Indeterminacy, Learnability and the Stabilizing Powers of Monetary Policy

Econ 208

Lecture 21

April 19, 2007
Wicksell’s Cumulative Process
Milton Friedman’s rendition (AER 1968)

- Question: How can monetary policy avoid major errors?
- Friedman’s answer - control a monetary aggregate, don’t try to control interest rates
- Problem is you will create a cumulative departure from full employment equilibrium unless you set the actual rate exactly equal to the natural rate.
- His accelerationist argument, and analysis of the natural rate of unemployment was presented as a paraphrasing of Wicksell’s argument, with unemployment replacing interest.
- Intuitive argument
A formal model of Friedman’s argument

\[ y_t = -\sigma (i_t - E_t \pi_{t+1} - \rho) \]  
IS curve

\[ i_t = \rho, \text{ constant} \]  
Rigid interest control

\[ y_t = \sigma E_t \pi_{t+1} \]  
Phillips curve

\[ \pi_t = \kappa y_t + E_t \pi_{t+1} \]

There is a perfect foresight equilibrium: \( y_t = \pi_t = 0 \) for all \( t \). But it won’t be reached under adaptive expectations. The reason is expectational errors are more than self-fulfilling

\[ \pi_t = (\kappa \sigma + 1) E_t \pi_{t+1} \] (from the last 2 equations)

So under adaptive expectations:

\[
\begin{align*}
E_{t+1} \pi_{t+2} &= E_t \pi_{t+1} + \alpha (\pi_t - E_t \pi_{t+1}) \\
E_{t+1} \pi_{t+2} &= E_t \pi_{t+1} + \alpha \kappa \sigma E_t \pi_{t+1} \\
E_{t+1} \pi_{t+2} &= (1 + \alpha \kappa \sigma) E_t \pi_{t+1}
\end{align*}
\]

which will explode unless we start with \( E_0 \pi_1 = 0 \)
Instability in inflation expectations implies instability in actual inflation, since

\[ E_t \pi_{t+1} = (1 - \alpha)^t E_0 \pi_1 + \alpha \Sigma_{j=1}^{t} (1 - \alpha)^{j-1} \pi_{t-j} \]

It also implies instability in real output, since

\[ y_t = \sigma E_t \pi_{t+1} \]

This is not an artifact of an outdated expectational model. Will work with any learning rule that tries to learn. (Howitt, JPE 1992).

Demonstrates a new criterion for judging monetary policy - does the policy permit convergence to a (full employment) rational expectations equilibrium?
How to prevent instability

The Taylor Principle

A Taylor Rule that obeys the Taylor principle will avoid the instability:

\[ y_t = -\sigma (i_t - E_t \pi_{t+1} - \rho) \]  
\[ i_t = \rho + \phi_\pi E_t \pi_{t+1} \]  
\[ y_t = \sigma (1 - \phi_\pi) E_t \pi_{t+1} \]  
\[ \pi_t = \kappa y_t + E_t \pi_{t+1} \]

IS curve
Taylor Rule
Phillips curve

Again \( y_t = \pi_t = 0 \) is a PFE, but now expectational errors are less than self-fulfilling if \( \phi_\pi > 1 \)

\[ \pi_t = (\kappa \sigma (1 - \phi_\pi) + 1) E_t \pi_{t+1} \] (from the last 2 equations)

So under adaptive expectations:

\[ E_{t+1} \pi_{t+2} = E_t \pi_{t+1} + \alpha (\pi_t - E_t \pi_{t+1}) \]  
\[ E_{t+1} \pi_{t+2} = E_t \pi_{t+1} + \alpha \kappa \sigma (1 - \phi_\pi) E_t \pi_{t+1} \]  
\[ E_{t+1} \pi_{t+2} = (1 + \alpha \kappa \sigma (1 - \phi_\pi)) E_t \pi_{t+1} \]

which converges to 0 if and only if \( \phi_\pi > 1 \).
Determinacy

Equilibrium is *determinate* if there exists only one stable REE, with

\[
\begin{align*}
y_t &= \sigma \left(1 - \phi_\pi\right) E_t \pi_{t+1} \\
\pi_t &= \kappa \sigma \left(1 - \phi_\pi\right) E_t \pi_{t+1} + E_t \pi_{t+1} = \lambda E_t \pi_{t+1}
\end{align*}
\]

Equilibrium is determinate if and only if the Taylor Principle is obeyed.

1. Suppose the Taylor Principle is violated. Then \( \lambda > 1 \). Let \( u_t \) be any AR1 variable with \( \rho = 1/\lambda \)

\[
u_{t+1} = \rho u_t + e_{t+1}, \quad E_t e_{t+1} = 0
\]

Then \( \pi_t = u_t, y_t = \sigma \left(1 - \phi_\pi\right) \rho u_t \) is a stable REE.

\[
\begin{align*}
\lambda E_t \pi_{t+1} &= \lambda E_t u_{t+1} = \lambda \rho u_t = u_t = \pi_t \\
\sigma \left(1 - \phi_\pi\right) E_t \pi_{t+1} &= \sigma \left(1 - \phi_\pi\right) (1/\lambda) u_t = y_t
\end{align*}
\]

2. If the Taylor Principle is satisfied then \( \lambda < 1 \). So any REE with \( \pi_t \neq 0 \) is explosive

\[
E_t \pi_{t+1} = (1/\lambda) \pi_t, \quad E_t \pi_{t+2} = (1/\lambda)^2 \pi_t, \quad E_t \pi_{t+k} = (1/\lambda)^k \pi_t
\]