Chapter 7: Equilibrium in the Flexible Price Model

QUESTIONS

In the flexible-price model, what keeps aggregate demand and the level of production equal to potential output?

In the flexible-price model, what makes the supply of funds – saving – equal to the demand for funds – investment – in financial markets?

When there is a change in saving or investment demand, what happens in this flexible-price model to the real interest rate, and why?

As government policies, the international economic environment, or other features of policy or the economic environment change, what happens in this flexible-price model to consumption, investment, government, and net export spending?

7.1 Full-Employment Equilibrium

Chapter 6 set out the determinants of the components of total spending. But knowing what determines consumption spending C, investment spending I, and net exports NX is not enough for understanding the macroeconomy. The macroeconomy is a system. The determinants of net exports are affected indirectly by the level of investment spending. Investment spending cannot be analyzed without knowing what has happened to consumption spending. But consumption spending depends on income, which in turn depends on the levels of net exports and investment spending.

We need a way of analyzing the macroeconomy as an interdependent system, rather than as a collection of parts we stack next to each other. What are the forces in the economy that make aggregate demand equal output?

There are two answers to the question. One answer is correct when we assume prices are fully flexible. A second – different – answer is correct when we assume prices are sticky. Starting in Chapter 9, we will look at the sticky-price model of the macroeconomy. In this chapter, we assume prices are fully flexible.

When prices are fully flexible, the amount of output the economy produces Y is always equal to its potential output Y*. So what guarantees that in a flexible-price economy, this full-employment level of output will also be an equilibrium level of output, where output equals aggregate demand?

It is the real interest rate r that assures equilibrium in a flexible-price macroeconomy. We saw in Chapter 6 that the real interest rate determines investment spending. Also, the real interest rate determines the real exchange rate ℓ, and this real exchange rate determines net exports. What you will learn in this chapter is that changes in the real interest rate are what make the demand for output AD equal to the available output – which in this flexible-price economy is the potential output Y*. We will call this the “flow-of-output approach” to understanding macroeconomic equilibrium in a flexible-price economy.
7.1.1 The Flow-of-Funds Approach

What you will also learn is that an equivalent approach is to start with the supply of funds – saving – and the demand for funds – investment. We will call this the “flow-of-funds approach” to understanding macroeconomic equilibrium in a flexible-price economy. The flow-of-funds through financial markets is key to understanding why the real interest rate brings the macroeconomy to equilibrium.

What is the real interest rate that it plays this role? The real interest rate is simultaneously the price the lender charges and the price of borrowing money. Money flows through financial markets. Savers try to find a productive, profitable, and interest-earning place to put their savings. Businesses try to find cheap financing for the investment projects they hope will be profitable.

Why do people lend money? Because they have no immediate spending use for it, and receiving some interest is better than having it sit underneath the mattress. Why do businesses borrow money? They borrow money because they hope to make a profit by using the funds they borrow to invest in new plant and equipment in order to expand their operations.

Thus the saving of households and others flow into financial markets, and the borrowing of businesses seeking to finance investment flow out of financial markets. This flow-of-funds through financial markets is a key set of economic transactions. The real interest rate is the price charged and received in this market for loanable funds. When the interest rate is at its long-run equilibrium level, the supply of loanable funds equals the demand for loanable funds. Financial markets are in balance.

7.1.2 Assumption of Price Flexibility

The key assumption that separates how we analyze equilibrium in this chapter from our analysis that begins in Chapter 9 is the assumption of price flexibility. In this chapter, we assume prices are fully flexible. (See Box 7.1 for an example of what it means for prices to be fully flexible.) We must confess: this assumption is not a realistic description of the short run. We use it because assuming prices are flexible is very helpful for analyzing the economy in the long run.

Box 7.1 If Prices Were Truly Flexible . . .

What does it mean for prices to be flexible? The authors work in Berkeley, where sometimes it seems every student in a morning class arrives with a paper coffee cup in hand. The lines at one of the most popular cafés, Café Strada, typically go out the door just before the 10:00 a.m. classes begin. Everyone in line needs to have their cappuccino, latte, or espresso if they’re going to make it through class. This is especially the case on our foggy, chilly mornings in late spring.

If prices were fully-flexible, the price of the coffee drinks would rise between the time the last student got in line and the time she reached the counter. The chill in the air increased demand. The time (morning) increased demand. In a world of fully flexible prices, the price of the product would respond by rising immediately. As you stood there, waiting to reach the counter, you’d see the price of your coffee drink rise. But 45 minutes later, when the sun had burned off the fog so the chill in the air was gone, and when everyone was already in class, the subsequent fall in demand would lead to falling prices. That swing in prices in immediate response to changes in demand would be an example of fully flexible prices.
This is, of course, an example on a micro scale. When the same story applies in industry after industry, then you have a macro story.

The long run model we already studied was Chapter 4's model of economic growth. Remember – or review – that when the saving rate increases in the long run, the capital-to-labor ratio and the capital-to-output ratio both increase. More saving produces a higher standard of living. But in Chapter 4, we had no story about how an increase in saving produces a higher capital-to-labor ratio. What is the mechanism? Chapter 7 provides the answer to that question: the real interest rate. You will learn in this chapter that when saving increases, real interest rates decline, and so investment spending increases. And more investment in plant and equipment produces a larger capital stock, which in the very long run increases the capital-to-labor ratio, the capital-to-output ratio, and output per worker.

Note that there will be a certain tension in this chapter. Prices are flexible: the time scale of the analysis must be long enough for prices to adjust so that there is not excess demand or excess supply in any of the economy’s markets. So this analysis of Chapter 7 applies to changes in the economy only if they take significantly longer than a month, or a quarter. On the other hand, we are going to assume that potential output \( Y^* \) does not change, which means that the analysis of Chapter 7 applies to changes in the economy only if they take significantly less than a decade. The usefulness of the flexible-price model thus tends to get squeezed between the sticky-price fluctuations model covered in later chapters and the long-run growth model covered earlier.

The long run model we already studied was Chapter 4's model of economic growth. Remember – or review – that when the saving rate increases in the long run, the capital-to-labor ratio and the capital-to-output ratio both increase. More saving produces a higher standard of living. But in Chapter 4, we had no story about how an increase in saving produces a higher capital-to-labor ratio. What is the mechanism? Chapter 7 provides the answer to that question: the real interest rate. You will learn in this chapter that when saving increases, real interest rates decline, and so investment spending increases. And more investment in plant and equipment produces a larger capital stock, which in the very long run increases the capital-to-labor ratio, the capital-to-output ratio, and output per worker.

Note that there will be a certain tension in this chapter. Prices are flexible: the time scale of the analysis must be long enough for prices to adjust so that there is not excess demand or excess supply in any of the economy’s markets. So this analysis of Chapter 7 applies to changes in the economy only if they take significantly longer than a month, or a quarter. On the other hand, we are going to assume that potential output \( Y^* \) does not change, which means that the analysis of Chapter 7 applies to changes in the economy only if they take significantly less than a decade. The usefulness of the flexible-price model thus tends to get squeezed between the sticky-price fluctuations model covered in later chapters and the long-run growth model covered earlier.

But before we get too far ahead of ourselves, let’s build the model.

**RECAP: Full-Employment Equilibrium**

In a flexible-price economy, real output \( Y \) always equals potential output \( Y^* \). At equilibrium in output markets, this potential output \( Y^* \) will equal aggregate demand \( AD \); this is the flow-of-output approach. We can also look at equilibrium with the flow-of-funds approach; saving equals investment in equilibrium. Changes in the real interest rate \( r \) will take the economy to equilibrium.

