Lecture Notes: Chapter 7: Equilibrium in the Flexible-Price Model

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Equilibrium and the Real Interest Rate

Under the flexible-price full-employment classical assumptions, GDP and national income Y equal potential output Y*:

$$Y = Y^*$$

But the determinants of the components of real GDP are various. We saw that the exchange rate is a function of (a) the real interest rate differential between home and abroad, and (b) foreign exchange traders' opinions:

$$\varepsilon = \varepsilon_0 - \varepsilon_r \times \left(r - r^f\right)$$

We saw the determinants of consumption spending:

$$C = C_0 + C_y \times (1 - t) \times Y$$

of investment spending:

$$I = I_0 - I_r \times r$$

and of net exports:

$$NX = \left(X_{yf} \times Y^f\right) + \left(X_\varepsilon \times \varepsilon_0\right) - \left(X_\varepsilon \times \varepsilon_r \times r\right) + \left(X_\varepsilon \times \varepsilon_r \times r^f\right) - \left(IM_y \times Y\right)$$

Fourth and last, we left the determination of government purchases to the political scientists:

$$G = G$$

These four components add up to aggregate demand, or total expenditure, written E when we want to emphasize that, conceptually at least, it is not quite the same as real GDP Y. However, the circular flow principle guarantees that in equilibrium aggregate demand will add up to real GDP Y:

$$C + I + G + NX = E = Y$$

However, the determinants of each of the components of total spending E seem to have nothing at all to do with the production function that determines the level of real GDP Y. How does aggregate demand add up to potential output? Can we be sure that all the output businesses think they can sell when they hire more workers is in fact sold? The answer is that in the flexible-price full-employment classical model of this section, the real interest rate r plays the key balancing role in making sure that the economy reaches and stays at equilibrium.

To understand what makes aggregate demand equal to potential output, we need to look at the market in which the interest rate functions as the price: the market for loanable funds. When you lend money the interest rate is the price you charge and the price the borrower pays. Thus we need to look at the flow of loanable funds through the financial markets, the places where household savings and other inflows into financial markets are balanced by outflows to firms seeking capital to expand their productive capacity. The equilibrium we are looking for is one in which supply equals demand in the financial markets. According to the circular flow principle if financial markets are in equilibrium then the sum of all the components of spending is equal to real GDP.

If supply equals demand in the flow-of-funds through financial markets then aggregate supply (real GDP, Y, equal to potential output Y*) is equal to aggregate demand (the sum of all the components of total spending: C+I+G+NX). To see this, begin by assuming that real GDP is equal to potential output Y* and that the circular flow principle holds: real GDP is equal to aggregate demand:

$$Y^* = Y = C + I + G + NX$$

Then rewrite this expression by moving everything except for investment spending I over to the left-hand side.

$$Y^* - C - G - NX = I$$

Now include taxes T in the left-hand side:

