Macroeconomic Dynamics

Political Economics: Week 5

Giacomo A. M. Ponzetto

CREI – UPF – Barcelona GSE

5th and 8th February 2010

Dynamic Policy Choices

- In a dynamic macroeconomic model both individuals and policy-makers face intertemporal optimization problems.
- Private decisions depend on expectations of future outcomes, including policy choices.
- Policy-making is sequential: fiscal policy and monetary policy are set every period, taking expectations as given.
- The absence of a commitment mechanism implies that the policy-maker loses control of expectations.
- Even a benevolent planner faces a *credibility* problem: agents expect ex post optimal policy decisions (Kydland and Prescott 1977).
- Both fiscal policy and monetary policy exhibit *time inconsistency*: ex post optimal policies differ from ex ante optimal policies.

A Macroeconomic Model

- Individuals maximize the objective function

$$\sum_{t=0}^{\infty} \beta^t u\left(c_t^i, s_t\right)$$

subject to the dynamic budget constraint

$$s_{t+1}^i = S\left(c_t^i, s_t^i, s_t, q_t\right),$$

  - c_t^i is the agent's choice variable;
  - s_t^i is the individual state variable, which aggregates to the economy-wide state variable s_t;
  - each atomistic agent has no impact on the aggregate.

- The policy decision q_t follows a state-contingent rule

$$q_t = \Psi\left(s_t\right).$$

Equilibrium under a Policy Rule

- The individual problem can be rewritten recursively:

$$W\left(s_t^i, s_t; \Psi\right) = \max_{c_t^i}\left[u\left(c_t^i, s_t\right) + \beta W\left(s_{t+1}^i, s_{t+1}; \Psi\right)\right]$$

  subject to

$$s_{t+1}^i = S\left(c_t^i, s_t^i, s_t, \Psi\left(s_t\right)\right),$$

  and to the aggregate dynamics

$$s_{t+1} = G\left(s_t, \Psi\left(s_t\right)\right).$$

- The solution to this problem is a value function $W\left(s_t^i, s_t; \Psi\right)$ that also implies a choice rule $c_t^i\left(s_t^i, s_t; \Psi\right)$ and individual dynamics

$$s_{t+1}^i = G^i\left(s_t^i, s_t, \Psi\left(s_t\right)\right).$$

- In equilibrium, individual and aggregate dynamics must be consistent:
  - aggregate dynamics are obtained by aggregating individual dynamics;
  - individual dynamics are optimal taking aggregate dynamics as given.

Credibility

- If a benevolent planner could choose the policy

$$\Psi^* = \arg\max_{\Psi} W\left(s_0^i, s_0; \Psi\right),$$

which defines the ex ante optimal policy rule.

- Given expectations of Ψ, it the policy-maker chose a one-period deviation to $\tilde{q}_t \neq \Psi\left(s_t\right)$, the individual problem would change to

$$\tilde{W}\left(s_t^i, s_t, \tilde{q}_t; \Psi\right) = \max_{c_t^i}\left[u\left(c_t^i, s_t\right) + \beta W\left(s_{t+1}^i, s_{t+1}; \Psi\right)\right]$$

subject to

$$s_{t+1}^i = S\left(c_t^i, s_t^i, s_t, \tilde{q}_t\right),$$

and to different aggregate dynamics

$$s_{t+1} = \tilde{G}\left(s_t, \tilde{q}_t; \Psi\right)$$

consistent with the optimal individual dynamics

$$s_{t+1}^i = \tilde{G}^i\left(s_t^i, s_t, \tilde{q}_t; \Psi\right).$$

Discretion

- If the government chooses policy sequentially, setting q_t at time t, it must not have any profitable deviation.
- Otherwise, people's expectation of Ψ would not be rational given the lack of commitment.
- The equilibrium requirement is that

$$\Psi\left(s_t\right) = \arg\max_{\tilde{q}_t} \tilde{W}\left(s_t^i, s_t, \tilde{q}_t; \Psi\right).$$

- Whenever this incentive constraint binds, there is by definition a loss of welfare.
- Commitment is valuable because it allows a constraint to be relaxed.
- Intuitively, commitment to a rule allows the policy-maker to set private expectations rather than letting be determined in equilibrium.

