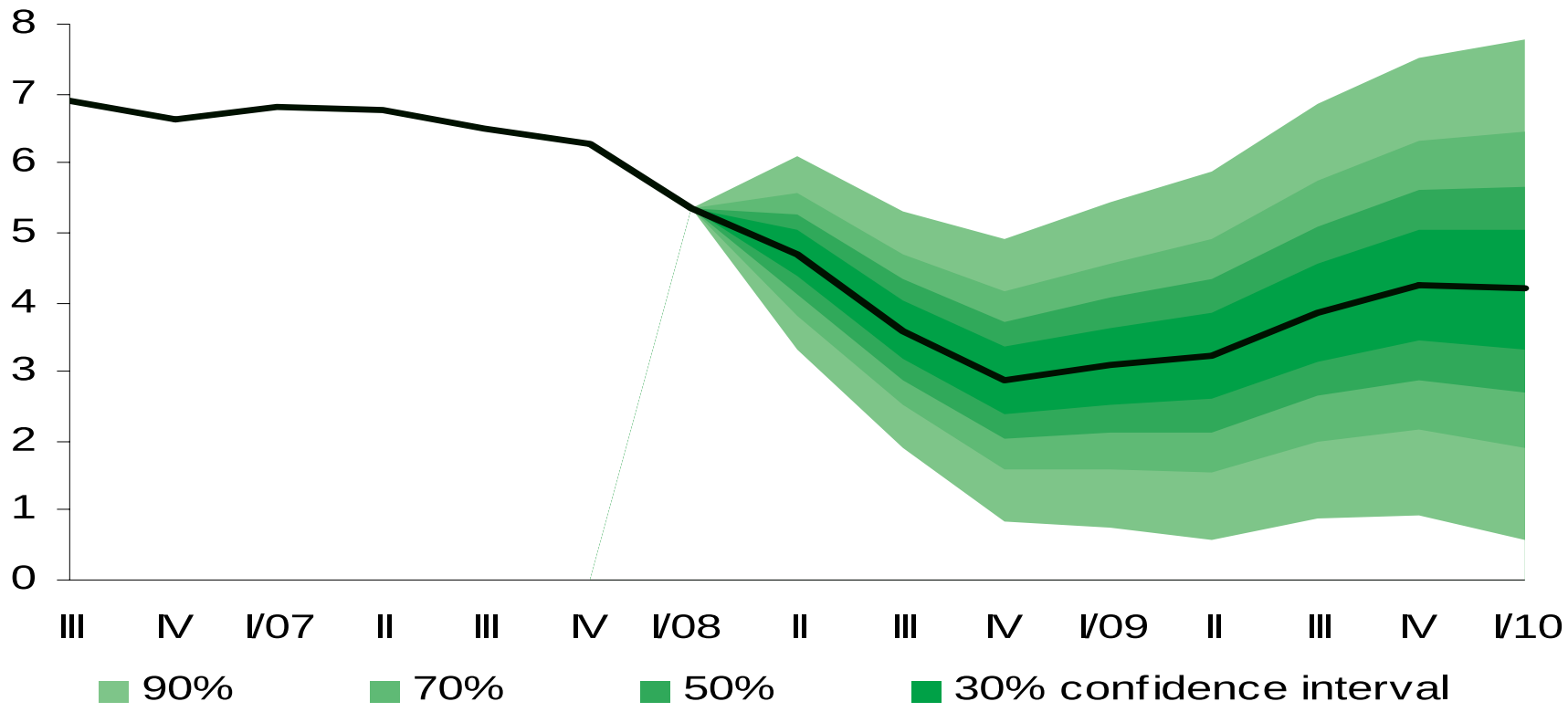
GDP Growth Forecast



- Pronounced slowdown in growth in 2008, with a gradual turn-around during 2009;
- Forecast lowered in comparison with the previous one.

GDP Growth Forecast

y/y change	2008	2009	2010
Gross domestic product	**4.1**	**3.6**	**4.1**
Household consumption	**3.0**	**3.9**	**4.1**
Government consumption	**1.4**	**1.9**	**2.1**
Investment	**4.6**	**4.9**	**4.3**
Exports	**10.9**	**7.8**	**8.7**
Imports	**10.1**	**8.4**	**8.6**

- Slowdown in investment and exports growth (weak foreign demand, strong exchange rate);
- Only gradual recovery of household consumption from the current slow-down (lower inflation and low real interest rates vs. slower wage growth and higher unemployment).

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Summary of the baseline forecast

- Economy has clearly passed its cyclical peak;
- Domestic factors (wages) still pro-inflationary;
- Offset by anti-inflationary exchange rate impact;
- Inflation will fall below 3 % during 2009;
- Forecast of regulated prices increased;
- Partly offset by lower outlook of non-regulated prices;
- Expected further slow-down in economic growth;
- Wage growth should slow down as well;
- Interest rates: a declining path for the rest of 2008 and broad stability for most of 2009.