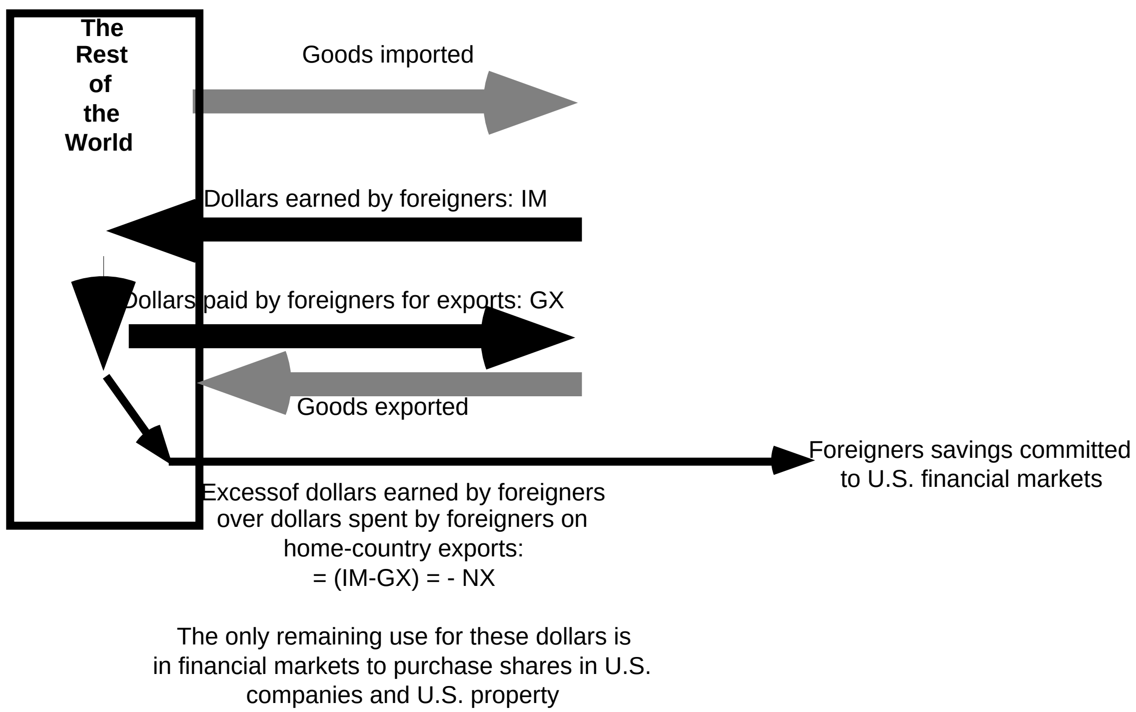
$$(Y^* - C - T) + (T - G) - NX = I$$

Note that the right-hand side is simply investment, the net flow of purchasing power out of the financial markets as firms raise money to build factories and structures and boost their productive capacity. The left-hand side is equal to total savings: the flow of purchasing power into financial markets as households, the government, and foreigners seek to save by committing their money to buy valuable financial assets here at home (see Figure 7.1). Thus we see that whenever the circular flow principle holds, the supply and demand in the flow of funds through financial markets balances as well.

The (Y*-C-T) inside the first set of parentheses are households' savings. Because national income is equal to potential output, Y* is just total household income. Take income, subtract taxes, subtract consumption spending, and what is left is household savings: the flow of purchasing power from households into the financial markets.

The (T-G) inside the second set of parentheses are just government savings: the government's budget surplus (or government dissaving, the government's budget deficit, if G happens to be larger than T). They are the flow of funds from the government into the financial markets.

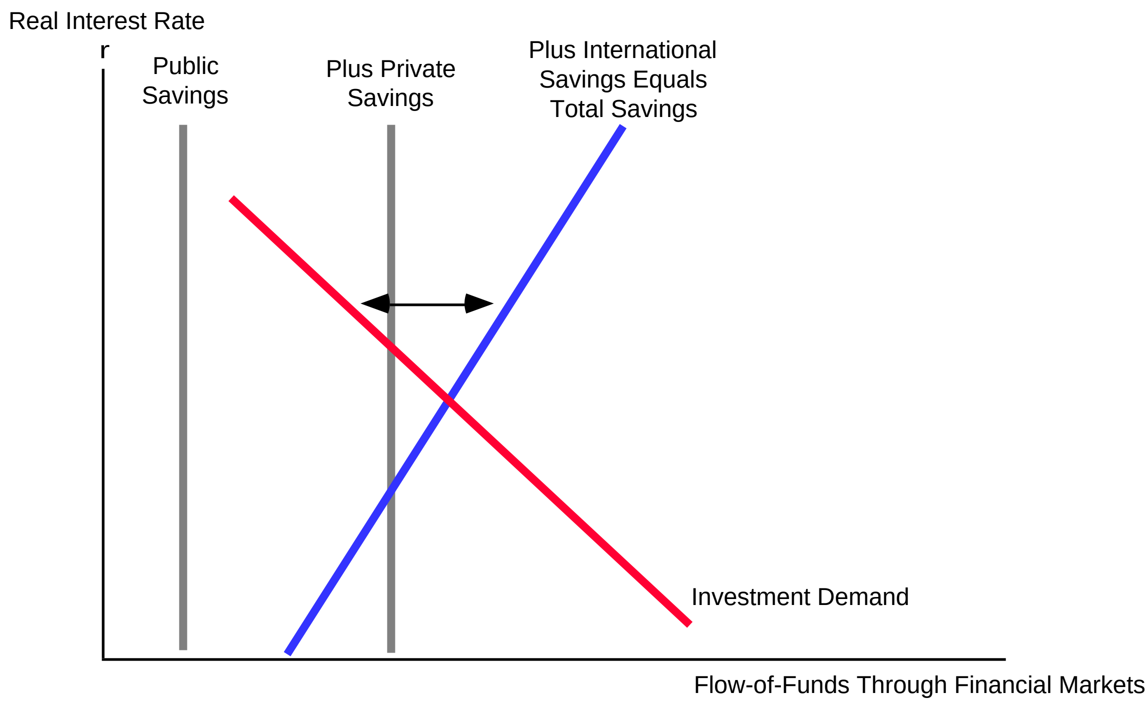
Minus Net Exports Equals the Capital Inflow



