What if the CB can commit to a rule?

Set $\pi = 0$. Now $u = u^n$, $\pi = 0$

Why can't the discretionary CB just promise to set $\pi = 0$?

The promise or announcement is not credible.

Suppose, the private sector believes the promise and sets $\pi^e = 0$. Then the CB will find it optimal to surprise the public by setting $\pi = \alpha/\gamma$

Implications of the Expectations-Augmented Phillips Curve for Monetary Policy

Expectations-Augmented Phillips Curve

$$u_t = u^n - \alpha(\pi_t - \pi_t^e)$$

or

$$\pi_t = \pi_t^e - h(u_t - u^n)$$

Note: Assuming the Central Bank always wants to lower the unemployment rate, the Expectations-Augmented Phillips Curve gives the Central Bank an incentive to surprise the public.

Assuming the public is aware of this incentive, what happens?

A Generalization

Again suppose, $u_t = u^n - \alpha(\pi_t - \pi_t^e)$

Also suppose the CB's Loss Function is, $L(u,\pi) = u + \gamma\pi^2$

If the CB cannot commit, what is its optimal choice of π?

$$L = [u^n - \alpha(\pi - \pi^e)] + \gamma\pi^2$$

$$\frac{dL}{d\pi} = -\alpha + 2\gamma\pi = 0 \qquad \text{[First-Order Condition]}$$

$$\Rightarrow \pi = \alpha/2\gamma$$

What is u? Because $\pi^e = \alpha/2\gamma$ (Rat'l. Expecting) it turns out $u = u^n$

Reputation and Trigger Strategies

Trigger Strategy: Start out trusting (i.e., believing) the CB, setting $\pi^e = 0$. If the CB ever takes advantage of you and surprises you (by increasing M), don't ever believe them again. Set $\pi^e = \alpha/2\gamma$ forever (starting next period).

Under what circumstances can this support the commitment outcome?

L^C = losses of the CB if it sticks to its promises

L^D = losses of the CB if it reneges (or defects).

L^N = losses in the sub-optimal one-period Nash equil.

$$L^D < L^C < L^N$$

$$L^C - L^D \leq \frac{\beta}{1-\beta}(L^N - L^C)$$

β: CB's discount rate $\frac{1}{1+r}$

$L^C - L^D$: one-shot gain from defecting

$L^N - L^C$: present value of future losses due to loss of reputation.

Commitment

$$\left.\begin{aligned} \pi = \pi^e &= 0 \\ u &= u^n \end{aligned}\right\} \Rightarrow L^c = u^n$$

Discretion (Nash Equilibrium)

$$\left.\begin{aligned} \pi = \pi^e &= \frac{\alpha}{2\gamma} \\ u &= u^n \end{aligned}\right\} \Rightarrow L^N = u^n + \frac{\alpha^2}{4\gamma}$$

One-Time Gain From Cheating

$$\left.\begin{aligned} \pi^e &= 0 \\ \pi &= \frac{\alpha}{2\gamma} \\ u &= u^n - \frac{\alpha^2}{2\gamma} \end{aligned}\right\} \Rightarrow L^D = u^n - \frac{\alpha^2}{4\gamma}$$

Sustainability Condition

$$L^c - L^D \leq \frac{\beta}{1-\beta}\left(L^N - L^c\right)$$

$$\Rightarrow \frac{\alpha^2}{4\gamma} \leq \frac{\beta}{1-\beta}\left(\frac{\alpha^2}{4\gamma}\right)$$

$$\Rightarrow \boxed{\beta \geq 1/2}$$

If the Central Bank's Discount Rate exceeds $1/2$ then commitment outcome is sustainable

