Monetary Economics: Macro Aspects, 22/3 2004
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Plan for today:

"0." Reputational solutions to credibility problems (see slides from March 17)

1. Further solutions to credibility problems
2. Delegation and independent central banks

   Literature: Walsh (Chapter 8, pp. 393-425)
3. Plan for next lectures

Introductory remarks

- The Barro and Gordon model provides a framework for analyzing time-inconsistency problems in monetary policy
- Important, as credibility problems have economic costs
  - In the particular model an inflation bias
  - In other fields:
    - Speculative attacks on non-credible exchange rate pegs
    - Hyperinflations if governments cannot credibly refrain from inflationary finance
    - Disinflations typically have significant output costs
    - Suboptimal savings and investments, if governments cannot credible refrain from impose "surprise" taxes on wealth

      "Read my lips: No more Taxes" — G. Bush (Sr.)
- The "market" mechanism can be one way of attaining credibility through reputation building and evolution of social norms
- If not viable, or takes a substantial amount of time, other mechanisms may be necessary

  => **Normative theories** of how to overcome time-inconsistency problems by **altering the central bank's incentives**
- In context of Barro and Gordon model, theories of **delegation**

Delegation and independent central banks

- The incentive to "surprise" inflation is often interpreted as arising from political pressures
- "Solution" to time-inconsistency problem could be achieved by
  - **Delegating** monetary policy conduct to **independent** central banks

  => Create monetary **institutions** securing **independence** and **appropriate policy incentives**
  - I.e., appropriate design of **policy regime** in broadest sense
- Several solutions proposed in the literature
- Analyses here are cast in versions of Barro Gordon model with variant 2 utility, I.e.,

$$U = -\frac{\lambda}{2}(y - y_n - k)^2 - \frac{1}{2}\pi^2$$

and with usual AS schedule:

$$y = y_n + a(\pi - \pi^e) + e$$

- Inflation is the policy instrument
- Remember the socially optimal, ex ante, policy:

$$\pi = -\frac{\lambda a}{1 + \lambda a^2} e$$

- New stage in the move structure; the "institutional design stage":
  1. Establishment of monetary delegation regime
  2. π^e is formed
  3. e is realized
  4. π is set
  5. y is determined

Delegation to a "conservative" central banker

- The idea is to appoint a central banker, who puts relative more weight on inflation stabilization than society
- I.e., monetary policy conduct is delegated to central banker with preferences

$$U^c = -\frac{\lambda}{2}(y - y_n - k)^2 - \frac{1+\delta}{2}\pi^2, \qquad \delta > 0$$

- This is Rogoff's "conservative" central banker; δ measures the "degree of conservativeness"
- Monetary policymaking by the central banker (taking as given π^e and e) is characterized by the first-order condition

$$-\lambda a(a(\pi - \pi^e) + e - k) = (1+\delta)\pi \qquad (*)$$

Note that $\delta > 0$ increases the marginal cost of inflation

- Rational inflation expectations follow by taking expectations on both sides of (*):

$$\lambda a k = (1+\delta)\pi^e$$

$$\Longrightarrow \quad \pi^e = \frac{\lambda a k}{1+\delta} < \lambda a k$$

- With a conservative central banker, the inflation bias is reduced from λak to $\lambda ak/(1+\delta)$
  - the private sector foresees the central banker's reduced incentive to increase inflation to achieve output gains
- Conservativeness, however, has a cost. The solution for actual inflation becomes (plug the solution for π^e back into (*))

$$\pi = \frac{\lambda ak}{1+\delta} - \frac{\lambda a}{1+\delta+\lambda ak}e \qquad (8.18')$$

- Stabilization of the shock is **distorted**
  - Compared to the socially optimal response to a supply shock, a conservative central bank responds less to the shock
  - Result is too stable inflation and too unstable output
- Appointing a conservative central bank thus involves a trade-off between
  a) Lower average inflation
  b) Poorer macroeconomic stabilization
- Will it ever be optimal to have $\delta > 0$?
- Yes, **always:**
  - At $\delta = 0$ a marginal increase in δ involves a **first-order social gain** of lower average inflation (at $\delta = 0$ average inflation is suboptimal)
  - At $\delta = 0$ a marginal increase in δ involves a **second-order social loss** of poorer stabilization (at $\delta = 0$ stabilization is optimal
  - A positive value of δ is therefore optimal

- The conservative central banker — appointing a governor with particular preferences — thus partially solves the time-inconsistency problem of monetary policymaking
- The cost of poorer stabilization begs the question of whether other preferences, or incentive structures, may solve the problem completely
- (Note that refinements of the Rogoff exists, where the government overrides the central banker in face of particular large supply shocks; this reduces the loss from poorer stabilization)
- This is the question asked in the "incentive contracts approach" to delegation

Incentive contracts

- Under this approach, the government appoints a central bank, and offers him/her a **performance contract**
- This contract rewards or punishes the central bank depending on its performance
- The contract could be "pecuniary" but more generally, it could represent public embarrassment if the central bank doesn't fulfill its "contract"
- Real world analogy: The Federal Reserve Act of 1989 in New Zealand: The governor can be **fired**, if he performs poorly....

