Monetary policy in practice

Blindern, 26 Mars 2009

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Agenda

1. Monetary policy in Norway

2. The interest rate decision 25 March 2009

3. Communication and the interest rate projection

4. Economic models at Norges Bank

Monetary policy in Norway

Objective:

- Low and stable inflation
  - close to 2.5 per cent over time

Implementation:

- A flexible inflation targeting regime

- Stabilise inflation in the medium term

Decision structure:

- Consensus seeking committee
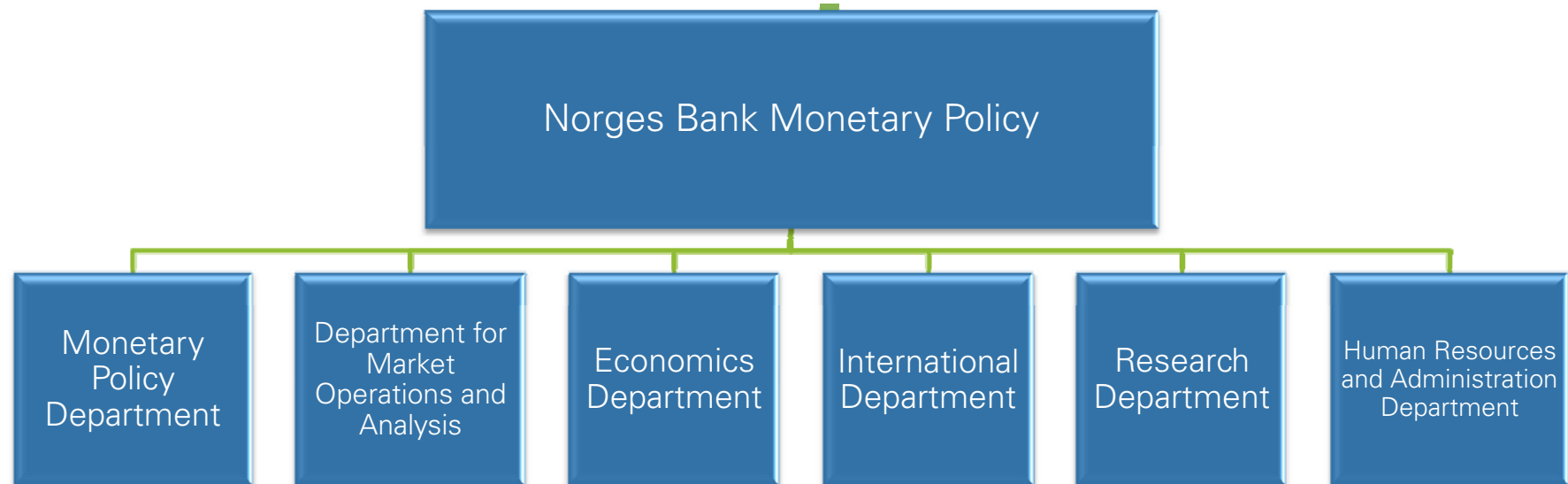
The decision making process

- Key rate decisions made by Executive Board every six weeks

- Executive Board is made up of the Governor, the Deputy Governor + 5 external members

- Decision on strategy interval for the key rate three times per year

Reporting

- Monetary policy decision

  - Press release at 2 pm

  - Executive Board's monetary policy statement

  - Press conference at 2.45 pm

- Monetary Policy Report (MPR)

  - Published three times a year (March, June, October/November)

  - Contains outlook for the interest rate and projections for the Norwegian economy

Organisation chart Monetary Policy Wing

Norges Bank Monetary Policy

- Monetary Policy Department
- Department for Market Operations and Analysis
- Economics Department
- International Department
- Research Department
- Human Resources and Administration Department

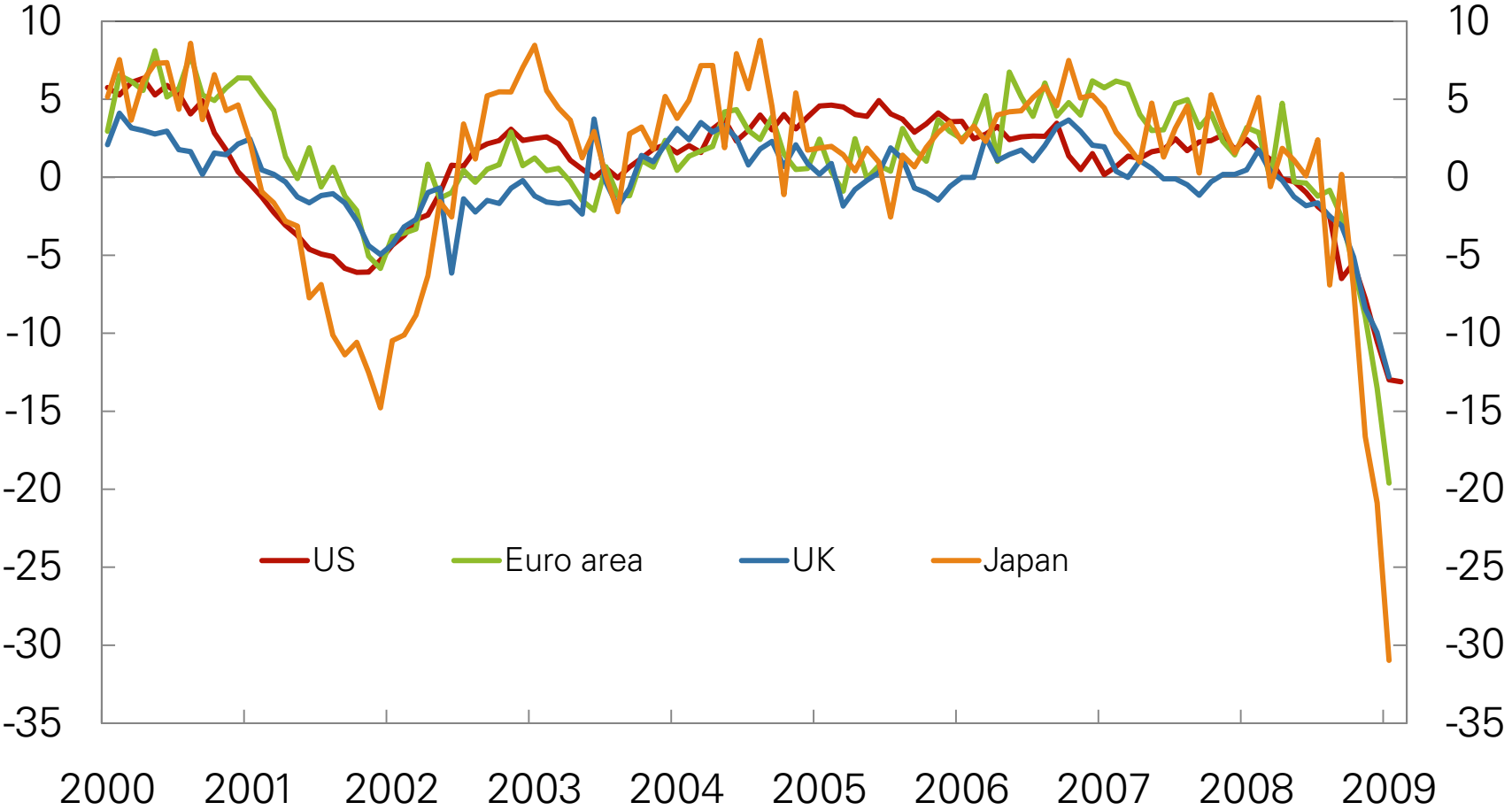# The interest rate decision 25 March 2009

Key policy rate
Actual developments, projection and strategy interval. Per cent
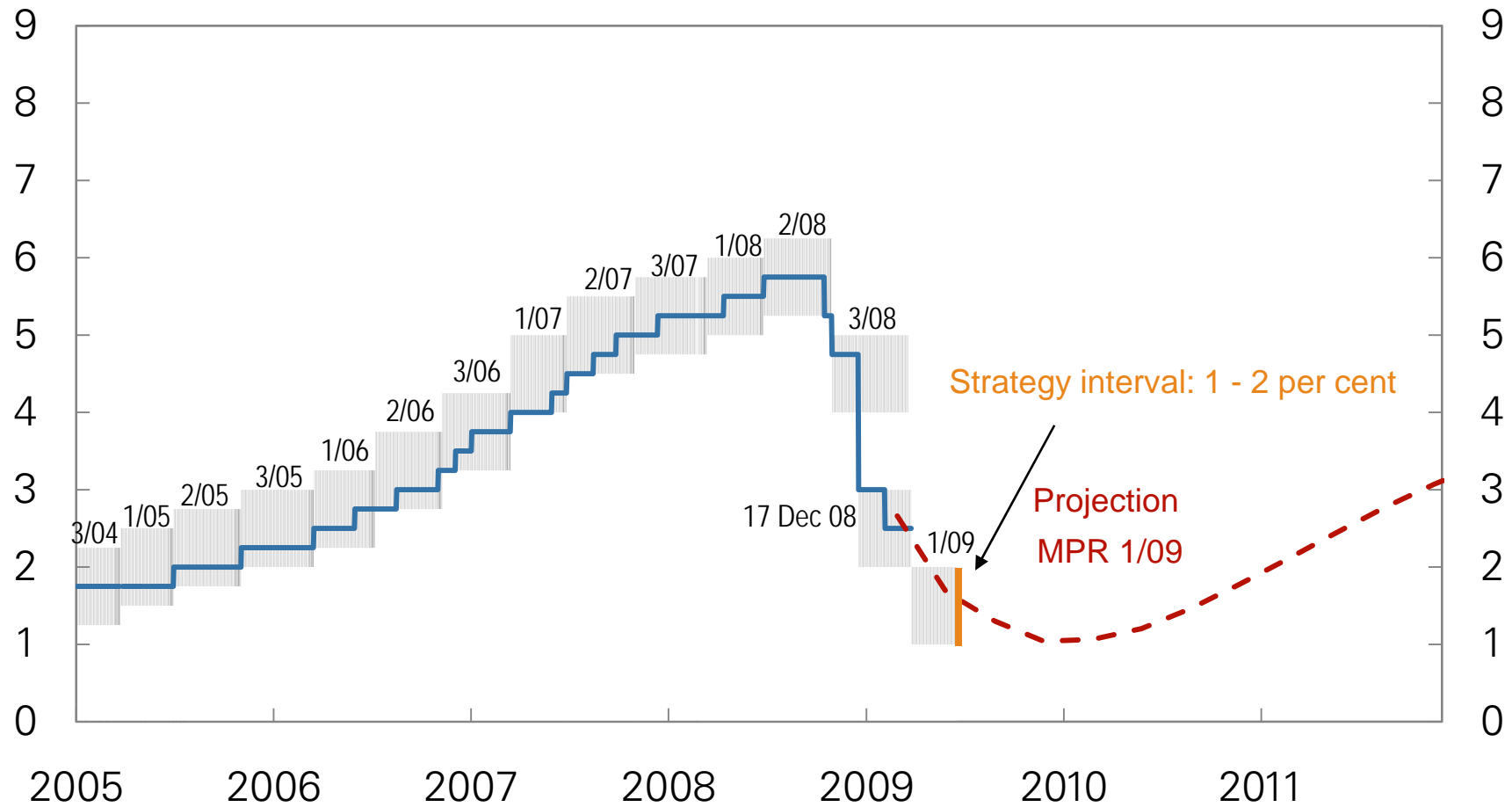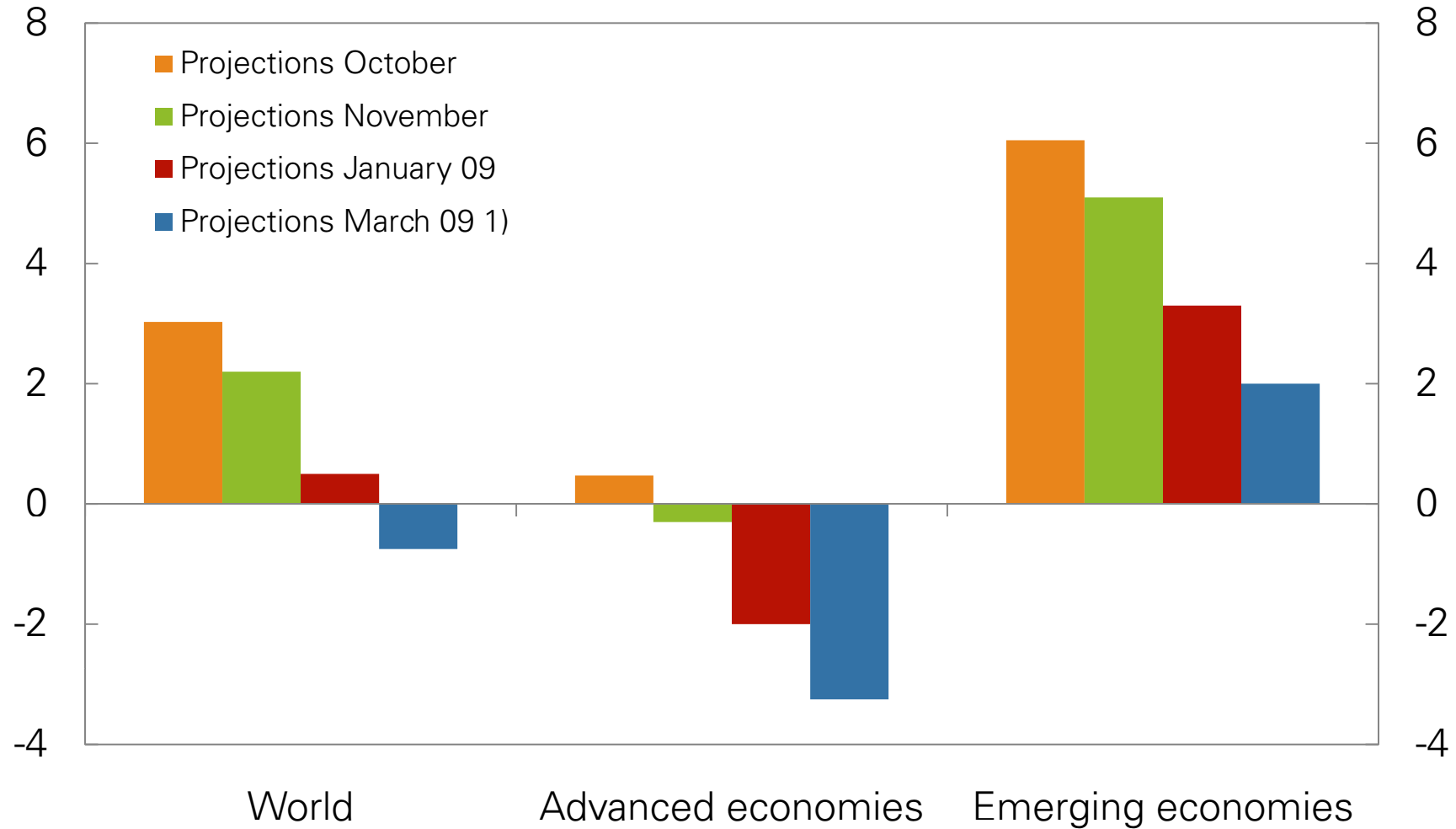

Source: Norges Bank

Manufacturing production

Volume. 12-month change. Per cent. January 2000 – January 2009

Legend: US, Euro area, UK, Japan

Source: Thomson Reuters

Growth projections for 2009
Projected by the IMF at different points in time

Legend:
- Projections October
- Projections November
- Projections January 09
- Projections March 09 1)

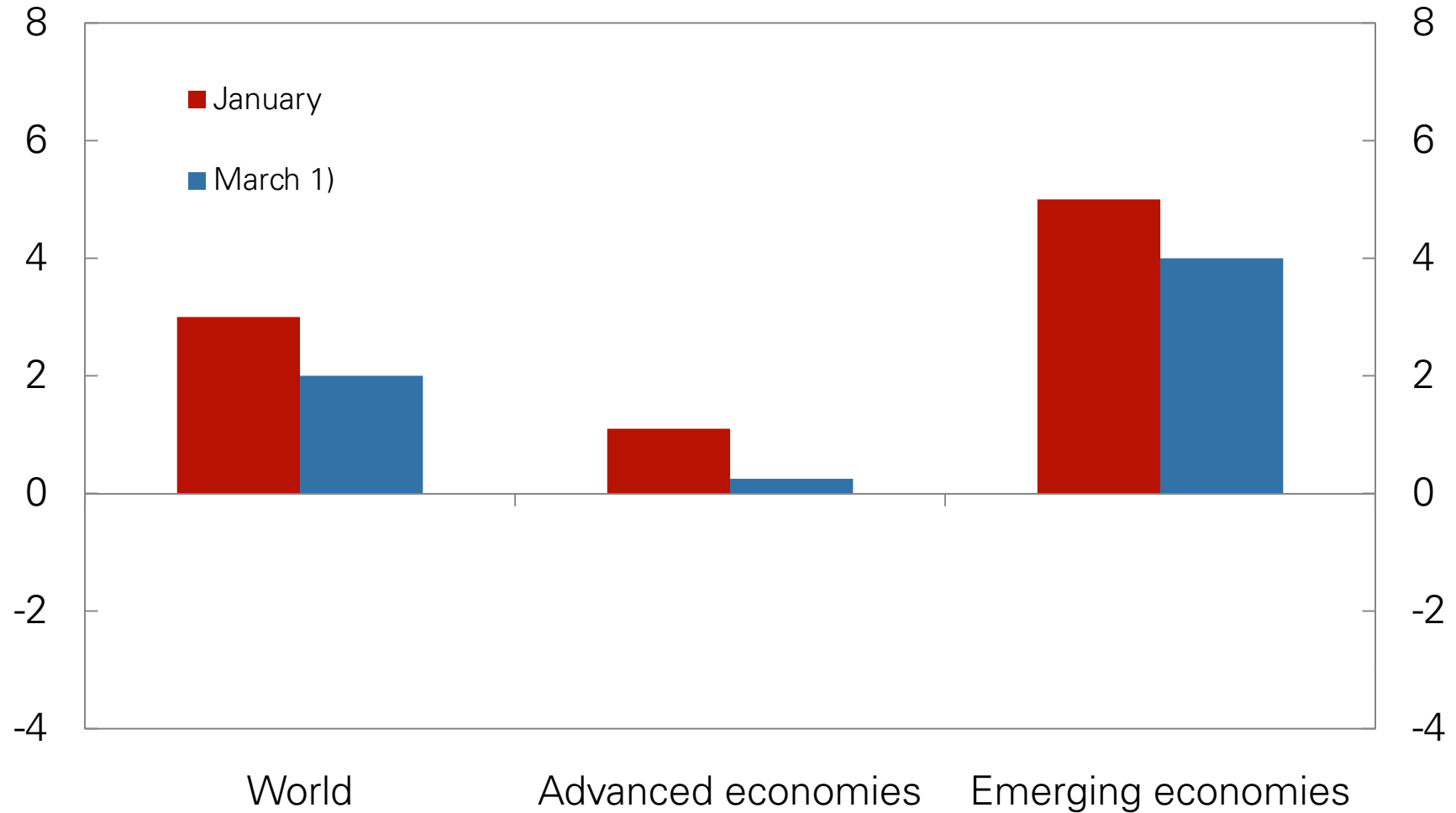Categories: World, Advanced economies, Emerging economies

