Advanced Macroeconomics – 9 May 2006

- Karsten Staehr (= KAR).
- Ph.D., visiting researcher in Eesti Pank.
- Inglise keele!
- 2.04 m.

Today
- 11:15-12:15 + 12:45-14:00.
- Romer, ch. 10: Inflation
  - Skip section 10.6.
  - Skip p. 497-499 in section 10.7.
- Exercises → Toomas!

Overheads and whiteboard!

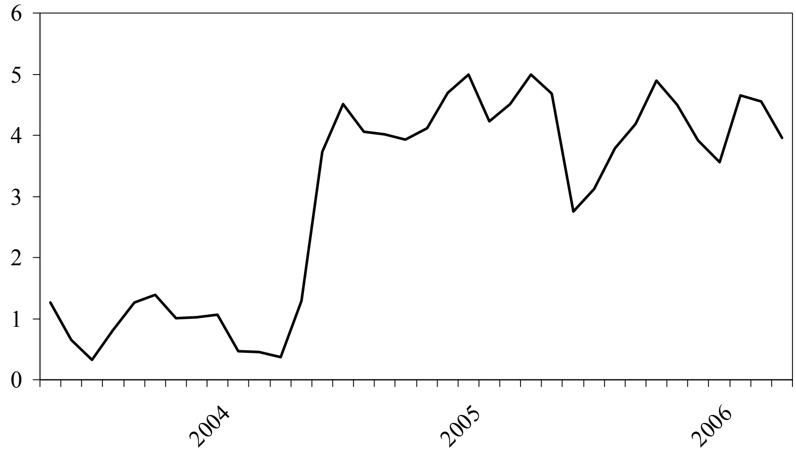
Next Tuesday
- Leftovers from ch. 10.
- Romer, ch. 11.

Ch. 10: INFLATION AND MONETARY POLICY

Has Estonia an inflation problem?

- Is inflation a problem for Estonians?
- Maastricht criteria → Max average of 3 lowest + 1%.

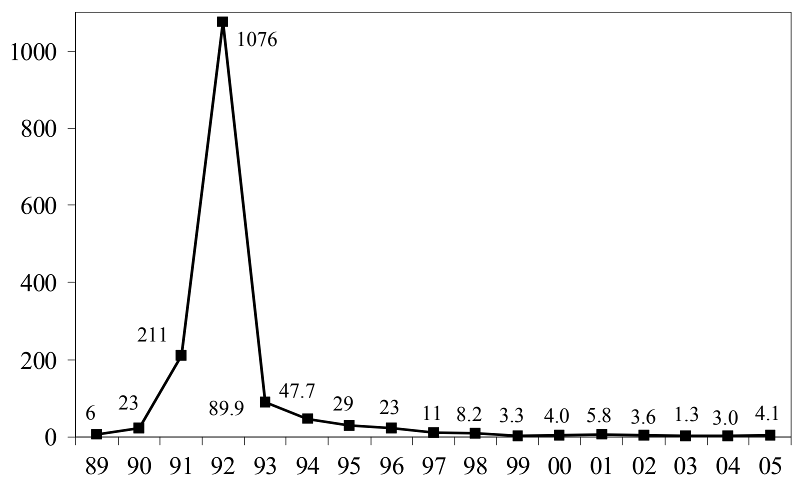
Figure 1. Consumer price inflation, month-on-month previous year, percent, April 2003 – March 2006



Sources: EBRD (various years), Statistical Office of Estonia

- Compare with past.

Figure 2. Consumer price inflation, percent per year



Sources: EBRD (various years), Statistical Office of Estonia

10.1 Introduction (p. 468-469)

Inflation = sustained increase in price level.
- General price level → not individual goods.
- Price jump ≠ inflation!

<u>"Types" of inflation</u>
- Hyperinflation (Cagan: π > 50% per month in 6 months).
- Extreme inflation (π > say 100% per year).
- Moderate inflation (π = 10-30% per year & persistence).
- "Low inflation"?
- Relative → low vs. high?

Disinflation = reduction of inflation rate.

Overview of inflation coverage

10.1 → Brief introduction.
10.9 → The costs of inflation.

Explaining hyper- and extreme inflation
10.2 → Background: money and inflation.
10.8 → Explaining hyperinflation.
10.3 → Background: term structure.

Explaining moderate and "low" inflation
5.4 (!) → The Phillips curve once again.
10.4-10.5 → Explaining low / moderate inflation [bias].

Monetary policy
10.6 → Does policy matter? SKIP!
10.7 → Conduct of monetary policy.

"Warning"
Ch. 10 → Inflation and monetary policy mainly in closed economy.

- Nothing on exchange rate policy, exchange rate bands, currency boards, currency unions, etc.
- Little on inertia / persistence, Balassa-Samuelson effect.

[Half picture ☹ / ☺.]

10.9 The Costs of Inflation (p. 519-524)

Inflation is costly! How costly?

- Economists → "nominal scaling" ⇒ costs moderate.
- USA → ☹, cf. "misery index".
- Russia → ☹
  "64 percent of Russians are most concerned about rising prices. [...] fewer than 1 percent said that their greatest concern is the limitation on human rights and democratic freedoms in Russia." (VTsIOM / Interfax → RFE/RL NEWSLINE Vol. 5, No. 206, Part I, 30 October 2001.)

