

Inflation Targeting and Optimal Monetary Policy

Michael Woodford
Columbia University

Intro

- Inflation targeting an increasingly popular approach to conduct of monetary policy worldwide
 - associated with reductions in both average level and volatility of inflation
- Largely developed by central banks with little guidance from academic literature on monetary policy rules
- How does it compare with the ideal monetary policy that would be recommended on the basis of current theory?

Overview of conclusions:

- IT incorporates a number of important features of optimal policy:
 - an explicit target for policy, announced in advance
 - publication of projections on which policy decisions are based
 - greater (though not exclusive) emphasis on price stability
- Yet current practices also fall short of the theoretical ideal in several respects

Features of IT

In its most developed form: *inflation-forecast targeting*

- A publicly stated *target* for some measure of inflation
- Commitment to a *decision procedure* under which CB will adjust its instrument as necessary in order to ensure that economy's projected evolution satisfies a *target criterion*
 - example of what Svensson calls a “targeting rule”
 - in practice: inflation to equal the target value at a certain horizon
- Regular publication of *Inflation Reports* that justify recent policy decisions in the light of these projections

Advantages of an Explicit Target

- The most important achievement of IFT: commitment to an explicit target
 - as opposed to the precise nature of the target
- A traditional prejudice of central bankers: unwise to commit, in order to preserve flexibility to respond to unanticipated developments
- Isn't this obviously prudent, if one can appoint someone competent to the job?
 - No, because forward-looking private-sector behavior makes it important for central bank to affect *expectations* about future policy

- Effective central banking depends on *management of expectations*
 - *Current level* of funds rate of little importance: policy effective by changing *expected future path* of overnight rates
 - When Fed affects expectations in the way desired, “bond market does its work for it”
 - Efforts to signal future policy especially important when zero lower bound is a relevant constraint (Japan, US now?)
 - Eggertsson and Woodford (2003): advantages of a *price-level target* as a way of creating the expectations that ward off a deflationary contraction

- Explicit targets useful approach to communication about future policy under normal circumstances as well
- *Inflation Reports* an especially effective means of clarification of policy commitments
 - can clarify nature of *state-contingent* policy by showing how decisions have been made in particular cases that have arisen
 - allows *verification* of CB's commitment to its target
 - *projected future path* of economy is what private sector most needs to know

- Not enough simply to *follow* a rule, without having also to *explain* it?
- If people have RE, explanation does *no harm*; so a more *robust* approach
- A better outcome if people must *learn*: see analysis of Orphanides and Williams (2005)
 - better output/inflation variability tradeoff available if private sector *knows* the long-run average inflation rate, and only must estimate dynamics of transitory fluctuations around it

- Advantages of a *targeting rule* as way of specifying a policy commitment
 - can improve upon simple rules by allowing *optimal responses to shocks*, in addition to anchoring long-run inflation expectations
 - More *practical* than attempting to explicitly commit oneself to an optimal *state-contingent instrument path*
- Giannoni and Woodford (2002) show the possibility of deriving a *robustly optimal* target criterion
 - commitment to *same* target criterion is optimal, *regardless* of the statistical properties of disturbances
 - necessary for commitment to be appealing in practice
 - see also Svensson and Woodford (2003), Svensson (2003)

Improving Upon Current Practice

- An optimal target criterion would involve more than just inflation
 - Numerous examples: Svensson and Woodford (2005), Giannoni and Woodford (2005)
 - Other variables that plausibly enter:
 - output gap
 - wage as well as price inflation (or real wage growth)
 - other relative prices (or sectoral, regional inflation)
 - nominal interest rate
- Optimal target criteria for an empirical model: Giannoni and Woodford (2005)