The last term--minus net exports, -NX--is the net flow of purchasing power that foreigners channel into domestic financial markets. If net exports are less than zero, foreigners have some dollars left over. They then have to do something with these extra dollars. Foreigners find dollars useful in only two ways. First, they are useful for buying our exports (but if net exports are less than zero there aren't enough exports to soak up all the dollars they earn). Second, dollars are useful for besides buying property here--land, stocks, buildings, bonds. So this last term is the net flow of purchasing power into domestic financial markets by foreigners wishing to park some of their savings here. (And when net exports are positive, this term is the net amount of domestic savings diverted into overseas financial markets).

What happens if the flow-of-funds does not balance--if at the current long-term real interest rate r the flow of savings into the financial markets exceeds the demand by corporations and others for purchasing power to finance investments? If the left-hand side is greater than the right, 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 securities and other investment vehicles to commit it to. They will try to underbid their competitors for the privilege of lending money or buying equity in some particular set of investment projects. How do they underbid? They underbid by saying that they would accept a lower interest rate than the market interest rate r. Thus if the flow of savings exceeds investment, the interest rate r falls. As the interest rate r fell, the number and value of investment projects firms and entrepreneurs found it worthwhile to undertake rises.

Excess Supply of Savings in the Flow-of-Funds Market



Legend: When the interest rate is such that there is an excess supply of savings: some savers are about to offer to accept a lower interest rate, and the interest rate is about to drop.

The process will stop when the interest rate r adjusts to bring about equilibrium in the loanable funds market. The flow of savings into the financial markets will then be just equal to the flow of purchasing power out of financial markets, and into the hands of firms and entrepreneurs using it to finance investment.

Solving the Model

At what level of the real interest rate will the flow-of-funds through financial markets in equilibrium?

First, let's look at the determinants of the supply of private savings:

$$Y* - C - T = (1 - t - (1 - t)C_y)Y* - C_0$$

Second, let's look at the determinants of public savings:

$$T - G = tY* - \bar{G}$$

Third, let's look at the determinants of international savings:

$$-NX = IM_y Y + X_\varepsilon \varepsilon_r r - X_{yf} Y^f - X_\varepsilon \varepsilon_0 - X_\varepsilon \varepsilon_r r^f$$

These three added together make up the flow-of-funds supply of savings. The flow-of-funds demand for savings is simply the investment function:

$$I = I_0 - I_r r$$

Equilibrium is, of course, where the supply of savings is equal to investment demand. To get an explicit expression for the interest rate, begin by writing out the determinants of all the pieces of savings:

$$\left((1 - t - (1 - t)C_y)Y* - C_0\right) + \left(tY* - \bar{G}\right) + \left(IM_y Y + X_\varepsilon \varepsilon_r r - X_{yf} Y^f - X_\varepsilon \varepsilon_0 - X_\varepsilon \varepsilon_r r^f\right) = I_0 - I_r r$$

