Chapter 12

International Trade

Chapter Introduction

This chapter builds on the model of the economy that we learned in Chapter 7. So far, we have dealt with a closed economy—an economy which does not trade with the rest of the world. In this chapter we add net exports to the model and open the economy. We also learn about the exchange rate—the price of domestic currency in terms of the foreign currency.

The Importance of International Trade

Over the past 75 years or so, the world trade has increased significantly; countries have been trading a lot more with one another. A measure of how much trade is taking place among countries is called the Openness Index. It is calculated by dividing the sum of exports and imports by GDP. One can use Equation (12.1) to calculate a country's openness index.

$$Openness\ Index = \left(\frac{Exports+Imports}{GDP}\right) \times 100 \tag{12.1}$$

Figure 12.1 plots the openness index of the world. It adds up exports and imports of all the countries in the world and divide this sum by the global GDP.

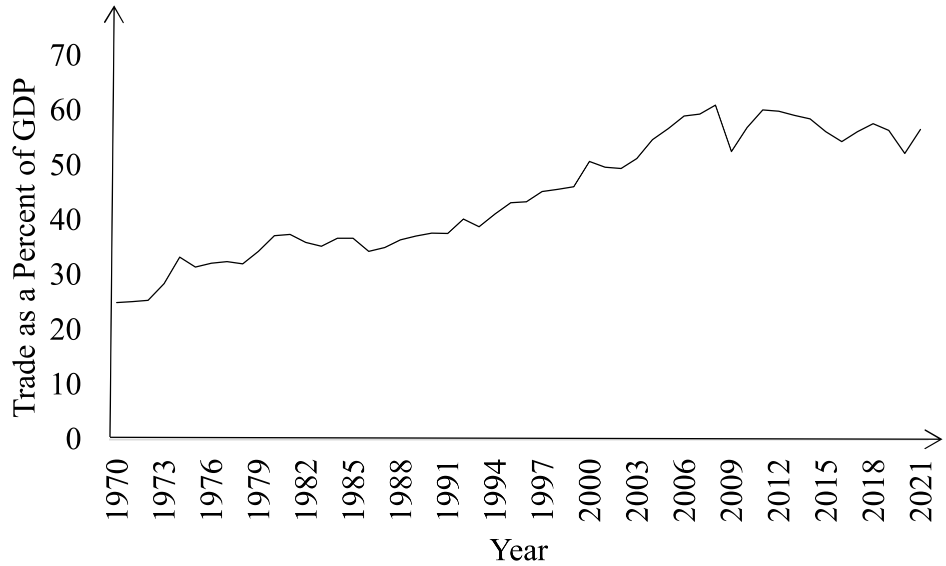

Figure 12.1: World Openness Index

Source: M. Ashraf. Data Source: The World Bank (https://data.worldbank.org/indicator/NE.TRD.GNFS.ZS) Accessed: March 21, 2023

Figure 12.1: The horizontal axis lists time in years, from 1970 to 2021. The vertical axis has the value of the World Openness Index—the sum of global imports and exports, divided by global GDP.

In Figure 12.1, the vertical axis reports the sum of global imports and exports divided by the global GDP. Note that while there have been ups and downs in the trade volume as a percentage of global GDP, the trend is positive for the most part. It indicates that the importance of world trade has been increasing. The index value reached its highest point during 2008. Since then, the index value seems to have leveled off. Note, however, that the data values start to increase again in 2021, the latest data available at the time of this writing. The drop around 2020 is the result of the COVID-19 pandemic.

To take a specific example, let’s calculate the Openness Index for the US. During 2021, the sum of exports ($2,539.6 billion) and import ($3,401.4 billion) was $5,941 billion. The value of GDP during 2021 was $23,315.1 billion.[1] These data are in 2021 US dollars. Using Equation (12.1), we get:

$$Openness\ Index = \left(\frac{2{,}539.6 + 3{,}401.4}{23{,}315.1}\right) \times 100 \approx 25.48\%$$

The openness index value for the US during 2021 was about 25.48. (Note that the difference between this figure and the figure reported in Table 12.1 is due to rounding.)

[1] Exports, Imports, GDP data. The Bureau of Economic Analysis (www.bea.gov)

Country Differences in Global Trade

We can calculate the openness index for any country for which we have data. Perhaps not surprisingly, the openness index values differ from country to country. As an example, let's compare the openness indices for the US, Canada, Germany, New Zealand, and Australia. I picked these countries for no other reason that Canada is the next-door neighbor of the US, Germany is Europe's largest economy, and New Zealand and Australia are in the Southern hemisphere, the furthest away from other countries. Table 12.1 lists openness index values for the US, Canada, Germany, New Zealand, and Australia, for various years.

Table 12.1: Openness Index—USA, Canada, Germany, New Zealand, and Australia

Year	USA	Canada	Germany	New Zealand	Australia
1970	11	42	32		26
1980	20	53	42	59	32
1990	20	50	46	53	32
2000	25	83	62	69	41
2010	28	60	80	58	41
2020	23	61	80	44	44
2021	25	61	89	49	40

Source: M. Ashraf.