1) The projections in March were given as intervals of 0.5 - 1 per cent, the bars show the middle points of these intervals

Source: IMF

Growth projections for 2010

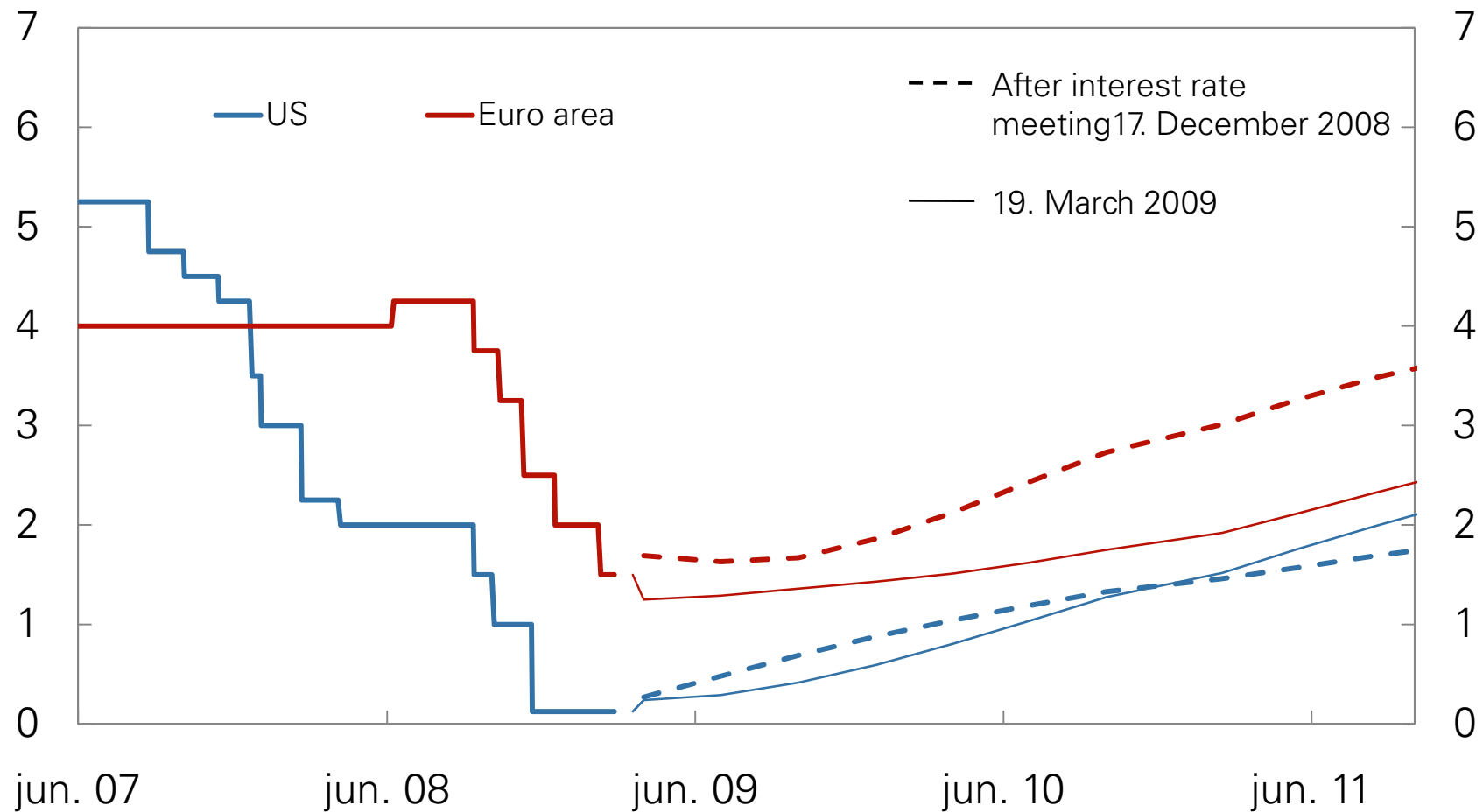Projected by the IMF at different points in time

1) The projections in March were given as intervals of 0.5 - 1 per cent, the bars show the middle points of these intervals

Source: IMF

Policy rates and estimated forward rates
Per cent. 1. June 2007 – 31. December 2012

Monetary policy when the key rate is low
– alternative measures used in other countries:

- ## Expectations channel
  – The Federal Reserve has announced that it expects an exceptionally low federal funds rate for some time

- ## Large supply of central bank liquidity and quantitative easing
  – to underpin low interest rates and reduction in money market risk premiums

- ## Targeted purchases of private sector securities

  – to ease funding conditions for the private sector. The Federal Reserve refers to this as credit easing

- ## Purchases of longer-term government securities

  – to influence the expected return on longer-term securities more directly than through short-term interest rates and expectations

Export from Mainland Norway

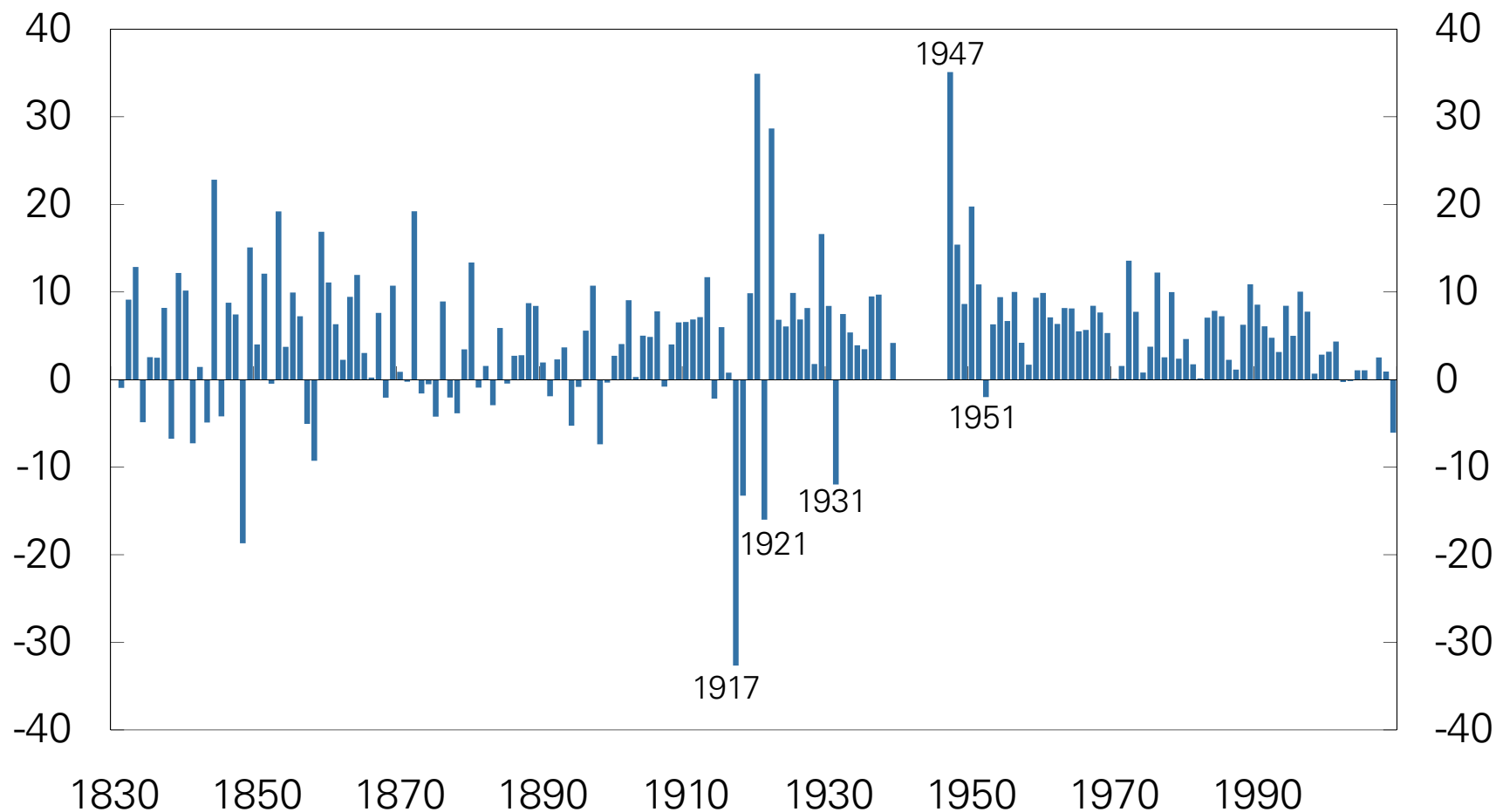Fixed 2006-prices. Annual growth. Per cent. 1970 - 2009 [1]
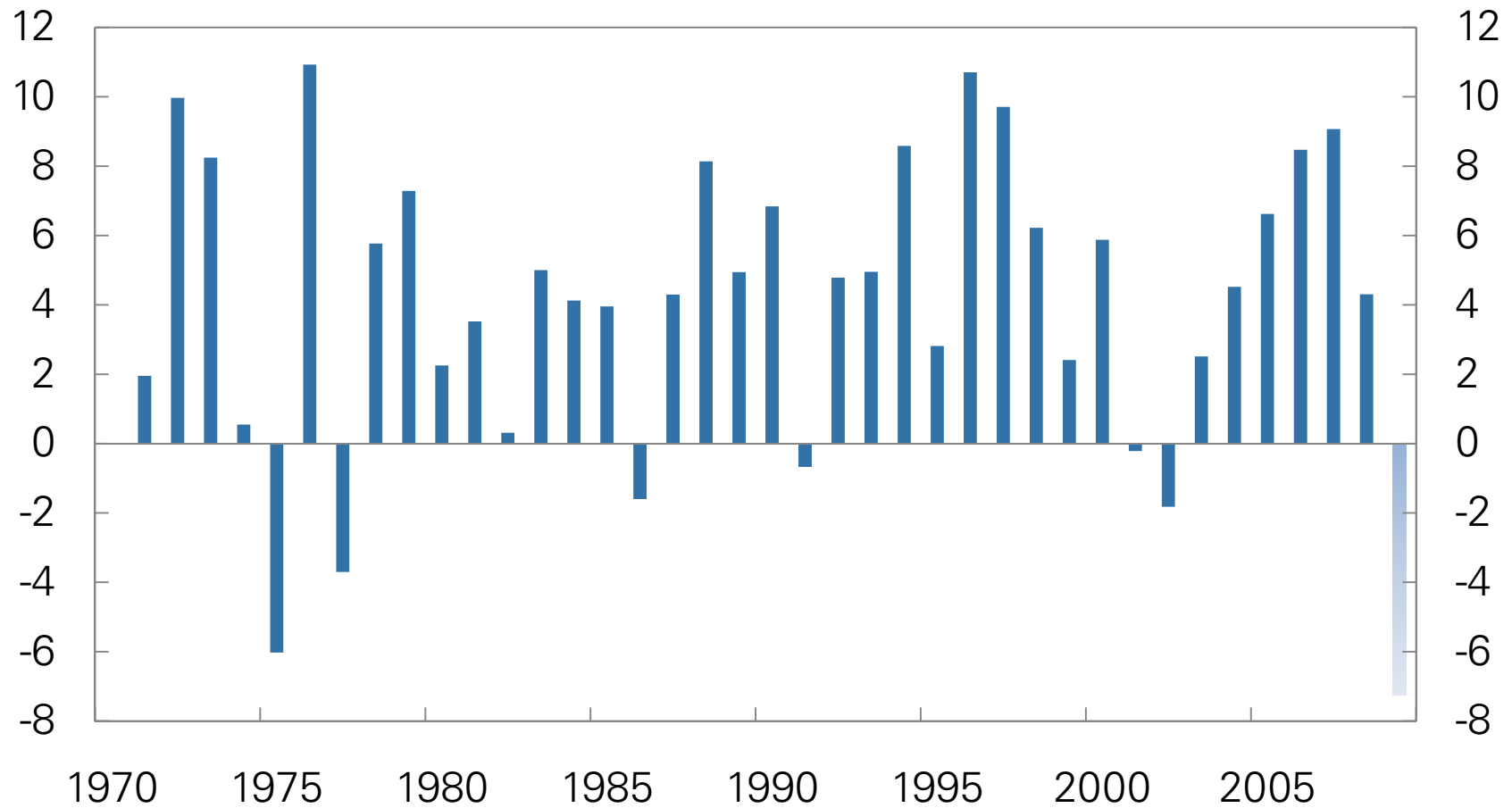
1) Estimate for 2009
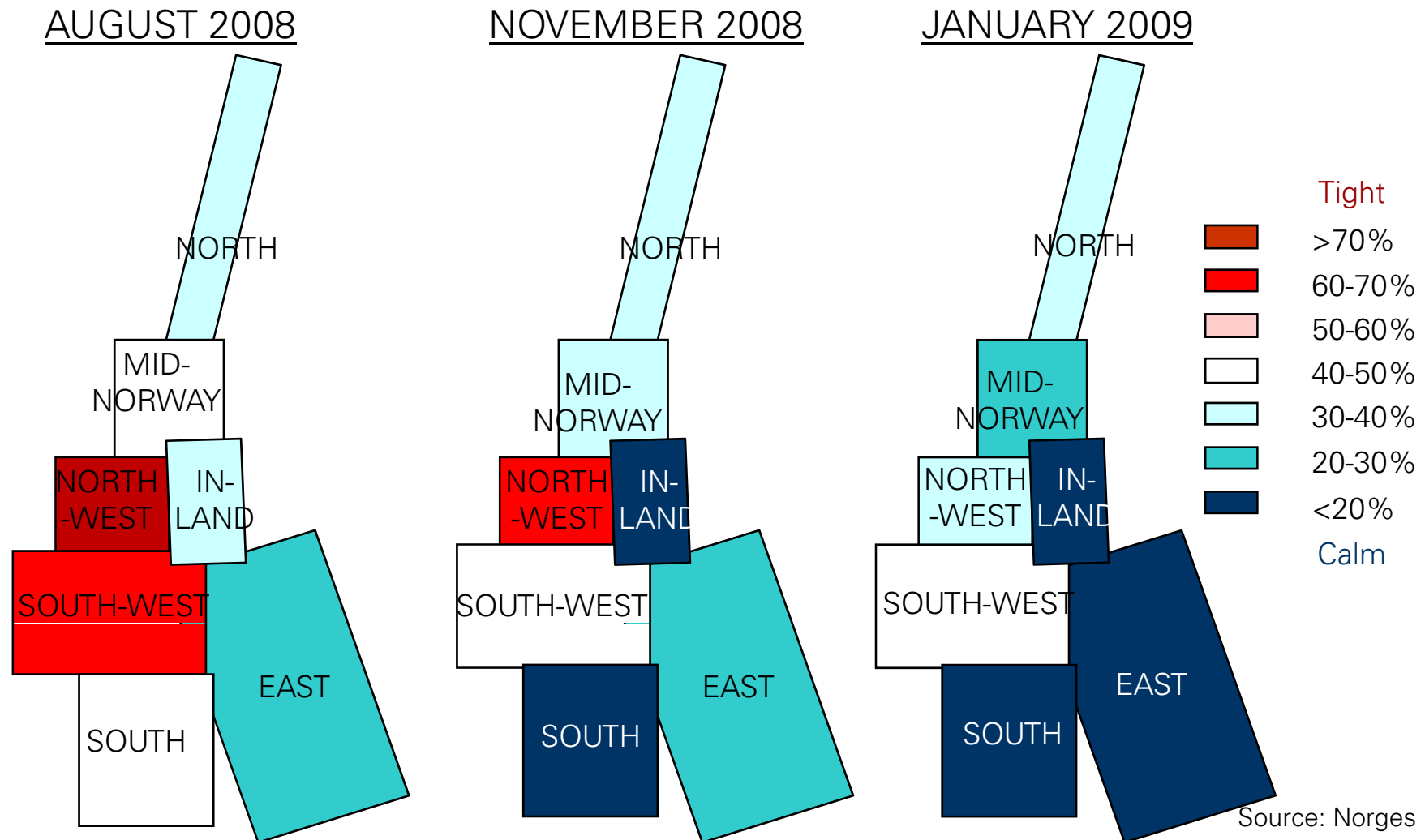
Export from Norway
Annual growth. Per cent. 1831 – 2009[1]

Kilde: Ø. Eitrheim, Jan T. Klovland og Jan F. Qvigstad (red)
(2004): " *Historical Monetary Statistics for Norway
1819-2003",* Norges Banks Skriftserie No. 35