**7.2 Two Approaches: One Model**

The goal of this chapter is to show how the real interest rate assures full-employment equilibrium in an economy with flexible prices. At equilibrium, two statements will be true: the supply of funds will equal the demand for funds, and aggregate demand for output will equal potential output. Both statements are true because there are two approaches to this one flexible-price model. In this section, we will show that these two approaches – the “flow-of-funds” approach and the “flow-of-output” approach – are mathematically equivalent.

Why, if the two approaches to this one model are equivalent mathematically, do we bother with two approaches? The answer is worth remembering, because this will not be the last time in your studies of economics that a second, mathematically equivalent, approach is suddenly substituted for an approach you have already figured out. There are times in economics – and this is one of them – when a
mathematically equivalent approach has much better economic intuition than the original approach you have already mastered. And the best economics is always the most intuitive story.

There are two ways to show that the flow-of-funds approach and the flow-of-output approach are equivalent ways of modeling the flexible-price economy. We can show the equivalence with algebra. And we can show the equivalence using the drawing introduced in Chapter 2 of the economy’s circular flow. Let’s start with the circular flow, depicted in Figure 7.1.

Figure 7.1 The Circular Flow Diagram
This version of the circular flow is complicated by the addition of the government and financial markets to the diagram. Not all final goods and services are bought by households. Some are bought by the government, which taxes to raise resources to finance itself. Some are bought by businesses seeking to invest, which raise the needed resources by issuing stock, issuing bonds, and borrowing — all of which take place in financial markets. This version is also complicated by its recognizing that there is a world outside a world that buys the products of domestic businesses and that invests through domestic financial markets.
7.2.1 Using The Circular Flow Diagram
Goods and services – output – are produced in businesses, generating income (the blue flow) for households. Household income includes not just wage and salary income, but interest income, rent income, retained business earnings, and more. Households can do three things with this income (the green flows): consume goods and services that are produced by businesses, pay net taxes to government, or save – household saving – in financial markets. With the net tax revenues, government can buy goods and services from businesses (the pink flow) or accumulate a surplus (green flow) which it saves in financial markets. Some goods and services are imported from other countries, so not all of the spending for goods and services flows back to domestic businesses; some of it flows to the rest of the world. Imports are at least partially offset by our exports of goods and services to other countries. The difference – imports less exports – represents funds from our economy that accumulate in the rest of the world. This net inflow of financial capital from the rest of the world (red flow) is saved in financial markets.

The financial markets lend the funds saved by households, government, and the rest of the world to businesses, which use the funds to invest in plant and equipment (pink flow). Total saving \( S \) is the sum of household saving \( S^H \), government saving \( S^G \), and foreign saving by the rest of the world \( S^F \). So through the financial markets, total saving \( S \) equals investment \( I \). This is the “flow-of-funds” approach to equilibrium.

The sum of consumption spending (pink flow from households), government spending (pink flow from government), investment spending (pink flow from financial markets), less the net imports (red flow to rest of the world) flows into businesses. This is aggregate demand. Businesses produce output in response to this aggregate demand. So through the output markets, aggregate demand equals output. This is the “flow-of-output” approach to equilibrium.

And the output produced by businesses generates income for households. Off we go on another round through the circular flow.

The circular flow diagram is one way to understand that the flow-of-funds and flow-of-output approaches to the macroeconomy are equivalent. We can also demonstrate that equivalence a second way: Algebra.

7.2.2 Using Some Algebra
We start from the familiar flow-of-output equilibrium condition, and derive the flow-of-funds equilibrium condition. Begin with the definition of aggregate demand \( AD \):

\[
AD = C + I + G + NX
\]

Under the flow-of-output approach, aggregate demand \( AD \) and output \( Y \) are equal in macroeconomic equilibrium. When wages and prices are flexible, then output \( Y \) equals the economy’s potential productive output \( Y^* \). So in flow-of-output equilibrium, potential output \( Y^* \) will equal aggregate demand \( AD \). We have

\[
Y^* = C + I + G + NX
\]
Now a few steps will take us to the equivalent flow-of-funds equilibrium statement. Subtract consumption C, government purchases G, and net exports NX from both sides in order to move everything except for investment spending I to the left-hand side:

\[ Y^* - C - G - NX = I \]

And then a little math trick will give us economically meaningful concepts: subtract and add net taxes T on the left-hand side by subtracting it from income Y* and adding it to -G. Add some parentheses so we can group terms by economic concepts:

\[ (Y^* - T - C) + (T - G) + (-NX) = I \]

Now let’s step back and look at what this equation means.

### 7.2.3 Unpacking the Flow-of-Funds Equation

The right-hand side of this equation is simply investment spending I. Under the flow-of-output approach, investment spending is simply spending by firms to build factories and structures and boost their productive capacity. But under the flow-of-funds approach, we think of investment I not as the output that businesses buy, but as the funds that businesses allocate to buying these investment goods. Investment spending I is the flow of funds out of financial markets to businesses which then use the funds to undertake investment. It is the demand for loanable funds.

The left-hand side of the equation measures the total saving flowing into financial markets from three different groups – households (which, remember, include not only the workers but also the owners of businesses), the government, and the rest of the world (see Figure 7.2).

The first term \( Y^* - T - C \) is equal to household saving \( S^H \). In this flexible-price model, potential output \( Y^* \) is equal to real output. Output and household income are always equal. So \( Y^* \) is just household income. Subtract net taxes T and consumption spending C from household income \( Y^* \) and what is left? What is left is household saving – the flow of funds from households into financial markets – because saving is the only thing that households do with income other than pay it to the government as taxes and spend it on consumption goods.

The second term \( T - G \) is equal to government saving \( S^G \). T is simply the taxes the government collects minus the transfer payments it makes to individuals. G is government purchases. So \( T - G \) is the...
difference between the taxes that the government collects and the transfer payments and purchases the government makes. When $T - G$ is positive, the government is running a budget surplus. The surplus is government saving $S^G$. When $T - G$ is negative, the government is running a deficit (as it is today). Then $S^G$ will be less than zero.

The last term — the opposite of net exports, $-NX$ — is foreign saving $S^F$. It is the capital inflow, the net flow of funds that the rest of the world channels into domestic financial markets. As Figure 7.3 illustrates, net exports are the difference between the dollars foreigners spend buying our exports and the dollars earned by foreigners selling us imports. If net exports are less than zero — which they typically are for America — foreigners have dollars left over after they buy all our exports they want. These internationally-owned dollars flow into financial markets. They aren’t spent buying our exports, and the only other useful thing the rest of the world can do with them is save them. (When net exports are positive, this term has a different interpretation. It is the net amount of domestic saving that is diverted into international financial markets — the amount of saving that does not show up as loanable funds available to finance investment at home, but instead finance investment abroad.)

We have derived the flow-of-funds equilibrium equation. The three left-hand side terms of

$$(Y* - T - C) + (T - G) + (-NX) = I$$

are the three flows of purchasing power into the financial markets: household saving $S^H$, government saving $S^G$, and foreign saving $S^F$. Added together they make up total saving $S$, which is the supply of loanable funds. The demand for loanable funds is simply investment spending $I$ — the right hand side of the equation above. So the flow-of-funds equilibrium equation can also be written

$$S^H + S^G + S^F = I$$
What we have shown is that the flow-of-output equilibrium condition – output equals aggregate demand – is equivalent to the flow-of-funds equilibrium condition – saving equals investment. When one statement is true, the other must also be true. When one is false, the other must also be false. If supply equals demand in the market for loanable funds:
\[ S^d + S^g + S^f = I \]
then aggregate demand in the flexible-price economy is equal to full-employment output. And if output equals aggregate demand in the markets for goods and services:
\[ Y^* = C + I + G + NX \]
then the supply and demand in the flow of funds through financial markets balances as well. (Although, as Box 7.2 points out, the relationship between the supply and demand for funds is not direct.)