Factor Taxation in a Closed Economy

- A simplified two-period model.
- In the first period, the representative agent has a unit endowment and allocates it to consumption and savings:

$$c_1^i + k^i = 1.$$

- In the second period, the agent allocates his time between labour and leisure

$$l^i + x^i = 1,$$

and consumes after-tax capital and labour income:

$$c_2^i = (1 - \tau_K)\, k^i + (1 - \tau_L)\, l^i.$$

- The utility function is

$$W^i = U\left(c_1^i\right) + c_2^i + V\left(x^i\right).$$

Private Responses to Tax Policy

- The representative agent's problem is

$$\max_{k^i,l^i} U\left(1-k^i\right)+\left(1-\tau_K\right)k^i+\left(1-\tau_L\right)l^i+V\left(1-l^i\right).$$

- The first-order conditions

$$U_c\left(1-k^i\right)=1-\tau_K \text{ and } V_x\left(1-l^i\right)=1-\tau_L$$

define the savings function

$$K\left(\tau_K\right)=1-U_c^{-1}\left(1-\tau_K\right)$$

and the labour-supply function

$$L\left(\tau_L\right)=1-V_x^{-1}\left(1-\tau_L\right).$$

- Both functions are monotone decreasing, with elasticities

$$\varepsilon_K\left(\tau_K\right)\equiv\frac{\tau_K K'\left(\tau_K\right)}{K\left(\tau_K\right)}<0 \text{ and } \varepsilon_L\left(\tau_L\right)\equiv\frac{\tau_L L'\left(\tau_L\right)}{L\left(\tau_L\right)}<0.$$

The Ex Ante Optimal Policy

- The government needs to finance a given budget: $G = \tau_L l + \tau_K k$.
- If it could commit ex ante to tax rates τ_K and τ_L, it would maximize

$$
\begin{aligned}
W(\tau_K, \tau_L) &= U(1 - K(\tau_K)) + (1 - \tau_K) K(\tau_K) \\
&\quad + V(1 - L(\tau_L)) + (1 - \tau_L) L(\tau_L).
\end{aligned}
$$

- The optimality condition is a form of the Ramsey rule:

$$
\varepsilon_K(\tau_K) = \varepsilon_L(\tau_L).
$$

- The factor with higher supply elasticity is taxed less.
- Labour supply is plausibly more inelastic than investment: $\tau_L^* > \tau_K^*$.
- In the steady state of a model with infinitely-lived households, the stronger *Chamley–Judd result* obtains: $\tau_K^* = 0$.
  - In a Ramsey world, consumption should be taxed equally at all times.
  - This result is not valid in a Mirrlees framework with private information.

Time Inconsistency

- If private agents expect a tax rate τ_K^e they accumulate $K(\tau_K^e)$.
- Then at time 2 the government can change the tax rate to $\tau_K \neq \tau_K^e$.
- By then, capital k is sunk, so τ_K no longer causes any distortion.
- The ex post optimal policy is

$$\tau_K = \frac{G}{K(\tau_K^e)} \text{ and } \tau_L = 0 \text{ if } G \leq K(\tau_K^e),$$

or

$$\tau_K = 1 \text{ and } \tau_L : \tau_L L(\tau_L) = G - K(\tau_K^e) \text{ if } G > K(\tau_K^e).$$

- In a rational expectations equilibrium, savers understand the government's incentives, so

$$\tau_K^e = \tau_K = \min\left\{1, \frac{G}{K(\tau_K)}\right\}.$$

Multiple Equilibria

- The government raises capital taxes until all its expenses are defrayed.
- If G is large, there is a unique equilibrium: $\tau_K = 1$ and $K(\tau_K) = 0$.
- If G is lower, there are other equilibria on the Laffer curve:

1. If savers expect lower tax rates, they accumulate less capital, so lower tax rates are sufficient to finance G.
2. If savers expect higher tax rates, capital accumulation is lower, so higher tax rates are required to finance G.

- All equilibria are inefficient compared to the full-commitment policy.
- The equilibria are Pareto ranked: the lower τ_K the better.
- Equilibrium multiplicity enables self-fulfilling confidence crises.

Redistribution across Factor Owners

- Heterogeneous agents with budget constraints

$$c_1^i + k^i = 1 - e^i \text{ and } l^i + x^i = 1 + e^i.$$

- Individual choices

$$l^i = L(\tau_L) + e^i \text{ and } k^i = K(\tau_K) - e^i.$$

- Indirect utility:

$$W^i(\tau) = W(\tau) + (\tau_K - \tau_L)\, e^i.$$

- Workers want higher taxes on capital, and capitalists higher taxes on labour.
- Capital income is more concentrated than labour income: the endowment parameter e^i has mean zero but positive median e^m.

