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Advanced Macroeconomics
Tutorial #9

Commitment vs. discretion in the new Keynesian model. Suppose the monetary authority seeks to minimize the expected discounted loss function

$$L = \mathbb{E}_0 \left\{ \sum_{t=0}^{\infty} \beta^t \frac{1}{2} \left(\hat{x}_t^2 + \lambda \hat{\pi}_t^2 \right) \right\}, \qquad \lambda > 0$$

subject to the modified new Keynesian Phillips curve

$$\hat{\pi}_t = \beta \mathbb{E}_t \left\{ \hat{\pi}_{t+1} \right\} + \kappa \hat{x}_t + u_t$$

where the cost push shocks u_t follow a stationary AR(1) process

$$u_{t+1} = \rho_u u_t + \varepsilon_{t+1}, \qquad 0 \leq \rho_u < 1$$

and where the innovations ε_t are IID normal with mean zero and variance σ_u^2. Suppose for simplicity that the natural real rate is constant and equal to the rate of time preference $r^n = \rho = 1/\beta - 1 > 0$.

To begin with, suppose the monetary authority cannot commit to future actions.

(a) Derive the monetary authority's optimal discretionary policy for inflation and the output gap and the dynamics of inflation implied by this discretionary policy.

(b) Guess that, in this scenario, inflation and the output gap are linear in the cost push shock, $\hat{\pi}_t = \psi_{\pi u} u_t$ and $\hat{x}_t = \psi_{xu} u_t$ for two coefficients $\psi_{\pi u}$ and ψ_{xu}. Use the method of undetermined coefficients to solve for $\psi_{\pi u}$ and ψ_{xu}. Explain intuitively how inflation and the output gap respond to a cost push shock. What does this imply for the equilibrium path of nominal interest rates?

Now suppose the monetary authority can commit to future actions.

(c) Derive the monetary authority's optimal policy with commitment and the dynamics of inflation implied by this policy.

(d) Guess that, in this scenario, the *price level* satisfies a law of motion of the form

$$\hat{p}_t = \psi_{pp} \hat{p}_{t-1} + \psi_{pu} u_t$$

for two coefficients ψ_{pp} and ψ_{pu}. Use the method of undetermined coefficients to solve for ψ_{pp} and ψ_{pu}. Explain intuitively how the price level, inflation, and the output gap respond to a cost push shock. What does this imply for the equilibrium path of nominal interest rates?

Now suppose the parameter values $\beta = 1/1.02$, $\kappa = 0.17$ and for the cost push shock process $\rho_u = 0.8$, $\sigma_u = 0.015$ and that the monetary authority's weight on inflation is $\lambda = 1$.

(e) Calculate the long-run variances of inflation, the output gap and nominal interest rate under both the discretion and commitment scenarios. Use these variances to calculate the (normalized) loss $2(1-\beta)L$ under these two scenarios. Give intuition for your findings.

(f) Suppose the economy is at steady state and that at $t = 0$ there is a 1 standard deviation cost push shock, i.e., $\varepsilon_0 = \sigma_u$. Calculate and plot for $T = 50$ periods after the shock the impulse response functions of inflation, the output gap, nominal interest rates and the price level under the two scenarios. Explain how these impulse response functions compare across the two scenarios.

(g) Now suppose the monetary authority gives more weight to inflation, $\lambda = 5$. How do your results for (e) and (f) change? What if $\lambda = 10$? What if $\lambda = 50$? Explain.