Data Source: The World Bank (https://data.worldbank.org/indicator/NE.TRD.GNFS.ZS) Accessed: March 21, 2023. Note: New Zealand data start from 1971.

Figure 12.2 plots the annual openness index values for four countries—USA, Canada, Germany, New Zealand, and Australia.

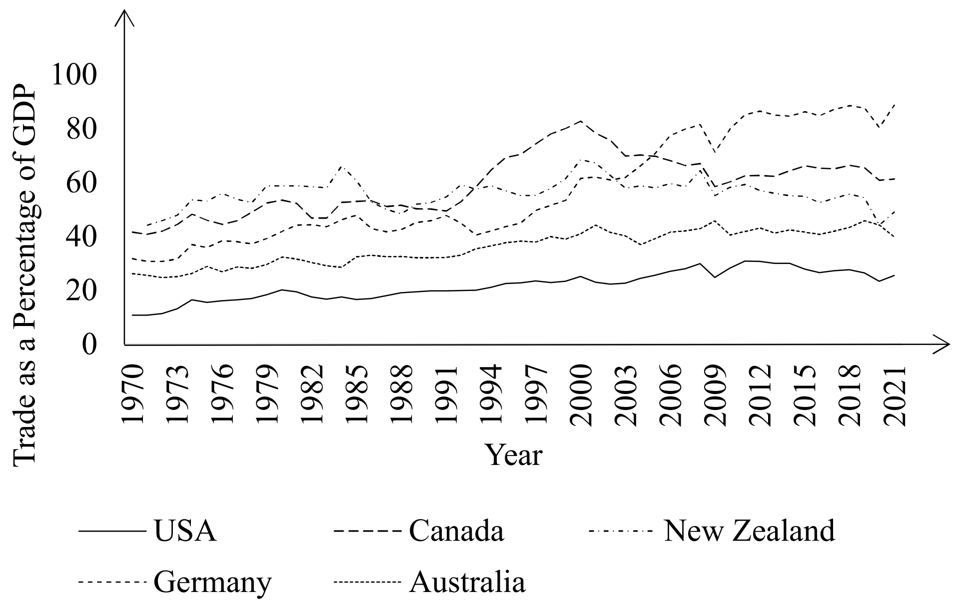

Figure 12.2: Openness Index—USA, Canada, Germany, New Zealand, and Australia

Source: M. Ashraf.

Data Source: The World Bank (https://data.worldbank.org/indicator/NE.TRD.GNFS.ZS) Accessed: March 21, 2023. Note: New Zealand data start from 1971.

Figure 12.2: The figure plots annual values of the openness index for the US, Canada, Germany, New Zealand, and Australia. The openness index values are plotted on the vertical axis and the horizontal axis lists years, from 1970 to 2021. There are differences among countries' openness as measured by the openness index. Canada and New Zealand reached their openness, as measured by the openness index around 2000. After that, the index values start declining for Canada and New Zealand.

The data in Figure highlight a few points.

a. There are differences among countries' openness as measured by the openness index.
b. Canada and New Zealand reached their openness, as measured by the openness index around 2000. After that, the index values start declining for Canada and New Zealand.
c. The openness index values seem to indicate that the US lags other countries whose data are plotted in this figure.

Some clarification is needed on point c. A main reason for this is the size of the US economy as compared with the economies of other countries. A measure of the size of the economy is per capita GDP. By this measure the US economy is a lot larger than the economies of other countries. For instance, in 2020, the per capita GDP of Canada was about 72% of the US GDP, Germany's GDP per capita was about 71% of per capita GDP of the US, the per capita GDP of New Zealand was about 67% of US GDP per capita, and the per capita GDP of Australia was about 99% of US GDP per capita. All data are in 2015 constant US dollars. In other words, the denominator in Equation (12.1) is lot larger as compared with other countries' dataset.

To better understand this difference, we need to compare trade volume (i.e., the sum of the US exports and imports), with the trade volume of other countries in this figure. That is, compare trade of these countries with the rest of the world with the trade of the US with the rest of the world. By way of highlighting this point, Table 12.2 presents these figures for select years—2000, 2005, 2010, 2015, and 2020.

Table 12.2: Country Trade as a Percentage of US Trade

Year	US	Canada	Germany	New Zealand	Australia
2000	100	28	51	2	10
2005	100	23	52	2	10
2010	100	18	53	2	10
2015	100	20	57	2	11
2020	100	22	61	2	15

Source: M. Ashraf.

Data Source: The World Bank (https://data.worldbank.org/indicator/NE.TRD.GNFS.ZS) Accessed: March 21, 2023. Note: The value of the US trade is set to 100.

In Table 12.1, the value of the US trade is set equal to 100 for comparison purposes. The data indicate that the US is the biggest trader in the world. Germany is a distant second, at about 55% of the US trade volume, Canada is third at about 22% of the US trade volume, New Zealand fourth at 2% of the US trade volume, and Australia is about 11.5% of the US trade volume.

