Solution to midterm exam

1. Derive NX=S-I from the national income accounts identity Y=C+I+G+NX. (10 points)

   Answer: From Y=C+I+G+NX, we have NX=Y-C-I-G. This implies NX=S-I, since S=Y-C-G by the definition of S.

2. In a big city, at any day time, there are 40% of hired taxis whose passengers get off from them. And 80% of empty taxis can counter passengers who want to hire them. How much fraction of taxis are empty in the steady state? (10 points)

   Answer: We denote the number of empty taxis U and the number of hired taxis E. We denote the total number of taxis L. Thus L=U+E. Let s denote the percent of hired taxis whose passengers get off from them. Let f denote the percent of empty taxis which can counter passengers hiring them.

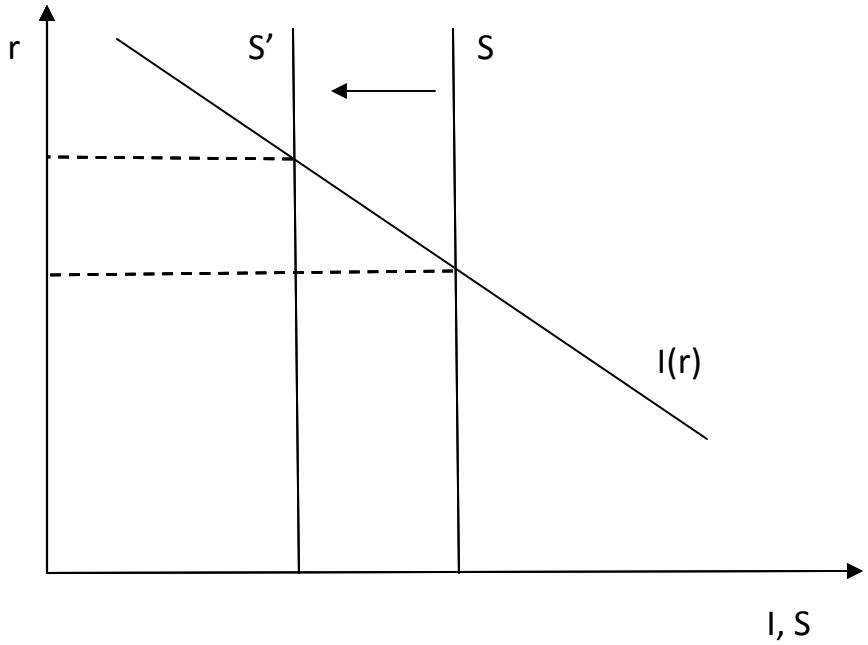
   By the equilibrium condition in the steady state, Uf=Es, we have $\frac{U}{L} = \frac{s}{f+s} = \frac{0.4}{0.8+0.4} = \frac{1}{3}$. Thus $\frac{1}{3}$ of taxis are empty in the steady state.

3. John Taylor has proposed the following monetary policy for the nominal interest rate i_t:
   $i_t = \pi_t + \rho + \theta_\pi(\pi_t - \pi_t^*) + \theta_Y(Y_t - \overline{Y}_t)$.
   What do ρ, π_t^*, θ_π and θ_Y represent in this equation? (10 points)

   Answer: ρ is the natural rate of interest. π_t^* is the central bank's target for the inflation rate. θ_π measures how much the central bank adjusts the interest rate when inflation deviates from its target. θ_Y measures how much the central bank adjusts the interest rate when output deviates from its natural level.

4. This question helps you to understand the term of "crowding effect". In a closed economy, please use the classical theory to analyze the effects of increase in government purchases, G, on private investment, I, and real interest rate, r. Suppose that government increases purchases by ΔG. Show that $\Delta I = -\Delta G$. Thus the increase in G implies the decrease in I. Government purchases are said to crowd out investment. (14 points)

   Answer: Since S=Y-C-G, increase of G implies decrease of S. We use a graph to show the impacts of this event.



   From the above graph we can see that increase of G causes I to decrease and r to increase.

