Monetary Policy
(Advanced Monetary Economics)

ECON 4325

Nina Larsson Midthjell - Lecture 2 - 22 January 2016

Curriculum for this lecture:

- Handout (available by email) and will be sent – on Monday night - to everyone who signed up on the seminar lists at lecture 1

- The handout should be seen as supplementary reading, the required reading for this lecture are these slides. Use the hand-out to fill gaps in your understanding of the slides.

- **If you did not attend the first lecture, please:**
  - Send an email to **nina-larsson.midthjell@norges-bank.no** where you also inform whether you will attend the Wednesday seminar or the Friday seminar.

Outline

- Rules versus discretion – Introduction
- The Barro Gordon model
  - Model set-up
  - The discretionary solution
  - Rational expectations
  - Commitment
  - Welfare losses
- Solutions to the time-inconsistency problem
  - Reputational solutions
  - Conservative preferences
  - Independence
  - Incentive-compatible contracts
  - Transparency
  - Accountability

Rules versus discretion

Introduction

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Definitions

- DISCRETION: The central bank has the power to decide or act without other control than its own judgment

- RULES: An outside procedural rule (in the sense of an established guide or regulation for action) laid down in the central bank's statutes.

Bretton Woods 1944-1971	The EMS	The ERM II	Interest rate rules	Fixed money growth
• Pegging currency to US dollar (gold)	• Snake in the tunnel • 1992 crisis	• Pegging currency to the euro • Criteria to join the eurozone	• "Modern" inflation targeting • Target π, not the exchange rate	• 5 % per year

Rules versus discretion

Introduction

The traditional debate

- FRIEDMAN: A central bank's knowledge of the economy is too limited or it is not interested in maximizing welfare.

Business cycles exist and policy should be contra- cyclical (stabilizing)	• Not possible because of inside and outside lags
Inside lags	• Takes time for the central bank to recognize the macroeconomic situation and to implement policy.
Outside lags	• Lags in the monetary transmission process - it takes time for the change in policy to affect the economy
Result	• Monetary policy interventions become PRO-cyclical (the economy is moved even further from steady state) and the outcome is destabilization of the economy
Solution	• Introduce an outside policy rule – less harmful

Rules versus discretion

The modern debate

- KYDLAND/PRESCOTT & BARRO/GORDON: There is a time-inconsistency problem for discretionary monetary policy

Everybody knows how the economy works	• Full information, both for the central banks and for economic agents
Central bank minimize welfare loss	• Assume welfare maximization (different from Friedman view)
Rational expectations	• Economic agents' predictions of the future value of economically relevant variables are not systematically wrong - all errors are random
Still a high inflation rate because of time-inconsistency	• Policy which is optimal today (in period t_0) is not optimal anymore after the reaction of economic agents to this policy (in period t_1) • Model of Barro Gordon

Rules versus discretion

Introduction

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Why do we spend time on this?

- If central bank behavior according to an optimal rule or promise is credible there will not be a time-inconsistency problem
- Firms and workers agree on nominal prices and wages based on expectations of future monetary policy
- If the central bank deviates from its rule/promise it might result in a short term gain from fooling the economic agents, but the agents cannot be fooled again and again – they will adjust their expectations.

You can fool all the people some of the time, and some of the people all the time, but you cannot fool all the people all the time

Abraham Lincoln

Rules versus discretion
Introduction

The analysis of time-inconsistency is important for two reasons:

1. Forces us to examine the incentives of the central bank
   - Must understand how expectations react to policy changes
   - Can only find such understanding if policy behaves systematically
   - This analysis is a natural starting point to understand why we have the systems of today
2. Models of time-inconsistency are important to understand why central bank behavior has been reformed and redesigned in recent years
   - Let's look at such a model!

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The Barro Gordon Model

Model set-up

- The classical time-inconsistency problem analyzed by Kydland and Prescott (1977) and Barro and Gordon (1983) is based on the following model:

The Lucas Supply curve

$$y_t = y_t^{natural} + \gamma(\pi_t - \pi_t^e) + \varepsilon_t, \qquad \gamma > 1, E_{t-1}(\varepsilon_t) = 0 \qquad (1)$$

$$\pi_t^e = E_{t-1}\pi_t \qquad (2)$$

- Why will an inflation surprise stimulate output??
- Alternatively: $u_t = u_t^{natural} - \gamma(\pi_t - \pi_t^e) - \varepsilon_t$

The Expectations augmented Phillips curve

- The higher γ the lower is the necessary increase in inflation in order to affect unemployment.

The Barro Gordon Model

Model set-up

2/4

- Target of the central bank: Maximize social welfare
- The central bank has preferences over:
  - Level of inflation
  - Level of output/unemployment

- In order to maximize welfare the central bank minimizes the following loss function:

$$L_t = \frac{1}{2}\left[(\pi_t - \pi^*)^2 + \lambda(y_t - y^*)^2\right], \qquad \lambda, y^* > 0, \pi^* \geq 0 \qquad (3)$$

where $y^* > y_t^{natural} \Leftrightarrow u^* < u_t^{natural}$

Interpretation:

The Barro Gordon Model

Model set-up

3/4

- Why is the socially optimal output level higher than its natural level?
  - Labor market distortions (e.g. because of taxes)?
  - Monopolistic competition – equilibrium output too low?
  - Election coming up, or political pressure in general?

- The first-best solution: Get rid of the distortions

- The second-best solution: Aim for a higher output target than the equilibrium outcome.
  - We will see that doing so will <u>not</u> yield the best outcome for the economy due to time-inconsistency.
  - Motivation for institutional reforms designed to minimize political pressure

Independence

Rules

The Barro Gordon Model

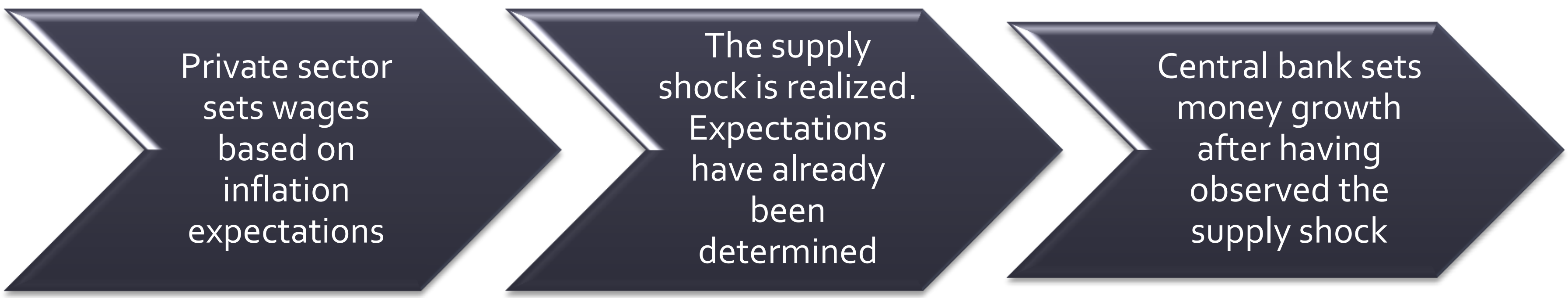
Model set-up

4/4

- The rest of the model is the link between inflation and the central bank instrument, in this case money growth:

$$\pi_t = \Delta m_t , \qquad (4)$$

- So how does it work? Timing is important:



$$y_t = y_t^{natural} + \gamma(\pi_t - \pi_t^e) + \varepsilon_t \qquad (1)$$

The discretionary solution

- The inflation level that minimizes the social loss function, and hence maximizes welfare, is found by minimizing the loss function subject to the Lucas supply curve (eq. 1), and the link between the central bank and money growth (eq. 4), taking π_t^e as given. That is:

$$\underset{\Delta m_t}{Min}\, L_t = \frac{1}{2}\left[(\Delta m_t - \pi^*)^2 + \lambda\left\{y_t^{natural} + \gamma(\Delta m_t - \pi_t^e) + \varepsilon_t - y^*\right\}^2\right] \qquad (5)$$

Remember that at time t, the central bank knows the supply shock , i.e. everything in the loss function is known.

The Barro Gordon Model
The discretionary solution

2/4

- The FOC yields:

$$\Delta m_t = \pi_t^{optimal} = \frac{1}{1+\lambda\gamma^2}\pi^* + \frac{\lambda\gamma}{1+\lambda\gamma^2}\left(y^* - y_t^{natural}\right) + \frac{\lambda\gamma^2}{1+\lambda\gamma^2}\pi_t^e - \frac{\lambda\gamma}{1+\lambda\gamma^2}\varepsilon_t = \phi\left(\pi_t^e\right) \quad (6)$$

→ Optimal inflation level in the economy depends on what private agents expect inflation to be. Lets study two alternatives:

$\pi_t^e = \pi^*$ Private agents expect inflation to be at the level assumed by the central bank to be socially optimal. (Plausible expectation in period zero)

$\pi_t^e = E_{t-1}\left(\pi_t^{optimal}\right)$ Private agents have rational expectations and expect inflation to be at the level that minimizes the central bank's loss function

The Barro Gordon Model

The discretionary solution 3/4

When $\pi_t^e = \pi^*$ the FOC reduces to:

$$\Delta m_t = \pi_t^{surprise} = \frac{1}{1+\lambda\gamma^2}\pi^* + \frac{\lambda\gamma}{1+\lambda\gamma^2}\left(y^* - y_t^{natural}\right) + \frac{\lambda\gamma^2}{1+\lambda\gamma^2}\pi^* - \frac{\lambda\gamma}{1+\lambda\gamma^2}\varepsilon_t$$

$$\Rightarrow \Delta m_t = \pi_t^{surprise} = \pi^* + \frac{\lambda\gamma}{1+\lambda\gamma^2}\left(y^* - y_t^{natural}\right) - \frac{\lambda\gamma}{1+\lambda\gamma^2}\varepsilon_t \qquad (7)$$

- The central bank (optimally) creates surprise inflation!
  - What was optimal prior to period t (π^*) is no longer optimal after the private sector has formed their expectations, the CB can boost output by creating inflation higher than what was believed by the private agents.
  - How much inflation is elevated depends on $\left(y^* - y_t^{natural}\right), \lambda, \gamma, \varepsilon_t$

Time-inconsistency

Assume $\lambda > \frac{1}{\gamma^2}$ in the following

The Barro Gordon Model

The discretionary solution 4/4

- The solution for output is found by inserting for optimal inflation and the inflation expectations in the Lucas supply curve:

$$y_t = y_t^{natural} + \gamma(\pi_t^{surprise} - \pi_t^e) + \varepsilon_t \Rightarrow y_t = y_t^{natural} + \frac{\lambda\gamma^2}{1+\lambda\gamma^2}\left(y^* - y_t^{natural}\right) + \frac{1}{1+\lambda\gamma^2}\varepsilon_t \quad (8)$$

- The surprise inflation generates an output level higher than its natural (potential) level, which is what the central bank finds socially optimal.

- The result relies on private agents being "fooled" .

- Can you fool everyone all the time??

Introducing rational expectations

The Barro Gordon Model

Rational expectations 1/4

- When the private agents observe that their inflation expectations were too low, they adjust their expectations.

- After a while, the agents understand how the central bank optimizes:

$$\pi_t^e = E_{t-1}\left(\pi_t^{optimal}\right)$$

- The private agents cannot observe the supply shock, hence they do not have perfect knowledge about the central bank's choice of inflation level.

$$E_{t-1}\left(\varepsilon_t\right) = 0$$

The Barro Gordon Model
Rational expectations

- When $\pi_t^e = E_{t-1}\left(\pi_t^{optimal}\right)$ the private agents solve the following in order to form their expectations:

$$\pi_t^e = E_{t-1}\left(\pi_t^{optimal}\right) = \frac{1}{1+\lambda\gamma^2}\pi^* + \frac{\lambda\gamma}{1+\lambda\gamma^2}\left(y^* - y_t^{natural}\right) + \frac{\lambda\gamma^2}{1+\lambda\gamma^2}\pi_t^e - \frac{\lambda\gamma}{1+\lambda\gamma^2}E_{t-1}\left(\varepsilon_t\right)$$

$$\Rightarrow \pi_t^e\left(\frac{1}{1+\lambda\gamma^2}\right) = \frac{1}{1+\lambda\gamma^2}\pi^* + \frac{\lambda\gamma}{1+\lambda\gamma^2}\left(y^* - y_t^{natural}\right) \Rightarrow \pi_t^e = \pi^* + \lambda\gamma\left(y^* - y_t^{natural}\right) \qquad (9)$$

- The private agents expect the elevated inflation that will arise in period *t* because of the central bank's desire of a socially optimal output level higher than potential output.

The Barro Gordon Model
Rational expectations

Hence, the FOC (eq.6) reduces to:

$$\Delta m_t = \pi_t^{rational} = \frac{1}{1+\lambda\gamma^2}\pi^* + \frac{\lambda\gamma}{1+\lambda\gamma^2}\left(y^* - y_t^{natural}\right)$$

$$+\frac{\lambda\gamma^2}{1+\lambda\gamma^2}\left[\pi^* + \lambda\gamma\left(y^* - y_t^{natural}\right)\right] - \frac{\lambda\gamma}{1+\lambda\gamma^2}\varepsilon_t$$

$$\Rightarrow \Delta m_t = \pi_t^{rational} = \pi^* + \left[\frac{1}{1+\lambda\gamma^2} + \frac{\lambda\gamma^2}{1+\lambda\gamma^2}\right]\lambda\gamma\left(y^* - y_t^{natural}\right) - \frac{\lambda\gamma}{1+\lambda\gamma^2}\varepsilon_t$$

$$\Rightarrow \Delta m_t = \pi_t^{rational} = \pi^* + \lambda\gamma\left(y^* - y_t^{natural}\right) - \frac{\lambda\gamma}{1+\lambda\gamma^2}\varepsilon_t \quad (10)$$

The solution for output is now:

$$y_t = y_t^{natural} + \gamma(\pi_t^{rational} - \pi_t^e) + \varepsilon_t \Rightarrow y_t = y_t^{natural} + \frac{1}{1+\lambda\gamma^2}\varepsilon_t \quad (11)$$

No longer effect on output from inflation surprise since no longer a surprise!