1) Estimate for 2009

Regional network – Capacity utilisation all sectors

Share reporting some or considerable capacity problems

AUGUST 2008

NORTH
MID-NORWAY
NORTH-WEST
IN-LAND
SOUTH-WEST
EAST
SOUTH

NOVEMBER 2008

NORTH
MID-NORWAY
NORTH-WEST
IN-LAND
SOUTH-WEST
EAST
SOUTH

JANUARY 2009

NORTH
MID-NORWAY
NORTH-WEST
IN-LAND
SOUTH-WEST
EAST
SOUTH

Tight
>70%
60-70%
50-60%
40-50%
30-40%
20-30%
<20%
Calm

Source: Norges Bank

GDP Mainland Norway

Annual growth. Per cent. 1971 - 2009[1]
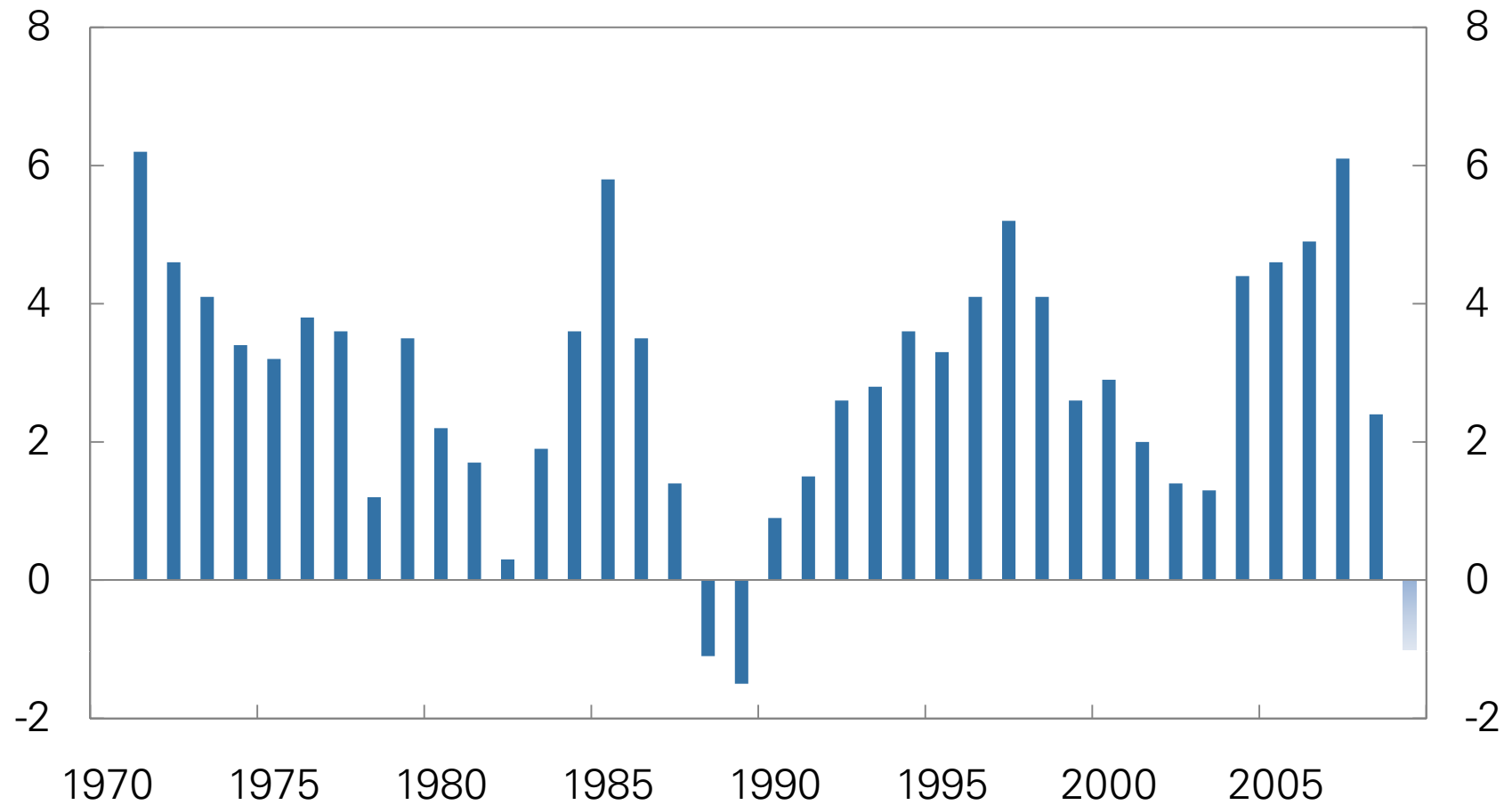
1) Estimate for 2009

Oil adjusted budget deficit

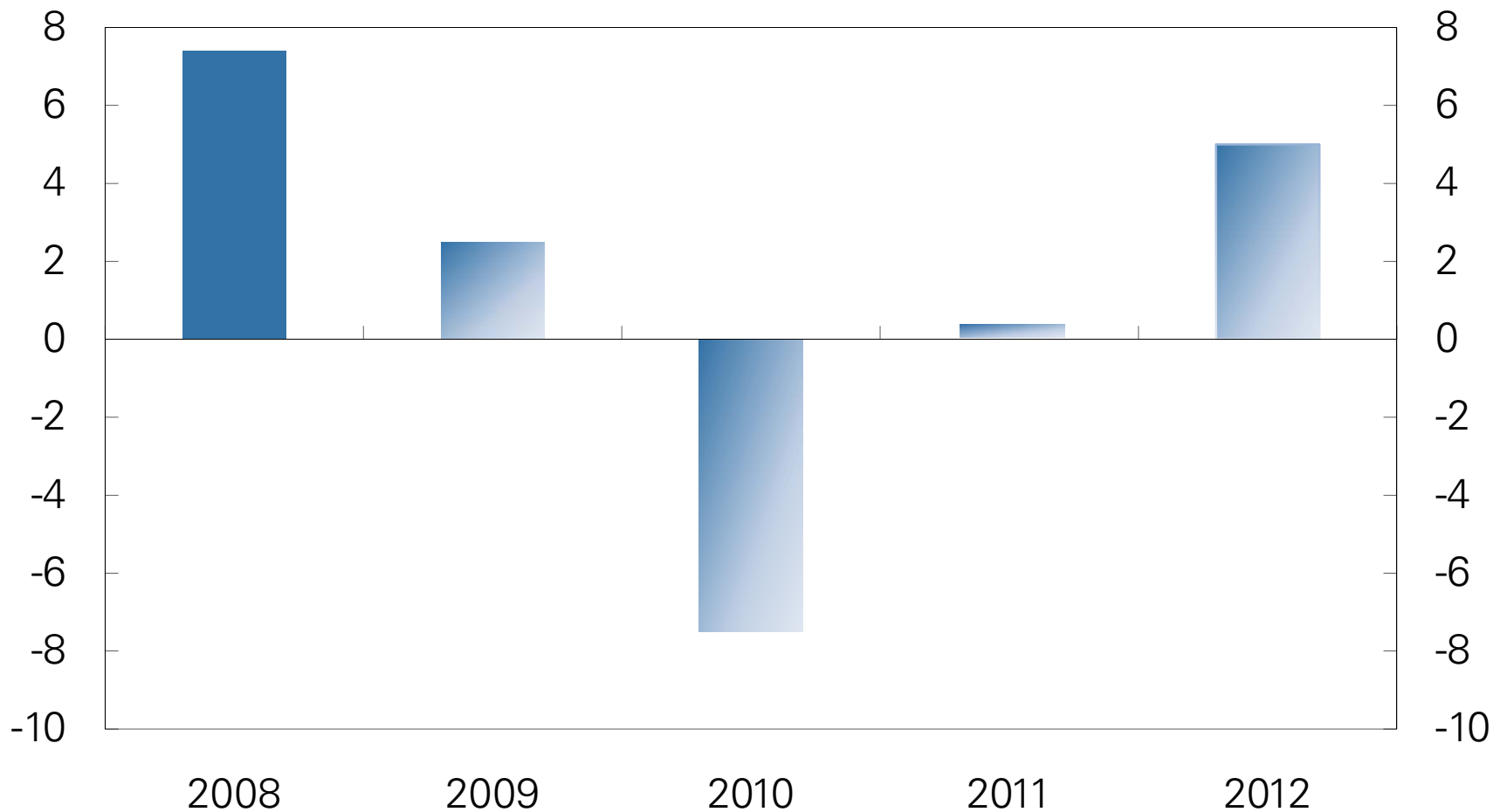Billion NOK. 2001 – 2009[1]
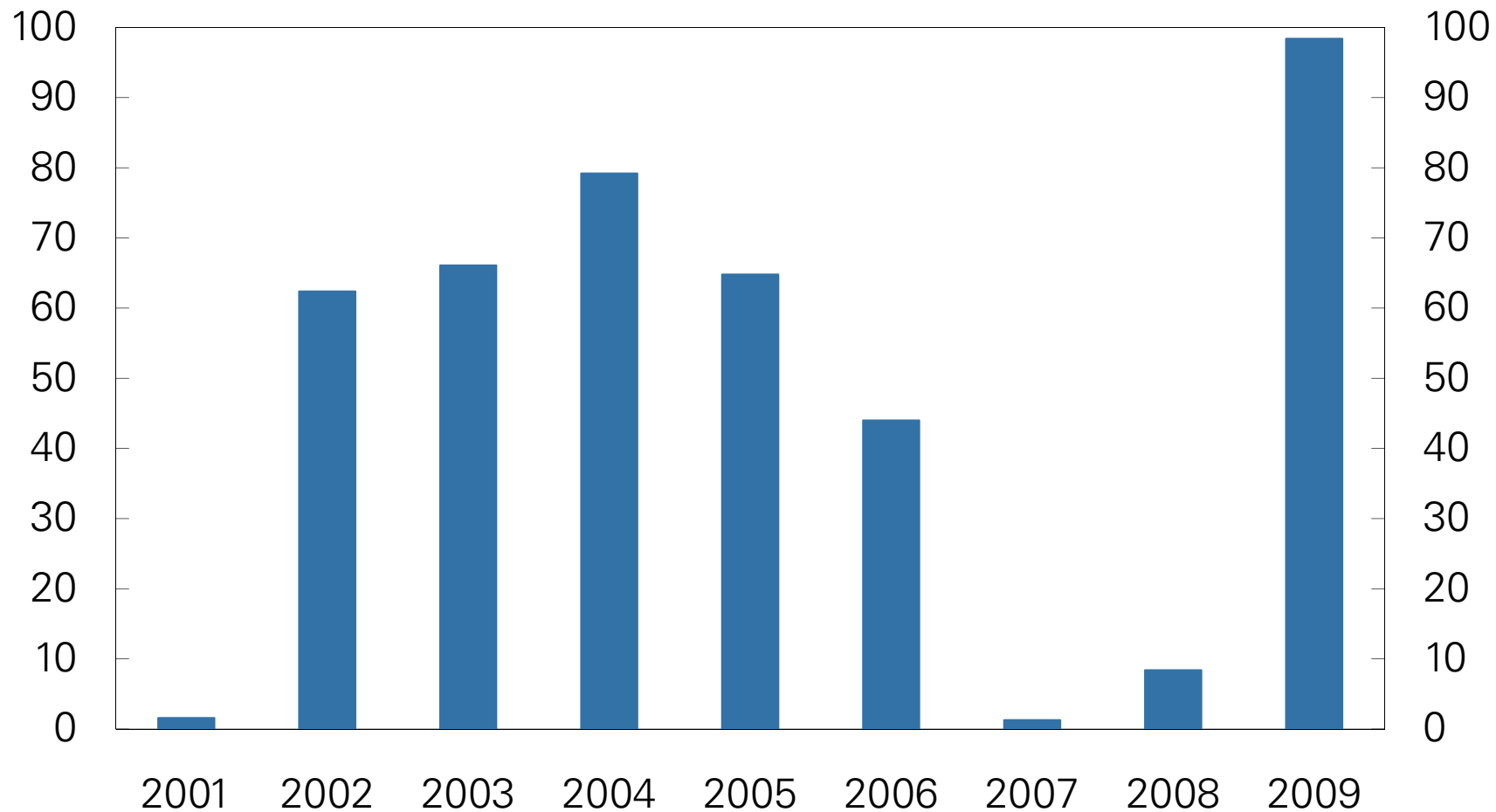
Kilde: Finansdepartementet

Oil investments
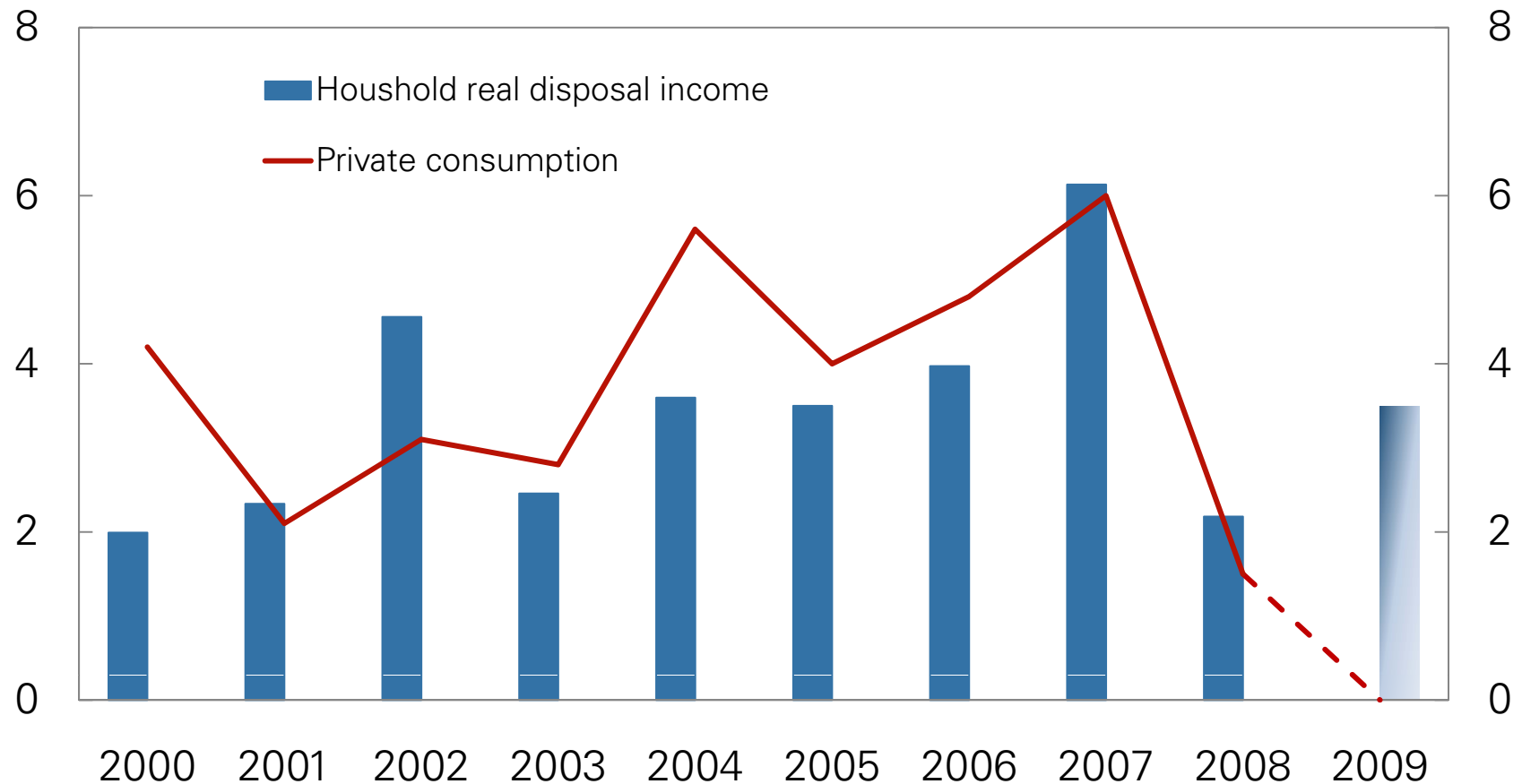
Annual growth. Per cent. 2008 – 2012 [1]

1) Estimate for 2009 – 2012

Kilder: Statistisk sentralbyrå og Norges Bank

Houshold real disposal income and private consumption
Annual growth. Per cent. 2000 – 2009[1]

1) Estimate for 2009

House prices and credit to households

12-month change. Per cent. January 2001 – January 2009

House prices

Credit to households (C2)

- 12-month change
- Annualised growth in 3-month moving average
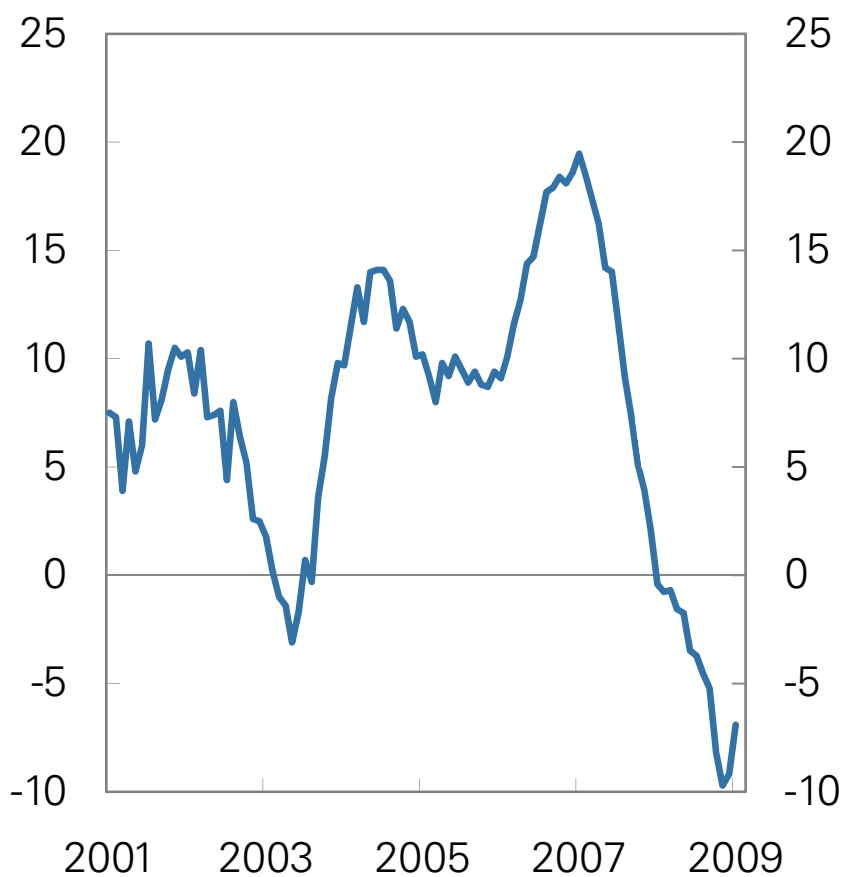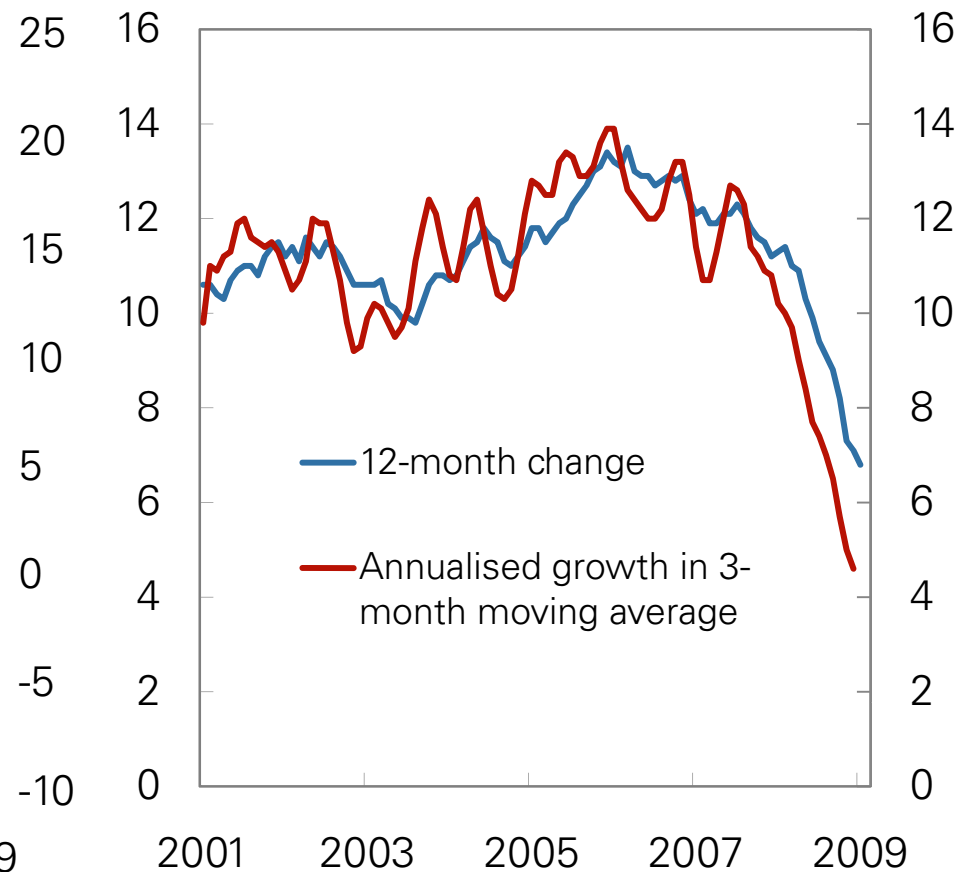
Sources: Norwegian Association of Real Estate Agents,
Association of Real Estate Agency Firms, FINN.no, ECON Pöyry and Norges Bank