- Explicit commitment needed to a *near-term* target criterion, not just “medium-term” target
 - Need to say *by what path* it is appropriate to return to the medium-term target following a disturbance
 - Otherwise, commitment is vague at best, as to how policy will actually be conducted
- Example: Giannoni-Woodford rule: target criteria place greatest weight on projections for 1 or 2 quarters in future
 - Does not mean that optimal response to disturbance may not involve only *gradual* return to steady state, over period of years
 - the point is to state the criterion that must hold *along the transition path*, which determines both the *degree* of permissible temporary departure from the medium-term target, and the appropriate *speed* of return

- The fact that target criterion is only a *medium-term* target explains the sole emphasis on inflation in the explicit target
 - Other goals presumably determine the choice of transition path
 - But arguments for explicit commitment apply here as well

- Optimal target criteria *do imply* a fixed target for the long-run rate of inflation
 - but commitment to that alone would be an *incomplete* policy commitment, that fails to uniquely determine REE
 - hence would not even determine what CB must *do* to comply

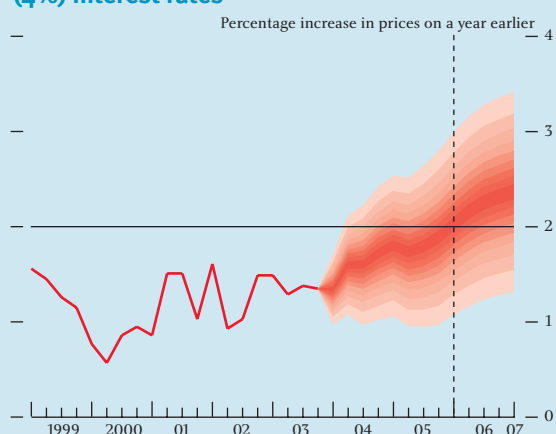
- CBs may believe that commitment cannot be made about transition path, because it will depend on the *nature of the individual disturbance*
- But Giannoni and Woodford (2002) show precisely that it is possible to state a near-term target criterion that identifies the optimal transition path *regardless* of the nature of the disturbance

Assumptions About Future Policy in Inflation-Forecast Targeting

- Point on which even the leading IFT CBs are less than fully transparent: their view of their own *likely future conduct of policy*
 - projections reported as basis for policy deliberations often *avoid* making any assumption about this
- Two popular ways of avoiding this issue:
 - projections conditional upon *constant interest rate* over forecast horizon: current rate assumed to be maintained [Riksbank; BoE before 8/04]
 - projections conditional upon *market expectations* of the forward path of interest rates, inferred from term structure [BoE since 8/04]

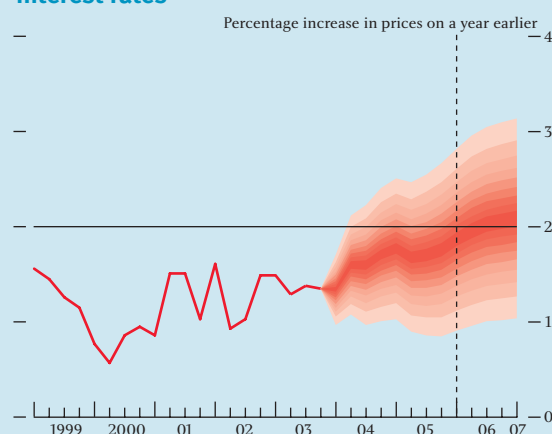
- Problems with CIR projections:
- Forward-looking models often imply equilibrium *indeterminate* under this assumption, so *can't answer* whether projection satisfies criterion
- Backward-looking models often imply *unstable dynamics* under this assumption, so hitting inflation target at a *single horizon* an unappealing criterion
 - apparently true of BoE projections
- Assumed forward path may *not* be consistent with bank's own beliefs
 - often not consistent with the projection itself!
 - then what interpretation of the exercise?