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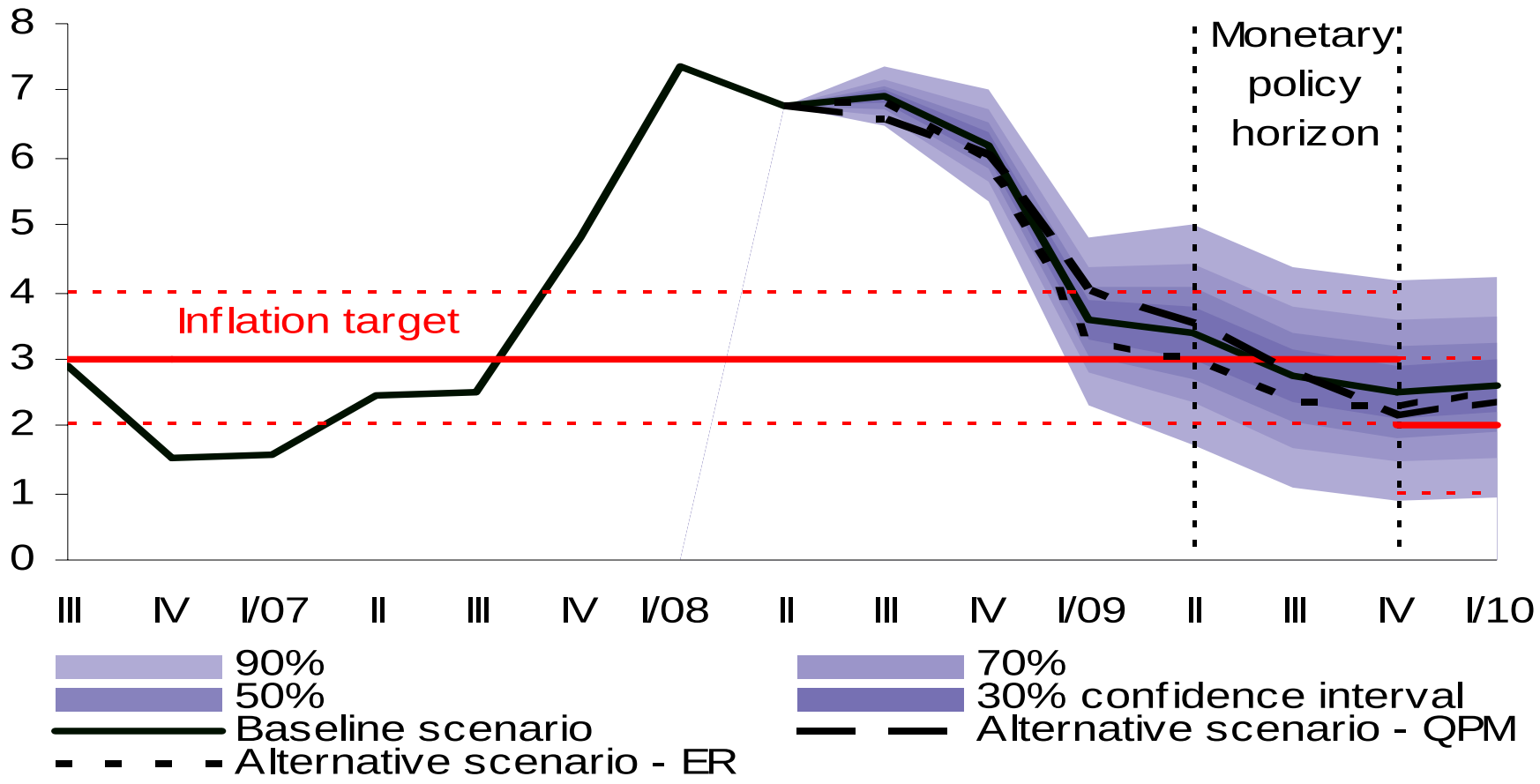
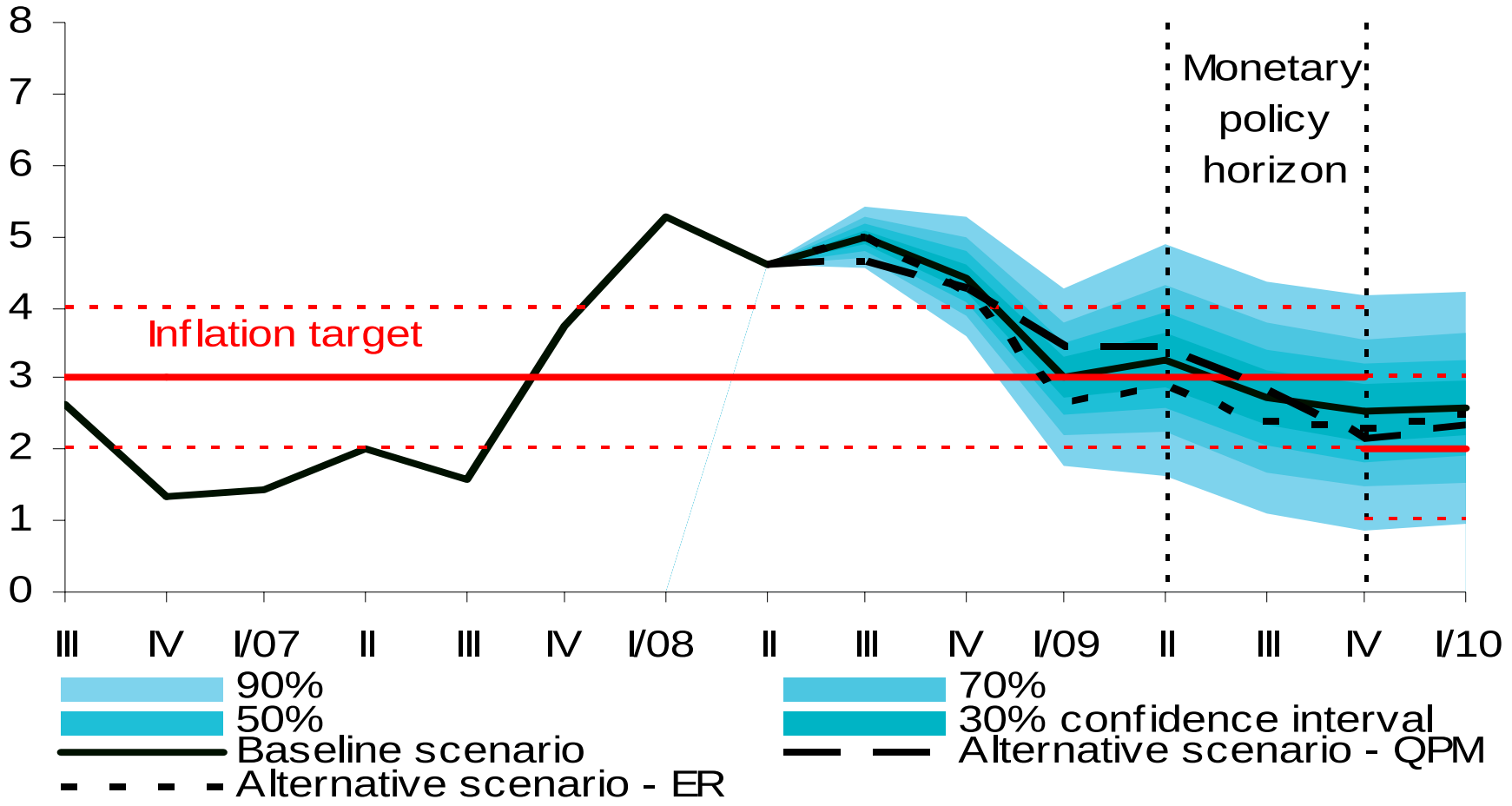
Headline Inflation – Alternative Scenarios