**RECAP: Two Approaches: One Model**
We can approach equilibrium in two ways. One is the flow-of-output approach: in equilibrium, output equals aggregate demand. The other is the flow-of-funds approach: in equilibrium, saving equals investment. We can show that these two approaches are equivalent using the circular flow diagram. We can also show they are equivalent algebraically, by starting with one equilibrium condition, \( Y = AD \), and deriving from it the other, \( S = I \).

---

**Box 7.2: Financial Transactions and the Flow of Funds: Some Details**

The relationship between the funds that flow into and the funds that flow out of financial markets is indirect. When the government runs a surplus, it does not directly lend money to a business that wants to build a new factory. Instead, the government uses the surplus to buy back some of the bonds that it previously issued. The bank that owned those bonds then takes the cash it received from the government and uses it to buy some other financial asset – perhaps bonds issued by a corporation.

Similarly, households or foreigners using financial markets to save rarely buy newly issued corporate bonds. Nor do they often buy shares of stock that are part of an initial public offering. On the rare occasion when they do, they are directly transferring purchasing power to a company undertaking investment. Instead, households and foreigners usually save by purchasing already-existing securities or simply depositing their wealth in a bank.

The relationship between the flows of funds into and out of financial markets is indirect, but it is very real.

---

**7.3 The Real Interest Rate Adjusts to Assure Equilibrium**

In a flexible-price economy, equilibrium exists when aggregate demand equals potential output. But what economic forces will make aggregate demand equal potential output? The determinants of \( C, I, G, \) and \( NX \) are things like consumers' optimism, interest rates, the sensitivity of exports to exchange rates, and so on. These determinants seem to have nothing at all to do with the determinants of \( Y^* \). It is the
form of the production function and the available resources on the supply side that determine the level of potential output $Y^*$. So what will make the sum of $C$, $I$, $G$, and $NX$ equal potential output?

The answer is: the real interest rate $r$ plays the key role. If government policy, the international economic environment, or domestic conditions change, then the real interest rate changes in response. In turn, the change in the real interest rate causes changes in investment spending, the exchange rate, and net exports. The real interest rate will continue to change until the economy is again at equilibrium. It is these changes in the real interest rate that assure that in the long run a flexible-price macroeconomy reaches and stays at equilibrium where aggregate demand equals potential output.

But how could a disequilibrium between aggregate demand and output lead to a change in the real interest rate? Here is where the flow-of-funds approach comes in. Equilibrium with aggregate demand equal to potential output is equivalent to equilibrium with the supply of funds – saving – equal to the demand for funds – investment. When aggregate demand is less than potential output, saving is greater than investment. And when aggregate demand is greater than potential output, investment is greater than saving.

When the supply of funds – saving – is greater than the demand for funds – investment – what will happen? The price of funds – the real interest rate $r$ – will fall. Some financial institutions – banks, mutual funds, venture capitalists, insurance companies, whatever – will find purchasing power piling up as more money flows into their accounts than they can find good projects to commit to. They will try to underbid their competitors. How do they underbid? They underbid by saying that they will accept a lower interest rate than the current real interest rate.

As the real interest rate falls, two things happen. The number and value of investment projects that firms and entrepreneurs find it profitable to undertake rises. Investment spending rises, closing the gap between saving and investment. (And, not coincidentally, closing the gap between aggregate demand and potential output.) And net exports rise, decreasing foreign saving and further closing the gap between saving and investment. (And, again not coincidentally, further closing the gap between aggregate demand and potential output.) The process will stop when the interest rate $r$ has fallen just enough to make the flow of saving into the financial markets equal to investment. So that’s the big bottom line: the real interest rate assures equilibrium in the flexible-price model because both investment and saving respond to changes in the real interest rate.

**7.3.1 Graphing the Saving-Investment Relationship**

We can depict these relationships graphically. Investment spending is the demand for loanable funds. As the real interest rate $r$ falls, investment spending $I$ rises. The graph in Figure 7.4 should remind you of Figure 6.10, though we have switched the horizontal and vertical axes.
Total saving is the supply of loanable funds. It has three components: household saving $S^H$, government saving $S^G$, and foreign saving $S^F$. Let’s start with foreign saving. As the real interest rate $r$ falls, foreign saving $S^F$ falls. The intuition is a bit roundabout. As the real domestic interest rate falls, the nominal and real exchange rates rise. (If you want to review why this is so, see Section 6.3.) When the real exchange rate $e$ rises, gross exports $GX$ rise. When gross exports rise, net exports $NX$ rise, which is the same thing as saying net imports ($-NX$) fall. When net imports fall, net foreign inflow of financial capital falls. And net foreign inflow of financial capital is just a long phrase for foreign saving, $S^F$.

The relationship is depicted in Figure 7.5. It is important to remember that foreign saving can be either negative or positive. When a country runs a trade surplus, foreign saving is negative. When it runs a trade deficit, as the United States has been doing for many years, foreign saving is positive. To remind ourselves that foreign saving can be negative or positive, we draw the foreign saving curve crossing the vertical axis, as in Figure 7.5.

Household saving is another component of total saving. Household saving $S^H$ is what’s left over after net taxes $T$ and consumption $C$ have been subtracted from household income $Y^*$. Consumption
spending depends on income, as do net taxes. But as we noted in Appendix 6.A real interest rates do not affect consumption. And because we are assuming that household income is always equal to potential output $Y^*$, which depends upon the supplies of inputs and the production function, then income is not dependent upon the real interest rate. And since neither the tax rate nor income depend upon the real interest rate, net taxes don’t change when the real interest rate changes. So household saving $S^H$ does not change when the real interest rate changes. We show the relationship between household saving and the real interest rate as a vertical line, as in panel (a) of Figure 7.6.

Government saving $S^G$ is the final component of total saving. But its value also does not depend upon the value of the real interest rate. So here again, we would show the relationship between government saving and the real interest rate as a vertical line. If government saving was negative – if the government was running a deficit – then the government saving line would be to the left of the vertical axis, as shown in panel (b) of Figure 7.6.

Total saving is the sum of foreign, household, and government saving. Graphically, we take the foreign saving line, shift it over by the amount of household saving, and shift it over again – or in the case of a government budget deficit shift it back – by the amount of government saving. This gives us the relationship between total saving $S$ and the real interest rate. We do this in Figure 7.7.
We now have the two sides of the loanable funds market. The demand for loanable funds is investment spending, depicted in Figure 7.4. The supply of loanable funds is total saving, depicted in Figure 7.7. Bring them together to see the market for loanable funds, as we have done in Figure 7.8. When total saving $S$ equal investment demand $I$, the market for loanable funds will be in equilibrium.

