Macroeconomics III

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Lecture 10

Policy and politics

So far when discussing macroeconomic policies we assumed a mechanical relation between policy choices and outcomes, as if policies were exogenous

In reality *policies themselves are endogenous* and we should consider the political process that leads to equilibrium policy (and allocation) outcomes

The policy maker is a rational agent that maximizes some utility function subject to restrictions

- Response of the private sector to different policies
- Institutional constraints

Outline

- Ex-ante optimality in monetary policy making (PT 15-15.2)
- Credibility in monetary policy making (PT 15.3)
- Reputation (PT 15.4)
- Institutions (PT 17-17.1.1)

The study of policy decision making has two objectives

- *Positive*, determining how policy makers react to different incentives
- *Normative*, given the positive analysis, how we should modify institutions to maximize welfare

Now we will study these issues with respect to monetary policy

Credibility issues in monetary policy

We are now ready to setup the basic model used by Persson and Tabellini in their analysis of credibility issues in monetary policy. This model features two equations:

- Reduced form demand equation
- New Keynesian Phillips (supply) curve

These equation are

$$
\begin{aligned}
\pi &= m + \nu + \mu && (1)\\
x &= \theta + (\pi - \pi^e) - \epsilon && (2)
\end{aligned}
$$

where x is output (or output growth), θ is the stochastic potential output level (or its growth rate), and $\pi^e = E[\pi]$

Here m is money growth, ν and ϵ are demand and supply shocks respectively

Finally, μ is randomness introduced by monetary policy (difference between desired policy and actual policy)

All shocks are white noise, orthogonal to each other

Timing - commitment

The timing of events is as follows

1. Monetary policy rule is announced
2. Private sector and government observe θ
3. π^e is formed as $\pi^e = E[\pi|\theta]$
4. ν and ϵ are observed (this gives an advantage to the CB)
5. Government determines m
6. μ is realized together with π and x

This timing captures, in a simplified way, the idea that *the government has more information than the private sector*. The latter only observes θ before forming expectations, while the former also observes ν and ϵ, and thus can condition policy on this information

Note that from (1) it must be that $E[\pi|\theta] = E[m|\theta]$, so from (2) only unanticipated policy moves affect real variables

$$x = \theta + m - E[m|\theta] + \nu + \mu - \epsilon$$

But when policy responds to shocks it can stabilize output. Thus this simple framework has the necessary ingredients to study monetary policy

Optimal policy

We need to specify a social welfare function in order to derive the optimal monetary policy. We postulate that the following *quadratic loss function* is used to evaluate outcomes

$$E[L(\pi, x)] = \frac{1}{2}E\left[(\pi - \bar{\pi})^2 + \lambda(x - \bar{x})^2\right] \tag{3}$$

where $\bar{\pi}$ and $\bar{x}$ are the desired, or target, levels of inflation and output, and λ is the relative weight on deviations from target (Di Tella MacCulloch and Oswald (2001) estimate $\lambda = 1.7$)

With a quadratic objective, it can be shown that optimal policies are always *linear*. So we can assume that policy is given by the following rule

$$m = \psi + \psi_\theta \theta + \psi_\nu \nu + \psi_\epsilon \epsilon$$

If this rule is credible, then

$$\pi^e = E[\pi|\theta] = E[m|\theta] = \psi + \psi_\theta \theta$$

And equilibrium is given by (1) and (2) evaluated using rule:

$$\pi = \psi + \psi_\theta \theta + (1 + \psi_\nu)\,\nu + \psi_\epsilon \epsilon + \mu$$

$$x = \theta + (\psi_\nu + 1)\,\nu + (\psi_\epsilon - 1)\,\epsilon + \mu$$

Plug the two equations above in (3):

$$E[L] = \frac{1}{2}E\begin{bmatrix} (\psi + \psi_\theta\theta + (1+\psi_\nu)\,\nu + \psi_\epsilon\epsilon + \mu - \bar{\pi})^2 \\ +\lambda(\theta + (\psi_\nu + 1)\,\nu + (\psi_\epsilon - 1)\,\epsilon + \mu - \bar{x})^2 \end{bmatrix}$$