Chart A
February 2004 CPI projection under constant (4%) interest rates



It should also be stressed that the profile for official interest rates derived from the market yield curve merely offers a convenient benchmark assumption. Even if market participants and the MPC have a common view about the economic outlook, the MPC may decide that it is

Chart B
February 2004 CPI projection under market interest rates



appropriate for official interest rates to follow a different path from that implied by the yield curve in order to achieve its *Remit*. Moreover, as emphasised in the main text, the economy is most unlikely to evolve along the path described by the central projection.

associated with more subdued consumption growth than in previous periods. So it seemed possible that a sharp decline in house price inflation would not imply a substantial weakening of household spending. Nevertheless, the MPC believes that a housing market turnaround would restrain future consumer spending to some extent. And with real household disposable income no longer rising so rapidly, consumption is likely to grow at just below its long-run average rate for much of the next two years. Compared with May, prospective consumption growth is a little weaker in the first year, but broadly the same further out.

Business investment

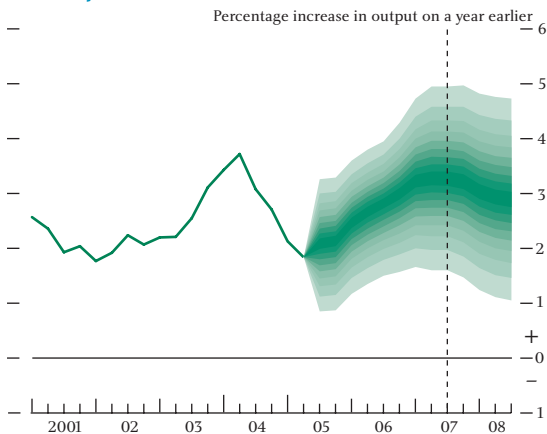
The recovery in business investment since early 2003 continued. Further growth is likely, as recent indicators of investment intentions suggest. Recoveries in investment during the past 25 years have typically seen four-quarter business investment growth of around 20% or more. The MPC does not expect such a surge to be repeated during the current upturn. The slowdown in investment was more muted than in previous cycles. Moreover, corporate debt remains high relative to assets and income. So firms may be less willing to borrow during the coming years and that may limit companies' investment spending growth. The MPC expects investment to grow a little faster than GDP during the forecast period. Compared with May, business investment growth is marginally stronger in the near term, but weaker further out.

- Projections based on market expectations:
 - avoids such obvious discrepancy between assumption about future policy and bank's own likely beliefs
- But *still subject* to the objections listed above
 - eq'm *indeterminate* in forward-looking model
 - eq'm *unstable* in backward-looking model
 - exercise self-contradictory if market expectations are *not* those of the CB itself

- Apparently more sophisticated variant of ME method: assume a *policy rule* such as Taylor rule, with a variable intercept
 - choose the *intercept sequence* so that projected interest-rate path coincides with market expectations
- But: this *doesn't* solve the problem of indeterminacy in forward-looking model, nor the problem of instability in backward-looking model
- Further problem: if the intercept shifts are treated as *policy surprises*, exercise is inconsistent:
 - projection implies that this interest-rate path will occur, but *should not be expected* by private sector

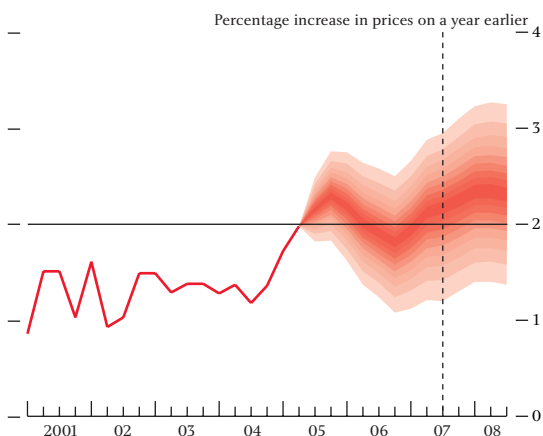
- Use of ME also creates *new* problem:
 - possible instability due to *self-fulfilling expectations* (in the economy, as opposed to CB's projections)
- How new decision procedure at BoE appears to work:
 - if projection based on market expectations *satisfactory*, then BoE adjusts repo rate to *conform to expected path*
 - 25 bp rise in 8/04, then held constant in 11/04 and 2/05; again held constant in 11/05
 - even when projection *not* satisfactory, policy action may nonetheless follow market expectations (8/05)
- Problem: if CB delivers *whatever interest rate is forecasted* by markets, nothing anchors what that forecast should be!