Downsian Redistribution

- If elections are held ex ante and politicians can commit to tax policy τ, the median-voter theorem implies

$$\frac{K(\tau_K) - e^m}{K(\tau_K)} [1 + \varepsilon_L(\tau_L)] = \frac{L(\tau_L) + e^m}{L(\tau_L)} [1 + \varepsilon_K(\tau_K)] .$$

- Distributional conflict is sufficient to raise capital taxes above the optimal level

$$e^m > 0 \Leftrightarrow \tau_K > \tau_K^* \text{ and } \tau_L < \tau_L^*.$$

- If elections are held ex post, when capital is sunk, even a benevolent planner desires $\tau_K = 1$.
- A fortiori, so does the median voter.
- Time inconsistency and distributional conflict reinforce each other.

Elections without Commitment

- Elections are held ex ante and politicians choose tax policy ex post.
- There is no commitment mechanism, so the politician chooses his favourite tax policy.
- Any politician with endowment $e^P \geq 0$ wants to minimize τ_L.
- A politician with $e^P < 0$ has an ideal ex post tax rate for labor

$$\tau_L^P\left(k, e^P\right) > 0 \text{ such that } \frac{k - e^P}{k}\left[1 + \varepsilon_L\left(\tau_L^P\right)\right] = \frac{L\left(\tau_L^P\right) + e^P}{L\left(\tau_L^P\right)},$$

which implies

$$\partial\tau_L^P/\partial k < 0 \text{ and } \partial\tau_L^P/\partial e^P < 0.$$

- A higher aggregate capital stock increases the temptation to tax it.
- A higher individual capital stock reduces the willingness to tax it.

Strategic Delegation

- Electing a politician with a low value of e^P induces an ex post tax rate $\tau_K < 1$.
- Every voter prefers to elect a capital friendly politician $e^{iP} < 0$.
- Every voter prefers a politician more capital-friendly than himself: $e^{iP} < e^P$.
- With exogenous candidacy, e^{mP} is elected because he is expected to prefer ex post the tax structure that the median voter prefers ex ante.
- In a citizen-candidate equilibrium, e^{mP} runs unopposed even if he is not his own favourite politician.
- Otherwise, there can be a two-candidate equilibrium with $e^R < e^{mP} < e^L$.

A Simple Model of Public Debt

- The representative consumer has utility

$$u = c_1 + c_2 + V(1 - l).$$

- The budget constraint is

$$c_1 + b = e \text{ and } c_2 = (1 - \tau) l + Rb.$$

- e is the exogenous initial endowment.
- b is the holding of public debt, the only savings instrument.
- The interest rate must be $R = 1$ in an interior equilibrium $b \in (0, e)$.
- The government budget constraint is

$$g_1 = b_1 \text{ and } g_2 + b = \tau L(\tau),$$

where again

$$L(\tau) = 1 - V_L^{-1}(1 - \tau).$$

Heterogeneous Preferences

- Each agent's preferences over private consumption can be expressed as a function of total government spending G
$$W(G) = \max\left\{(1-\tau)l + V(1-l)\right\} \text{ with } \tau L(\tau) = G$$
such that government spending is privately costly $(W_G < 0)$ and induces increasing distortions $(W_{GG} < 0)$.
- Individuals belong to two groups of equal size, D and R, who desire different public goods g^D and g^R.
- Total welfare for an agent in group J is
$$w^J = W(G) + H\left(g_1^J\right) + H\left(g_2^J\right).$$
- The utilitarian social optimum is described by consumption smoothing: $g_1^D = g_1^R = g_2^D = g_2^R = g^*$ for $t = 1, 2$ and $J = D, R$.
- The optimality condition is
$$2W_G(G^*) + H_g(g^*) = 0 \text{ with } G^* = 4g^*.$$

The Common-Pool Problem

- Each group determines public spending on its own good: e.g., norm of reciprocity, devolution to local governments, coalition government, ...
- Sequential decision-making, to be analyzed by backwards induction.
- At $t = 2$, for a given b the Nash equilibrium of the spending game is

$$\begin{cases} g_2^D = \arg\max_{g \geq 0} \left\{ W\left(b + g_2^R + g\right) + H\left(g\right) \right\} \\ g_2^R = \arg\max_{g \geq 0} \left\{ W\left(b + g_2^D + g\right) + H\left(g\right) \right\} \end{cases}.$$

- The unique, symmetric equilibrium is

$$g_2^D = g_2^R = g^J\left(b\right) \text{ such that } W_G\left(b + 2g^J\right) + H_g\left(g^J\right) = 0.$$

- Each group overspends because it internalizes all benefits but only half of the costs: the law of $1/N$.
- Outstanding debt increases the marginal cost of public spending and therefore reduces it: $g_b^J\left(b\right) < 0$.