$$= \frac{1}{2}\begin{bmatrix} \psi^2 + \bar{\pi}^2 - 2\psi\bar{\pi} + \psi_\theta^2\sigma_\theta^2 + (1+\psi_\nu)^2\,\sigma_\nu^2 + \psi_\epsilon^2\sigma_\epsilon^2 + \sigma_\mu^2 \\ +\lambda(\bar{x}^2 + \sigma_\theta^2 + (1+\psi_\nu)^2\,\sigma_\nu^2 + (\psi_\epsilon - 1)^2\,\sigma_\epsilon^2 + \sigma_\mu^2\,) \end{bmatrix}$$

where I have set to zero all the correlations between different stochastic variables (recall these are uncorrelated). Furthermore, the cross-products between a constant (as ψ or $\bar{\pi}$) and a stochastic variable (as θ, ν, ϵ, μ) are all zero in expected value (as the shocks have zero mean). Only the cross product between ψ and $\bar{\pi}$ survives.

FOCs for ψ, ψ_θ, ψ_ν, and ψ_ϵ:

1. $\frac{dE[L(\pi,x)]}{d\psi} = 0 \longrightarrow \psi = \bar{\pi}$
2. $\frac{dE[L(\pi,x)]}{d\psi_\theta} = 0 \longrightarrow \psi_\theta = 0$
3. $\frac{dE[L(\pi,x)]}{d\psi_\nu} = 0 \longrightarrow \psi_\nu = -1$
4. $\frac{dE[L(\pi,x)]}{d\psi_\epsilon} = 0 \longrightarrow \psi_\epsilon + \lambda(\psi_\epsilon - 1) = 0 \longrightarrow \psi_\epsilon = \frac{\lambda}{1+\lambda}$

So the first two FOC tell us that the rule “anchors" inflationary expectations at desired level $\bar{\pi}$. Third FOC says that rule fully stabilizes demand shocks, while the last FOC shows that supply shocks are traded into prices and output according to society’s preferences (captured by λ)

Optimal rule is then

$$m = \bar{\pi} - \nu + \frac{\lambda}{1+\lambda}\epsilon$$

With this the equilibrium is

$$\begin{aligned} \pi^C &= \bar{\pi} + \frac{\lambda}{1+\lambda}\epsilon + \mu \\ x^C &= \theta - \frac{1}{1+\lambda}\epsilon + \mu \end{aligned}$$

Since policy cannot correct control shocks μ, we will disregard them (although in reality they are always present). And since demand shocks, ν, present no conflict we eliminate them as well

Credibility

In reality monetary policy decisions are made repeatedly in time and not once and for all. And it is more realistic to assume that policymakers only control current decisions and must take future policy choices as not being under their direct control

Nevertheless future decisions are affected by current decisions, thus equilibrium policy is the solution of a complex fixed point problem that takes into consideration these feedback effects (on top of economic effects of policy choices)

Dynamic models with endogenous policy choice are beyond the scope of this course, but we can study many credibility issues with static models

Timing - discretion

We now consider the equilibrium in the static economy under the assumption that the government has no commitment

The timing of events is as follows

1. Private sector and government observe θ
2. π^e is formed as $\pi^e = E[\pi|\theta]$
3. ϵ is observed
4. Government determines m, and thus π and x

Note that now expectations on inflation must be made before the government chooses monetary policy. However, the private sector does internalize the government's ex post incentives with respect to the growth rate of money. Thus an equilibrium must satisfy

1. Policy be ex post optimal, i.e. $\frac{dL}{dm} = 0$ given π^e and ϵ
2. π^e is formed as $\pi^e = E[\pi|\theta]$, i.e. expectations are rational

Note that these conditions imply the equilibrium is Nash (both "players" choose their actions optimally taking as given the actions of the other)

Let's solve by backward induction determining first the policy choice, observing expectations and the supply shock. As the policy choice takes place after uncertainty is realized, we don't have expectations on the social loss function

$$L(\pi, x) = \frac{1}{2}\left[(\pi - \bar{\pi})^2 + \lambda(x - \bar{x})^2\right]$$

and supply and demand are given by

$$\begin{aligned} x &= \theta + (\pi - \pi^e) - \epsilon \\ \pi &= m \end{aligned}$$

Thus we can think of the government directly choosing π instead of m

Optimal policy choice

FOC for the ex post choice of π is

$$\frac{dL(\pi, x)}{d\pi} = 0 \rightarrow \pi - \bar{\pi} + \lambda \left(\theta + \pi - \pi^e - \epsilon - \bar{x}\right) = 0$$

