ECON20001 Intermediate Macroeconomics

Tutorial 5 (Week 6)

Zheng Fan

The University of Melbourne

This tutorial will be recorded for self-isolating students.

Introduction

Zheng Fan

- Ph.D student in Economics at Unimelb
- Consultation & Ed discussion board (your first priority)
- Email Dr. David Moreton for all administrative issues
- Consult Stop 1 for special consideration

Before asking any questions, make sure you have gone through the Ed discussion board, subject guide and Q&A on Canvas!

Assignment 1 is available now! — 12 - Sep

Last week lectures

AS curve:

- Production function: $Y = AN \rightarrow Y/N = A$
- Price equals to marginal cost: $P = W/A$
- Wage setting: $W = P^e F(Y)$
- Aggregate supply curve: $P = P^e F(Y)/A$
- Natural level of output: $A = F(Y_n)$ when $P = P^e$

$$\rightarrow P = P^e \frac{F(Y)}{F(Y_n)} = P^e \frac{Y^\phi}{Y_n^\phi}$$

and assume $F(Y) = Y^\phi$

Last week lectures

$\log \frac{P}{P_{-1}} = \log P - \log P_{-1} \simeq \frac{P - P_{-1}}{P_{-1}} = \pi_t$

Dynamics AS curve

take log

Okun's law.

- Aggregate supply relationship: $\frac{P}{P_{-1}} = \frac{P^e}{P_{-1}} \left(\frac{Y}{Y_n} \right)^{\phi}$
- Taking log: $\pi_t = \pi^e + \phi(y_t - y_n)$
- Expectations augmented Phillips curve: $\pi_t = \pi^e - \phi(u_t - u_n)$
- Doubts: only in short-run, no long-run trade-off (after mid 70s)
- Adaptive expectations: $\pi^e_t = \pi_{t-1}$
- Accelerationist Phillips curve: $\pi_t - \pi_{t-1} = -\phi(u_t - u_n)$
  - u_n is called the non-accelerating inflation rate of unemployment

NAIRU.

Last week lectures

The five key building blocks of the dynamic AS-AD model

- Output equation: $Y_t = \bar{Y} - \alpha(r_t - \rho) + \varepsilon_t; \quad \alpha > 0$
- Fisher equation: $r_t = i_t - \mathbb{E}_t[\pi_{t+1}]$
- Expectations-augmented Phillips curve:
  $\pi_t = E_{t-1}(\pi_t) + \phi(Y_t - \bar{Y}) + v_t; \quad \phi > 0$
- Adaptive expectations: $E_{t-1}(\pi_t) = \pi_{t-1}$
- Monetary policy rule:
  $i_t = \pi_t + \rho + \theta_\pi(\pi_t - \pi^*) + \theta_Y(Y_t - \bar{Y}); \quad \theta_\pi, \theta_Y > 0$

DAS

Last week lectures

Long run Equilibrium:

- Nominal interest rate, inflation and expected inflation at target, others at natural level
- Monetary neutrality: Monetary policy does not affect equilibrium values of real variables
- Classical dichotomy: Separation of real from nominal variables.

Short run Equilibrium:

- Dynamic AS $\pi_t = \pi_{t-1} + \phi(Y_t - \bar{Y}) + v_t$
- Dynamic AD $Y_t = \bar{Y} - \frac{\alpha\theta_\pi}{1+\alpha\theta_Y}(\pi_t - \pi^*) + \frac{1}{1+\alpha\theta_Y}\varepsilon_t$

In-tutorial Sheet - Q2

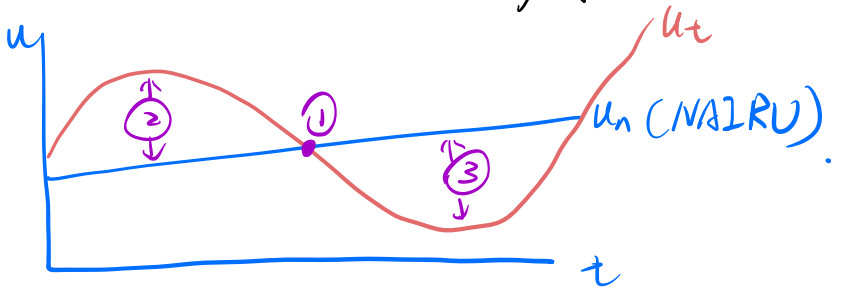
2. Based on your understanding of the Phillips curve, explain what happens to actual inflation (relative to expected inflation) when the actual unemployment rate is either above or below the natural rate of unemployment.