The Barro Gordon Model

Rational expectations

So what do we have so far?

With surprise inflation and

$$\pi_t^e = \pi^*$$

$$\pi_t^{surprise} = \pi^* + \frac{\lambda\gamma}{1+\lambda\gamma^2}\left(y^* - y_t^{natural}\right) - \frac{\lambda\gamma}{1+\lambda\gamma^2}\varepsilon_t$$

$$y_t = y_t^{natural} + \frac{\lambda\gamma^2}{1+\lambda\gamma^2}\left(y^* - y_t^{natural}\right) + \frac{1}{1+\lambda\gamma^2}\varepsilon_t$$

With rational expectations

$$\pi_t^{rational} = \pi^* + \lambda\gamma\left(y^* - y_t^{natural}\right) - \frac{\lambda\gamma}{1+\lambda\gamma^2}\varepsilon_t$$

$$y_t = y_t^{natural} + \frac{1}{1+\lambda\gamma^2}\varepsilon_t$$

Inflation bias!

$$\pi_t^{surprise} < \pi_t^{rational}$$

With surprise inflation the central bank managed to affect output.

When private agents adjusted their expectations, it became optimal for the central bank to create even more inflation, but now there would be no effect on output! If no shocks, optimal output = potential output.

The discretionary equilibrium is sub-optimal!

The Barro Gordon Model

Commitment 1/4

- So, if there is nothing to gain but higher inflation from this policy, why is the inflation bias persistent?

- Reason: As soon as the private expectations are adjusted back to socially optimal inflation π^*, then the central bank will have an incentive to create surprise inflation; the optimal policy has changed after the private expectations are formed.

- The reason for the time-inconsistency problem in this model is that private expectations are formed **before** the government sets the inflation rate.

- What if the central bank had been able to commit to a policy rule **prior to** the formation of private expectations ?

- The central bank will conduct stabilization policies in the presence of a supply shock, so an appropriate rule could be:

$$\Delta m_t = \pi_t^{commitment} = a + b\varepsilon_t$$

The Barro Gordon Model

Commitment

- What would be an optimal policy under such commitment?

- The optimal choice of **a** and **b** can be found by inserting for the rule in the loss function and solving for **a** and **b**. Inflation expectations will now be formed in the following way (given that the rule is credible…):

$$E_{t-1}\left(\Delta m_t = \pi_t^{commitment}\right) = a + b\underbrace{E_{t-1}(\varepsilon_t)}_{=0} = a \qquad (12)$$

- The minimization problem:

$$\underset{a,b}{Min}\, L_t = \frac{1}{2}\left[(a + b\varepsilon_t - \pi^*)^2 + \lambda\left\{y_t^{natural} + \gamma(a + b\varepsilon_t - a) + \varepsilon_t - y^*\right\}^2\right] \qquad (13)$$

- NBNB! The central bank commits itself to this rule prior to private expectations are formed, and prior to the shock is realized, i.e. optimal **a** and **b** must be chosen to minimize the **unconditional expectation** of the loss function.

The Barro Gordon Model

Commitment

3/4

- The unconditional expectation of the loss function:

$$E_{t-1}(L_t) = E_{t-1}\frac{1}{2}\left[(a + b\varepsilon_t - \pi^*)^2 + \lambda\left\{y_t^{natural} + (1+\gamma b)\varepsilon_t - y^*\right\}^2\right]$$

$$= \frac{1}{2}\left[\underbrace{\left(a - \pi^*\right)^2 + b^2\sigma_\varepsilon^2}_{E_{t-1}(a+b\varepsilon_t-\pi^*)^2}\right] + \lambda\frac{1}{2}\left[\underbrace{\left(y_t^{natural} - y^*\right)^2 + (1+\gamma b)^2\sigma_\varepsilon^2}_{E_{t-1}\left(y_t^{natural}+(1+\gamma b)\varepsilon_t-y^*\right)^2}\right] \quad (14)$$

where $$\sigma_\varepsilon^2 = Var(\varepsilon_t) = E_{t-1}\left(\varepsilon_t^{\,2}\right) - \left[E_{t-1}(\varepsilon_t)\right]^2 = E_{t-1}\left(\varepsilon_t^{\,2}\right) \quad (15)$$

Minimizing equation 14 wrt **a** and **b** yields the following FOCs:

$$a^* = \pi^* \quad (16)$$

$$b^* = -\frac{\lambda\gamma}{1+\lambda\gamma^2} \quad (17)$$

The Barro Gordon Model
Commitment
4/4

- Optimal policy under commitment (the choice that would minimize the loss function) is therefore equal to:

$$\Delta m_t = \pi_t^{commitment} = a^* + b^* \varepsilon_t = \pi^* - \frac{\lambda\gamma}{1+\lambda\gamma^2}\varepsilon_t \qquad (18)$$

No inflation bias!

- Corresponding output level:

$$y_t = y_t^{natural} + \gamma(\pi_t^{commitment} - \pi_t^{e}) + \varepsilon_t = y_t^{natural} + \gamma\left(\pi^* - \frac{\lambda\gamma}{1+\lambda\gamma^2}\varepsilon_t - \pi^*\right) + \varepsilon_t$$

$$= y_t^{natural} + \frac{1}{1+\lambda\gamma^2}\varepsilon_t \qquad (19)$$

Same as under discretion with rational expectations

- Only difference between discretionary equilibrium and the optimal commitment equilibrium is that the former gives too high average inflation. Responses to shocks are identical (i.e. same stabilization policy)

- In order to gain <u>credibility</u> the central bank must loose <u>flexibility.</u> How to find the right balance between these two is crucial.