CPI and CPIXE
12-month change. Per cent. January 2007 – March 2009
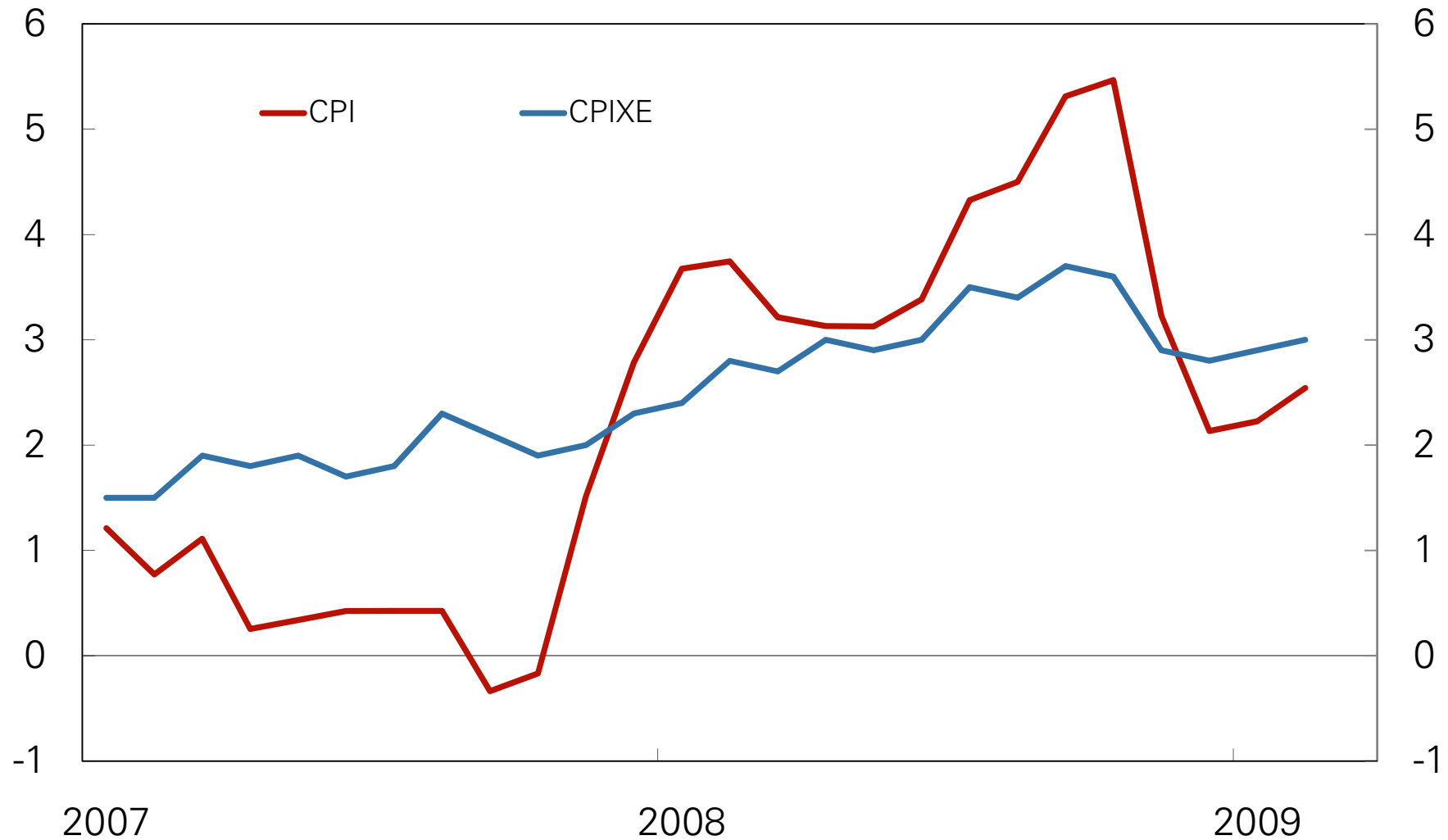
Sources: Statistics Norway and Norges Bank

Unemployment

Unemployed as a percentage of labour force. Seasonally adjusted. Monthly figures. January 1997 – February 2009
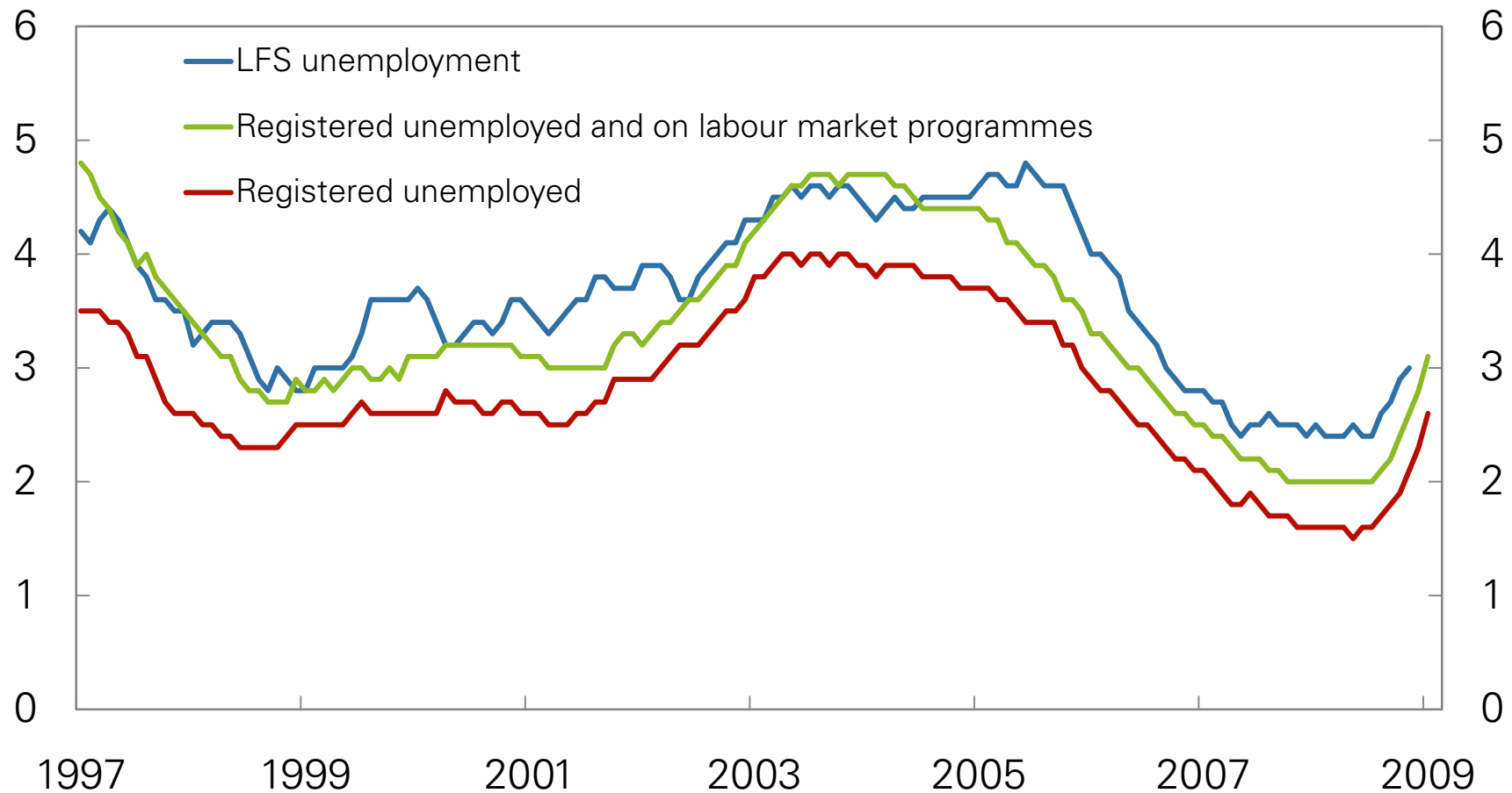
Sources: Statistics Norway and Nowegian Labour and Welfare Administration (NAV)

Expected annual wage growth
Per cent. October 2002 – January 2009
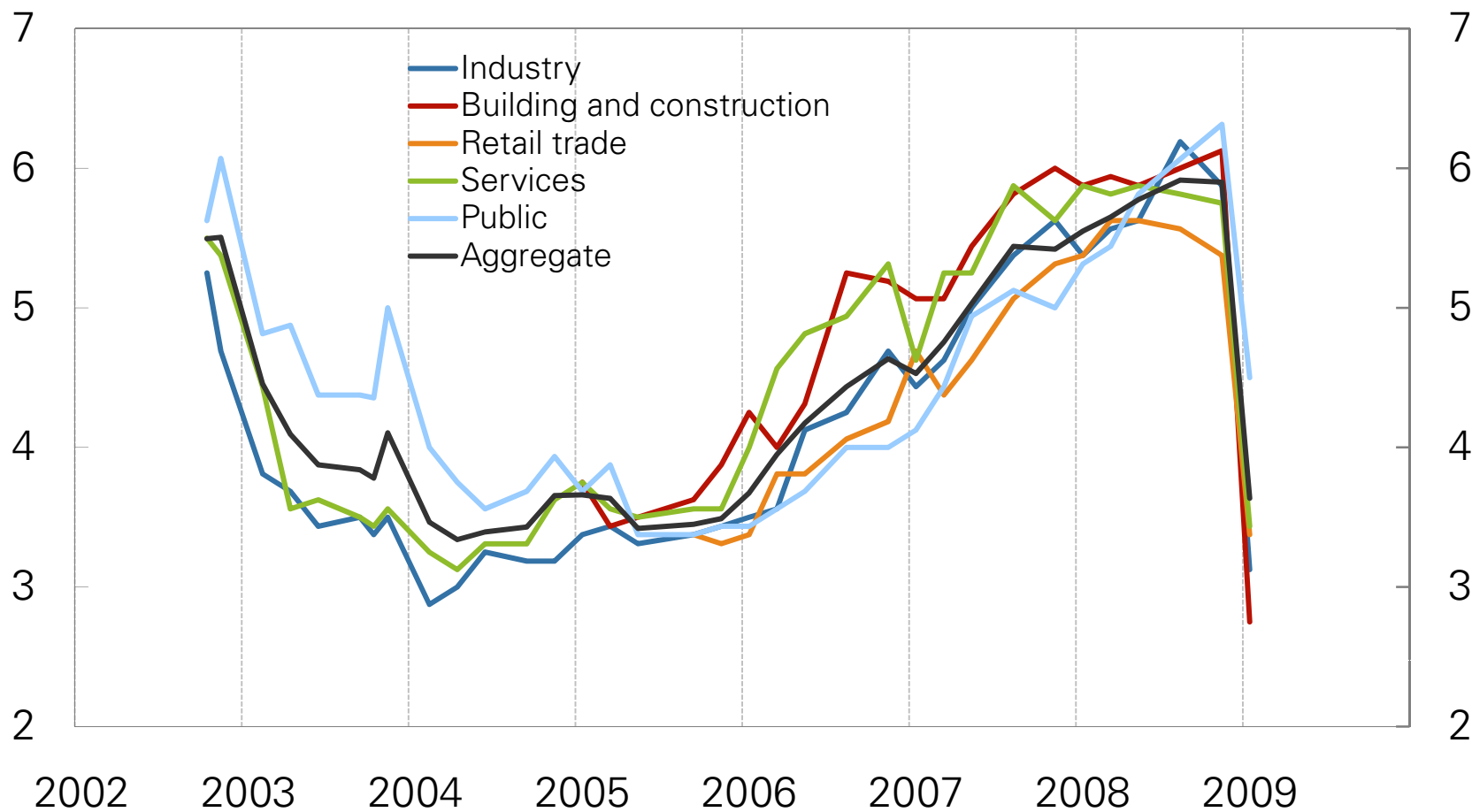
Kilde: Norges Bank

Wage costs and prices[1]

Y.o.y growth. Per cent. 1. kv. 2000 – 4. kv. 2009[2]

— Wage costs per produced unit

— Prices on domestically produced goods and services
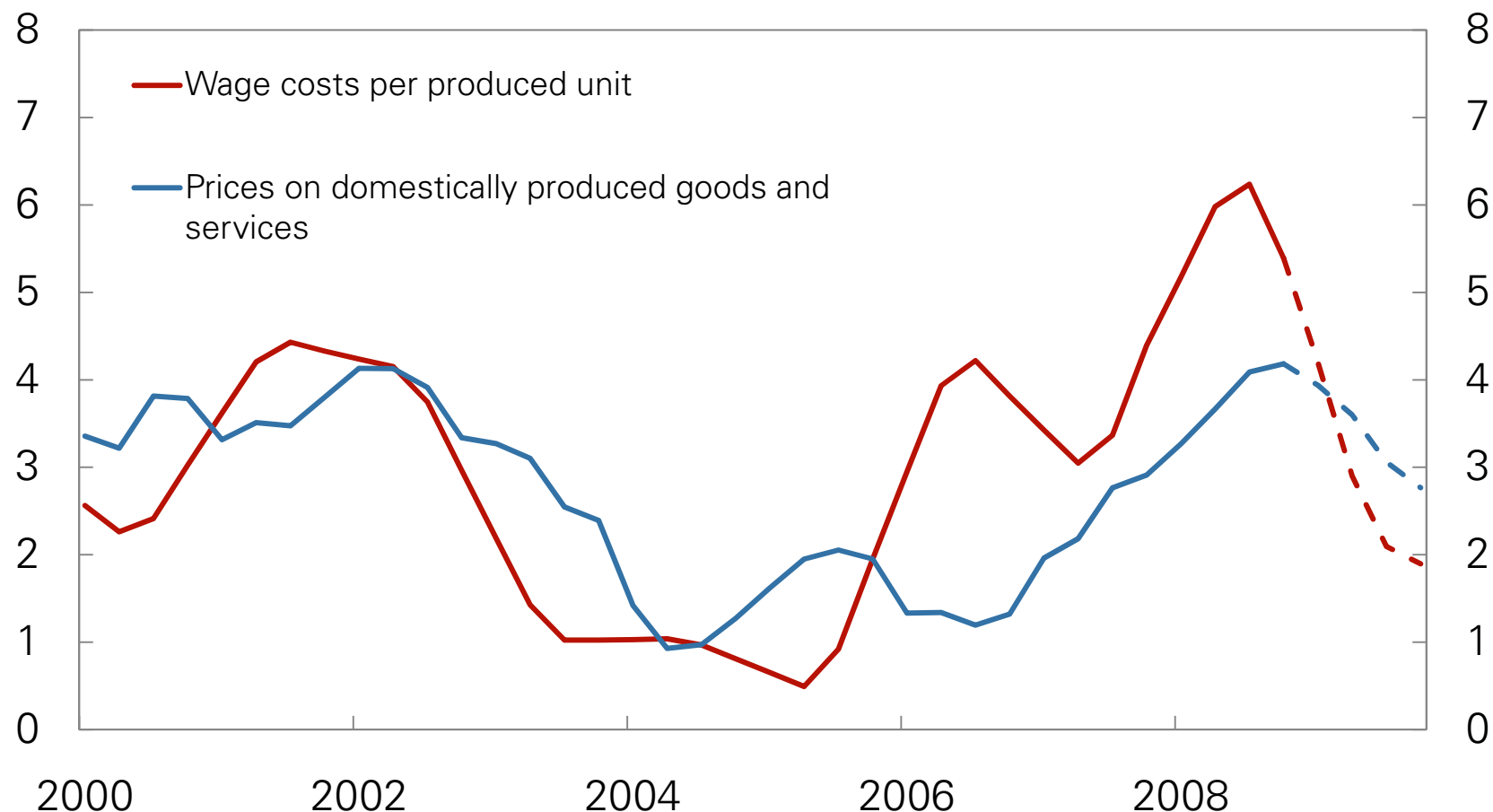
1) Norges Banks beregninger
2) Anslag for 2009

