ECON 815

Interest Rate Rules

Winter 2020

Monetary Policy

A monetary authority controls the short-term nominal interest rate.

A rule is formalized as the nominal interest rate i_t reacting to some relevant variables such as π_t or x_t.

$$i_t = \bar{\iota} + f(\pi_t, x_t, \dots)$$

We will ask three questions.

- Does the interest rule lead to a determinate equilibrium?
- How does the economy react to shocks for a given rule?
- What is the optimal monetary policy rule?

The Classical Model

Recall that the monetary and the real side are separated.

Technology

Productivity follows an AR(1) process given by

$$a_t = \rho_a a_{t-1} + \epsilon_{at}$$

Monetary policy

Monetary policy follows an interest rate rule of the form

$$i_t = \bar{\iota} + \phi_\pi \pi_t + v_t$$

where v_t follows an AR(1) process, or $v_t = \rho_v v_{t-1} + \epsilon_{vt}$ and $\phi_\pi > 1$.

We normalize $\bar{\pi} = 0$, so that in steady state we have $\bar{\iota} = \bar{r} = \rho$.

Solving for Inflation Dynamics

We use the Fisher equation

$$r_t = i_t - E[\pi_{t+1}]$$

and solve forward to obtain

$$\pi_t = \frac{1}{\phi_\pi}\left(r_t - \rho - v_t + E_t[\pi_{t+1}]\right) = \frac{1}{\phi_\pi} E_t\left[\sum_{s=t}^{\infty}\left(\frac{1}{\phi_\pi}\right)^{s-t}(r_s - \rho - v_s)\right]$$

Monetary Policy Shock:

$$\pi_t = \frac{1}{\phi_\pi}\sum_{s=0}^{\infty}\left(\frac{\rho_\nu}{\phi_\pi}\right)^{s}(-1)\epsilon_{\nu t}$$

Technology shock:

$$\pi_t = \frac{1}{\phi_\pi}\left(\sigma\psi_1(\rho_a - 1)\right)\sum_{s=0}^{\infty}\left(\frac{\rho_a}{\phi_\pi}\right)^{s}\epsilon_{at}$$

where we have used the IS equation and $y_t = \psi_0 + \psi_1 a_t$.

Response to a MP Shock – No Liquidity Effect

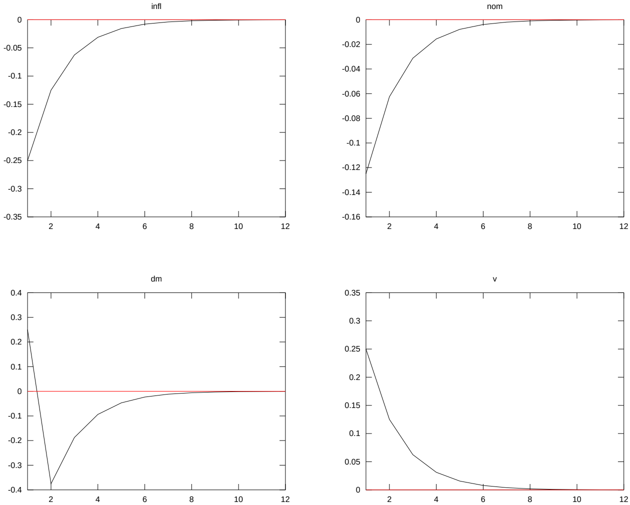

Figure: 25 bps increase in v_t ($\rho_v = 0.5$, $\phi_\pi = 1.5$)

Response to a Technology Shock

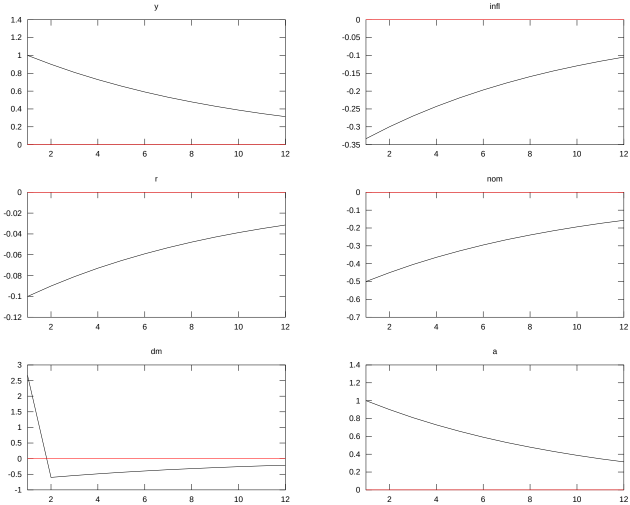

Figure: 1% increase in a ($\rho_a = 0.9$)

The NK Model

Monetary policy is described by a *Taylor-rule*

$$i_t = \bar{\iota} + \phi_\pi \pi_t + \phi_x x_t + v_t$$

where x_t is the output gap.