The Barro Gordon Model

Welfare losses

- What are the expected losses related to the different optimal rates of inflation and output presented so far? Recall the loss function:

$$L_t = \frac{1}{2}\left[(\pi_t - \pi^*)^2 + \lambda(y_t - y^*)^2\right], \qquad (3)$$

- What is the expected loss under discretion with surprise inflation?
- Recall:

$$\pi_t^{surprise} = \pi^* + \frac{\lambda\gamma}{1+\lambda\gamma^2}\left(y^* - y_t^{natural}\right) - \frac{\lambda\gamma}{1+\lambda\gamma^2}\varepsilon_t$$

With surprise inflation and $\pi_t^e = \pi^*$

$$y_t = y_t^{natural} + \frac{\lambda\gamma^2}{1+\lambda\gamma^2}\left(y^* - y_t^{natural}\right) + \frac{1}{1+\lambda\gamma^2}\varepsilon_t$$

- The expected loss is then:

$$E_{t-1}\left(L_{surprise}\right) = \frac{1}{2}\left\{\frac{\lambda}{1+\lambda\gamma^2}\left[(y^* - y_t^{natural})^2 + \sigma_\varepsilon^2\right]\right\}, \qquad (20)$$

The Barro Gordon Model

Welfare losses 2/5

- What is the expected loss under discretion with rational expectations?
- Recall:

$$L_t = \frac{1}{2}\left[(\pi_t - \pi^*)^2 + \lambda(y_t - y^*)^2\right], \qquad (3)$$

With rational expectations

$$\pi_t^{rational} = \pi^* + \lambda\gamma\left(y^* - y_t^{natural}\right) - \frac{\lambda\gamma}{1+\lambda\gamma^2}\varepsilon_t$$

The inflation bias

$$y_t = y_t^{natural} + \frac{1}{1+\lambda\gamma^2}\varepsilon_t$$

- The expected loss is then:

$$E_{t-1}(L_{rational}) = \frac{1}{2}\left\{\lambda\left(1+\lambda\gamma^2\right)\left(y^* - y_t^{natural}\right)^2 + \left[\frac{\lambda}{\left(1+\lambda\gamma^2\right)}\sigma_\varepsilon^2\right]\right\} > E_{t-1}\left(L_{surprise}\right), \qquad (21)$$

- The expected welfare loss is higher with rational expectations than under surprise inflation. Why?

The Barro Gordon Model

Welfare losses

3/5

- What is the expected loss under commitment?
- Recall:

$$L_t = \frac{1}{2}\left[(\pi_t - \pi^*)^2 + \lambda(y_t - y^*)^2\right], \qquad (3)$$

With commitment

$$\pi_t^{commitment} = \pi^* - \frac{\lambda\gamma}{1+\lambda\gamma^2}\varepsilon_t$$

No inflation bias

$$y_t = y_t^{natural} + \frac{1}{1+\lambda\gamma^2}\varepsilon_t$$

- The expected loss is then:

$$E_{t-1}(L_{rule}) = \frac{1}{2}\left\{\lambda(y^* - y_t^{natural})^2 + \left[\frac{\lambda}{(1+\lambda\gamma^2)}\sigma_\varepsilon^2\right]\right\} \qquad (22)$$

- Interpret why: $E_{t-1}(L_{surprise}) < E_{t-1}(L_{rule}) < E_{t-1}(L_{rational})$

The Barro Gordon Model
Welfare losses

- What happens if the central bank does not take stabilization of shocks into account…is a rule then always better than discretion?

With a rule, not considering supply shock stabilization

$$\pi_t^{rule\_alternative} = \pi^*$$

$$y_t = y_t^{natural} + \gamma(\pi^* - \pi^*) + \varepsilon_t = y_t^{natural} + \varepsilon_t$$

- The expected loss is then:

$$E_{t-1}\left(L_{rule\_alternative}\right) = \frac{1}{2}\left\{\lambda(y^* - y_t^{natural})^2 + \lambda\sigma_\varepsilon^2\right\} \quad (23)$$

- The expected loss is higher than under a rule that takes output stabilization into account, but is it lower than the expected loss under discretion? It turns out:

$$E_{t-1}\left(L_{surprise}\right) < E_{t-1}\left(L_{rule}\right) < E_{t-1}\left(L_{rule\_alternative}\right) \leq or \geq E_{t-1}\left(L_{rational}\right)$$

The Barro Gordon Model
Welfare losses

- A policy rule is only superior to discretion under these circumstances iff:

$$E_{t-1}\left(L_{rule\_alternative}\right) \leq E_{t-1}\left(L_{rational}\right)$$

which is the case when
$$\frac{1}{1+\lambda\gamma^2}\sigma_\varepsilon^2 < (y^* - y_t^{natural})^2 \qquad (24)$$

Interpretation:

The Barro Gordon Model

- A rule removes the inflation bias, but at the same time it removes flexibility.

- Are there alternative ways to reduce the inflation bias and deal with the time-inconsistency problem?

- Let's look at some solutions:

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  - Welfare losses

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  - Reputational solutions
  - Conservative preferences
  - Independence
  - Incentive-Compatible contracts
  - Transparency
  - Accountability

Solutions to the time-inconsistency problem

Reputational solutions 1/17

Reputational solutions

- Assumption in model: One-shot game. What happens if the game is played for more than one period?
  - The central bank may want to build a reputation and be prepared to suffer higher unemployment in order to reduce inflation

- Alternative 1: Trigger-strategy
  - The private sector sets low wages as long as the central bank sets low inflation
  - If the central bank cheats, the private sector responds with higher wages in the next period

- Alternative 2: Bayesian approach
  - Private sector attaches probability to the central bank being *tough* or *weak* on inflation

- Problem: Quickly becomes complex and gives rise to multiple equilibria
  - How to coordinate on one equilibrium?

Conservative preferences

- Compromise between credibility and flexibility, see Rogoff (1985)
  - Inflation bias because politicians are short-sighted
  - Should delegate monetary policy to an independent central bank!
  - Appoint central bankers who place greater relative weight on inflation, that is, who have the following preferences:

$$L_t = \frac{1}{2}\left[(\pi_t - \pi^*)^2 + \lambda^{cb}(y_t - y^*)^2\right], \qquad \text{where} \qquad \lambda^{cb} < \lambda \qquad (25)$$

  - This will reduce inflation bias under discretion:

$$\pi_t^{rational} = \pi^* + \underbrace{\lambda^{cb}\gamma\left(y^* - y_t^{natural}\right)}_{Inflation bias} - \frac{\lambda^{cb}\gamma}{1+\lambda^{cb}\gamma^2}\varepsilon_t$$

  - Independent central banks will have a long run view.
  - Central banks can realize long-run price stability and can react to shocks
  - However, stabilization policy is distorted – the response to shocks will be sub-optimal

Solutions to the time-inconsistency problem

Conservative preferences 3/17

Conservative preferences con't

- Must search for optimal preferences for the central banker (optimal λ^{cb})
  - Will depend on the expected size of the shocks

- Lohmann (1992): Government can do even better if it appoints a conservative central banker, BUT limits the central banker's independence.
  - If shock is too large, override the central bank!
  - E.g. German unification and the Bundesbank
  - Not appreciated by the central bankers..
  - In equilibrium the central bank **is** never overridden

- Conclusion: One can reduce the inflation bias this way, but only at the cost of higher output variability:

$$y_t = y_t^{natural} + \frac{1}{1+\lambda\gamma^2}\varepsilon_t < y_t^{natural} + \frac{1}{1+\lambda^{cb}\gamma^2}\varepsilon_t$$