$\pi_t = \pi_t^e - \phi(u_t - u_n) \Rightarrow \pi_t - \pi_t^e = -\phi(u_t - u_n)$ ② < 0

① $u_t = u_n \longrightarrow \pi_t = \pi_t^e$

② $u_t > u_n \longrightarrow \pi_t < \pi_t^e \longrightarrow \pi_t \downarrow$

③ $u_t < u_n \longrightarrow \pi_t > \pi_t^e \longrightarrow \pi_t \uparrow$.



In-tutorial Sheet - Q2

2. Based on your understanding of the Phillips curve, explain what happens to actual inflation (relative to expected inflation) when the actual unemployment rate is either above or below the natural rate of unemployment.

The expectations-augmented Phillips curve suggests $\pi_t = \pi_t^e - \phi(u_t - u_n)$.

$u_t = u_n$: The actual unemployment rate is equal to the natural rate of unemployment

- $\pi_t = \pi_t^e$: actual inflation and expected inflation must be equal
- All else fixed, inflation π_t will not change

In-tutorial Sheet - Q2

The expectations-augmented Phillips curve suggests $\pi_t = \pi_t^e - \phi(u_t - u_n)$.

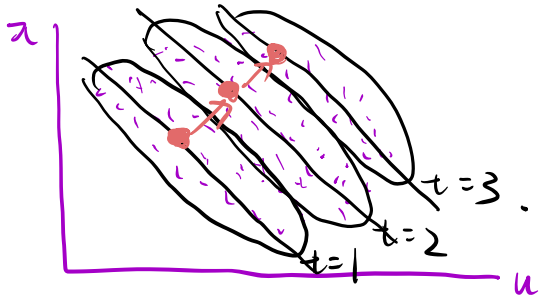
$u_t < u_n$: The actual unemployment rate falls below the natural rate

- Inflation π_t would increase
- The natural rate of unemployment u_n may also be referred to as the non-accelerating-inflation rate of unemployment (the NAIRU)

$u_t > u_n$: The actual unemployment rises above natural unemployment

- Actual inflation π_t will fall.

In-tutorial Sheet - Q3



3. Discuss the following statements

(i) The Phillips curve implies that when unemployment is high, inflation is low, and vice versa. Therefore we may experience high inflation or high unemployment, but we will never experience both together.

No. $\pi_t = \pi_t^e - \phi(u_t - u_n) = \pi_t^e + \phi u_n - \phi u_t$.

intercept. slope.

$t=1$: $\pi_1^e + \phi u_n$.

$t=2$: $\pi_2^e + \phi u_n$

$t=3$: $\pi_3^e + \phi u_n$.

① $\pi_t^e \uparrow \longrightarrow \pi_t \uparrow \longrightarrow \pi_t < \pi_t^e \longrightarrow u_t > u_n \rightarrow u_t \uparrow$

② $u_n \uparrow$ 80% $\longrightarrow u_t \uparrow$ 70% $\longrightarrow u_t < u_n \longrightarrow \pi_t > \pi_t^e \rightarrow \pi_t \uparrow$

In-tutorial Sheet - Q3

3. Discuss the following statements

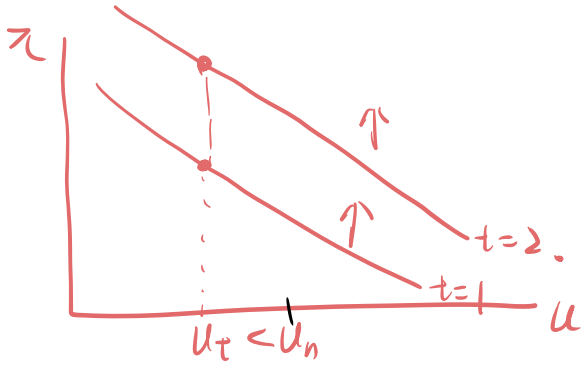
(i) The Phillips curve implies that when unemployment is high, inflation is low, and vice versa. Therefore we may experience high inflation or high unemployment, but we will never experience both together.

No. In the 1970s, we experienced high inflation and high unemployment.

$$\pi_t = \pi_t^e - \phi(u_t - u_n)$$

Given inflation expectations, increases in the natural rate lead to an increase in both the unemployment rate and the inflation rate. In addition, increases in inflation expectations imply higher inflation for any level of unemployment and tend to increase the unemployment rate in the short run. In the 1970s, both the natural rate and expected inflation increased, so both unemployment and inflation were relatively high.

In-tutorial Sheet - Q3



(ii) As long as we don't object to high inflation, we may achieve as low a level of unemployment as we want. All we have to do is increase the demand for goods and services by using, for example, expansionary fiscal policy.

False.

$u_t < u_n \longrightarrow \pi_t > \pi_t^e \rightarrow \pi_t \uparrow \rightarrow \pi_{t+1}^e \uparrow$

$t = 1 \cdots T.$

$\downarrow$

$\pi_{t+1} \uparrow$

$\downarrow$

$\pi_{t+2}^e \uparrow$

$\downarrow \cdots$

In-tutorial Sheet - Q3

(ii) As long as we don't object to high inflation, we may achieve as low a level of unemployment as we want. All we have to do is increase the demand for goods and services by using, for example, expansionary fiscal policy.