Costs of anticipated (stable) inflation

- Shoe leather costs → Cost of non-interest bearing assets ↑ ⇒ economise on cash (more visits to bank / less liquidity services of money).
- Menu costs → change nominal prices more often.
- Distort tax system → difficult index tax system.
- Nominal prices changed infrequently (even if indexed) ⇒ steady inflation causes relative price variability.
- "Nominal blindness" ~ "money illusion"→ more difficult to form expectations when future price changes.
  - NB: Stable anticipated 10% inflation of the kilometre. 1 km = 1000 m, 1100 m, 1210 m, 1331 m, 1461.1 m …
- Inflation as a signal about the ability / credibility of government. [Self-fulfilling expectations → Laar / Kallas]

Costs of Variable Inflation

- Nominal contracts do not incorporate variable inflation $\Rightarrow$ real uncertainty $\Rightarrow$ possible welfare loss.
  - Real wage uncertainty.
  - Real investment outcome uncertainty.

Empirically

- High inflation negatively correlated with growth (e.g. in estimations for transition economies)
  - Causality, reverse causality or common factor behind?
- NB: Price jumps often correlated with output increases.

Potential Benefits of Inflation

- If nominal wages downward rigid → inflation allows real wage fall (adjustment possibility).
- Nominal interest rates ≥ 0 → inflation implies real interest rates can be negative (expansive monetary policy).
- Inflation as revenue source for government (high inflation, low inflation).
- Irrational / uninformed agents might look at nominal wages: inflation $\Rightarrow$ nominal wage growth ↑ → people ☺.

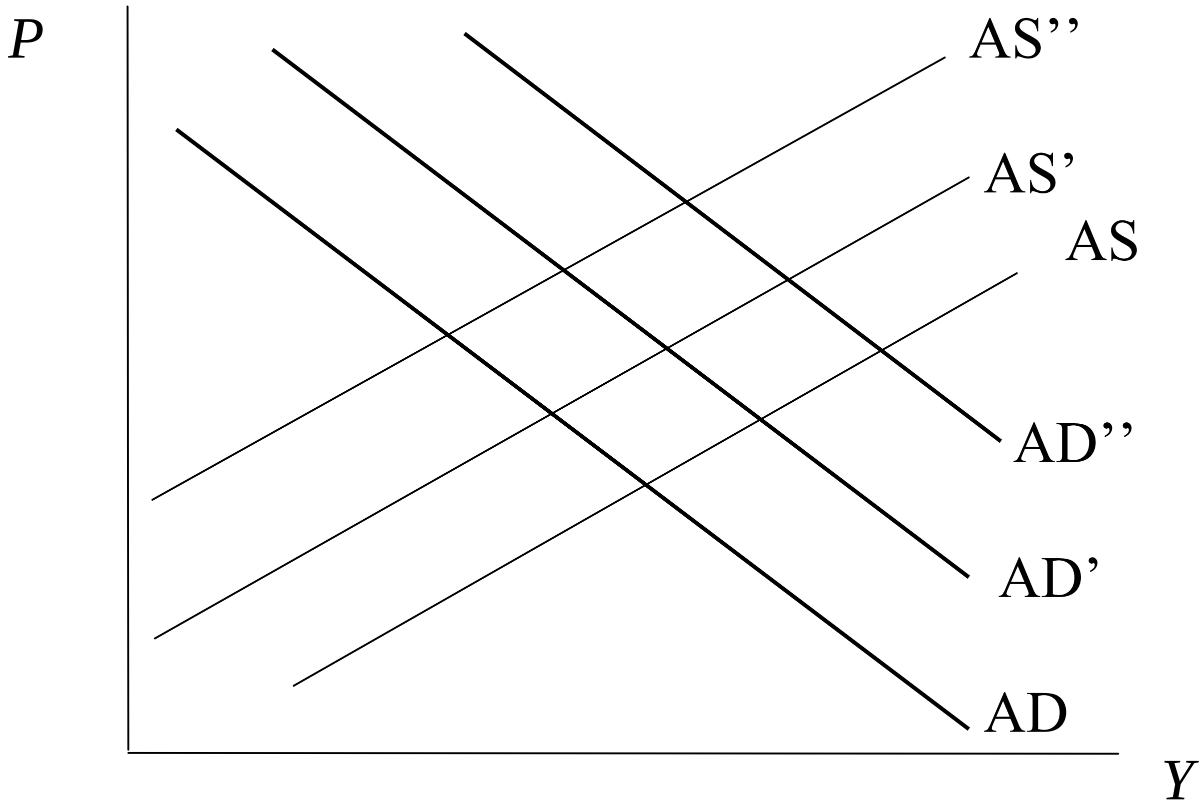
The "unfounded consensus" (p. 523-524) → Low inflation ☺, < 10% per year, better with 2% = "price stability"…

10.2 Inflation, Money Growth and Interest Rates (p. 469)

The "ultimate" cause of (high) inflation (1980s):

- Monetarists → money! → AD shocks
- Structuralists → structures / institutions! → AS shocks

