Intermediate Macroeconomics (UN3213)
Recitation 3

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Question

Exercise 1 (Unanchoring of Expectations). Consider an economy where the Phillips curve is

$$\hat{\pi} = \beta\hat{\pi}^e + \kappa\hat{y} + \epsilon^{cp}$$

and the IS curve is

$$\hat{y} = -\gamma(\hat{i} - \hat{\pi}^e) + \epsilon^d,$$

where $\hat{\pi}$ denotes the deviation of inflation from the intended target, $\hat{y}$ denotes the deviation of output from full employment, $\hat{\pi}^e$ denotes the deviation of expected inflation from the inflation target, ϵ^{cp} is a cost-push shock, and ϵ^d is a demand shock. Suppose that the central bank's objectives are price stability and full employment. Let $\beta = 0.75$, $\kappa = 0.1$, and $\gamma = 0.5$. Suppose also that there are no shocks buffeting the economy ($\epsilon^{cp} = \epsilon^d = 0$), but that inflationary expectations are unanchored. Specifically, assume that $\hat{\pi}^e = 1$. Calculate the equilibrium values of $\hat{\pi}$, $\hat{y}$, and $\hat{i}$ under the following monetary interventions:

1. The central bank does not intervene, $\hat{i} = 0$.
2. The central bank is ultra hawkish and intervenes to ensure that the inflation rate is at its target level, $\hat{\pi} = 0$.
3. The central bank is ultra dovish and intervenes to ensure full employment, $\hat{y} = 0$.
4. The central bank adopts an intermediate position and intervenes to ensure that the deviation of inflation from the intended target is the mean of the ones that obtain under the ultra dovish and the ultra hawkish stances.

Show your work and explain the intuition behind your results.

Answear

Answear

Answear

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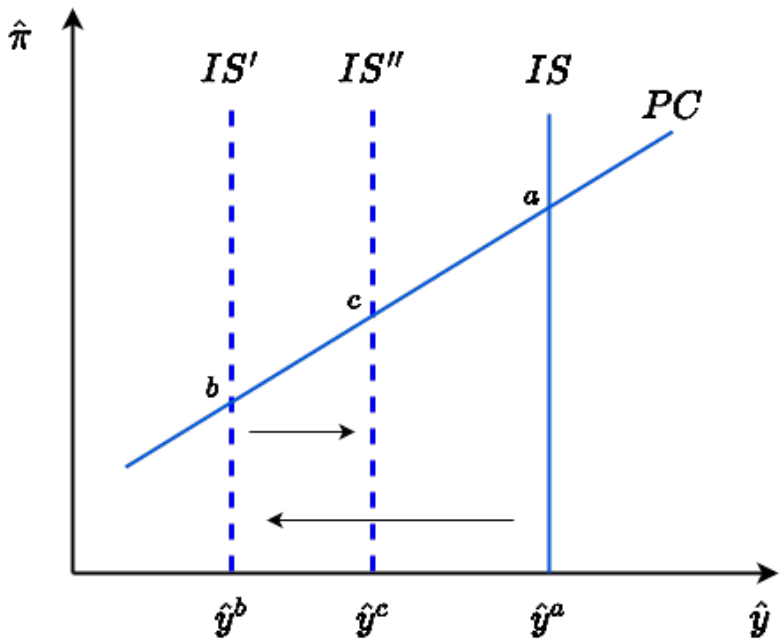
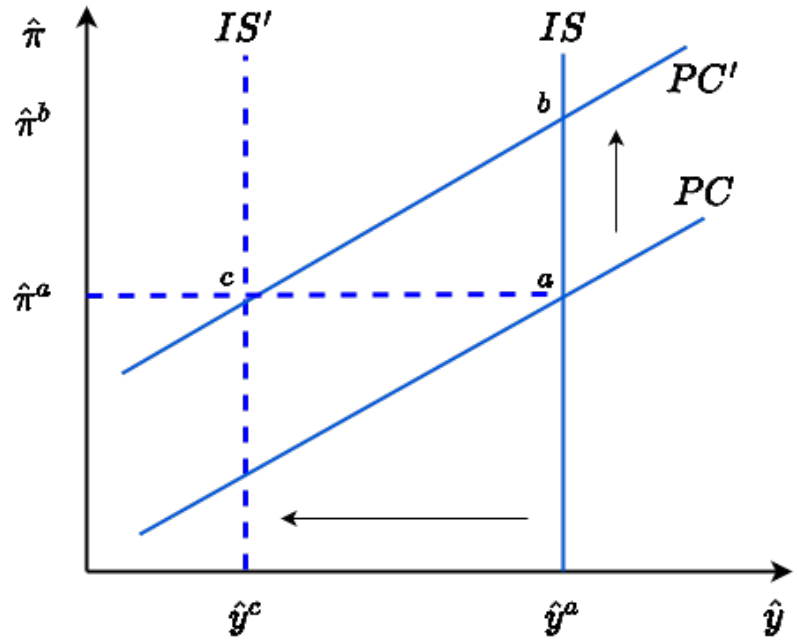
Rule vs. Discretion