- Formally, the central bank is offered a contract, such that it maximizes

$$U + t$$

where t is the contract transfer

- Assume that the contract transfer cannot be made contingent on the supply shock, so only a transfer depending on observed inflation is considered: $t = t(\pi)$
- Task of government is to choose the optimal $t(\pi)$ (at institutional design stage)
- Central bank takes expectations and the supply shock as given, and maximizes

$$-\frac{\lambda}{2}\left(a\left(\pi - \pi^e\right) + e - k\right)^2 - \frac{1}{2}\pi^2 + t(\pi)$$

- The first-order condition is

$$-\lambda a\left(a\left(\pi - \pi^e\right) + e - k\right) = \pi - t'(\pi) \qquad (**)$$

- If $t'(\pi) < 0$ we see that the marginal cost of inflation is higher than without the transfer; i.e., the contract **punishes inflation incrases**
- Rational inflation expectations follow by taking expectations on both sides of (**):

$$\lambda a k = \pi^e - \mathrm{E}\left[t'(\pi)\right]$$

$$\Longrightarrow \pi^e = \lambda a k + \mathrm{E}\left[t'(\pi)\right]$$

- Insert these expectations back into (**) to get actual inflation

$$-\lambda a\left(a\left(\pi - \lambda a k - \mathrm{E}\left[t'(\pi)\right]\right) + e - k\right) = \pi - t'(\pi)$$

$$\pi = \lambda a k + \frac{\lambda a^2}{1+\lambda a^2}\mathrm{E}\left[t'(\pi)\right] + \frac{t'(\pi)}{1+\lambda a^2} - \frac{\lambda a}{1+\lambda a^2}e$$

- Optimal policy is implemented if the transfer function satisfies

$$\lambda a k + \frac{\lambda a^2}{1+\lambda a^2}\mathrm{E}\left[t'(\pi)\right] + \frac{t'(\pi)}{1+\lambda a^2} = 0$$

- This is accomplished if

$$t'(\pi) = -\lambda a k$$

- A transfer function with this property:

$$t(\pi) = t_0 - \lambda a k\,\pi$$

- A **linear** inflation contract
- Linear because the incentive to "surprise" the private sector is a constant in equilibrium; hence, a constant marginal punishment eliminates the inflation bias (also for non-quadratic utility)
- In contrast to a conservative central banker, the linear inflation contract portrays the optimal **incentive structure**, implementing
  - **optimal average inflation** *and*
  - **optimal shock stabilization**

- Under the optimal contract the central bank retains flexibility to respond optimally towards shocks
- Often monetary institutions, however, are set up to limit this flexibility in order to reduce, e.g., the central bank's vulnerability towards political pressures
- This is often modelled as **targeting rules** prescribing goals that the central bank should achieve through policy
- I.e., the central bank is judged on its ability to attain these goals (note analogy with contract approach.....)
- Examples are exchange rate targeting, inflation targeting, money supply targeting,.....

Targeting rules

- Targeting rules can be either **flexible** or **strict**
- Flexible allows some concern for "social welfare" in addition to attaining the target
- Under strict targeting rules, attaining the target is the overriding objective of monetary policy

- An example of flexible inflation targeting: The central bank's preferences are

$$U - \frac{h}{2}\left(\pi - \pi^T\right)^2, \qquad h > 0$$

where

  - π^T is the inflation target
  - h measures how strict the targeting rule is (higher h higher emphasis on attaining $\pi = \pi^T$)

- The central bank optimal behavior, taking as given expectations and the supply shock, is to maximize

$$-\frac{\lambda}{2}\left(a\left(\pi - \pi^e\right) + e - k\right)^2 - \frac{1}{2}\pi^2 - \frac{h}{2}\left(\pi - \pi^T\right)^2$$

- The first-order condition is

$$-\lambda a\left(a\left(\pi - \pi^e\right) + e - k\right) = \pi + h\left(\pi - \pi^T\right) \qquad (***)$$

  Inflation targeting implies a higher marginal cost of inflation when $\pi > \pi^T$

- Expected inflation follows from (***) as

$$\begin{aligned} \lambda a k &= \pi^e + h\left(\pi^e - \pi^T\right) \\ \Longrightarrow \quad \pi^e &= \frac{h}{1+h}\pi^T + \frac{1}{1+h}\lambda\alpha k \end{aligned}$$

- Hence, $h > 0$ reduces the inflation bias associated with $\lambda\alpha k$, and a lower than social optimal value of π^T can also reduce average inflation