Group all the terms that depend on Y* on the left of the left-hand side, all the terms that are constant in the middle of the left –hand side, all the terms that depend on international factors on the right of the left-hand side, and move all the terms with the real interest rate r over to the right-hand side:

$$\left(1 - \left((1 - t)C_y - IM_y\right)\right)Y* - \left(C_0 + I_0 + \bar{G}\right) - \left(X_{yf} Y^f + X_\varepsilon \varepsilon_0 + X_\varepsilon \varepsilon_r r^f\right) = -\left(I_r + X_\varepsilon \varepsilon_r\right)r$$

And divide by $-(I_r + X_\varepsilon \varepsilon_r)$ to determine the equilibrium real interest rate r:

$$r = \frac{(C_0 + I_0 + \bar{G}) + (X_{yf}Y^f + X_\varepsilon \varepsilon_0 + X_\varepsilon \varepsilon_r r^f) - \left(1 - \left((1-t)C_y - IM_y\right)\right)Y^*}{\left(I_r + X_\varepsilon \varepsilon_r\right)}$$

Example: Solving for and Verifying the Equilibrium Real Interest Rate

Given the parameters of the flexible-price model and the value of potential GDP, it is straightforward to calculate the equilibrium real interest rate r by substituting the parameters into the formula:

$$r = \frac{(C_0 + I_0 + \bar{G}) + (X_{yf}Y^f + X_\varepsilon \varepsilon_0 + X_\varepsilon \varepsilon_r r^f) - \left(1 - \left((1-t)C_y - IM_y\right)\right)Y^*}{\left(I_r + X_\varepsilon \varepsilon_r\right)}$$

For example, when parameter values are:

Potential output Y* = \$10,000 billion
Baseline consumption C_0 = \$3,000 billion
Baseline investment I_0 = \$1,000 billion
Government purchases G = \$2,000 billion
The tax rate t = 25%
The MPC C_y = 0.67
The propensity to import IM_y = 0.2
Abroad, X_{yf}=0.1 and Y^f = \$10,000 billion
Foreign exchange speculators' long-run view ε_0 = 100
The sensitivity of exports to the exchange rate X_ε = 10
The sensitivity of investment to the interest rate I_r = 9000
The sensitivity of the exchange rate to the interest rate ε_r = 600

Then replacing each of the parameters with its value produces:

$$r = \frac{(3000 + 1000 + 2000) + (0.1 \times 10000 + 10 \times 100) - \left(1 - \left((1 - 0.25) \times 0.67 - 0.2\right)\right) \times 10000}{(9000 + 600 \times 10)}$$

$$r = \frac{(6000) + (2000) - (0.7) \times 10000}{15000}$$

$$r = \frac{1000}{15000} = .0667$$

An equilibrium real interest rate of 6.67% per year.

Is the economy in fact in equilibrium when the real interest rate is 6.67% per year? Yes. At that level of the interest rate:

- Private savings equal -$500 billion (yes, they are less than zero: households are drawing down their wealth in order to finance high current consumption), as you can see by substituting the parameters into the equation:
  $$Y^* - C - T = (1 - t - (1-t)C_y)Y^* - C_0$$
  that determines private saving.
- Government savings equal $500 billion, as you can see by subtracting government purchases from taxes.
- The capital inflow from abroad—minus net exports—equals $400 billion, as you can see by substituting the parameter values and a real interest rate of 6.67% into the equation:
  $$-NX = IM_y Y + X_\varepsilon \varepsilon_r r - X_{yf} Y^f - X_\varepsilon \varepsilon_0 - X_\varepsilon \varepsilon_r r^f$$
  that determines minus net exports.
- These three components of saving add up to $400 billion.
- And investment is equal to $400 billion.

Thus the flow of funds through financial markets balances.

Looking at the components of real GDP:

- Consumption spending equals $8,000 billion
- Investment spending equals $400 billion
- Government purchases equal $2,000 billion
- Net exports equal -$400 billion
- All these add up to $10,000 billion: the level of potential output

Total spending—aggregate demand—is indeed equal to real GDP.