This clarification should also serve as a reminder that one should be careful comparing various data; a comparison only makes sense when similar data are compared. Otherwise, the results are not informative, and indeed, might even be misleading.

The Keynesian Cross Diagram Again (Open Economy)

So far, we have built a model that assumes that the economy is closed. That is, the country does not trade with any other country. For a complete picture of the economy, we must include net exports to our model.

As we learned in Chapter 6, net exports equal exports of goods and services minus the imports of goods and services. That is,

$$NX \equiv EX - IM \tag{12.1}$$

Where NX represents net exports, EX refers to exports of goods and services, and IM represents imports of goods and services.

Another commonly used term for net exports is "balance on goods and services." According to the Bureau of Economic Analysis, "The two measures [net exports and balance on goods and services] are very similar, but they differ in coverage, definitions, and in timing of revisions."[2]

When exports are greater than imports ($EX > IM$), it is referred to as trade surplus and when exports are less than imports ($EX < IM$), it is referred to as trade deficit. That is,

Trade Surplus: $EX > IM$

Trade Deficit: $EX < IM$

Recall from Chapter 7, that the main building block of the Keynesian model is the consumption function, in which aggregate consumption depends upon disposable aggregate income or output—see for instance, Equation (7.23), $C = \alpha + \beta(Y_d)$. Furthermore, the slope of the consumption function, which is called the marginal propensity to consume, $MPC = \frac{\Delta C}{\Delta Y}$, determines the value of the investment multiplier, $\left[\frac{1}{1-\beta}\right]$, the government spending multiplier, $\left[\frac{1}{1-\beta}\right]$, and the tax multiplier$\left(-\left[\frac{\beta}{1-\beta}\right]\right)$. In Chapter 7, we used the Greek letter, β, to represent MPC. That is, $\beta \equiv MPC$.

Because the main features of the model remain the same as those detailed in Chapter 7, to solidify your understanding of how we reached at the equilibrium condition, I encourage you to review Chapter 7 before moving on.

In Chapter 7, we learned that the economy was in equilibrium when the planned aggregate expenditure (AE) was equal to the aggregate output (Y)—See Equation (7.16), reproduced here.

$$Y = AE \tag{7.16}$$

Where AE in a closed economy is equal to $C + I + G$. See Equation (7.20), reproduced here.

$$\mathrm{AE} \equiv \mathrm{C} + \mathrm{I} + \mathrm{G} \tag{7.20}$$

Using Equation (7.16) and Equation (7.20), we wrote the equilibrium condition as expressed in Equation (7.21), reproduced here.

$$Y = C + I + G \tag{7.21}$$

Now that we have added net exports ($NX \equiv EX - IM$) to the model, planned aggregate expenditure is,

$$AE \equiv C + I + G + NX \tag{12.1}$$

And now our equilibrium condition is,

$$Y = C + I + G + NX \tag{12.2}$$

[2] Net exports and balance on goods and services. The Bureau of Economic Analysis (https://www.bea.gov/resources/methodologies/nipa-handbook/pdf/chapter-08.pdf). Accessed: April 17, 2023.

By way of providing an example, we modify Table 7.6, and add net exports, *NX*. The resulting data are presented in Table 12.3.

Table 12.3: Adding Net Exports to the Model

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
Y	T	$Y_d \equiv Y - T$	$C = 100 + 0.8(Y_d)$	I	G	NX	AE
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
1,900	100	1,800	1,540	200	200	80	2,020
2,000	100	1,900	1,620	200	200	80	2,100
2,100	100	2,000	1,700	200	200	80	2,180
2,200	100	2,100	1,780	200	200	80	2,260
2,300	100	2,200	1,860	200	200	80	2,340
2,400	100	2,300	1,940	200	200	80	2,420
2,500	100	2,400	2,020	200	200	80	2,500
2,600	100	2,500	2,100	200	200	80	2,580
2,700	100	2,600	2,180	200	200	80	2,660

Source: M. Ashraf

In the interest of space, I limit the number of lines presented in Table 12.3; the three dots (⋮) indicate the lines not printed here. As in Chapter 7, I am assuming that the lumpsum taxes (*T*), presented in Column [2], are 100. The disposable income is presented in Column [3]. In this table I am assuming that *MPC* is 0.8, so that out consumption function is $C = 100 + 0.8(Y_d)$. The values are presented in Column [4]. Furthermore, government spending (*G*) and planned investment spending (*I*), both are 200 each. These data are presented in Columns [5] and [6], respectively. Column [7] is the net exports (*NX*). Net exports are 80 for every income level. The planned aggregate expenditure (*AE*) is presented in Column [8].

In Table 12.3, the equilibrium is reached at income level 2,500. At this level of income, aggregate income, *Y*, is equal to planned aggregate expenditure, *AE*; the equilibrium condition, Equation (12.2) is met.