(a) Negative demand shock



(b) Positive cost push shock

Figure: Central bank's response to shocks

- The central bank wants to
  - cut interest rates when output is low
  - raise interest rates when inflation is high

Taylor rule

- Helps formalize the notion of the dual mandate of the central bank with regard to output and inflation stabilization

$$\hat{i} = \alpha_\pi \hat{\pi} + \alpha_y \hat{y} + \epsilon^m$$

where $\alpha_\pi, \alpha_y > 0$. ϵ^m is the monetary shock.

- *Taylor principle*: $\alpha_\pi > 1$
The Fed responds aggressively to changes in inflation. Nominal interest rate must change by a higher amount than inflation to affect real interest rate.

- Along with the IS and PC, the Taylor rule closes the model (3 equations in 3 unknowns $\hat{\pi}, \hat{y}, \hat{i}$).

$$\hat{\pi} = \beta \hat{\pi}^e + \kappa \hat{y} + \epsilon^{CP}$$

$$\hat{y} = -\gamma(\hat{i} - \hat{\pi}^e) + \epsilon^d$$

$$\hat{i} = \alpha_\pi \hat{\pi} + \alpha_y \hat{y} + \epsilon^m$$

$\hat{i}$ is now an endogenous variable. We can solve this system and study the effect of monetary shocks on the equilibrium.

Modified IS curve

Use the Taylor rule to eliminate $\hat{i}$ from the IS curve

$$\hat{y} = -\gamma\left(\alpha_\pi \hat{\pi} + \alpha_y \hat{y} + \epsilon^m - \hat{\pi}^e\right) + \epsilon^d$$

$$\iff \hat{\pi} = -\frac{1+\gamma\alpha_y}{\gamma\alpha_\pi}\hat{y} - \frac{1}{\alpha_\pi}\epsilon^m + \frac{1}{\gamma\alpha_\pi}\epsilon^d$$

The modified IS curve exhibits a negative relation (with slope $-\frac{(1+\alpha_\pi)}{\gamma\alpha_\pi}$ between $\hat{\pi}$ and $\hat{y}$ unlike the IS curve which was vertical.
Now we can solve the modified IS and the Phillips curve to get the equilibrium $(\hat{y}, \hat{\pi})$

$$\hat{\pi} = -\frac{1+\gamma\alpha_y}{\gamma\alpha_\pi}\hat{y} - \frac{1}{\alpha_\pi}\epsilon^m + \frac{1}{\gamma\alpha_\pi}\epsilon^d$$