Chart 1
Current GDP projection based on market interest rate expectations



The fan chart depicts the probability of various outcomes for GDP growth in the future. If economic circumstances identical to today's were to prevail on 100 occasions, the MPC's best collective judgement is that GDP growth over the subsequent three years would lie within the darkest central band on only 10 of those occasions. The fan chart is constructed so that outturns of GDP growth are also expected to lie within each pair of the lighter green areas on 10 occasions. Consequently, GDP growth is expected to lie somewhere within the entire fan chart on 90 out of 100 occasions. The bands widen as the time horizon is extended, indicating the increasing uncertainty about outcomes. See the box on pages 48–49 of the May 2002 *Inflation Report* for a fuller description of the fan chart and what it represents. The dashed line is drawn at the two-year point.

Chart 2
Current CPI inflation projection based on market interest rate expectations



The fan chart depicts the probability of various outcomes for CPI inflation in the future. If economic circumstances identical to today's were to prevail on 100 occasions, the MPC's best collective judgement is that inflation over the subsequent three years would lie within the darkest central band on only 10 of those occasions. The fan charts are constructed so that outturns of inflation are also expected to lie within each pair of the lighter red areas on 10 occasions. Consequently, inflation is expected to lie somewhere within the entire fan chart on 90 out of 100 occasions. The bands widen as the time horizon is extended, indicating the increasing uncertainty about outcomes. See the box on pages 48–49 of the May 2002 *Inflation Report* for a fuller description of the fan chart and what it represents. The dashed line is drawn at the two-year point.

and early 2004, output subsequently slowed more sharply. But business surveys and reports from the Bank's regional Agents suggest that the slowdown may have been less marked than implied by the current vintage of official data. The Committee has given some weight to that evidence in evaluating the recent pace of expansion.

Chart 1 shows the MPC's assessment of the outlook for four-quarter GDP growth under the assumption that official interest rates follow a path implied by market yields. In the central projection, output growth remains subdued in the near term, reflecting the continued sluggishness of domestic demand. Output growth then picks up as the impetus from recent movements in asset prices works through to consumption, investment and net trade. The profile is weaker in the near term than in the *May Report*, but stronger further out.

Costs and prices

Consistent with the loss of momentum in activity, total hours worked fell in the three months to May and claimant-count unemployment edged higher. Reports from the Bank's regional Agents point to a further easing in employment growth. Settlements in the private sector edged up, but regular pay growth eased. Unit labour cost growth picked up on the back of decelerating productivity, but only to around recent averages.

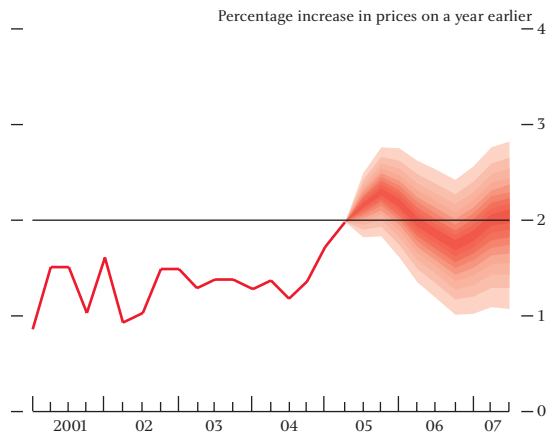
Other cost pressures were mixed. Manufacturers' input price inflation rose, reflecting higher fuel prices, but output price inflation eased from its recent high levels. The available indicators for services output prices, though mixed, on balance point to little change in inflationary pressures in that sector. The prices of imported consumer goods have stopped falling.