As we did in Chapter 7, we can represent this equilibrium condition graphically. Figure 12.3 is a modified version of Figure 7.9. In Figure, we add *NX* exports, which shifts the planned aggregate expenditure, *AE*, curve up by the amount net exports.

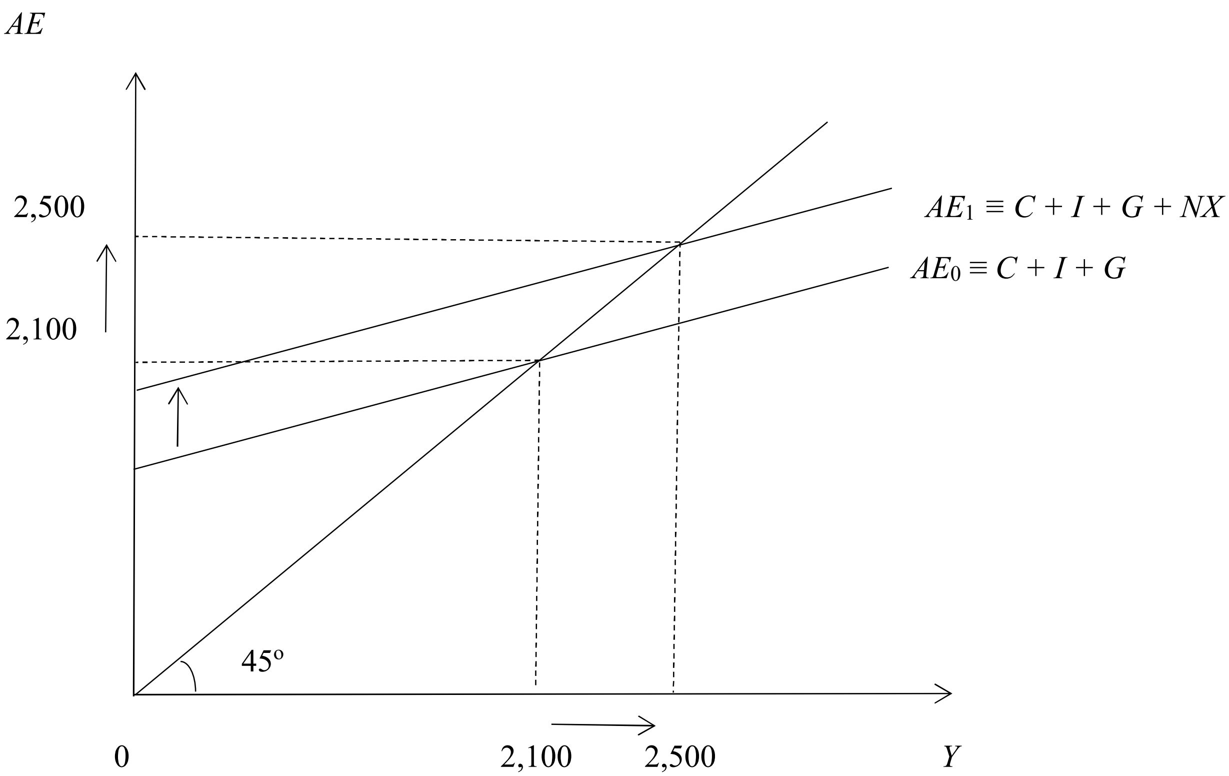

Figure 12.3: Adding Net Exports to the Model

Source: M. Ashraf

Figure 12.3: Aggregate output or income (*Y*) is on the horizontal axis, and planned aggregate expenditure (*AE*) is on the vertical axis. The 45-degree line is reference line. AE_0 represents planned aggregate expenditure before adding net exports (*NX*) to the model. AE_1 represents planned aggregate expenditure after adding *NX* to the model. The vertical distance between AE_0 and AE_1 represents the amount of *NX*. Because of this upward shift of the *AE* curve, the new equilibrium output level is 2,500.

As we learned in Chapter 7, in Figure 12.3, the 45-degree line, serves as a reference line; it is the loci of the points where the values of the two variables on the horizontal axis and the vertical axis are the same. The equilibrium takes place where aggregate output, *Y*, is equal to planned aggregate expenditure, *AE*. Just as in Table 12.3, when we add net exports to the model, and shifted the *AE* curve up by the amount of *NX*, equilibrium output increases from 2,100 to 2,500.

Compare the equilibrium level of income in Table 12.3 with the equilibrium level of income in Table 7.6, where we did not have net exports. Note the difference of equilibrium level of income, 2,100, in Table 7.6 versus the equilibrium level of income, 2,500, after adding net exports, 80, in Table 12.1. Why did this change take place? We answer this question next.

Net Exports Multiplier

How much will output change when net exports change by a certain amount, ΔNX? That is, what is the value of the net-exports multiplier?