Which gives optimal choice of π given π^e and ϵ

$$\pi = \frac{1}{1+\lambda}\bar{\pi} + \frac{\lambda}{1+\lambda}\left(-\theta + \pi^e + \epsilon + \bar{x}\right) \tag{4}$$

We assume that $\bar{x} > \theta$. Distortions imply that potential output (or employment) is below desired level

Equilibrium

Knowing that policy will be chosen according to (4) the private sector forms expectations

$$\pi^e = E[\pi|\theta] = \bar{\pi} + \lambda(\bar{x} - \theta)$$

and our equilibrium without commitment is

$$\pi^D = \bar{\pi} + \lambda(\bar{x} - \theta) + \frac{\lambda}{1+\lambda}\epsilon$$

$$x^D = x^C = \theta - \frac{1}{1+\lambda}\epsilon$$

where the superscript D stands for "discretion". Note that credibility problems produce an *inflation bias* with no gain in output stabilization. Also π^D is more volatile than π^C (volatility in θ)

One can interpret this equilibrium as if the government tries, unsuccessfully, to boost the economy through surprise inflation

Model predicts positive correlation between inflation levels and its volatility (both depend on λ). This is consistent with the data

Reputation

Since we have described the Nash equilibrium of the static game (thus with no physical state variable) with no commitment we can study when a repeated interaction between the government and the private sector might result in an outcome better than the repetition of this Nash equilibrium

This depends on the rule that the private sector follows in forming expectations based on past policy choices (that is why we say that the link between current and future policy choices is *expectational*)

In this repeated setting the government faces a trade-off between a current gain from producing surprise inflation and future losses due to shifts in expectations

The government evaluates these gains and losses by

$$E_t \sum_{j=0}^{\infty} \beta^j E[L(\pi_{t+j}, x_{t+j})]$$

To simplify we assume $L(\pi, x) = \frac{\pi^2}{2} - \lambda x$. For this case the static equilibria under commitment and discretion are

$$\begin{aligned} \pi^C &= 0 \\ \pi^D &= \lambda \quad \left(\frac{\partial L(\pi, x)}{\partial \pi} = 0 \rightarrow \pi = \lambda\right) \\ x^C = x^D &= \theta - \epsilon \quad \text{(no cost of output volatility)} \end{aligned}$$

Assume the following rule for inflation expectations formation

$$\pi_t^e = \begin{cases} 0 \text{ iff } \pi_\nu = \pi_\nu^e \;\; \nu = t-1, \ldots, t-T \\ \lambda \text{ otherwise} \end{cases}$$

The government has a choice that reflects a *reward* if it satisfies expectations, and a *punishment* if it deviates (if it does so, it will choose optimal deviation $\pi = \lambda$)

Satisfying expectations leads to the following social loss

$$L_t = -\lambda E_t \sum_{j=0}^{\infty} \beta^j (\theta_{t+j} - \epsilon_{t+j}) \tag{5}$$

which reduces to

$$
\begin{aligned}
L_t &= -\lambda E_t \sum_{j=0}^{\infty} \beta^j (\theta_{t+j} - \epsilon_{t+j}) \\
&= -\lambda(\theta_t - \epsilon_t) - \underbrace{\lambda E_t \sum_{j=1}^{\infty} \beta^j (\theta_{t+j} - \epsilon_{t+j})}_{=0} \\
&= -\lambda(\theta_t - \epsilon_t)
\end{aligned}
$$

Prior to calculate costs and benefits, let's find the optimal deviation strategy at time t. To this end, set the following problem:

$$\min_{\pi_t} L_t = \frac{\pi_t^2}{2} - \lambda(\theta_t + \pi_t - \epsilon_t)$$

where we have imposed $\pi^e = 0$, so as to assume that the policy maker takes advantage of the public's expectations. The FOC reads as:

$$\frac{\partial L(\pi_t, x_t)}{\partial \pi_t} = 0 \rightarrow \pi_t = \lambda$$

which implies $x_t = \lambda + \theta_t - \epsilon_t$. Thus, the current (i.e., time t) benefit from deviating from committment is:

$$B = L\left(0, \theta_t - \epsilon_t\right) - L\left(\lambda, \lambda + \theta_t - \epsilon_t\right) = \frac{\lambda^2}{2}$$