$$\hat{\pi} = \beta\hat{\pi}^e + \kappa\hat{y} + \epsilon^{CP}$$

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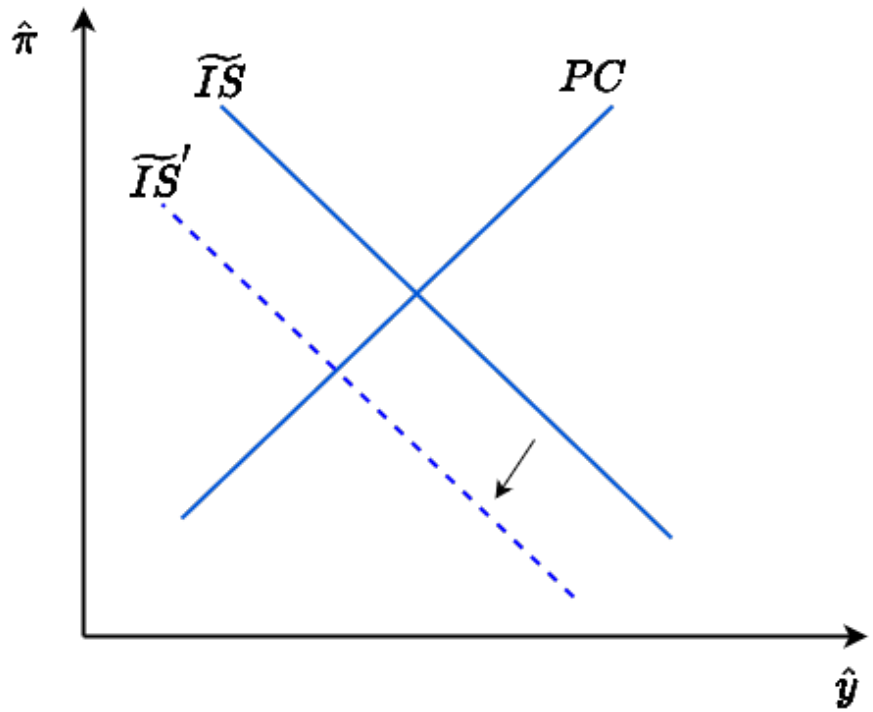
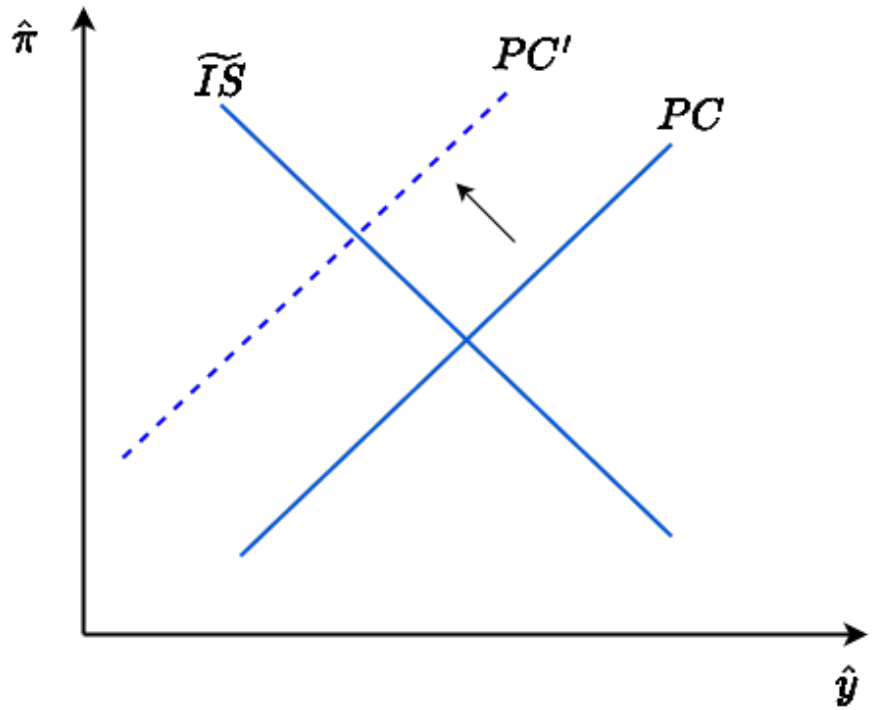
Negative demand shock



A negative demand shock leads to lower equilibrium output and lower inflation. But the central cannot do anything to negate these effects. It no longer has discretion (the central bank's response is already implicit in the modified IS).

Positive cost push shock



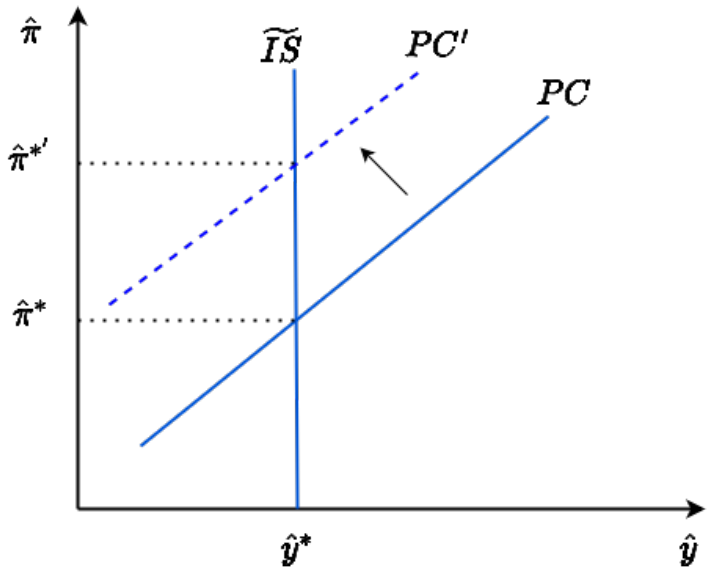
A positive cost push shock leads to higher equilibrium inflation and lower output. Compare this to the case with discretion where the IS curve was vertical and output remained unchanged.
The parameters α_π and α_y in the interest rate rule determine how hawkish/dovish the central bank is.

