JEM004 Macroeconomics
IES, Fall 2010
Lecture Notes
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11 Inflation and Monetary Policy

11.1 Inflation and Money Growth

Inflation = increase in the average price of goods and services

What is the most important determinant? - Look at the money market:

$$\frac{M}{P} = L(i, Y) \quad \Rightarrow \quad P = \frac{M}{L(i, Y)}$$

Most important factor with greatest variation = **growth in money supply M**:

- unlikely long-term decline in output Y
- observed variation in real interest component $r = i - \pi^e$ is limited
- no reason for repeated falls in money demand L

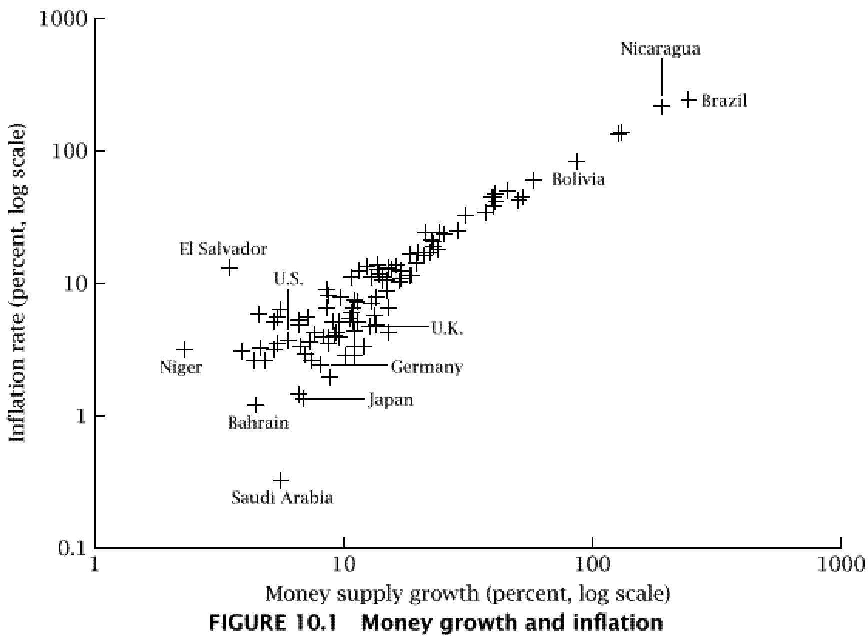

FIGURE 10.1 Money growth and inflation

Effect of money growth:

- **long term** => prices are flexible => no effect on real output $\bar{Y}$ or real interest rate $\bar{r}$, where $\bar{r} = i - \pi^e$ (Fisher identity)

  $$P = \frac{M}{L(\bar{r} + \pi^e, \bar{Y})}$$

  * assume permanent increase in money growth => P will have to grow at the same rate as M, π^e adjusts immediately to account for the new rate of money growth
  * at the moment of change: π^e jumps up => one-to-one increase in i => discontinuously lower demand for $\frac{M}{P}$ => P has to jump up discontinuously
- **short term** => incomplete price flexibility
  * in reality: higher M => lower i - **liquidity effect**
  * explanation: higher M => higher Y & lower r (new investment) which offsets increase in π^e and, thus, lower i

11.2 Dynamic Inconsistency of Low-Inflation Monetary Policy

What can cause a high money growth?

- seignorage (revenue from money creation) - not important in developed countries
- short term output - inflation trade-off

Kydland and Prescott (1977)

- if π^e is low, then policymaker have incentive to pursue expansionary policy to push output above the natural level
- however, as policymaker cannot reliably commit to low inflation, people will expect deviation and there expectations will push inflation up without positive effect on output

11.2.1 Model:

- Output-inflation trade-off: $y = \bar{y} + b(\pi - \pi^e), \quad b > 0$
  - $\hat{y}$ - log of flexible-price level of output, by assumption lower than socially optimal level of output y^* (due to positive externalities from higher output coming from taxation or market imperfections)
- Social loss function $L = \frac{1}{2}(y - y^*)^2 + \frac{1}{2}a(\pi - \pi^*)^2, \quad a > 0$
  - inflation above some level (π^*) is costly, with increasing marg. costs

11.2.2 Analysis:

- Setting π with binding commitment - before π^e is realized
  - he would choose π that maximizes $L \Rightarrow \pi = \pi^*$
- Setting π with discretion - simultaneous determination of π and π^e

$$\begin{aligned}
\min_{\pi} \quad & \frac{1}{2}[\bar{y} + b(\pi - \pi^e) - y^*]^2 + \frac{1}{2}a(\pi - \pi^*)^2 \\
(\pi): \quad & [\bar{y} + b(\pi - \pi^e) - y^*]b + a(\pi - \pi^*) = 0 \\
& \pi = \pi^* + \frac{b}{a+b^2}(y^* - \bar{y}) + \underbrace{\frac{b^2}{a+b^2}}_{<1}(\pi^e - \pi^*)
\end{aligned}$$