The Dynamic Common-Pool Problem

- At $t = 1$, each group anticipates future (over-)spending, and thus solves

$$g_1^J = \arg\max_{g=\geq 0} \left\{ W\left(b + 2g^J(b)\right) + H(g) + H\left(g^J(b)\right) \right\}$$
$$\text{s. t. } b = g + g_1^{\neg J}.$$

- The unique, symmetric equilibrium is $g_1^D = g_1^R = g_1^J$ such that

$$W_G(G)\left[1 + g_b^J(b)\right] + H_g\left(g_1^J\right) = 0,$$
$$b = 2g_1^J \text{ and } G = b + 2g^J(b).$$

- Each group has an additional incentive to overspend at $t = 1$: $W_G g_b^J > 0$. Higher g_1^J increases public debt b, which lowers spending by the other group at $t = 2$.
- The dynamic common-pool problem leads not only to overspending but also to excessive debt accumulation:

$$g_1^J > g_2^J \text{ and } G > G^*.$$

Political Turnover

- Each group is represented by one party, and only one party is in power in each period.

1. The party in power at time 1 sets g_1^D and g_1^R, and thus determines $b = g_1^D + g_1^R$
2. The party in power at time 2 inherits b and sets g_2^D and g_2^R.

- Probability p_J that J remains in office at $t = 2$.
- The possibility of losing power creates the incentive for strategic budget deficits.
- The incumbent tries and to rush pet projects and to bind the hands of future governments

Disagreement over the Composition of Spending

- At $t = 2$, the ruling party J provides public goods to its own group:

  $g_2^{\neg J} = 0$ and $g_2^J = g^J(b)$ such that

  $$W_G\left(b + g_2^J\right) + H_g\left(g_2^J\right) = 0.$$

- Again, outstanding debt reduces public spending: $g_b^J(b) < 0$.
- At $t = 1$, the ruling party J provides public goods to its own group:

  $g_1^{\neg I} = 0$ and $g_1^I = b$ such that

  $$W_G\left(b + g^J(b)\right)\left[1 + g_b^J(b)\right] + H_g(b) + p_I H_g\left(g^J(b)\right) g_b^J(b) = 0.$$

Political Instability and Overspending

- The two first-order conditions yield

$$H(g_1) = H_g(g_2)\left[1 + (1 - p_I)\, g_b^J(g_1)\right].$$

- A stable government optimally smooth public goods: $g_1 = g_2$ if and only if $p_I = 1$
- Any government that could lose power is overeager to borrow: $g_1 > g_2$ for all $p_I < 1$.
- The more unstable the government, the greater deficit spending.
- Spending is also inefficient because only one public good is provided in each period
- As with the dynamic common-pool problem, aggregate spending is excessive: $G > G^*$.

Disagreement over the Amount of Spending

- There is only one global public good, but groups have heterogeneous valuations

$$w^J = W(g_1 + g_2) + \alpha^J [H(g_1) + H(g_2)], \text{ with } \alpha^R < \alpha^D.$$

- At $t = 2$ the ruling party J provides

$$g^J(b) \text{ such that } W_G\left(b + g_2^J\right) + \alpha^J H_g\left(g_2^J\right) = 0.$$

- As usual $g_b^J(b) < 0$, but now also $g^R(b) < g^D(b)$ for all b.
- Suppose party R is in office at $t = 1$. Its objective function is

$$\begin{aligned} \mathbb{E}w^R(b) &= p_R W\left(b + g^R(b)\right) + (1 - p_R) W\left(b + g^D(b)\right) \\ &\quad + \alpha^R\left[H(b) + p_R H\left(g^R(b)\right) + (1 - p_R) H\left(g^D(b)\right)\right]. \end{aligned}$$

Strategic Debt

- Party R's optimality condition at $t=1$, anticipating policy at $t=2$:

$$\alpha^R\left[H_g(b)-H_g\left(g^R(b)\right)\right]=$$
$$=(1-p_R)\left(\alpha^D-\alpha^R\right)H_g\left(g^D(b)\right)g_b^D(b)$$
$$+(1-p_R)\left[W_G\left(b+g^R(b)\right)-W_G\left(b+g^D(b)\right)\right].$$

