

# **Inflation projection of the National Bank of Poland based on ECMOD model**

April 2007

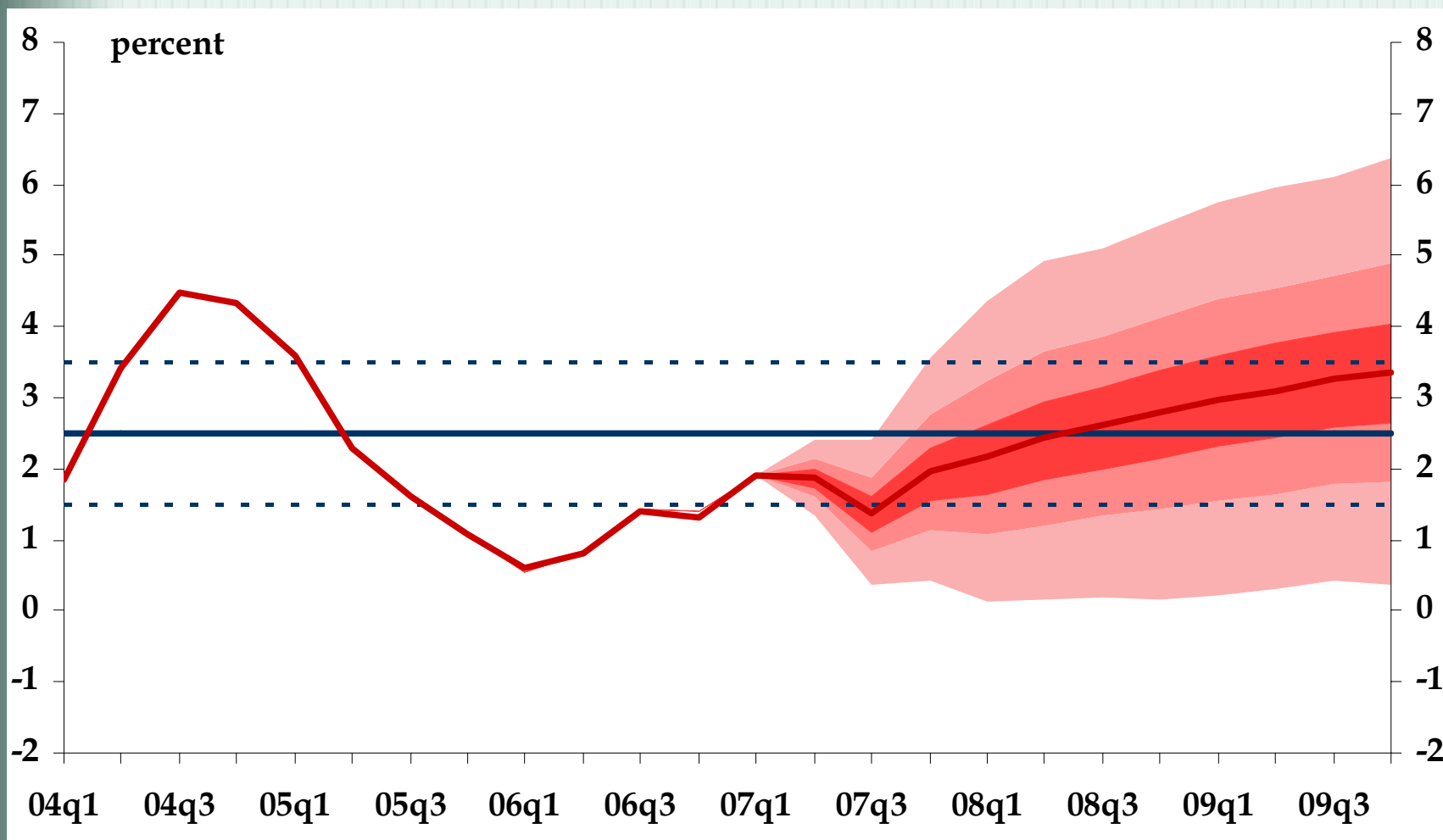
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# Projection vs. forecast

- Inflation projection  $\neq$  inflation forecast
  - Inflation projection is a conditional forecast, i.e. it shows potential inflation rate under the condition that all assumptions are met, including no monetary policy reaction
  - More information on the differences between projection and forecast can be found at [www.nbportal.pl](http://www.nbportal.pl):

[http://www.nbportal.pl/library/pub\\_auto\\_B\\_0002/KAT\\_B3984.PDF](http://www.nbportal.pl/library/pub_auto_B_0002/KAT_B3984.PDF)

# Inflation projection – April 2007



Source: Macroeconomic and Structural Analyses Department

# Presentation plan

- Model
  - Changes in the model after the January projection (including: re-estimation)
  - Implications for the projection
  
- Central projection
  - Starting point as compared to the January projection
  - Projection for 2007-2009
  - April projection as compared to the January projection
  - Expert adjustments
  - Exogenous determinants of CPI inflation
  
- Analysis of inflation projection uncertainty
  - Risk factors accounted for in the model – fan charts
  - Risk factors unaccounted for in the model

# Projection conditions

- Monetary policy:
  - Constant level of interest rates.
- Fiscal policy in 2007 and 2008:
  - Nominal anchor: general government deficit at approx. PLN 30 billion,
  - Nominal expenditure = nominal income + PLN 30 billion.
- Structural policy:
  - No change.

# Model

## Changes in the model introduced after the January projection

- Yearly re-estimation of ECMOD model
  - Accounting for data through 2006 Q4 and adjustments of earlier data,
- Changes in the model:
  - Endogenisation of the NAWRU (Non-Accelerating Wage Rate of Unemployment),
  - Introduction of additional couplings between fiscal sector and other modules of the model (modification of the block was necessary also due to changes in the labour market module),
  - Re-definition of the series of capital stock (from net to gross value of fixed assets),
  - Behavioural equation of inventories (allowing a gradual adjustment of inventories to long-term level).

## Other changes

- **Balanced seasonal adjustment:**
  - National accounts data adjusted jointly so as to preserve identity relationships among time series after seasonal adjustment
- **Stiffening the assumption on the number of people working outside agriculture**
  - The path of the number of people working in agriculture in the projection horizon is determined by experts once a year (when the model is re-estimated) and then sustained in constant relationship to the path of the economically active between subsequent re-estimations (weakening of the impact of frequent and strong changes of this assumption on projection results)



## Changes in behavioural equations

- New wage equation (derived from a theoretical model of wage bargaining)
- Accounting for tax wedge in unit labour costs
- Accounting for the impact of indirect taxes and subventions on price determination
- Increased significance of wealth (at the expense of disposable income) in explaining private consumption
- Removing the output gap (assumption of pro-cyclicality of profit margins) from net inflation equation
- The impact of unit labour costs on net inflation was weakened while the impact of import prices strengthened
- The form of re-estimated model equations is presented in the material: “ECMOD Model of the Polish Economy – April 2007 Version” to be found at [www.nbp.pl](http://www.nbp.pl)

## Implications for the April projection: changes in price equations

- Re-estimation of the model – price equations
  - Reduction of imbalance implied by the model between the level of prices and their cost determinants (at the starting point of the projection) and the consequent weakening of the catching-up effect,
  - Changes in the parameters of net inflation equation point to a slowdown in the rate at which prices return to their long-term equilibrium.

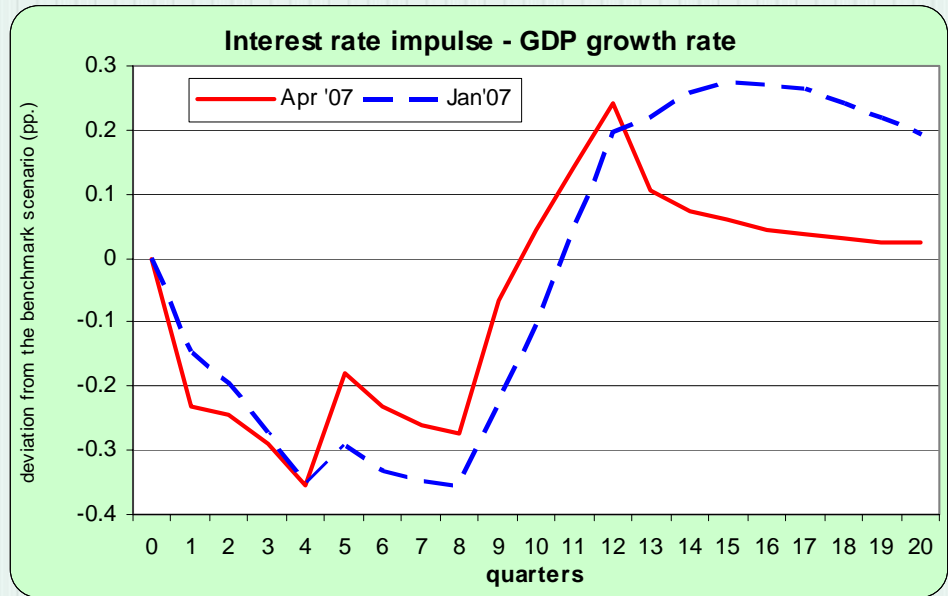
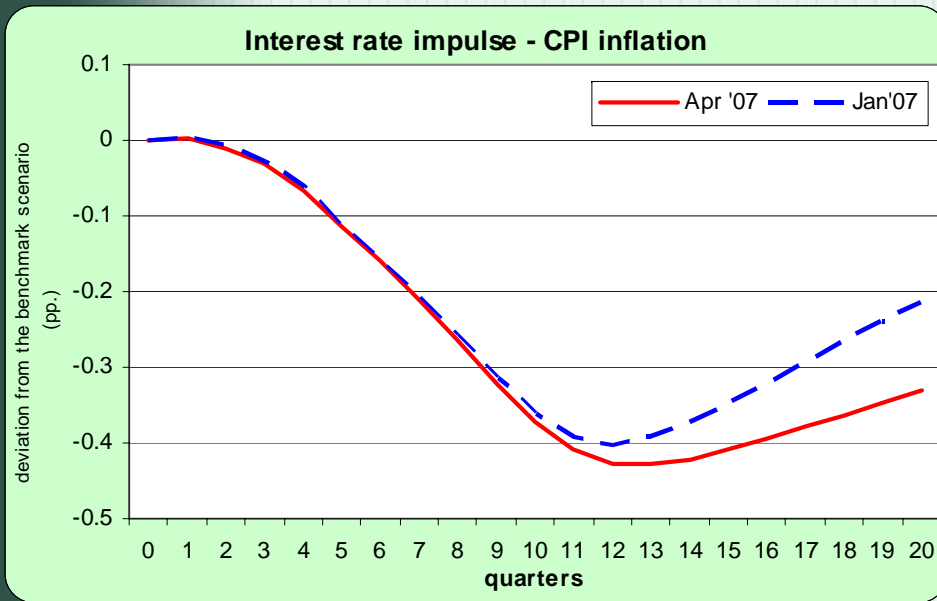
## Implications for the April projection: labour market

- Labour market more flexible than in the January projection:
  - Endogenous NAWRU is responding to forecast changes in the supply and demand for labour; it declines faster than accounted for by experts in the January projection (exogenous NAWRU),
  - Accounts for a positive medium-term impact of forecast economic recovery on unemployment rate through the hysteresis effect (this could not be done by experts), as a result:
    - The gap in unemployment at the end of projection horizon narrows down, which was not the case in the January projection,
    - Increased demand for labour leads to a greater economic activation of the economically inactive (increased supply of labour – the initial assumption required an expert adjustment).

## Changes in the model after the January projection

### Monetary impluse

- Interest rate rise of 1pp for the period of 8 quarters. Beginning with the ninth quarter the interest rate is set according to the Taylor's rule.

