Theory of Monetary Policy: A Review

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Outline

Objective
To review the main developments in the theory of monetary policy

Outline of presentation
Static (one-period) framework with flexible price
  - Quantity Theory of Money
  - Natural rate hypothesis
  - Rational expectations hypothesis
  - Time inconsistency problems from Rule VS Discretion
Dynamic (multi-period) framework with flexible price
  - Reputation models
  - Monetary policy under the New Keynesian framework
  - Time inconsistency problems revisited

Static (one-period) framework with flexible price

- Quantity Theory of Money
  \[ M \times V = P \times Y \]
  - M: Money supply
  - V: Velocity of money (assumed as constant)
  - P: Price level
  - Y: Real output (determined by real variables such as labour supply)

Under the Gold Standard

\[ \Delta M \rightarrow \Delta P \rightarrow \Delta Y \]

backed up by gold supply

Static (one-period) framework with flexible price

- Attempts to explain
  - Natural rate hypothesis (Friedman, 1968)
  - Imperfect information: knowing p but not \( \pi \)
  - Short-run effects: output returns to original after mistake realised (classical dichotomy)
  - Rational Expectations hypothesis (Lucas, 1975)
  - Using all available information to form expectations
  - Only unexpected \( \Delta M \) leads to \( \Delta Y \): mistake as increase in \( \pi \) hence, demand
  - Long-run effects: output returns to original after mistake realised

\[ \text{The gov. can stimulate the real economy through monetary policy!!} \]

Static (one-period) framework with flexible price

Natural rate hypothesis
Rational Expectations hypothesis
assuming direct relationship between \( \pi^r \) and \( \Delta \pi \), i.e.\[ \text{gov can manipulate } \pi \text{ directly} \]

Aggregate supply
\[ y^* = \frac{y}{\alpha} + \beta (\Delta \pi^r) + \epsilon \]
\( y^* \): output, \( y^r \): natural rate of output
\( \Delta \pi^r \): expected inflation
\( \epsilon \): supply shock

Possibility for the use of monetary policy to stimulate the real economy by setting a loss function to be minimised!!
Static (one-period) framework with flexible price

Loss function: $L = (y - ky^*)^2 + a\pi^2$, where $a$ is a positive constant (weight)
Attempts to stabilise inflation and output around their corresponding targets, 0 and $ky^*$

Logics
- Targeting $\pi = 0$ for simplicity
- Targeting $y$ at $ky^*$ where $k > 1$ because the government
  - can stimulate the real economy
  - perceives $y^*$ as too low due to:
    - Frictions in the labour market: search/mismatch, hence unemployment is too high
    - Longer time to correct the labour market
- We do not know the private sector’s objectives, only that
  - They form expectation rationally, using all available information and normally $\pi = \pi^e$
  - They know the government’s loss function

Supply shock $\varepsilon$ observed only by the gov BUT NOT the private sector

Prices and output determined

Static (one-period) framework with flexible price

- Time-inconsistency problems: Rule VS Discretion (Kydland & Prescott, 1977 and Barro & Gordon, 1983)
  - Discretion
    Given private expectation $\pi^e$
    Gov minimises the loss function: $L = (y - ky^*)^2 + a\pi^2$
    subject to AS: $y = y^* + b(\pi - \pi^e) + \varepsilon$

  Result:
on average $\pi = b(k-1)y^*/a > 0$ (inflationary bias)
  The gov attempts to stimulate the economy above $y^*$ – this is known to the private sector

  Can’t do any better????

Static (one-period) framework with flexible price

- Time-inconsistency problems: Rule VS Discretion
  (Kydland & Prescott, 1977 and Barro & Gordon, 1983)
  - Rule
    The gov sets a rule $\pi = \alpha + \beta\varepsilon$ and sticks to it
    Private sector believes the gov will stick to this rule and will not push $y$ above $y^*$
    Hence, $\pi = \pi^e$
    Gov minimises the loss function (targeting $y^*$) $L = (b(\pi^e) + \varepsilon)^2 + a(\alpha + \beta\varepsilon)^2$
    subject to AS: best strategy is to set $\alpha = 0$

  Result:
on average $\pi = 0$ and $y = y^*$
  However, temptation to cheat is ever present since $k > 1$
  Once $\pi = 0$, the gov does not stick to the rule, on average $\pi = b(k-1)y^*/(a+b^2)$ and $y = y^*$
  Private sector knows in advance of this temptation, therefore, would not set $\pi = 0$

  This is time inconsistency problem: the best strategy is to stick to the rule
  but the rule is not plausible/credible due to temptation to cheat.

