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14.02 Principles of Macroeconomics
Spring 2014
Problem Set 4
Due: April 18, 2014

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1 Phillips curve (35 pts)

Consider the framework of chapter 7, with a wage-setting relation given by

$$W_t = P_t^e(1 - \alpha u_t + z)$$

where W is the nominal wage, P^e the expected price level, u represents the unemployment rate and z captures unemployment benefits. Consider the standard price-setting relation

$$P = (1 + m)W$$

where m denotes the mark-up.

1. State the AS equation for this economy. [4 pts.]
Answer:
As usual, the AS equation represents labour market equilibrium. So combining wage-setting and price-setting, we obtain

$$P_t = P_t^e(1 + m)(1 - \alpha u_t + z)$$

2. . Let $\pi_t = (P_t/P_{t-1}) - 1$ and $\pi_t^e = (P_t^e/P_{t-1}) - 1$.
(a) Show, step by step, how you can derive the following equation from the AS relation [6 pts.]

$$\pi_t = \pi_t^e - \alpha u_t + (m + z) \tag{1}$$

Answer: See the Appendix to Ch. 8 in the textbook (p. 182).

(b) If you used any approximations to derive this equation from the AS relation, state them and also discuss which assumptions are required in order for them to work. [2 pts.]
Answer: The derivation uses two approximation rules

$$
\begin{aligned}
(1 + x)(1 + y) &\approx 1 + x + y \\
\frac{1 + x}{1 + y} &\approx 1 + x - y
\end{aligned}
$$

which only work provided x and y are suffciently small.

3. Given expected inflation and unemployment, what is the effect of increasing unemployment benefits z in period t on the inflation rate in period t, π_t? Explain both intuitively and analytically (i.e. with algebra). [6 pts.]

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Answer:

An increase in unemployment benefits is modelled as an increase in the catch-all variable z. From equation (1), we see that since π_t^e is given, an increase in z leads to an immediate increase in inflation. The intuition is that more generous unemployment benefits make the prospect of unemployment less distressing, thereby increasing the bargaining power of workers. This tends to increase nominal wages for all values of the unemployment rate. As a result, production costs increase and firms increase their prices. Since the previous period price, P_{t-1}, is pre-determined in period t, an increase in inflation ensues.

4. Show that you can eliminate m and z from equation (1) and express it as

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

where u_n is the natural rate of unemployment. [6 pts.]

Answer:

Recall that the natural rate of unemployment is defined as the rate of unemployment consistent with labour market equilibrium when workers' expectations are correct, $P_t = P_t^e$. Then when $u_t = u_n$, it must be the case that $\pi_t = \pi_t^e$. As a result, by equation (1) we obtain that

$$u_n = \frac{m + z}{\alpha}$$

which shows that the natural rate increases with m and z and decreases with α. Then we have that

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

5. What is the value of u_n in this economy? [2 pts.]

Answer: See above.

6. Suppose that expectations of inflation are formed according to the rule

$$\pi_t^e = \theta \pi_{t-1}$$

Explain briefly in word what this equation means. [2 pts.]

Answer:

This equation says that when inflation is positive in one period, workers expect it to be positive in the next period as well. This means that people think that inflation is persistent.

7. Can a single value of θ be used to account for the observed pattern of inflation and unemployment in the U.S. between 1950 and 2000? [7 pts.]

Answer:

No. Before the 1960s, a value of $\theta = 0$ would have done a good in fitting the data for inflation and unemployment. To account for the data after 1970 or so, we need a positive value of (close to 1). See pages 164-168 in the textbook for a more detailed explanation.

2 Uncovered interest rate parity (35 pts.)

1. UK bond is demoninated in british pounds, and US bond is denominated in dollars. For both 1-year US and UK bonds, the interest rate is 2%. The yield to maturity in 2 year bonds is 4% in the UK and 2% in the US. Suppose now that the exchange rate is 1.7 dollars per pound.

(a). What is the value of expected exchange rate at the end of the first year? (7 pts)
Answer:
Since both countries have the same one year interest rate, the expected exchange rate is unchanged, i.e. 1.7 dollars per pound.

(b). What is the value of expected exchange rate at the end of the second year? (7 pts)
Answer:
Note that the yield to maturity is the "annualized" return if the bond is held until maturity. Since YTM in UK is higher than U.S., dollar is expected to appreciate. According to the UIP condition, the expected exchange rate is

$$E^e = 1.7(\frac{1.02}{1.04})^2 = 1.63$$

2. Currently the interest rates on one year Spanish bonds and German bonds are 6%, and 1%, respectively. Spain and Germany share the same currency (i.e. Euro).

(a). Suppose that the individuals believe that Spain will remain in the Euro Area but there is risk that it can default on its debt. What is the default risk premium that Spain is paying? (7 pts)
Answer:
The default risk premium is 5%. Since Spain and Germany share the same currency, the nominal exchange rate between the two country is always equal to 1. If UIP holds, the nominal return should be the same. The higher interest rate on Spanish bonds reflects a default risk premium.