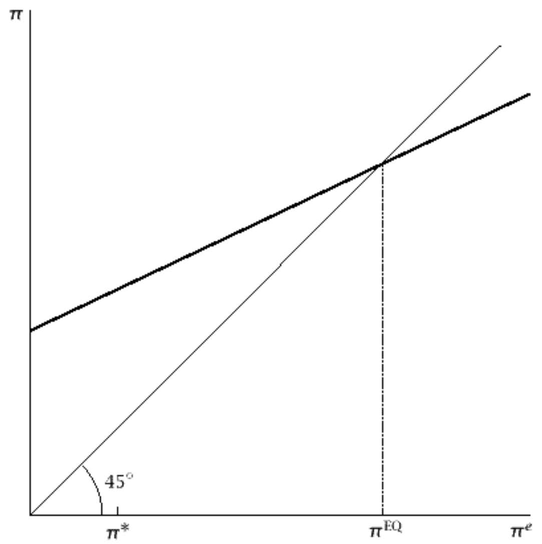

FIGURE 10.3 The determination of inflation in the absence of commitment

If the expectations of people would be at optimal level, i.e. $\pi^e = \pi^*$, then the optimal policy would be to exploit the output-inflation tradeoff, namely set inflation as

$$\pi = \pi^* + \underbrace{\frac{b}{a+b^2}}_{>0}\underbrace{(y^* - \bar{y})}_{>0}$$

In equilibrium, however, there is no uncertainty and expectations and realized level of inflation has to be equal $\pi = \pi^e$.

$$\begin{aligned}
\pi^e &= \pi^* + \frac{b}{a+b^2}(y^* - \bar{y}) + \frac{b^2}{a+b^2}(\pi^e) \\
\pi^e &= \pi = \pi^* + \frac{b}{a}(y^* - \bar{y}) \\
y &= \bar{y} + b((\pi - \pi^e) = \bar{y} < y^*(\text{optimal})
\end{aligned}$$

Policymaker achieves inflation higher than optimal, with output lower than optimal.

11.2.3 Summary:

The policy of keeping low inflation ($\pi = \pi^*$) is **dynamically inconsistent**

- as soon as people would build their expectation based on announcing $\pi^e = \pi^*$, policymaker would have an incentive to deviate
- people can anticipate this, so they adapt their expectations

11.3 Addressing the Dynamic Inconsistency Problem

One option = monetary policy determined by binding rules

- rules cannot account for unexpected circumstances, e.g. credit crunch
- even economies without fixed rules (e.g. Germany) were able to keep a low levels of inflation

11.3.1 Model of Reputation:

policymakers are in the office for 2 periods, public builds expectations based on their past behavior

- output-inflation relationship: $y_t = \bar{y} + (\pi_t - \pi_t^e)$
- social welfare (positive): $w_t = (y_t - \bar{y}) - 1/2a\pi_t^2 = \underbrace{b(\pi_t - \pi_t^e)}_{\text{addit. output}} - \underbrace{1/2a\pi_t^2}_{\text{cost of inflation}}$
- 2 types of policymakers:
  - type 1 (prob p): maximizes $W = w_1 + \beta w_2$, is aware of output-inflation tradeoff
  - type 2 (prob $1-p$): fights inflation - sets $\pi_1 = \pi_2 = 0$

  Decision-making of type 1 policymaker:
  2^{nd} period:

$$\max_{\pi_2} \quad b(\pi_2 - \pi_2^e) - 1/2a\pi_2^2$$

$$b - a\pi_2 = 0 \quad => \quad \pi_2 = b/a$$

  1^{st} period: his decision affects π_2^e

  - if he chooses $\pi_1 \neq 0$ => public knows he is type one => $\pi_2^e = b/a$ => he will choose (again) $\pi_1 = b/a$, Total welfare would thus be:

$$W_{INFL} = b\Big(\frac{b}{a} - \pi_t^e\Big) - \frac{1}{2}a\Big(\frac{b}{a}\Big)^2 + \beta\Big[b * 0 - \frac{1}{2}a\frac{b^2}{a^2}\Big] = \frac{1}{2}(1-\beta)\frac{b^2}{a} - b\pi_t^e$$

