Macroeconomics, Part IIB
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Supervision 3:
Monetary Policy

Short question (250 words max)

1. Suppose that the output gap y is determined by

$$y = \alpha - (\kappa + \varepsilon) r + \upsilon$$

where r is the policy instrument controlled by the policymaker; α is an anticipated shock that is observed by the policymaker when it sets r; κ is a positive parameter capturing the effectiveness of the policy instrument; and ε and υ are independent shocks that are not observed by the policymaker, with zero means and positive variances σ_κ^2 and σ_υ^2, respectively. The policymaker minimizes the loss function $L = \mathrm{E}[y^2]$.
Derive the optimal policy r^*, and explain how the optimal policy response to α depends on σ_υ^2 and σ_κ^2. Give an economic interpretation of the results.

Problems

2. The following model describes the process for output and inflation:

$$\begin{aligned} y_t &= -\beta (i_t - \pi_t^e) + \eta_t & \beta > 0 \\ \pi_t &= \pi_t^e + \alpha y_t + \varepsilon_t & \alpha > 0 \end{aligned}$$

where y_t is the output gap, i_t is the nominal interest rate, π_t is the inflation rate, and π_t^e is the expected inflation rate for period t, which is formed at the end of period $t-1$ using rational expectations. The additive aggregate disturbances η_t and ε_t follow zero mean, serially uncorrelated stochastic processes with variances σ_η^2 and σ_ε^2, respectively. These shocks are observed in period t by the monetary policymaker, who sets the nominal interest rate i_t to minimise the quadratic loss function

$$L_t = \lambda y_t^2 + \pi_t^2$$

where $\lambda > 0$. [cf Tripos 2003]

(a) Derive the optimal interest rate rule $i_t = \theta \eta_t + \gamma \varepsilon_t$, where θ and γ are constant parameters. Give a brief intuitive explanation.

(b) Derive the efficient policy frontier and explain why different types of shock pose different problems for the policymaker.

(c) If both output and inflation became more volatile would this affect the policy rule derived in part (a)? Briefly discuss what other forms of uncertainty a policymaker might face in practice and how these affect the conduct of policy.

3. Consider the following model for output and inflation

$$y_t = -\beta r_t + \eta_t \qquad \beta > 0 \tag{1}$$
$$\pi_t = \pi_t^e + \alpha y_t + \varepsilon_t \qquad \alpha > 0 \tag{2}$$

where y_t is the output gap, r_t is the real interest rate, π_t is the inflation rate, and π_t^e is the expected inflation rate for period t, which is assumed to equal zero. The shocks η_t and ε_t are zero mean, independent and serially uncorrelated normally distributed random variables with variances σ_η^2 and σ_ε^2, respectively. Assume that the policymaker has rational expectations and minimizes the expected value of the loss function

$$L_t = \pi_t^2 + \lambda y_t^2 \qquad \lambda \geq 0 \tag{3}$$

Suppose that in period t the monetary policymaker perfectly observes η_t and ε_t. [cf Tripos 2006]

(a) Give a brief economic explanation of equations (1), (2) and (3).

(b) Derive the optimal real interest rate r_t. Briefly comment on its properties.

Now suppose that the policymaker faces uncertainty and cannot perfectly observe the shock η_t. The policymaker has two independent forecasts of η_t, one produced by its own staff economists, $\eta_{S,t}$, and one by the International Monetary Fund (IMF), $\eta_{IMF,t}$:

$$\eta_{S,t} = \eta_t + \upsilon_{S,t}$$
$$\eta_{IMF,t} = \eta_t + \upsilon_{IMF,t}$$

where $\upsilon_{S,t}$ and $\upsilon_{IMF,t}$ are zero mean, independent forecast errors with variances σ_S^2 and σ_{IMF}^2, respectively. Both forecasts produce unbiased estimates of the true shock η_t, but the staff economists have a better forecasting record than the IMF, so $\sigma_S^2 < \sigma_{IMF}^2$.

(c) Derive the best unbiased forecast of η_t that the policymaker can make. Provide an intuitive explanation of the result.

(d) Explain what the optimal real interest rate r_t is in this case. Compare your answer to part (b).

Main readings

- Batini, Martin & Salmon (1999), "Monetary Policy and Uncertainty", *Bank of England Quarterly Bulletin*, May, pp. 183-189
- Carlin & Soskice (2015), *Macroeconomics: Institutions, Instability and the Financial System*, chapter 13
- Conway (2000), "Monetary policy in an uncertain world", *Reserve Bank of New Zealand Bulletin* 63(3), pp. 5-15
- Dennis (2005), "Uncertainty and Monetary Policy", *Federal Reserve Bank of San Francisco Economic Letter* 2005-33, pp. 1-3
- Taylor (1994), "The Inflation/Output Variability Trade-off Revisited", in Fuhrer (ed.), *Goals, Guidelines, and Constraints Facing Monetary Policymakers'*, pp. 21-38

Supplementary references

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- Bean (1998), "The New UK Monetary Arrangements: A View from the Literature", *Economic Journal* 108, November, pp. 1795-1809.
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- McCaw and Haare Morka (2005), "Monetary Policy and the Trade-off between Inflation and Output Variability", *Norges Bank Economic Bulletin* 05 Q1, pp. 42-49.
- Powell, Jerome (2018), "Monetary Policy in a Changing Economy", speech at Federal Reserve Bank of Kansas City Economic Policy Symposium "Changing Market Structure and Implications for Monetary Policy", Jackson Hole, 24 August 2018.
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