To answer this question, first, just as we did in Chapter 7, we rewrite the equilibrium condition, Equation (12.2), and substitute the aggregate consumption by the aggregate consumption function, Equation (7.6). This gives us,

$$Y = \alpha + \beta(Y_d) + I + G + NX \qquad (12.3)$$

Just as in Chapter 7, we will bring Y the left-hand side and solve the equation. This gives us

$$Y = \left[\frac{1}{1-\beta}\right] \times (\alpha - \beta T + I + G + NX) \qquad (12.4)$$

And just as in Chapter 7, we can rewrite Equation (12.4) in change form, and we get,

$$\Delta Y = \left[\frac{1}{1-\beta}\right] \times (\Delta\alpha - \beta\Delta T + \Delta I + \Delta G + \Delta NX) \qquad (12.5)$$

In Equation (12.5), the term, $\left[\frac{1}{1-\beta}\right]$, is the net exports multiplier. This states that when net exports change by an amount, ΔNX, the change in output, ΔY, is equal to the change in net exports times the multiplier, $\left[\frac{1}{1-\beta}\right]$, holding changes in other variables constant.

Compare the value of multipliers presented in Chapter 7, the consumption function intercept multiplier, the planned investment spending multiplier, and the government-spending multiplier. Note that all these multipliers are represented by the same equation, $\left[\frac{1}{1-\beta}\right]$. This is not an accident; all these multipliers have the same basic model that we saw in Chapter 7. The only variable that we are adding here is net exports, NX. Compare Equation (7.25) with Equation (12.5) to see this.

Now back to the question of why did equilibrium output change from 2,100 to 2,500 after we added NX to Table 12.1? The change in equilibrium output, 400, is not an accident. Here is why?

Recall that in Table 12.1, MPC is equal to 0.8. This means that the value of multiplier is 5. We can get the value of multiplier by plugging in MPC into the net-exports multiplier, $\left[\frac{1}{1-\beta}\right] = \left[\frac{1}{1-0.8}\right] = 5$. Given than the change net exports, ΔNX, is 80—net exports changed from zero to 80—, and the other variables in Equation (12.5) did not change (i.e., $\Delta\alpha = \beta\Delta T = \Delta I = \Delta G = 0$), the change in output, ΔY, will be equal to 400 (= 5 × 80). Indeed, this is exactly what we see when we compare the equilibrium level of output in Table 7.6 with the equilibrium level of output in Table 12.3—that is, 2,100 versus 2,500.

Exchange Rate

As we know, exports are the goods and services that that a country sells to the rest of the world. And imports are goods and services that a country buys from the rest of the world. When a US resident buys goods and services from the resident of foreign country, he/she (almost always) needs to convert US dollars into the foreign country's currency. The reason is that the seller residing in a foreign country sells her/his goods and services in that country's currency. So, if you want to buy goods and services from her/him, you much convert US dollars into that country's currency.

The reverse is also true: When a foreign economic agent—an individual, a firm, or a foreign government—buys goods and services from the US, the foreign economic agent must convert its country's currency into US dollars.

Let us take an example. Suppose you visit to Berlin, Germany, from Raleigh, NC. Euro is the currency that is used in Germany. When you arrive at the airport in Berlin, you decide to take train from the airport to center city. To purchase train ticket, you will need to convert US dollars into euros. You will also need to convert US dollars into euros to pay for the hotel, dinners, and other expenses while in Berlin.

Now suppose that someone visits Raleigh, NC, from Berlin. Since US dollar is the currency used in Raleigh, the visitor from Berlin will need to convert euros into US dollars to take a cab, pay for the hotel, dinners, and other expenses.

I used "almost always" because in a few cases, countries may use a common currency. One such example is the euro-are countries. There are 20 countries that have adopted the euro as their currency.[3] So, if you were a resident of, say, Germany, and you wanted to buy goods and services from someone in France, you will not need to change your currency; both Germany and France use the same currency.

Note also, that in some situations, a country may substitute its currency with another country's currency. This referred to as dollarization. Note that "dollarization" does not mean that the country is using US dollars as money; it is a term used to refer to the situation when one country adopts another country's currency. It does not have to be US dollar. Developing countries that are going through political and economic turmoil tend to adopt another stable country's currency. For instance, in the aftermath of political and economic crises, Ecuador adopted US dollar as its legal tender in January 2000. Dollarization is different than adopting a common currency as the euro-area countries did.

Back to exchange rate: Exchange rate is the price of one country's currency in another country's currency. Let us continue our example to you visiting Berlin. When you convert US dollars into euros to pay for various expenses, the price of a euro that you pay in terms of US dollars is called dollar-euro exchange rate. We can use the following formula to calculate the dollar-euro exchange rate.