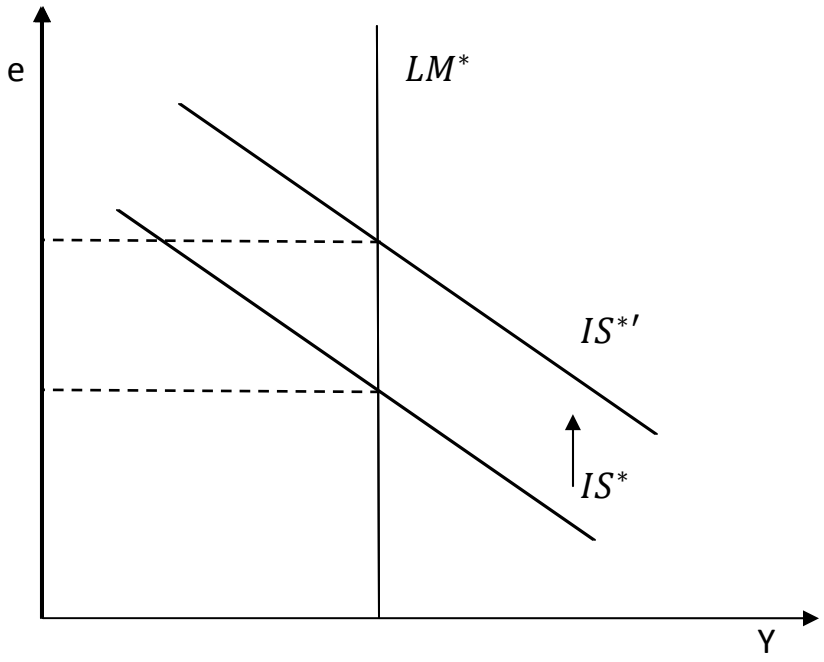
   Suppose that government increases purchases by ΔG. Since Y=C+I+G, we know that I=Y-C-G. Thus we have $\Delta I = -\Delta G$.

5. In a small open economy, the private housing investment increases because mortgage becomes easier to apply for in the financial market. Please use Mundell-Fleming model to predict what would happen to aggregate

income, the exchange rate, and the trade balance under both floating and fixed exchange rates. (16 points)

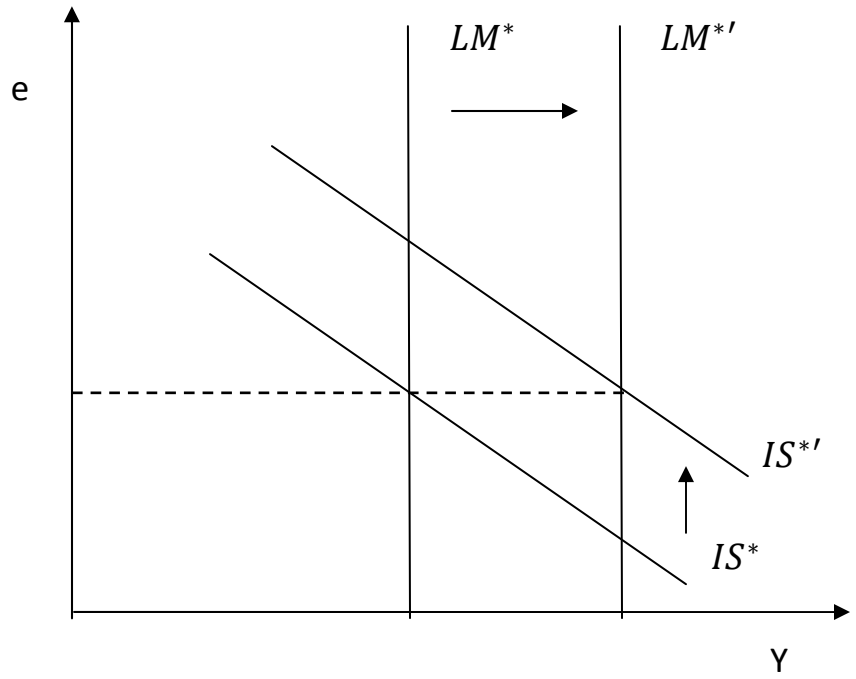
Answer: The increase of private housing investment causes the total investment to increase. This causes IS^* curve to shift upward.

Under floating exchange rate, we have the graph:



Thus Y does not change and e increases. NX decreases, since NX(e) has negative relationship with e.

Under fixed exchange rate, we have the graph:



Thus Y increases and e does not change. NX does not change since e does not change.

6. Consider a small open economy in the long run. The economy is described by the following equations:

   Y=C+I+G+NX

   Y=100

   T=20

   G=20

   C=10+0.9(Y-T)

   I=80-30r

   NX=40-6ε

   And the world interest rate $r^* = 2$.