– if he chooses $\pi_1 = 0$ with prob $q =>$ public expectations given that it observes $\pi_1 = 0$ are: with prob $1-p$ he is type 2 and he will set $\pi_2 = 0$ as well, and with prob qp he is type 1 and he will set $\pi_2 = b/a$. Thus

$$\begin{aligned} \pi_2^e &= \frac{1-p}{(1-p)+pq} * 0 + \frac{qp}{(1-p)+pq}\frac{b}{a} < \frac{b}{a} \\ W(q) &= b(0-\pi_e^e) - \frac{1}{2}a * 0 + \beta\Big[b\Big(\frac{b}{a} = \frac{qp}{(1-p)+pq}\frac{b}{a}\Big) - \frac{1}{2}a\frac{b^2}{a^2}\Big] \\ &= \frac{b^2}{a}\beta\Big[\frac{1}{2} - \frac{qp}{(1-p)+pq}\Big] - b\pi_2^e \end{aligned}$$

Obviously, with higher q the probability of being a "cheater" is higher, which drives up π_2^e and consequently lowers the social benefit W(q).

$$W(0) = \frac{b^2}{a}\beta\frac{1}{2} - b\pi_2^e$$

There exist 3 possible equilibria:

– $W(0) < W_{INF} \Leftrightarrow \beta < \frac{1}{2}$: $q = 0$ and policymaker chooses $\pi_1 = b/a$

– $W(1) > W_{INF} \Leftrightarrow \beta > \frac{1}{2}\frac{1}{1-p}$: $q = 1$ and policymaker chooses $\pi_1 = 0$

– $W(0) > W_{INF} > W(1) \Leftrightarrow \frac{1}{2} < \beta < \frac{1}{2}\frac{1}{1-p}$ and policymaker chooses $\pi_1 = 0$ with probability $q = \frac{1-p}{p}(2\beta - 1)$ that would lead to $W_{INF} = W(q)$

Summary:

– uncertainty about policymaker's characteristics reduces inflation

– abidingness of reputation is greater when policymaker places greater weight on future period (see case 3, where q is positively related to β

11.3.2 Model of Delegation:

Monetary policy should be delegated to an institution that is specially averse to inflation

- output-inflation trade-off: $y = \bar{y} + b(\pi - \pi_e)$
- social loss function: $L = \frac{1}{2}(y - y^*)^2 + \frac{1}{2}a(\pi - \pi^*)^2$
- policymaker's loss function: $L' = \frac{1}{2}(y - y^*)^2 + \frac{1}{2}a'(\pi - \pi^*)^2$, where $a' > a$

Intuitivelly, policymaker will set lower π than is he would take into consideration social loss function (baseline Kydland and Prescott (1977) model).

In the equilibrium $\pi = \pi^e$ which implies $y = \bar{y}$. The difference $\pi - \pi^e$ will become smaller $=>$ social welfare will increase.

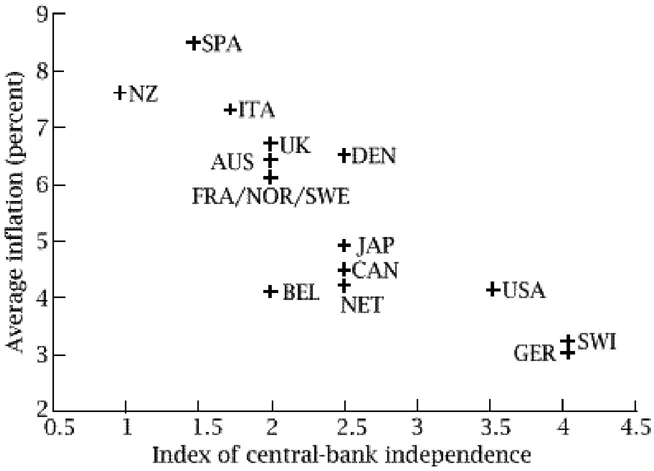

FIGURE 10.5 Central-bank independence and inflation[14]

Empirical justification:
Alesina (1993) - central bank independence as a measure of delegation - negative relationship with average inflation Critique:

- independence of CB does not have to imply aversion to inflation
- if the relationship exists, the causality can be reverse (e.g. Germany)

References:

Tables are reproduced from Romer (2006) - see reference in the syllabus.

Alesina, A., and Summers, L.H. (1993). Central Bank Independence and Macroeconomic Performance. *Journal of Money, Credit and Banking* 25 (May): 151-162

Kydland, F.E., and Prescott, E.C. (1977). Rules Rather than Discretion: The Inconsistency of Optimal Plans. *Journal of Political Economy* 85 (June): 473-492