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[3] The euro-area countries. Austria, Belgium, Croatia, Cyprus, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Portugal, Slovakia, Slovenia, and Spain.

$$Dollar\ (\$) - Euro\ (€)\ Exchante\ Rate = \frac{€}{\$} \tag{12.6}$$

Suppose that you pay 110 US dollars to buy 100 euros. Using Equation (12.6) we get,

$$Dollar\ (\$) - Euro\ (€)\ Exchante\ Rate = \frac{€}{\$} = \frac{€100}{\$110} \approx €\ 0.91$$

That is, each US dollar is worth (approximately) 0.91 euros. Note that this formula is the same that we used to calculate opportunity cost in Chapter 2. Indeed, exchange rate is nothing more than the opportunity cost of one currency in terms of another currency. In this example, the opportunity cost of one US dollar, in terms of euros is (approximately) 0.91 euros.

Note that we can calculate the exchange rate of a foreign currency in terms of the domestic currency, or equivalently we can calculate the exchange rate of the domestic currency in terms of a foreign currency, as we did here. Both ways of calculating exchange rate are correct so long as you keep track of how you have calculated the exchange rate.

Using the example of US dollar and euro exchange rate, if we were to calculate the dollar-euro exchange rate as $\frac{US\ Dollars}{Euros} = \frac{\$110}{€100} = \$1.10$, it will tell us that the price of each euro in terms of US dollars is one dollar and ten cents. These are both equivalent ways to reaching the same answer. The reason is that $\frac{1}{\frac{US\ Dollars}{Euros}} = \frac{Euros}{US\ Dollars}$.

By way of establishing convention, we will calculate exchange rate as the price of a US dollar in terms of a foreign currency. Using the example of the dollar-euro exchange rate, we will calculate exchange rate as we did in Equation (12.6). That is, $\frac{€}{\$}$.

Appreciation and Depreciation of Currency

When the price of domestic currency, in terms of a foreign currency, increases, we say that domestic currency has appreciated. And when the price of the domestic currency in terms of foreign currency decreases, we say that the domestic currency has depreciated. Using our notation, the quantity, $\frac{€}{\$}$, decreases. Now the reverse is happening, the denominator in $\frac{€}{\$}$ is increasing, leading to a decrease in the quantity $\frac{€}{\$}$.

For instance, if the US dollar became more expensive in terms of the euro, we would say that the US dollar has appreciated. And if the US dollar became cheaper in terms of the euro, we would say that the US dollar has depreciated. Often in the press, an appreciation of the US dollar is referred to as the US dollar strengthening, and a depreciation of the US dollar is referred to as the US dollar weakening.

When US dollar appreciates in value, using our notation, the quantity, $\frac{€}{\$}$, increases. This is because fewer US dollars are needed to purchase a euro—the denominator in $\frac{€}{\$}$ decreases. On the other hand, when the US dollar depreciates, the quantity, $\frac{€}{\$}$, decreases. The reason is that now more US dollars are needed to purchase a euro, the denominator in $\frac{€}{\$}$ increases, leading to a decrease in the quantity $\frac{€}{\$}$.

Nominal Exchange Rate versus Real Exchange Rate

The price of a country's currency in terms of another country's currency is the nominal exchange rate. In our example of the US dollar-euro exchange rate, we have calculated the nominal exchange rate. When we calculate exchange rate in terms of goods and services, we call it the real exchange rate. In other words, real exchange rate tells us the purchasing power of a country's currency. Most often, however, when you hear about the US dollar exchange rate in the press, they are referring to the nominal exchange rate. Since nominal exchange rate is the one most often quoted, we will use the nominal exchange rate in the discussion that follows.

How Are Exchange Rates Determined?

By now, it should not come as a surprise that the answer to this question is that the exchange rate is determined by the interaction of demand for and supply of a country's currency in the currency exchange market (i.e., foreign exchange market). That is, the forces of demand and supply lead to the equilibrium price of one country's currency in terms of the other country's currency. In our example, the exchange rate of the US dollar in terms of the euro is determined at the point where the quantity demanded of US dollars is equal to the quantity supplied of US dollars in the foreign exchange market.

Simple enough! But from where do the demand for and the supply of the US dollar come? Let us continue with our example of you visiting Berlin and converting US dollars into euros. When you converted US dollars into euros, you supplied US dollars, and demanded euros. And when the German resident visited Raleigh, and converted euros into US dollars, she/he demanded US dollars and supplied euros.

Net Exports and the Exchange Rate

Now we are ready to understand the relationship between net exports and exchange rate. Take the example of US dollar-euro exchange rate, $\frac{€}{\$}$, and the US net exports.

Recall that net exports are the difference between exports and imports. That is, $NX \equiv EX - IM$. See Equation (12.1).

Suppose that the US dollar appreciates—the quantity $\frac{€}{\$}$ increases because fewer US dollars are needed to buy a euro, the denominator decreases. Two things happen simultaneously. On the one hand, as the US dollar appreciates, US goods and services become more expensive for the residents of the euro-area countries. So, they buy fewer of the US goods and services. That is, the US exports decrease—$EX\downarrow$. On the other hand, with the appreciation of the US dollar, the goods and services produced in the euro-area countries become cheaper for the US residents. So, the imports in the US increase—$IM\uparrow$. Both these changes lead to a decline in net exports of the US—$NX\downarrow$.

