

Chapter 17

The Income Adjustment Mechanism and Synthesis of Automatic Adjustments

"The conventional answer to the question, what is the effect of devaluation on the trade balance of the devaluing country, runs in terms of the supply and demand conditions in the devaluing country and in the rest of the world. ...a more fruitful approach can be based on a concentration on the relationships of real expenditure to real income and on the relationships of both of these to the price levels, rather than on the more traditional supply and demand analysis."

Sidney Alexander, "Effects of a Devaluation on a Trade Balance",
IMF Staff Papers, April, 1952, pp.263–278.

I. Chapter Outline

- 17.1 Introduction
- 17.2 Income Determination in a Closed Economy
 - 17.2a Determination of the Equilibrium National Income in a Closed Economy
 - 17.2b Multiplier in a Closed Economy
- 17.3 Income Determination in a Small Open Economy
 - 17.3a Import Function
 - 17.3b Determination of the Equilibrium National Income in a Small Open Economy
 - 17.3c Graphical Determination of the Equilibrium National Income
 - 17.3d Foreign Trade Multiplier
- 17.4 Foreign Repercussions
- 17.5 Absorption Approach
- 17.6 Monetary Adjustments and Synthesis of the Automatic Adjustments
 - 17.6a Monetary Adjustments
 - 17.6b Synthesis of Automatic Adjustments
 - 17.6c Disadvantages of Automatic Adjustments

II. Chapter Summary and Review

In Chapter 16, the role of income in the adjustment to external imbalances was not considered. The level of income was held constant in order to focus on the role of prices (including exchange rates) in the adjustment to a balance-of-

payments surplus or deficit. In this chapter, prices are initially assumed to be constant in order to focus on how income adjusts to a balance-of-payments surplus or deficit. This chapter ends by integrating price and income adjustments under alternative exchange rate systems.

In a **closed economy** (no imports or exports) with no government sector, the **equilibrium level of national income** occurs where national income (output) equals spending, i.e.,

$$Y = C + I \text{ (Eq. 1)}$$

Y = national income or output (GDP),

C = spending by consumers, and

I = **desired or planned investment** spending by firms

If Y exceeds $C + I$, then production exceeds planned spending so inventories accumulate. Producers respond to inventory accumulation by lowering production (prices are assumed constant). If Y is less than $C + I$, then production is less than spending, so inventories will decline. Producers respond to decreases in inventories by increasing production. Only when production equals spending, $Y = C + I$, will income be in equilibrium.

It is assumed that investment spending, I , is given exogenously, but C depends upon the level of income. A **consumption function** in linear form is

$$C = a + bY, \text{ (Eq. 2)}$$

where a and b are constants. As income changes, C changes by b times the change in income. For example, if $a = 100$ and $b = 0.8$, then $C = 100 + 0.8Y$. If Y increases by 100, then C increases by 80. Algebraically, $\Delta C = 0.8\Delta Y$, or $\Delta C/\Delta Y = 0.8$. This ratio of increased consumption to increased income is called the **marginal propensity to consume (MPC)**. The MPC in equation (2) is the constant b .

Equilibrium can also be written in terms of saving and investment. Rearranging equation (1),

$$Y - C = I.$$

The difference between income (Y) and consumption (C) is saving, so equilibrium

can also be written as

$$S = I.$$

Like consumption, saving increases with income. The ratio of the change in saving to the change in income, $\Delta S/\Delta Y$, is the **marginal propensity to save (MPS)**. An increase in income must be saved or spent, so $MPC + MPS = 1$, or $b + MPS = 1$.

Because consumption depends upon income, a change in investment will lead to a change in spending larger than the change investment because of induced consumption. If investment spending increases by, say, 100, then producers will respond by increasing production to meet the new demand. The receipt of the 100 by producers will be paid out as income (e.g., wages and profits), which will generate (induce) more consumption (by the MPC times the change in income), which will generate more production, and the cycle continues.