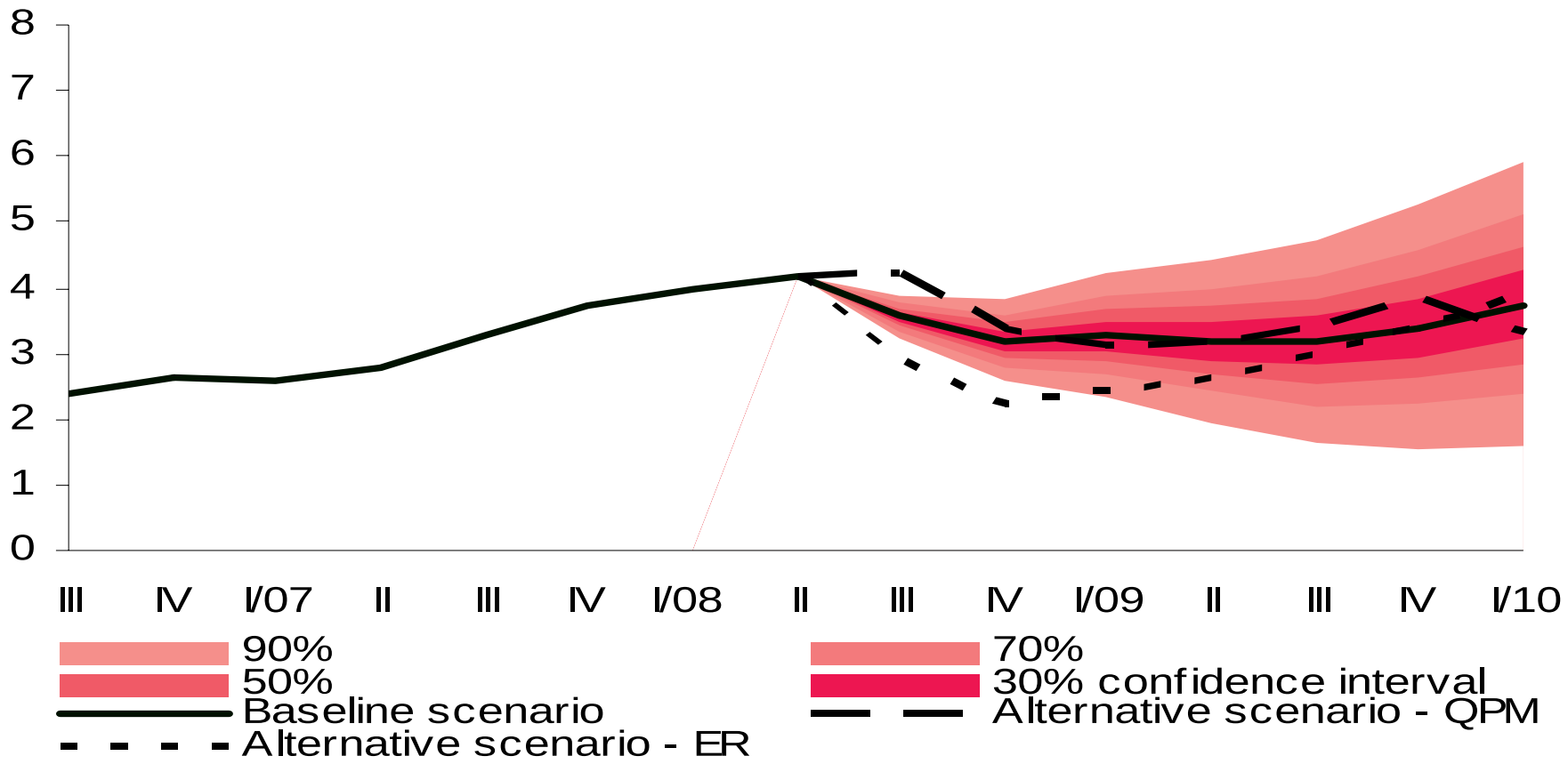
- Alternative scenarios not substantially different from the baseline on the MP horizon.

MP Inflation – Alternative Scenarios



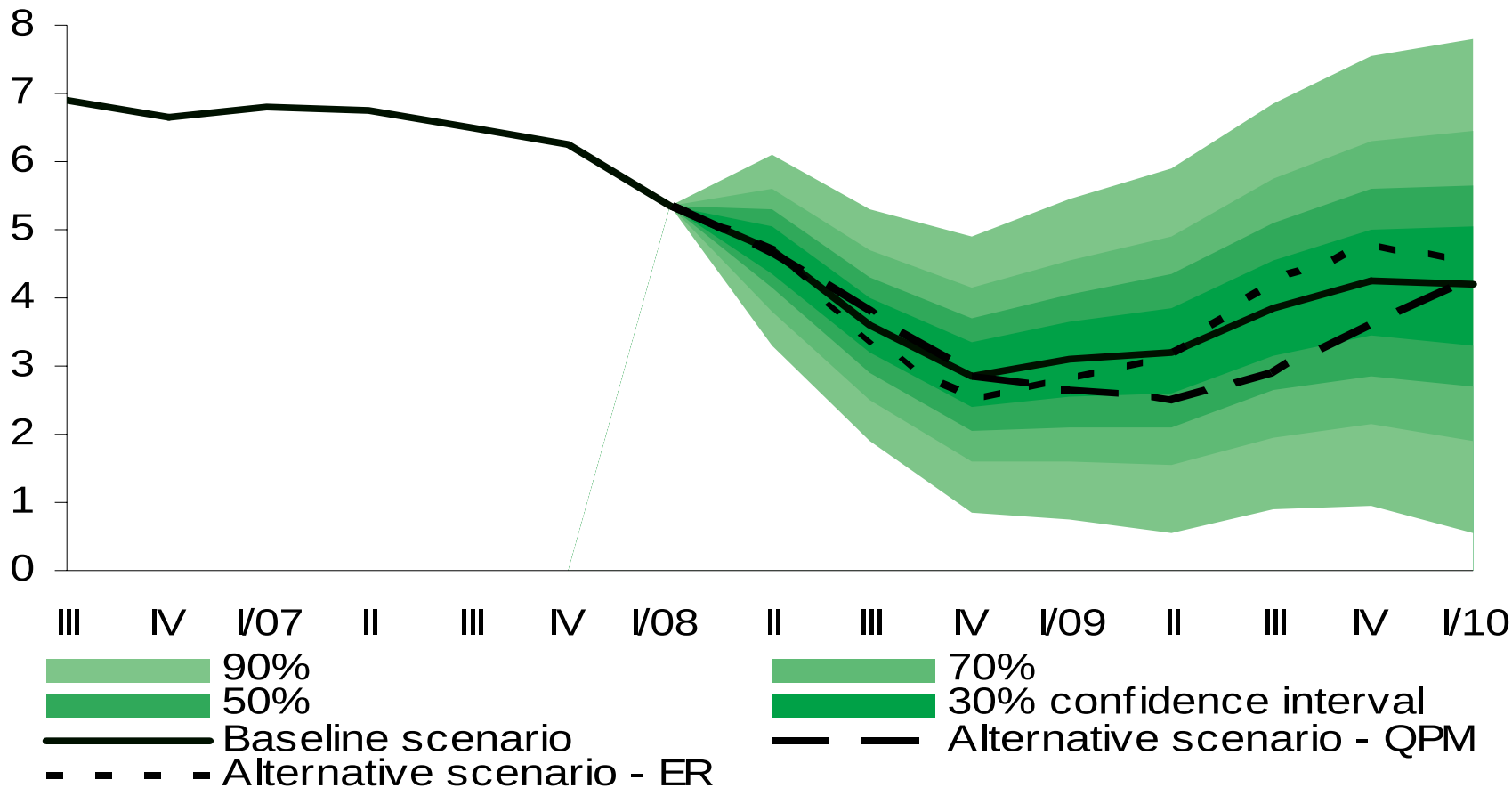
- MP inflation also similar to the baseline.