Kilder: Statistisk sentralbyrå og Norges Bank

3-month interest rate differential and import-weighted exchange rate (I-44)[1]

January 2002 – December 2012

I-44
(left-hand scale)

23 March 2009

23 March 2009

4 February 2009

Weighted interest rate differential
(right-hand scale)

2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012
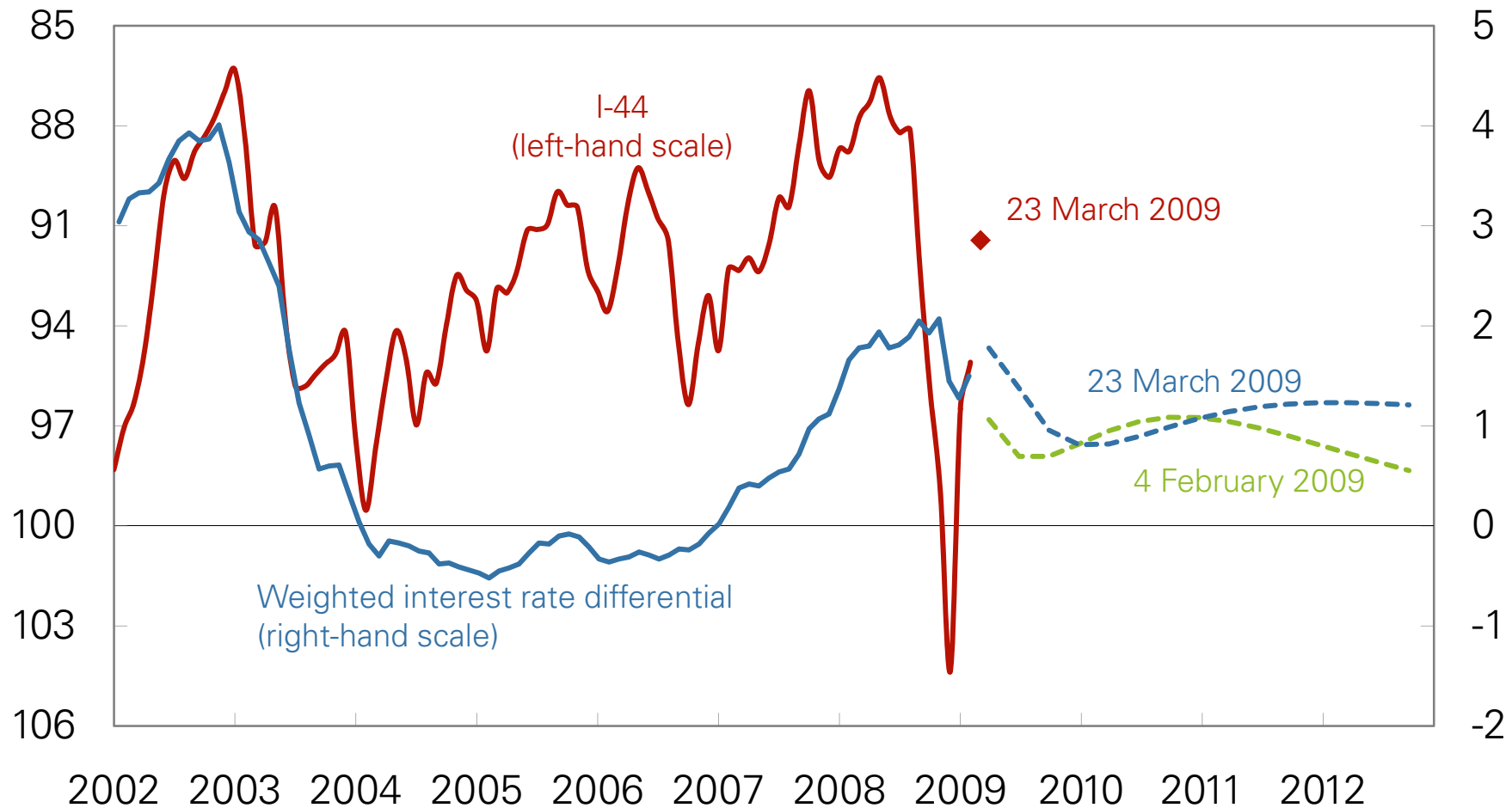
[1] A rising curve denotes an appreciation of the krone

Sources: Thomson Reuters and Norges Bank

Reference path MPR 1/09
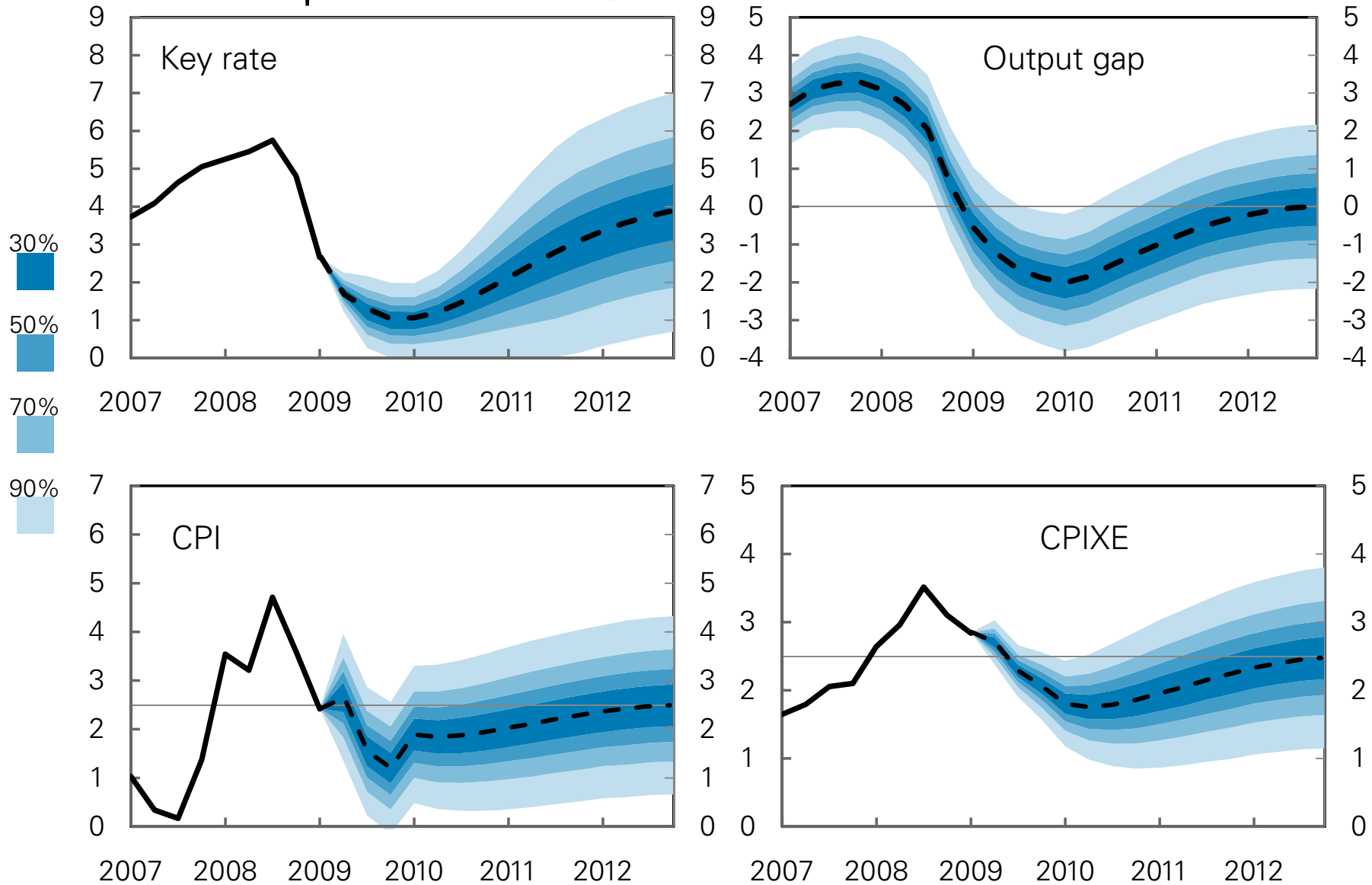
Kilder: Statistisk sentralbyrå og Norges Bank

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Communication and the interest rate projection

Key elements of Norges Bank communication

1. The interest rate forecast
   - a reasonable balance between the objectives of monetary policy
   - with output gap and inflation forecasts
   - with uncertainty bands

Reference path MPR 1/09
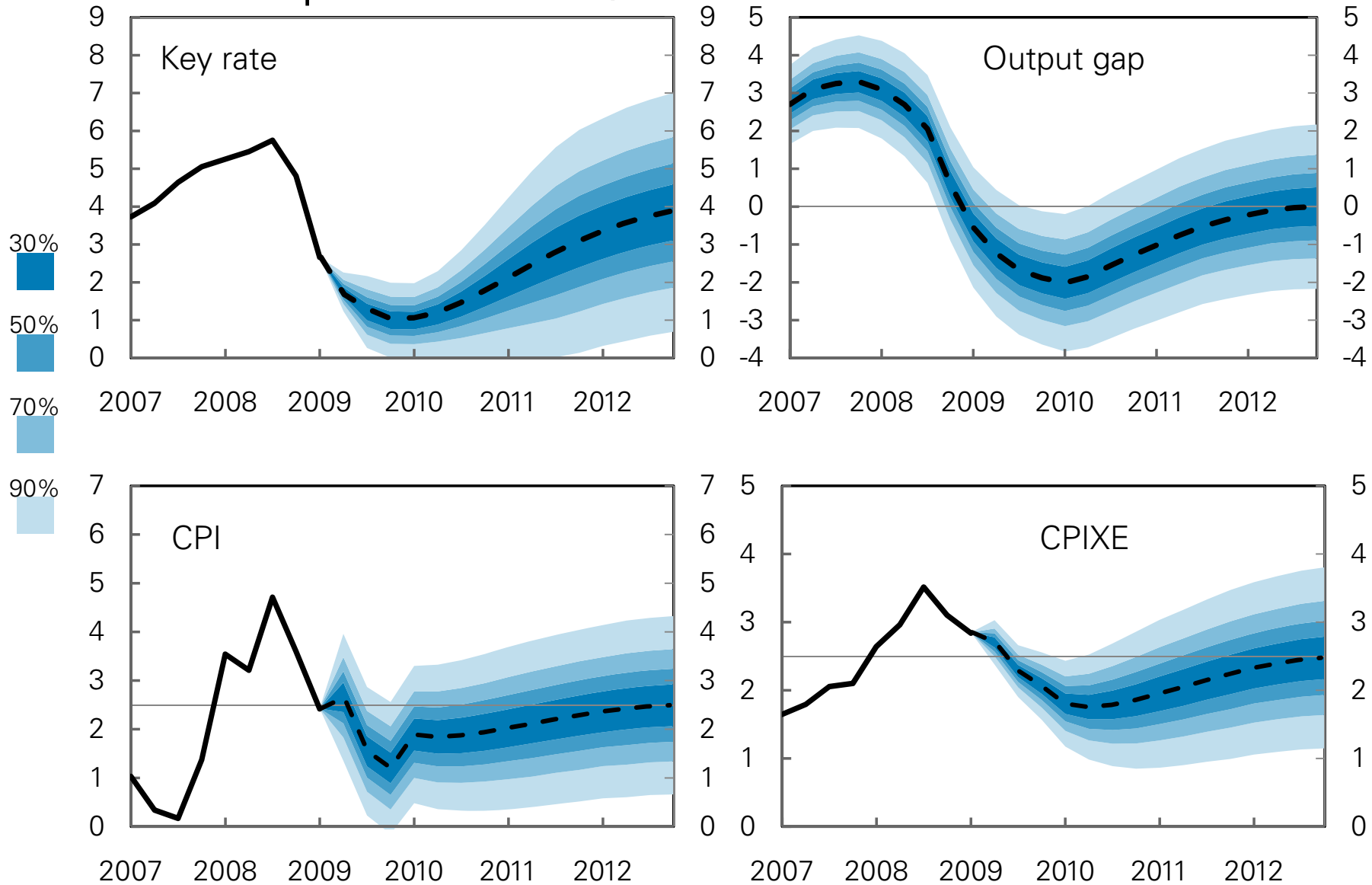
Kilder: Statistisk sentralbyrå og Norges Bank

☙NB☙ NORGES BANK

Key elements of Norges Bank communication

1. The interest rate forecast

    -   a reasonable balance between the objectives of monetary policy

    -   with output gap and inflation forecasts

    -   with uncertainty bands

2. Risk scenarios

    -   with realistic and consistent interest rate reactions

Alternative paths for key rate
Per cent. Q1 2007 – Q4 2012
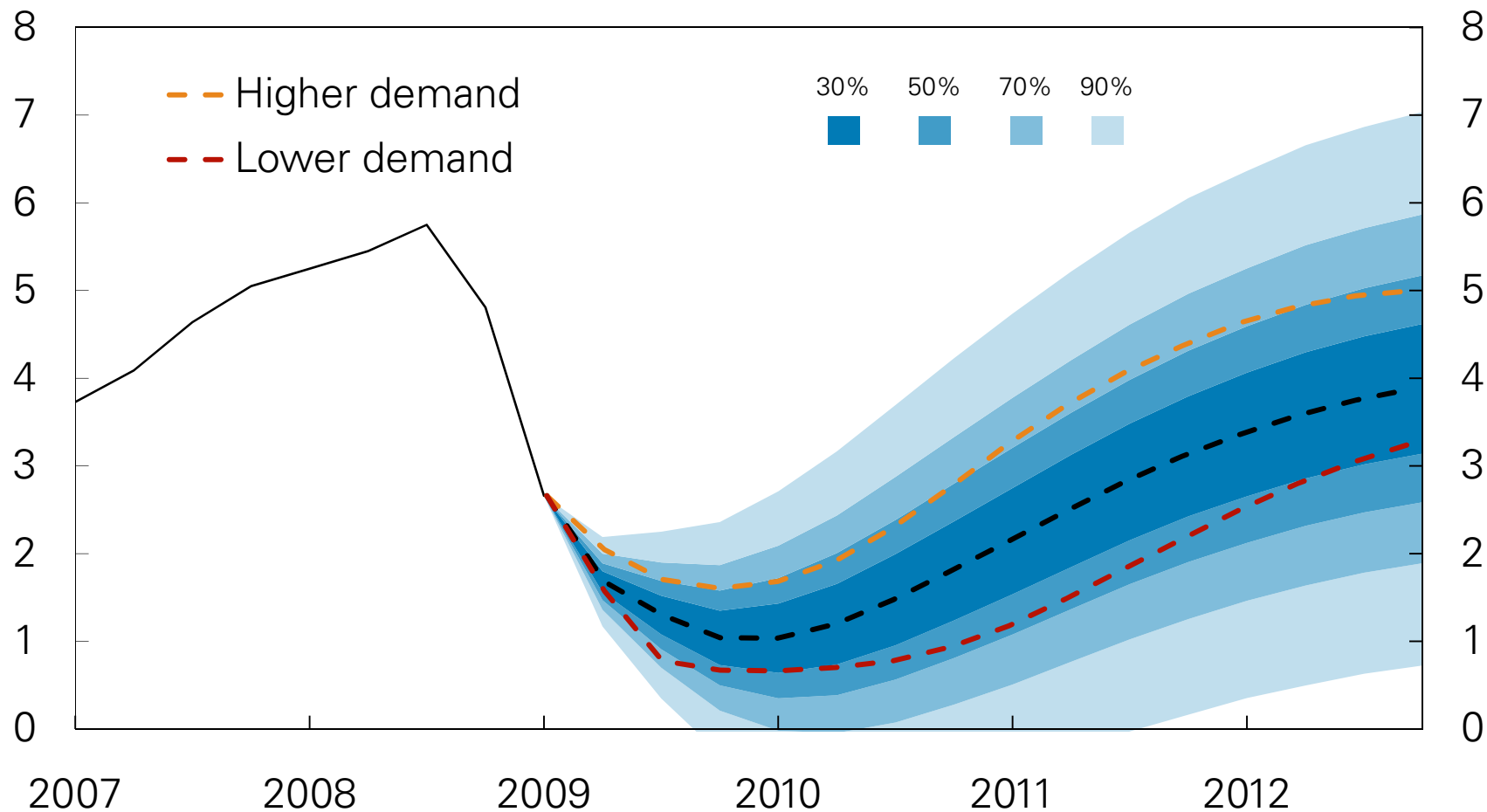
Alternative paths for CPIXE
Y.o.y growth. Per cent. Q1 2007 – Q4 2012
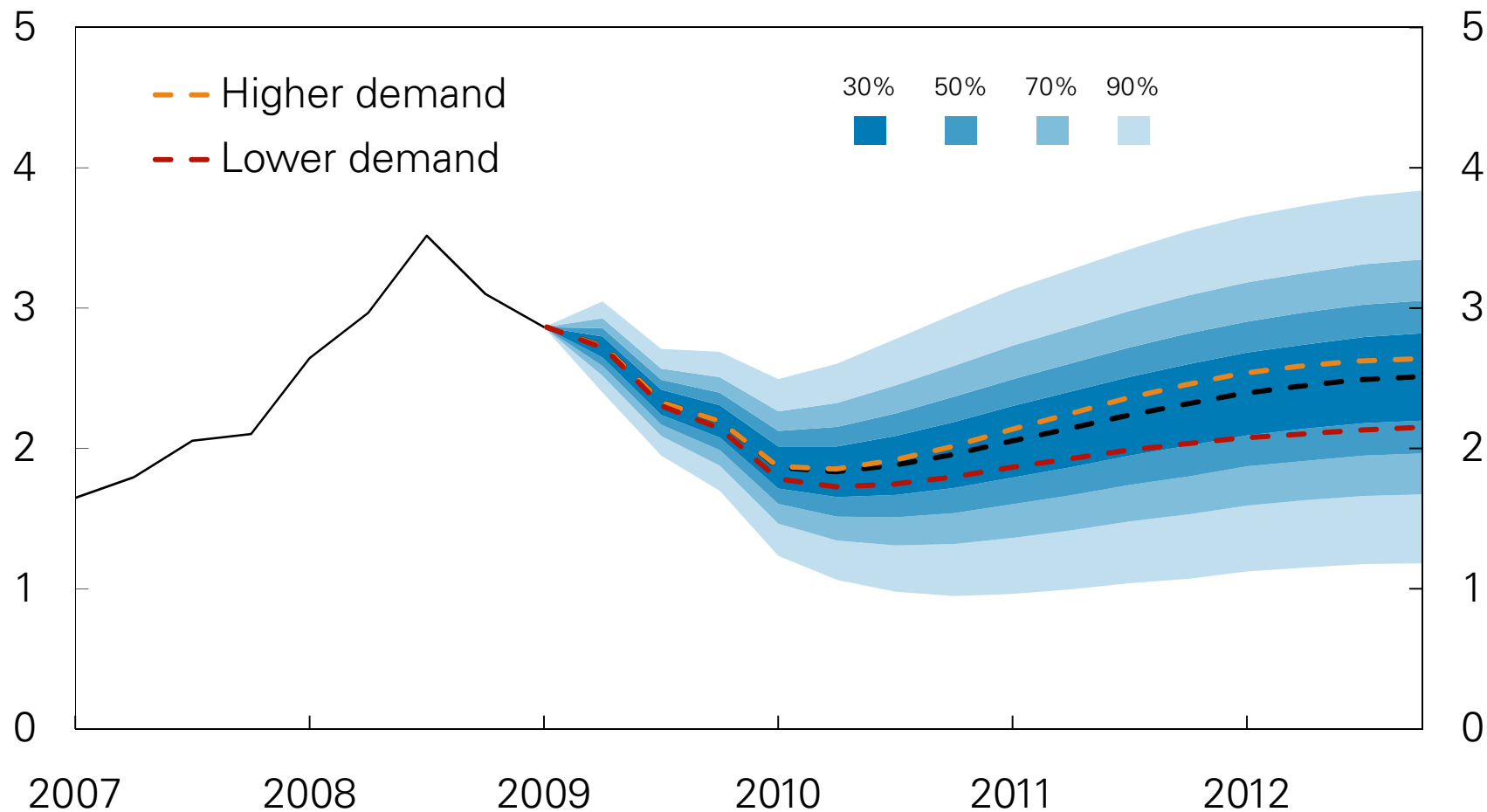
Kilde: Norges Bank