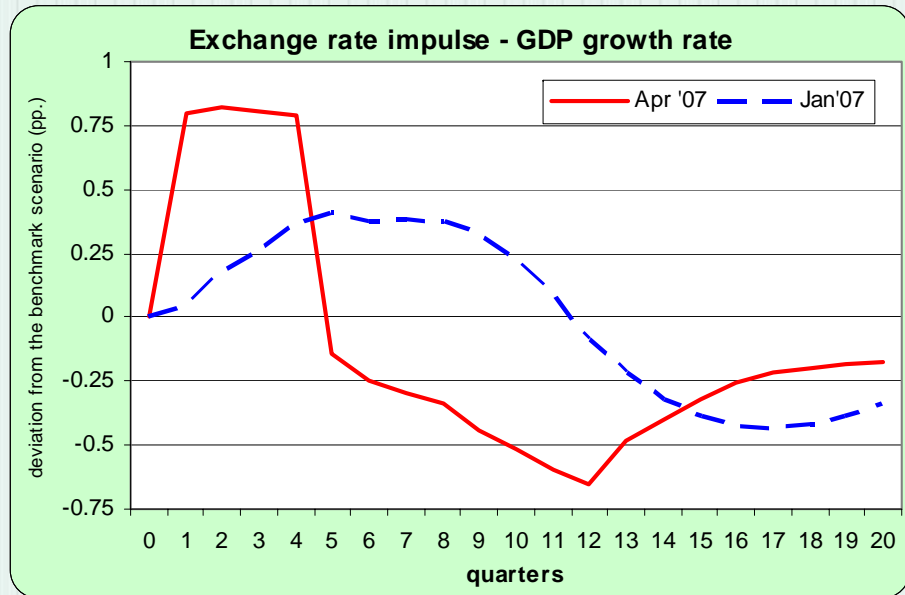
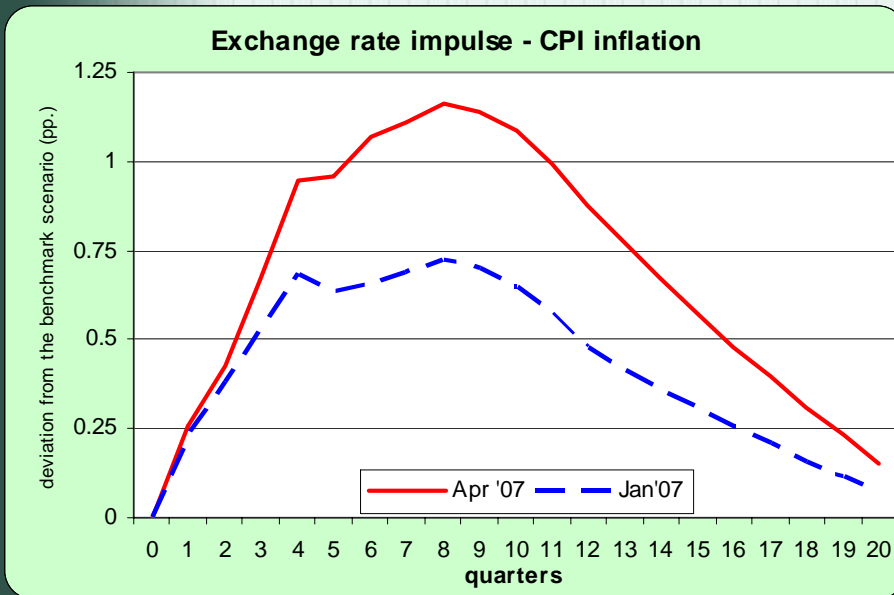


- No major changes
- Almost identical depth and reaction delays in the first 12 quarters

## Changes in the model after the January projection

### Exchange rate impulse

- 10-percent depreciation of the exchange rate for 8 quarters. Beginning with the ninth quarter the exchange rate equation is activated. Simulation was carried out with Taylor's rule included.



- Increased significance of the exchange rate connected with:
  - the rise in the significance of import and export prices in explaining the volumes of foreign trade
  - the rise in a short-term impact of import prices on net inflation

# Central projection

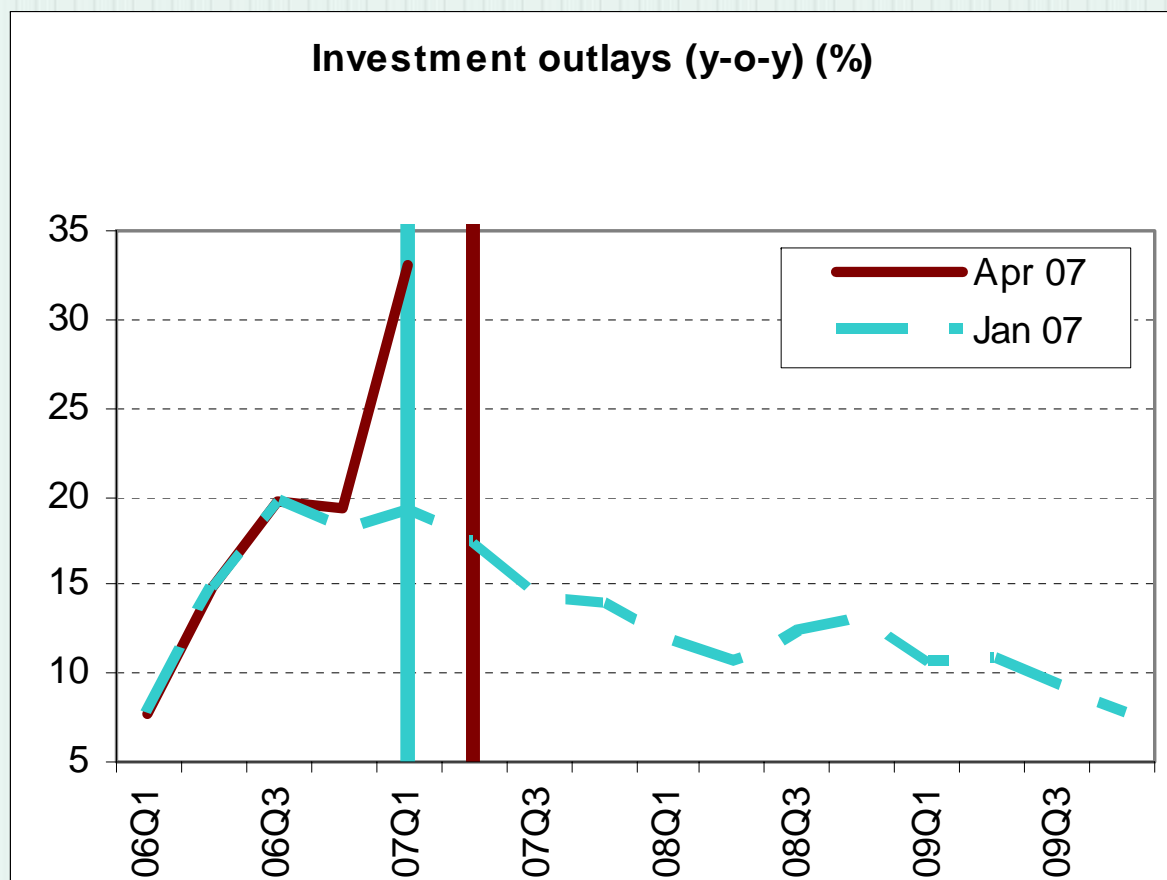
## **Starting point of the projection as compared to the January projection**

- GDP and its components
- Labour market
- CPI and core inflation

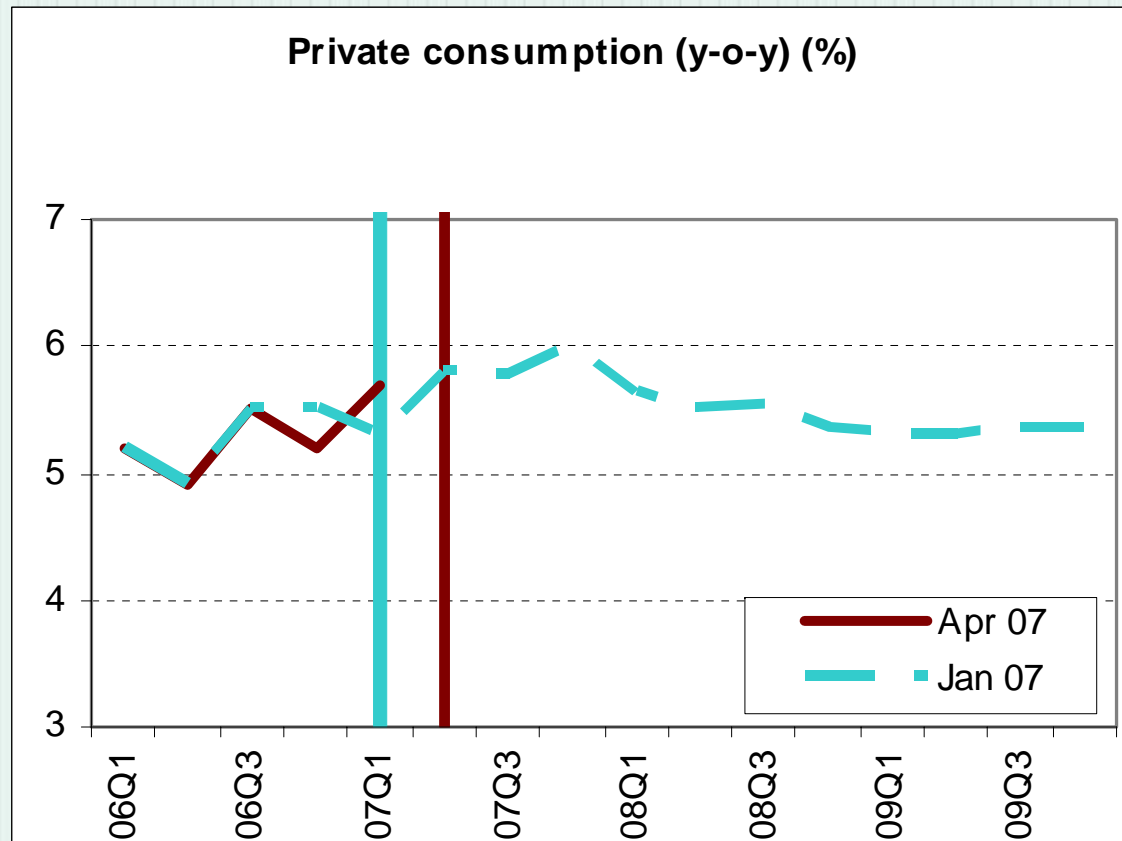
# GDP



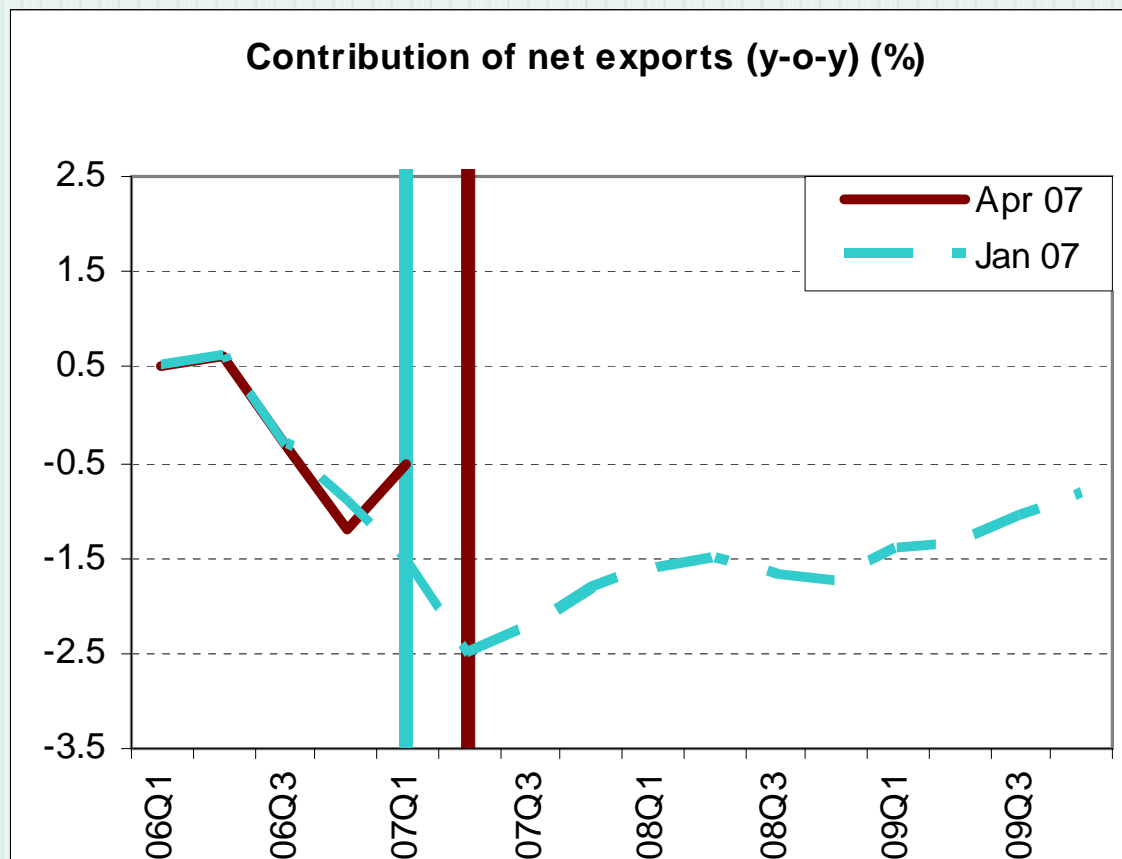
# Fixed capital formation: faster growth