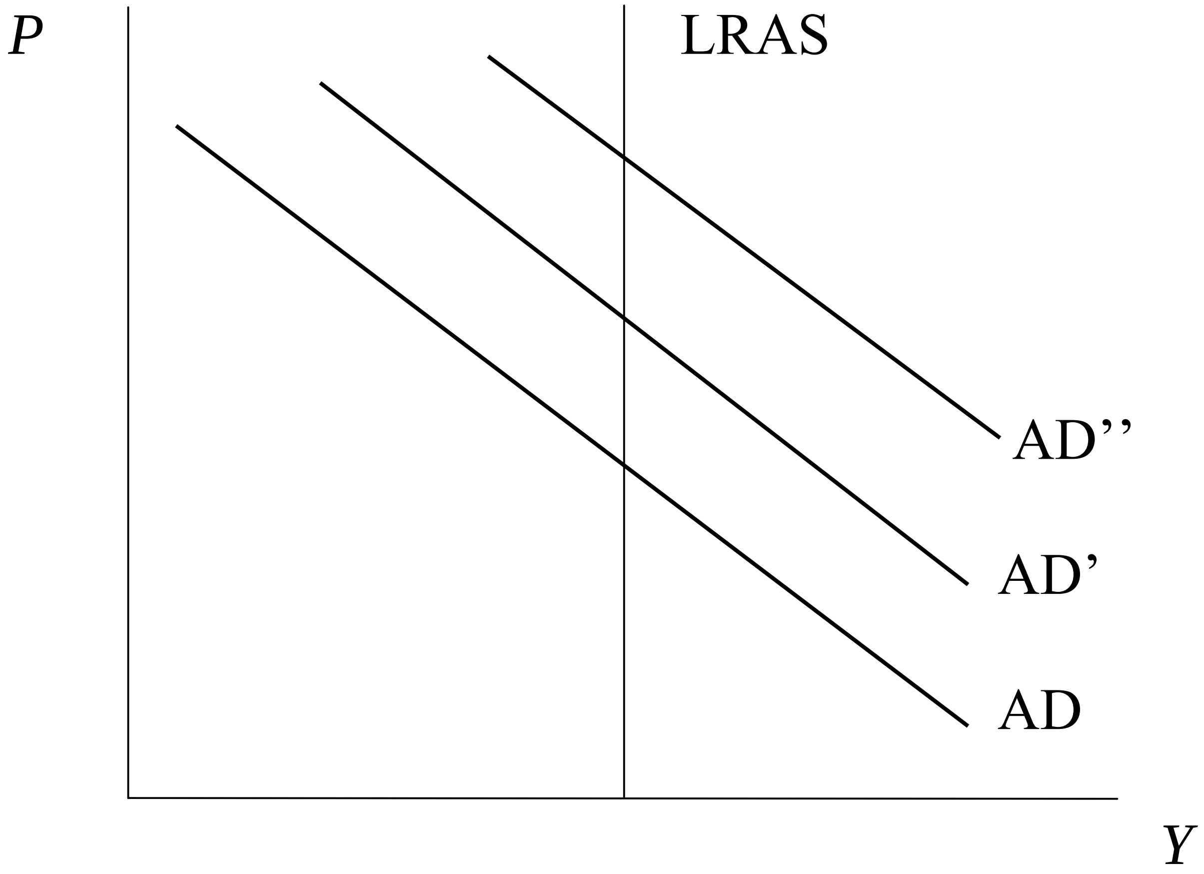
AD-AS diagram



AS (e.g. bad productivity shocks) → not "forever" ☹
AD shocks (e.g. $M\uparrow$) → long-term ☺

KAR: Convergence in views! → Institutions lead to excessive money issuance.

Long term → AS curve vertical



From derivation of AD curve → money market equilibrium:

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

$$\Rightarrow$$

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

If nominal interest rate *i* and income *Y* constant $\Rightarrow$ proportionality between *M* and *P* $\Rightarrow$ growth rates correlated.

105 countries, 1980-95

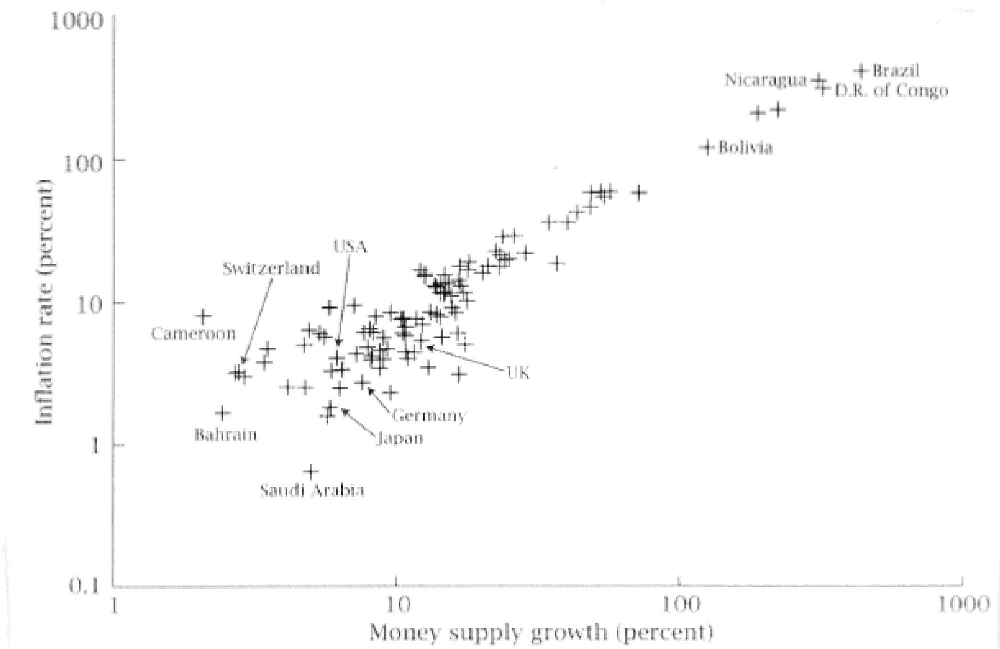


FIGURE 10.2 Money growth and inflation

- Inflation is a monetary phenomenon…
- … at least if inflation is high
- … at least in the longer term
- Individual country differences, mainly at low levels!

What about *i*?

<u>Ex post</u>: $r = i - \pi \Rightarrow i = r + \pi$.

<u>Ex ante</u>: Fisher identity: $i = r + \pi^e$, where π^e = expected inflation.

