Commitment, discretion and optimal delegation

- Commitment and discretion (time consistency, dynamic inconsistency)
  - Commitment to optimal rule
  - Discretion (absence of commitment mechanism)

- Optimal delegation (Svensson 97b)
  - Output targeting
  - Linear inflation contracts
  - Inflation targeting
  - ‘Conservative’ central banks
  - Simple rules
  - Escape clause
  - Reputation
  - Transparency

Commitment and discretion

- Model basics
  - Supply function, Phillips curve
    Output, natural rate $\bar{y}$, $|\rho| < 1$
    \[ y_t = (1 - \rho)\bar{y} + \rho y_{t-1} + \alpha(\pi_t - \pi_t^e) + \varepsilon_{yt} \]
    Employment, natural rate $\bar{l}$
    \[ l_t = (1 - \rho)\bar{l} + \rho l_{t-1} + \alpha(\pi_t - \pi_t^e) + \varepsilon_t \quad (1) \]
    Unemployment, natural rate $\bar{u}$
    \[ u_t = (1 - \rho)\bar{u} + \rho u_{t-1} - \alpha(\pi_t - \pi_t^e) - \varepsilon_{ut} \]
    Employment/supply shock
    \[ E[\varepsilon_t] = 0, \quad \text{Var}[\varepsilon_t] = \sigma^2 \]
    For simplicity
    \[ \bar{l} = 0. \]
    Rational expectations
    \[ \pi_t^e = E_{t-1}\pi_t \quad (2) \]
    Derive in different ways (Rogoff 85, Mankiw textbook)
    * Persistence: Lockwood-Philippopoulos 94, Jonsson 95, Gottfries-Horn 87, Blanchard-Summers 86.
    * Standard case: no persistence, $\rho = 0$.
    * New-Keynesian Phillips curve (Flodén 96, Clarida-Gali-Gertler 99) (w/o persistence)
    \[ \pi_t = \beta\pi_{t+1|t} + \alpha y_t \]
– Society/government’s preferences

\[
\min E_0 \sum_{t=1}^{\infty} \beta^{t-1} L_t
\]  
(3)

\[
L_t = \frac{1}{2} \left[ (\pi_t - \pi^*)^2 + \lambda (l_t - l^*)^2 \right]
\]  
(4)

\[
l^* \geq \bar{l}
\]  
(5)

* If \( l^* > \bar{l} \), average benefit of surprise inflation
  
  - Output, employment, distortion
  
  - Public debt, distortionary taxation
  
  - Weak banking sector

– Transmission mechanism, monetary control

* \( \pi_t \) directly controlled by central bank

* \( l_t \) directly controlled by central bank

* \( i_t \) instrument, aggregated demand (IS equation)

\[
r_t = i_t - E_2 \pi_{t+1}
\]

\[
l_t = -\alpha_1 r_t + \eta_t
\]

\[
m_t = \ln M_t \text{ instrument, money demand equation (} p_t = \ln P_t \text{)}
\]

\[
m_t - p_t = -\alpha_2 i_t + \alpha_3 y_t
\]

• First best policy: Remove distortions. Increase \( \bar{l} \) to \( l^* \) (structural policy). Suppose this cannot be done.

  – Still, stabilization bias under discretion

  \[
  \pi_t = \pi^* - b^* \varepsilon_t
  \]  
(10)

\[
b^* = \frac{(\lambda + \beta \gamma^2) \alpha}{1 + (\lambda + \beta \gamma^2) \alpha^2}
\]  
(11)

Employment

\[
l_t = \rho l_{t-1} + (1 - \alpha b^*) \varepsilon_t.
\]  
(12)

• Optimal rule under commitment (second best)

Assume commitment mechanism

Decision problem (Persson-Tabellini 93)

\[
V^*(l_{t-1}) = \min_{\pi_t, \pi_t^*} \left\{ \frac{1}{2} \left[ (\pi_t - \pi^*)^2 + \lambda (l_t - l^*)^2 \right] + \beta V^*(l_t) \right\}
\]  
(6)

subject to (1) and (2).