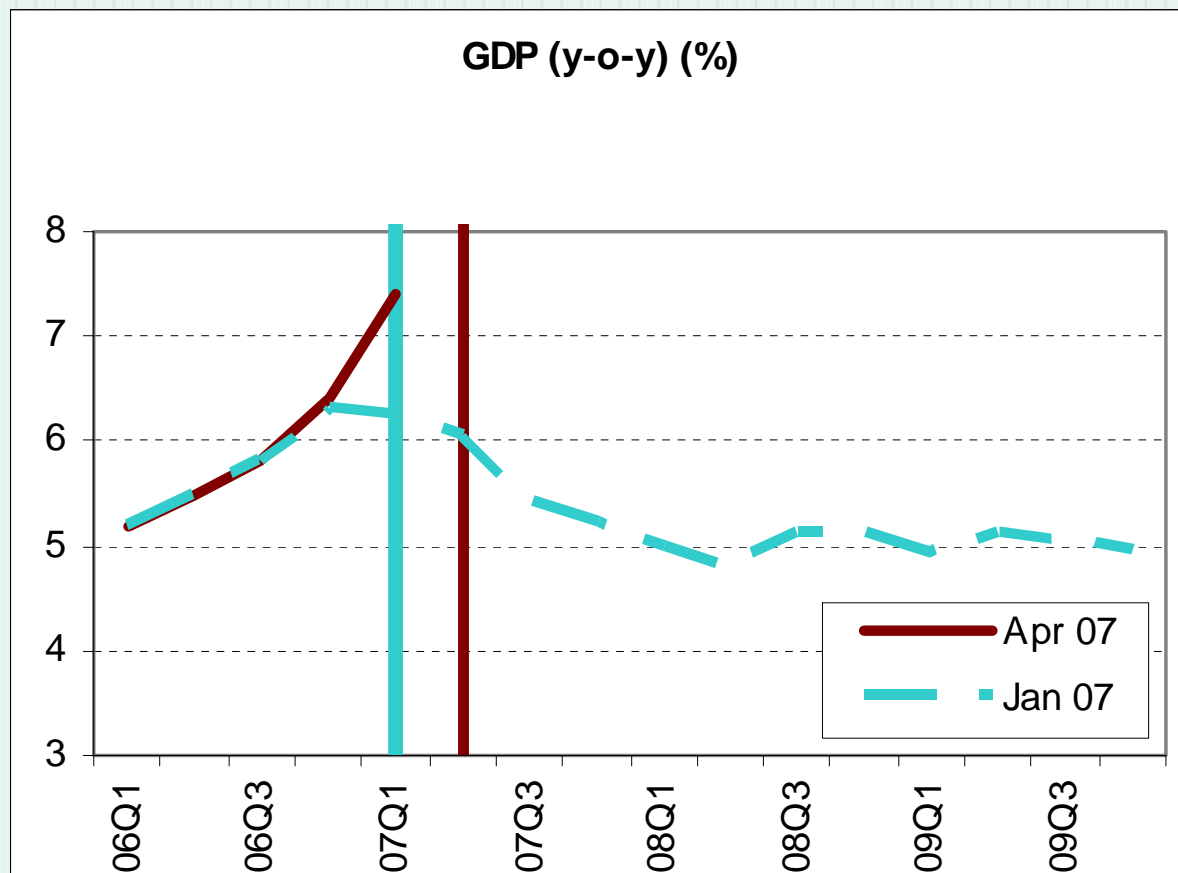
# Private consumption: in line with expectations



# Contribution of net exports: less negative



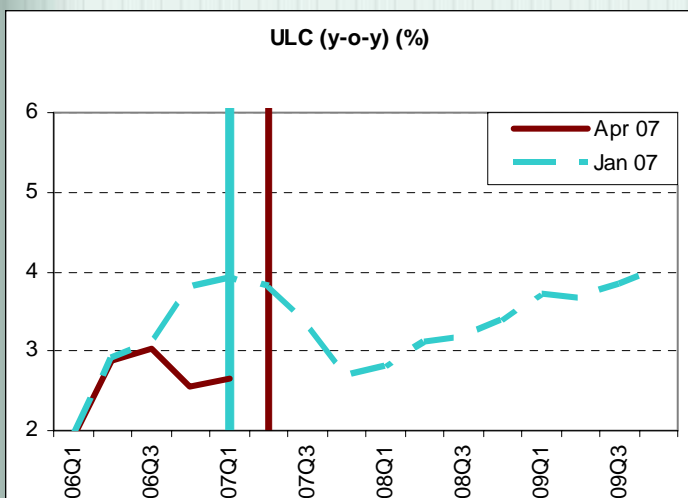
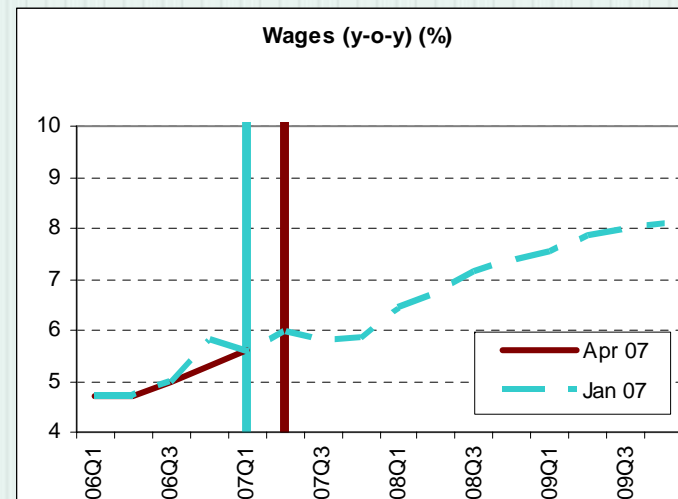
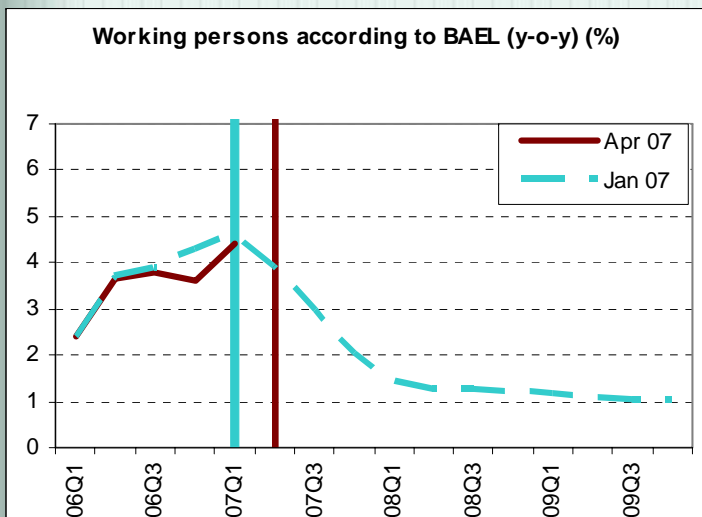
# GDP: significantly high growth rate



# **Labour market**

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# Working persons, wages and ULC

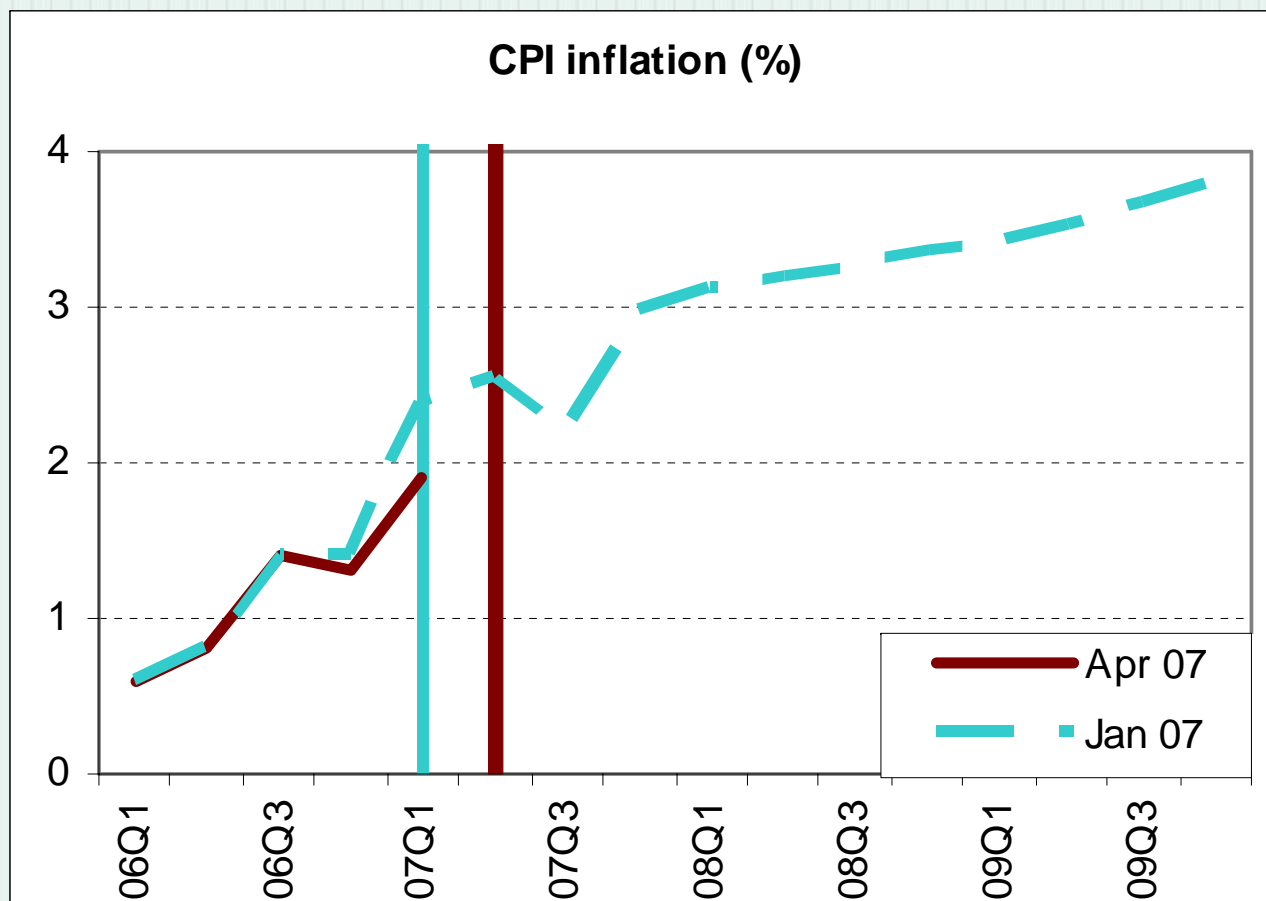


- Working persons: in line with expectations
- Wages: in line with expectations
- ULC: slower growth

# Inflation

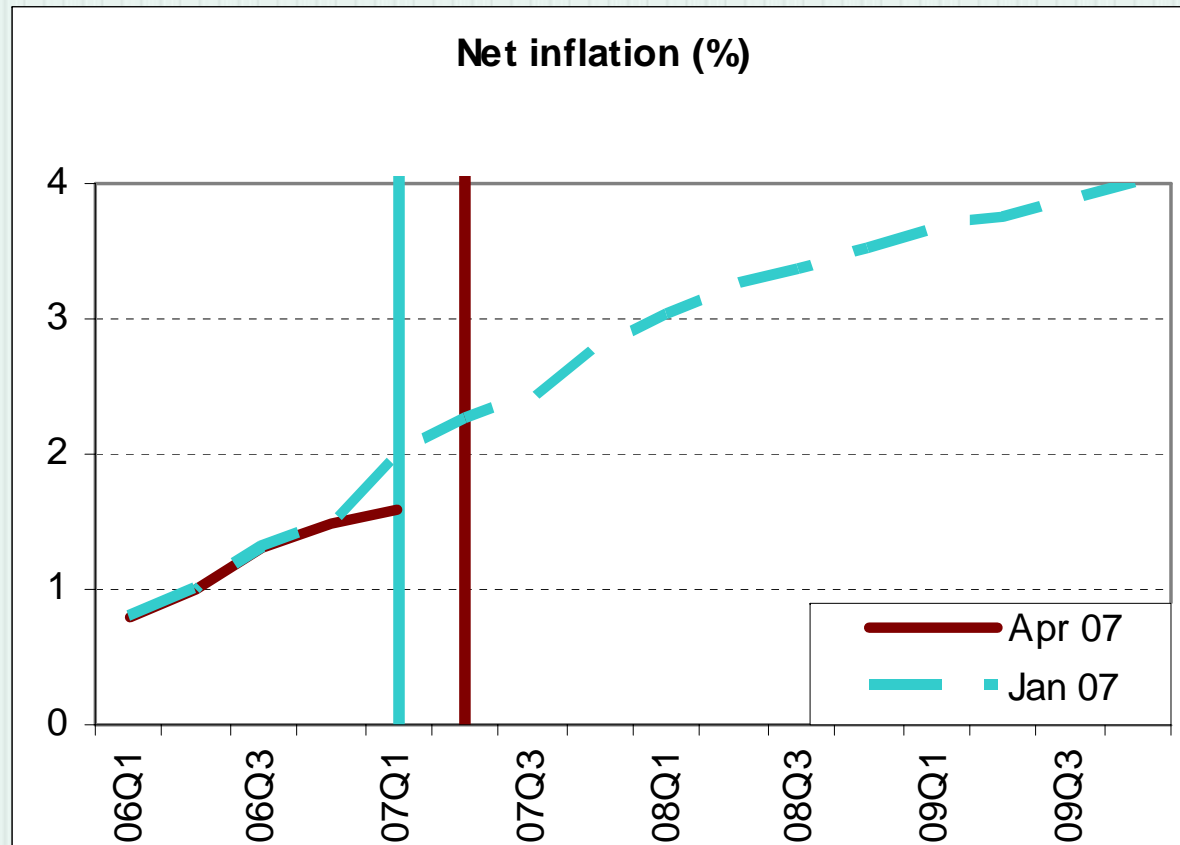
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# Inflation: at a lower level