Interest Rate Forecast – Alternative Scenarios



- Sharper interest rates cuts required in the shock exchange rate (ER) appreciation scenario.

GDP Growth Forecast – Alternative Scenarios



- More pronounced GDP growth slowdown in the QPM scenario (but higher wage growth at the same time).

Thank you
for your attention.

(Tomas.Holub@cnb.cz)

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New Forecasting Model of the CNB

Forecasting and Policy Analysis

Macroeconomic Forecasting Division
Monetary and Statistics Dept

Meeting with Analysts, Prague, 15 August 2008

Outline of the Talk

(i) New core model used for baseline

(ii) Basic structure of the model

(iii) Real marginal costs & output-gap concepts

(iv) Brief digression on initial conditions identification

The King is Dead. Long live the King!

The **g3** model has replaced **QPM** as a core model of the Czech National Bank.

- CNB is one of the first central banks to use a DSGE (Dynamic Stochastic General Equilibrium) model as a **core policy tool**
- Joining the “club” with Sveriges Riksbank (RAMSES), Bank of Finland (Aino) or Bank of Canada (ToTEM) . . .
- The g3’s features & tools provoked interest in the model (BoF, ECB, Riksbank, BoE. . .)

- CNB used the g3 model since Jan 2007 along with the QPM model for “shadow forecast” and analytical insights
- The g3 FPAS expands analytical scope and brings brand new, powerful tools while preserving the CNB’s view of the economy

The Model is Tested and Ready (i)

After intensive and thorough testing the g3 is ready to take-off!

How we tested. . .

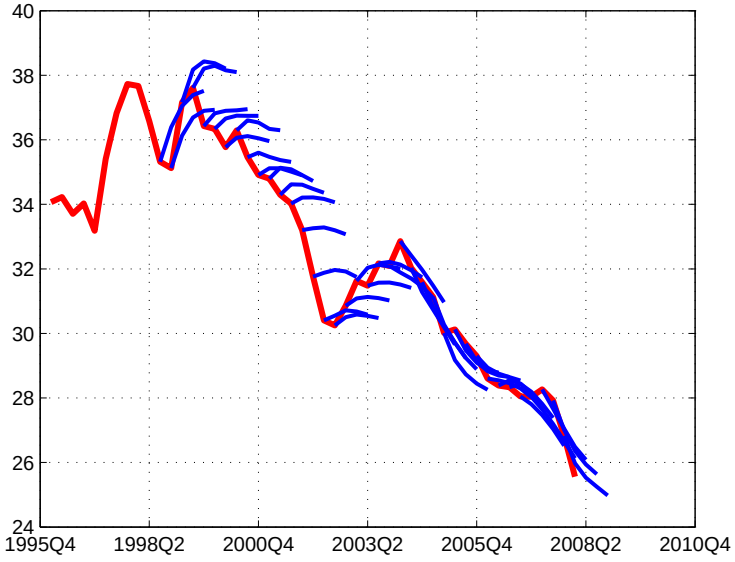
- Real-time forecasting exercises since Jan 2007
- Time & frequency-domain properties
- Historical recursive filtering & forecasting
- FEVD, GSA, . . .

Note:
The “fit” of recursive forecast may vary also due to

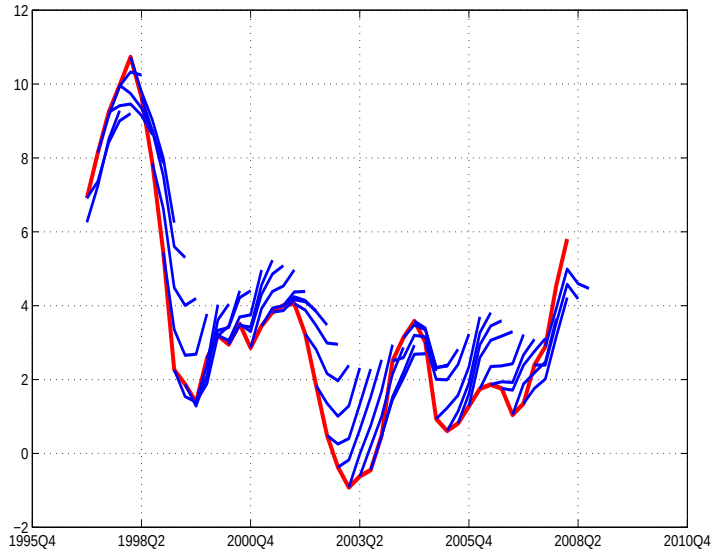
- information set considered
- unconditional nature of the forecast (i.e. endogenous monetary policy)

The Model is Tested and Ready (ii)

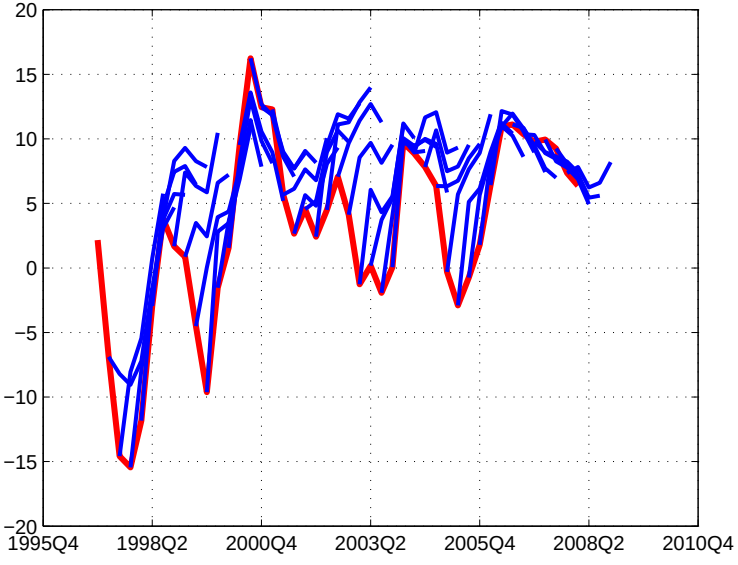
Exchange-rate CZK/EUR (T+4)



Consumer Inflation, YoY % (T+4)



Gross Investment (T+4)



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Bird's Eye View

(i) Small open economy model, taylor-made for the Czech economy

(ii) Designed mainly for forecasting and policy analysis

(iii) Based on behavioral principles and production structure of the economy

(iv) Consistent with quarterly national accounts

(v) Cascade of wage and price rigidities, imperfect exchange rate pass-through

(vi) Rich set of real rigidities and frictions

(vii) Emphasis on foreign trade issues
(import intensity of exports, openness, non-price competitiveness, . . .)