Indirect loss function \( V^*(l_{t-1}) \)

\[
V^*(l_{t-1}) = \gamma_0^* + \gamma_1^* l_{t-1} + \frac{1}{2} \gamma_2^* l_{t-1}^2.
\]  
(7)

Lagrangian

\[
L_t = E_2 \left\{ \frac{1}{2} \left[ (\pi_t - \pi^*)^2 + \lambda (l_t - l^*)^2 \right] + \beta V^*(l_t) \right\} - \theta_{t-1} (\pi_t - E_{t-1} \pi_t)
\]

First order conditions with respect to \( \pi_t \) and \( \pi_t^* \)

\[
(\pi_t - \pi^*) + \lambda \alpha (l_t - l^*) + \beta \alpha V_t^*(l_t) + \theta_{t-1} = 0
\]

\[-E_{t-1} [\lambda \alpha (l_t - l^*) + \beta \alpha V_t^*(l_t)] - \theta_{t-1} = 0
\]

Eliminate the multiplier

\[
(\pi_t - \pi^*) + \lambda \alpha (l_t - l^*) + \beta \alpha V_t^*(l_t) - E_{t-1} [\lambda \alpha (l_t - l^*) + \beta \alpha V_t^*(l_t)] = 0
\]  
(8)

Take expectations at \( t-1 \) of (8):

\[
E_{t-1} \pi_t = \pi^*,
\]  
(9)

Substitute (1), (2), (9) and (7) into (8):

\[
\pi_t = \pi^* - b^* \varepsilon_t
\]  
(10)

\[
b^* = \frac{(\lambda + \beta \gamma^2) \alpha}{1 + (\lambda + \beta \gamma^2) \alpha^2}
\]  
(11)
Identify $\gamma_1$ and $\gamma_2$. Substitute (10) and (12) into (6). Combine with (7):

$$
\gamma_1^* = -\frac{\lambda \rho l^*}{1 - \beta \rho} \leq 0 \quad \text{and} \quad \gamma_2^* = \frac{\lambda \rho^2}{1 - \beta \rho^2} > 0. \quad (13)
$$

Use in (11)

$$
b^* = \frac{\lambda \alpha}{1 + \lambda \alpha^2 - \beta \rho^2}. \quad (14)
$$

Properties

- No inflation bias, $E_{t-1} \pi_t = \pi^*$
- $\pi_t$ only depends on the private information of the central bank.
- $b^*$ is larger under persistence ($\rho > 0$, $\gamma_2^* > 0$) than without ($\rho = \gamma_2^* = 0$). Since current employment changes affects future employment it becomes more important to stabilize employment; hence inflation is allowed to fluctuate more.

Question

- Relation to $t_0$-optimality and optimality in a time-less perspective?

- Discretion (fourth best)
  Government/society controls CB directly; CB has preferences (3)
  No commitment mechanism
  Decision problem of central bank
  $$
  \hat{V}(l_{t-1}) = E_{t-1} \min \left\{ \frac{1}{2} \left( (\pi_t - \pi^*)^2 + \lambda (l_t - l^*)^2 \right) + \beta \hat{V}(l_t) \right\}, \quad (15)
  $$
  subject to (1) but for given inflation expectations $\pi_t^*$. CB no longer internalizes the effect on inflation expectations. Takes into account that current employment will affect current expectations of future inflation (incorporated in $\hat{V}(l_t)$).
  Indirect loss function
  $$
  \hat{V}(l_{t-1}) = \hat{\gamma}_0 + \hat{\gamma}_1 l_{t-1} + \frac{1}{2} \hat{\gamma}_2 l_{t-1}^2. \quad (16)
  $$
  First order condition
  $$
  \pi_t - \pi^* + \lambda \alpha (l_t - l^*) + \beta \alpha \hat{V}(l_t) = \pi_t - \pi^* + (\lambda + \beta \hat{\gamma}_2) \alpha l_t - (\lambda l^* - \beta \hat{\gamma}_1) \alpha = 0, \quad (17)
  $$
  where (16) is used. The marginal loss of increased inflation expectations vanished.
  Take expectations
  $$
  E_{t-1} \pi_t = \pi^* + (\lambda l^* - \beta \hat{\gamma}_1) \alpha - (\lambda + \beta \hat{\gamma}_2) \alpha \rho l_{t-1}. \quad (18)
  $$
  Combine (1), (2), (17) and (18):
  $$
  \pi_t = \hat{a} - \frac{\hat{b}}{1 - \alpha \hat{b}} l_t = \hat{a} - \hat{c} l_{t-1} - \hat{b} \varepsilon_t, \quad (19)
  $$
  $$
  \hat{a} \equiv \pi^* + \alpha (\lambda l^* - \beta \hat{\gamma}_1), \quad \hat{b} \equiv \frac{(\lambda + \beta \hat{\gamma}_2) \alpha}{1 + (\lambda + \beta \hat{\gamma}_2) \alpha^2}, \quad \hat{c} \equiv \alpha \rho (\lambda + \beta \hat{\gamma}_2). \quad (20)
  $$
  Employment
  $$
  l_t = \rho l_{t-1} + (1 - \alpha \hat{b}) \varepsilon_t. \quad (21)
  $$