The total effect of an increase in investment can be found by substituting $C = a + bY$ into $Y = C + I$ to produce

$$Y = a + bY + I.$$

Solving for Y ,

$$Y = \frac{(a + I)}{(1 - b)} \quad (Eq. 3)$$

If, now, I increases while a is held constant, then

$$\Delta Y = \frac{\Delta I}{(1 - b)} = \Delta I \left[\frac{1}{1 - b} \right] \quad (Eq. 4)$$

If $\Delta I = 100$, and $b = 0.8$, then

$$\Delta Y = 100[1/(1 - 0.8)] = 100[5] = 500.$$

An increase in investment spending of 100 leads to an increase in income (output) of 500. This multiplier effect is due to the effect of increased income on consumption, which increases income, etc., as explained above. The **multiplier** in this case is 5, which is equal to $\left[\frac{1}{1 - b} \right]$. Because the MPC (b) and the MPS must

add to one, equation (4) can be written as

$$\Delta Y = \Delta I \left[\frac{1}{MPS} \right]$$

Notice that variables a and I enter equation (3) in the same way. An increase in the variable a in the consumption function will have the same multiplier effect on income as an increase in variable I . Variable a can be interpreted as those things that affect consumption other than income.

With this brief review of the principles of income determination in a closed economy, we can now add exports and imports. We are continuing to assume, as in Chapter 16, the absence of autonomous financial capital flows, focusing on international trade in goods and services.

Consumption (C) is total consumption by domestics, so in an open economy it includes consumption of both domestic and foreign goods. To get domestic spending by consumers, imports must be subtracted. Domestic spending by consumers is $C - M$. The value of exports is the value of spending on domestic goods by foreigners. In an open economy, then, total spending on domestic goods is $C - M + I + X$ or $C + I + X - M$, where X is exports and M is imports. Domestic income will be in equilibrium when

$$Y = C + I + X - M \quad (Eq. 5)$$

Equilibrium can be written in an alternative way by subtracting C from both sides of equation (5) to produce

$$Y - C = I + X - M$$

The difference between Y and C is just savings, so

$$S = I + X - M$$

Or,

$$S + M = I + X.$$

This is an expression of equilibrium using the leakages-injections approach. In the absence of trade, the only leakage from spending is saving and the only injection is investment. Thus, in a closed economy, equilibrium occurs

where $S = I$. In an open economy, imports represent an additional leakage from spending and exports represent an additional injection. (With a government sector, another leakage would be taxes and another injection would be government spending.)

It is assumed that exports, like investment, do not depend upon domestic income. Imports, however, do depend on domestic income in much the same way that total consumption depends upon domestic income. As domestic income increases, imports will increase. If the relationship is linear, then the **import function** can be written as

$$M = c + dY,$$

where c and d are constants. As income increases, imports increase by d , or $\Delta M = d\Delta Y$, or $\Delta M/\Delta Y = d$. Just like b is the MPC, d is the **marginal propensity to import (MPM)**, and represents the fraction of an *increase* in income that is spent on imports. Notice that the MPM is *not* the fraction of income that goes towards imports, but the fraction of an increase in income that goes towards imports. The fraction of income that goes towards imports is M/Y , and is called the **average propensity to import (APM)**.

In an open economy, imports will influence the size of the multiplier. If, say, investment increases, then production will increase as firms satisfy the new spending. They will receive that as income and consume some fraction, and the process will continue. However, in an open economy, some income leaks out into imports. Thus the presence of imports will change the multiplier. To derive the multiplier, first write out equilibrium as

$$Y = C + I + X - M$$

Now, using $C = a + bY$, and $M = c + dY$,

$$Y = a + bY + I + X - (c + dY)$$

Solving for Y produces

$$Y = (a + I + X - c) \left[\frac{1}{1 - b + d} \right] \quad (6)$$

Now if I increases while a , X , and c are held constant, then the change in Y will be

$$\Delta Y = \Delta I \left[\frac{1}{1 - b + d} \right]$$

The multiplier is now $[1/(1 - b + d)]$. Letting $b = 0.8$ and $d = 0.3$ (recall that $b = MPC$ is a fraction and $d = MPM$ is a fraction), the multiplier is

$$[1/(1 - 0.8 + 0.3)] = 2.0$$

If there were no imports ($d = 0$), then the multiplier would be

$$[1/(1 - 0.8 + 0)] = 5$$

Imports serve to reduce the size of the multiplier because some of the increased spending "leaks" abroad in the form of spending on imports. Notice that the variable X enters equation (6) in the same way that variables a , I and $-c$ do, so they will all be subject to the same multiplier effect. Summarizing:

$$\Delta Y = \Delta I \left[\frac{1}{1 - b + d} \right] \text{ if } X, a, \text{ and } c \text{ do not change}$$

$$\Delta Y = \Delta a \left[\frac{1}{1 - b + d} \right] \text{ if } X, I, \text{ and } c \text{ do not change}$$

$$\Delta Y = \Delta X \left[\frac{1}{1 - b + d} \right] \text{ if } a, I, \text{ and } c \text{ do not change}$$

$$\Delta Y = -c \left[\frac{1}{1 - b + d} \right] \text{ if } a, I, \text{ and } X \text{ do not change}$$

The above multipliers for changes in the variables a, I, X , and c assume a small country. If the country is large then any changes in the domestic economy will affect its trading partners and produce **foreign repercussions**. If, for example, domestic investment increases in the United States, then U.S. income will increase by the multiplier effect. Along with the increase in U.S. income will be an increase in U.S. imports. Thus, exports of foreign countries will increase, which will increase foreign income. When foreign incomes are higher, foreigners will import more from the United States, which will increase U.S. exports. This will

now further increase U.S. income, and the cycle, although smaller at each step in the process, continues. The presence of foreign repercussions will increase the size of the multiplier.

This is one way in which economic activity is transmitted between countries. A recession in Europe will produce a recession in the United States, which will reinforce the recession in Europe, etc. The process also works in reverse. Expansion in Europe can produce expansion in the United States, which will reinforce the expansion in Europe, etc.

Given the relationship between trade and income just described, we can begin a synthesis of the price adjustments of Chapter 16 and the income adjustments described thus far in this chapter. In Chapter 16, we saw that currency depreciation (or devaluation in a fixed exchange rate system) would improve the trade balance if the Marshall-Lerner condition for elasticities were met. However, when income adjustments and the level of economic activity are introduced, the process is more complex. First, an improvement in the trade balance ($X - M$) will increase domestic income because it means an increase in exports relative to imports—an increase in spending on domestic income. If domestic income increases, this generates an increase in imports, offsetting some of that increase in domestic income. Second, the trade balance can improve only if income is below its full employment level. If income is at full employment, then an increase in $X - M$ will only cause prices to increase in the long run, which will make an economy less competitive relative to its trading partners, reversing the correction of the deficit. (The simple model makes the assumption that below full employment real production can be increased with no changes in prices, but at full employment or above, any increase in demand will increase prices with no change in real production.)

The importance of the level of economic activity in adjustment is emphasized by the **absorption approach** to adjustment. The absorption approach begins with the equilibrium condition for income:

$$Y = C + I + X - M$$

Domestic absorption is total spending by domestics (the value of goods absorbed by the domestic economy), and so is equal to $C + I$. Let absorption be A , so $A = C + I$. Substituting this into the equilibrium condition and solving for the trade balance produces

$$X - M = Y - A$$

The absorption approach emphasizes the arguments just made above about the effectiveness of depreciation (devaluation) in correcting a trade deficit. The trade balance ($X - M$) can increase only if Y increases relative to A . If Y is at less than full employment, then currency depreciation will increase Y because it will increase spending on domestic goods by both foreigners and domestics. (Depreciation of a country's currency makes domestic goods relatively cheaper to foreigners and makes foreign goods relatively more expensive to domestics. Depreciation "switches" demand from foreign to domestic goods.) As Y increases, it also increases consumption, which is part of A . Thus, depreciation increases Y and A , and will only improve the trade balance if Y increases faster than A .

If Y is at full employment, then Y cannot increase in the long run so depreciation will work only if it decreases A . There are a number of possible channels (see the *International Economics* text) by which A could be reduced, but these are very uncertain. The absorption approach strongly suggests that depreciation may have to be accompanied by other domestic policies (fiscal and/or monetary) that will directly reduce A .