- NB1: Fisher "identity" → a "postulate", e.g. no risk-premium.
- NB2: Quantity equation sometimes also called Fisher identity…

If Fisher equation holds and inflation π does not affect *r*, then <u>Fisher effect</u>:

$\pi \uparrow \Rightarrow \pi^{e} \uparrow \Rightarrow i \uparrow$ (one-to one)

<u>Disinflation with the Fisher effect</u>

Assume $\bar{r}$ and $\bar{Y}$ constant $\Rightarrow$

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

Assume initial steady state → π^{e} constant $\Rightarrow$ *P* proportional to *M* $\Rightarrow$

$$\pi = \frac{\dot{P}}{P} = \frac{\dot{M}}{M} = g_{M}$$

$= \pi^{e}$

[Often labelled μ]

Assume: Disinflation policy with $g_M \downarrow$ announced.

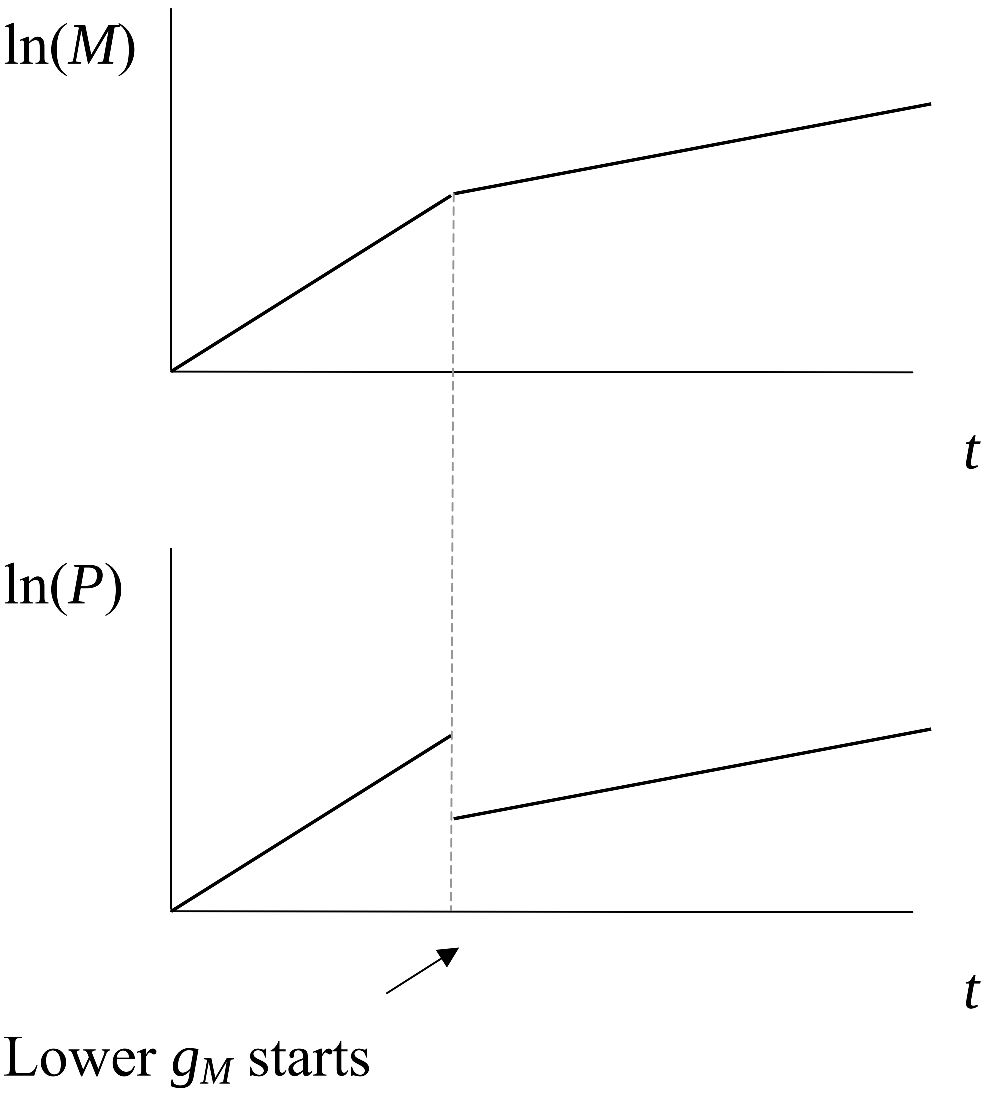
- If believed / credible $\Rightarrow \pi^{e} \downarrow$

  $\Rightarrow$

- $L(\bar{r} + \pi^{e}, \bar{Y}) \uparrow$

  $\Rightarrow$

- $P \downarrow$ (even before $g_M \downarrow$)



<u>“Real life problems” with money-based stabilisation</u>

- Incentive to announce stabilisation (to attain price level dropping).
- Price ↓ ⇒ real wage ↑ ⇒ extra recessionary pressure.

Küsimus: How did Estonia disinflate in 1992?

10.8 Seignorage and Inflation (p. 510)

Explaining hyperinflation or extreme inflation.

- Why issue so much money?
- Model of money issuance…

Hyperinflation → inflation ≥ 50% per month (for at least 6 months).

- $1.5^{12} \approx 129 = 12900\%$.
- Hyperinflation → always short periods.

- Germany: Jan. 1923 – Nov. 1923 → $2.6 \cdot 10^8$.
- Hungary: Aug. 1945 – July 1946 → 10^{27}.
- Yugoslavia: Mid 1992 – mid 1993 → 10^{12}.

Extreme inflation → inflation ≈ 100-1000% or 5000% per year.

- Latin America.
- Longer periods of time.

Explanation → money growth! But why?

Money issuance as a way to finance government expenditures → Seignorage = senioraaž, emissioonitulu.