The model can then be rewritten as

$$\begin{pmatrix} x_t \\ \pi_t \end{pmatrix} = \mathbf{A} \begin{pmatrix} E_t[x_{t+1}] \\ E_t[\pi_{t+1}] \end{pmatrix} + \mathbf{B}(r_t^n - \bar{r}_t^n - v_t)$$

where $\mathbf{A}$ and $\mathbf{B}$ are functions of parameters.

We assume that

$$\kappa(\phi_\pi - 1) + (1 - \beta)\phi_y > 0,$$

which holds for Taylor's original estimates $\phi_\pi = 1.5$ and $\phi_y = 0.5/4$.

Response to a MP Shock – Liquidity Effect

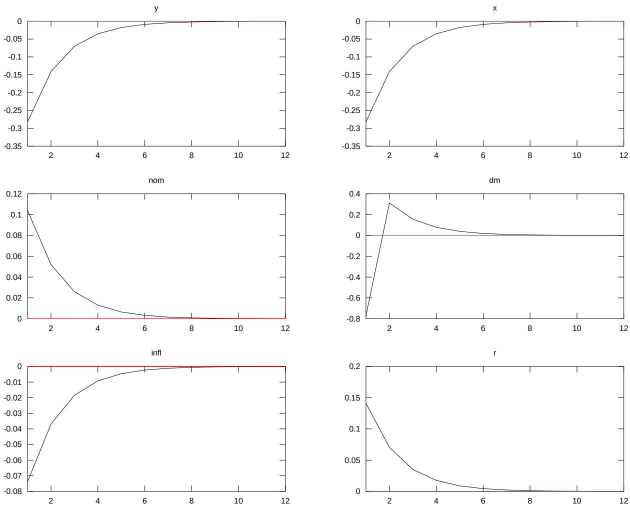

Figure: 25 bps increase in v_t with $\theta = 2/3$

Think about the MP shock as a *tightening* in the policy stance (i.e., $\bar{\iota}$).

The increase in the nominal interest rate brings down inflation and output.

However, the interest rate rule moderates the MP shock.

This is the **liquidity effect**.

- tightening implies an increase in the nominal interest rate
- this must be accompanied by a change in the money supply in the opposite direction

Money supply rules in the classic model cannot deliver this effect.

Question:

Is this necessarily a success story for the NK model?

How Sticky are Prices?

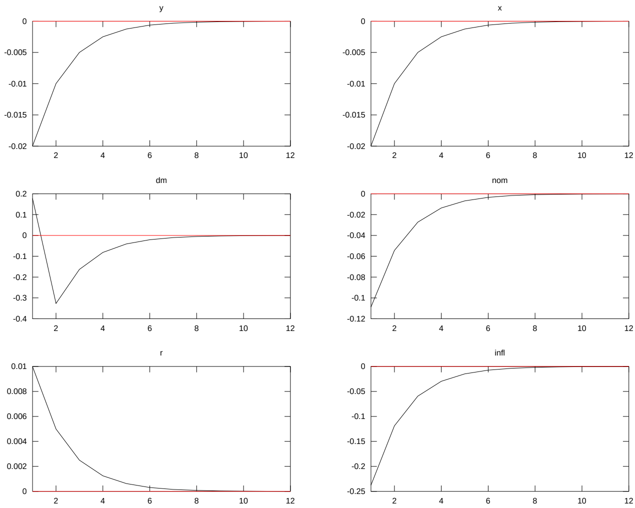

Figure: 25 bps increase in v_t with $\theta = 0.1$

Response to a Technology Shock

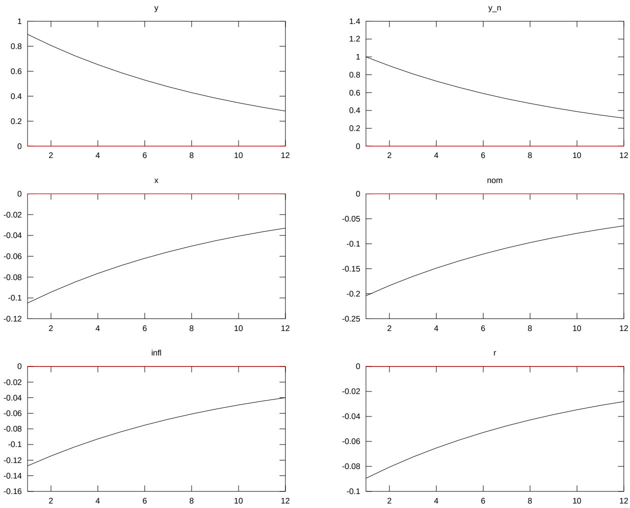

Figure: 1% increase in a

The response to a technology shock (supply shock) is counterintuitive.

Both, natural output and actual output go up. But there is a *negative* output gap.

This requires a *decrease* in the nominal interest rate, so that the MP accommodates the positive shock.

The reason is that there is too little demand as not all firms can react to the technology shock by decreasing their prices and hiring more people.