

Solutions to Problem Set 7

In part B, you are given relations for the variables, this solution set assumes that those relations hold through the entire problem set!!

I. Open Economy Mechanics or “Why isn’t the world flat?”¹

- A. The goods market equilibrium is where production is equal to the demand for domestic goods. Thus:

$$Y = C(Y - \bar{T}) + I(Y, i) + \bar{G} + X(Y^*, E) - EQ(Y, E) \quad (1)$$

The trade balance equilibrium is where export demand is equal to import demand, that is: $X(Y^*, E) = EQ(Y, E)$. Call the level of output associated with this, Y_{TB} .

- B. We are now given functional relationship for various variables. Finding equilibrium output in the goods market is obtained by using the identity above and rearranging. Thus:

$$Y = b_0 + b_1Y + c_0 + c_1Y + \bar{G} + d_0 + d_1Y^* - E(e_0E + e_1Y) \quad (2)$$

$$Y_{eq} = \psi[b_0 + c_0 + \bar{G} + d_0 + e_1Y^* + e_0E^2] \quad (3)$$

where $\psi = \frac{1}{1-b_1-c_1+e_1E}$; this is the multiplier for the open economy. In the closed economy, the multiplier is just $\frac{1}{1-b_1-c_1}$. Thus, the multiplier is larger in a closed economy. This implies that a country with a large trade volume, government policy will be less effective in stimulating the economy and increasing output.

- C. The IS-LM can be graphed in (I,Y) space or in (E,Y) space without any problem. To graph it in (I,Y) space, just use the following relations:

$$Y = b_0 + b_1Y + c_0 + c_1Y + \bar{G} + d_0 + d_1Y^* - E(e_0E + e_1Y) \quad (4)$$

$$M^s = YL(i) \quad (5)$$

See figure I.

For the (E,Y) diagram use the above relation, but remember to plug in for the interest rate parity equation and assume that the Marshall-Lerner condition holds:

$$Y = b_0 + b_1Y + c_0 + c_1Y + \bar{G} + d_0 + d_1Y^* - E(e_0E + e_1Y) \quad (6)$$

$$M^s = YL(i^* + \frac{\bar{E}^e}{E} - 1) \quad (7)$$

¹All the figures are located in the postscript file entitled fig7.ps

See figure II.

The IS is downward sloped in the (I,Y) diagram because as interest rates move, they effect the exchange rate through demand for domestic relative to foreign bonds. Thus, as the domestic interest rate decreases, foreigners want to hold less US dominated bonds and so the exchange rate **depreciates**. This causes net exports to increase and hence the equilibrium output of the economy increases. Thus, the IS curve slopes downward. Be careful and note that in this particular case, the IS is **not** downward sloping because of the impact of interest rates on investment!!

One can use this same line of reasoning to understand why the IS curve slopes upward in the (E,Y) space. If, exchange rates increase, thus a **depreciation** of one's currency, then net exports increase and equilibrium output is higher. Thus, the IS curve is upward sloping in (E,Y) space.

What about "our friend" the old LM curve? Well, let's begin with the (I,Y) space. Suppose, we have an increase in income at a given interest rate. Then we know that money demand is greater than money supply or equivalently we have a disequilibrium in the money market which can only be reconciled by an **increase** in interest rates. Thus, the LM curve is going to slope upwards in (I,Y) space to maintain money market equilibrium. Note, this argument is the same as in the closed economy!

In (E,Y) space, we must simply remember that as interest rates increase, through the bonds markets and exchange rate markets they affect the exchange rate. In particular, they cause the exchange rate to **appreciate**. Thus, when we think of income increasing, we know that interest rates must rise and hence exchange rates must fall to maintain money market equilibrium. Thus, the LM curve is downward sloped in (E,Y) space.