…*Whiteboard (1)*

10.3 Monetary Policy and the Term Structure of Interest Rates (p. 474)

…Whiteboard (2)

EA: The Response of the Term Structure to Changes in the Federal Reserve's Federal-Funds-Rate Target (p. 476)

Instrument of monetary policy in the USA → OMO operation on the Federal Funds (FF) market (overnight interbank rate).

- New York Fed → gold in basement, interventions on 12th floor!
- Küsimus: Interbank interest rates in EE?

Close correlation between FED's stated target rate and the FF rate ⇒ FF "exogenous".

Are long rates affected → term structure? [Cf. theory?]

ΔR_t^i = change in long-term interest rate (during i).
ΔFF_t = change in FF (short-term) interest rate.

Estimations:

$$\Delta R_t^i = b_1^i + b_2^i \Delta FF_t + u_t^i$$

Results:

$i = 3$ months → $b_2^i = 0.55$

$i = 1$ year → $b_2^i = 0.5$

$i = 5$ year → $b_2^i = 0.21$

$i = 20$ year → $b_2^i = 0.10$

NB: Short-term interest rates positively correlated with long-term rates. ☹

- Explanation → read rest of EA [other rates, premium]!

5.4 Output-Inflation Tradeoffs (p. 247-252)

The Phillips curve once again!

Equation (5.36), p. 248:

$$\pi_t = \pi_t^* + \lambda(\ln Y_t - \ln \bar{Y}_t) + \varepsilon_t^S$$

where π_t^* is "core inflation" or expected inflation.

Phillips curve → Empirical finding or theoretically derived from AD-AS model (with AD shocks tracing the curve).

Often assume that $\pi_t^* = \phi\pi_t^e + (1-\phi)\pi_{t-1}$,
where π_t^e is expected inflation.

$$\pi_t = \phi\pi_t^e + (1-\phi)\pi_{t-1} + \lambda(\ln Y_t - \ln \bar{Y}_t) + \varepsilon_t^S$$

If Phillips curve → four sources of inflation

1) Public expect inflation to be high
2) Inflation was high last period (inertia)
3) Lack of capacity in economy
4) (Supply) shocks, e.g. higher oil prices.

NB: If open economy:

- Assume shocks capture foreign price shocks.
- Add additional term.

Aurelius & Dmitry working on it!

Problemos in steady-state when:

- Output at potential level $Y_t = \bar{Y}_t$.
- No shocks
- $\pi_t = \pi_{t-1}$

$\Rightarrow$

- $\pi_t = \pi_t^e$! → What determines π_t^e and/or π_t?

Before: Seignorage → not relevant for low or moderate inflation levels.

10.4 The Dynamic Inconsistency of Low-Inflation Monetary Policy (p. 478)

Nobel Prize territory!

Experiences from 1970s → inflation in 5-15% range > historical average.

General: If short-term trade-off between inflation (surprise) and output ⇒ incentive to inflate to exploit trade-off ⇒ private sector anticipates incentive ⇒ increase inflation expectations ⇒ inflate to avoid output below the natural rate.

DK: The story about the flying prime minister and the "smart" labour union leader!

Kydland & Prescott (1977):

- If discretion → dynamic inconsistency → high inflation!
- One solution → commitment → "tie yourself to the mast" → (binding) rules. [Achilles]
- Other solutions?

Why? Government incentive to inflate, will not carry burden of disinflation

Model

Lucas supply curve:

$$y = \bar{y} + b(\pi - \pi^e)$$

Government's loss function:

$$L = \tfrac{1}{2}(y - y^*)^2 + \tfrac{1}{2}a(\pi - \pi^*)^2, \qquad y^* > \bar{y},\ a > 0$$

Inflation in discretionary (Nash) equilibrium:

$$\pi^{EQ} = \pi^* + \frac{b}{a}(y^* - \bar{y})$$

Inflationary bias: $\pi^{EQ} > \pi^*$ and $y = \bar{y}$.

…*Whiteboard (3)*

10.5 Addressing the Dynamic-Inconsistency Problem (p. 483)

I) Rules / (binding) commitment.
II) Reputation.
III) Delegation.

I) Rules / (binding) commitment (p. 483)

$\pi = \pi^*$ (binding / commitment) $\Rightarrow \pi^e = \pi^* \Rightarrow y = \bar{y}$.

→

1. Lower inflation, natural output.
2. Like EE…
3. No/little flexibility.

II) Reputation (p. 484-487)

Government sets low inflation now / "nice guy" (does not give in for incentive to inflate) to build "reputation"!

Why be nice guy? → Benefit in the future!

- Future surprise / "bad guy" → Mimicking in Perfect Bayesian equilibrium in signalling game.
- Future "good guy" → equilibrium path in Subgame Perfect trigger Equilibrium.

Reputation in signalling game

Two periods, $t = 1, 2$

Policymaker's intertemporal objective:

$W = w_1 + \beta w_2$, where discount factor $0 < \beta \leq 1$

Two policymaker types, both with inflation target $\pi^* = 0$:

Type 1 → soft / wet → incentive to inflate:

$$w_t = (y_t - \bar{y}) - \tfrac{1}{2} a\pi_t^2 = b(\pi_t - \pi_t^e) - \tfrac{1}{2} a\pi_t^2$$

Type 2 → tough / hardnosed → no incentive to inflate:

$$w_t = -\tfrac{1}{2} a\pi_t^2$$

Private sector's prior probability in period 1 of policymaker being type 1 = Pr(type 1) = *p*.