# Net inflation: lower

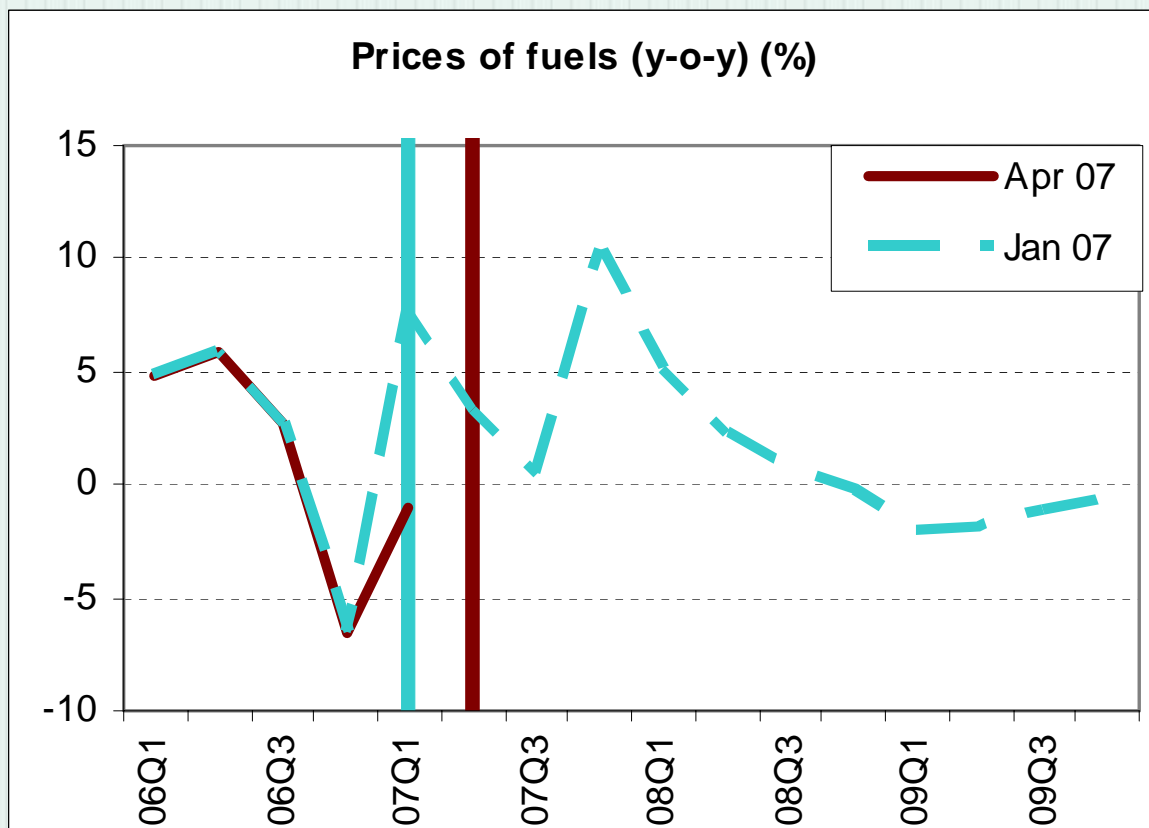


## Y-o-y food prices: higher rate of price growth



- Decreasing impact of expert-set food prices on net inflation, it subsides after 4 quarters
- Food price growth rate converges with net inflation growth rate (no sequence of shocks is forecast which would deviate food price inflation from net inflation)

# Y-o-y fuel prices: lower



# **Macroeconomic projection for 2007-2009**

**Constant interest rates**

## Assumptions – external factors (1)

### GDP growth (y-o-y) (%)

	2007	2008	2009
euro area	2.2	2.1	2.1
UK	2.6	2.6	2.6
US	2.4	2.8	3.0
Total	2.2	2.2	2.2

### GDP deflator (y-o-y) (%)

	2007	2008	2009
euro area	2.0	2.0	2.0
UK	2.5	2.3	2.2
US	2.2	2.1	2.0
Total	2.1	2.1	2.0

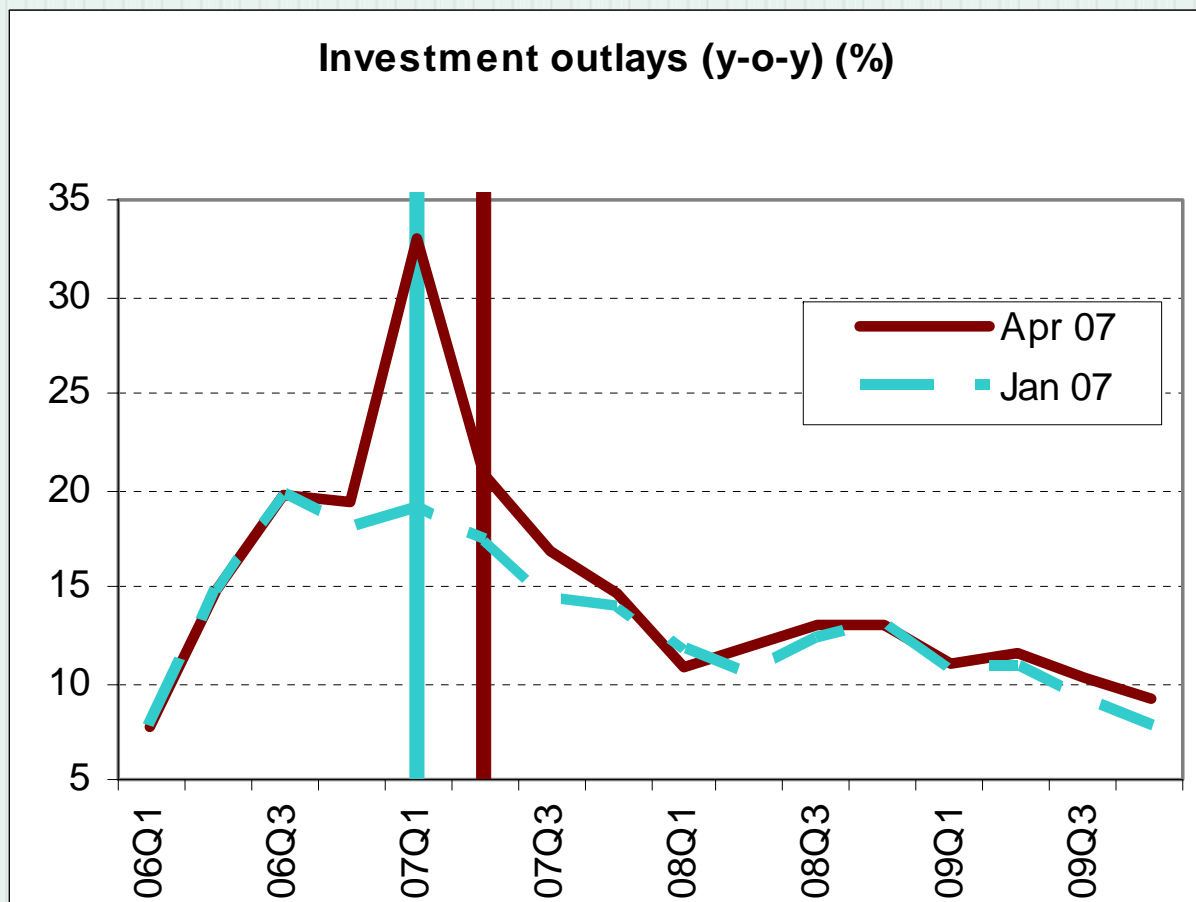
## **Assumptions – external factors (2)**

- Oil prices lower than in the January projection in the short-term horizon and higher in the final year of the forecast

## **Assumptions – internal factors**

- No significant changes in the assumptions concerning the utilisation of EU funds
- In the fiscal sector – account was taken of the results of structural changes to come into force in 2008-2009 (VAT, PIT), budget anchor was maintained
- Slightly higher growth of fuel prices in 2008-2009, lower at the beginning of the projection