The cost of deviating today will unravel from $t+1$ onwards, so that

$$\begin{aligned} C &= E_s \sum_{t=s+1}^{T} \beta^{t-s} \left[L\left(\lambda, \theta_t - \epsilon_t\right) - L\left(0, \theta_t - \epsilon_t\right) \right] \\ &= E_s \sum_{t=s+1}^{T} \beta^{t-s} \left[\frac{\lambda^2}{2} - \lambda\left(\theta_t - \epsilon_t\right) + \lambda\left(\theta_t - \epsilon_t\right) \right] \\ &= \beta \frac{1-\beta^T}{1-\beta} \frac{\lambda^2}{2} \end{aligned}$$

Incentives

The government will not deviate as long as

$$B \leq C$$

This requires

$$\frac{\lambda^2}{2} < \beta \frac{1-\beta^T}{1-\beta} \frac{\lambda^2}{2} \rightarrow 1 < \beta \frac{1-\beta^T}{1-\beta}$$

Note that for $T = 1$ there can be no equilibrium with zero inflation. As T increases, as long as $\beta > \frac{1}{2}$, then reputation can help sustain an equilibrium with low inflation

If we had retained a loss function that was quadratic on output, then the incentives to deviate would depend on the realization of θ

The main insight of reputation models is that ongoing interaction between the government and the private sector can mitigate the inflation bias

The main weakness of these models is that there are multiple equilibria and it is not clear who, and how, chooses a rule for expectation formation

Lack of suggestions for policy improvement directed research to analysis of institutions and its effects on policy incentives

Institutions

We take an “institution" to be a set of rules that are hard to change in the short run, and thus influence expectations on policy formation over the short run (when institutions are fixed)

Thus we are silent on *how* or *why* institutions are chosen (independent central bank, currency peg, currency union, inflation target, etc.)

We will take institutions as given and ask how they affect equilibrium level and volatility of inflation and volatility of output

Simple rules

Small open economies, like Denmark, have commonly pegged the exchange rate as a means of anchoring inflationary expectations. These schemes sometimes are successful, others fail. We will study them using the usual framework

We call foreign inflation π^*. A credible peg will result in domestic inflation being equal to π^*

If the peg is not credible, expectations will be formed as if the government deviates and follows its ex post optimal policy. Thus $\pi^e > \pi^*$, which can be interpreted as a *devaluation spiral*

If the peg is credible, equilibrium is given by

$$\begin{aligned} \pi^S &= \pi^* \\ x^S &= \theta - \epsilon \end{aligned}$$

where S stands for “simple" rule

Note: this presumes π^* observed when forming π^e

Is this outcome desirable? Society must evaluate a trade-off of lower inflation but higher output volatility

Under discretion (assuming $\bar{\pi} = 0$):

$$\begin{aligned} \pi^D &= \lambda\left(\bar{x} - \theta\right) + \frac{\lambda}{1+\lambda}\epsilon \\ x^D &= x^C = \theta - \frac{1}{1+\lambda}\epsilon \end{aligned}$$

Plug it into the static loss function:

$$L(\pi^D, x^D) = \frac{1}{2}\left[\left(\lambda\left(\bar{x} - \theta\right) + \frac{\lambda}{1+\lambda}\epsilon\right)^2 + \lambda\left(\theta - \frac{1}{1+\lambda}\epsilon - \bar{x}\right)^2\right]$$

Take expectations (do):

$$E[L(\pi^D, x^D)] = \frac{1}{2}\lambda(1+\lambda)\left[\bar{x}^2 + \sigma_\theta^2 + \frac{1}{(1+\lambda)^2}\sigma_\epsilon^2\right]$$

While under the peg (assuming $E[\pi^*] = 0$)

$$L(\pi^S, x^S) = \frac{1}{2}\left[\pi^{*2} + \lambda\left(\theta - \epsilon - \bar{x}\right)^2\right]$$

Comparing both social losses

$$E[L(\pi^D, x^D)] - E[L(\pi^S, x^S)] = \frac{1}{2}\left[\lambda^2(\bar{x}^2 + \sigma_\theta^2 - \frac{1}{1+\lambda}\sigma_\epsilon^2) - \sigma_{\pi^*}^2\right]$$

The first two terms are the gain from peg that eliminates inflation bias. The last two terms are the cost from excessive output volatility and being subject to foreign shocks to inflation