The adjustments described above focus on the effect of exchange rate changes. If exchange rates are fixed, then a monetary adjustment will occur, as was described in the monetary approach to the balance of payments in Chapter 15, and in the context of the gold standard in Chapter 16. With fixed exchange rates, a deficit will initially put downward pressure on a country's exchange rate, to which the central bank will have to respond by buying its own currency with foreign exchange reserves. This reduces the domestic money supply, which has a number of effects. First, less money will reduce prices relative to trading partners, which will improve the trade balance, as in the price-specie-flow mechanism. Second, less money will contract income in the short run, which will reduce imports, which improves the trade balance. Finally, less money increases interest rates and attracts foreign financial capital, allowing a nation to finance its deficit by borrowing from abroad. (Recall from Chapter 13 on the balance of payments that a trade deficit can be financed by an inflow of financial capital.) Inflows of financial, to this point, have not been included in the analysis, but trade deficits are often financed through an inflow of financial capital rather than through an elimination of the trade deficit.

A brief summary of the adjustment mechanisms is in order. In a flexible

exchange rate system, a deficit will cause a depreciation of a country's currency. The absorption approach points out that this may not work if the economy is at full employment, because it will eventually translate into price increases that will restore the deficit. If the economy is at less than full employment, then currency depreciation will also increase domestic absorption, which will partially offset the improvement in the deficit, requiring a larger depreciation. The cost to a country of relying on changes in the value of its currency includes foreign exchange risk as well as the very real costs to producers and workers associated with continually expanding and contracting export- and import-competing sectors.

In a fixed-rate system a deficit leads to monetary contraction, a fall in prices and income, and an increase in interest rates. As emphasized in Chapters 15 and 16, a fixed exchange rate means giving up control of the money supply in order to maintain the fixed exchange rate.

Because of the costs associated with adjustment under both types of exchange rate systems, as well as the dubious effectiveness of adjustment under flexible exchange rates, countries have often resorted to discretionary policies (fiscal and monetary) to supplant or replace the automatic adjustments described in this and the previous chapter.

III. Questions

1. This question reviews equilibrium income and multipliers in a closed economy. Suppose that $C = 100 + .75Y$ and $I = 400$.

- a) What is numerical value of the MPC?
- b) Calculate the value of the equilibrium level of income.
- c) Calculate the change in equilibrium income change if investment increases by 50.
- d) Why did income increase in part b by more than the increase in investment?
- e) Calculate the change in income if the consumption function shifts up to $C = 150 + .75Y$.
- f) What could cause the consumption function to shift up?

- g) Calculate the multiplier when $C = 100 + .75Y$.
- h) Calculate the multiplier when $C = 100 + .9Y$.
- i) Explain why the multiplier changed from part h to part i.

2. Suppose the components of spending in an economy are:

$$C = 100 + .75Y$$

$$I = 400$$

$$M = 50 + .25Y$$

$$X = 300$$

- a) Calculate the equilibrium level of income.
- b) Calculate the trade balance, $(X - M)$, at this equilibrium.
- c) Suppose exports increase by 100. Calculate the new equilibrium level of income if this is a small economy.
- d) Calculate the trade balance, $(X - M)$, at the new equilibrium. Did the trade balance improve by the increase in exports of 100? Explain.
- e) How would your answer to c change if this were a large economy? Don't calculate the difference; simply explain the difference.

3. Suppose that the price elasticities of demand for imports and exports are of the correct size, i.e., the Marshall-Lerner condition is met. Will a depreciation of the country's currency necessarily lead to an improvement in a trade deficit? Relate your answer to the opening quote of this chapter.

4. a) Suppose Kenya is currently experiencing full employment, has a fixed exchange rate relative to its major trading partners, and exports currently equal imports. If Kenya's trading partners experience a severe recession, explain the automatic adjustments that will take place in Kenya. Include a discussion of Kenya's exports, imports (and import-competing sectors), money supply, income,

price level, interest rates and international financial capital flows. (Ignore repercussion effects.)

b) Why might Kenya be reluctant to allow the automatic adjustments to take place?

5. a) Now assume that Kenya has a floating exchange rate. Describe the adjustments that will take place in Kenya as a result of recession in its trading partners' economies. Include a discussion of the exchange rate, income, price level, exports, and imports (and import-competing sectors). (Assume that the Marshall-Lerner condition is met.)

b) Why might Kenya be reluctant to allow the automatic adjustments to take place, at least on a regular basis, as foreign economies go through continual cycles of expansion and contraction?