Lecture 14 - Notes

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Intermediate Macroeconomics, Econ 102

Thus far, we have developed the Keynesian arguments for the case of a closed economy. For example, the note on the Keynesian cross and the Keynesian multiplier (available here), the note on the paradox of thrift (available here), and the note on deficit reduction (available here), all implicitely assumed that the economy was closed. One could therefore think of these models as applying well to the world economy. However, the relevance of the theory is then considerably diminished, because fiscal and monetary policy are largely decided at a national level.

When the economy is open, the fiscal multiplier is lower because some of the increased demand is addressed to foreign products. Keynes (1936) describes this phenomenon in *The General Theory of Employment, Interest and Money* as follows:

> In an open system with foreign-trade relations, some part of the multiplier of the increased investment will accrue to the benefit of employment in foreign countries, since a proportion of the increased consumption will diminish our own country's favourable foreign balance; so that, if we consider only the effect on domestic employment as distinct from world employment, we must diminish the full figure of the multiplier. On the other hand our own country may recover a portion of this leakage through favourable repercussions due to the action of the multiplier in the foreign country in increasing its economic activity.

In this lecture, we consider this possibility.

1 Open economy multiplier

In an open economy, the demand for domestic goods, Z, is given by:

$$Z = C + I + G - IM/\epsilon + X$$

Consumption is still an increasing function of disposable income $Y - T$ so that:

$$C = C\left(Y - T\right)$$

Note that here, we neglect the fact that Y is, in principle, equal to GDP, and therefore $Y - T$ does not quite correspond to disposable income for US residents. Therefore, we should add net transfers and net income to GDP, in principle. So implicitely, $NI = NT = 0$.

Investment depends positively on production, and negatively on the real policy rate r:

$$I = I\left(Y, r\right)$$

The real exchange rate ϵ, defined as the relative price of local goods with respect to the price of foreign goods:

$$\epsilon = E\frac{P}{P^*}$$

where E was the nominal exchange rate, is used to convert the quantity of foreign goods given by IM in domestic equivalent. As I said during the lecture, if the real exchange rate is more appreciated, then the same level of imports contributes less negatively to domestic demand.

We also assume that imports are higher when the real exchange rate is at a higher level, because foreign goods now are cheaper than local goods:

$$IM = IM\left(Y, \epsilon\right), \quad \frac{\partial IM}{\partial Y} > 0, \quad \frac{\partial IM}{\partial \epsilon} > 0$$

In contrast, exports depend on foreign demand and negatively on the real exchange rate:

$$X = X\left(Y^*, \epsilon\right), \quad \frac{\partial X}{\partial Y^*} > 0, \quad \frac{\partial X}{\partial \epsilon} < 0$$

Example. Assume that consumption is a linear function of disposable income, that investment is a linear function of output and does not depend on the interest rate, that imports are a constant fraction m_1 of total demand Y, and that exports are a constant fraction x_1 of foreign demand Y^*. Therefore:

$$\begin{aligned} C &= c_0 + c_1\left(Y - T\right) \\ I &= b_0 + b_1 Y \\ IM &= \epsilon m_1 Y \\ X &= \frac{x_1 Y^*}{\epsilon} \end{aligned}$$

In this case:

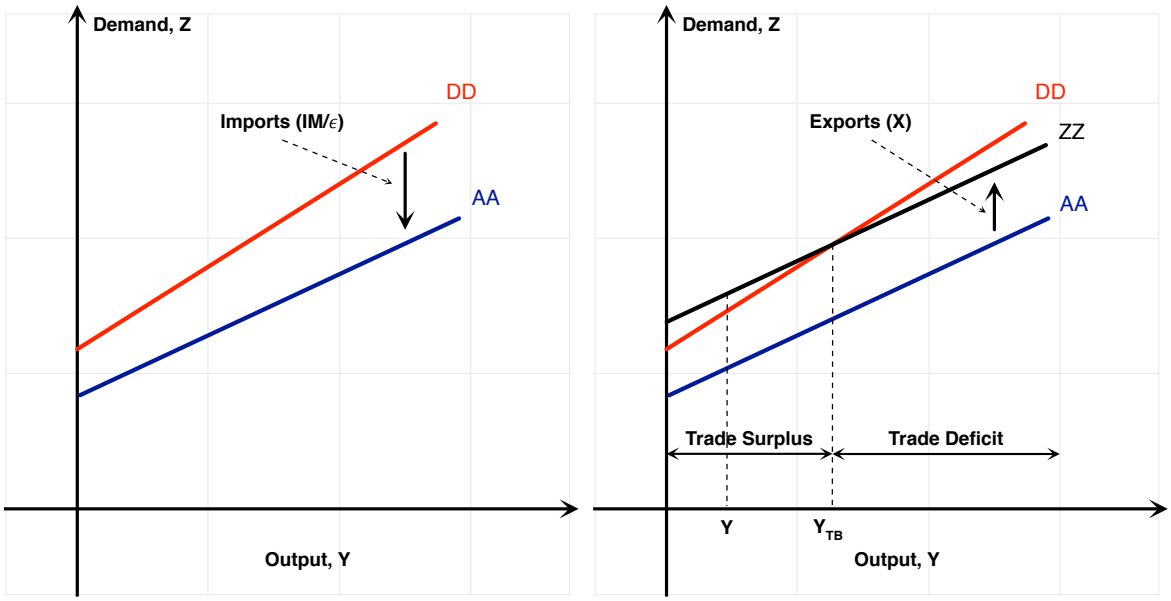
$$\begin{aligned} Z &= C + I + G - \frac{IM}{\epsilon} + X \\ &= c_0 + c_1\left(Y - T\right) + b_0 + b_1 Y + G - m_1 Y + \frac{x_1 Y^*}{\epsilon} \\ Z &= \left(c_0 - c_1 T + b_0 + G + \frac{x_1 Y^*}{\epsilon}\right) + \left(c_1 + b_1 - m_1\right) Y \end{aligned}$$