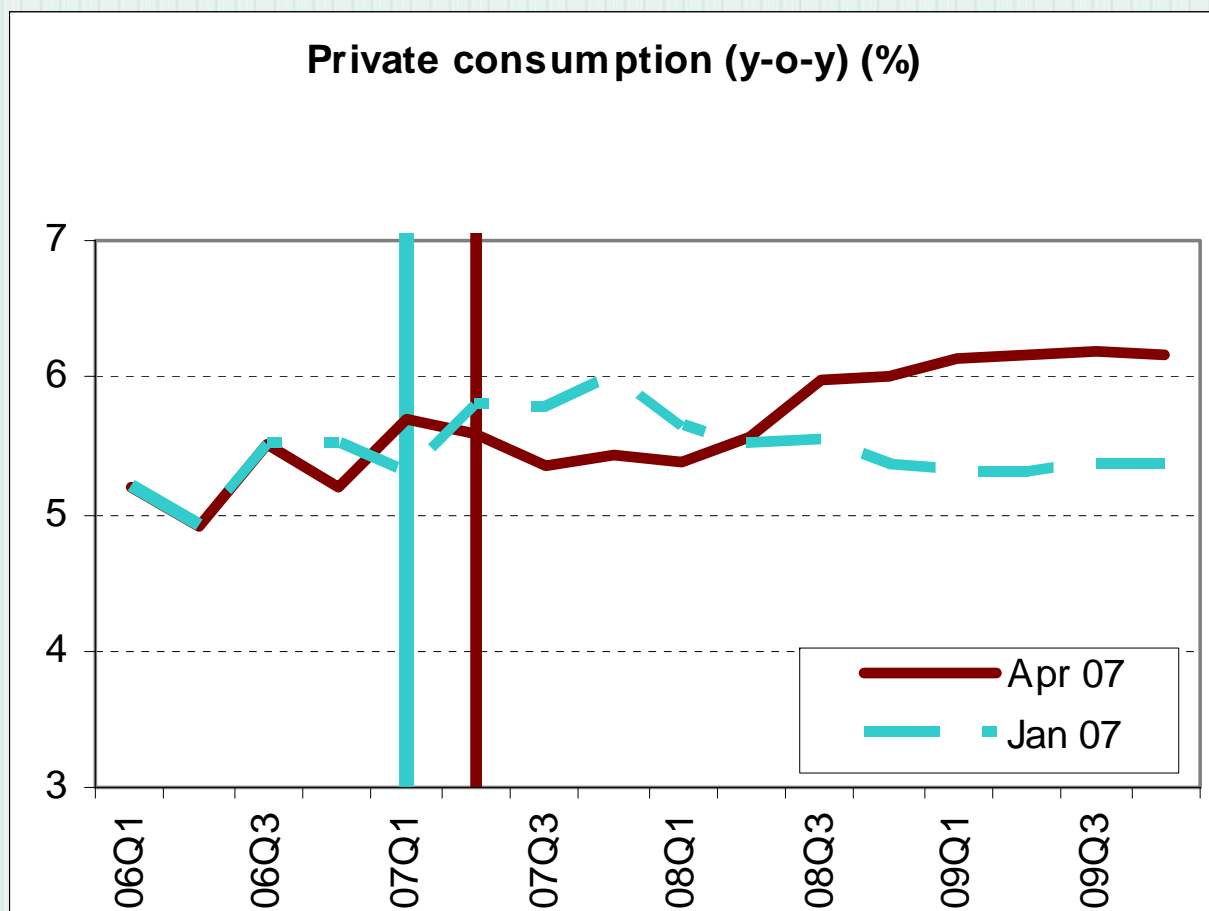
# GDP and its components



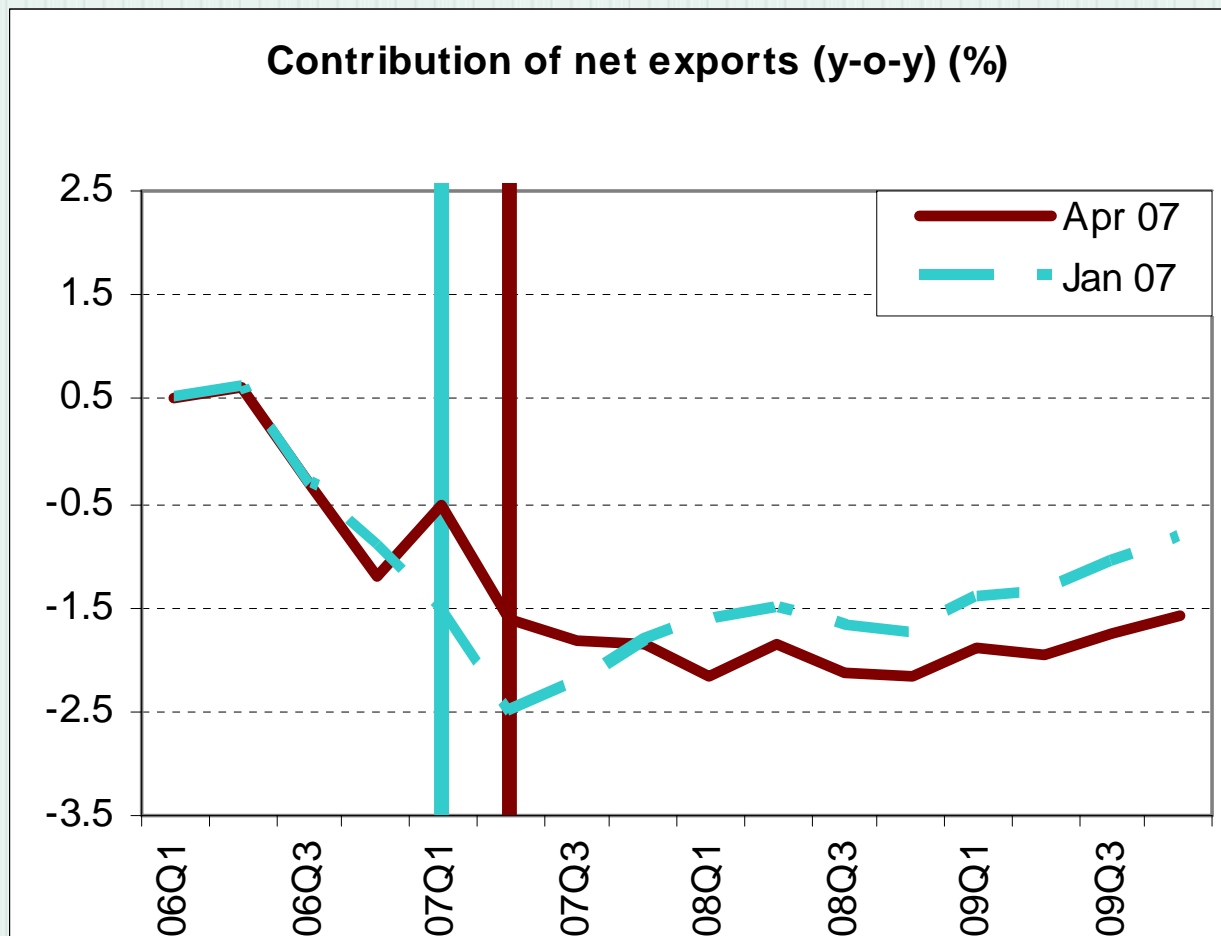
- Stronger short-term growth



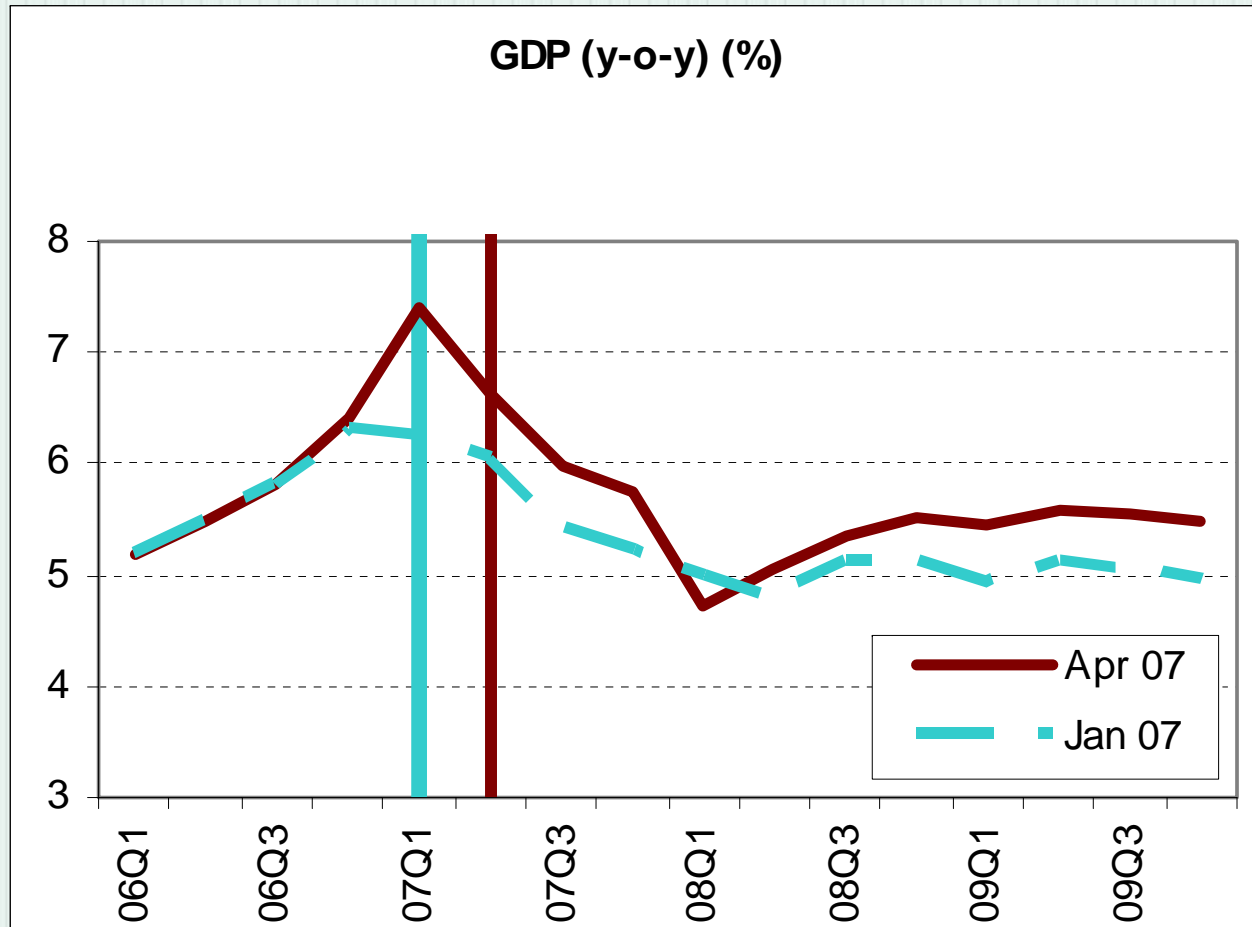
# GDP and its components



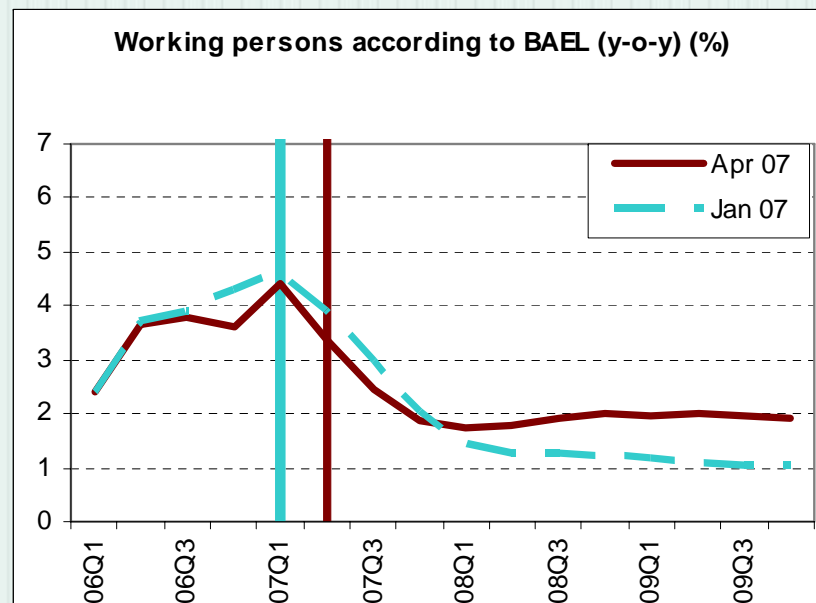
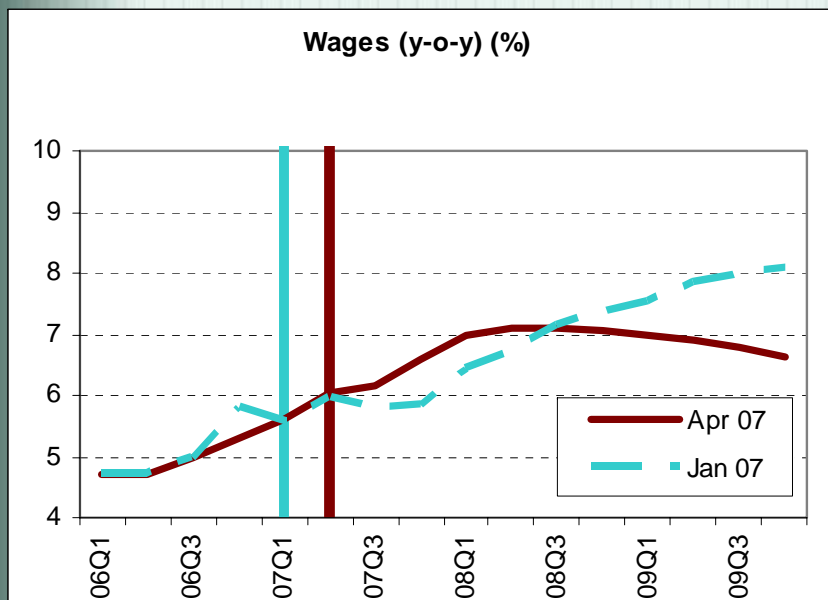
# GDP and its components