- For $p_R<1$, the right-hand side captures two strategic considerations:

1. By spending more at $t=1$, R forces D to spend less at $t=2$. This is captured by the negative term: $\alpha^D-\alpha^R>0$, $H_g>0$, and $g_b^D<0$.
2. By spending less at $t=1$, R reduces the distortion caused by D's excessive taxation at $t=2$. This is captured by the positive term: $g^R<g^D$, $W_G<0$, and $W_{GG}<0$.

Starving the Leviathan

- If $p_R = 1$ then $g_1 = g_2$, even if it is lower than the utilitarian social optimum.
- If $p_R < 1$ and the strategic effect dominates, a party-R government will over-issue debt at $t = 1$ in order to tie the hands of a possible party-D successor.
- This effect is stronger the more polarized the parties (the greater $\alpha^D - \alpha^R$).
- The preferences of the two parties are always the opposite: in the strategic scenario, a party-D government underspends in order to avoid deep spending cuts by a possible party-R successor.
- A probabilistic voting model also predicts over-borrowing by weak parties: a higher b makes the difference between α^D and α^R less salient, so each party tends to lose support in its "natural" constituency while stealing votes in the opponent's.

A Simple Model of Monetary Policy

- The demand side of the economy is represented by the monetary equation

$$\pi = m + v + \mu,$$

where π denotes inflation, m money growth, v a velocity (demand) shock, and μ a "control error" in monetary policy.

- The quantity theory of money would require output growth x on the left-hand side, but since we are doing political economics rather than macroeconomics we can simplify the equation without sacrificing important insights.
- The supply side is represented by the Phillips curve

$$x = \theta + \pi - \mathbb{E}\pi - \varepsilon,$$

where x denotes output (employment) growth, θ the stochastic potential output (or natural rate of unemployment), and ε a supply-side (productivity) shock.

What Monetary Policy Can Do

1. Everyone observes θ and the public forms expectations $\mathbb{E}(\pi|\theta)$.
2. The shocks v and ε are realized and the policymaker chooses m.
3. μ is realized and π and x are determined.

- The policymaker can react to v and ε faster than wage-setters in the private sector.
- Monetary policy can be used to stabilize the economy, but perfect fine-tuning is impossible.
- All shocks are uncorrelated mean-zero white noise.
- Rational expectations imply

$$x = \theta + m - \mathbb{E}(m|\theta) + v + \mu - \varepsilon.$$

$\Rightarrow$ Only unexpected aggregate demand policy affects real variables.

Commitment

- Social welfare is described by the quadratic loss function

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

  where $(\bar{\pi}, \bar{x})$ is the societal bliss point and λ is the relative cost of output volatility.
- A policy rule takes the form $m = \Psi(\theta, v, \varepsilon)$, and in our linear-quadratic setup the optimal policy is linear

$$m = \psi + \psi_\theta \theta + \psi_v v + \psi_\varepsilon \varepsilon.$$

- If the policy-maker can commit to a rule Ψ, expectations are

$$\mathbb{E}(m|\theta) = \psi + \psi_\theta \theta.$$

- The equilibrium under the rule is

$$\pi = \psi + \psi_\theta \theta + (\psi_v + 1) v + \psi_\varepsilon \varepsilon + \mu,$$
$$x = \theta + (\psi_v + 1) v + (\psi_\varepsilon - 1) \varepsilon + \mu.$$

Ex Ante Optimality

- Welfare under the rule is described by

$$\begin{aligned}\mathbb{E}L(\Psi) &= (\psi-\bar{\pi})^2+\psi_\theta^2\sigma_\theta^2+(\psi_v+1)^2\sigma_v^2+\psi_\varepsilon^2\sigma_\varepsilon^2+\sigma_\mu^2 \\ &\quad +\lambda\left[\bar{x}^2+\sigma_\theta^2+(\psi_v+1)^2\sigma_v^2+(\psi_\varepsilon-1)^2\sigma_\varepsilon^2+\sigma_\mu^2\right].\end{aligned}$$

1. $\psi^C=\bar{\pi}$ and $\psi_\theta^C=0$. The optimal rule anchors inflation expectations at the optimal level, so that $\mathbb{E}(\pi|\theta)=0$. Policy does not react to information that the private sector has already acted upon, which would merely increase the volatility of inflation.
2. $\psi_v^C=-1$. The optimal rule perfectly offsets demand-side shocks, stabilizing both output and inflation.
3. $\psi_\varepsilon^C=\lambda/(1+\lambda)$. Supply-side shock induce a trade-off between stabilizing the volatility of output and of inflation.