Solutions to the time-inconsistency problem
Independence

Definitions of independence

Federal Reserve
Most independent

BoE
The Government decides

ECB and Norges Bank
Cannot choose inflation target

- Goal independence
  - Central Bank can choose output and inflation targets
  - Central bank can choose horizon of price stability
  - Central bank can choose price index, level of index…
- Instrument independence
  - Much more important form of independence
  - Central bank controls short-term interest rates (Canada, NZ and UK: Government can override the decision)
  - Central bank "controls" the exchange rate (as much as an exchange rate can be controlled..)
  - Restrictions on CB credit to the government (e.g. Maastricht treaty. ECB more independent than others on this point.)
- Personal independence – Central bankers are not politicians

Empirical results of independence (Alesina and Summers (1993):

- Negative correlation between independence and inflation
- Free lunch: No effect on output variability

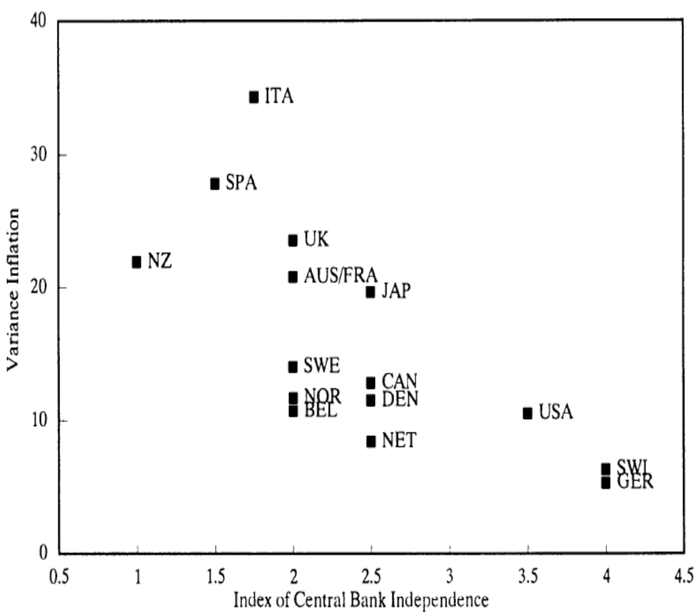


FIG. 1b. Variance Inflation

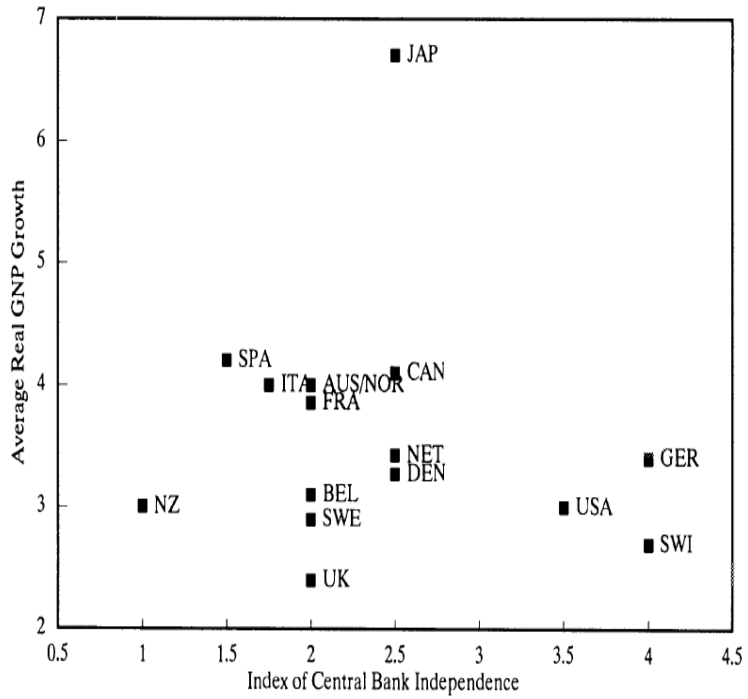


FIG. 2a. Average Real GNP Growth

Incentive Compatible Contracts

- Walsh(1995): Principal (the government) – Agent (the Central Bank) problem where the principal delegates a conduct of monetary policy to the agent with certain incentives.
  - The principal can affect the incentives by specifying a contract
  - The second-best equilibrium can be achieved by offering a linear inflation contract:

$$L_t = \frac{1}{2}\left[(\pi_t - \pi^*)^2 + \lambda(y_t - y^*)^2\right] + \underbrace{c\pi_t}_{contract}, \quad (26)$$

  - Optimal policy is then achieved when $c = \underbrace{\lambda\gamma\left(y^* - y_t^{natural}\right)}_{Inflation bias}$
  - Alternatively, the government can assign a loss function with a specific (conservative) inflation target, as suggested by Svensson (1997)

$$L_t = \frac{1}{2}\left[(\pi_t - \pi^{gov})^2 + \lambda(y_t - y^*)^2\right], \quad (27)$$

For what value of π^{gov} is the optimal policy achieved?

Solutions to the time-inconsistency problem

Transparency

Transparency

- There is a lag in monetary transmission mechanisms
- The central bank must provide as much information as possible so that the public can evaluate its monetary policy
- Efficiency of monetary policy should improve if the public understand the policy better
  - Being clear about mandate should improve credibility
  - Good for self-discipline of policy makers
  - Should improve the formation of expectations
  - Can help to reduce uncertainty and volatility in financial markets

Solutions to the time-inconsistency problem
Transparency 8/17

Different forms of transparency

- Political transparency
  - Openness with respect to goals
  - Priorities
  - Quantification of targets
- Economic transparency
  - Economic information used for monetary policy
  - Data, models and forecasts
  - ECB: Economic Bulletin (8 times per year, two weeks after each mp meeting)
  - BoE and Norges Bank: Inflation Report and fan charts