7.3.2 The Adjustment to Flow-of-Funds Equilibrium
Suppose that the real interest rate is initially greater than the equilibrium real interest rate, as shown in Figure 7.9. Saving will exceed investment by the amount labeled “excess saving.” Some lenders will offer to accept a lower interest rate. As interest rates fall, investment spending will increase, moving along the investment demand curve. And as interest rates fall, foreign saving will fall, moving along the total saving curve. The macroeconomy will move to the equilibrium interest rate, where saving equals...
investment. And, as we showed above, when saving equals investment, aggregate demand equals potential output. When prices are fully flexible, the real interest rate adjusts to assure full employment.

**Figure 7.9 Excess Saving in the Market for Loanable Funds**

**RECAP: The Real Interest Rate Adjusts to Assure Equilibrium**

In the flexible-price model, the real interest rate is the price that equilibrates the market for loanable funds — the place where saving flows into and investment financing flows out of financial markets. What happens if the flow of funds does not balance — if at the current real interest rate, the flow of saving into the financial markets exceeds the demand by corporations and others for purchasing power to finance investment? Then the price of loans — the real interest rate — will fall, until the supply of funds — saving — equals the demand for funds — investment. Conversely, if investment demand exceeds saving, the real interest rate will rise. When the real interest rate is at its equilibrium value, saving equals investment, \( S = I \), and aggregate demand equals full-employment real GDP, \( AD = Y^* \).

7.4 Using the Model: What Makes the Real Interest Rate Change?

We can use this graphical way of looking at the flow-of-funds to figure out what happens to the equilibrium real interest rate when there is some change in the economic environment or in economic policy. Some changes make either the saving or the investment curve shift. Other changes also affect the slope of the saving or investment curve. When one or both of the curves shift or change slope, there will be a new equilibrium real interest rate. Let’s take a look.

7.4.1 The Effect of a Change in Saving

Total saving \( S \) is the sum of household, government, and foreign saving. So a decrease in any of those components of \( S \) will decrease total saving. It could be a decrease in household saving, decreasing \( S^H \). It could be an increase in government spending which decreases government saving \( S^G \). It could be a decrease in our imports, which decreases foreign saving \( S^F \). Any of these changes would be shown by a shift to the left of the total saving \( S \) curve, as shown in Figure 7.10.

As an example, let’s suppose the economy is in equilibrium when policy makers decide to increase
annual government purchases by the amount $\Delta G$. More government purchases mean less government saving. Less government saving means that the supply-of-saving in the loanable funds market is shifted to the left: at each possible interest rate, there is less in the way of total saving flowing into the loanable funds market.

At the original real interest rate, investment demand will now exceed total saving. This shortfall in saving will cause the real interest rate $r$ to rise; some borrowers bid up interest rates in an attempt to obtain funding for their investment projects. But the rising interest rate squeezes other borrowers out of the market; the total quantity of funds demanded for investment falls, moving us up and to the left along the investment demand curve. The rising real interest rate also lowers the real exchange rate $g$, which increases foreign saving flowing into domestic financial markets, moving us along the second total saving curve. The real interest rate will rise until saving again equals investment. In the end, the flow-of-funds market settles down to equilibrium at a new, higher equilibrium interest rate $r$ with a new, lower level of investment.

When the supply of funds $S$ decreases, the real interest rate $r$ rises, investment spending falls, and (not surprisingly) the amount of saving falls. But notice what has happened. The final change in investment and saving, shown along the horizontal axis, is smaller than the change in saving that threw the flow-of-funds markets out of equilibrium. How could that be? The final change in saving is smaller than the initial change in saving because foreign saving rose when the real interest rate $r$ rose. But this rise in foreign saving is relatively small so, overall, saving still falls.
A drop in household saving $S^H$ would be analyzed the same way, as would a drop in foreign saving $S^F$ that occurred at every interest rate. In both of these cases, the total saving curve shifts to the left, raising the real interest rate, increasing foreign saving slightly to offset part but not all of the initial drop in saving, and decreasing investment demand.

A tax cut has a slightly different effect. It is very like the effect of a government purchases increase. But because a tax cut increases disposable income and the marginal propensity to consume is less than 1, so there is one difference. The difference is that a portion of the addition to household income from the tax cut shows up as household saving. So the initial shift to the left of the Total Saving curve is smaller than the drop in government saving by the amount of this change in household saving. Otherwise the effects are very similar: like a government purchases increase, a tax cut leads to an increase in the interest rate, a rise in foreign saving, and a fall in investment spending.

Why do economists make such a big deal out of a decrease in government saving – whether it’s due to a decrease in taxes or an increase in government purchases? Because as Figure 7.10 illustrates, in the long run, a decrease in government saving – an increase in the budget deficit – makes interest rates rise, which reduces investment spending. And remember one of the lessons of Chapter 4: investment spending increases the capital stock, which ultimately increases the standard of living. In the long run, increases in government borrowing “crowd out” – reduce – investment spending which, all else equal, slows the country’s rate of economic growth while the economy adjusts to a lower balanced growth path.

7.4.2 The Effect of a Change in Investment Demand

We can also use the flow-of-funds graph to see the effect of an increase in investment $I$. Suppose that businesses suddenly become more optimistic about the future and increase the amount they wish to spend on new plant and equipment (as they did in the late 1990s). What would be the effect of such a domestic investment boom?

Investment – the demand-for-loanable-funds curve – shifts to the right, as Figure 7.11 shows. At the initial interest rate, investment demand now exceeds saving. Firms that wish to increase their investment spending will bid up interest rates as they compete for scarce loans. As interest rates rise, two things happen. One, other firms will decrease their investment spending because their planned investment projects are no longer profitable at these now-higher interest rates – a movement along the new investment demand curve. Also, the higher real interest rate leads to a fall in the real exchange rate, to a fall in net exports, and thus to an increase in foreign saving flowing into domestic financial markets – a movement along the saving curve. In the end, the flow-of-funds market settles down to a higher interest rate with an increased level of saving and investment.
Notice what happened: The higher interest rates due to the first shift in investment led to a subsequent decrease in investment that partly – but not entirely – offset the initial shift. But investment did increase. What made the increase in investment possible? The increase in foreign saving. If saving had not increased in reaction to the higher interest rates, investment could not increase. Without an increase in saving, the shift in investment demand would make interest rates rise so much that investment spending fell right back to its initial position. Instead, when foreign saving increases with real interest rates, both saving and investment increase in response to increased business optimism.

**7.5 Calculating the Equilibrium Real Interest Rate: Algebra**

The flow-of-funds graphs let us figure out whether interest rates rise or fall in reaction to a change in policy or economic environment that affects investment demand or total saving. But what if we are policy makers who want to know the precise value of the real interest rate at equilibrium, and by how much the interest rate will change if we implement some policy? To figure out the value of the interest rate and how much it changes in reaction to a change in policy or economic environment, we need to do some algebra.

What we need are the equations for total saving S and for investment demand I. Equilibrium occurs when:

\[ S = I \]

Equilibrium occurs when the total saving equals the investment demand.
when saving $S$ equals investment $I$, so we will just set the equations equal to each other. Then we solve for the real interest rate.

It sounds straightforward – and it is. But the equations can get quite messy. Don’t get discouraged. If the notation and the algebra get to be a bit much, remember that all we’re doing is setting saving equal to investment and solving for $r$.