CPI inflation edged up to 2.0% in June. The pickup in CPI inflation since last year is likely to reflect both the direct and indirect impacts of higher oil prices as well as the pressure of demand on supply in the first half of last year.

The outlook for inflation

Chart 2 shows the Committee's assessment of the outlook for CPI inflation, also assuming that official interest rates move in line with market yields. Under the central projection, inflation moves above the 2% target and then dips, as the impact of recent increases in oil prices wanes and pressures on capacity ease. Inflation then rises above the target once more, as output growth picks up and the contribution from import prices increases. Compared with May, the profile is a little higher in the near term and also somewhat higher in the final year of the projection.

Chart 3
Current CPI inflation projection based on
constant nominal interest rates at 4.5%



See footnote to Chart 2.

Chart 3 shows the corresponding projection for inflation assuming that interest rates are maintained at their current level of 4.5%. Output growth is a little weaker under this assumption, and the pickup in inflation towards the end of the projection is consequently less marked.

As usual there are substantial risks surrounding the central projections. These include: the momentum in consumer spending; the sources of the recent pickup in inflation; and the prospect for oil prices. There is a range of views among members, but the Committee judges that, relative to the central projection, the overall balance of risks to growth is slightly to the downside in the near term. The balance of risks to inflation is correspondingly slightly to the downside further out.

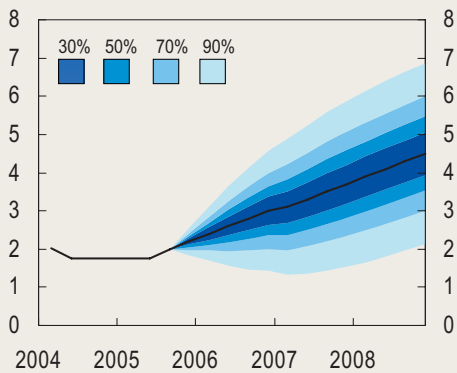
The policy decision

At its August meeting, the Committee noted that under the central projection conditioned on market interest rates, annual output growth remained subdued in the near term but grew briskly thereafter, with inflation rising to, and then above, the target two or so years ahead. The Committee also noted that under the central projection conditioned on a constant interest rate of 4.5%, growth was projected to be a little weaker, with inflation close to the target at the two-year horizon. In the light of this outlook, and bearing in mind the balance of risks, the Committee judged that a reduction of 0.25 percentage points in the repo rate to 4.5% was necessary to keep inflation on track to meet the target in the medium term.

- Only approach that avoids these problems: base projection on assumption of future policy determined by a *policy rule*, that
 - (i) indicates how interest rates will respond to fluctuations in inflation, output, and
 - (ii) is regarded by CB as a reasonable representation of its “typical” behavior

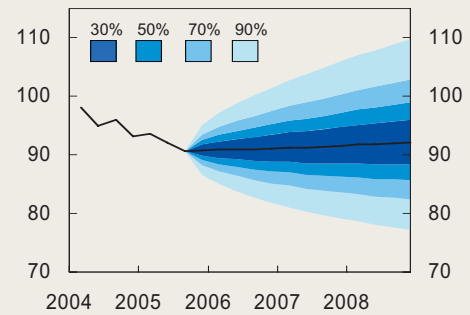
— approach used by RBNZ (and Norges Bank since 11/05)
- Objection: assumption about future policy will be misunderstood to represent a *commitment*, constraining future policy
 - apparently not a problem in New Zealand
 - Norges Bank: use of a “fan chart”, alternative scenarios helps to make clear that the path is not a commitment

Chart 1.5a The sight deposit rate in the baseline scenario with fan chart. Per cent. Quarterly figures. 04 Q1 – 08 Q4



