Monetary theory

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Chapter 4: Instruments and target of monetary policy

Section 1: the issue

Introduction

- The choice of the optimal instrument and the target has been an issue since WW2.
- 50's: Timbergen : target in terms of either price or quantity; but leaves the question of instruments open
- 70's: Adoption of (intermediate) targets in terms of monetary aggregates
- 80's : This strategy is questioned due to poor performances in terms of inflation $\rightarrow$ revisit the question of the choice of instruments
- 90's Major shift : most of central banks use now short term interest rates .
- The (official) strategy of the ECB is a mix between the 70's and 90's (see later) but in practice only use interest rates (repurchase agreements).

Connection with other issues

- Rules vs discretion : choice of an active or passive MP but does not address the choice of instruments. Just choose between π_d or π_p .
- Connection with accountability: if objectives are clarified, this increases political accountability.
- Question of independence is linked to the question of both the target (inflation or not) and the instruments. Remember distinction between political and economic independence
- Inflation targeting : public announcement of an explicit inflation target (ex. New Zealand)

Concepts

- the conduct of MP is made difficult because
- not a direct control on some variables such as money stock, inflation (ex: oil shock) or output
- uncertainty on the relationships between MP and variables
- transmission lags
- $\Rightarrow$ the implementation of MP involves different types of variables

Types of variables

- Objectives; examples: inflation, unemployment; targeted values will determine the choice of values for
- Intermediate targets : these variables link objectives and operational targets; the intermediate targets provide information to the CB on the stance of economic developments which affect the objectives;
- Examples of intermediate targets: exchange rates available at daily frequencies, M3 growth (Bundesbank or ECB) as a predictor of future inflation, ...
- Operational targets : these variables reflect the orientation of MP but the CB has no direct control on these variables

Types of variables

- Examples of operational target: overnight market interest rates (Eonia, Fed funds in the US); level of borrowed and non borrowed bank reserves
- Instruments : these variables are directly controlled by the CB
- Examples: interest rates on the borrowed reserves : rate on marginal facilities, ...: reserve ratios (ratio of compulsory reserves over deposits)
- Example of implementation process: Inflationary pressures (objectives) are reflected by increase in labor costs and M3 growth (intermediate targets) $\Rightarrow$ need to slow the pace of credits through an increase of the reserves (operational target) implemented through an increase in key interest rates (discount, ...) (instruments).

Section 2:Choice of instruments under uncertainty

Reminder : usual instruments

- In a modern world, MP conducted through the variation of bank's reserves.
- $M_0 = Currency + Reserves$.
- $Deposits = (\frac{1}{rr})Reserves$ where rr is called the reserve ratio and is comprised between 0 and 1.
- The CB manages the total amount of Reserves through different channels : chages in rr, open market operations or lending of reserves.

Reminder : usual instruments

- The CB changes rr ; nevertheless not very often (in the Euro zone, $rr = 0.02$)
- The CB influences the supply of reserves through purchases and sales of assets (open market operations): this is the usual strategy now adopted by major central banks
- Lending of reserves : 70's.
- The bank can also influence credits though legislation and regulation.

Choice of CB

- The CB is in monopoly → it can
- **set interest rates** → supply of reserves (or base money) perfectly elastic at this level of interest rates
- **acts on the level of reserves** → supply of reserves perfectly inelastic to the level of interest rates and interest rates adjust to reach supply and demand equilibrium
- →basic choice between interest rates and monetary aggregate
- Key feature : choice under uncertainty .

Nature of uncertainty

- Two basic types of uncertainty.:
- Uncertainty on the structure of the economy but the structure is known by agents . $\longrightarrow$ the relationships are subject to stochastic shocks (supply and demand shocks for instance) $\longrightarrow$ Analysis of Poole (1970)
- The structure of the economy is unknown $\longrightarrow$ not considered here)

Basic analysis

- Analysis developed in a Keynesian framework $\rightarrow$ emphasis on aggregate demand.
- static model (1 period).
- Basic IS-LM structure augmented with stochastic disturbances:

$$y = -\alpha i + u. \tag{1}$$

$$m = -ci + y + \nu. \tag{2}$$

Shocks

- u stands for AD shock (ex: restrictive fiscal policy, decrease in exports, ...) with $E(u) = 0$, $E(u^2) = \sigma_u^2$.
- ν stands for money demand shock related to financial markets with $E(\nu) = 0$, $E(\nu^2) = \sigma_\nu^2$
- Allows a graphical representation with lower and upper shifts in the curves.

Objective of the monetary authorities

- In the Poole analysis, objective is to stabilize the variability of output. $\rightarrow$: min $E(y^2)$. There is no problem of time inconsistency
- Comparison between choice of i (interest rate) and m (money stock)

Events sequence

- Choice of i or m by monetary authorities
- realizations of shocks u and ν
- realization of the 2 endogenous variables, i and y under the two instruments
- Comparison of $E(y^2)$ between choice of i and m

Monetary policy with m

- express $y = \frac{\alpha m + cu - \alpha\nu}{\alpha + c}$
- choose m such as $E(y) = 0 \Rightarrow m = 0$
- $y = \frac{cu - \alpha\nu}{\alpha + c}$
- $E(y^2) = \frac{c^2\sigma_u^2 + \alpha^2\sigma_\nu^2}{(\alpha + c)^2}$
- In this case, fixing m, i.e. fixing the money supply allows to dampen partially the impact of demand shocks : $0 \leq \frac{c^2}{(a+c)^2} \leq$
- Limit case : vertical LM : this does not allow to insure against financial shocks
- The variability of m allows to smooth the fluctuations of output.