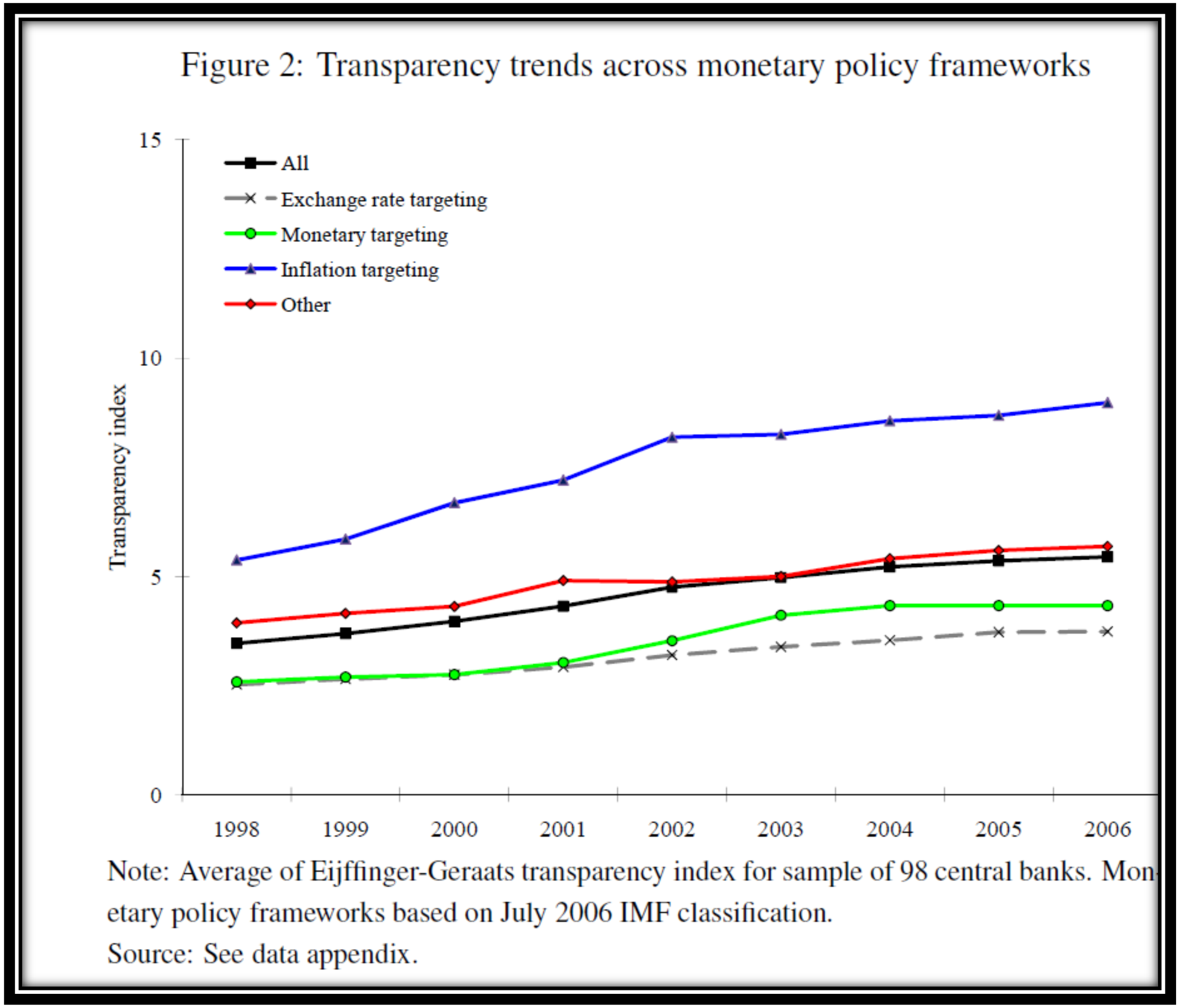
Solutions to the time-inconsistency problem

Transparency

<u>Different forms of transparency con't</u>

- Procedural transparency
  - The way monetary policy decisions are made (Norges Bank very active – see webpage)
  - Strategy
  - Minutes and voting
- Policy transparency
  - Prompt announcement of policy decisions (press conference)
  - Explanation of decision and where you plan to go from there (interest rate path)
- Operational transparency
  - Explain implementation of central bank policy
  - Control errors, macroeconomic disturbances that affect the transmission of monetary policy and evaluation of outcome

Transparency (Geraats 2009):