Source: Norges Bank

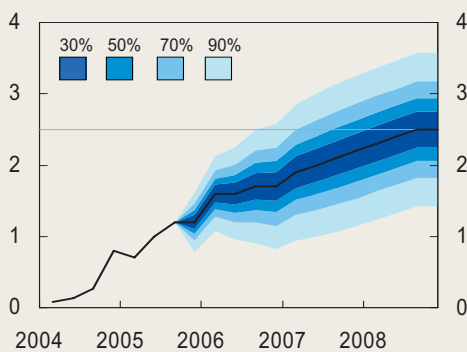
Chart 1.5b Import-weighted exchange rate (I-44)¹⁾ in the baseline scenario with fan chart. Quarterly figures. 04 Q1 – 08 Q4



¹⁾ A rising curve denotes a weaker krone exchange rate. It is assumed that strengthening by a certain percentage is just as likely as weakening by the same percentage.

Source: Norges Bank

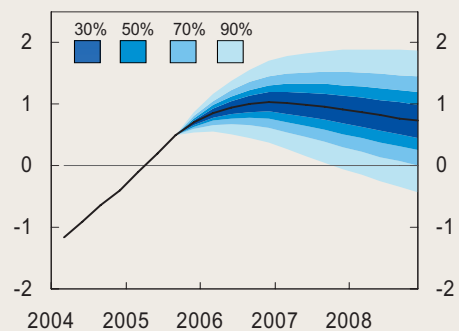
Chart 1.5c Projected CPI-ATE in the baseline scenario¹⁾ with fan chart. 4-quarter change. Per cent. 04 Q1 – 08 Q4



¹⁾ Other measures of underlying inflation are shown in a separate box in Section 2.

Sources: Statistics Norway and Norges Bank

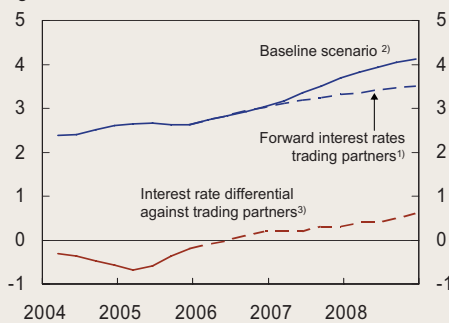
Chart 1.5d Estimated output gap in the baseline scenario¹⁾ with fan chart. Per cent. Quarterly figures. 04 Q1 – 08 Q4



¹⁾ Uncertainty concerning the current situation is not taken into account in the calculation.

Source: Norges Bank

Chart 1.6a Interest rate projections for trading partners and interest rate differential. Quarterly figures. 04 Q1 – 08 Q4



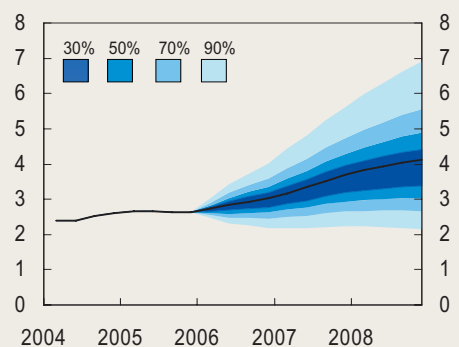
¹⁾ Estimated as a weighted average of trading partners' forward rates. Forward rate at 27 October.

²⁾ As in the two previous reports, the forward rate is adjusted somewhat as from 2007.

³⁾ Interest rate differential against trading partners in the baseline scenario from 05 Q4 (broken line).

Source: Norges Bank

Chart 1.6b Trading partners' interest rates¹⁾ in the baseline scenario with fan chart²⁾. Per cent. Quarterly figures. 04 Q1 – 08 Q4



¹⁾ 3-month money market rate.

²⁾ Fan chart is based on prices for interest rate options.