   (1) Solve for national saving, investment, the trade balance and the equilibrium exchange rate. (8 points)

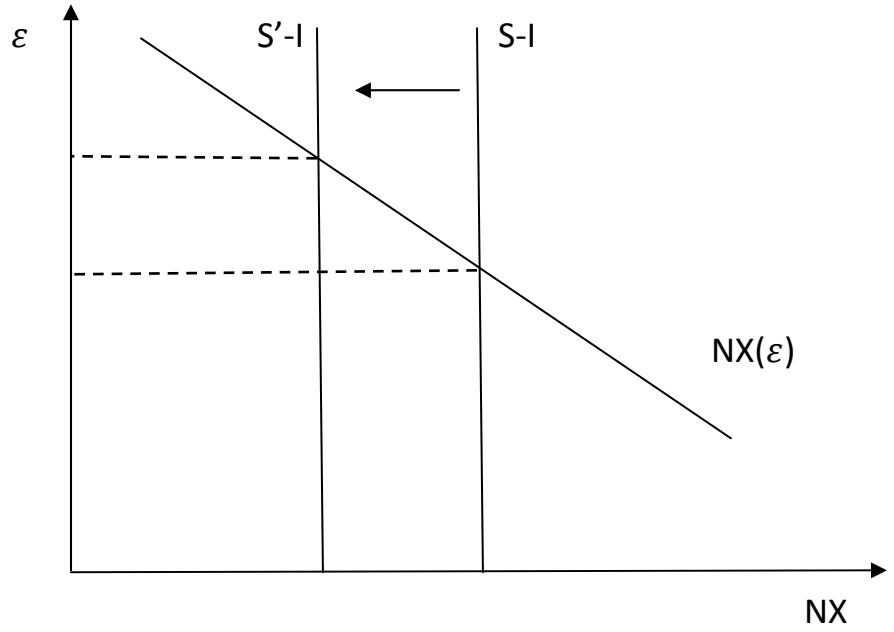
(2) Suppose that government cuts T from 20 to 10. Solve for national saving, investment, the trade balance and the equilibrium exchange rate. Use a graph to explain what you find. (12 points)

Answer:

(1) By the consumption function, we have C=10+0.9(Y-T)=82. Thus national saving S=Y-C-G=100-82-20=-2. By the investment function I=80-30r=80-30r^*=20. Thus net exports NX=S-I=-2-20=-22. Solving the equation NX=40-6ε=-22, we have the equilibrium exchange rate $\varepsilon = \frac{31}{3}$.

(2) By the consumption function, we have C=10+0.9(Y-T)=91. Thus national saving S=Y-C-G=100-91-20=-11. By the investment function I=80-30r=80-30r^*=20. Thus net exports NX=S-I=-11-20=-31. Solving the equation NX=40-6ε=-31, we have the equilibrium exchange rate $\varepsilon = \frac{71}{6}$.

Comparing with (1), we find that decrease of T causes NX to decrease and ε to increase. The reason is that decrease of T causes increase of consumption. The increase of consumption in turn causes decrease of saving since S=Y-C-G. The impacts on NX and ε follow from the following graph:



7. Consider a closed economy in the short run.
   The consumption function is C=10+0.9(Y-T). The investment function is I=80-30r. And the fiscal policies of this economy are G=20, and T=20.
   The money demand function of this economy is $\left(\frac{M}{P}\right)^d = Y - 60r$. And the money supply M is 330, and the price level P is 3.
   (1) Derive the equations of IS curve and LM curve. Solve for the equilibrium interest rate r and the equilibrium income Y. (15 points)
   (2) Derive the equation of the aggregate demand curve. (5 points)
   End of exam.

Answer:

(1) By the equilibrium of goods and services market, we have

Y=C+I+G=10+0.9(Y-20)+ 80-30r+20. Thus we have the equation of IS curve Y=920-300r.

By the equilibrium of money market, we have $\frac{M}{P} = Y - 60r$. We know that M=330 and P=3. Thus we have the equation of LM curve Y=110+60r.

Combining the equations of IS curve and LM curve, we can solve the equilibrium r=2.25 and the equilibrium Y=245.

(2) From the equilibrium of money market, we have $\frac{330}{P} = Y - 60r$. From the IS curve we have $r = \frac{920}{300} - \frac{Y}{300}$. Combing these two equations we have the aggregate demand equation $\frac{330}{P} = 1.2Y - 184$.