The slope is $c_1 + b_1$. Income is equal to demand and therefore, if $c_1 + b_1 < 1$:

$$\boxed{Y = \underbrace{\frac{1}{1 - \left(c_1 + b_1 - m_1\right)}}_{\text{Multiplier}} \times \left(c_0 - c_1 T + b_0 + G + \frac{x_1 Y^*}{\epsilon}\right)}$$

Graphical interpretation. The DD curve represents total domestic demand, $C + I + G$. AA represents domestic demand for domestic goods. As income increases, some of the additional domestic demand falls on foreign goods rather than on domestic goods. Therefore, AA is flatter than DD. ZZ represents total demand for domestic goods. Where the DD curve and the ZZ curve cross corresponds to an equilibrium in the trade balance: output is then

Figure 1: The Keynesian Cross in an Open Economy



equal to Y_{TB}. When output is lower than Y_{TB}, we have a **trade surplus**; when output is higher than Y_{TB}, we have a **trade deficit**. Therefore, a trade deficit can be a sign of a booming economy, while a trade surplus can be a sign of a depressed economy.

Armed with these tools, we are now in a position to ask how demand affects output in an open economy. We start with an increase in government spending, and then turn to the effects of an increase in foreign demand.

Increase in government spending. What happens when we have an increase in government spending ΔG? Then we have an effect on output that is given by:

$$\Delta Y = \frac{\Delta G}{1-(c_1+b_1-m_1)} < \frac{\Delta G}{1-(c_1+b_1)}.$$

In this situation, there is an effect on the trade balance. The effect on exports is zero, since foreign output does not change by assumption – however, note that if the foreign country's GDP also depends on the home GDP, then foreign output might change as well, and this may also boost exports – this is what Keynes (1936) suggested in the above quote when he stated that: "On the other hand our own country may recover a portion of this leakage through favourable repercussions due to the action of the multiplier in the foreign country in increasing its economic activity."

Therefore, the effect on exports is:

$$\Delta X = 0$$

The effect on imports is given by:

$$\Delta\left(\frac{IM}{\epsilon}\right) = m_1 \Delta Y = \frac{m_1}{1-(c_1+b_1-m_1)}\Delta G.$$

Finally, the effect on the trade balance is:

$$\Delta\left(X - \frac{IM}{\epsilon}\right) = -\frac{m_1}{1-(c_1+b_1-m_1)}\Delta G.$$

This effect is greater, the greater the openness ratio m_1. Therefore, in countries where the openness ratio is higher, this "leakage" of demand is more severe.

Increase in foreign demand. What happens if there is an increase in foreign demand, that is, an increase in Y^*? This could be due to an increase in foreign government spending, G^*, for example, which would then increase Y^*. What would then happen the home countries' GDP and the trade balance? From the above expression, the increase in the country's GDP would be:

$$\Delta Y = \frac{1}{\epsilon}\frac{x_1}{1-(c_1+b_1-m_1)}\Delta Y^*$$

Moreover, there is an improvement in the trade balance, as:

$$\begin{aligned}\Delta\left(X - \frac{IM}{\epsilon}\right) &= \frac{x_1}{\epsilon}\Delta Y^* - m_1\Delta Y \\ &= \frac{x_1}{\epsilon}\Delta Y^* - \frac{1}{\epsilon}\frac{m_1 x_1}{1-(c_1+b_1-m_1)}\Delta Y^* \\ \Delta\left(X - \frac{IM}{\epsilon}\right) &= \frac{1-(c_1+b_1)}{1-(c_1+b_1-m_1)}\frac{x_1}{\epsilon}\Delta Y^* > 0\end{aligned}$$

Note that there is both an increase in exports, coming from higher foreign demand, as well as an increase in imports, coming from the higher home output. However, since this is a second round effect, the second effect is dominated by the first.