- Actual inflation follows by inserting π^e into (***):

$$\pi = \frac{h}{1+h}\pi^T + \frac{1}{1+h}\lambda\alpha k - \frac{\lambda a}{1+h+\lambda a^2}e$$

- Shock stabilization is distorted, $h > 0$
- Indeed, the flexible inflation targeting regime "mimics" a conservative central banker for $\pi^T = 0$, as the relevant utility function of the central banker is

$$-\frac{\lambda}{2}(y - y_n - k)^2 - \frac{1+h}{2}\pi^2$$

- h has just replaced δ
- So a flexible inflation targeting rule is equivalent to appointing a Rogoff conservative central banker

- Note that an analogy between flexible inflation targeting and a linear inflation contract has been provided by Svensson (1997)
- Consider the utility function:

$$-\frac{\lambda}{2}(y - y_n - k)^2 - \frac{1+h}{2}\left(\pi - \pi^T\right)^2$$

- Under this, the central bank's first-order condition reads

$$-\lambda a\left(a\left(\pi - \pi^e\right) + e - k\right) = (1+h)\left(\pi - \pi^T\right)$$

- Inflation expectations become

$$\begin{aligned} \lambda a k &= (1+h)\left(\pi^e - \pi^T\right) \\ \Longrightarrow \quad \pi^e &= \frac{\lambda a k}{1+h} + \pi^T \end{aligned}$$

- Actual inflation follows as

$$\pi = \frac{\lambda a k}{1+h} + \pi^T - \frac{\lambda a}{1+h+\lambda a^2}e$$

- Optimal policy is achieved with $h = 0$ and $\pi^T = -\lambda a k$
- Hence, no conservativeness ($h = 0$) but a constant marginal penalty of inflation (like under the linear contract)

- **Strict targeting rules** will typically involve trade-offs
- A strict inflation targeting rule corresponds to $h \to \infty$ and implies $\pi^T = 0$
  - Excessively unstable output
  - Undesirable if supply shock variance is large relative to k — the average output distortion causing the credibility problem
- May, however, be easier to monitor and enforce
- Note that some rules, even strict targeting rules, **will** involve output shock stabilization
  - An example is strict nominal income groth targeting
  - This, however, puts equal weight to output and inflation stability (while the socially optimal weight may not be one)
- Other approaches?
  - What is the fundamental source of the inflation bias problem?

  - What could another optimal preference structure look like?

  - First to send me the formal answer receives D.kr. 20

    $t(\text{correct answer}) = 20$

Evidence on time-inconsistency problems

- Not many direct tests of the model per se; mostly indirect evidence
- However, Ireland (1999, *Journal of Monetary Economics*) finds time-series support for the Barro and Gordon model on US data, when it is extended with a time-varying natural rate
  - The lower inflation in the 1980s compared to the 1970s is consistent with the model as the natural rate of unemployment has fallen
- Romer (1993) finds cross-country evidence, as an open economy version of the Barro and Gordon model predicts that **more open economies** should have a **lower inflation bias**
  - Cost of a monetary expansion is higher in an open economy:
    - Associated real depreciation creates higher CPI inflation
  - The negative relationship is found for non-OECD countries
- Indirect evidence is that higher degrees of central bank independence are negatively correlated with inflation across countries
  - The lower inflation does not come at the cost of more output instability as Rogoff model would suggest
  - Indication of institutional design shaping incentives in the right direction?

Summary

- Various institutional mechanisms can be seen as reducing or eliminating the time inconsistency problem
- Criticism: Delegation merely "relocate" the time-inconsistency problem to the institutional design stage
  - Under contract approach, why not offer a new contract after inflation expectations have been formed so as to get an inflation surprise?
- Defense: Institutions, like an inflation targeting regime, are much more costly to change period by period than is policy itself
- So, setting up an incentive mechanism acts as a **commitment device**
- Barro Gordon model: A simple vehicle for thinking about credibility problems
- Provides a framework for thinking about how to overcome them
  - Enormous influence on real-life policy design (the ECB, inflation targeting regimes, etc.)
- This has generality that moves beyond the simple inflation predictions of the model
- The model and related frameworks have had great influence on how policymakers and academics think about **designing institutions for monetary stability (**title of Persson and Tabellini 1993 paper on the contract approach)

Plan for next lectures

Wednesday, March 24

1. Operating procedures and choice of monetary policy instrument
2. Intermediate targets in policymaking

Literature: Walsh (Chapter 9, pp. 429-448)

Monday, March 29

Interest rate policies (I)

1. Price level (in)determinacy
2. The term structure of interest rates
3. Models for monetary policy analysis and the impact of interest rate rule parameters

Literature: Walsh (Chapter 10, pp. 473-480; pp. 488-499; pp. 499-507)