The First Best

- The optimal rule is

$$m = \bar{\pi} - v + \frac{\lambda}{1+\lambda}\varepsilon.$$

- The optimal outcome under commitment is

$$\pi^C = \bar{\pi} + \frac{\lambda}{1+\lambda}\varepsilon + \mu,$$

$$x = \theta - \frac{1}{1+\lambda}\varepsilon + \mu.$$

- Consistent with a technocratic approach to monetary policy.
- There is no political tension concerning demand-side shocks v.
- There is nothing to be done about control errors μ.

$\Rightarrow$ Simplify further to $\mu \equiv 0 \equiv v$: the policymaker sets π directly

Discretion

- After the public has formed expectations π^e and the shock ε is realized, the policymaker chooses π.
- The objective function is then

$$L(\pi) = (\pi - \bar{\pi})^2 + \lambda (\theta + \pi - \pi^e - \varepsilon - \bar{x})^2 .$$

- The ex post optimal policy is

$$\pi = \frac{\bar{\pi} - \lambda (\theta - \pi^e - \varepsilon - \bar{x})}{1 + \lambda}.$$

- The ex ante optimal rule is not credible:

$$\pi^e = \bar{\pi} \Rightarrow \pi = \bar{\pi} + \frac{\lambda}{1 + \lambda} (\bar{x} - \theta + \varepsilon) .$$

Credible Policy

- In a rational expectations equilibrium

$$\pi^e \equiv \mathbb{E}\left(\pi|\theta\right) = \bar{\pi} + \lambda\left(\bar{x} - \theta\right).$$

- Conditional on these rational expectation, ex post optimal policy is

$$\pi^D = \bar{\pi} + \lambda\left(\bar{x} - \theta\right) + \frac{\lambda}{1+\lambda}\varepsilon.$$

- Whenever the policymaker wants to boost output and employment $(\bar{x} > \theta)$, discretion induces an inflation bias: $\pi^D > \pi^C$.
- The response to supply shocks ε is unchanged, but this is not a general result.
- Inflation volatility also increases, because $\left(\bar{x} - \theta\right)$ is stochastic.
- Higher λ implies higher and more volatile inflation—the level and volatility of inflation are in fact positively correlated in the data.

Strategic Delegation

- Suppose the policymaker is a central banker whose objective function gives a weight λ_B to output volatility.
- The social loss is

$$\mathbb{E}L(\lambda_B) = \left(\lambda + \lambda_B^2\right)\left(\bar{x}^2 + \sigma_\theta^2\right) + \frac{\lambda + \lambda_B^2}{(1+\lambda_B)^2}\sigma_\varepsilon^2.$$

- Trade-off between inflation bias and output volatility.
- The optimal policy-maker has λ_B such that

$$\lambda_B\left[1 + (1+\lambda_B)^3\frac{\bar{x}^2 + \sigma_\theta^2}{\sigma_\varepsilon^2}\right] = \lambda$$

- A conservative central banker: $0 < \lambda_B < \lambda$.
  - At the same time, $\lambda_B > 0$ for all $\sigma_\varepsilon^2 > 0$
  - Naturally $\partial\lambda_B/\partial\lambda > 0$, $\partial\lambda_B/\partial\bar{x}^2 < 0$, $\partial\lambda_B/\partial\sigma_\theta^2 < 0$, and $\partial\lambda_B/\sigma_\varepsilon^2 > 0$.

An Infinitely-Repeated Policymaking Game

- An infinite horizon and a simplified objective function

$$W_s = \mathbb{E}_s \left[\sum_{t=s}^{\infty} \beta^{t-s} \left(\lambda x_t - \frac{1}{2} \pi_t^2 \right) \right]$$
$$= \sum_{t=s}^{\infty} \beta^{t-s} \mathbb{E}_s \left[\lambda \left(\theta_t + \pi_t - \pi_t^e - \varepsilon_t \right) - \frac{1}{2} \pi_t^2 \right].$$

- The ex ante optimal rule is given by

$$\min_{\{\pi_t\}_{t=s}^{\infty}} \mathbb{E}_s \left[\sum_{t=s}^{\infty} \beta^{t-s} \pi_t^2 \right] \Rightarrow \pi_t^C = 0 \text{ for all } t,$$

because employment volatility is not costly and the average level of output cannot be manipulated given rational expectations.