No. The expectations-augmented Phillips curve implies that maintaining a rate of unemployment below the natural rate requires increasing (not simply high) inflation. This is because inflation expectations continue to adjust to actual inflation.

In-tutorial Sheet - Q4

five building blocks: 1. Output 2. Fisher 3. DAS ← 4. Adaptive 5. MPR

4. Suppose the monetary policy rule has the wrong natural rate of interest. That is, the central bank follows this rule

$$i_t = \pi_t + \rho' + \theta_\pi(\pi_t - \pi^*) + \theta_Y(Y_t - \bar{Y}_t)$$

where ρ' does not equal ρ, the natural rate of interest in the equation for goods demand. The rest of the dynamic AS-AD model is the same as in the chapter. Solve for the long-run equilibrium under this policy rule. Explain in words the intuition behind your solution.

In-tutorial Sheet - Q4

4. Suppose the monetary policy rule has the wrong natural rate of interest. That is, the central bank follows this rule

$$i_t = \pi_t + \rho' + \theta_\pi(\pi_t - \pi^*) + \theta_Y(Y_t - \bar{Y}_t)$$

where ρ' does not equal ρ, the natural rate of interest in the equation for goods demand. The rest of the dynamic AS-AD model is the same as in the chapter. Solve for the long-run equilibrium under this policy rule. Explain in words the intuition behind your solution.

The Phillips curve

$$\pi_t = E_{t-1}(\pi_t) + \phi(Y_t - \bar{Y}) \quad = 0 \ .$$

Stable inflation and adaptive expectations imply

$$\mathbb{E}_t(\pi_{t+1}) = \pi_t = \pi_{t-1} = \mathbb{E}_{t-1}(\pi_t)$$

So from the Phillips curve we have real output at its natural level

$$Y_t = \bar{Y}$$

In-tutorial Sheet - Q4

Since real output is related to the real interest rate by

Output eqn: $Y_t = \bar{Y} - \alpha(r_t - \rho) = 0$.

We therefore have the real interest rate is at the natural real interest rate

$$\boxed{r_t = \rho}$$

Fisher equation

$$r_t = i_t - \mathbb{E}_t[\pi_{t+1}] = i_t - \pi_t = \rho.$$

Since the real interest rate is at the natural rate, we then have that the nominal interest rate is

$$i_t = \rho + \pi_t$$

Monetary policy rule (suppose with correct ρ):

$$i_t = \pi_t + \rho + \theta_\pi(\pi_t - \pi^*) + \theta_Y(Y_t - \bar{Y})$$

($\theta_\pi(\pi_t - \pi^*) = 0$, $\theta_Y(Y_t - \bar{Y}) = 0$.)

We should have inflation at target ($\pi_t = \pi^*$) if it is ρ in the equation

In-tutorial Sheet - Q4

However, instead of the following as expected

$$i_t = \pi_t + \rho + \theta_\pi(\pi_t - \pi^*) + \theta_Y(Y_t - \bar{Y})$$

The "mis-specified" monetary policy rule given in this question is

$$i_t = \pi_t + \rho' + \theta_\pi(\pi_t - \pi^*) + \theta_Y(Y_t - \bar{Y})$$

we plug in the nominal rate $i_t = \rho + \pi_t$ from the Fisher curve and that real output is at the natural level $Y_t = \bar{Y}_t$ we have the following:

$$\pi_t = \pi^* + \frac{1}{\theta_\pi}(\rho - \rho')$$

$$i_t = \rho + \pi_t = \rho + \pi^* + \frac{1}{\theta_\pi}(\rho - \rho')$$

In-tutorial Sheet - Q4

natural real interest rate (natural r_t)

$\rho = \rho'$: the long run inflation is at its target π^*

$\rho > \rho'$:

- the monetary authority believes the natural rate is lower
- the long run inflation is higher than its target π^*
- the monetary authority is wrongly targeting a higher inflation rate
- the long run nominal interest rate is higher

$\rho < \rho'$: the long run inflation is lower than its target π^*

- the monetary authority believes the natural rate is higher
- the long run inflation is lower than its target π^*
- the monetary authority is wrongly targeting a lower inflation rate
- the long run nominal interest rate is lower

In-tutorial Sheet - Q4

$Y_t = \bar{Y}$

This misspecification does not affect the real variables, since in this model monetary policy is neutral in the long run in the sense that in the long run monetary policy cannot affect the values of real variables, only the values of nominal variables.

$r_t = \rho$.

The end

Thanks for your attention! 😄