(viii) No use of ad-hoc detrending and/or pre-filtering

(ix) Trends and cycles are not separable

Structure of the Model (i)

Households and Government

(i) Households consume consumption goods, offer labor, own firms

(ii) Government collects tax revenues, consumes goods, issues nominal bonds

Firms

(i) Production structure – firms operate in multiple final-goods sectors (consumption goods, export goods, . . .)

(ii) Nominal wages (contracts) are rigid

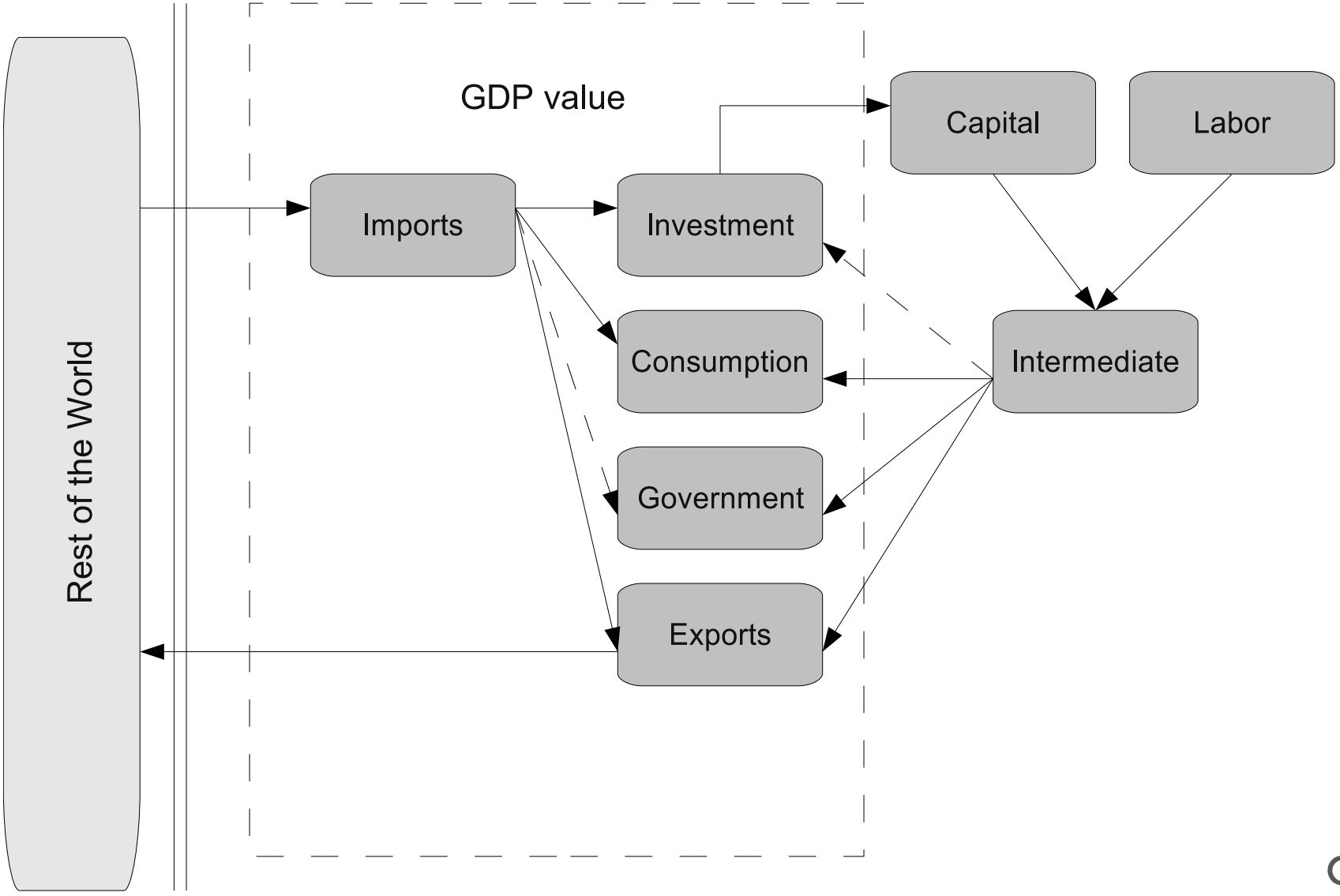
(iii) Various degrees of price-stickiness in each sector (Calvo-Yun Pricing) (exporters sticky in foreign currency, other firms in home currency . . .)

Monetary Policy

(i) Forward-looking central bank implements **inflation targeting regime** using interest rate policy