Monetary policy with i

- if i is fixed, uncertainty on y comes only from u
- $E(y^2) = \sigma_u^2$
- in order to choose the optimal instrument, compare $E(y^2)$ under the 2 instruments $\rightarrow r$ is chosen if $\sigma_u^2 < \frac{c^2\sigma_u^2+\alpha^2\sigma_\nu^2}{(\alpha+c)^2}$ or if $\frac{\sigma_\nu^2}{\sigma_u^2} > (1+\frac{2c}{\alpha})$
- r will be favored when:
- the variance (size) of money demand shocks (financial shocks) relative to the variance (size) of real demand shocks is large
- LM curve (slope=$\frac{1}{c}$) is steep
- IS curve (slope=$-\frac{1}{\alpha}$) is flat.

Choice of monetary aggregate

- The choice of instrument will depend on
- the respective size of shocks : σ_u^2,σ_ν^2,
- the structure of the economy : α, c.
- example : if we assume that σ_ν^2 or that $\nu = 0$, i.e. only real shocks matter, in this case, choosing m is the best strategy; see a graphical representation of that
- graphical representation
  Real shocks and choice of instruments.
- example : if we assume that σ_u^2 or that the size of real shocks is negligible, in this case, choosing i is the best strategy; think a graphical representation of that!!!

Implications in terms of policy horizon

- This analysis suggests the use of various instruments depending on the stabilization horizon
- at a quarterly frequency , the demand of money is relatively stable but the (real) economy is subject to fluctuations of the aggregate demand side $\longrightarrow$ this suggests the use of a stable growth rate of the money stock
- in the very short term (day to day basis, weekly frequency), financial markets are volatile but real markets are more stable because there are production plans within such a short period $\longrightarrow$ this suggests the use of interest rate for the sake of the short term stabilisation policy

Example : the Bundesbank and the ECB

- Is this two-instrument strategy realistic? yes
- Example of the two-pillar strategy of the Bundesbank of the ECB
- use of short-term interest rates (repo rates) for the day-to-day management of the liquidity of financial markets
- Use of an monetary aggregate for the conduct of monetary policy in the medium run : use of M3 aggregate as an intermediate target
- Caution: justification of the ECB is not stabilisation of the real side but the control of inflation : inflation is always and everywhere a monetary phenomenon .

Development of financial markets

- In the 50's and 60's, demand for money was very stable $\rightarrow$ choice of stable monetary aggregates.
- In the 70's and the 80's, the volatility of financial markets has increased $\rightarrow$ increasing use of interest rates
- From the 90's, choice of instruments mostly in terms of r in major central banks.

Section 3: Extension to uncertainty of the control over m

Monetary base as an instrument

- The previous analysis has several limitations; important one : m is not really an instrument but rather an intermediate target .
- Why ? control of m is indirect and influence goes through the monetary base (Reserves+currency), denoted b.
- Consider rather the use of b as an instrument rather than m
- Additional equation :

$$m = b + hi + \omega \tag{3}$$

Monetary base as an instrument

- The money multiplier ($m - b$ or $ln(\frac{m}{b})$) depends on i
- $h > 0$: excess reserves depend negatively on the level of interest rates (opportunity costs of holding reserves that do not yield a high return)
- ω might be interpreted as a shock on the money multiplier with variance σ_ω^2, i.e. some kind of liquidity shock (example : credit crunch)

Monetary base as an instrument

- if b is the instrument :
- choose $E(y) = 0 \Rightarrow E(m) = 0$, i.e. $b = 0$
- $\Leftrightarrow y = \frac{(c+h)u - \alpha\nu + \alpha\omega}{a+c+h}$
- $\Leftrightarrow E(y^2) = \frac{(c+h)^2\sigma_u^2 + \alpha^2(\sigma_\nu^2 + \sigma_\omega^2)}{(a+c+h)^2}$
- i preferred if and only if
- $\sigma_u^2 < \frac{(c+h)^2\sigma_u^2 + \alpha^2(\sigma_\nu^2 + \sigma_\omega^2)}{(a+c+h)^2}$
- $\frac{\sigma_\nu^2 + \sigma_\omega^2}{\sigma_u^2} > (1 + \frac{2(c+h)}{\alpha})$

- The shocks affecting the money multiplier have an influence on the decision about the instrument
- Previous conclusion of Poole(1970) strengthened
- Higher volatility of financial markets (σ_ν^2 and σ_ω^2) makes the choice of interest rates more interesting
- Once more, the choice of instrument depends on the policy horizon (interest rates in the short run, monetary aggregates in the medium run)
- One important limitation of this analysis : based on a particular function of the preferences of the CB, i.e. focusing only on output stabilization (does not account for time inconsistency).