Case 1: $\alpha_\pi = 0$

Modified IS:

$$\hat{\pi} = -\frac{1+\gamma\alpha_y}{\gamma\alpha_\pi}\hat{y} - \frac{1}{\alpha_\pi}\epsilon^m + \frac{1}{\gamma\alpha_\pi}\epsilon^d$$

If $\alpha_\pi = 0$, the slope of the modified IS curve is infinite. Therefore the modified IS is vertical, as in the case of discretion.



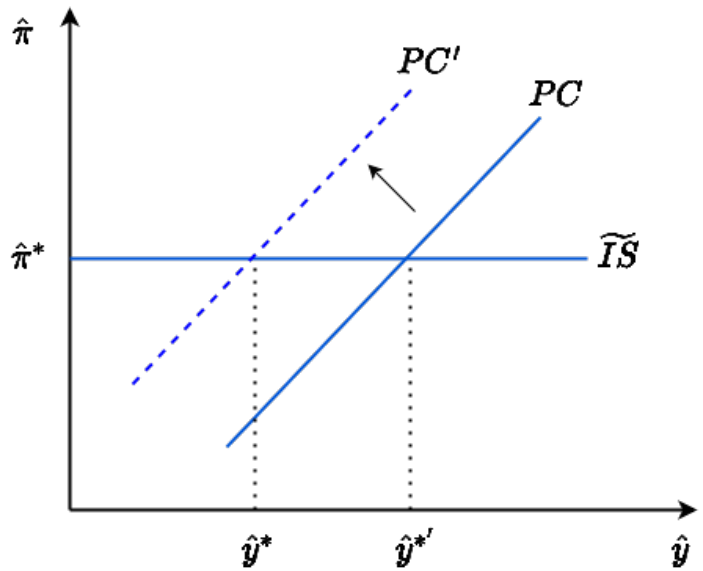
This mimics the case of a dovish central bank under discretion (prioritizes full employment over inflation stabilization).

Case 2: $\alpha_\pi = \infty$

Modified IS:

$$\hat{\pi} = -\frac{1+\gamma\alpha_y}{\gamma\alpha_\pi}\hat{y} - \frac{1}{\alpha_\pi}\epsilon^m + \frac{1}{\gamma\alpha_\pi}\epsilon^d$$

If $\alpha_\pi = \infty$, the slope of the modified IS curve is zero. Therefore the modified IS is horizontal.



This mimics the case of a hawkish central bank under discretion (aggressively targets inflation, even at the cost of a severe contraction in output).

A numerical example

- Consider the following paramterization of the model.
  $\beta = 0.99, \kappa = 0.1, \gamma = 1, \alpha_\pi = 1.5, \alpha_y = 0.5, \hat{\pi}^e = 1$
- Re-writing the system of equations,

$$\hat{\pi} = 0.99 + 0.1\hat{y} + \epsilon^{CP}$$
$$\hat{y} = -(\hat{i} - 1) + \epsilon^{d}$$
$$\hat{i} = 1.5\hat{\pi} + 0.5\hat{y} + \epsilon^{m}$$

  Note that the Taylor principle holds here ($\alpha_\pi > 1$).

- The final solution is

$$\hat{y} = -0.2939 - 0.9091\epsilon^{CP} - 0.6061\epsilon^{m} + 0.6061\epsilon^{d}$$
$$\hat{\pi} = 0.9606 + 0.9091\epsilon^{CP} - 0.0606\epsilon^{m} + 0.0606\epsilon^{d}$$
$$\hat{i} = 1.294 + 0.9091\epsilon^{CP} + 0.6061\epsilon^{m} + 0.3939\epsilon^{d}$$

  Effect of shocks is what we see graphically.