The reverse happens when the US dollar depreciates. That is, the quantity $\frac{€}{\$}$ decreases because more US dollars are needed to buy a euro, the denominator increases. On the one hand, as the US dollar depreciates, US goods and services become cheaper for the residents of the euro-area countries. So, they buy more of the US goods and services. That is, the US exports increase—$EX\uparrow$. On the other hand, the goods and services produced in the euro-area countries become more expensive for the US residents. So, the imports in the US decrease—$IM\downarrow$. Both these changes lead to an increase in net exports of the US—$NX\uparrow$.

Figure 12.4 plots this negative relationship between the exchange rate and net exports.

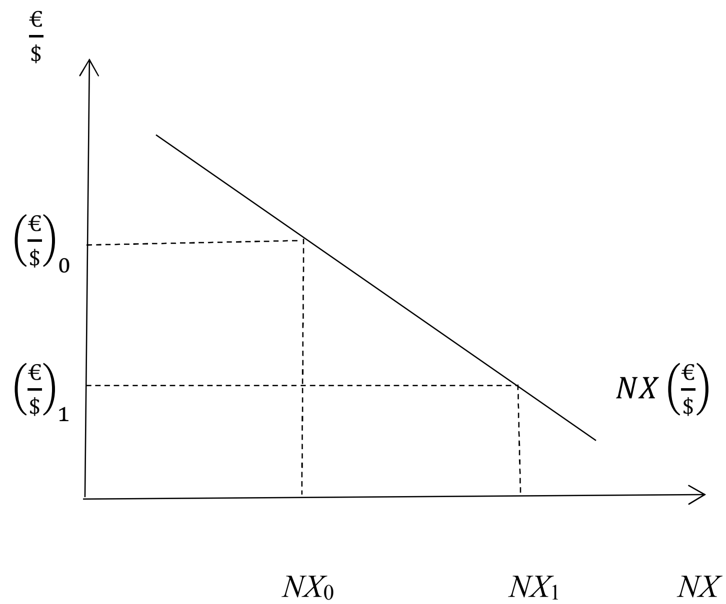

Figure 12.4: Net Exports

Source: M. Ashraf

Figure 12.4: On the horizontal axis, we have net exports (NX), and on the vertical axis we have the exchange rate $\left(\frac{€}{\$}\right)$. The net exports curve, $NX\left(\frac{€}{\$}\right)$, which is a negative function of the exchange rate, shows the negative relationship between the exchange rate and net exports.

In Figure 12.1 we plot the net exports curve in the exchange rate, $\left(\frac{€}{\$}\right)$, and net exports, ($NX$) space. The net exports curve, $NX\left(\frac{€}{\$}\right)$, represents the negative relationship between exchange rate and net exports. When the exchange rate is $\left(\frac{€}{\$}\right)_0$, next exports are NX_0. When the exchange rate decreases to $\left(\frac{€}{\$}\right)_1$, net exports increase to NX_1.

We can show the impact of change in net exports on the value of equilibrium output graphically. Figure 12.5 shows this impact.