In order to determine $\hat{\gamma}_1$ and $\hat{\gamma}_2$, substitute (19) and (21) into (15). Using (16) to identify the coefficient for $l_{t-1}$ results in

$$\hat{\gamma}_2 = (\lambda + \beta \hat{\gamma}_2)\rho^2 + (\lambda + \beta \hat{\gamma}_2)^2 \alpha^2 \rho^2. \tag{22}$$

$c^2 - \frac{1 - \beta \rho^2}{\alpha \beta \rho} c + \frac{\lambda}{\beta} = 0$

Second-degree equation in $\hat{c}$, two potential roots. The equation has real roots if and only if existence condition 1

$$\lambda \leq \hat{\lambda}_1 = \frac{(1 - \beta \rho)^2}{4 \alpha^2 \rho^2} \tag{23}$$

Only the smaller solution, relevant (see Lockwood-Philippopoulos 94 and Svensson 97b).

$$\hat{c} = \frac{1 - \beta \rho^2 - \sqrt{(1 - \beta \rho^2)^2 - 4 \lambda \beta \rho^2}}{2 \beta \alpha \rho} > 0. \tag{24}$$

Identification of the coefficient for $l_{t-1}$, $\hat{\gamma}_1$, results in

$$\hat{\gamma}_1 = - \frac{\lambda}{1 - \beta \rho [1 + (\lambda + \beta \hat{\gamma}_2) \alpha^2] \rho} \leq 0. \tag{25}$$

Finite solution to $\hat{\gamma}_1$: Existence condition 2 (appendix)

Result

$$a \equiv \pi^* + \frac{\lambda \alpha \rho^*}{1 - \beta \rho - \beta \alpha \hat{c}}$$

$$\dot{b} \equiv \frac{\lambda \alpha + \beta \alpha \hat{c}^2}{1 + \lambda \alpha^2 - \beta \rho^2 + \beta \alpha^2 \hat{c}^2} \text{ (Note } \frac{\partial \dot{b}}{\partial \hat{c}} > 0)$$

Properties

- Inflation bias
  * Conditional expected inflation
    $$E_t \pi_{t+1} - \pi^* = \frac{\lambda \alpha \rho^*}{1 - \beta \rho - \beta \alpha \hat{c}} - \hat{c}_{t-1}$$
  * Average inflation bias
    $$E[\pi_t] - \pi^* = \frac{\lambda \alpha \rho^*}{1 - \beta \rho - \beta \alpha \hat{c}} \geq 0,$$
    larger than the inflation bias $\lambda \alpha \rho^*$ for $\rho = 0$

- Stabilization bias.
  * Without persistence ($\rho = 0$), $\hat{\gamma}_2 = \gamma_2^* = \hat{c} = 0$. Then $\dot{b} = b^*$.
  * With persistence ($\rho > 0$), $\hat{\gamma}_2 > \gamma_2^*, \hat{c} > 0$. Then $\dot{b} > b^*$. Since future inflation depends on current employment, it becomes more important to stabilize employment, which requires a stronger inflation response.