Key elements of Norges Bank communication

1. The interest rate forecast
   - a reasonable balance between the objectives of monetary policy
   - with output gap and inflation forecasts
   - with uncertainty bands

2. Risk scenarios
   - with realistic and consistent interest rate reactions

3. Interest rate account
   - changes in the interest rate forecast
   - partial effects from demand, foreign interest rates, exchange rates and prices and costs

Key rate with uncertainty bands from MPR 3/08
Per cent

Legend:
- – – MPR 3/08
- – – 17.des.08
- – – MPR 1/09

30%   50%   70%   90%

Factors behind changes in the interest rate path since MPR 3/08.
Accumulated contribution. Percentage points. 2009 Q2 – 2011 Q4
Chart 2
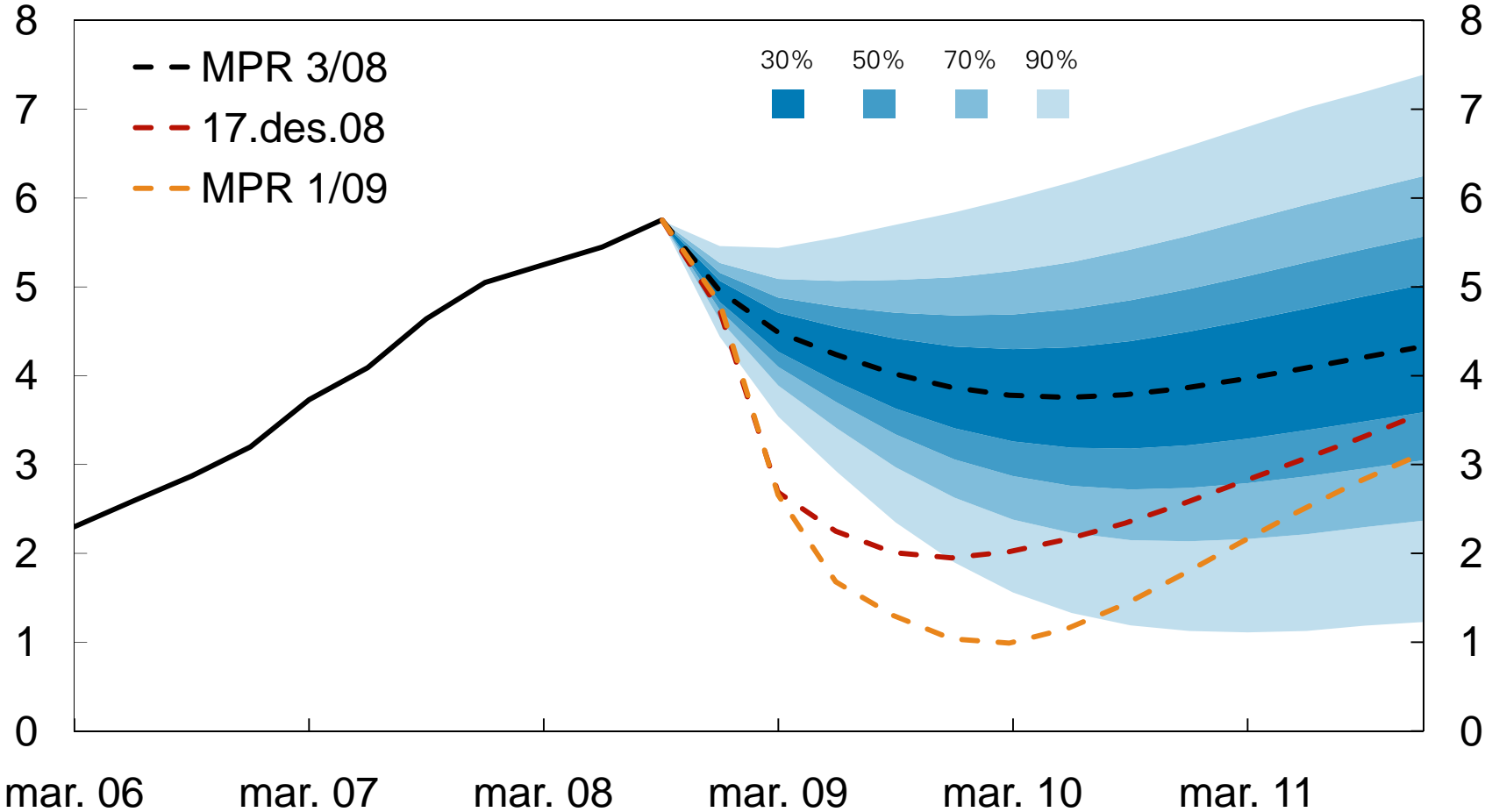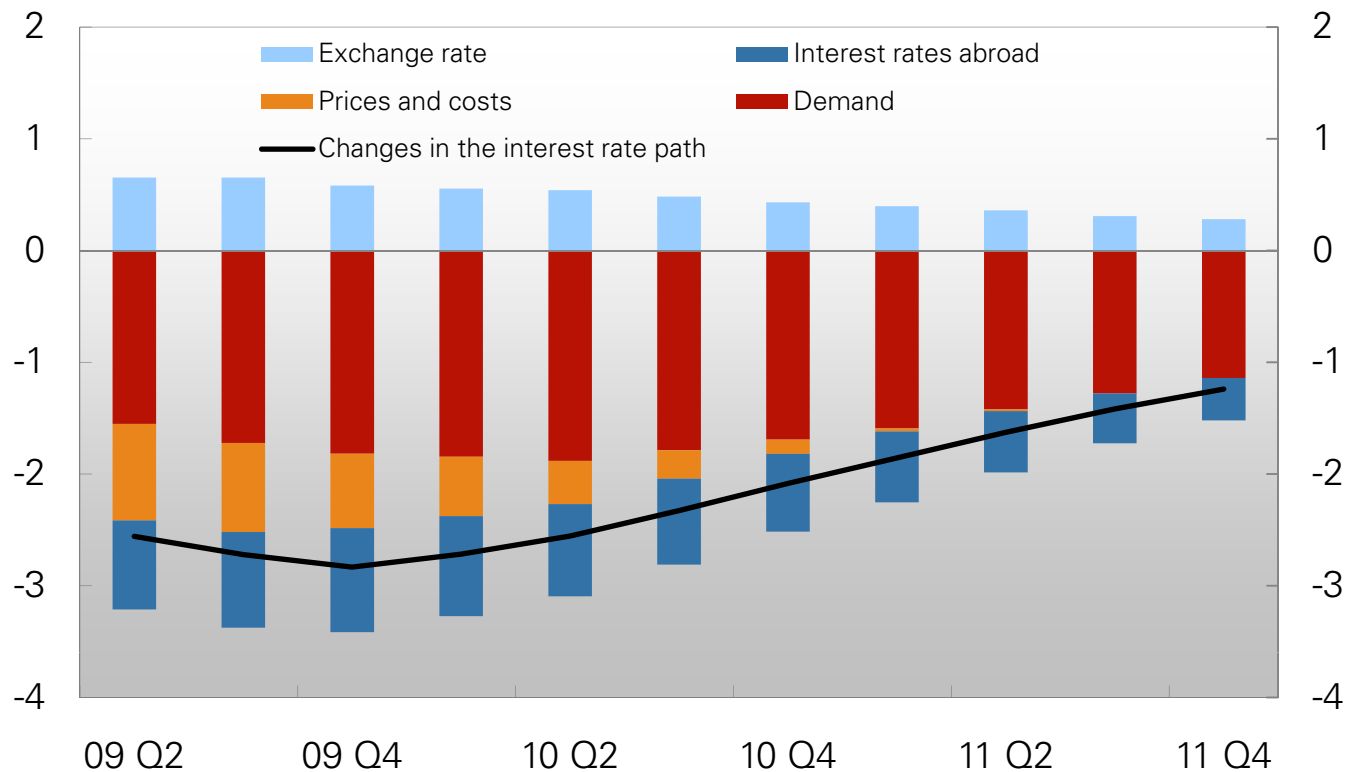
Source: Norges Bank

Factors behind changes in the interest path since 17 December 2008

Accumulated contribution. Percentage points. 2008 Q4 – 2011 Q4

Legend:
- Exchange rate
- Interest rates abroad
- Prices and costs
- Demand
- Changes in the interest rate path
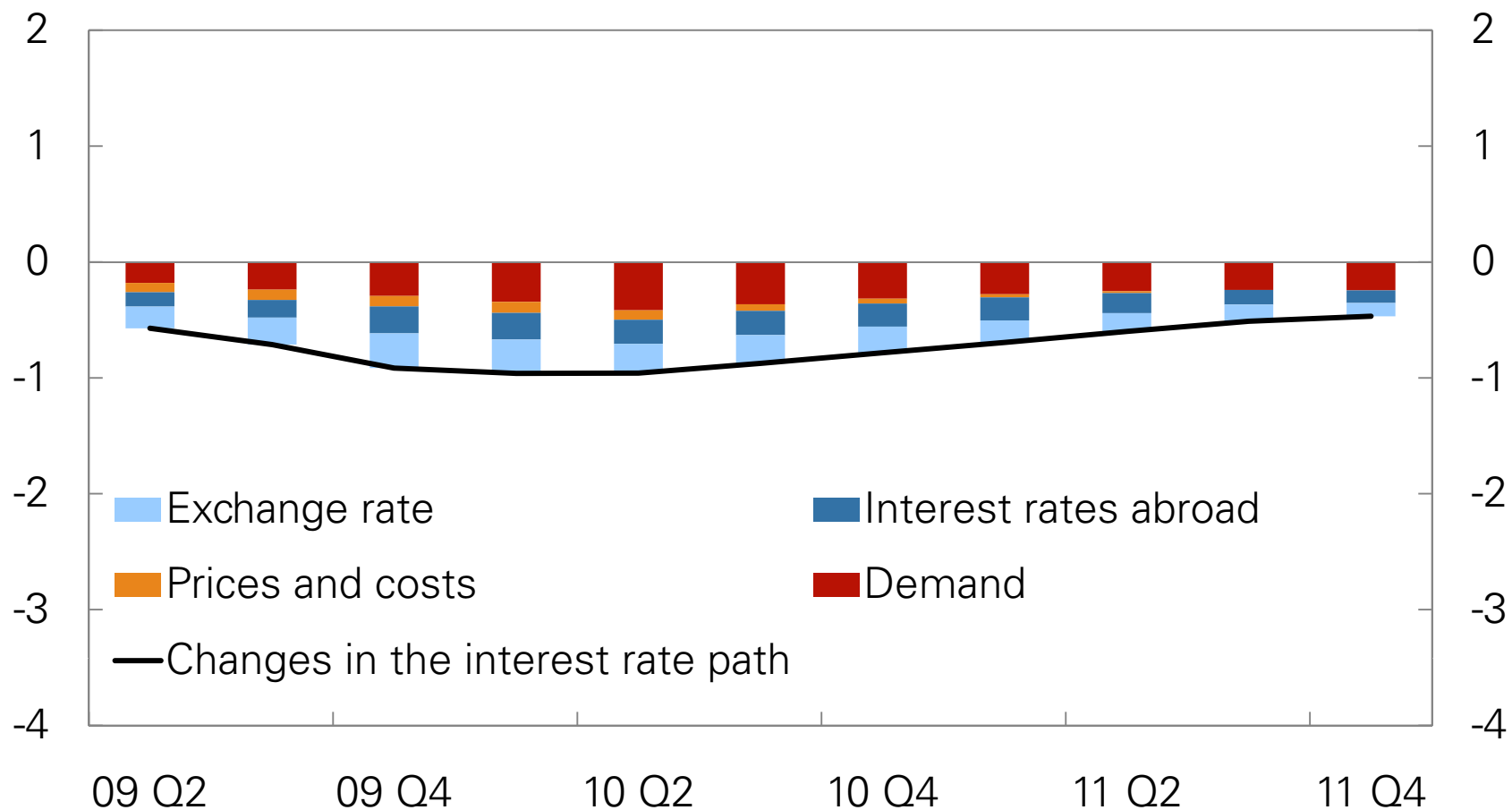
Source: Norges Bank

Everyone talks about the future…

- *"In these circumstances, the Committee believes that policy accommodation can be maintained for a considerable period"*

  (FED, 2003-2004)

- *"…strong vigilance is therefore of the essence to ensure that risks to price stability over the medium term do not materialise."*

  (Trichet, August 2007)

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Verbal deliberations might create confusion

- Claude Trichet, June 5:

  "….the possibility is not excluded that, […], we could decide to move our rates by a small amount in our next meeting in order to secure the solid anchoring of inflation expectations…."

- Claude Trichet, June 25:

  "I didn't say that we could envisage a series of increases. I didn't say that."

Why publish the interest rate projection?

It's the expectations, stupid…

- Monetary policy as management of expectations

  "Central banks generally control only the overnight interest rate, an interest rate that is relevant to virtually no economically interesting transactions." (Blinder, 1998)

  "For not only do expectations about policy matter, but (…) very little else matters." Woodford (2005)

- Interest rate forecasts make it easier to affect expectations $\longrightarrow$ monetary policy more effective

Why do we publish the interest rate projection?

Norges Bank's interest rate assumption from 2001:

- 2001–2002   Constant interest rate

- 2003–2005   Markets' interest rate expectations with comments

  "The most appropriate alternative now seems to be that the interest rate should be kept unchanged for a longer period than indicated by market expectations."   (Inflation Report 2/04)

- 2005–   Our own interest rate forecast

Criteria for an appropriate interest rate path

1. Stabilising inflation close to target in medium term
2. Reasonable balance between the path for inflation and the path for capacity utilisation

In the assessment, potential effects of asset prices are taken into account

Criteria for an appropriate interest rate path

Assuming the above criteria have been satisfied, the following additional criteria are useful

3. Robustness: acceptable developments in inflation and output also under alternative assumptions about the economic situation and the functioning of the economy

4. Gradualism and consistency with previous response pattern

5. Cross-checking: explain systematic deviations from simple monetary policy rules

Money market rates
Per cent. Q1. 2007 – Q4. 2012
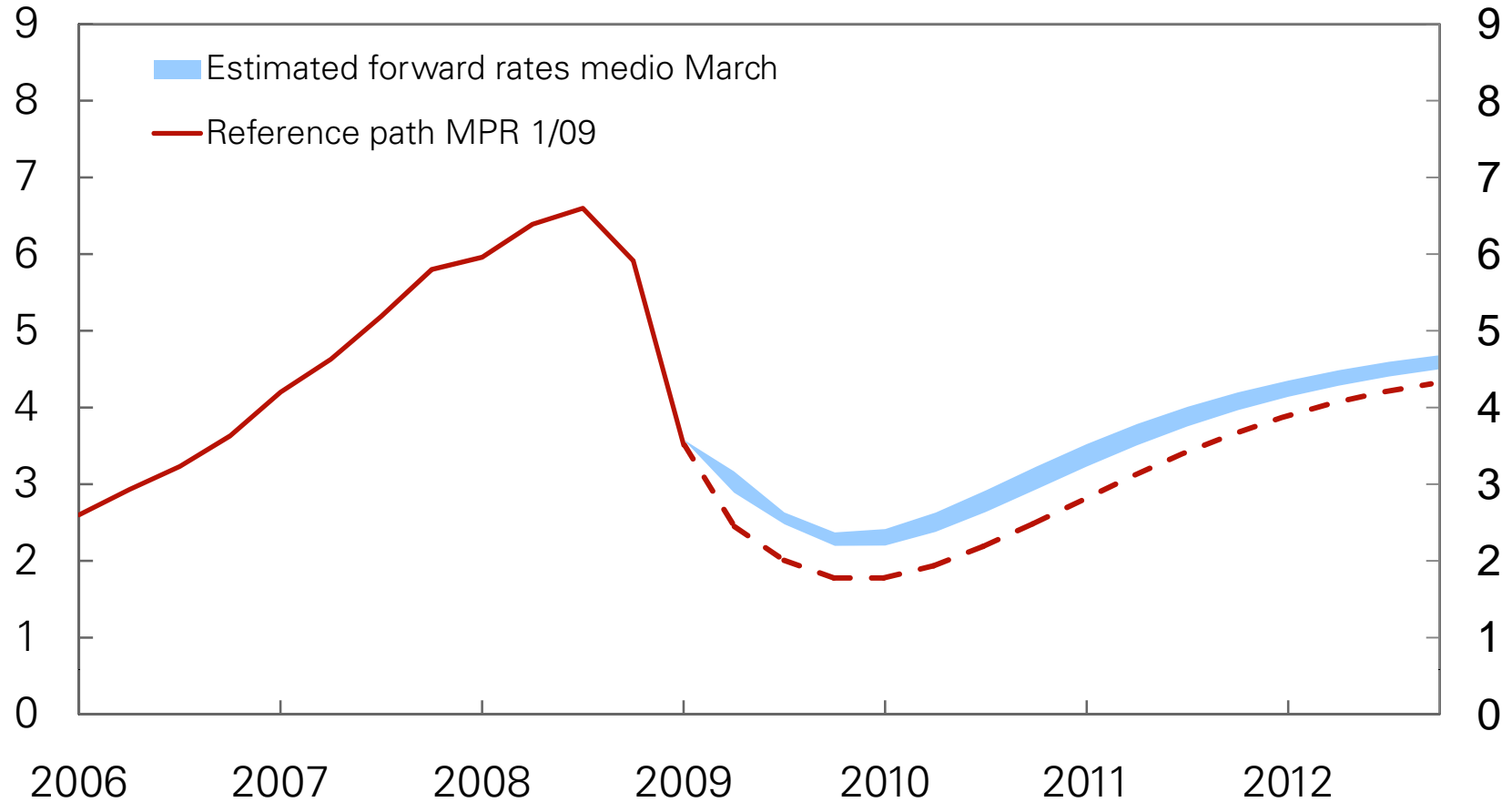
Kilde: Norges Bank

