14.02 Principles of Macroeconomics

Problem Set 5 Solutions

Fall 2017

Question 1 (Chapter 9)

Remember that the medium run equilibrium is characterized by these four conditions:

- Output equals its potential level
$$Y = Y^n$$
- Unemployment rate equals the natural rate
$$u = u_n$$
- The real policy interest rate is equal to the natural rate of interest r_n when aggregate demand equals Y^n
- The expected rate of inflation π^e is equal to the actual rate of inflation π

(a)

If the level of expected inflation is formed so that $\pi^e = \pi_{t-1}$, that is, previous year inflation, find the level of inflation π_t consistent with a medium run equilibrium.

Solution: note that:
$$\pi_t = \pi^e = \pi_{t-1}$$
so inflation will be constant.

(b)

If the level of expected inflation is $\bar{\pi}$, what is π_t in the medium-run equilibrium?

Solution: note that:
$$\pi_t = \pi^e = \bar{\pi}$$
so again inflation will be constant.

(c)

Write the IS relation as:
$$Y = C(Y - T) + I(r + x, Y) + G$$
Suppose $r_n = 2\%$. If the risk premium increases from 3% to 5%, how must the Central Bank change r_n to maintain output at the natural level in the existing medium-run equilibrium?

Solution: to keep output at the natural level, $r_n + x$ must be held constant. Therefore, r_n must decrease by 2%.

(d)

Suppose G increases. In what direction must the Central Bank change r_n to maintain output at its natural level?

Solution: As is well known, an increase in G increases output Y. Therefore, the Central Bank must increase r_n to bring output back to Y_n.

(e)

Discuss whether the following statement is true: In the medium run, a fiscal expansion leads to an increase in the natural rate of interest.

Solution: remember that in a medium-run equilibrium, output is constant at its natural rate Y_n. Then we have two cases:

- *permanent fiscal expansion: r_n must increase to bring output Y back to Y_n*
- *temporary fiscal expansion: r_n need not change, because in the medium-run output will be back to its natural rate once the stimulus is over.*

Question 2 (Chapter 17 - ?)

Consider two bonds, one issued in euros (€) in Italy and one issued in dollars ($) in the U.S. Assume that both government securities are one-year bonds—paying the face value of the bond one year from now. The exchange rate, E, stands at 0.75 euros per dollar.

The face value of the U.S. bond is $10,000. The face value of the Italian bond is €10,000. The price of the U.S. bond is $9,615.38. The price of the Italian bond is €9,433.96.

(a)

Compute the nominal interest rate on each of the bonds.

Solution: The nominal interest rate can be computed using the formula

$$price = (1 + i) \times face\ value$$

For the US bond it is 4% and for the Italian bond it is 6%.

(b)

Compute the expected exchange rate next year consistent with uncovered interest parity.

Solution: The uncovered interest parity is given by

$$1 + i = (1 + i^\star) \frac{E}{E^e}$$

$$E^e = \frac{1 + i^\star}{1 + i} E$$

Plugging in the given values, we get $E^e = 0.764$.

(c)

If you expect the dollar to depreciate relative to the euro, relative to the current exchange rate, which bond should you buy?

Solution: This would mean that $E^e < 0.75 < 0.764$. *Since uncovered interest parity holds when expectations are* $E^e = 0.764$, *a lower* E^e *implies that the Italian bond is more attractive, so it is the bond you should buy.*

(d)

Assume that you are a U.S. investor and you exchange dollars for euros at time t at the current exchange rate $E_t = 0.75$, and purchase the Italian bond today. For this subpoint, assume that the exchange rate realization at $t + 1$ is actually $E_{t+1} = 0.72$ euros per dollar. What is your realized rate of return in dollars compared to the realized rate of return you would have made had you held the U.S. bond?

Solution: The realized return from holding Italian bonds is

$$(1 + i^\star) \frac{E_t}{E_{t+1}} = 10.4\%$$

The realized return on the US bond is still 4% so the fact that the US dollar depreciated with respect to the euro made the return on the Italian bond higher.

(e)

Are the differences in rates of return in (d) consistent with the uncovered interest parity condition? Why or why not?

*Solution: Yes, it is consistent. the UIP relation holds *in expectation*. However, the realized returns may differ.*

Question 3 (Chapter 17 - ?)

Consider an open economy of the type described in Chapter 17. Suppose the domestic currency depreciates (E falls). Assume that P and $P^\star$ remain constant.

(a)

How does the nominal depreciation affect the relative price of domestic goods (i.e., the real exchange rate)? Given your answer, what effect would a nominal depreciation likely have on (world) demand for domestic goods? What about the domestic unemployment rate?

Solution: The real exchange rate is given by

$$\varepsilon = \frac{EP}{P^\star}$$

Hence, a nominal depreciation implies a real depreciation when prices are fixed. The real depreciation makes domestic goods cheaper in terms of foreign currency, so it is likely that the foreign demand for domestic goods will increase. If this happens, domestic production will increase and hence unemployment will decline.

(b)

Given the foreign price level, $P^\star$, what is the price of foreign goods in terms of domestic currency? How does a nominal depreciation affect the price of foreign goods in terms of domestic currency? How does a nominal depreciation affect the domestic consumer price index?

[Hint: Remember that domestic consumers buy foreign goods (imports) as well as domestic goods. Assume that the change in prices does not affect the weight assigned to each type of goods in computing the price index. In what follows, denote the weight on domestic goods with α and on foreign goods by $1 - \alpha$.]

Solution: The price of foreign goods in terms of the domestic currency is given by $P^\star/E$. A nominal depreciation will increase the price of foreign goods in terms of domestic currency. Assume that local families consume a fraction α of their income in domestic goods and a fraction $1 - \alpha$ in foreign goods. Asume that we can write the CPI as

$$CPI = \alpha P + (1 - \alpha)\frac{P^\star}{E}$$

The details of the formula are not important. What matters is that the CPI is a weighted average of domestic and foreign goods prices. Hence, if P and $P^\star$ are fixed, but E decreases, then the CPI increases.

(c)

If the nominal wage remains constant, how does a nominal depreciation affect the real wage?

Solution: The real wage is defined as W/CPI, where W is the nominal wage. If W remains constant, then the real wage declines.

(d)

Briefly comment on the following statement: "A depreciating currency puts domestic labor on sale."

Solution: If nominal depreciation is not followed by an increase in nominal wages, then workers lose purchasing power when the currency depreciates. The simple exercise we performed here shows a case in which this is true. One can easily build a model in which this is not the case.