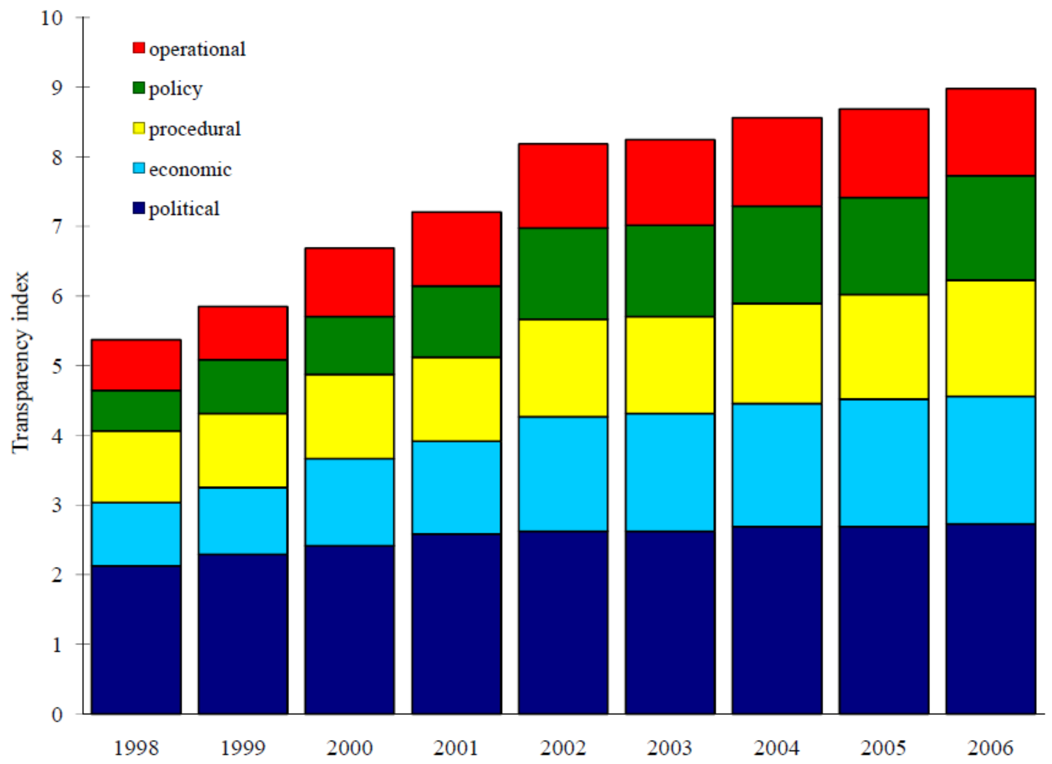


Solutions to the time-inconsistency problem

Transparency

<u>Transparency (Geraats 2009):</u>

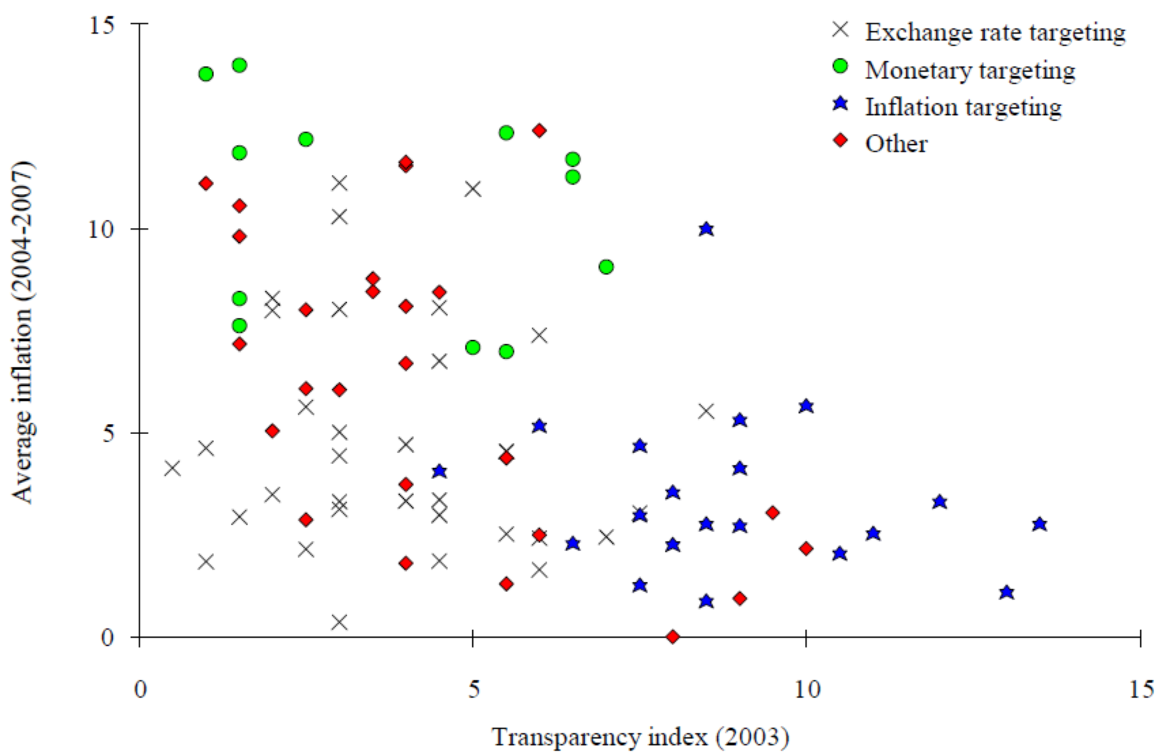
Figure 5: Transparency trend for inflation targeters



Note: Average of Eijffinger-Geraats transparency index over 24 central banks categorized as inflation targeters as of July 2006. Sources: See data appendix.

Transparency (Geraats 2009):

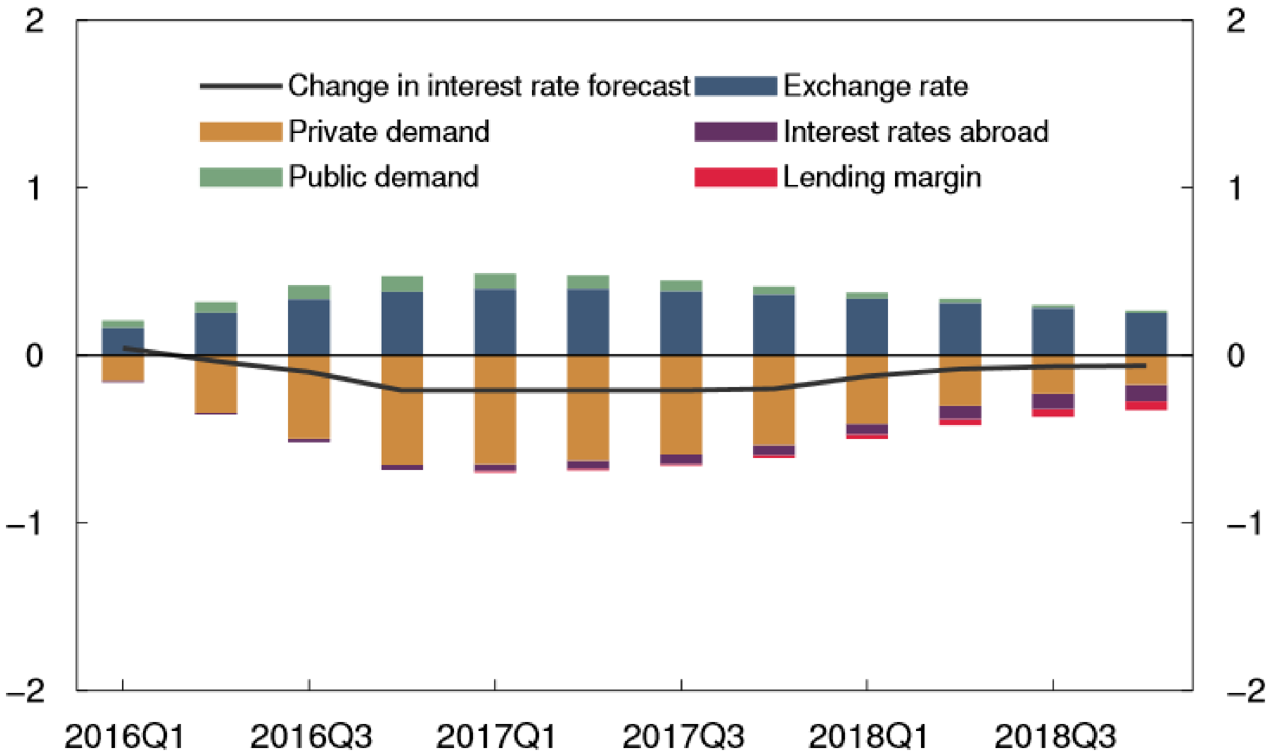
Figure 7: Relation between transparency and inflation.



Note: Eijffinger-Geraats transparency index for 2003. Sample: 92 central banks. Sources: See data appendix.

Super-Transparency: Norges Bank

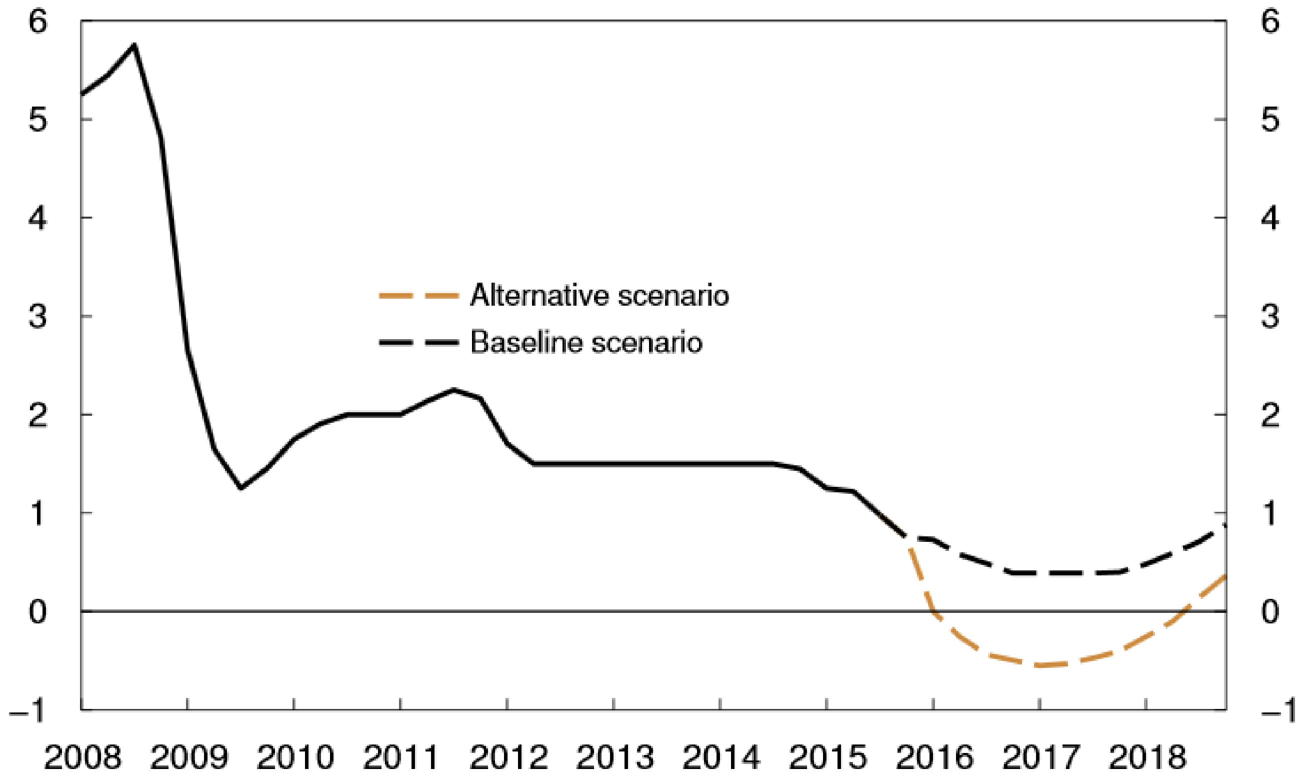
Chart 2.23 Factors behind changes in the interest rate forecast since MPR 3/15.
Cumulative contribution. Percentage points. 2016 Q1 – 2018 Q4