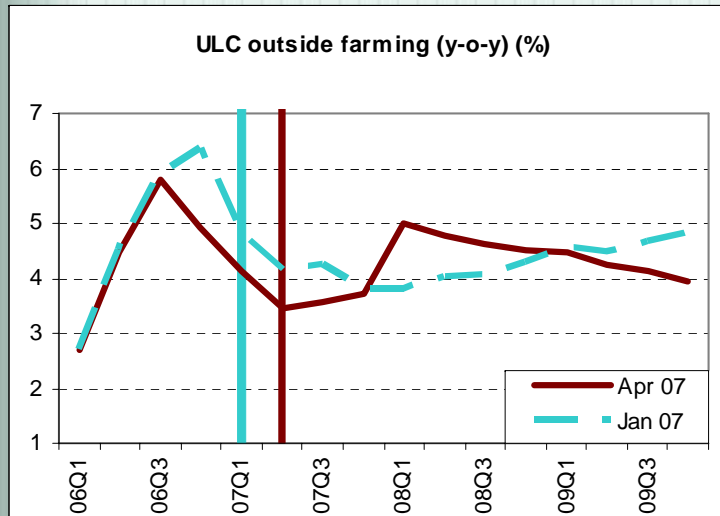
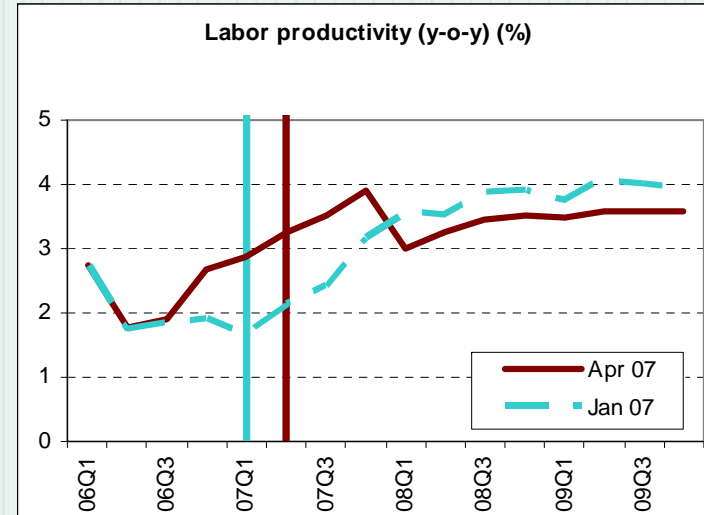
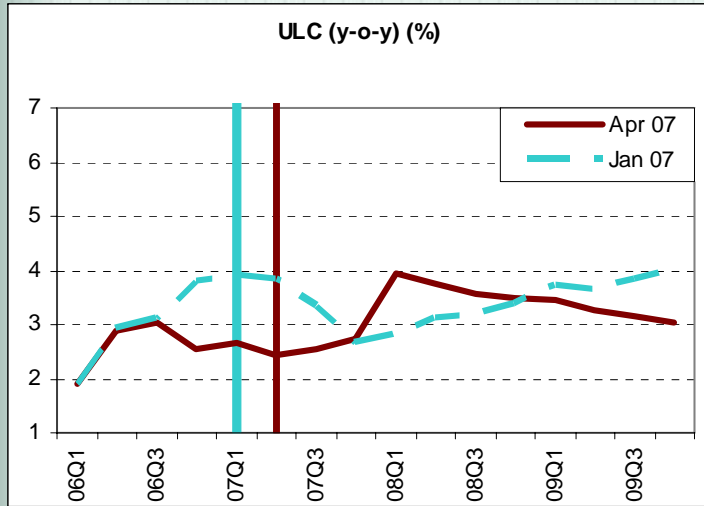
- Negative contribution of net exports throughout the horizon
- Negative contribution of net exports connected with economic recovery



# Labour market

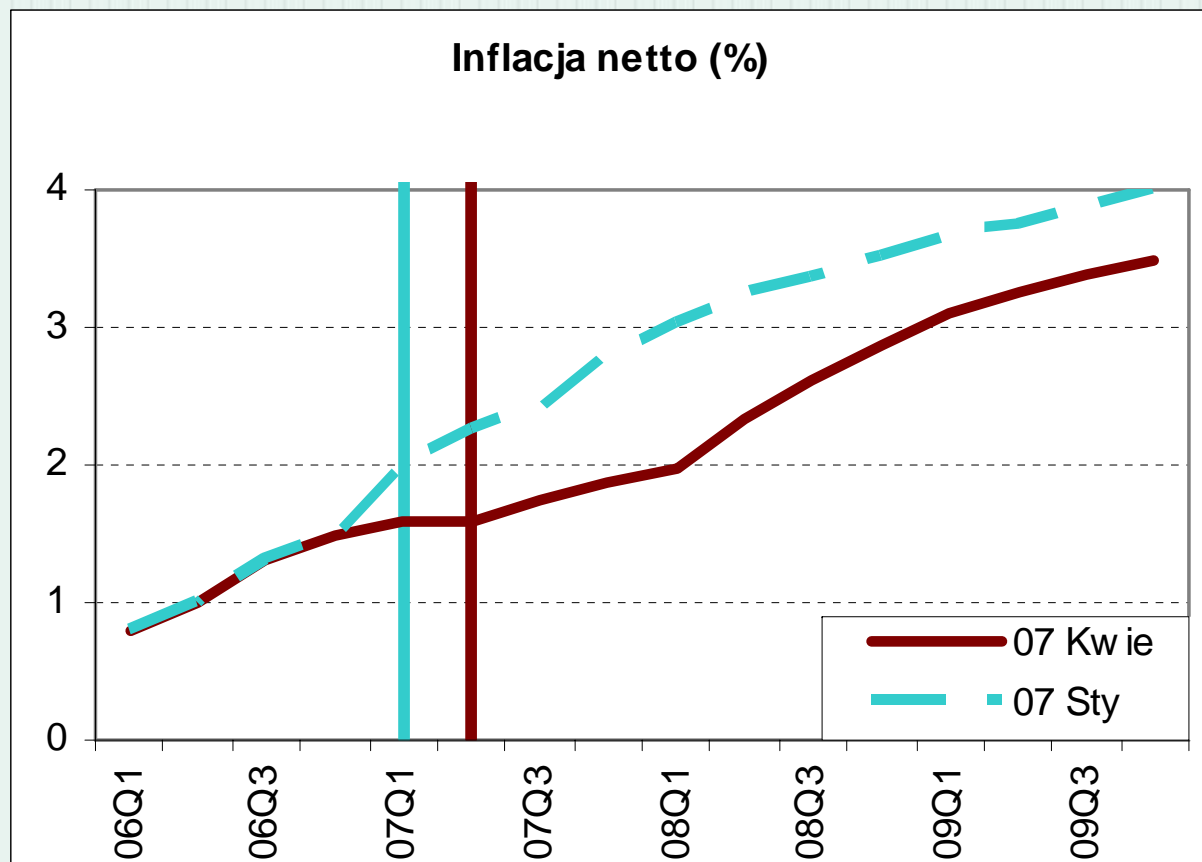


# Labour productivity and ULC

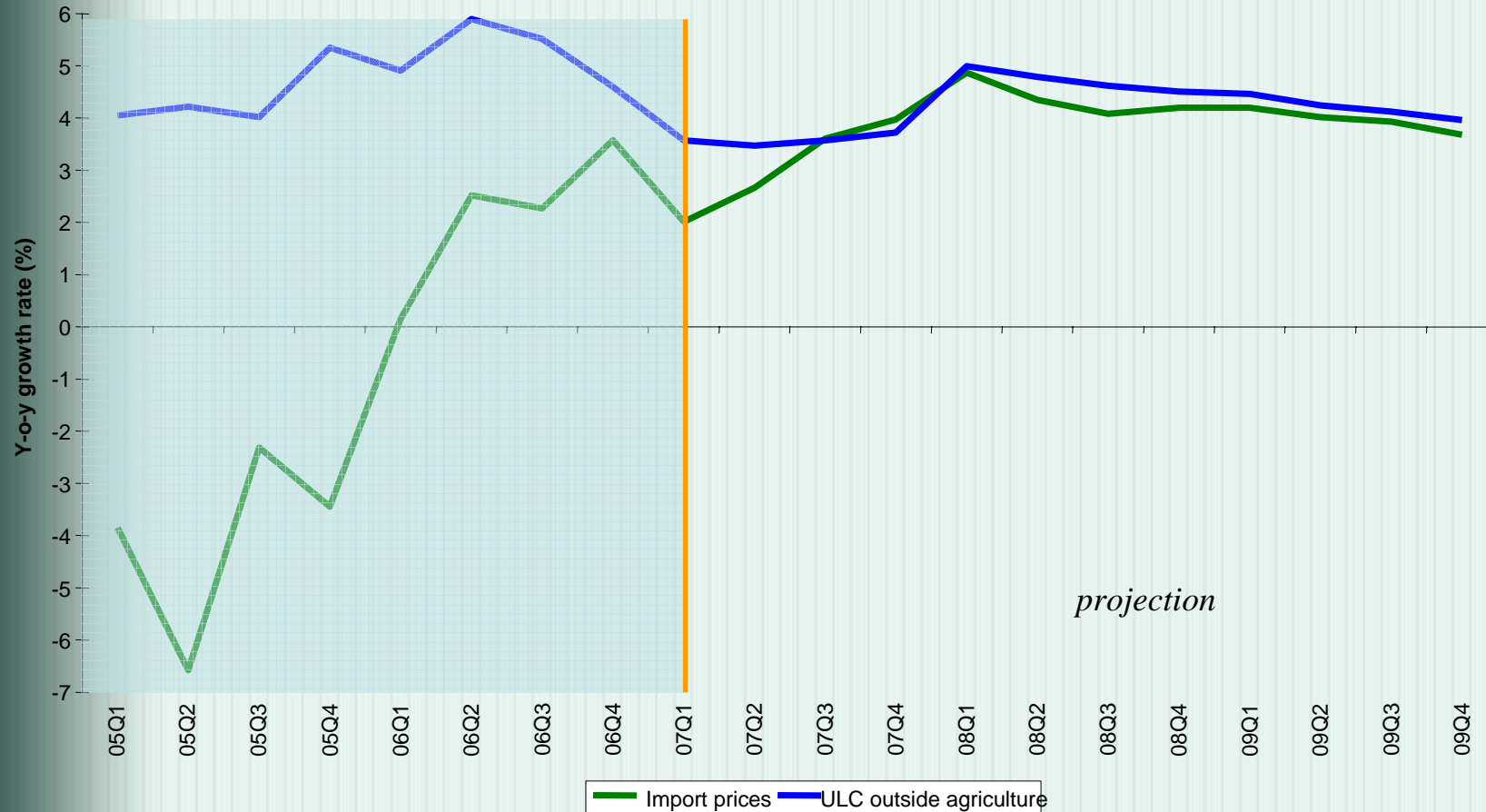


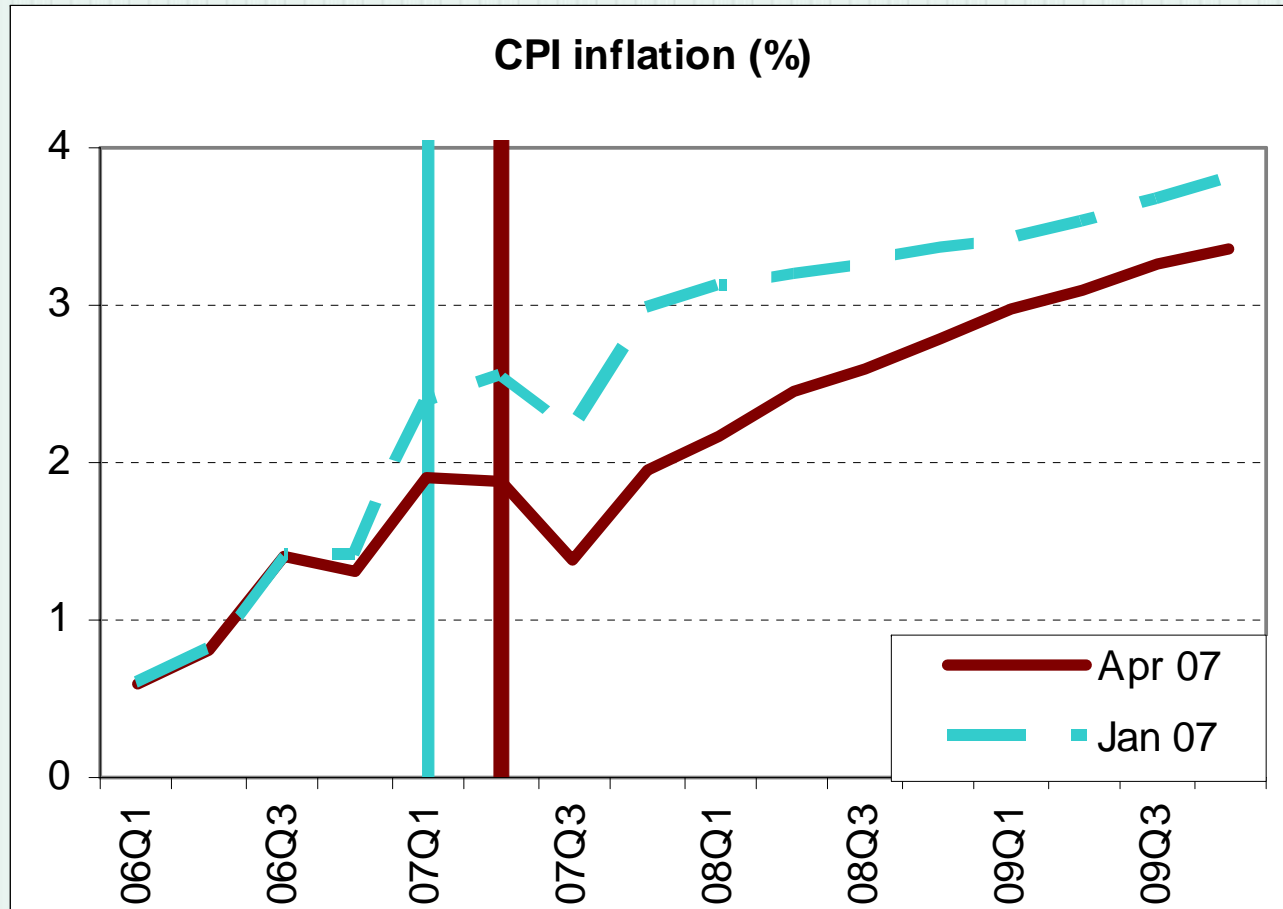
- Throughout the projection horizon the growth of real wages outpaces the growth rate of productivity