Terminology

- “Commitment equilibrium not time-consistent”
- “Discretion equilibrium time-consistent”
- Misleading? Commitment equilibrium time-consistent under commitment mechanism
- Commitment mechanism is part of technology, not subject to choice
Optimal delegation

General problem: If commitment to optimal rule not feasible, how can discretion equilibrium be improved?

Central bank objective function

\[
\min \mathbb{E}_0 \sum_{t=1}^{\infty} (\beta^b)^{t-1} L^b_t
\]

\[
L^b_t = \frac{1}{2} \left[ (\pi_t - \pi^b_t)^2 + \lambda^b (l_t - l^b_t)^2 \right]
\]

Interpretations

- Goal-independent and instrument-independent central bank governor. Appoint governor for life with parameters \(\beta^b, \pi^b_t, \lambda^b, l^b_t\) (Rogoff 85, different \(\lambda^b\)). Indirect commitment mechanism. (Parameters observable? No change?)

- Society/government/parliament assigns objective function with parameters \(\beta^b, \pi^b_t, \lambda^b, l^b_t\). Instrument-independent central bank. Accountability. Assignment for a minimum time, legislation. Commitment mechanism.

Principal-agent approach.

“General targeting rule”  
Main interpretation here.

- Average of governor’s preferences and other preferences

\[
L^1_t = \frac{1}{2} \left[ (\pi_t - \pi^1)^2 + \lambda^1 (l_t - l^1)^2 \right]
\]

\[
L^2_t = \frac{1}{2} \left[ (\pi_t - \pi^2)^2 + \lambda^2 (l_t - l^2)^2 \right]
\]

\[
L^b_t = \varphi L^1_t + (1 - \varphi) L^2_t
\]

\[
= \frac{1}{2} \left[ a_{11} \pi_t^2 + a_{22} l_t^2 + a_{33} + 2a_{12} \pi_t l_t + 2a_{13} \pi_t + 2a_{23} l_t \right]
\]

‘Independence’ and ‘conservativeness’

\(L^1_t\) governor’s loss function, \(L^2_t\) society/government’s loss function, \(\varphi\) degree of (goal-‘independence’, \(\mu\) degree of ‘conservativeness’

\[
L^1_t = \frac{1}{2} \left[ (1 + \mu) (\pi_t - \pi^*)^2 + \lambda (l_t - l^*)^2 \right]
\]

\[
L^2_t = \frac{1}{2} \left[ (\pi_t - \pi^*)^2 + \lambda (l_t - l^*)^2 \right]
\]

\[
L^b_t = \frac{1}{2} \left[ (1 + \varphi \mu) (\pi_t - \pi^*)^2 + \lambda (l_t - l^*)^2 \right]
\]

As if the weight \(\lambda\) is replaced by the weight

\[
\lambda^b = \frac{\lambda}{1 + \varphi \mu} < \lambda
\]

- General quadratic form

\[
L_t = \frac{1}{2} \left[ \pi_t \ l_t \ 1 \right] A^b \left[ \pi_t \ l_t \ 1 \right]
\]

where \(A^b\) is symmetric and \(3 \times 3\)
Employment targeting

- State-contingent employment target: Equilibrium employment (short-run natural rate)
  \[ \beta^b = \beta, \quad \pi^b_t = \pi^* \]
  \[ l^b_t = \rho l_{t-1} \]

Define
  \[ \tilde{l}_t \equiv l_t - l^b_t = l_t - \rho l_{t-1} \]

Loss function
  \[ L_t = \frac{1}{2}\left[(\pi_t - \pi^*)^2 + \lambda^b \tilde{l}_t^2\right] \]

Phillips curve
  \[ \tilde{l}_t = \alpha(\pi_t - \pi^*_t) + \varepsilon_t \]

Static problem. Solution
  \[ \pi_t = \pi^* - \tilde{b}\varepsilon_t \]
  \[ \tilde{l}_t \equiv l_t - \rho l_{t-1} = (1 - \alpha \tilde{b})\varepsilon_t \]
  \[ \tilde{b} \equiv \frac{\lambda^b \alpha}{1 + \lambda^b \alpha^2}, \quad b^* = \frac{\lambda \alpha}{1 + \lambda \alpha^2 - \beta \rho^2} \]

* No average inflation bias
* No state-contingent inflation bias
* Stabilization bias (\( \tilde{b} > b^* \) if \( \lambda^b = \lambda \)) (error in Svensson 97b!)