Comparative Statics as a Method of Analysis

The flexible-price, full-employment model we have built in the last two chapters gives us the capability to determine the level and composition of real GDP and national income. If we know the economic environment and economic policy, we can use the model to determine the equilibrium real interest rate, either by solving the algebraic equations or by drawing the flow-of-funds diagram and looking for the point where supply balances demand, or both. We can then calculate the equilibrium values of a large number of economic variables—real GDP, consumption spending and investment spending, imports and exports, the real exchange rate, and more. In fact, three of the six key economic variables—real GDP, the exchange rate, and the real interest rate—come directly from the model. We will see how to calculate the price level and inflation rate in the next chapter, Chapter 8. In a flexible-price model like this one the unemployment rate is not interesting, for the economy is always at full employment. And we have seen that the stock market is proportional to and a leading indicator of investment spending.

However, the model so far gives us the capability not just to calculate the current equilibrium position of the economy, but how that equilibrium will change in response to changes in the economic environment or in economic policy. To do so we use a method of analysis economists call *comparative statics*. We determine the response of the economy to some particular shift in the environment or policy in three steps. We first look at the initial equilibrium position of the economy without the shift. We then look at the equilibrium position of the economy with the shift. We then identify the difference in the two equilibrium positions as the change in the economy in response to the shift.

Let's see how the model can be used to analyze the consequences of disturbances to the economy:

Changes in Fiscal Policy

Suppose the economy is in equilibrium when policy makers decide to increase annual government purchases by the amount ΔG—as before Δ, a capital Greek letter delta, stands for "change."

Let’s look at what happens to the components of aggregate demand one by one. First, 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:

$$\Delta C = 0$$

While the shift in government purchases has no *direct* effect on investment, there will be an indirect effect. 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 function:

$$I = I_0 - I_r r$$

we can conclude that the level of investment spending will change by:

$$\Delta I = -I_r \Delta r$$

That is, the shift 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 changes. Nor does the level of potential output does not change. So looking at the net exports function:

$$NX = X_{yf} Y^f + X_\varepsilon \varepsilon_0 - X_\varepsilon \varepsilon_r r + X_\varepsilon \varepsilon_r r^f - IM_y Y$$

it is clear that here as well, the only shift will be a proportional change in response to the shift in the equilibrium real interest rate:

$$\Delta NX = -(X_\varepsilon \varepsilon_r \Delta r)$$

Finally, real GDP Y does not change because otential output does not change, and this is a full-employment model with real GDP is always equal to potential output:

$$\Delta Y = \Delta Y^* = 0$$

Putting all these pieces together, we have assembled the relevant components of aggregate demand in "change" form. We can see that as government purchases shift, the other components of aggregate demand will have to shift with it:

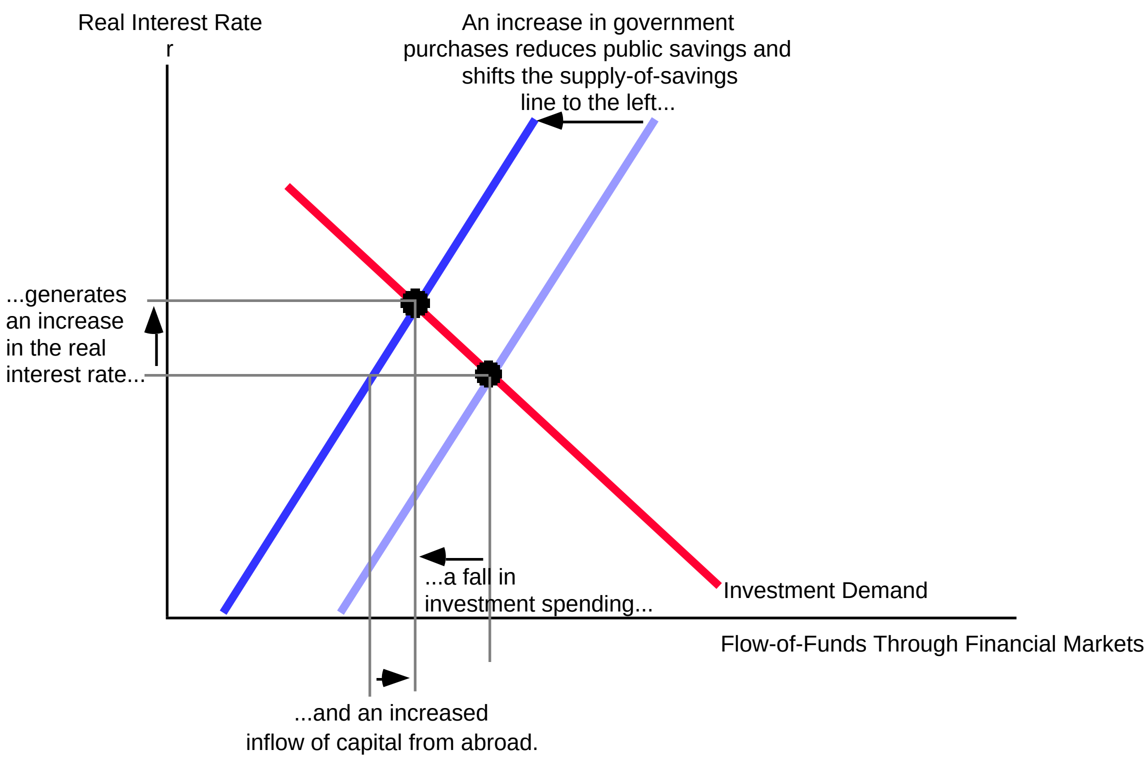
$$\Delta Y = \Delta I + \Delta G + \Delta NX$$