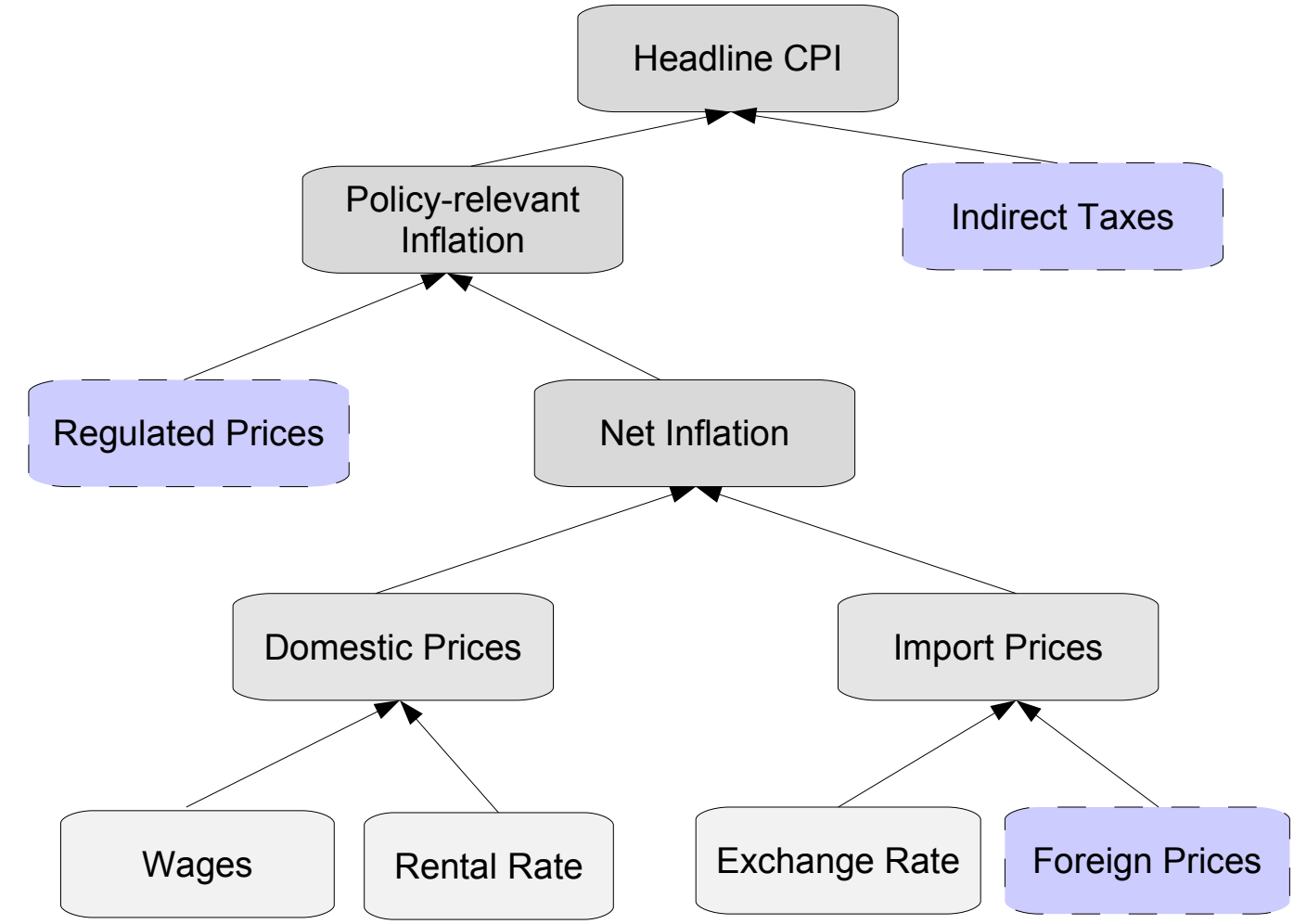
Structure of the Model (ii)

Flow of goods & services



Structure of the Model (iii)

Consumer prices cost structure example...



Real Marginal Costs and Pricing Behavior (i)

(i) Pricing behavior is modelled via extended Calvo-Yun setup

(ii) Individual firm chooses an optimal price, given an expected time of keeping the price unchanged and expected development of costs and demand

(iii) The firm set prices in order to achieve a desired profit markup on average

(iv) Real marginal costs (RMC) – ratio of nominal costs to price
$RMC_t = Costs_t / P_t$

(v) Real marginal costs are an indicator of inflation pressures

(vi) We inspect RMC in consumption, export, production, etc. sectors

Note: RMC definition of g3 and QPM are different!

Real Marginal Costs and Pricing Behavior (ii)

(i) **RMC gap** determines the difference between actual and firms' desired profit markup

(ii) For a given desired markup, positive RMC gap can be closed either by future price increase $\uparrow P$ or decrease in nominal costs $\downarrow Costs$.

(iii) With flexible prices, desired and actual markup coincide...

$$RMC_t = Costs_t / P_t \tag{1}$$

$$P_t^{\text{desired}} = markup_t^{\text{desired}} \times Costs_t \tag{2}$$

$$RMC_t^{\text{desired}} = 1 / markup_t^{\text{desired}}$$

$$RMC_{gap,t} = \frac{RMC_t}{RMC_t^{\text{desired}}} = \frac{markup_t^{\text{desired}}}{markup_t} \tag{3}$$

What about the Output-Gap?

The g3 model does not work with **the** “outpug-gap” à la QPM, due to its different theoretical foundation.

- The concept of output-gap is not explicitly needed in the model
- The g3 model however introduces **technologies**, e.g. labour-augmenting technology or export-specific technology, that are estimated using the model

Output-gap is a useful but only an *univariate* measure with many definitions and estimation procedures. . .

CNB continues to calculate output-gap using various methods to support policymaking:

- production function approach
- semi-structural unobserved components (à la QPM)
- freqency-domain filtering

What about the Output-Gap?

Although the model does not explicitly need an output-gap, still variants can be calculated. . .

In theory and in a DSGE model like g3 we can think of output and all variables in terms of

- *potential* (efficient) level/growth – that would prevail if products and labor markets were perfectly competitive
- *(Neo-Wicksellian) natural level/growth* – level that would prevail under imperfect markets, but with flexible prices and wages
- deviation of output from a Balanced Growth Path (BGP) of the (model) economy

However, these natural/potential outputs may not correspond to smoothly trending ouputs and their identification is highly model-dependent.

Forecasting and Policy Analysis with the Model

1. Initial state of the economy – identification & interpretation
2. Unconditional forecast
3. Scenaria analysis & forecast dynamics decomposition
4. Difference analysis with respect to previous forecasts, factor-by-factor

Initial Conditions – Identification and Analysis (i)

Initial state of the economy is identified using **model-consistent filtering** to estimate unobservables.

Intuition:

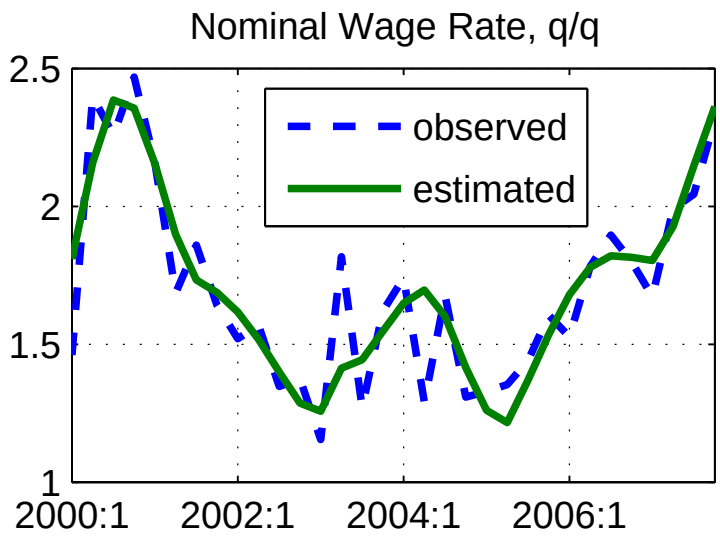
- Model works with observed and unobserved/unobservable variables
- **Filtering** – given all observables, what are the values of unobservables that would generate these observations using the model?
- **Measurement errors** used if plausible for non-reliable and/or noisy data
- More than 17 observables used to interpret the economy brings many complex cross-resctrictions
  (GDP components and deflators, CPI, interest rates, exchange rates, wages, foreign variables. . .)