### 7.5.1 The Formula for the Equilibrium Real Interest Rate

Start with total saving, which is the sum of household saving $S^H$, government saving $S^G$, and foreign saving $S^F$.

\[ S = S^H + S^G + S^F \]

Household saving is equal to total income $Y$ minus taxes $T$ minus consumption spending $C$. But since we are in a world of flexible prices (that’s our assumption in this chapter, remember), total income $Y$ is always equal to potential output $Y^*$. Consumption spending depends on baseline consumption $C_0$, the marginal propensity to consume $C_y$, the tax rate $t$, and potential income $Y^*$ (peek back at Section 6.2 to refresh your memory).

\[ S^H = Y^* - T - C = Y^* - tY^* - (C_0 + C_y(1 - t)Y^*) \]

Government saving is equal to net taxes $T$ minus government purchases $G$. As in Chapter 6, let net taxes be a constant proportion of income: $T = tY$. Government saving then equals

\[ S^G = T - G = tY^* - G \]

Notice that neither household saving nor government saving depend on the real interest rate. That is why we graphed household saving $S^H$ and government saving $S^G$ as vertical lines in Figure 7.6.

What about foreign saving $S^F$? Here the real interest rate plays a role. (Section 6.3 laid out the details.) Foreign saving is imports minus exports. The determinants of foreign saving are three parameters—the propensity to import $IM_y$, foreigners’ propensity to buy exports $X_f$, and the sensitivity of exports to the exchange rate $X_e$ — and three variables—foreign incomes $Y_f$, domestic total income $Y^*$, and the exchange rate $\varepsilon$.

\[ SF = -NX = (IM_y Y^*) - (X_f Y_f) - (X_e \varepsilon) \]

And it is the exchange rate that changes when the real interest rate $r$ changes:

\[ \varepsilon = \varepsilon_0 + \varepsilon_r (r - r_f) \]

where the real exchange rate $\varepsilon$ depends upon the baseline value of the real exchange rate $\varepsilon_0$, the sensitivity of the real exchange rate to changes in interest rates $\varepsilon_r$, the domestic real interest rate $r$, and the foreign real interest rate $r_f$.

So, because foreign saving depends on the exchange rate, and because the exchange rate depends on the interest rate, foreign saving $S^F$ depends on the real interest rate $r$. When the real interest rate rises, the total saving flow increases. Why? Because an increase in the real interest rate attracts foreign capital into domestic financial markets, and increases foreign saving. We can write this as:

\[ SF(r) = (IM_y Y^*) - (X_f Y_f) - (X_e \varepsilon r) = (X_e \varepsilon r - X_e \varepsilon r_f) \]

We write foreign saving as $SF(r)$ to remind ourselves that foreign saving depends on the real interest rate.
On the other side, demand for funds is simply investment spending. Use the investment equation from Section 6.2: When the real interest rate \( r \) rises, investment spending \( I \) falls:

\[
I(r) = I_0 - I_r r
\]

We write investment spending as \( I(r) \) to remind ourselves that the level of investment spending depends upon the real interest rate.

The flow-of-funds equilibrium is where supply and demand balance — where the supply of savings is equal to investment spending:

At equilibrium, \( S_H + S_G + S_F(r) = I(r) \)

So now we solve this equation for \( r \), the equilibrium real interest rate. The details of the derivation are given in Box 7.3. In equilibrium, the real interest rate \( r \) will equal

\[
r = \frac{I - (Y - C_0 - C_y(1-t)Y^*) + G - (I_M Y^* - X_f Y_f - X_e e - X_e r^*)}{I_e + X_e e}
\]

**Box 7.3 Deriving the Equilibrium Interest Rate Equation**

To derive the equation for the equilibrium real interest rate, we start from either the flow-of-output or the flow-of-funds equilibrium statement.

\[
Y = C + I + G + NX \quad \text{or} \quad S_H + S_G + S_F = I
\]

Because one equilibrium statement leads to the other — see Section 7.2 — many students like to start from the more familiar statement \( Y = C + I + G + NX \). If you do so, you’ll follow the same “plug-and-chug” steps that we use here. But here, let’s use the flow-of-funds approach, so we begin with the flow-of-funds equilibrium statement \( S_H + S_G + S_F = I \)

First, we need the expression for household saving:

\[
S_H = Y^* - C - T
\]

Substituting the equations for taxes and for consumption gives us

\[
S_H = Y^* - tY^* - C_0 - C_y(1-t)Y^*
\]

Next, we need the expression for government saving, into which we substitute the equation for taxes

\[
S_G = T - G = rY^* - G
\]

Finally, we need the expression for foreign saving

\[
S_F = -NX = IM - GX
\]

First we substitute the equations for imports and for exports

\[
S_F = IM_y Y^* - (X_f Y_f + X_e e)
\]

And then we substitute the equation for the real exchange rate

\[
S_F = IM_y Y^* - X_f Y_f - X_e (e_0 - e \gamma (r - r^*)) = IM_y Y^* - X_f Y_f - X_e e_0 + X_e e_\gamma \gamma (r - r^*)
\]
Remember the equation for investment

\[ I = I_0 - I_r \epsilon \]

Now “plug and chug”: Set saving – the sum of household, government, and foreign saving – equal to investment:

\[
\left( Y - Y^* - C_0 - C \frac{1}{1 - t} Y^* \right) + G = \left( IM \right) Y^* - X_f Y_f - X_e Y_e - X_r Y_r - I_0 + I_r \epsilon
\]

Notice that \( t Y^* \) cancels out. Make that cancellation and also move every term that includes the real interest rate to the left hand side, and every other term to the right hand side of the equation:

\[
I_r + X_e \epsilon = I_0 - \left( Y^* - C_0 - C \frac{1}{1 - t} Y^* \right) - G - \left( IM \right) Y^* - X_f Y_f - X_e Y_e - X_r Y_r
\]

Now isolate the real interest rate on the left hand side, and we’re done:

\[
\frac{I_r + X_e \epsilon}{I_r + X_e} = \frac{I_0 - \left( Y^* - C_0 - C \frac{1}{1 - t} Y^* \right) - G - \left( IM \right) Y^* - X_f Y_f - X_e Y_e - X_r Y_r}{I_r + X_e}
\]

### 7.5.2 Interpreting the Equilibrium Real Interest Rate Equation

What does that equation say? First look at the numerator. When \( I_0 \) increases – when business people become more optimistic – the real interest rate will increase. That is what we found in Figure 7.11.

When \( G \) increases – when the government runs a larger deficit, decreasing its saving – the real interest rate will rise. That is what we found in Figure 7.10.

But now we can figure out by how much the real interest rate will increase. The answer comes from looking at the denominator: \( I_r + X_e \epsilon \). The larger the denominator, the smaller the change in \( r \) when investor’s optimism rises.

Why? The first term \( I_r \) captures the change in investment due to a change in the real interest rate. The larger the sensitivity of investment to interest rates \( I_r \), the flatter the Investment demand curve; the more quickly investment spending will fall in response to a rise in interest rates (the movement along the now flatter investment curve). And the faster investment falls when interest rates rise, the smaller the rise in interest rates that is needed to restore equilibrium in the flow-of-funds.

The second term \( X_e \epsilon \) captures the change in foreign saving due to a change in the real interest rate. The larger is foreigners’ sensitivity to the exchange rate \( X_e \), or the larger the sensitivity of the real exchange rate to changes in interest rates \( \epsilon \), the flatter is the Total Saving curve; the larger is the change in foreign saving when the real interest rate rises (the movement along the now flatter S curve). And the larger the change in foreign saving, the less interest rates will be pulled up by a rise in investment demand.