Static (one-period) framework with flexible price

Ways to alleviate inflationary bias
- Conservative central banker (Rogoff, 1985)
- Inflation contract (Walsh, 1995)
- Inflation targeting (Svensson, 1997)
Static (one-period) framework with flexible price

- Ways to alleviate inflationary bias
  
  **Consensus control banker** (Rogoff, 1985)
  
  - Gov appoints CB with different loss function (with higher weight attached to inflation)
  
  \[ L = (y - ky)^2 + a(\pi - \pi^*)^2 \]
  
  - On average, \( \pi \) is lower than discretion but still \( > 0 \)

**Inflation contract** (Walsh, 1995)

- Gov appoints CB with the same loss function as the gov
  
  - CB pay depends on performance on inflation: utility \( = -\text{pay contract} - \text{loss function} \)
  
  - Possible for \( \pi = 0 \) if the contract is set properly
  
  - Problems with feasibility (though NZ attempted it) how to convert utility into money-equivalent pay?

**Inflation targeting** (modification from Svensson, 1997)

- Gov appoints CB and assigns different loss function
  
  \[ L = (y - ky)^2 + a(\pi - \pi^*)^2 \]

- Gov sets explicit inflation target \( \pi^* \) directly related to output target \( y^* \)

- If output is targeted at \( y^* \), \( \pi \) must be negative (definition) to achieve \( \pi = 0 \)

- Most practical way to eliminate inflationary bias

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Dynamic (multi-period) framework with flexible price

- After all, the government is not as myopic. Due to penalty, cheating may not be worthwhile. Development of dynamic (multi-period) framework with flexible price follows...

- Examples are reputation models such as:
  
  - Barro & Gordon (1983)
  
  - Backus & Driffill (1985)

  1. Assumption on the desire to push \( y \) above \( y^* \) remains

  2. Most reputation models utilised multi-period game theory where decision whether to cheat depends on the present value of benefits against the costs of cheating

  3. Nash equilibrium depends on private expectation of the probability of cheating

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Dynamic (multi-period) framework with sticky price

- Under **flexible price**, rule is better than discretion only because the target output \( (\pi y^*) \) is above the natural level of output \( y^* \)

Without inflationary bias, is Rule still better than Discretion under sticky price model ??

- **Sticky price** is associated with Keynesian strand of literature.

Combining with rational expectation and microeconomic foundation of macroeconomics, which emerged after J.M. Keynes’ death, it was termed the New Keynesian framework

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Dynamic (multi-period) framework with sticky price

What are the intuitions behind AS & AD under the New Keynesian framework?

**AS**

- in each period, a proportion of firms reset their prices

- Probability of not being able to reset prices in each period

- Once able to reset prices, firms need to form expectations on what will happen to prices in the following periods

- \( y \) is directly related to real marginal costs \( \pi^* \) (under linear production function)

- Prices set at a markup over marginal costs \( \pi^* \) (wages, which determine labour supply)

**AD**

- Household optimisation by maximising discounted streams of utility (consumption and labour supply) subjected to budget constraints (spending on consumption and wages)

- Interest rate (policy instrument) used in the calculation of the present value of spending and wages

\[ \Delta y \rightarrow \Delta y \text{ in AD} \rightarrow \Delta \pi \text{ in AS} \]
Dynamic (multi-period) framework with sticky price

- In each period, optimal conditions of output and inflation are found from minimisation of the loss function subject to the aggregate supply. From the aggregate demand function, interest rate, consistent with optimal conditions of output and inflation, is chosen.

### Results

1. Optimal reaction function: \( r_t = \gamma \pi_t + \rho r_{t+1} \)
   - Policy decision in this period is made based on the expected future inflation and output.
   - Rule is more aggressive than discretion to show commitment.
   - To reduce one percentage point of expected future inflation, a higher increase in interest rate is required under rule.

2. Short-run trade-off between inflation and output is better under rule.
   - A reduction in output of one unit (from interest rate changes) leads to a greater reduction in inflation. Under credible rule, inflation expectation is pinned down, hence becomes lower than under discretion as in the case of flexible prices.

### Conclusion

- Monetary policy has an impact on the real economy.
- Whether the desire for higher output above the natural level is present, rule is always better than discretion due to its impact on private expectations.
- Even though rule is the first-best solution, it is harder to implement than discretion.
- In practice, policymakers attempt to set the rule for monetary policy conduct. The precise nature of the rule will be presented next…