Source: Norges Bank

Transparency: Norges Bank interest rate path MPR 4/15

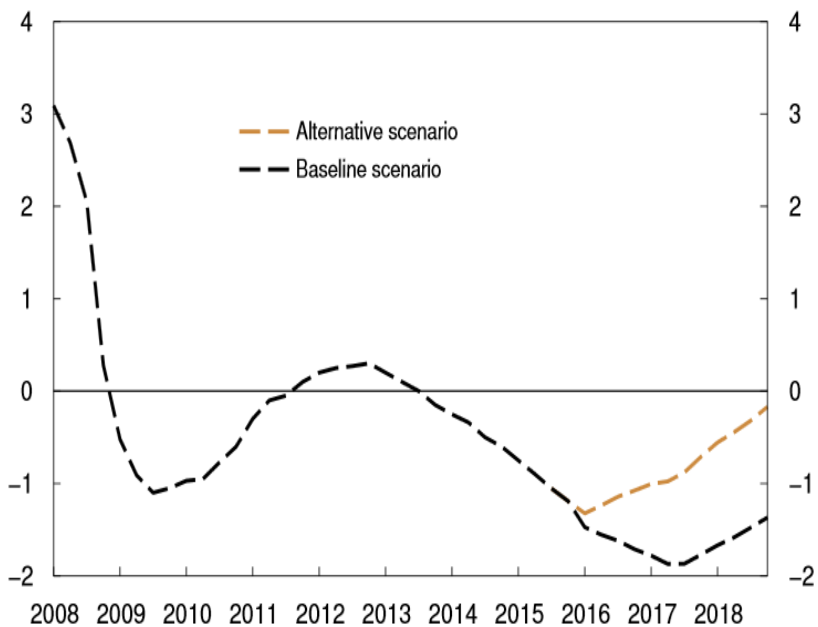
Chart 2.21a Key policy rate. Percent. 2008 Q1 – 2018 Q4



Source: Norges Bank

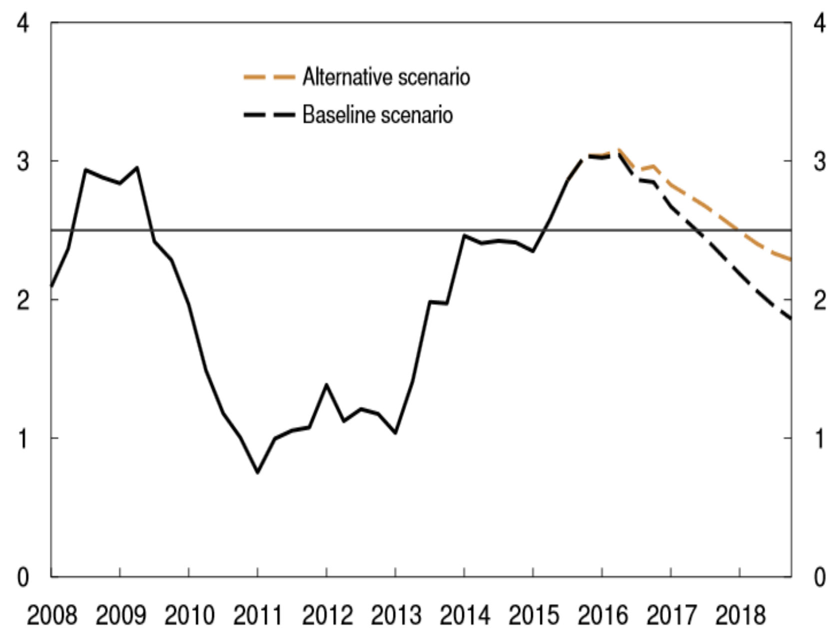
Transparency: Norges Bank output gap and inflation paths MPR 4/15

Chart 2.21b Output gap. Percent. 2008 Q1 – 2018 Q4



Source: Norges Bank

Chart 2.21c CPI-ATE.[1)] Four–quarter change. Percent. 2008 Q1 – 2018 Q4



1) CPI adjusted for tax changes and excluding energy products.
Sources: Statistics Norway and Norges Bank

Solutions to the time-inconsistency problem
Accountability 16/17

Accountability

- Only central banks are responsible for reaching the inflation target
- How can an independent central bank be controlled by the public and the parliament?
  - Norges Bank Watch
- Distinction between ex-post and ex-ante accountability
  - Ex post: CB is accountable if target is not achieved
  - Ex ante: CB is accountable if forecasts deviate from target
- In practice, the CB must give an explanation if:
  - Positive or negative demand shocks accompanied with a deviation of inflation from target
  - Positive or negative supply shocks accompanied with high inflation variability or output variability

Solutions to the time-inconsistency problem

Accountability 17/17

Accountability con't

Responsibility

- The ECB Governing council is collectively responsible for decisions taken and is accountable by the European Parliament
  - Individual accountability difficult because NCB governors are not appointed by the European Parliament AND because they are responsible for the eurozone as a whole.
- BoE, Fed: Every member is individually responsible for its voting behavior

Reporting

- ECB: after each meeting and annual reports
- Fed: Bi-annual
- BoE: quarterly
- NB: Four times per year and annual reports

Next week

- Readings: Galí book, chapter 2
- Discuss a simple RBC model - the starting point of New Keynesian Models
- Introduce log-linearization

Monetary Policy
(Advanced Monetary Economics)

ECON 4325