Figure 7.12 gives two examples. In panel (a), the sensitivity of investment to changes in the real interest rate is very low. In panel (b), it is very high. Notice how a decrease in saving has a much larger effect on the real interest rate when \( I_r \) is small (panel a) than when it is large (panel b).
With the algebraic equations, we can calculate the equilibrium value of the real interest rate. To do so requires the value of all of those constants in the equilibrium equation above. Often times, however, the information is given to us not as a list of values of parameters such as the marginal propensity to consume \( C_y \) and so on, but as equations for the four components of aggregate demand. Here again, we can calculate the equilibrium value of the real interest rate. We just remember that equilibrium occurs when saving \( S \) equals investment \( I \) which is the same thing as aggregate demand \( AD \) equals output \( Y \).

Box 7.4 is an example of substituting in values of the parameters. Box 7.5 starts from the equations for Aggregate Demand and calculates the value of the equilibrium real interest rate.

**Box 7.4 Calculating the Equilibrium Real Interest Rate From Parameter Values**

Assume that the parameters of the model are:

- \( I_0 = 12,000 \) Baseline investment spending of $12,000 billion per year
- \( Y^* = 21,000 \) Potential output of $21,000 billion per year
- \( C_0 = 0 \) Baseline consumption spending
- \( C_y = 0.8 \) A marginal propensity to consume of 80 percent
- \( t = 0.375 \) Tax rate of 37.5 percent of income
- \( G = 2,000 \) Government spending of $2,000 billion per year
- \( IM_y = 0.3 \) Imports are 30 percent of total spending
- \( X_i = 0.1 \) A $1 billion increase in foreign income increases our exports by $0.1 billion
- \( Y_f = 1,000 \) Foreign income is $1,000 billion per year
- \( X_f = 600 \) A 1 point increase in the real exchange rate increases exports by $600 billion
- \( g_0 = 5 \) Baseline value of the real exchange rate is 5
- \( r_f = 0.05 \) The foreign real interest rate is 5 percent
- \( I_r = 9,000 \) A 1 percentage point fall in the interest rate \( (\Delta r = -0.01) \) increases investment
To find the equilibrium real interest rate, we substitute these values into the equation for the real interest rate, and then simplify.

\[ r = \frac{I - (Y - C_0 - C_t(Y^Y) + G - IM) - X - X_f - X_e - X_r f r}{I + X_e r} \]

\[ r = \frac{12000 - (21000 - 0.8(1 - 0.375)21000) + 2000 - 0.3(21000) - 0.1(1000) - 600(5) - 600(10)(0.05))}{9000 + 600(10)} \]

\[ r = 600 \quad 15,000 = 0.04 \]

When the economy is in equilibrium, the real interest rate will be 0.04 or 4 percent.

### Box 7.5 Calculating the Equilibrium Real Interest Rate from Aggregate Demand Equations

Suppose that we had the same economy that was described in Box 7.4, but instead of being given the values of the parameters, we were given the aggregate demand equations themselves:

\[ Y^* = 21,000 \]

\[ C = 0 + 0.8(1 - 0.375)21,000 = 10,500 \]

\[ I = 12,000 - 9,000r \]

\[ G = 2,000 \]

\[ GX = 0.1(1000) + 600(5 - 10(r - 0.05)) \quad \text{and} \quad IM = 0.3(21,000) \]

which simplifies to

\[ NX = -2,900 - 6,000r \]

Now how do we find the equilibrium real interest rate? We can’t exactly look at the equation \( C = \]

10,500 and pick out the values of \( C_0, C_t, t, \) and \( Y^* \).

In this case, we start from the flow-of-output equilibrium statement, and then solve for the equilibrium real interest rate. In equilibrium output \( Y^* \) equals aggregate demand AD which is the sum of consumption \( C \), investment \( I \), government \( G \), and net exports \( NX \).

\[ 21,000 = 10,500 + (12,000 - 9,000r) + 2,000 + (-2,900 - 6,000r) \]

\[ -600 = -15,000r \]

\[ 0.04 = r \]

When the economy is in equilibrium, the real interest rate will be 0.04 or 4 percent.

### 7.5.3 Determining the Effect of a Change in Policy on Aggregate Demand

With the graphs of saving and investment, we were able to figure out whether the interest rate would increase or decrease. Now we can figure out the effect of a change in policy on the real interest rate and on the values of consumption, investment, government, and net exports. Let’s use a familiar example: an increase in government purchases \( G \).

Because the equilibrium real interest rate is

\[ r = \frac{12000 - (21000 - 0.8(1 - 0.375)21000) + 2000 - 0.3(21000) - 0.1(1000) - 600(5) - 600(10)(0.05))}{9000 + 600(10)} \]

a change in government spending \( G \) will change the real interest rate \( r \) by
\[ \Delta r = \frac{\Delta G}{I_r + X_r \varepsilon_r} \]

The size of the change in the real interest rate depends on the sensitivity of investment to changes in the real interest rate, the sensitivity of exports to a change in the real exchange rate, and the sensitivity of the real exchange rate to a change in domestic real interest rates. That is, it depends on how much investment and saving change when interest rates change.

When government spending rises, what happens to the components of aggregate demand?

The change in government purchases has no effect on consumption. Because potential output does not change, national income does not change. Neither national income, baseline consumption, the tax rate, nor the marginal propensity to consume shifts, so there is no effect on the consumption function

\[ C = C_0 + C_Y (1 - t) Y^* \]

Thus the change in consumption spending is zero:

\[ \Delta C = 0 \]

The shift in government purchases has an indirect effect on investment. Investment depends on the interest rate, and the interest rate will change as a result of the change in government purchases. So from the investment equation:

\[ I = I_0 - r I_r \]

We see that investment spending will change by:

\[ \Delta I = -I_r \Delta r \]

Substituting in the change in the real interest rate gives us

\[ \Delta I = -I_r \left( \frac{\Delta G}{I_r + X_r \varepsilon_r} \right) \]

Investment spending will fall when government spending rises. This is what we call “crowding out”: The rise in government purchases increases real interest rates which “crowds out” private investment spending. The change in investment spending will be equal to the sensitivity of investment to the interest rate times the shift in the equilibrium real interest rate.

Nothing in the international economic environment – our propensity to import, foreigners’ propensity to export – changes when domestic fiscal policy changes. Nor does the level of potential output change. But the interest rate does change. Look back at our exchange rate equation

\[ g = g_0 - r (r - r_f) \]

A change \( \Delta r \) in the domestic real interest rate will change the exchange rate by an amount \(-X_g \Delta r\).

Looking back at our export equation, a change in the exchange rate of \(-X_g \Delta r\) will in turn change exports by an amount \(-X_g \Delta r\). So net exports will shift too:

\[ \Delta NX = \Delta GX - \Delta IM = -X_g \varepsilon r \Delta r - 0 \]

Substituting in the change in the real interest rate gives us

\[ \Delta NX = -X_g \varepsilon r \left( \frac{\Delta G}{I_r + X_r \varepsilon_r} \right) \]

Last, real GDP does not change because potential output does not change, and this is a long-run full-employment model, with real GDP always equal to potential output:
The change in aggregate demand is 0. The increase in government spending \( \Delta G \) is just offset by the decreases in investment spending and net exports. Aggregate demand does not change when government spending changes because this is a long-run model in which we have assumed that real GDP is always equal to its potential value \( Y^* \). In the long run, a change in one of the components of aggregate demand leads to a reallocation of aggregate demand, but doesn’t change the overall value of aggregate demand.

