Econ702
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Homework 12

1. Consider a partial sticky price New Keynesian model. Suppose that the equations of the demand side are given as follows:

$$C_t = c_1(Y_t - G_t) + c_2(Y_{t+1} - G_{t+1}) - c_3 r_t$$

$$I_t = -b_1 r_t + b_2 A_{t+1} - b_3 K_t$$

$$M_t = P_t - m_1(r_t + \pi^e_{t+1}) + m_2 Y_t$$

Here, c_1,c_2 and c_3 are positive parameters, as are b_1, b_2 and b_3 and m_1 and m_2. Government spending G_t is exogenous.

(a) Suppose the parameters are given as follows: $c_1 = 0.6$, $c_2 = 0.5$, $c_3 = 10$, $b_1 = 20$, $b_2 = 1$, $b_3 = 0.1$, $m_1 = 15$ and $m_2 = 1$. Suppose that $Y_{t+1} = 15$, $G_t = 10$, $G_{t+1} = 10$, $A_{t+1} = 5$, $K_t = 15$, $M_t = 25$ and $\pi^e_{t+1} = 0$. Using the parameter values, derive the IS curve. Using the IS curve and the LM curve, derive the AD curve.
Answer:
Plugging consumption function and investment demand function into $Y_t = C_t + I_t + G_t$ and rearranging give the following IS curve;

$$Y_t = -\frac{b_1 + c_3}{1 - c_1} r_t + \frac{c_2}{1 - c_1}(Y_{t+1} - G_{t+1}) + \frac{b_2}{1 - c_1} A_{t+1} - \frac{b_3}{1 - c_1} K_t + G_t$$

Substituting parameter values into the algebraic expression gives the following IS curve

$$Y_t = -75 r_t + 25$$

The following AD curve can be derived after combining IS and LM curves rearranging;

$$Y_t = \frac{1}{(1 + \frac{b_1+c_3}{1-c_1}\frac{m_2}{m_1})}\{\frac{b_1 + c_3}{1 - c_1}\pi^e_{t+1} - \frac{b_1 + c_3}{(1 - c_1)m_1}(P_t - M_t) + \frac{c_2}{1 - c_1}(Y_{t+1} - G_{t+1}) + \frac{1}{1 - c_1}(b_2 A_{t+1} - b_3 K_t) + G_t$$

Substituting parameter values into the algebraic expression gives the following AD curve

$$Y_t = -\frac{5}{6} P_t + 25$$

(b) Suppose that the AS curve is given as follows;

$$P_t = 0.3 Y_t - 3$$

Calculate the equilibrium level of price and output using the AS and AD curve.
Answer:
Along with AD curve and the given AS curve, this is a system of two equations with two unknowns. The solution is

$$P_t = 3.6, Y_t = 22$$

(c) If the equilibrium you derived in part (b) equals medium run equilibrium, what are the values of $\bar{P}_t$, Y_t^f and the natural rate of interest?
Answer:
Since the equilibrium features medium run, the following is trivial

$$\bar{P}_t = 3.6, Y_t^f = 22$$

We know that the natural rate of interest r_t^f satisfies the following equation

$$Y_t^f = -75r_t^f + 25$$

Solving for r_t^f, one can get

$$r_t^f = 0.04$$

2. Suppose the economy was initially at the medium run equilibrium you derived in Q1. Now people get more optimistic about the future and the value of A_{t+1} increases to 6.2. This is an example of positive IS shocks.

(a) Using the parameter values and exogenous variables given in Q1 and the new A_{t+1}, derive the new IS curve.
Answer:
Since $A_{t+1} = 6.2$, the new IS curve is given by

$$Y_t = -75r_t + 28$$

(b) From the IS curve you derived in part (a), provide Y_t^f and the natural rate of interest. What would be the medium run values of consumption and investment?
Answer:
Y_t^f is unaffected since the change in A_{t+1} is a IS shock. The natural rate if interest can be derived by plugging Y_t^f into the new IS curve derived in part (a) and solving for r_t^f. The solutions are

$$Y_t^f = 22, r_t^f = 0.08$$

Then the corresponding medium run values of consumption and investment spending are

$$C_t = 8.9, I_t = 3.1$$

(c) Suppose the central bank in the economy conducts monetary policy which aims to maintain the short run equilibrium output as the medium run level. Calculate the values of M_t and r_t which are consistent with this policy objective. (Hint: Derive the AD curve with unknown M_t. That AD curve should be the same as the one you derived in Q1 (a).)
Answer:
Following the hint, one can get the following AD curve expression

$$Y_t = -\frac{5}{6}P_t + \frac{5}{6}M_t + \frac{14}{3}$$

This should be the same algebraic expression as the one in Q1 (a). The corresponding value of M_t is

$$M_t = 24.4$$

The central bank nullifies the A_{t+1} shock by decreasing its money supply by 0.6 unit. $r_t = 0.08$ since the IS curve is the same as the one in part (a) and the economy attained the Y_t^f in the short run by the monetary policy.

(d) If one relies on the fiscal policy instead of the monetary policy to achieve the same goal, how much the government spending G_t should change? What would be the value of r_t in this case? (Hint: Derive the IS curve with unknown G_t. That curve should be the same as the one you derived in Q1 (a).)
Answer:
Following the hint, one can get the following IS curve expression

$$Y_t = -75r_t + 18 + G_t$$

This should be the same algebraic expression as the one in Q1 (a). The corresponding vale of G_t is

$$G_t = 7$$

The government nullifies the A_{t+1} shock by decreasing its spending by 3 units. $r_t = 0.04$ since the IS curve is the same as the one in Q1 (a) and the economy attained the Y_t^f in the short run by the fiscal policy.

(e) Compare the consumption, investment level and the real interest rate in part (c) and (d). Which policy (monetary or fiscal policy) attains the values derived in part (b)? Discuss why most economists may not favor using fiscal policy to stabilize the economy using the results.
Answer:
Consumption and investment spending under the monetary policy are

$$C_t = 8.9, I_t = 3.1$$

Consumption and investment spending under the fiscal policy are

$$C_t = 11.1, I_t = 3.9$$

Clearly it is the the monetary policy which attains the consumption and investment level in the medium run. This is one of reasons why most economists may favor monetary over fiscal policy as a stabilization tool since the latter can affect the composition of output relative to the neoclassical (medium run) equilibrium.