The need for international coordination. Countries prefer to run trade surpluses rather than trade deficits. There are many reasons for this: aversion to foreign debt, risks of losing one's manufacturing base (cf. Donald Trump), etc. Moreover, all countries benefit from one country's increase in government spending G, but it only raises the public debt of one country. Therefore, in equilibrium, there is too little expansionnary policies. In times of recession, there needs to be international coordination, as all countries would like other countries to increase their government spending, but do not want to increase their own. This is what the G20 agreed on when it met in an emergency meeting in Washington, in November 2008.

2 Depreciation, the Trade Balance, and Output

Imagine that the government can take a policy measure that leads to a depreciation of the exchange rate. What would be the effect on the trade balance? Marshall-Lerner expresses the conditions under which this a real depreciation leads to an improvement in the trade balance. Intuitively, the effect on the trade balance of a real depreciation is indeed ambiguous:

- On the one hand, a real depreciation increases exports $X\left(Y^*, \epsilon\right)$ and reduces imports $IM(Y, \epsilon)$, both of which work to improve the trade balance.

- On the other hand, a real depreciation makes imports more expensive, and therefore worsens the trade balance through the $1/\epsilon$ term.

Therefore, we need to do some maths in order to determine which effects dominates overall. If we start from the definition of net exports:

$$NX = X - \frac{IM}{\epsilon}$$

Replacing X and IM by their expressions:

$$NX = X\left(Y^*, \epsilon\right) - \frac{IM(Y, \epsilon)}{\epsilon}$$

Again, the Marshall-Lerner condition is the condition under which a real depreciation, a decrease in the real exchange rate leads to an improvement in the trade balance. Indeed:

$$\frac{\partial IM}{\partial \epsilon} > 0, \quad \frac{\partial X}{\partial \epsilon} < 0, \quad \frac{\partial 1/\epsilon}{\partial \epsilon} = -\frac{1}{\epsilon^2} < 0$$

Therefore, with a real depreciation, or a fall in $\epsilon (d\epsilon < 0)$, imports are lower as goods are more expensive abroad, exports increase as goods are cheaper abroad, but the valuation effect means that initially at least, the trade balance deteriorates. The Marshall-Lerner condition considers a case where trade is initially balanced, so that:

$$IM = \epsilon X$$

Starting from:

$$NX = X - \frac{IM}{\epsilon}$$

and first differentiating this function with respect to ϵ:

$$\frac{dNX}{d\epsilon} = \frac{dX}{d\epsilon} - \frac{1}{\epsilon}\frac{dIM}{d\epsilon} - IM\frac{d(1/\epsilon)}{d\epsilon}$$
$$\frac{dNX}{d\epsilon} = \frac{dX}{d\epsilon} - \frac{1}{\epsilon}\frac{dIM}{d\epsilon} + IM\frac{1}{\epsilon^2}$$

Therefore, if the real exchange rate changes from ϵ to $\epsilon + d\epsilon$, then the change dNX is given by (just multiply the previous expression by the small increment $d\epsilon$):

$$dNX = dX - \frac{dIM}{\epsilon} + \frac{IM}{\epsilon^2}d\epsilon$$

Therefore:

$$\frac{dNX}{X} = \frac{dX}{X} - \frac{dIM}{\epsilon X} + \frac{IM}{\epsilon X}\frac{d\epsilon}{\epsilon}$$

Using that $IM = \epsilon X$, we get:

$$\boxed{\frac{dNX}{X} = \frac{dX}{X} - \frac{dIM}{IM} + \frac{d\epsilon}{\epsilon}}$$

With a depreciation, exports rise so $dX/X > 0$, imports decline so $-dIM/IM > 0$, so both contribute positively to the change in net exports dNX/X. On the other hand, the

depreciation itself contributes negatively to the change in net exports since $d\epsilon/\epsilon$. So which effect dominates? Empirically grounded numbers for the effect of a depreciation on exports and imports are that a 1% depreciation leads to a proportional increase in exports of 0.9%, a proportional decrease in imports of 0.8%. Therefore, in total we get that the trade balance changes by $-1\% + 0.9\% + 0.8\% = 0.7\%$. Therefore, the Marshall-Lerner condition holds, and a depreciation indeed leads to an improvement in the trade balance.

References

Keynes, John Maynard, *The General Theory of Employment, Interest, and Money* 1936.