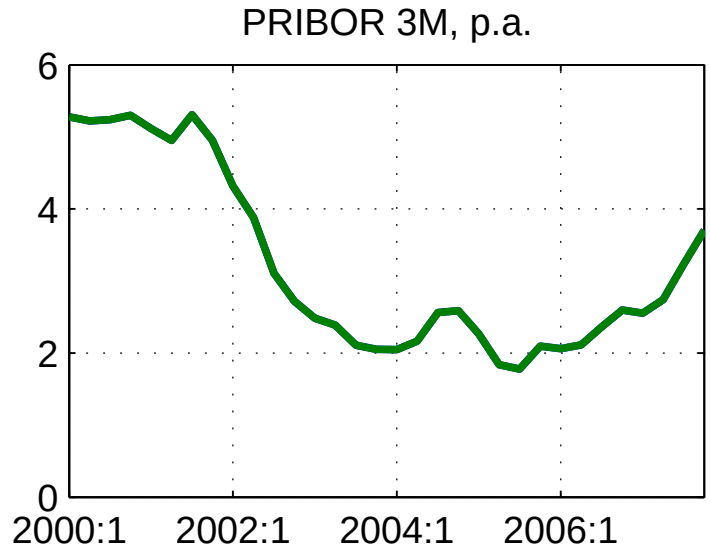
Formally:

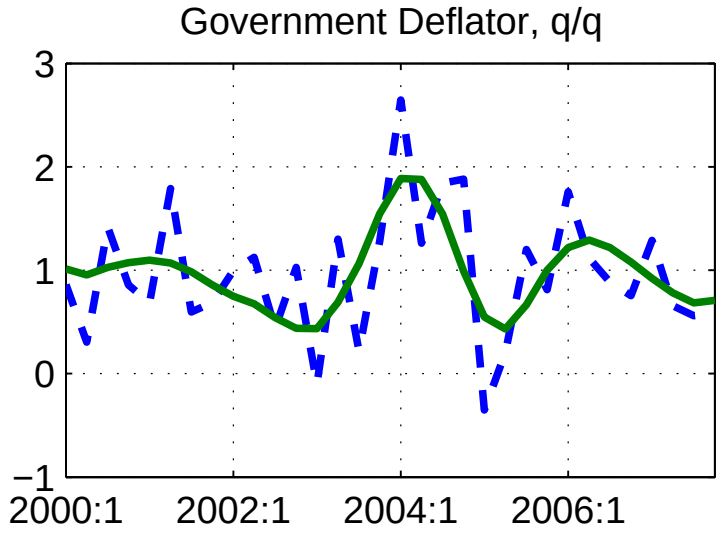
- Multivariate, structural time-invariant, two-sided filter (smoother) with a state-space structure
- Nonstationary, init. conds. either diffuse or fixed-unknown

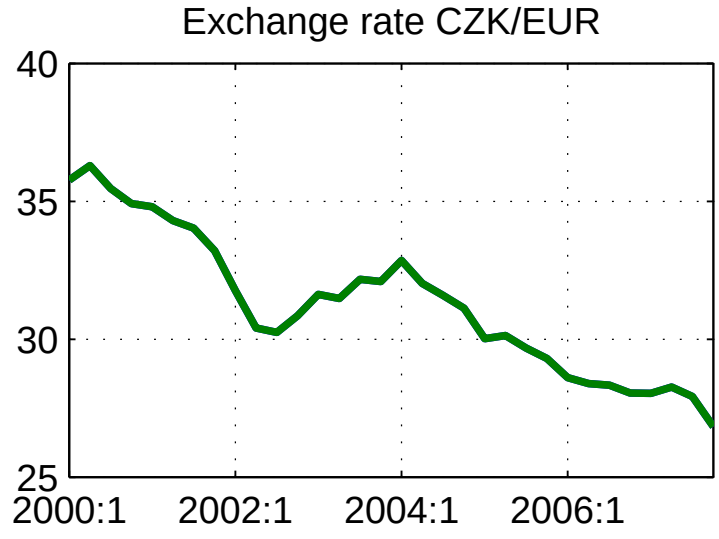
Initial Conditions – Identification and Analysis (ii)

Measurement errors – capturing data-uncertainty & noise









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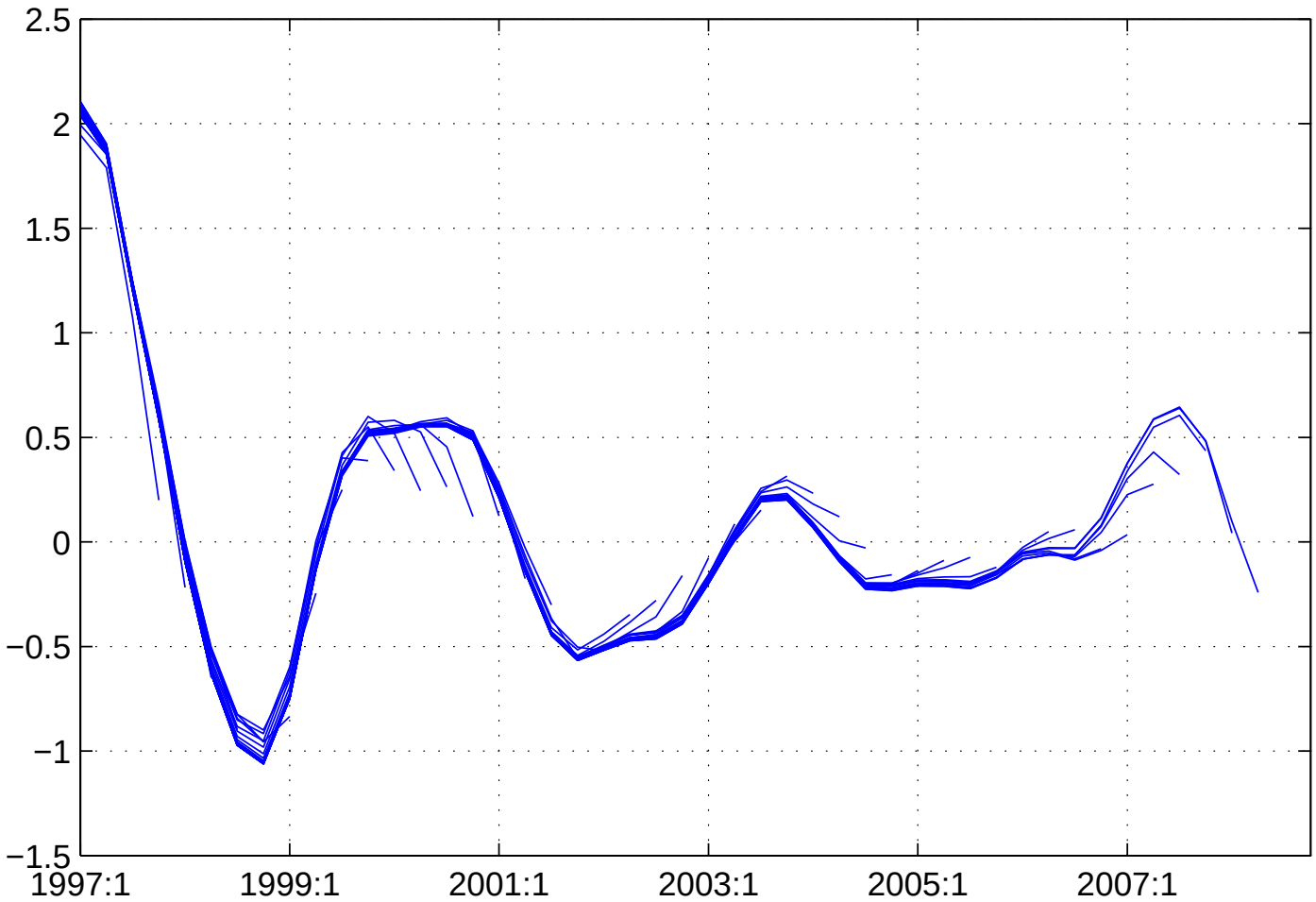
Initial Conditions – Identification and Analysis (iii)