$$0 = -I_r \Delta r + \Delta G - X_\varepsilon \varepsilon_r \Delta r$$

Put the change in the real interest rate on the left-hand side of the equation and everything else on the right, we discover that the shift in government purchases means that the equilibrium real interest rate must change by:

$$\Delta r = \frac{\Delta G}{I_r + X_\varepsilon \varepsilon_r}$$

Effect of an Increase in Government Purchases on the Flow-of-Funds



Once the change in the equilibrium interest rate has been calculated, determining what happens to the rest of the economy is straightforward. Simply substitute the change in the equilibrium interest rate back into the model's behavioral relationships, and so calculate the changes in the equilibrium levels of the components of GDP, and in the equilibrium level of the real exchange rate. There is no effect on the level of real GDP Y or on consumption spending C:

$$\Delta Y = 0$$

$$\Delta C = 0$$

The change in government purchases G is just equal to itself: the change in government purchases was the trigger that shifted the economy's equilibrium position:

$$\Delta G = \Delta G$$

The change in investment spending is the interest sensitivity of investment I_r times the change in the equilibrium real interest rate, which we already calculated above.

$$\Delta I = -I_r \times \Delta r = \frac{-I_r}{I_r + X_\varepsilon \varepsilon_r} \Delta G$$

The changes in net exports and in the exchange rate are also equal to their sensitivities to the real interest rate times the change in the equilibrium real interest rate.

$$\Delta NX = \frac{-X_\varepsilon \varepsilon_r}{I_r + X_\varepsilon \varepsilon_r} \Delta G$$

$$\Delta \varepsilon = \frac{-X_\varepsilon}{I_r + X_\varepsilon \varepsilon_r} \Delta G$$

The overall picture of the changes generated by the increase in government purchases is clear. The increase in government purchases has led to a shortfall in savings and a rise in real interest rates. The higher real interest rates have led to lower investment, and to an appreciation in the home currency: a lower level of ε. This exchange rate appreciation has led to a decline in net exports. The declines in net exports and in investment spending just add up to the increase in government purchases, so the level of GDP is unchanged and still equal to potential output--as we assumed it would be.

Note that the fall in investment is not as large as the rise in government purchases. The increase in government purchases reduced the flow of domestic savings into financial markets, but the increased flow of foreign-owned capital into the market partially offset this reduction.

Example: A Government Purchases Boom

Assume that the parameters of the model are:

t = 0.33	Tax rate of 1/3 of income.
I_r = 9000	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.

ε_r=10	With an initial value for the real exchange rate ε set at the traditional indexed value of 100, a 1 percentage point change in the interest rate difference vis-à-vis abroad generates a 10% shift in the exchange rate.
X_ε=600	A 1% change in the exchange rate leads to a $6 billion a year change in exports.