Type 2:
$\pi_1 = 0,\ \pi_2 = 0$ (dominant strategy)

Type 1:

- Reveal type in period 1 (play $\pi_1 \neq 0$) → separating equilibrium.
- Mimic type 2 (play $\pi_1 = 0$) → pooling equilibrium.
- Mixed equilibrium…

Period 2 → use backward induction:

$$\max_{\pi_2} b(\pi_2 - \pi_2^e) - \tfrac{1}{2} a\pi_2^2 \Rightarrow \pi_2 = \frac{b}{a}.$$

>> If type 1 reveals type $\Rightarrow \pi_1 = \frac{b}{a}$.

Revelation $\Rightarrow \pi_2^e = \frac{b}{a}$.

$$W(\pi_1^e \mid reveal) = \left[b\left(\frac{b}{a} - \pi_1^e\right) - \tfrac{1}{2} a\left(\frac{b}{a}\right)^2 \right] + \beta\left[0 - \tfrac{1}{2} a\left(\frac{b}{a}\right)^2 \right]$$

$$\Rightarrow$$

$$W(\pi_1^e \mid reveal) = -b\pi_1^e + \tfrac{1}{2}\frac{b^2}{a}(1-\beta)$$

>> If type 1 mimics type 2 $\Rightarrow$ $\pi_1 = 0$.

NB: Private sector knows that type 1 (weak) policymaker might “cheat” / mimic strong policymaker!

Label $q = \Pr(\pi_1 = 0 \mid \text{type}\,1)$ = probability that a type 1 policymaker mimics.

If $\pi_1 = 0$ observed:

- Type 2 → probability = $\Pr(\text{type}\,2) \cdot \Pr(\pi_1 = 0 \mid \text{type}\,2)$ = $(1-p) \cdot 1$ = $(1-p)$.
- Type 1 mimicking → probability = $\Pr(\text{type}\,1) \cdot \Pr(\pi_1 = 0 \mid \text{type}\,1)$ = pq.

Expectation mathematically correct / unbiased → based on Bayes' theorem → Perfect Bayesian equilibrium.

Bayes' theorem:

$$\Pr(\text{type}\,1 \mid \pi_1 = 0) = \frac{\Pr(\text{type}\,1) \cdot \Pr(\pi_1 = 0 \mid \text{type}\,1)}{\Pr(\pi_1 = 0)}$$

$$= \frac{\Pr(\text{type}\,1) \cdot \Pr(\pi_1 = 0 \mid \text{type}\,1)}{\Pr(\text{type}\,1) \cdot \Pr(\pi_1 = 0 \mid \text{type}\,1) + \Pr(\text{type}\,2) \cdot \Pr(\pi_1 = 0 \mid \text{type}\,2)}$$

$\Rightarrow$

$$\Pr(\text{type}\,1 \mid \pi_1 = 0) = \frac{pq}{pq + (1-p)}$$

$$\pi_2^e \big|_{\pi_1=0} = \mathrm{E}[\pi_2 \mid \pi_1 = 0] = \frac{pq}{pq+(1-p)}\frac{b}{a} + \left(1 - \frac{pq}{pq+(1-p)}\right)0$$

$$\Rightarrow$$

$$\pi_2^e \big|_{\pi_1=0} = \mathrm{E}[\pi_2 \mid \pi_1 = 0] = \frac{pq}{pq+(1-p)}\frac{b}{a}$$

$$W(\pi_1^e, q \mid mimic) = b(0 - \pi_1^e) - \tfrac{1}{2}a \cdot 0^2$$

$$+\beta\left[b\left(\frac{b}{a} - \frac{pq}{pq+(1-p)}\frac{b}{a}\right) - \tfrac{1}{2}a\left(\frac{b}{a}\right)^2\right]$$

$$\Rightarrow$$

$$W(\pi_1^e, q \mid mimic) = -b\pi_1^e + \frac{b^2}{a}\beta\left[\tfrac{1}{2} - \frac{pq}{pq+(1-p)}\right]$$

(*i*) If $q = 0$ → type 1 never mimics. Requires that never favourable to type 1 to mimic:

$$W(\pi_1^e, q = 0 \mid mimic) \le W(\pi_1^e \mid reveal)$$

$$\Rightarrow$$

$$-b\pi_1^e + \frac{b^2}{a}\beta\left[\tfrac{1}{2} - 0\right] \le -b\pi_1^e + \tfrac{1}{2}\frac{b^2}{a}(1-\beta)$$

$$\Rightarrow$$

$$\beta \le \tfrac{1}{2}$$

If weak policymaker very impatient, inflate early → no reputation building.

(ii) If $q=1$ → type 1 always mimics. Requires that always favourable for type 1 to mimic!

$W($

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An aside: Calculate posterior when $q=1$ and $\pi_1 = 0$ observed: $\Pr(\text{type}\,1 \mid \pi_1 = 0) = \dfrac{p \cdot 1}{p \cdot 1 + (1-p)} = p$, i.e. private sector learns nothing about policymaker type from observing $\pi_1 = 0$.

$$\Rightarrow$$

$$-b\pi_1^e + \frac{b^2}{a}\beta\left[\tfrac{1}{2} - p\right] \ge -b\pi_1^e + \tfrac{1}{2}\frac{b^2}{a}(1-\beta)$$

$$\Rightarrow$$

$$\beta \ge \tfrac{1}{2}\frac{1}{1-p}$$

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If very patient $\Rightarrow$ always mimic → pooling equilibrium!

Patient relative to prior probability of type 1 → if high probability of type 1, then little gain from mimicking and surprising in period 2.

(*iii*) If $\frac{1}{2} < \beta < \frac{1}{2}\frac{1}{1-p}$ $\Rightarrow$ mixed / randomising strategy supports Perfect Bayesian equilibrium → semi-separating equilibrium! (Choose randomising probability $0 < q < 1$ so that type 1 indifferent between $\pi_1 = 0$ and $\pi_1 = b/a$.)