- Discretion implies

$$\pi_t^D = \arg\max_{\pi_t} \left\{ \lambda \pi_t - \frac{1}{2} \pi_t^2 \right\} = \lambda \text{ for all } t,$$

implying again a detrimental inflation bias.

Reputation

- The policy-maker has a reputation for setting inflation $\hat{\pi} \in [0, \lambda)$.
- Wage setters have expectations

$$\pi_t^e = \begin{cases} \hat{\pi} & \text{if } \pi_s = \hat{\pi} \text{ for all } s < t \\ \lambda & \text{otherwise} \end{cases} .$$

- If he disappoints expectations, the policymaker can set $\pi_t = \lambda$ and earn a temporary benefit

$$\begin{aligned} B(\hat{\pi}) &= \left[\lambda(\lambda - \hat{\pi}) - \frac{1}{2}\lambda^2\right] - \left(-\frac{1}{2}\hat{\pi}^2\right) \\ &= \frac{1}{2}(\lambda - \hat{\pi})^2 . \end{aligned}$$

Credible Commitment

- The cost of a deviation is a permanent loss of reputation:

$$
\begin{aligned}
C(\hat{\pi}) &= \sum_{t=s+1}^{\infty} \beta^{t-s} \mathbb{E}_s \left(-\frac{1}{2} \hat{\pi}^2 \right) - \sum_{t=s+1}^{\infty} \beta^{t-s} \mathbb{E}_s \left(-\frac{1}{2} \lambda^2 \right) \\
&= \frac{1}{2} \frac{\beta}{1-\beta} \left(\lambda^2 - \hat{\pi}^2 \right).
\end{aligned}
$$

- Reputational concerns allow credible commitment to any rule

$$
\hat{\pi} \geq (1 - 2\beta) \lambda.
$$

- Mirroring the folk theorem, full commitment is possible if $\beta \geq 1/2$.
- More generally, the problem is that commitment to a simple rule is a second-best solution in the presence of unobservable shocks.

Heterogeneous Policy Competence

- Representative voter's preferences:

$$W_s = \mathbb{E}_s \left[\sum_{t=s}^{\infty} \beta^{t-s} \left(\lambda x_t - \frac{1}{2} \pi_t^2 \right) \right].$$

- Phillips curve

$$x_t = \pi_t - \pi_t^e - \varepsilon_t.$$

- The policymaker's competence is

$$\varepsilon_t = -\eta_t - \eta_{t-1}.$$

- $\eta_0 = 0$, while η_t is i.i.d. with $E\eta = 0$ and distribution $F(\eta)$ with density $f(\eta)$ for all $t \geq 1$.

Retrospective Voting with Symmetric Information

1. Private agents observe π_{t-1} and form rational expectations π_t^e.
2. The policymaker sets π_t.
3. η_t is realized and x_t is publicly observed.
4. An election is held if t is an election year, which is true every other period.

- With rational expectation π_t^e, voters can perfectly infer

$$\eta_t = x_t - \eta_{t-1} \text{ for all } t \geq 1.$$

- Challengers are randomly drawn from $F(\eta)$.
- The incumbent is re-elected with probability 1 if

$$\eta_t > E\eta = 0 \Leftrightarrow x_t > \eta_{t-1}.$$

Career Concerns

- Politicians have the same welfare function as the representative voter, and additionally derive an ego rent R from holding office.
- A politician that is voted out of office can never be re-elected.
- In an off-election year, the incumbent cannot increase his chance of re-election, because competence shocks last one period and are observed in the next. The optimal policy with discretion is

$$\pi_t^e = \pi_t = \lambda.$$

- In an election year, the incumbent is re-elected if

$$\eta_t > \pi_t^e - \pi_t.$$

- When π_t is chosen η_t is unknown and the probability of re-election is

$$p_t = 1 - F\left(\pi_t^e - \pi_t\right).$$

Continuation Values

- Regardless of who wins the election, future policy will be λ in off-election years and $\hat{\pi}$ in election years.
- This implies expected welfare at the beginning of the post-election period :

$$w = -\frac{\lambda^2 + \beta \hat{\pi}^2}{2\left(1-\beta^2\right)}.$$

- In future elections, the incumbent is re-elected with probability

$$p = 1 - F\left(0\right).$$

- The value of winning the present election is

$$v = \frac{\left(1+\beta\right) R}{1-\beta^2 p}.$$

- None of this depend on competence, which is unknown and rapidly decaying.