Cross checks

Key policy rate, Taylor rule, growth rule and rule with external rates.
Per cent. 2007 Q1 – 2009 Q3
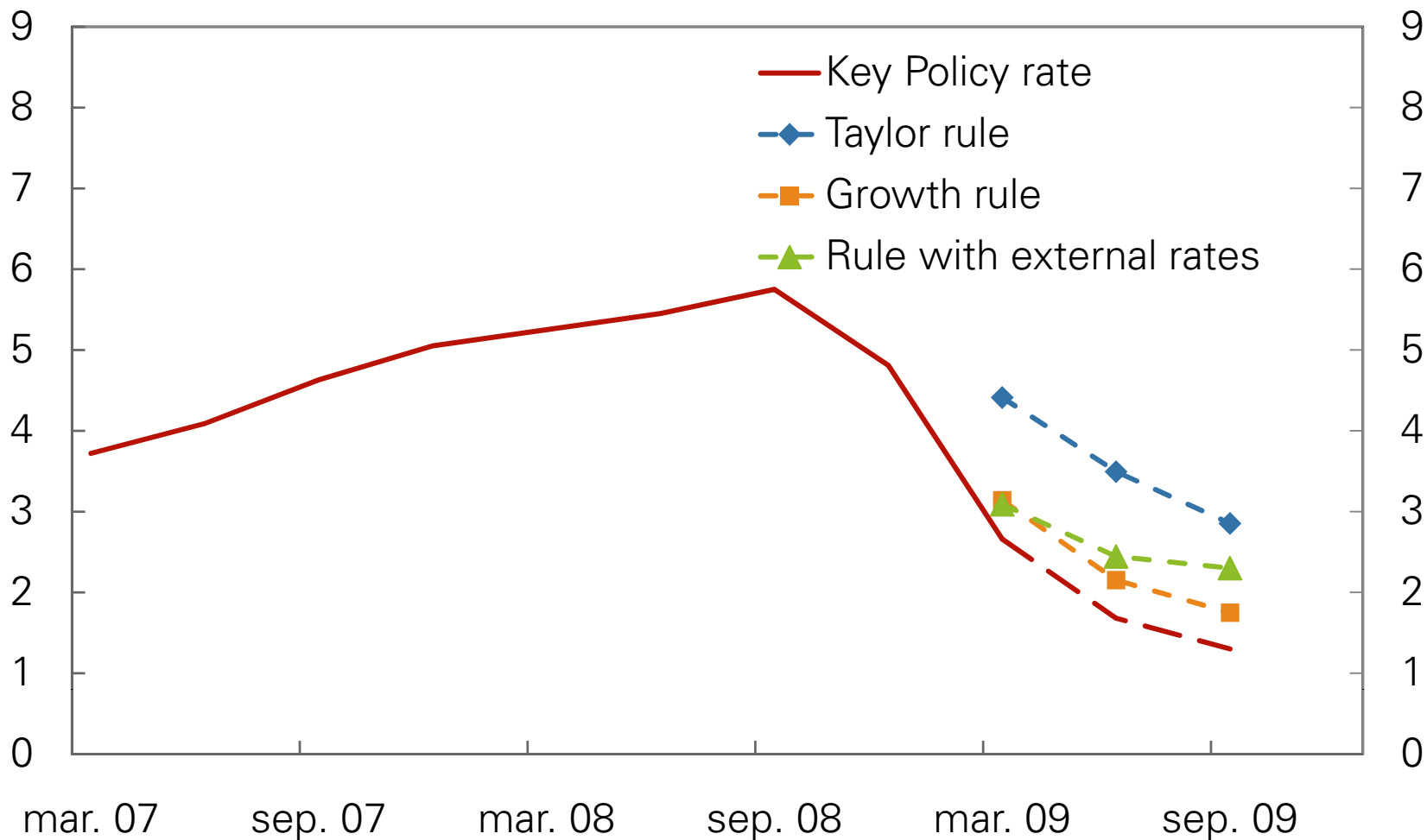
Sources: Statistics Norway and Norges Bank

Cross checks

Norges Bank's average pattern of interest rate setting [1)]
Per cent. 2000 Q1 – 2009 Q3

Interest rate movement that follow from Norges Bank's average patern of interest rate setting with a 90% confidence interval (blue area)

Key Policy rate
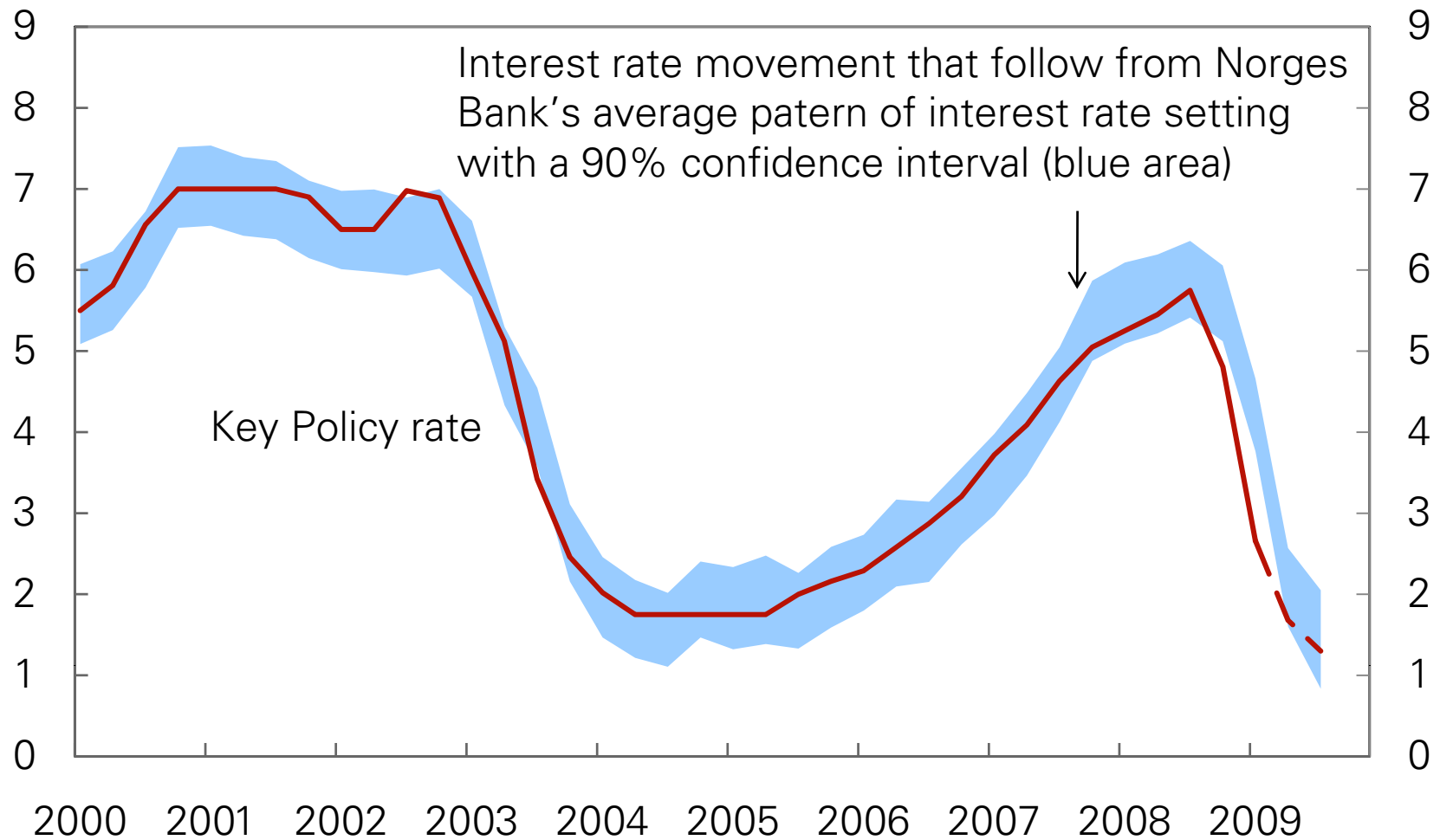
Source: Norges Bank

Economic models at Norges Bank

What do we use economic models for?

- Analysis of the current economic situation and identification of shocks

- Projections

- Impose discipline and ensure consistency over time

- Policy analysis and analysis of risks and uncertainty

- Communication ('story-telling')

"All models are wrong. Some are useful." (George Box)

The suite of models approach
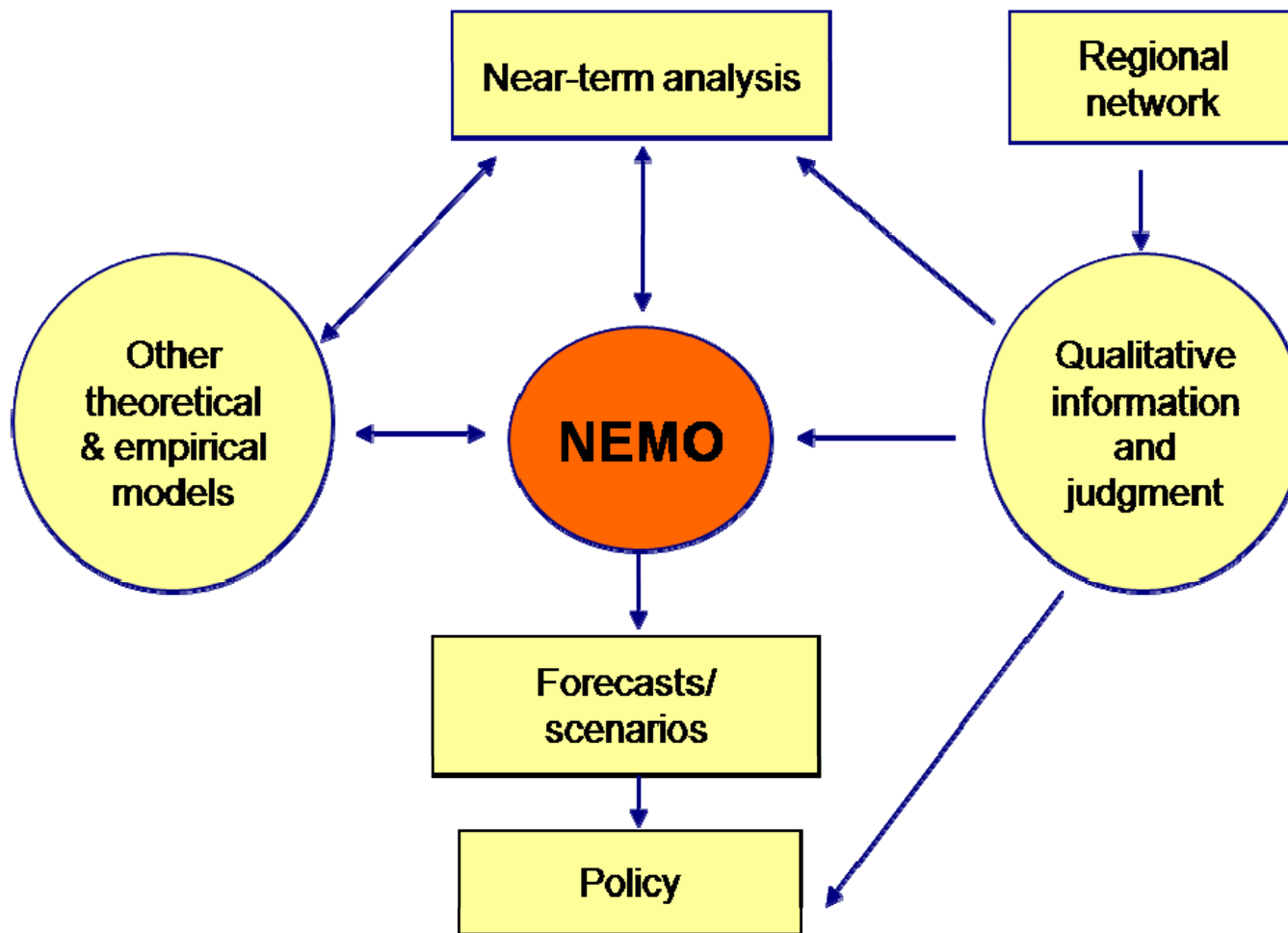
Outside the core model
Nowcasting system

- Short-term forecasting models for inflation and GDP

- Combines forecasts from different models based on past forecasting performance

- Examples of models in nowcasting system

  - Vector autoregressions (VARs)

  - Factor models

  - Autoregressive (AR) and Autoregressive Moving Average (ARMA) models

  - Term structure models

  - Survey indicator models

Outside the core model
Regional network

- Established in 2002

- Purpose

  - Obtain timely information about the stance of the economy

  - Obtain information not available in official statistics

- Organisation

  - Norway divided into 7 regions

  - Five rounds per year (each round comprises about 300 visits)

  - Firms selected to reflect the production structure of the economy (industry/geography)

The suite of models approach
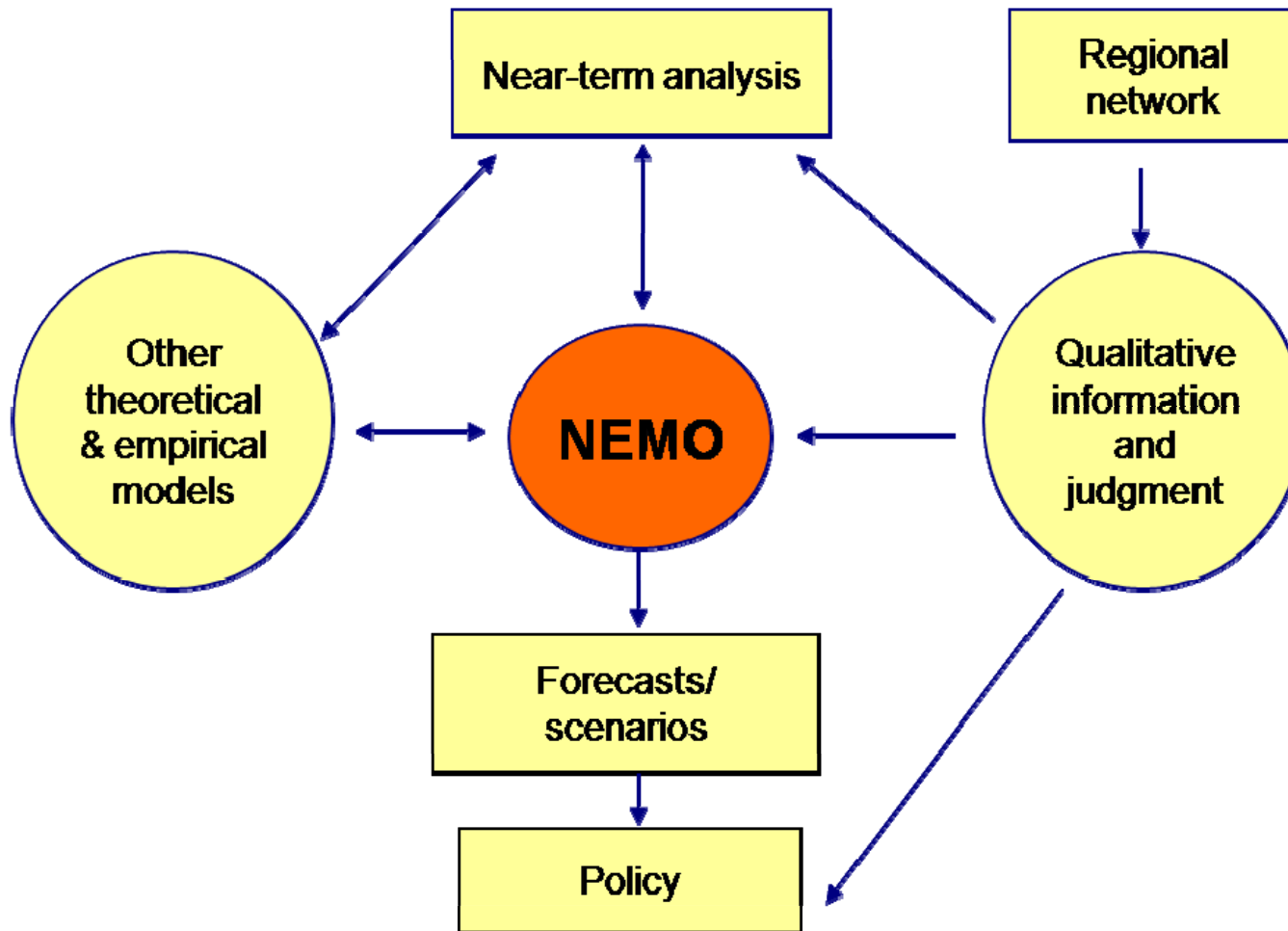
What is NEMO?