To get second-best equilibrium (optimal rule under commitment), choose “weight-liberal” loss function, \( \lambda^b > \lambda \)
  \[ \tilde{b} \equiv \frac{\lambda^b \alpha}{1 + \lambda^b \alpha^2} = \frac{\lambda \alpha}{1 + \lambda \alpha^2 - \beta \rho^2} \equiv b^* \]
  \[ \lambda^b = \frac{\lambda}{1 - \beta \rho^2} > \lambda \]

This results in
  \[ \pi_t = \pi^* - b^* \varepsilon_t \]
  \[ l_t = \rho l_{t-1} + (1 - \alpha b^*)\varepsilon_t \]

Both state-contingent employment target and weight-liberal loss function required for second-best equilibrium

- Constant employment target: Long-run natural rate
  \[ l^b_t = 0 \]

This results in
  \[ \pi_t = \pi^* - \bar{\alpha} l_{t-1} - \tilde{b}\varepsilon_t \]
  \[ l_t = \rho l_{t-1} + (1 - \alpha \tilde{b})\varepsilon_t \]

Third best, no average inflation bias. Stabilization bias.
If \( \rho = 0 \), second best
• State-contingent optimal inflation target (Svensson 97b)

\[ L^b_t = \frac{1}{2} \left[ (\pi_t - \pi^b_t)^2 + \lambda (l_t - l^*)^2 \right] \]
\[ \pi^b_t = g_0 + g_1 l_{t-1} \]

\[ g_0 = \pi^* - (\lambda \alpha l^* - \beta \alpha \dot{\gamma}_1) \]
\[ g_1 = \alpha \rho (\lambda + \beta \dot{\gamma}_2) = \dot{\epsilon} \]

This results in third-best equilibrium

\[ \pi_t = \pi^* - \dot{\epsilon} \]
\[ l_t = \rho l_{t-1} + (1 - \alpha \dot{b}) \epsilon_t \]

No inflation bias. Still stabilization bias \( \dot{b} > b^* \).

In order to get second best, choose \( \lambda^b < \lambda \) (Rogoff ‘conservative’ banker) to get \( \dot{b}^b = b^* \). Then choose \( g_0 \) and \( g_1 \) to remove average and state-contingent inflation bias (given \( \dot{\gamma}_1^b, \dot{\gamma}_2^b \)).

If \( \rho = 0 \), second best.

• Constant optimal inflation target

\[ L^b_t = \frac{1}{2} \left[ (\pi_t - \pi^b)^2 + \lambda (l_t - l^*)^2 \right] \]
\[ \pi^b = \pi^* - (\lambda \alpha l^* - \beta \alpha \dot{\gamma}_1) \]

This results in

\[ \pi_t = \pi^* - \dot{b} l_{t-1} - \dot{\epsilon} \]
\[ l_t = \rho l_{t-1} + (1 - \alpha \dot{b}) \epsilon_t \]

Third best. No average inflation bias. Stabilization bias.

If \( \rho = 0 \), second best.

• State-contingent linear inflation contract (Walsh 95, Persson-Tabellini 93, Lockwood 97, Lockwood-Miller-Zang 98)

\[ L^b_t = \frac{1}{2} \left[ (\pi_t - \pi^*)^2 + \lambda (l_t - l^*)^2 \right] + (f_0 + f_1 l_{t-1}) (\pi_t - \pi^*) \]

\[ f_0 = \lambda \alpha l^* - \beta \alpha \dot{\gamma}_1 = \frac{\lambda \alpha l^*}{1 - \beta \rho} \]
\[ f_1 = - (\lambda + \beta \dot{\gamma}_2) \alpha \rho = - \frac{\lambda \alpha \rho}{1 - \beta \rho^2} \]

This results in second-best equilibrium (optimal rule under commitment)

\[ \pi_t = \pi^* - \dot{b} \epsilon_t \]
\[ l_t = \rho l_{t-1} + (1 - \alpha \dot{b}) \epsilon_t \]
Why state-contingent optimal inflation target and state-contingent linear inflation contract different (for $\rho > 0$)?