# Y-o-y net inflation



Determinants of y-o-y net inflation (%)







## April projection as compared to the January projection

- The April projection of CPI inflation runs below the January projection throughout the projection horizon.
- Particularly large differences are visible in the first two years of the projection (0.7 pp on average), lower in the final year of the projection (0.4 pp).
- Differences in inflation paths result from:
  - a lower path of net inflation and
  - Lower than forecast in January growth rates of food and fuel prices (through 2007)

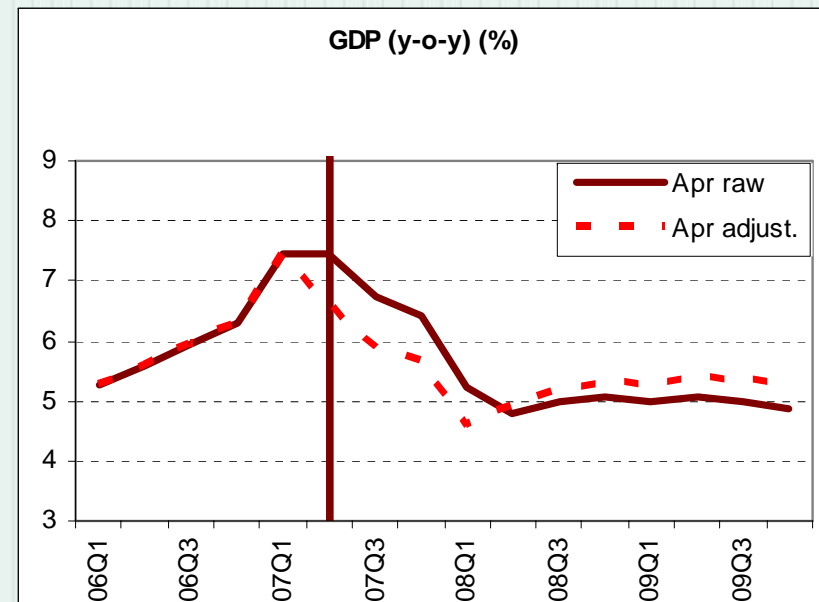
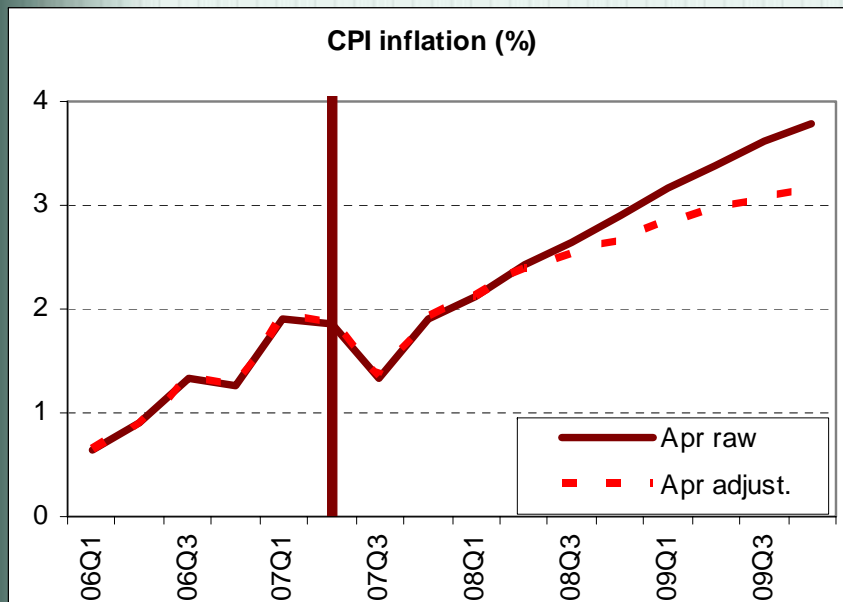
## April projection as compared to the January projection: net inflation

- A lower forecast of the path of net inflation was connected with:
  - Lower level of net inflation at the starting point (0.4 pp lower)
  - Changed parameters of the model following the re-estimation, in particular the parameters of the equation describing net inflation
  - Endogenous labour market in the new model proved more flexible than accounted for in the January scenario

## Expert adjustments

- Standard way of accounting for experts' knowledge in the model's solution
- Main areas of adjustments in the April prognostic period:
  - a) Fixed capital formation,
  - b) Private consumption,
  - c) Volume of imports,
  - d) Total Factor Productivity (TFP),
  - e) Position of the general government sector and public consumption.
- Additional upward adjustment, in relation to the expert assumptions, of an exogenous variable: number of economically active persons

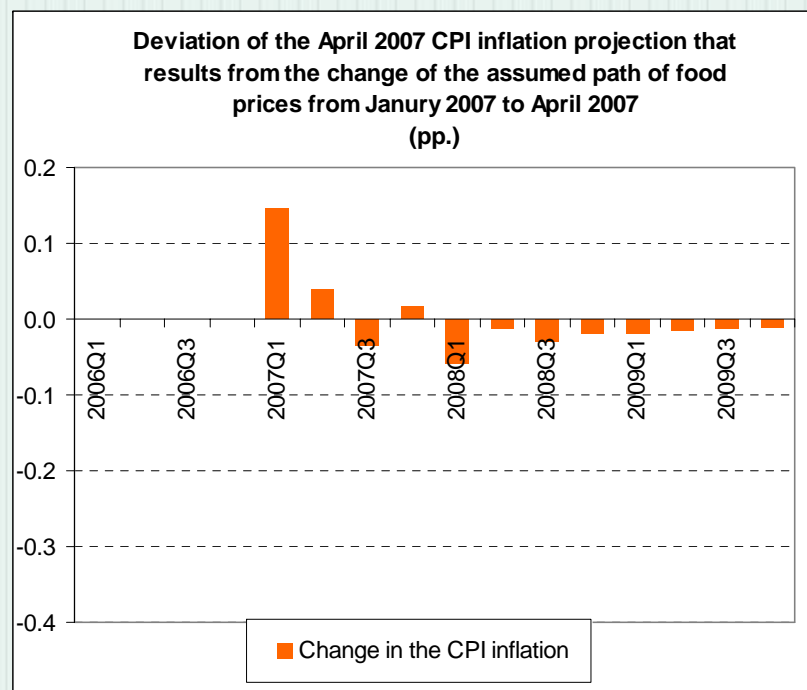
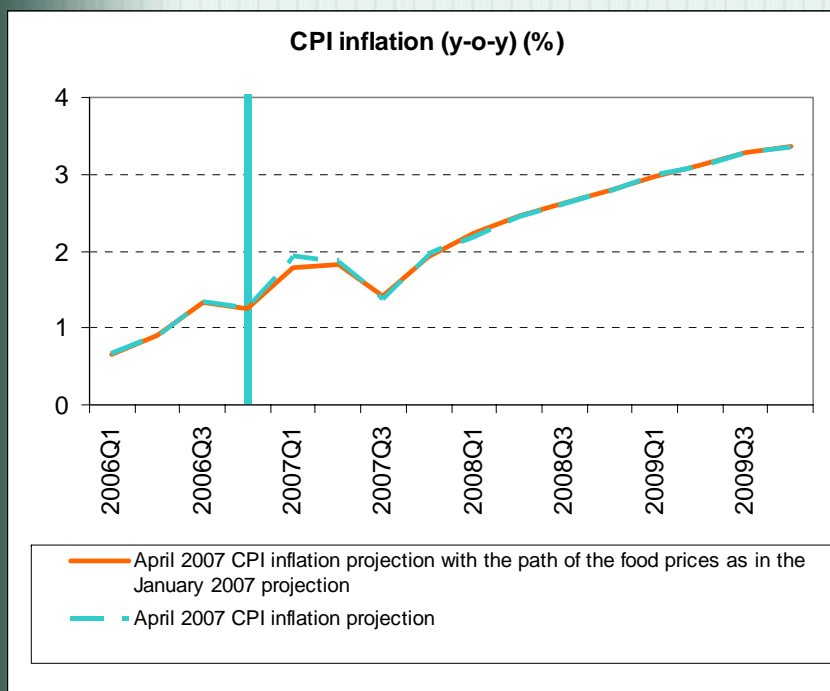
# Joint effect of adjustments on inflation and GDP



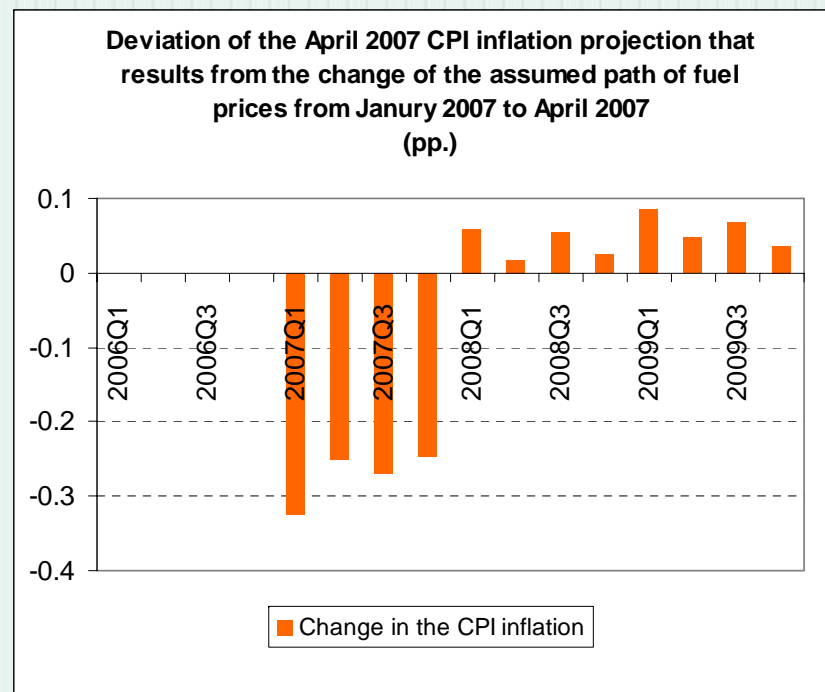
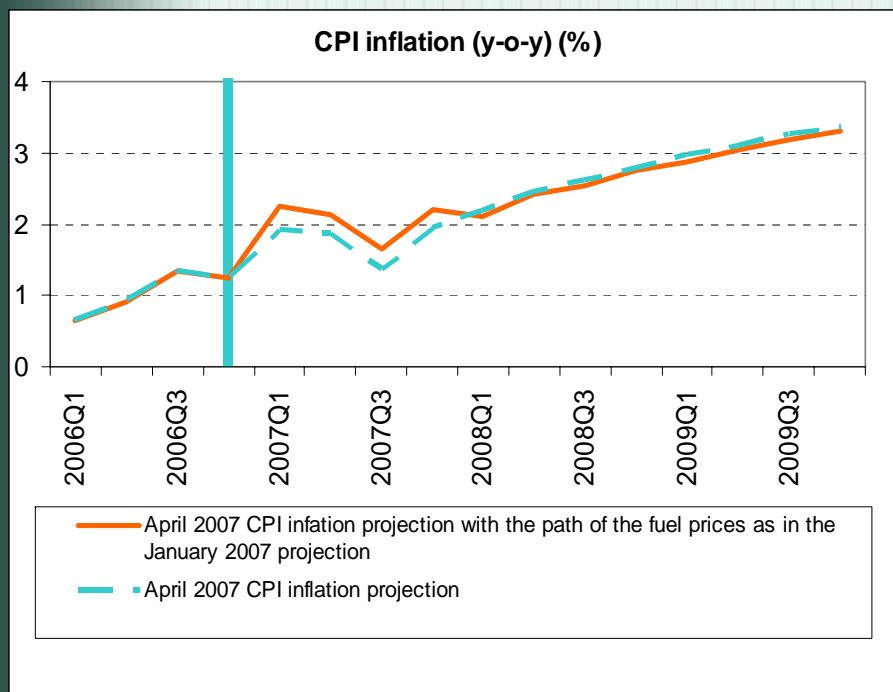
# Exogenous determinants of CPI inflation