- ▶ Core model used by the Monetary Policy Department in the preparation of the interest rate path
- ▶ Dynamic Stochastic General Equilibrium (DSGE) model
  - ▶ Explicit microfoundations:
    - ▶ Equations derived from explicit optimization problems of households and firms
    - ▶ Model consistent expectations
  - ▶ New Keynesian features:
    - ▶ nominal rigidities
    - ▶ imperfect competition
  - ▶ Classical long-run properties:
    - ▶ no trade-off between inflation and unemployment
    - ▶ monetary policy determines inflation

Norwegian Economy Model (NEMO)
Monetary policy transmission mechanism

Distinguish between three channels

•The demand channel

•The exchange rate channel

•The expectations channel
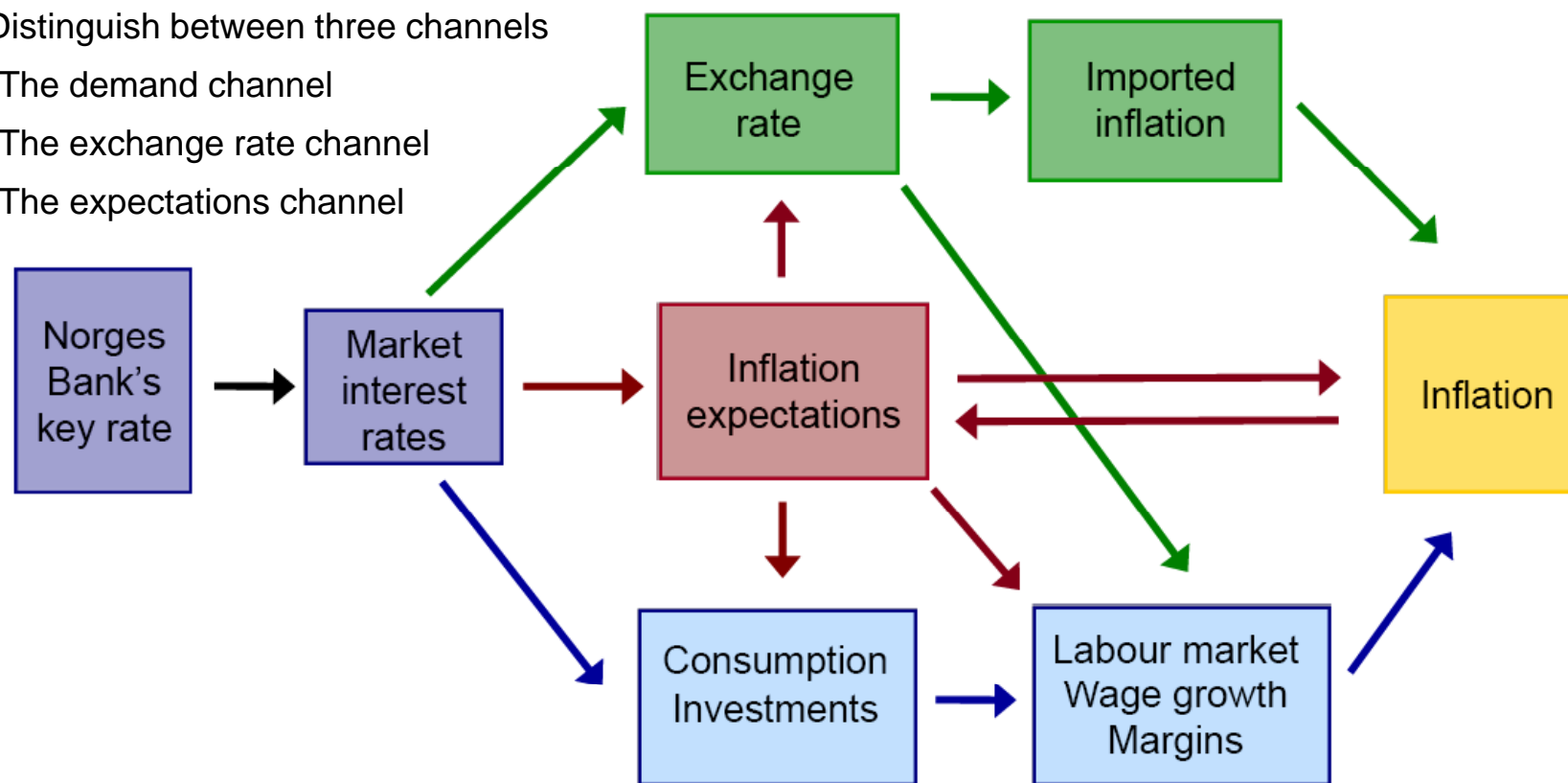
Shock decomposition

Why has inflation been so low?
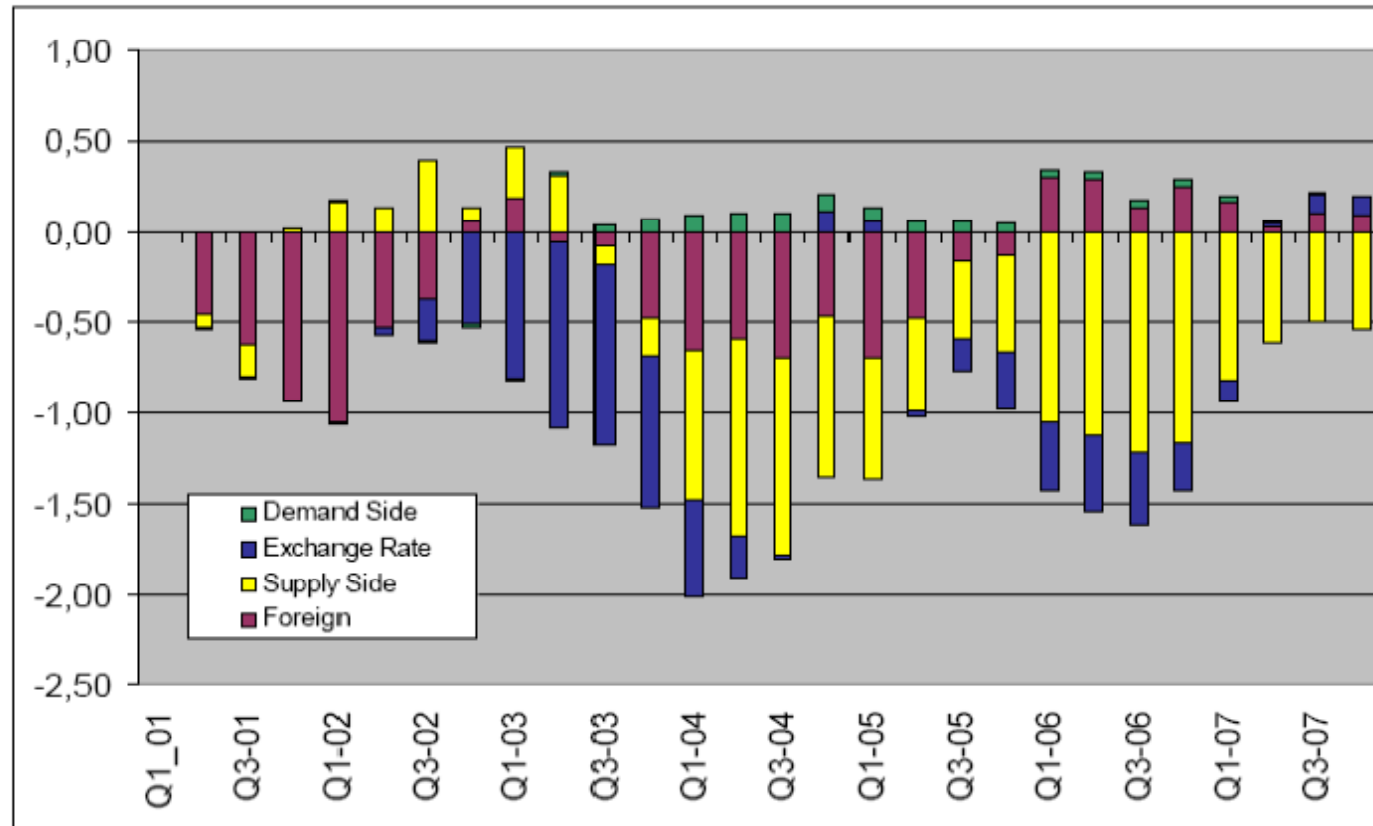
Norwegian Economy Model (NEMO)
Key assumptions

- Quarterly, small open economy model

- Three types of agents: Households, firms and government

- Two production sectors: intermediate goods and final goods

- Two factor inputs: labour and capital

Norwegian Economy Model (NEMO)
Key assumptions cont'd

- Market structure:

  - Imperfect competition in labour and intermediate goods markets

  - Perfect competition in market for final goods

- Nominal price- and wage stickiness

- Balanced growth

- International market segmentation

Norwegian Economy Model (NEMO)
Overview of the real side
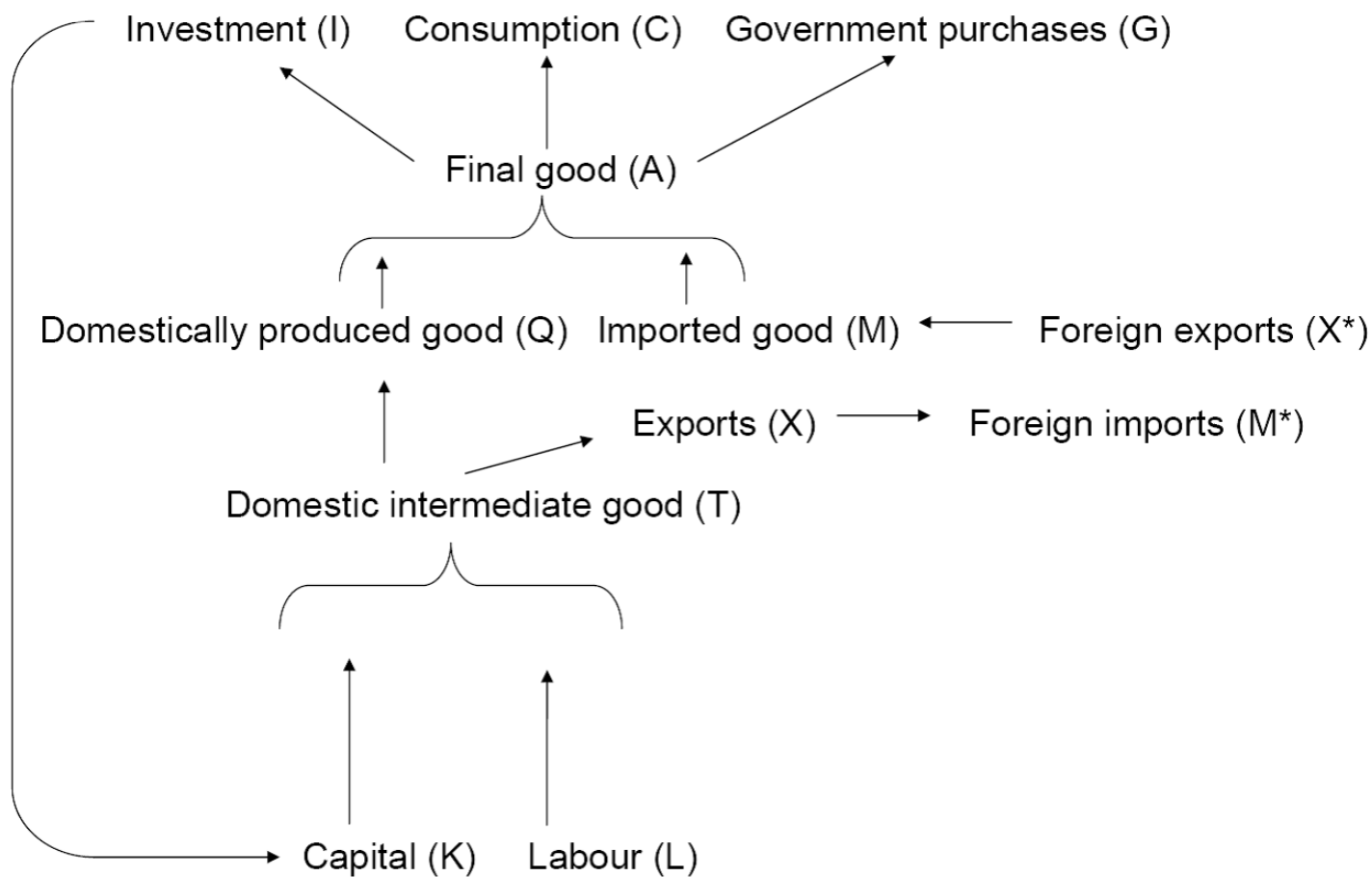
Model structure

Households

- Households maximise expected lifetime utility subject to an intertemporal budget constraint

- Consumption Euler equation

$$c_t = (1 - \alpha_1)c_{t-1} + \alpha_1 E_t c_{t+1} - \alpha_2 (r_t - E_t \pi_{t+1}) + z_t^c$$

where

$$rr_t = r_t - E_t \pi_{t+1}$$

- Solving forward

$$c_t = c_{t-1} - \alpha_3 \sum_{i=0}^{\infty} E_t rr_{t+i} + \alpha_5 z_t^c$$

Model structure
Households

- Each household supplies a differentiated labour service and sets wages subject to quadratic adjustment costs
- Wage Phillips curve

$$\pi_t^w = (1 - \alpha_6)\pi_{t-1}^w + \alpha_6 E_t \pi_{t+1}^w + \alpha_7(w_t^* - w_t) + z_t^w$$

- Alternative representation

$$
\begin{aligned}
\pi_t^w &= (1 - \alpha_6)\pi_{t-1}^w + \alpha_6 E_t \pi_{t+1} \\
&\quad + \alpha_8(\alpha_9 c_t + \alpha_{10}\Delta c_t + \alpha_{11}l_t - \alpha_{12}(y_t - l_t) - \alpha_{13}mc_t) + z_t^w
\end{aligned}
$$

Model structure

Households

- ► Households invest in foreign and domestic bonds
- ► The 'risk premium' on foreign bonds is a function of the economy's net foreign asset position
- ► Modified UIP condition for the real exchange rate

$$s_t = E_t s_{t+1} - rr_t + rr_t^* - \alpha_{14} b_t^* + z_t^*$$

Model structure
Intermediate goods firms

- Large number of firms selling differentiated goods in monopolistically competitive markets

- Production function for a representative firm

$$y_t = \alpha_{15}\overline{k}_t + (1 - \alpha_{15})l_t + (1 - \alpha_{15})z_t^i$$

- Level of effective capital can be adjusted by varying the degree of capital utilisation

- Varying the investment to capital ratio incurs quadratic adjustment costs

- Investment equation

$$i_t - k_{t-1} = \alpha_{16}E_t(i_{t+1} - k_t) + \alpha_{17}(i_{t-1} - k_{t-2}) - \alpha_{18}rr_t + \alpha_{19}Er_t^K + z_t^i$$

Model structure

Intermediate goods firms

- ▶ Firms set distinct prices in domestic and foreign market subject to quadratic costs of price adjustment
- ▶ Local currency pricing: prices are set in the currency of the buyer
- ▶ Phillips curve for domestic inflation

$$\pi_t^q = (1 - \alpha_{20})\pi_{t-1}^q + \alpha_{20}E_t\pi_{t+1}^q - \alpha_{21}(p_t^q - mc_t) + z_t^q$$

- ▶ Solving forward

$$\pi_t^q = \pi_{t-1}^q - \alpha_{22}\sum_{i=0}^{\infty}\alpha_{23}^i E_t(p_{t+i}^q - mc_{t+i}) + \alpha_{24}z_t^q$$

Model structure

Foreign firms

▶ Symmetric modelling of foreign firms yields Phillips curve for imported inflation

$$\pi_t^m = (1 - \alpha_{25})\pi_{t-1}^m + \alpha_{25} E_t \pi_{t+1}^m - \alpha_{26}(p_t^m - mc_t^* - s_t) + z_t^m$$

Model structure

- ▶ Domestic and imported intermediate goods are combined to form a final good
- ▶ Total demand for final goods in domestic economy

$$a_t = c_t + i_t + g_t$$

- ▶ Aggregate demand for domestic goods

$$y_t = a_t + s_t p_t^{m*} m_t^* - p_t^m m_t$$

Estimation
Method

- ▶ Estimate model using Bayesian techniques:
  - ▶ combine information from data with prior information (e.g., from micro data, other empirical analyses)
  - ▶ generate probability distributions for the parameters conditional on the observed data
- ▶ Use quarterly data for Norwegian mainland economy from 1981-2007
- ▶ Domestic variables used in estimation: GDP, private consumption, business investment, exports, hours, real wages, exports, inflation (CPI-ATE), imported inflation, nominal interest rate, real exchange rate
- ▶ Main software tool: MATLAB/DYNARE

Norwegian Economy Model (NEMO)
Monetary policy

- When publishing interest rate forecasts, one has to consider how to model monetary policy

- Two choices for modelling monetary policy

  - Simple instrument rule

  - Optimal policy approach (minimise loss function)

- Example of simple rule

$$r_t = \alpha_{13}r_{t-1} + (1 - \alpha_{13})(\alpha_{14}\pi_t + \alpha_{15}y_t) + z_t^r$$

Norwegian Economy Model (NEMO)
Optimal policy approach

- Set interest rate to minimise

$$E_t \sum_{j=0}^{\infty} \beta^j \left[\pi_{t+j}^2 + \alpha_{16} y_{t+j}^2 + \alpha_{17} \left(r_{t+j} - r_{t+j-1} \right)^2 \right]$$

subject to the equations describing private sector behaviour and market clearing conditions

Norwegian Economy Model (NEMO)
Optimal policy approach

- Discretion

  - Re-optimize each period

  - Take expectations as given

- Commitment

  - Seek to affect private expectations

  - Ramsey rule

    - Re-optimize today, but commit in all future periods

    - Dynamically inconsistent

  - Timeless perspective: act as if you committed long time ago

Useful references

- Monetary policy in Norway
  - www.norges-bank.no
  - Occasional Paper No 34 (chapter 7) (only in Norwegian)
- Communicating monetary policy
  - Holmsen et al. (2007): "Implementing and communicating optimal monetary policy", Staff Memo 2007/3
- Models
  - Brubakk et al. (2006): "Finding NEMO", Staff Memo 2006/6
  - Brubakk and Sveen (2008): "NEMO – en ny makromodell for prognoser og pengepolitisk analyse", Penger og Kreditt 1/2008
  - Bjørnland et al. (2008): "Improving and evaluating short term forecasts at the Norges Bank", Staff Memo 2008/3

Monetary policy in practice

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