(b). Suppose that individuals believe that Spain will honor its debt using a different currency, Pesetas. Suppose that the exchange rate today is 1 Peseta per Euro. Given the interest rate differential, what is the expected exchange rate between Peseta and Euro in one year. (7 pts)
Answer:
The expected exchange rate is 1.05 pesetas per euro.

(c). In light of your answers, can you always interpret interest rate differential as having the same sign as expected depreciation? (7 pts)
Answer:

No. The interest rate differential reflects two terms: currency and default risk. (In reality, it also reflects other risk, e.g. liquidity risk).

3 The goods market in the Open Economy (10 pts)

Consider a small open economy with its exchange rate pegged to the US dollar. According to the UIP condition, its interest rate is equal to the interest rate in the US, which is taken as exogenous. Government spending is equal to G. The following equations characterize the economy's other variables.

$$C = c_0 + c_1 (Y - T)$$

$$I = d_0 + d_1 Y - d_2 r$$

$$IM = m_1 Y - m_2 r$$

$$X = x_1 Y^*$$

Find the equilibrium output in this economy. How does equilibrium output change when foreign output increases? What is the effect of an increase in government spending? Suppose that government spending is given by a budget balanced rule $G = T = tY$. Find the equilibrium output. What is the effect of lowering (tax rate) t on equilibrium output.

Answer:
Equilibrium is

$$Y = G + c_0 + c_1 (Y - T) + d_0 + d_1 Y - d_2 r + x_1 Y^* - (m_1 Y - m_2 r)$$

So,

$$Y = \frac{G + c_0 - c_1 T + d_0 - d_2 r + x_1 Y^* - m_1 Y + m_2 r}{1 + m_1 - c_1 - d_1}$$

When foreign output increases by 1 unit, equilibirum output increases by $\frac{x_1}{1 + m_1 - c_1 - d_1}$. Intuitively, when foreign output increases, foreigners will consume more domestic goods, which in turn increases output and income in domestic country. The increase in income, on the one hand increases consumption and investment demand for domestic goods, on the other hand increases demand for foregin goods. Therefore, the multiplier is positively depending on c_1 and d_1, but is negatively depending on m_1.

The effect of increasing government spending is

$$\frac{dY}{dG} = \frac{1}{1 + m_1 - c_1 - d_1}$$

Same intuition on the feedback channel applies.

For the case with endogeneous taxes and balanced budget rule, equilibrium output is given by

$$Y = tY + c_0 + c_1(Y - tY) + d_0 + d_1Y - d_2r + x_1Y^* - (m_1Y - m_2r)$$

Solve the equation for Y,

$$\begin{aligned} Y &= \frac{c_0 + d_0 - d_2r + x_1Y^* + m_2r}{1 + m_1 - c_1 - d_1 - t + c_1t} \\ &= \frac{K}{1 + m_1 - c_1 - d_1 - t + c_1t} \end{aligned}$$

Where, $K = c_0 + d_0 - d_2r + x_1Y^* + m_2r$.

The effect of lowering tax rate is given by Y's first derivative with respect to t,

$$\frac{dY}{dt} = \frac{(1 - c_1)K}{(1 + m_1 - c_1 - d_1 - t + c_1t)^2} > 0$$

4   The trilemma (20 pts)

Suppose that a small open economy has its exchange rate pegged to the US dollar. The IS and the LM are given by $Y = C(Y-T)+I(Y,i)+G+NX(Y,Y^*,E)$ (with Y,T,i,G,Y^*,E output, taxes, nominal interest rate, government spending, foreign output and the nominal exchange rate, respectively) and $\frac{M}{P} = YL(i)$. Use the IS-LM-UIP diagrams to answer the following questions.

1. There is perfect capital mobility and the public fully trust the exchange rate regime. Is monetary policy effective? (5pts)

Answer:

Monetary policy is ineffective because interest rate in the domestic economy will be determined by the UIP equation.

2. Suppose now that the government can control who buys and sells foreign currency. Does the UIP holds? Does money supply a ect the domestic interest rate? (5pts)

Answer:

This is a case of imperfect capital mobility. If the interest rate in the domestic economy is reduced, investors cannot buy foreign bonds, because they cannot get foreign currency. So, even with fixed exchange rate, the Central Bank, by increasing money supply, can change the domestic interest rate. The UIP will not hold.

3. Suppose that the government does not fix the exchange rate. Does an increase in money supply affect the interest rate? (5pts)

Answer:

Yes. Now, the UIP holds, because there is perfect capital mobility, but current exchange rate can be adjusted one for one to the change in interest rate.

4. Is it possible to have simultaneously effective monetary policy, perfect capital mobility, and fixed exchange rate? (5pts)

Answer:

No.

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