**7.5.4 Determining the Effect of a Change in Policy on Saving**

What about the effect of an increase in government purchases on total saving \( S \)? Since neither household income nor consumption changes, household saving does not change.

\[ \Delta S^H = 0 \]

Government purchases, however, do change. Since government saving is taxes minus government purchases, and since government purchases have gone up, the change in government saving is:

\[ \Delta S^G = -\Delta G \]

Foreign saving is the opposite of net exports, so foreign saving changes by:

\[ \Delta S^F = X_r e_r \left( \frac{\Delta G}{I_r + X_r e_r} \right) \]

Put all these pieces together and we get

\[ \Delta S = \Delta S^H + \Delta S^G + \Delta S^F = 0 + (-\Delta G) + X_r e_r \left( \frac{\Delta G}{I_r + X_r e_r} \right) \]

\[ \Delta S = -I_r \left( \frac{\Delta G}{I_r + X_r e_r} \right) \]

The change in total saving just equals the change in investment. This is precisely what Figure 7.10 led us to expect. The increase in government purchases reduces the flow of saving into financial markets. The interest rate rises. The higher interest rate reduced businesses’ plans for investment spending but also calls forth additional saving from foreigners. And so the higher interest rate has returned the flow of funds to balance.

Note that the falls in investment and in total saving are not as large as the rise in government purchases. This is also what Figure 7.10 led us to expect. The increase in government purchases reduced the flow of domestic saving into financial markets, but the increased flow of foreign-owned capital into the market partially offset this reduction. The extra foreign saving kept the decline in investment from being as large as the rise in government purchases, as Figure 7.10 showed.
What is the point of the march through the algebra? It allows us to calculate quantitative effects: to know not just that the interest rate will go up, but by how much the interest rate will go up. An example of how to actually calculate the change in the interest rate is provided in Box 7.6.

**Box 7.6 A Government Purchases Boom: An Example**

Start with the same economy that was described in Boxes 7.4 and 7.5. We have

- \( C_y = 0.8 \) A marginal propensity to consume of 80 percent
- \( t = 0.375 \) Tax rate of 37.5 percent of income
- \( X_x = 600 \) A 1 point increase in the real exchange rate increases exports by $600 billion
- \( r_e = 10 \) A one percentage point increase in the difference between domestic and foreign interest rates (\( \Delta r = 0.01 \) or \( \Delta r^e = -0.01 \)) decreases the real exchange rate by 0.1
- \( I_r = 9,000 \) A 1 percentage point fall in the interest rate (\( \Delta r = -0.01 \)) increases investment spending by $90 billion a year.

Initially we had an equilibrium real interest rate of 4 percent, \( r = 0.04 \).

Suppose that there is a sudden but sustained increase in government purchases of $150 billion a year. This sustained boom in spending increases the equilibrium real interest rate by 1 percentage point:

\[
\Delta r = \frac{\Delta G}{I_r + X_e} = \frac{150}{9,000 + 600 \cdot 10} = \frac{150}{15,000} = 0.01 = 1\%
\]

The new interest rate will be \( r = 0.05 \) or 5%. As a result, the equilibrium values of the components of aggregate demand will change by

\[
\Delta \text{AC} = 0
\]
\[
\Delta I = -I_r \left( \frac{\Delta G}{I_r + X_e} \right) = -9,000 \left( \frac{150 \text{ billion}}{9,000 + 600 \cdot 10} \right) = -90 \text{ billion}
\]
\[
\Delta G = +$150 \text{ billion}
\]
\[
\Delta NX = -X_e \epsilon_r \left( \frac{\Delta G}{I_r + X_e} \right) = -(600 \cdot 10) \left( \frac{$150 \text{ billion}}{9,000 + 600 \cdot 10} \right) = -$60 \text{ billion}
\]

And total saving will change by

\[
\Delta S = \Delta S^G + \Delta S^C + \Delta S^F = 0 + (-150) + (60) = -90 \text{ billion}
\]

Figure 7.13 illustrates the change in real interest rate, investment, and saving.
We can use this same approach to analyze any change to economic policy or the economic environment. Suppose business people become optimistic and increase their investment spending. The change in autonomous investment $\Delta I_0$ will generate an increase in the interest rate equal to $\frac{\Delta I_0}{I_0 + X_0 \varepsilon}$. Suppose the foreign real interest rate $r^f$ rises. The increase in $r^f$ will generate an increase in the domestic real interest rate equal to $\frac{X_0 \varepsilon r^f}{I_0 + X_0 \varepsilon}$. Suppose consumers become wealthier due to a stock market boom and so increase their baseline consumption by $\Delta C_0$. The change in $C_0$ will generate an increase in the real interest rate equal to $\frac{\Delta C_0}{I_0 + X_0 \varepsilon}$. Suppose the government cuts the tax rate by $\Delta t$. The tax cut will generate an increase in the real interest rate equal to $\frac{-C_t Y^t \Delta t}{I_0 + X_0 \varepsilon}$.

Notice the appearance, over and over again, of the expression $I_0 + X_0 \varepsilon$. It is the sum of two terms. The first, $I_0$, is the amount by which an increase in interest rates reduces investment spending. The second, $X_0 \varepsilon$, is the amount by which an increase in interest rates raises the inflow of capital from abroad. The sum of these two terms is a measure of how powerful changes in the interest rate are in stabilizing the loanable funds market, of how big a gap between supply and demand is closed by each change in the interest rate. If these two terms add up to a large number, shocks to the economy will have little effect on interest rates because only a small change in interest rates will be needed to powerfully affect both demand for funds to finance investment and the supply of savings. If these two terms add up to a small number, shocks to the economy will have large effects on interest rates, because big changes in interest rates will be needed to restore equilibrium.

**RECAP: Calculating the Equilibrium Real Interest Rate**

We can use the flexible-price model to calculate the equilibrium real interest rate. With the equations for the components of aggregate demand and the value of potential output, we would use the flow-of-output equilibrium condition – set aggregate demand equal to output – and solve for equilibrium $r$. Or, we can use the flow-of-funds equilibrium condition – set total saving equal to investment – and solve for equilibrium $r$. Either approach gives the same result. We can then use the equilibrium real interest rate and our knowledge of the economic environment to calculate the equilibrium values of the components of aggregate demand and total saving. We can also use the model to calculate how the economy’s equilibrium will change in response to changes in the environment or in policy.

### 7.6 Conclusion

This chapter has analyzed a flexible-price macroeconomy in the short run — a time span in which neither labor nor capital stocks have an opportunity to change enough to materially affect the level of potential output. It has taken a snapshot of the economy in equilibrium at a point in time. It has asked how the equilibrium would be different if the economic environment or economic policy were different. It has at times implicitly talked about the dynamic evolution of the economy in the short run by describing the economy as shifting from one equilibrium to another in response to a change in policy or in the environment.

Remember that there was a tension: prices are flexible so output always adjusts to its potential, but potential output does not change. We are caught between the long-run model of Chapter 4 and the
upcoming short-run model of Chapters 9-12. Nevertheless, the flexible-price model presented here is powerful. It allows us to say a great deal about the way various kinds of shocks will affect the economy and the composition of total spending and output as long as full employment is maintained. And we have been able to resolve the big mystery of Chapter 4: how does a change in consumption or government spending cause the standard of living to fall.

In the flexible-price model, the interest rate plays the key role in keeping the economy in balance: keeping aggregate demand equal to potential output, and the economy at full employment. Changes in economic policy and the economic environment induce changes in the mix of spending. They shift the proportions of aggregate demand between consumption, investment, government purchases, and net exports. But they do not affect the level of aggregate demand. Things that reduce saving – whether they reduce household saving, government saving, or the capital inflow – raise interest rates and reduce investment. Changes in economic policy and in the economic environment that increase saving lower interest rates and increase investment.