- D. For this solution, I suggest you look at figures III, IV, and V. In words: an increase in the supply of money causes the interest rate to decrease in order to maintain money market equilibrium. This in turn, from interest rate parity causes the exchange rate to increase (a depreciation of the exchange rate), which effects the goods markets through net export demand increasing. This, causes equilibrium output to increase via the multiplier. The final result is that equilibrium output is higher, consumption is higher, investment is higher, net exports are higher, and interest rates are lower.
- E. For this solution, I suggest you look at figures VI, VII, and VIII. In words: the government increases government spending, thus increasing demand for domestic

goods, through the multiplier this raises equilibrium output. As equilibrium output rises, we have an increase in import demand or equivalently a decrease in net exports.² Also, as incomes rise, we have interest rates rising along the LM curve in order to maintain money market equilibrium. As interest rates rise, we have investors wanting to hold more domestic bonds, hence from interest rate parity, the current exchange rate appreciates. One can see all this in the figures. The final result is that equilibrium output is higher, consumption is higher, investment is higher (the ambiguity disappears from the example in the text, because investment does not depend on interest rates), net exports are lower (in fact, in this case we move to a trade deficit), and interest rates are higher.

- F. With a country such as the USA, we know that the IS curve would be **steeper** than in Luxembourg in (E,Y) space. We also know that from above, a closed economy has a larger multiplier. Thus, for a given change in government spending the IS curve would shift out **more** for the United States. Thus, the direction of the effects would be the same, however the change in equilibrium output in the US would be greater. $\Delta Y_{eq}^{USA} > \Delta Y_{eq}^{LUX}$.
- G. If you look at the figures VI, VII, and VIII. One notices that the fiscal expansion in the United States has an effect on the trade balance and the exchange rate. Well, this expansion has the effect of improving Luxembourg's trade balance with respect to the United States and giving her economy a boom.³

II. Investment, Savings, Fiscal and Trade Deficits or “Where did Grandpa hide the money?”

- A. From the lecture notes and class, we can derive the following relation:

$$(S - I) + (T - G) = NX \Rightarrow \quad (8)$$

$$\Delta S - \Delta I + \Delta T - \Delta G = \Delta NX \quad (9)$$

In the case above where there is an increase in government spending and no change in taxes, $\Delta T = 0$ and $\Delta G > 0$:

$$\Delta(G - T) + \Delta(I - S) = -\Delta NX \quad (10)$$

Thus, the increase in the fiscal deficit must either be financed by an increase in private saving over investment or in a trade deficit. We are not exactly sure what is the source of finance without explicit equations for the LM curve. However,

²Note, in the graphs I assumed that we started from a zero trade balance, so this led us eventually to a trade deficit.

³It is an old tradition to name countries by the feminine.

we can say that the increase in government spending causes both investment and savings to increase, and for the trade balance to worsen. Perhaps both of those are financing the budget deficit.

- B. The increase in autonomous investment can be represented as an increase in c_0 . In this case, we would have $\Delta G = \Delta T = 0$. We would also have $\Delta I > 0$. Thus:

$$\Delta(I - S) = -\Delta NX \quad (11)$$

We cannot make precise predictions, however we can say that the increase in investment must be financed by either an increase in private saving or an improvement in the trade balance. However, we know that an increase in autonomous investment will increase equilibrium output and thus worsen the trade balance, so that $\Delta NX < 0$. This suggests that the trade deficit is being financed by foreign investment in the United States.

- C. An increase in private savings would be similar to a decrease in b_0 . This would shift the IS curve to the left and cause equilibrium output to fall. In addition, $\Delta C < 0$, $\Delta S < 0$, and $\Delta NX > 0$. Thus:

$$\Delta(I - S) = -\Delta NX \Rightarrow \quad (12)$$

$$\Delta I = \Delta S - \Delta NX \quad (13)$$

We have that saving decreases in the economy and the trade balance worsens. It must be the case that investment in Luxembourg actually declines.

- D. Foreign markets would like Luxembourg to spend a lot and not save because that would increase demand for foreigners' goods and stimulate the economies of foreign countries.
- E. An increase in US government spending will give the Luxembourg economy a boost in terms of increase export demand. If we believe that $\Delta(S - I) \approx 0$ and that in a more realistic setting, taxes are a proportion of income, then we would conclude that tax receipts will be higher and thus aid Luxembourg in financing its public debt. The converse case is not true.