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## Food prices



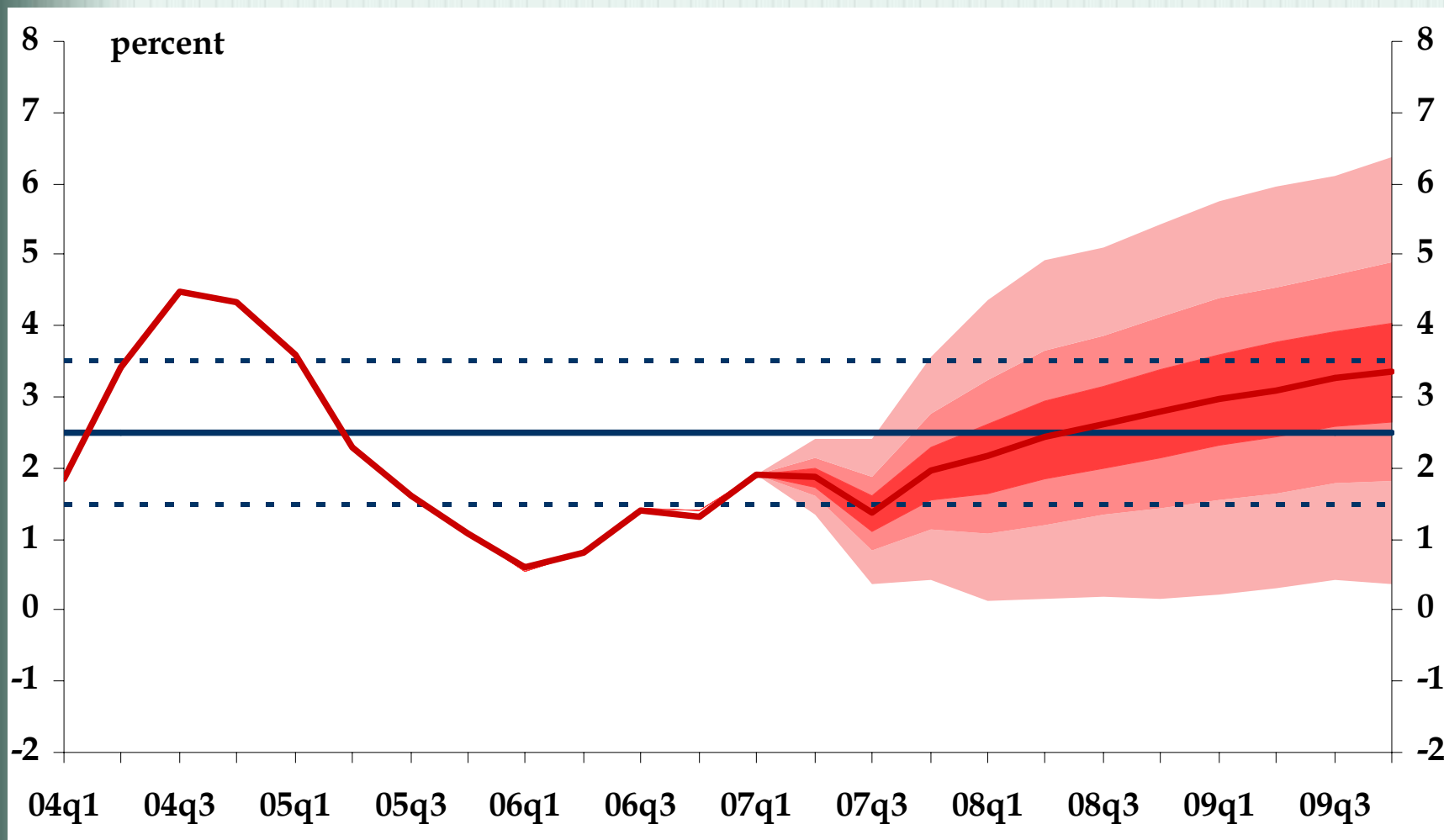
# Fuel prices



# Uncertainty of macroeconomic projection - fan chart



# Inflation projection – April 2007



Source: Macroeconomic and Structural Analyses Department

## Inflation projection – April 2007 (constant interest rates)

- Central path indicates that inflation will be running below the inflation target (2.5%) until mid-2008, will overshoot the target in Q3 (at 2.6%) to approach the upper tolerance limit for deviations towards the end of the forecast (3,5%)
- Fan chart indicates a similar risk of a downward and upward deviation of inflation from the central path in the projection horizon

## Overview of probabilities for inflation

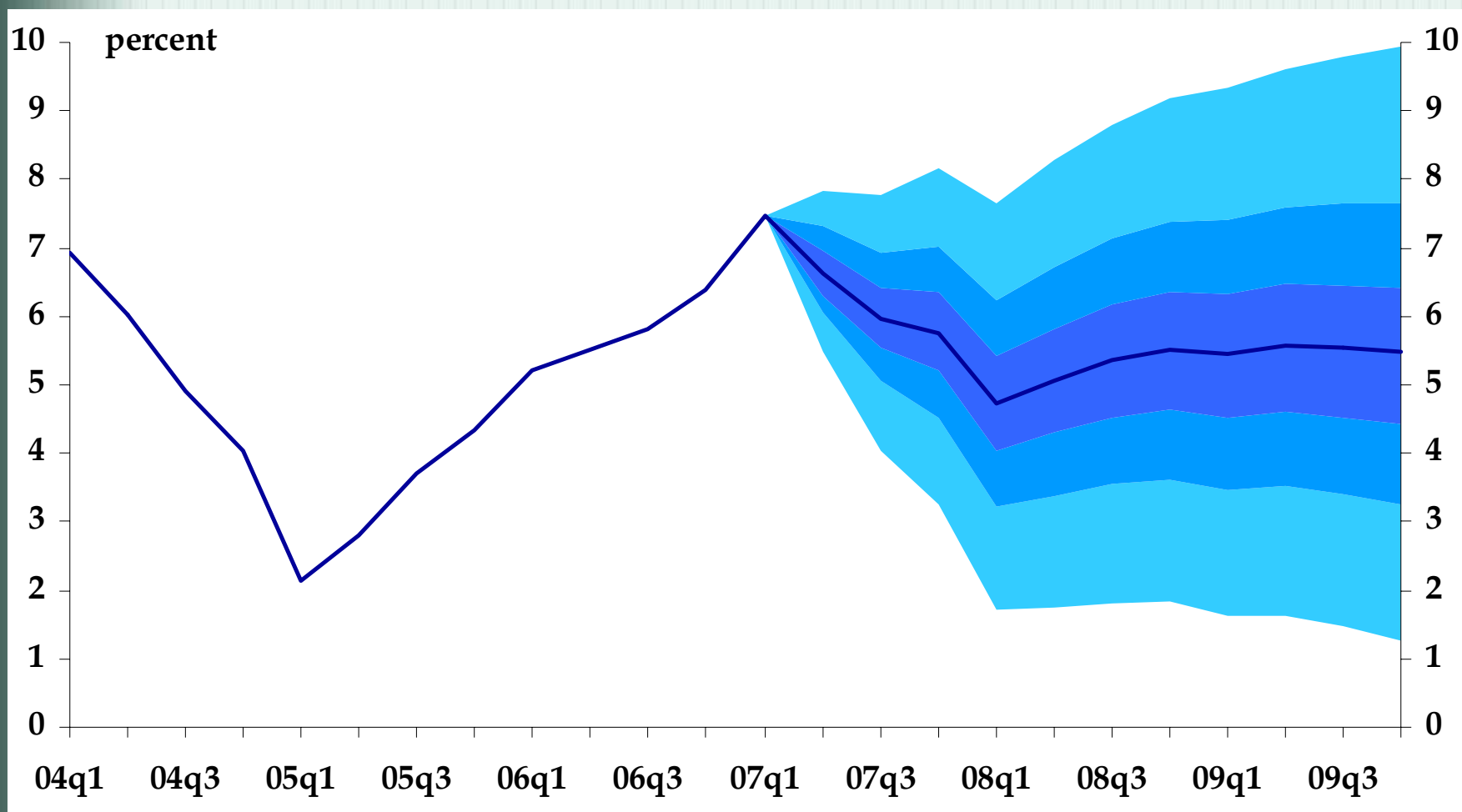
	Probability of inflation running:				
	below 1.5%	below 2.5%	below 3.5%	below central path	in the range (1.5%- 3.5%)
2007 Q2	0.12	0.97	1.00	0.506	0.88
2007 Q3	0.59	0.96	0.99	0.510	0.41
Q4 2007	0.33	0.72	0.94	0.512	0.62
2008 Q1	0.31	0.61	0.85	0.514	0.54
2008 Q2	0.26	0.53	0.77	0.515	0.51
2008 Q3	0.23	0.48	0.73	0.507	0.50
2008 Q4	0.21	0.43	0.68	0.503	0.46
2009 Q1	0.19	0.39	0.63	0.504	0.43
2009 Q2	0.18	0.36	0.59	0.501	0.42
2009 Q3	0.16	0.33	0.56	0.502	0.40
2009 Q4	0.15	0.32	0.53	0.503	0.38

Source: Macroeconomic and Structural Analyses Department

# Decomposition of the uncertainty of central path of inflation (fan decomposition)

- **In the short term:** dominant impact on uncertainty of inflation is exerted by uncertainty of food prices, net inflation and oil prices;
- **In the medium term:** the most important factor is still the uncertainty of food prices. Additionally, though to a lesser extent, the inflation uncertainty is affected by the uncertainty of the oil price path and the uncertainty of residuals in the equations of net inflation, GDP deflator, exchange rate and import prices.
- The fan does not account for the uncertainty connected with expert adjustments (concerning the deviation of net inflation after adjustments from net inflation following from the raw model).
- The fan does not account for the uncertainty of the model (it is constructed with the assumption of the model's adequacy)

## Projection of GDP growth rate – April 2007



Source: Macroeconomic and Structural Analyses Department

## Decomposition of the uncertainty of the central path of GDP growth rate (fan decomposition)

- **In the short term:** the greatest impact on GDP projection uncertainty is exerted by the risk of inaccurate statistical mapping of the equation of imports and inventories. A smaller role in explaining the uncertainty of GDP projection in the short term is played by investments, exports and consumption.
- **In the medium term:** the uncertainty as to the path of omitted variables in the investment equation becomes more significant in explaining the uncertainty of GDP projection. Apart from that, still significant is the impact of the uncertainty connected with imports, though its relative importance is slightly smaller than it is in the short term.

# Uncertainty factors unaccounted for in the model

(1)

- Labour market developments:
  - The risk of a slower growth of the effective supply of labour than accounted for in the projection (e.g. due to intensification of economic migrations),
  - The risk of a weaker than projected reaction of the NAWRU to changes in economic activity,
  - Should these factors materialise, they would lead to higher inflation.
- Uncertainty connected with BAEL data:
  - The risk of a weaker than recorded growth rate in the number of working persons in 2006,
  - The risk that 2006 did not mark a drop in labour force participation rate,
  - The actual imbalance in the labour market and the goods market at the starting point of the projection might in fact have been smaller than it follows from the data,
  - Should this scenario play out, it would lead to lower inflation.

## Uncertainty factors unaccounted for in the model

(2)

- Risk connected with inadequate mapping of inflation determinants:
  - Future increase in labour costs with no possibilities of reducing the remaining costs may not only lead to price increases (as suggested in the projection) but also to reduced production.
- Slowdown of the world economy:
  - Risk of a hard landing of the world economy (smaller than in the January projection).
- Unfulfilled assumption of no economic policy change in the projection horizon
- Exchange rate path:
  - With greater probability, the exchange rate will strengthen than weaken in relation to the projection path.



## Uncertainty factors unaccounted for in the model (3)

- Discussion of data released after 23 March 2007:
  - Fuel price growth rate in the nearest future may prove slightly higher than it was assumed,
  - The risk of the level of food and alcoholic beverage prices proving slightly higher rise than accounted for in the projection in the horizon of the next 12 months,
  - The wage growth assumed at the starting point of the projection is probably underestimated, which will have consequences for the dynamics of this category in the short-term horizon of the projection,
  - The choice of Poland and Ukraine as organisers of the European Championships (Euro 2012).

## Balance (1)

- The distribution of risks accounted for in the fan chart is almost **symmetrical**
- **In the short term**, however, the factors unaccounted for in the chart make a slightly higher price growth rate more probable than it would follow from the central path
  - Such an outcome is mainly supported by the possibility of oil, fuel and food prices settling above the path accounted for in the projection.

## Balance (2)

- We assess that **in the medium and longer term** the risk of future inflation deviating from the central projection path is roughly symmetrical
- **Considering the full picture of the projection, i.e. the central path together with the balance of risk factors ascribed to it, the differences between the April and January projection are significantly smaller than it would follow from a mere comparison of the central paths**