State-contingent optimal inflation target

$$L^b_t = \frac{1}{2} \left[ \left( \pi_t - \pi^*_t \right)^2 + \lambda (l_t - l^*_t)^2 \right]$$

$$= \frac{1}{2} \left[ \left( \left( \pi_t - \pi^* \right) - \left( \pi^*_t - \pi^* \right) \right)^2 + \lambda (l_t - l^*_t)^2 \right]$$

$$= \frac{1}{2} \left[ \left( \pi_t - \pi^* \right)^2 + \lambda (l_t - l^*_t)^2 \right] + \left( \pi^* - \pi^*_t \right) \left( \pi_t - \pi^* \right) + \frac{1}{2} \left( \pi^* - \pi^*_t \right)^2$$

$$= \frac{1}{2} \left[ \left( \pi_t - \pi^* \right)^2 + \lambda (l_t - l^*_t)^2 \right] + \left( \pi^* - \pi^*_t \right) \left( \pi_t - \pi^* \right) + \frac{1}{2} \left( \pi^* - \pi^*_t \right)^2$$

Select $\pi^*_t = \pi^* - f_0 - f_1 l_{t-1}$?

$$L^b_t = \frac{1}{2} \left[ \left( \pi_t - \pi^* \right)^2 + \lambda (l_t - l^*_t)^2 \right] + \left( f_0 + f_1 l_{t-1} \right) \left( \pi_t - \pi^* \right) + \frac{1}{2} \left( f_0 + f_1 l_{t-1} \right)^2$$

Third term not constant. Contains $l_{t-1}^2$, implies stabilize $l_t$ more, hence $\beta > \beta^*$.  

• Constant linear inflation contract (Walsh 95, Persson-Tabellini 93)

$$L^a_t = \frac{1}{2} \left[ \left( \pi_t - \pi^* \right)^2 + \lambda (l_t - l^*_t)^2 \right] + f (\pi_t - \pi^*)$$

$$f = \lambda a l^* - \beta a \gamma_1$$

This results in

$$\pi_t = \pi^* - \hat{c} l_{t-1} - \hat{b} \varepsilon_t$$

$$l_t = \rho l_{t-1} + (1 - \alpha \beta) \varepsilon_t$$

Third best, no average inflation bias. Stabilization bias.  

If $\rho = 0$, second best.

• ‘Conservative banker’ (Rogoff 85)

$$L^b_t = \frac{1}{2} \left[ \left( \pi_t - \pi^* \right)^2 + \lambda^b (l_t - l^*_t)^2 \right], \quad \lambda^b < \lambda$$

This results in

$$\pi_t = \hat{a} - \hat{c} l_{t-1} - b \varepsilon_t$$

$$l_t = \rho l_{t-1} + (1 - \alpha \beta) \varepsilon_t$$

Lower average inflation bias, $\hat{a} < \hat{a}$.  

For $\rho = 0$, $\hat{b} < \beta = b^*$, $\hat{c} = \hat{c} = 0$. Third best. Stabilization bias. (Rogoff 85)

For $\rho > 0$, $b < \hat{b} > b^*$, $\hat{c} < \hat{c} > 0$. Third best. Stabilization bias? (Lockwood-Miller-Zang 98)

• Ex post surprising that so much attention has been directed towards the $\lambda^b < \lambda$ case, when (at least) three other parameters to consider ($\beta^b, \pi^b, l^b$).

• Cf. interpretation above

• ‘Conservative’

  • ‘Weight-conservative’, $\lambda^b < \lambda$
  • ‘Inflation-conservative’, $\pi^b < \pi^*$
  • ‘Employment-conservative’, $l^b < l^*$

• Empirical result: Low inflation not correlated with high output variability.