Reputation → pooling equilibrium → a weak policymaker builds reputation as tough (hide weakness) and thus sustains low inflation.

"Do not reveal who you really are" → "behave well to avoid consequences if people realise who you really are"!

Repeat many (potentially infinite number of) periods → low inflation reputation sustained for long periods.

III) Delegation (p. 487-491)

Model

$$y = \bar{y} + b(\pi - \pi^e)$$

Government's loss:

$$L = \tfrac{1}{2}(y - y^*)^2 + \tfrac{1}{2}a(\pi - \pi^*)^2, \qquad y^* > \bar{y},\ a > 0$$

Inflation in discretionary equilibrium:

$$\pi^{EQ} = \pi^* + \frac{b}{a}(y^* - \bar{y})$$

Delegate to Central Bank$'$ with a':

$$L' = \tfrac{1}{2}(y - y^*)^2 + \tfrac{1}{2}a'(\pi - \pi^*)^2$$

Inflation in discretionary equilibrium with delegation:

$$\pi^{EQ'} = \pi^* + \frac{b}{a'}(y^* - \bar{y})$$

$$\pi^e = \pi^{EQ'} \Rightarrow y = \bar{y}.$$

Insert in Government's loss function:

$$L = \tfrac{1}{2}(\bar{y} - y^*)^2 + \tfrac{1}{2}a(\pi^* + \tfrac{b}{a'}(y^* - \bar{y}) - \pi^*)^2$$

$$\Rightarrow$$

$$L = \tfrac{1}{2}(\bar{y} - y^*)^2 + \tfrac{1}{2}a(\tfrac{b}{a'})^2(y^* - \bar{y})^2$$

Result: $a' \uparrow \Rightarrow L \downarrow$.

Society / government better off appointing "conservative Central Banker" with large degree of inflation aversion, i.e. a' large.

- $a' \rightarrow \infty$ would yield first best.

EA: Central-Bank Independence and Inflation (p. 489)

If III) correct: Countries with "delegation" of monetary policy $\Rightarrow$ lower inflation, Ceteris Paribus → delegation if CB is "independent" (monetary policy with *a´* and <u>not</u> government's *a*).

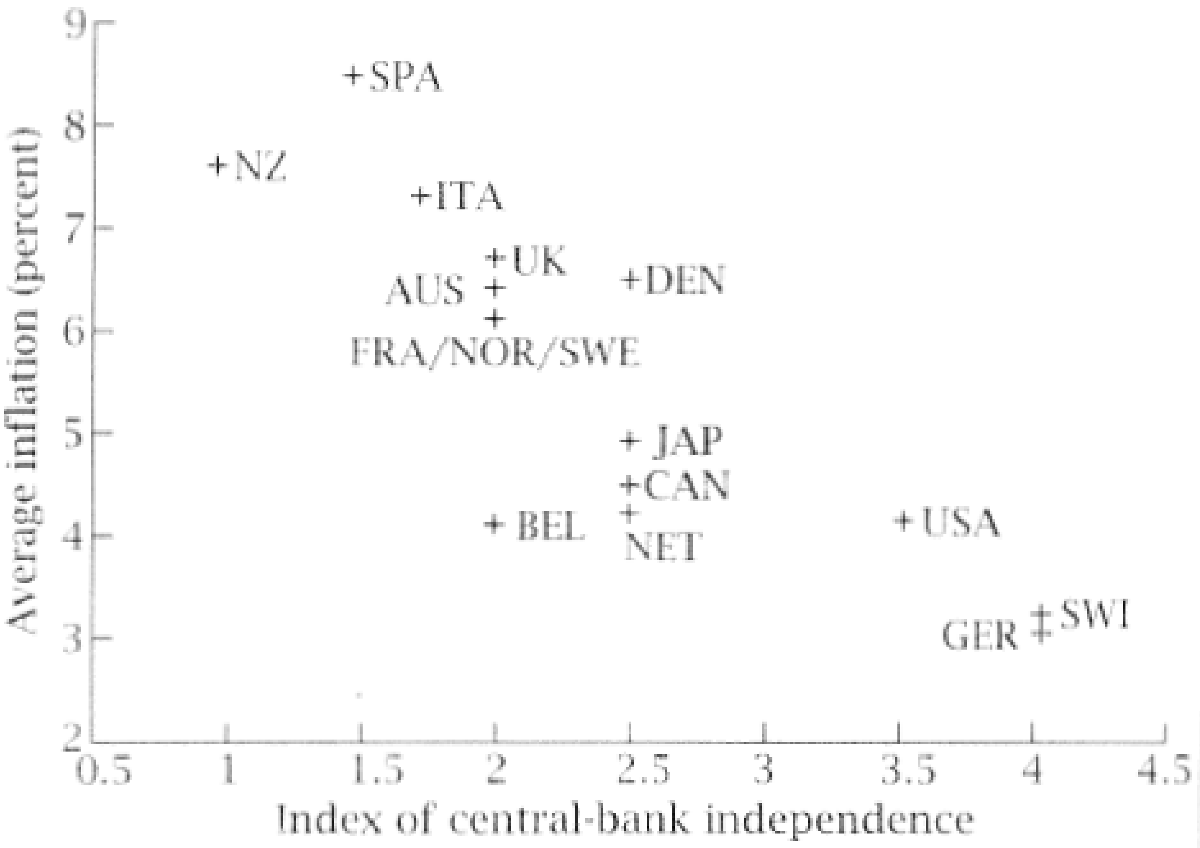

FIGURE 10.6 Central-bank independence and inflation[15]

NB: Causality direction, backward-laying factor like the government's inflation aversion?

<u>Discussion</u> of dynamic inconsistency (p. 491-493)

1. Are forward-looking expectations so important?
2. Inflation affected by variables which are not policy-affected, e.g. oil prices.