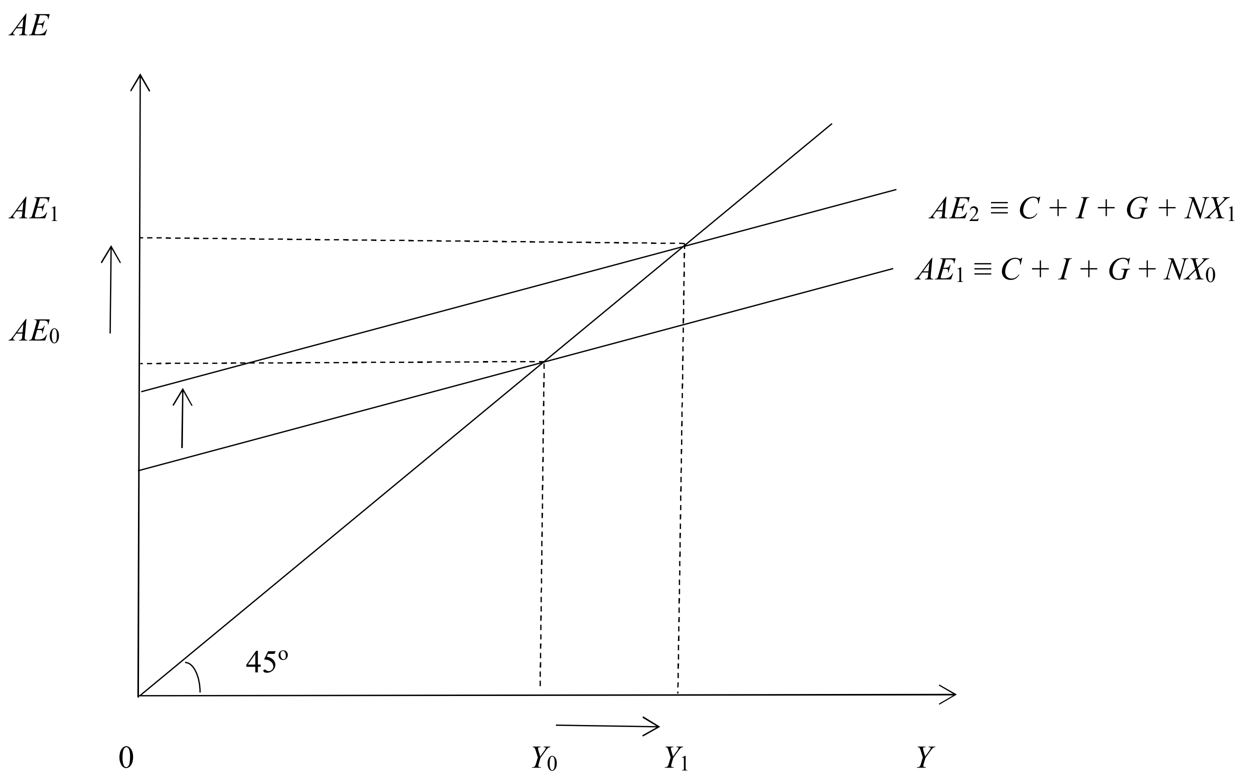

Figure 12.5: Impact of Change in Net Exports on Equilibrium Output

Source: M. Ashraf

Figure 12.5: Aggregate output or income (Y) is on the horizontal axis, and planned aggregate expenditure (AE) is on the vertical axis. The 45-degree line is reference line. AE_0 represents planned aggregate expenditure when net exports are equal to NX_0. AE_1 represents planned aggregate expenditure when net exports are equal to NX_1. Because of this upward shift of the AE curve, the equilibrium output level changes from Y_0 to Y_1.

In Figure 12.5, aggregate output or income (Y) is on the horizontal axis, and planned aggregate expenditure (AE) is on the vertical axis. The 45-degree line is reference line. AE_0 represents planned aggregate expenditure when net exports are equal to NX_0. AE_1 represents planned aggregate expenditure when net exports are equal to NX_1. Because of this upward shift of the AE curve, the equilibrium output level changes from Y_0 to Y_1.

Compare Figure 12.5 with Figure 12.3. As we saw earlier when we added net exports to the planned aggregate expenditure, the planned aggregate expenditure curve in the Keynesian Cross diagram, Figure 12.3, shifted up. The magnitude of the shift represented the addition of net exports. That, in turn, led to a change in the equilibrium output. The change in equilibrium output was equal to the change in net exports times the net exports multiplier. That is, $\Delta Y = \left(\frac{1}{1-MPC}\right) \times \Delta NX$. We see the same impact on output due to change in net exports.

To solidify your understanding, you may want to take another look at Table 12.3. When we added net exports worth 80 to the table—Column [7]—the equilibrium output changed from

2,100 to 2,500. As stated in that example, the net exports changed from zero to 80. That is, ΔNX = 80. Given the value of the net-exports multiplier—$\left(\frac{1}{1-MPC}\right) = \left(\frac{1}{1-0.8}\right) = 5$—the change in equilibrium output was equal to 400.

Chapter Conclusion

We started this chapter by showing how world trade as a percentage of world GDP has been increasing over the past three-quarters of a century. Given the importance of international trade, it is important to add net exports to our model to develop a better understanding of the functioning of the economy. In this chapter we did that; we added net exports to the model that we built in Chapter 7. We learned about exchange rates and how changes in exchange rate affected net exports. We also learned about the impact of changes in net exports on the equilibrium output; we calculated the net-exports multiplier.

Just by way of whetting the appetite, I mention in passing that a country's fiscal and monetary policies affect exchange rates, and hence net exports. A discussion of the topic, however, beyond the scope of this textbook. Students are encouraged to take intermediate macroeconomics and international trade courses to fully appreciate the impact of fiscal policy and monetary policy on the economy.

A Review of Terms

- Openness Index: It is the sum of exports and imports divided by the GDP. It is calculated as $Openness\ Index = \left(\frac{Exports+Impo}{GDP}\right) \times 100$.
- Foreign Exchange Market: The market in which currencies of different countries are traded.
- Nominal Exchange Rate: The price of one country's currency in terms of another country's currency.
- Real Exchange Rate: The exchange rate calculated in terms of goods and service. It expresses the purchasing power of a country's currency.
- Currency Depreciation: A decrease in the value of one country's currency in terms of another country's currency.
- Currency Appreciation: An increase in the value of one country's currency in terms of another country's currency.
- Net Exports Multiplier: It show the multiple by which equilibrium output will change due to a given change in net exports. It is calculated as $\left(\frac{1}{1-MPC}\right) \equiv \left(\frac{1}{MPS}\right)$. Note that it is identical to the government-spending multiplier, planned investment-spending multiplier, and autonomous consumption-spending multiplier.
- Trade Deficit: Exports < Imports
- Trade Surplus: Exports > Imports