  • Not consistent with weight-conservative CBs
  • Consistent with inflation-conservative or employment-conservative CBs
• Nominal-income-growth targeting (Beetsma-Jensen 99)

\[ g_t = \pi_t + y_t - y_{t-1} \]

\[ L_t = \frac{1}{2}[(1 + f)(\pi_t - \pi^*)^2 + \lambda(y_t - \hat{y})^2 + \psi(g_t - g^*)^2] \]

Select \( f \) and \( \psi \) to achieve second best

• Alternative Phillips curve (Clark–Goodhart-Huang 99)

\[ y_t = \alpha(\pi_t - \pi^*_t) + \varepsilon_t \]

\[ \pi^*_t = \gamma\pi_{t-1} + (1 - \gamma)E_{t-1}\pi_t \]

Commitment

\[ \pi_t = a^* + c^*\pi_{t-1} - b^*\varepsilon_t \]

\[ y_t = \gamma\alpha a^* - \gamma\alpha(1 - c^*)\pi_{t-1} + (1 - \alpha b^*)\varepsilon_t \]

Discretion

\[ \pi_t = \hat{a} + \hat{c}\pi_{t-1} - \hat{b}\varepsilon_t \]

\[ y_t = \gamma\alpha \hat{a} - \gamma\alpha(1 - \hat{c})\pi_{t-1} + (1 - \alpha \hat{b})\varepsilon_t \]

Stabilization bias in the other direction

\[ \hat{b} < b^* \]

\[ \hat{c} > c^* \]

Microfoundations?

• General quadratic form

\[ L_t = \frac{1}{2} \begin{bmatrix} \pi_t & \pi_{t-1} & l_t & l_{t-1} & 1 \end{bmatrix} A^b \begin{bmatrix} \pi_t \\ \pi_{t-1} \\ l_t \\ l_{t-1} \\ 1 \end{bmatrix} \]

where \( A^b \) is symmetric and \( 5 \times 5 \).

• Commitment to simple rule, simple target

  – Constant money growth rule (Friedman, \( k\% \) rule)

\[ m_t = m_{t-1} + k \]

\[ L_t^b = \frac{1}{2}(m_t - m_{t-1} - k)^2 \]

where \( m_t = \ln M_t \).

  – Constant inflation

\[ \pi^b = \pi^* \]

\[ L_t^b = \frac{1}{2}(\pi_t - \pi^*)^2 \]

\[ \lambda^b = 0 \]

Compare indirect loss function

Incentives to deviate

  – Fixed exchange rate

• Escape clause (fixed inflation rate, or fixed exchange rate)

\[ \pi_t = \begin{cases} \pi_t = \pi^* & \text{if } |l_t| < \hat{l} \\ \hat{a} - \frac{b}{1-ab}\hat{l} & \text{if } |l_t| \geq \hat{l} \end{cases} \]

Flood-Isard 89, Lohmann 92, Obstfeld 91, Alexius 95
• Reputation equilibria
  
  – Trigger strategies
  
  – Incomplete information.
    Incomplete information about government/central bank preferences. Reputation is private sector’s Bayesian estimate of government/CB type.
      * Cukierman-Meltzer 86. Type is stochastic process. Faust-Svensson 99a
      * Backus-Driiffill 85. CB is one of two types. Finite game. Signalling. Rogoff 89.

• McCallum 95 criticism of discretion equilibria: Just do it
  
  – CB can just choose to follow optimal rule under commitment, even without a commitment mechanism
  
  – Objection: Not equilibrium
    – Implicit commitment mechanism? Reputation? (Not trigger strategies.)
  
  – McCallum other point: Relocation of enforcement.
    * Delay sufficient, eliminates surprise (Persson-Tabellini 99).

• Transparency, reputation and optimality (Faust-Svensson 99a)
  
  – Increased transparency makes CB’s reputation more sensitive to its actions. Increases cost to deviate from officially announced goals. Implicit commitment mechanism.