Sources: Reuters and Norges Bank

The benchmark index on the Oslo Stock Exchange has declined markedly recently. The index is still 4% higher than when the previous *Inflation Report* was published, and 25% higher than at the beginning of the year. Compared with average earnings over the past five years, prices for Norwegian equities have become somewhat higher since the beginning of the year, while there has been little change since end-June. The rise in Norwegian equity prices this year may be seen against the background of the increase in actual earnings last year and expected earnings for 2005 and 2006.

Uncertainty with regard to financial stability in the longer term is mainly related to the historically high household debt burden and asset price developments.

Uncertainty surrounding the projections

There is considerable uncertainty surrounding the projections. The projections above, including the interest rate projections, are based on the information Norges Bank has at present and Norges Bank's assessment of how the economy functions. If unexpected disturbances arise, we must be prepared for a situation where a different interest rate path may be more appropriate in order to achieve the objectives. The fan charts in Charts 1.5a-d illustrate the uncertainty that can be expected based on recent history.

The economy will occasionally be exposed to major disturbances. In recent years, the unexpected fall in inflation, the sharp rise in oil prices and substantial fluctuations in the krone exchange rate are events that were difficult to capture in advance in Norges Bank's projections. The origins of such disturbances may often lie outside Norway. We must be prepared for unexpected events to occur again in the future, and the Executive Board must continuously assess the consequences these disturbances may have for monetary policy. The effects may also prove to be more pronounced than we have experienced in the recent past. The monetary policy strategy should result in acceptable developments in inflation and output under alternative, albeit not unrealistic, assumptions concerning the economic situation and the functioning of the economy.

Current statistics and news about the Norwegian economy may reveal whether developments in the economy are in line with the scenario on which the monetary policy strategy is based. Information will not necessarily be unequivocal, and information about different aspects of economic developments is published at different times. It may be difficult to distinguish erratic effects on current statistics from real disturbances. It may therefore take time to determine whether economic developments differ from our assumptions.

Chart 1.9a Sight deposit rate in the baseline scenario and in the alternatives with stronger trade shifts and lower wage growth (red line) and higher inflation (yellow line). Per cent. Quarterly figures. 04 Q1 – 08 Q4

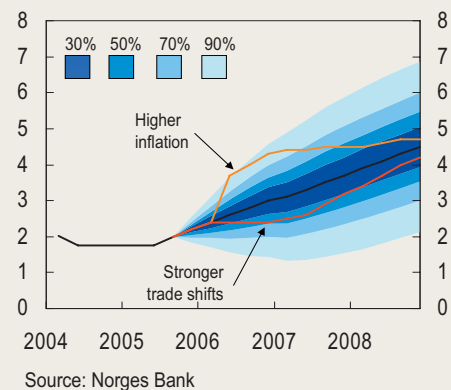


Chart 1.9b Projected CPI-ATE in the baseline scenario and in the alternatives with stronger trade shifts and lower wage growth (red line) and higher inflation (yellow line). 4-quarter change. Per cent. 04 Q1 – 08 Q4

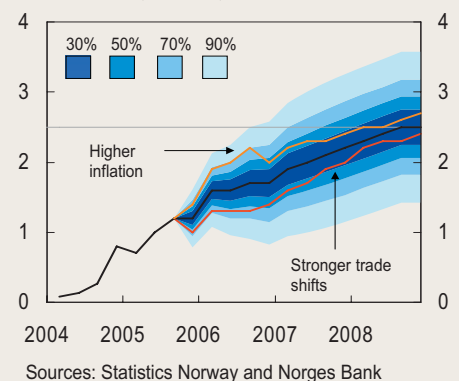
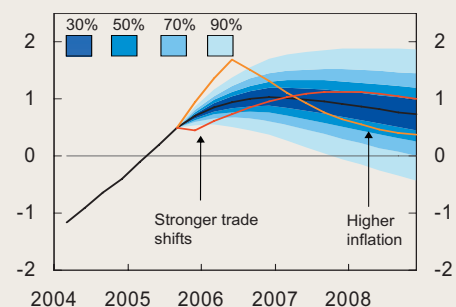


Chart 1.9c Estimated output gap in the baseline scenario¹⁾ and in the alternatives with stronger trade shifts and lower wage growth (red line) and higher inflation (yellow line). Per cent. Quarterly figures. 04 Q1 – 08 Q4



¹⁾ Uncertainty concerning the current situation is not taken into account in the calculation.