10.6 What Can Policy Accomplish?

Skip!

10.7 The Conduct of Policy

Skip p. 497-499!

Monetary policy increasingly delegated to "independent" or semi-independent central bank.

What do they do? What should they do?

Interest rate rules (p. 500)

CBs in practice → monetary policy using <u>nominal</u> interest rate:
- Banks' refinancing facilities → ECB, Norway.
- OMO → USA.

NB: Nominal interest rate <u>rules</u> to avoid instability → react to ensure stability:
- Constant nominal interest rate and $\pi \uparrow \Rightarrow$ real interest rate $\downarrow \Rightarrow y \uparrow \Rightarrow \pi \uparrow$, and so on.

<u>Taylor (1993)</u>
- FED argues its interest rate setting based on discretionary policies incorporating "∞" variables.
- Taylor: *i* setting well described by a rule of form:

$$i_t - \pi_t = \bar{r} + b(\pi_t - \pi^*) + c(\ln Y_t - \ln \bar{Y}_t)$$

where π^* = target inflation, $\bar{Y}_t$ = natural output at time t.

Taylor rule!

Taylor (1993) for USA:
$b = 0.5$, $c = 0.5$, $\bar{r} = 2\%$, $\pi^* = 2\%$, $\bar{Y}_t$ = smoothed GDP.

"Issues in the Design…" (p. 501-503) → read yourself!

Taylor rule used normatively

Is monetary policy expansionary or contractionary?

- Taylor rule indicating "neutral" monetary policy.
- Compare actual real interest rate with real interest rate if Taylor rule followed.

Monetary Conditions Index

Open economy → changes in real exchange rate (e) affect Y and $\pi \Rightarrow$ interest rate policy should take this into account.

$$i_t - \pi_t = \bar{r} + b(\pi_t - \pi^*) + c(\ln Y_t - \ln \bar{Y}_t) + de_t$$

where sign of d depends on definition of e. (Real appreciation $e \downarrow \Rightarrow$ real interest rate $\uparrow$ to retain monetary tightness / same "monetary conditions".)

$$-de_t + (i_t - \pi_t) = \bar{r} + b(\pi_t - \pi^*) + c(\ln Y_t - \ln \bar{Y}_t)$$

where LHS is the Monetary Conditions Index, i.e.:

$$\text{MCI} = -de_t + (i_t - \pi_t)$$

MCI $\uparrow \Rightarrow$ tighter / more contractionary monetary conditions.

NB: Sometimes only nominal (and not real) interest rate in MCI.

MCI "intermediate target" in Canada and New Zealand.

A Model for Analysing Policy Rules (p. 503)

Question: What is the loss if CB implements monetary policy as a simple Taylor rule (with inflation and output) even if possible to contingent on many other variables?

Simple model with lags:

$$y_t = -\beta r_{t-1} + \rho y_{t-1} + \varepsilon_t, \qquad \beta > 0,\ 0 < \rho < 1$$

$$\pi_t = \pi_{t-1} + \alpha y_{t-1} + \delta_t, \qquad \alpha > 0$$

Shocks ε_t and δ_t → white noise and independent of each other.

After observing ε_t and δ_t, CB sets r_t — to minimise the discounted sum of the instantaneous loss:
$\mathrm{E}_t[(y_t - 0)^2] + \lambda \mathrm{E}_t[\pi_t{}^2]$.

Desired output (normalised)

Interest rule linear in model variables.

NB1: Current y_t determined by past variables (and shock) $\Rightarrow$ CB's policy in t can only affect y_{t+1} $\Rightarrow$ CB's period t policy must target $\mathrm{E}[y_{t+1}]$.

NB2: Inflation in period $t+1$ cannot be controlled by period t policies $\Rightarrow$ $\mathrm{E}[\pi_{t+1}]$ given.

Paths of output and inflation for $t+2$ and onwards are, in addition to shocks, determined by $\mathrm{E}[y_{t+1}]$ and $\mathrm{E}[\pi_{t+1}]$, where $\mathrm{E}[\pi_{t+1}]$ "exogenous".

Optimal policy ~ trade-off between $\mathrm{E}[\pi_{t+1}]$ and $\mathrm{E}[y_{t+1}] \Rightarrow$

$\mathrm{E}[y_{t+1}] = -q\,\mathrm{E}[\pi_{t+1}]$

Can show: Optimal $q^* = \dfrac{-\lambda\alpha + \sqrt{\alpha^2\lambda^2 + 4\lambda}}{2}$.

- If $\lambda = 0$, i.e. no inflation concern $\Rightarrow q^* = 0$, i.e. expected output back to desired level asap.
- If $\lambda \to \infty$, i.e. no output concern $\Rightarrow q^* = 1/\alpha$, i.e. expected inflation back to 0 asap → "inflation combated by recession".

Optimal policy $\Rightarrow$

$r_t = \dfrac{\rho + q^*\alpha}{\beta} y_t + \dfrac{q^*}{\beta}\pi_t$, i.e. simple Taylor rule!

NB: Theory suggests (cross) restrictions on parameters in Taylor rule. Satisfied in practice?

Inflation Targeting (p. 508)

Inflation targeting = IT.

IT > CB only targets inflation!

Inflation targeting regime:

- Explicit inflation target.
- Place large weight on inflation target.
- CB's policies transparent and accountable.
- KAR: High degree of CB independence w.r.t. policies.

IT can be optimal policy (if convergence speed to inflation target correct).

<u>Two views</u>

- Explicit specification of policy regime → credibility, transparency, accountability.
    - Credibility ⇒ disinflation less costly.
- "Conservative window-dressing". (Change in monetary policy pre-empt change to IT).