Ways to Overcome the Time Consistency Problem

1.) Adopt Rules

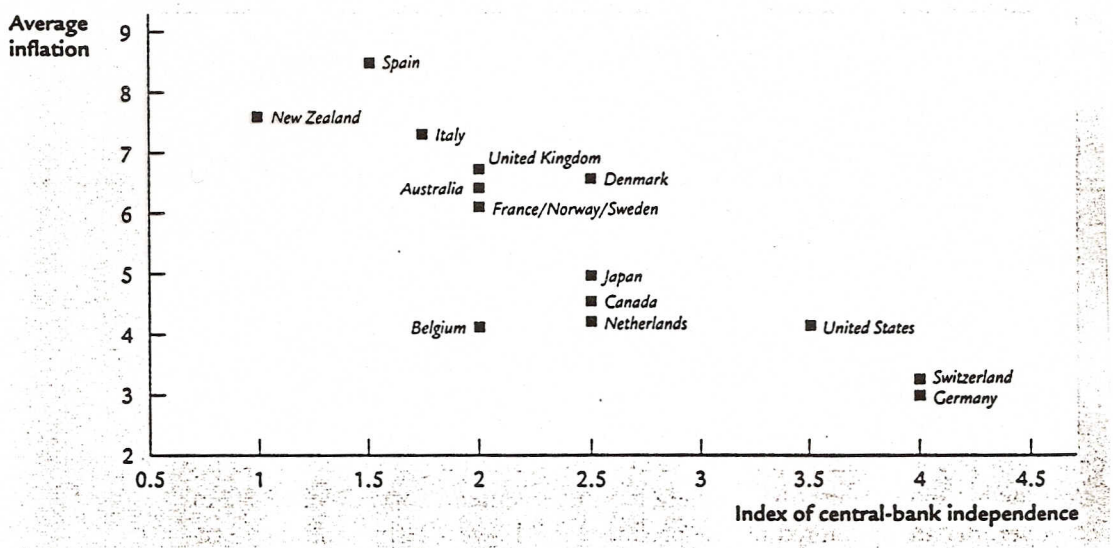
2.) Alter the incentives of the CB

Suppose you change the CB's loss functin to $L(u,\pi) = u + \gamma\pi^2 + \alpha\pi$.

Verify that the optimal discretionary rule is to set $\pi = 0$.

3.) Reputation

4.) Make the CB politically independent



Inflation and Central-Bank Independence This scatterplot presents the international experience with central-bank independence. The evidence shows that more independent central banks tend to produce lower rates of inflation.

Source: Figure 1a, page 155, of Alberto Alesina and Lawrence H. Summers, "Central Bank Independence and Macroeconomic Performance: Some Comparative Evidence," *Journal of Money, Credit, and Banking* 25 (May 1993): 151–162. Average inflation is for the period 1955–1988.

The Taylor Rule

- The benefits of basing monetary policy on an explicit objective are now widely appreciated by most countries

- There is also widespread agreement that, operationally, Central Banks should base policy on a systematic (but flexible) rule.

- Unfortunately, there is less agreement about what exactly this rule should be.

- In practice, it appears that many Central Banks follow a simple rule whereby the interest rate responds to just two variables
  1.) The current deviation of inflation from the inflation target
  2.) The current "output gap" (deviation between current output + the full-employment output).

- These kinds of rules are called "Taylor Rules".

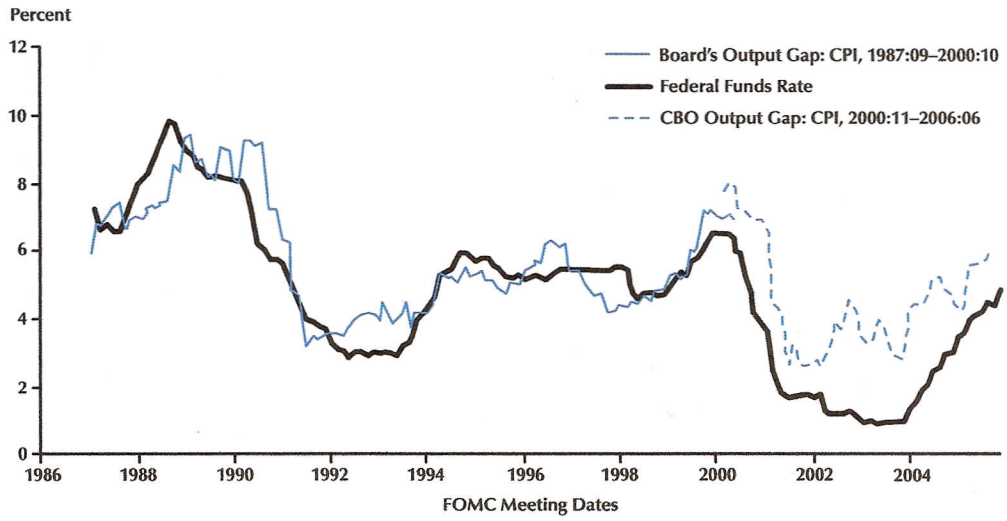
The Taylor Rule

$$i_t = \pi_t + r^* + 0.5(\pi_t - \pi^*) + 0.5(y_t - \bar{y}_t)$$

- r^*: the "natural" rate of interest
- π^*: target inflation
- y_t: actual output
- $\bar{y}_t$: full employment output

Figure 1

Greenspan Years: Federal Funds Rate and Taylor Rule
(CPI $p^* = 2.0$, $r^* = 2.0$) $a = 1.5$, $b = 0.5$



- In practice, estimating $\bar{y}_t$ can be challenging. If $\bar{y}_t$ is mismeasured, it can produce policy errors.