Think back to Chapters 4 and 5: long-run growth depended on the economy’s saving-investment rate. Here we have seen how a great many changes in economic policy and in the economic environment affect saving and investment. There are powerful links in the long run between shifts that change equilibrium interest rates and the economy’s long-run growth path.

It would be too hard and too complicated to draw those links explicitly. Nevertheless, remember when doing analyses using this chapter’s flexible-price model that this chapter’s assumption that the level of potential output is not changed by different levels of investment spending is just a “snapshot” simplifying assumption. In the long run of Chapters 4 and 5, changes in investment have powerful effects on production and prosperity.

We have covered a lot of ground in this chapter. However, it is worth emphasizing what this chapter has not done:

- As the paragraphs above stressed, this chapter has not dealt with the impact of changes in policy and the economic environment on economic growth — that was done in Part II, Chapters 4 and 5. Refer to those chapters to analyze how changes in saving and investment ultimately affect productivity and material standards of living in the long run.

- It has ignored the nominal financial side of the economy — money, prices, and inflation — completely. That topic will be covered in Chapter 8.

- It has maintained the full-employment assumption — that notion will be relaxed in Part III, the chapters starting with Chapter 9.
CHAPTER SUMMARY

1. When the economy is at full employment, real GDP is equal to potential output.

2. In a flexible-price full-employment economy, the real interest rate shifts in response to changes in policy or the economic environment to keep real GDP equal to potential output.

3. The real interest rate balances the supply of loanable funds committed to financial markets by savers – total saving – with the demand for funds to finance investments – investment demand. The circular flow principle guarantees that when the saving equals investment, aggregate demand will equal potential output.

4. An increase in saving will make the real interest rate fall. An increase in investment makes the real interest rate rise. How much the interest rate changes depends upon the sensitivity of investment demand to real interest rates, the sensitivity of exports to the real exchange rate, and the sensitivity of the real exchange rate to the real domestic interest rate.

5. In a flexible-price, full-employment economy, an increase in aggregate demand leads to a reallocation of output amongst the components of aggregate demand – consumption, investment, government, and net export spending – but not to a change in the level of aggregate demand.

6. In analyzing the effects of changes in economic policy or the economic environment on the macroeconomy, we can use the equations for flow-of-funds equilibrium.

Key Terms

- Financial markets (p. 3)
- Total saving (p. 9)
- Household saving (p. 12)
- Government saving (p. 12)
- Capital inflow (p. 13)
- Foreign saving (p. 13)
- Crowding out (p. 44)

Analytical Exercises

1. Suppose that in the flexible-price full-employment model, the government increases taxes and government purchases by equal amounts. The tax increase reduces consumption spending. What happens qualitatively (tell the direction of change only) to investment, net exports, the real exchange rate, the real interest rate, and potential output?

2. What happens according to the flexible-price full-employment model if the intercept $C_0$ of the consumption function rises? Explain qualitatively (tell the direction of change only) what happens to consumption, investment, net exports, the real exchange rate, the real interest rate, and potential output.

3. Explain qualitatively the direction in which consumption, investment, net exports, the real exchange rate, the real interest rate, and potential output move in the flexible-price full-
employment model if the government raises taxes.

4. Give three examples of changes in economic policy or in the economic environment that would shift the total saving curve on the flow-of-funds diagram to the left.

5. Give three examples of changes in the economic environment or in economic policy that would increase the equilibrium real interest rate.

Policy Exercises

1. Suppose that the relevant parameters of the economy are:
   \[ t = 0.33 \]  Tax rate of one-third.
   \[ I_t = 90 \]  A 1-percentage-point fall in the interest rate raises investment spending by $90 billion a year.
   \[ C_y = 0.75 \]  A marginal propensity to consume of three-quarters.
   \[ \epsilon_r = 10 \]  A 1-percentage point increase in the gap between domestic and foreign real interest rates decreases the real exchange rate by 1.
   \[ X_c = 6 \]  A 1 point increase in the real exchange rate leads to a $6 billion a year increase in gross exports.

   And suppose that irrational exuberance causes a stock market boom that leads consumers to increase their spending by $200 billion at a constant level of disposable income. What would be the increase in interest rates in response to such an exuberance-driven consumption boom?

2. In the economy presented in question 1, suppose that total GDP is $10 trillion and that the government does not want real interest rates to rise and investment to fall in response to the stock market-generated consumption boom. What kinds of policies can the government undertake? How successful will they be?

3. When President Bill Clinton took office, he spent essentially all his political capital on his first-year effort to raise taxes and cut spending by $300 billion a year in an economy with an annual GDP of $6 trillion. What, qualitatively and quantitatively, does the flexible-price full-employment model say should have been the consequences of these policies if the relevant parameters of the economy are those given in question 1?

4. When President George W. Bush took office, he cut taxes by $300 billion and raised spending by $200 billion a year in an economy with an annual GDP of $9 trillion. What, qualitatively and quantitatively, does the flexible-price full-employment model say should have been the long-run consequences of these policies if the relevant parameters of the economy are those given in question 1?

5. Consider two economies. In one, the relevant parameters are:
   \[ Y^* = 10,000 \]  In billions; potential output equals $10 trillion.
   \[ t = 0.33 \]  Tax rate of one-third.
   \[ I_t = 90 \]  A 1-percentage-point fall in the interest rate raises investment spending by $90 billion a year.
   \[ C_y = 0.75 \]  A marginal propensity to consume of three-quarters.
   \[ \epsilon_r = 10 \]  A 1-percentage point increase in the gap between domestic and foreign real interest rates decreases the real exchange rate by 1.
   \[ X_c = 6 \]  A 5 point increase in the real exchange rate leads to a $6 billion a year increase in gross exports.

Page 7-55

Page 7-56
6. One of the most interesting—from an economic theory point of view—policies of the Bush administration is the idea of replacing some of the Social Security system by private accounts. In terms of our model, this policy involves (a) a reduction in government tax revenues and (b) an increase in private after-tax incomes (c) but the government requires that the increase in after-tax income be saved. Qualitatively, how would you think that the consumption function would change as a result of this policy? What would happen in equilibrium to the interest rate? To the exchange rate? To national savings?

7. Most economists at the start of 2005 were anticipating a rise in $e_0$, in foreign exchange speculators’ assessments of the underlying fundamental value of foreign currency, as they began to focus on the long-run implications of America’s foreign trade deficit. Qualitatively, what would you expect to happen to the economy if $e_0$ were to suddenly rise?

**Margin Definitions**

**Financial markets**

The stock market, the bond market, the short-term borrowing market, plus firms’ borrowings from banks.

**Total saving**

Household saving plus government saving (the government’s surplus, negative when the government runs a deficit) plus foreign saving.
Household saving

Equal to households’ disposable incomes (which includes earnings retained by corporations and then reinvested) minus their consumption spending. Household saving includes both saving done directly by households and saving done on their behalf by firms whose stock they own.

Government saving

The government’s surplus. Government saving is negative when the government runs a budget deficit.

Capital inflow

Net investment by the citizens of one country in another — the “flow” of financial capital from one country to another.

Foreign saving

The net amount of money that foreigners are committing to buying up property and assets in the home country, equal to minus net exports.

Crowding out

Decreases in investment spending caused by a drop in government saving that leads to higher real interest rates.