Section 4: Extension to a more flexible policy rule

Policy rule

- On might see the Poole procedures as particular cases of a policy rule
- $$b = b_0 + \mu(i - E(i)) \quad (4)$$
- normalizing, one can write $b = \mu i$.
- μ will determine the extent to which b changes when i changes; $\Rightarrow$ 3 cases
- $\mu = 0 \Rightarrow b = b_0$: procedure of fixing the monetary base

Policy rule

- $\mu = -h$; combining with $m = b + hi + \omega \Rightarrow m = \omega$: b is adjusted such as keeping m constant (on average) : procedure of money supply adjustment with b the instrument and m is the intermediate target.
- $\mu = \infty \Rightarrow$: i is fixed and b adjusts : procedure of interest rate (see why after determining the value of i)

Policy rule

- The rule describes the way the instrument b is set
- 4 equations (5-8)
- one gets $i = \frac{\nu - \omega + u}{\alpha + c + \mu + h}$
- if $\mu \to \infty \Rightarrow i \to 0$: the interest rate is fixed (in deviation from the mean): we recover the procedure of fixing the interest rate
- The obtained values of μ will allow to compare the flexible solution (the policy rule) with the simple cases analyzed before. Interesting case : check optimal value of μ

Optimal μ

- $y = \frac{(c+h+\mu)u-\alpha(\nu-\omega)}{(\alpha+c+\mu+h)}$.
- Computing the variance: $\sigma_y^2 = \frac{(c+h+\mu)\sigma_u^2+\alpha^2(\sigma_\nu^2+\sigma_\omega^2)}{(\alpha+c+\mu+h)^2}$
- The optimal value of μ is obtained by minimizing this expression: $\mu* = -(c+h) + \alpha\frac{\sigma_\nu^2+\sigma_\omega^2}{\sigma_u^2}$
- We see that none of the single-instrument case is optimal ($\mu = \infty, \mu = 0, \mu = -h$) $\rightarrow$ in general, the combination of more than one instrument provides better results.
- As before, the choice depends on the relative sizes of the real and financial shocks.

Real shocks case

- Focus on real shocks : $\sigma_\nu^2 = \sigma_\omega^2 = 0$,
- In the single-instrument case (section 2) the use of interest rate was dominated by the use of monetary aggregate
- now:$\mu * = -(c+h)$ or put differently: $b = -(c+h)i$: of course, $(c+h) > 0$ (check why !!!)
- This expression shows that the information contained in the interest rate can be useful to choose the optimal variation in the monetary base.
- After a positive shock ($u > 0$), the rise of interest rate signals the need for a monetary contraction through a decrease in the monetary base ($\Delta b < 0$); this contraction amplifies the rise in interest rate : leaning-with-the-wind policy.

Financial shocks case

- Financial shocks occur : $\sigma_\nu^2 > 0, \sigma_\omega^2 > 0$
- In this case, the procedure of interest rate might become more desirable : $\mu* > -(c+h)$
- For large financial shocks (relative to real shocks), $\mu*$ might become positive.
- If $\mu* > 0$, in the case of a negative money demand shock ($\nu < 0$), the rise in interest rates signals a rise in b in order to increase the money stock and balance the negative impact of the initial shock on y. $\rightarrow$ leaning-against-the-wind policy.

Signal extraction problem

- By definition, shocks are not directly observable $\rightarrow$ use of intermediate targets that give information of the stance of the economic situation
- We can see this as a signal extraction problem: i will provide information on the realization of shocks
- in the case of observable shocks (perfect information case: highly unrealistic!!!) : $b = \mu_u u + \mu_\nu \nu + \mu_\omega \omega$
- We obtain: $y = \frac{(c+h+\alpha\mu_u)u - \alpha(1-\mu_\nu)\nu + \alpha(1+\mu_\nu)\omega}{(\alpha+c+h)}$
- In this case, minimizing σ_y^2 gives: $\mu_u = \frac{-(c+h)}{\alpha}$; $\mu_\nu = 1$;$\mu_\omega = -1$.

Signal extraction problem

- In the case of unobservable shocks (realistic case !!!), the conduct of monetary policy must rely on estimated shocks : $\widehat{u}, \widehat{\nu}, \widehat{\omega}$
- $b = \frac{-(c+h)}{\alpha}\widehat{u} + \widehat{\nu} - \widehat{\omega}$
- the forecasts of ν, u and ω will be made on the basis of the variations in the interest rate :
$\widehat{u} = \delta_u i$,$\widehat{\nu} = \delta_\nu i$,$\widehat{\omega} = \delta_\omega i$
- The monetary policy rule becomes :
$$b = \underbrace{(\frac{-(c+h)}{\alpha}\delta_u + \delta_\nu - \delta_\omega)}_{\mu*} i$$
- The optimal response of the CB in terms of i also corresponds to the optimal response of the CB in terms of the forecasted shocks which are estimated on the basis of the interest rate.