Source: Norges Bank

Conclusions – monetary policy strategy

The Executive Board's assessment is:

- The interest rate path presented in this *Report* will provide a reasonable balance between the objective of bringing inflation up to target and the objective of stabilising developments in output and employment, conditional on the information Norges Bank has at this juncture.
- The interest rate may gradually – in small, not too frequent steps – be brought back towards a more normal level. The objective of bringing inflation back to target and anchoring inflation expectations nevertheless implies a continued expansionary monetary policy.
- The sight deposit rate should lie in the interval 2-3% in the period to the publication of the next *Inflation Report* on 16 March 2006, conditional on economic developments that are broadly in line with the projections.
- Monetary policy must be assessed regularly on the basis of new information that is of significant importance for the outlook for inflation and output. New information may reveal economic developments that indicate that the Norwegian economy is following other paths than projected. Stronger trade shifts and increased labour market competition may, on the one hand, result in lower price and wage inflation. The unusually low real interest rate may, on the other hand, result in a higher-than-projected rise in output and inflation. The monetary stance must be assessed in the light of the reasons for, and the expected duration of disturbances.

- Objection: not practical for MPC to decide about *forward path* of policy in addition to current interest rate
- But rule used should be same *default* specification each time, *unless* foreseeable reason to deviate from it under current conditions
 - only specify departures from the default rule as far in the future as it is possible to agree upon them

- The fact that such an approach will require more explicitness about the likely future conduct of policy should improve effectiveness of policy
 - for effects of policy largely depend on *expectations* of path of policy
- Already in the US, it has been found useful to give *signals* about the likely future course of policy, even though not in the context of a forecast-targeting exercise
- Discussing CB expectations regarding future interest rates in the context of forecast-targeting would avoid some of the problems associated with recent FOMC signalling:
 - much more *flexible* language for describing likely future policy
 - easier to make it clear that the projected path is *not a commitment*

Inadequacy of a Purely Forward-Looking Target Criterion

- A general difference between the target criteria of IFT CBs [even Norges Bank] and optimal criteria: criteria relate only to *prospective* paths of inflation and output
 - “let bygones be bygones”
- Why *not* a characteristic of optimal policy:
 - desirable to shape how *expectations* respond to current shocks
 - but this requires that policy be expected to be *history-dependent* in future!

- Examples:
 - commitment to subsequent *reflation* following deflationary “trap” [Eggertsson-Woodford]
 - commitment to *undo* price increases due to “cost-push” shock

- Type of target criterion that is needed: target path for *price level* rather than inflation rate
 - more precisely: target path for *output-gap adjusted price level* [EW 2003, Svensson-Woodford 2005]

- Price-level targeting also more *robust* to CB error in assessing state of economy and/or correct structure
 - would avoid a replay of the error of 1970s policy, as analyzed by Orphanides: allowing high inflation for years, due to persistent overestimate of output gap
 - improved inflation/output variability tradeoff, in the case that CB has to *learn* correct model parameters: Aoki-Nikolov (2003)
- Also increases *accountability* of the targeting regime:
 - public (or government) can monitor success of *actual* price level in tracking target path (over long enough intervals), not just *projections*

Conclusions

- IFT an important advance in the conduct of monetary policy
 - big step toward more rule-based policy
 - great improvement in transparency
 - both very important given forward-looking behavior
 - stability of inflation expectations valuable
- Yet room for improvement:
 - avoidance of commitment to a near-term target criterion a fundamental weakness of much current practice
 - and target criteria in practice all too forward-looking