The Political Business Cycle

- Given π_t^e, the incumbent's problem in an election year is

$$\max_{\pi_t} \left\{ \lambda \left(\pi_t - \pi_t^e \right) - \frac{1}{2} \pi_t^2 - \beta v F \left(\pi_t^e - \pi_t \right) \right\}.$$

- The first-order condition is

$$\lambda - \pi_t + \beta v f \left(\pi_t^e - \pi_t \right) = 0.$$

- In a rational expectations equilibrium

$$\pi_t = \pi_t^e \equiv \hat{\pi} = \lambda + \beta v f \left(0 \right) = \lambda + R \frac{\beta \left(1 + \beta \right) f \left(0 \right)}{1 - \beta^2 p}.$$

- Policy is more expansionary in election years, because the incumbent has even lower credibility than usual, given his incentives to create inflationary surprises to boost output and gain re-election.

Asymmetric Information

- If the policymaker knows η_t when choosing π_t, the problem becomes one of signalling.
- Let η_t take either of two values $\underline{\eta} < 0$ and $\bar{\eta} > 0$, with probability q of high competence.

1. A competent politician cares more about winning the election, because he knows he will generate higher social welfare.
2. A competent politician has a lower cost of signalling through higher output growth.

$\Rightarrow$ A separating equilibrium generally emerges

1. An incompetent politician sets $\pi_t = \lambda < \pi_t^e$, which induces a recession and gets him voted out of office.
2. A competent politician set $\pi_t > \pi_t^e$, which induces a boom and secures his re-election.

Heterogeneous Preferences

- Voter i's preferences:

$$W_s^i = \mathbb{E}_s \left[\sum_{t=s}^{\infty} \beta^{t-s} \left(\lambda_i x_t - \frac{1}{2} \pi_t^2 \right) \right].$$

- Phillips curve

$$x_t = \theta + \pi_t - \pi_t^e.$$

1. Expectations π^e are formed and wages are set.
2. An election is held if t is an election year, which is true every other period.
3. The elected candidate $P \in \{L, R\}$ sets policy, with $\lambda_L > \lambda_R$.

Partisan Cycles

- There is perfect information, so there is no incentive to behave differently in election years.
- Each party sets $\pi_P = \lambda_P$ whenever in office.
- In off-election years, private agents perfectly anticipate inflation, so $x = \theta$.
- Party R is expected to win the election with probability p_R.
- In election years, expected inflation is

$$\pi^e = \lambda_R + (1 - p_R)(\lambda_L - \lambda_R).$$

- If L wins, output is

$$x_L = \theta + p_R(\lambda_L - \lambda_R).$$

- If R wins, output is

$$x_R = \theta - (1 - p_R)(\lambda_L - \lambda_R).$$

Political Support

- Left-wing governments boost employment but increase inflation.
- Right-wind governments depress employment but reduce inflation.
- Over the tenure of a government, voter i has welfare

$$W_L^i = \lambda_i p_R \left(\lambda_L - \lambda_R\right) - \frac{1+\beta}{2}\lambda_L^2,$$

$$W_R^i = -\lambda_i \left(1 - p_R\right)\left(\lambda_L - \lambda_R\right) - \frac{1+\beta}{2}\lambda_R^2.$$

- Thus a voter prefers party R's economic policy if

$$\lambda_i < \frac{1+\beta}{2}\left(\lambda_L + \lambda_R\right)$$

- Since discretion determine an inflation bias, conservative politicians are advantaged.
  - Party R has an incentive to increase the inflation bias, e.g., by reducing wage indexation.

Empirical Evidence

- Alesina, Roubini, and Cohen (1997) find empirical support for rational partisan cycles in the U.S. and more broadly in OECD countries with a two-party system.
- The time-series properties of the data have been questioned (simultaneity bias, omitted variables), but the evidence remains supportive of the hypothesis overall.
- The effects are stronger for growth than for inflation, possibly because the latter depends on noisy factors such as exchange-rate fluctuations.
- Little evidence that macroeconomic policy is manipulated before elections. Weakly positive evidence for fiscal policy.
- Recall the results on the term-limit effect and U.S. governors: identification off of national elections is difficult.