Cross-restrictions of many observables mitigate revisions and sharpen the accuracy of estimates

Real Marginal Costs in Consumption Sector, %



Initial Conditions – Identification and Analysis (iv)

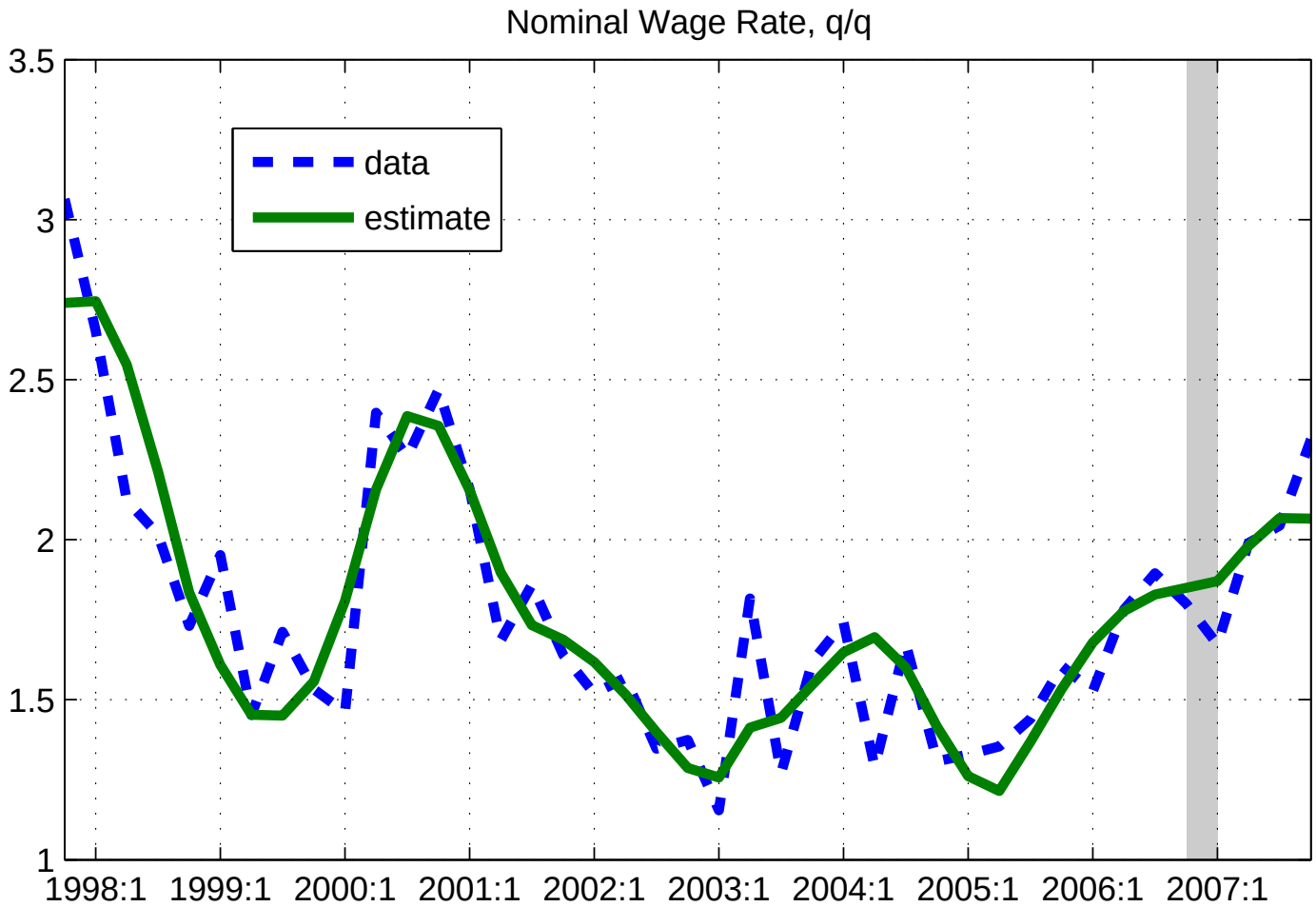
Our filtering framework allows us to

- Carry-out decomposition into structural shocks (shock $\longrightarrow$ observables)
- Understand how each observable contributes to estimation of unobservable (observables $\longrightarrow$ shocks)
- Analyze in detail how data-revisions & new observations change the economics behind the data. . .
- Estimate certain “unreliable” observables conditioned on observing other variables
- . . .

Initial Conditions – Identification and Analysis (v)

Simple example: nowcasting & data checks

Imagine nominal wage rate would be unobserved in 2007:1–2007:4, we can obtain model-consistent estimate conditioned on other series. . .



Thank You For Your Attention

APPENDIX – QPM vs. g3

g3	QPM
explicit derivation using ”behavioral principles”	reduced form
model-consistent expectations	model-consistent expectations
consistence of stocks & flows	flows only
replicates national accounts	no GDP structure
works with level variables	“gaps”
BGP, technology trends	equilibrium trends
simple fiscal block	implicit treatment
forward-looking interest rate rule	forward-looking interest rate rule
carefully chosen ”structural shocks”	residuals for each equation