A numerical example

- Now suppose $\alpha_\pi = 0.5$

$$\hat{\pi} = 0.99 + 0.1\hat{y} + \epsilon^{CP}$$
$$\hat{y} = -(\hat{i} - 1) + \epsilon^{d}$$
$$\hat{i} = 0.5\hat{\pi} + 0.5\hat{y} + \epsilon^{m}$$

- The new solution is

$$\hat{y} = 0.326 - 0.3223\epsilon^{CP} - 0.6452\epsilon^{m} + 0.6452\epsilon^{d}$$
$$\hat{\pi} = 1.022 + 0.967\epsilon^{CP} - 0.0645\epsilon^{m} + 0.0645\epsilon^{d}$$
$$\hat{i} = 0.6738 + 0.3225\epsilon^{CP} - 0.3548\epsilon^{m} + 0.3548\epsilon^{d}$$

- Note that inflation is now more responsive to the cost push shock, and output less so. This is because the central bank is more dovish in its response (modified IS is steeper)

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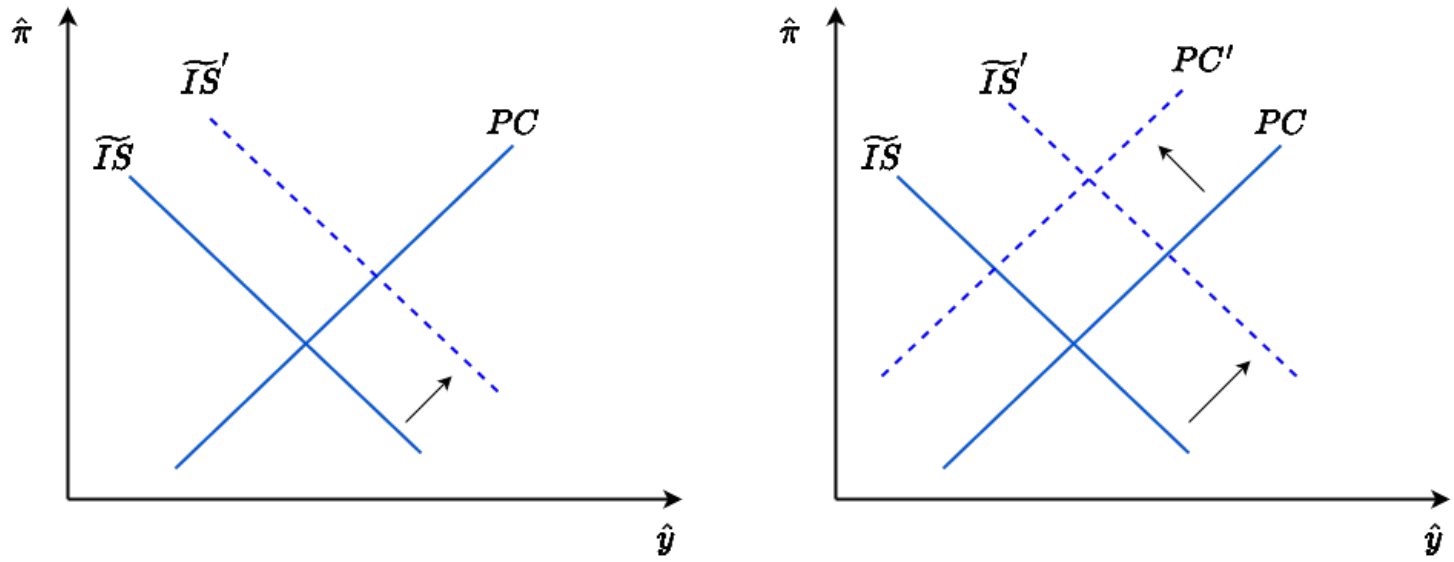
Interference in monetary policy



There are two effects of an accommodative monetary policy. The first is the direct effect of the cut in interest rates (shifts IS rightward). The second is the effect of higher inflation expectations (shifts IS further and PC upward).

A debt erosion motive

- Apart from electoral reasons, there is another motive for the Treasury to prefer easy monetary policy and high inflation.
- The fiscal surplus for the government can be defined in simple terms as $F = T - B$
- Taxes (T) increase in nominal terms with inflation (both wages and prices rise). But government debt (B) remains fixed in nominal terms
- High inflation devalues debt $\Rightarrow$ Government pays back less in real terms (repaying debt with cheaper dollars).