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

$$\Delta r = \frac{\Delta G}{I_r + X_\varepsilon \varepsilon_r} = \frac{\$150}{9000 + 600 \times 10} = \frac{150}{15000} = .01 = 1\%$$

As a result, the equilibrium values of the other variables in the economy will change by:

$$\Delta G = \Delta G = +\$150 \ \ billion$$

$$\Delta I = \frac{-I_r}{I_r + X_\varepsilon \varepsilon_r}\Delta G = \frac{-9000}{9000 + 600 \times 10}\$150 = -\$90 \ \ billion$$

$$\Delta C = 0$$

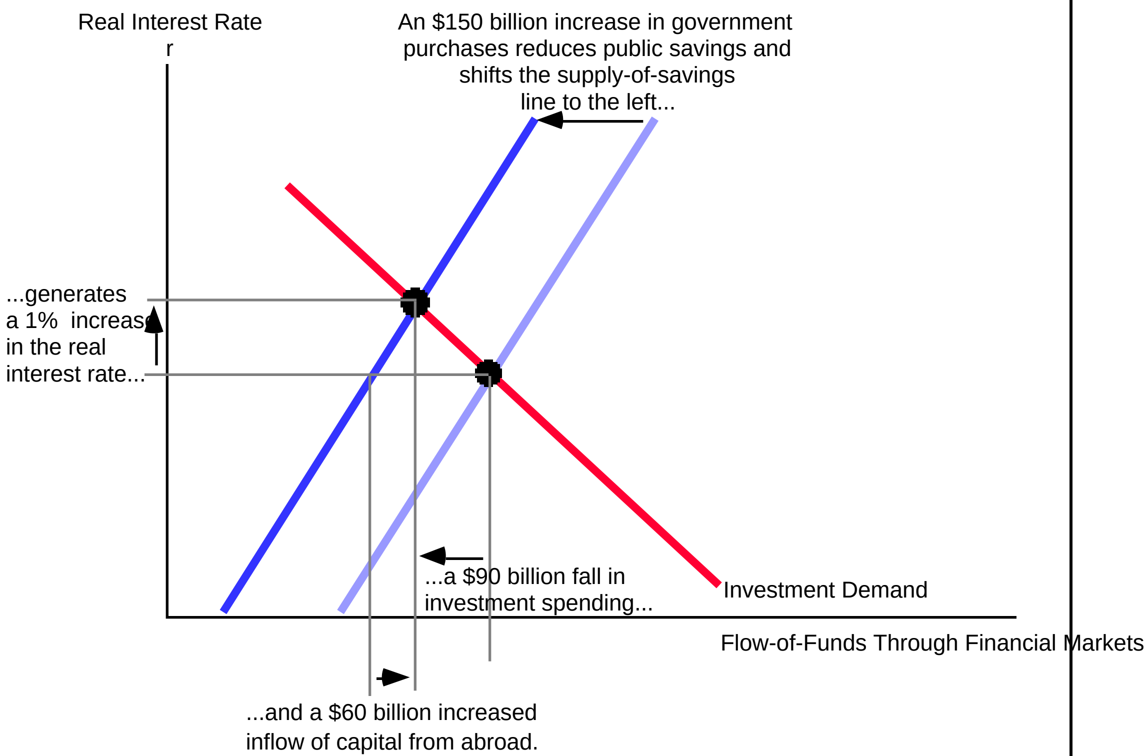
$$\Delta NX = \frac{-X_\varepsilon \varepsilon_r}{I_r + X_\varepsilon \varepsilon_r}\Delta G = \frac{-(600 \times 10)}{9000 + 600 \times 10}\$150 = -\$60 \ \ billion$$

$$\Delta \varepsilon = \frac{-\varepsilon_r}{I_r + X_\varepsilon \varepsilon_r}\Delta G = \frac{-10}{9000 + 600 \times 10}\$150 = -0.1 = -10\% \ \ change$$

In sum, the $150 billion increase in annual government purchases has shifted the economy's equilibrium by raising the real interest rates by 1%. Such an increase in the real interest rate carries with it a 10% fall in the exchange rate. The interest rate increase reduces investment spending by $90 billion a year. The exchange rate decline reduces net exports by $60 billion a year.

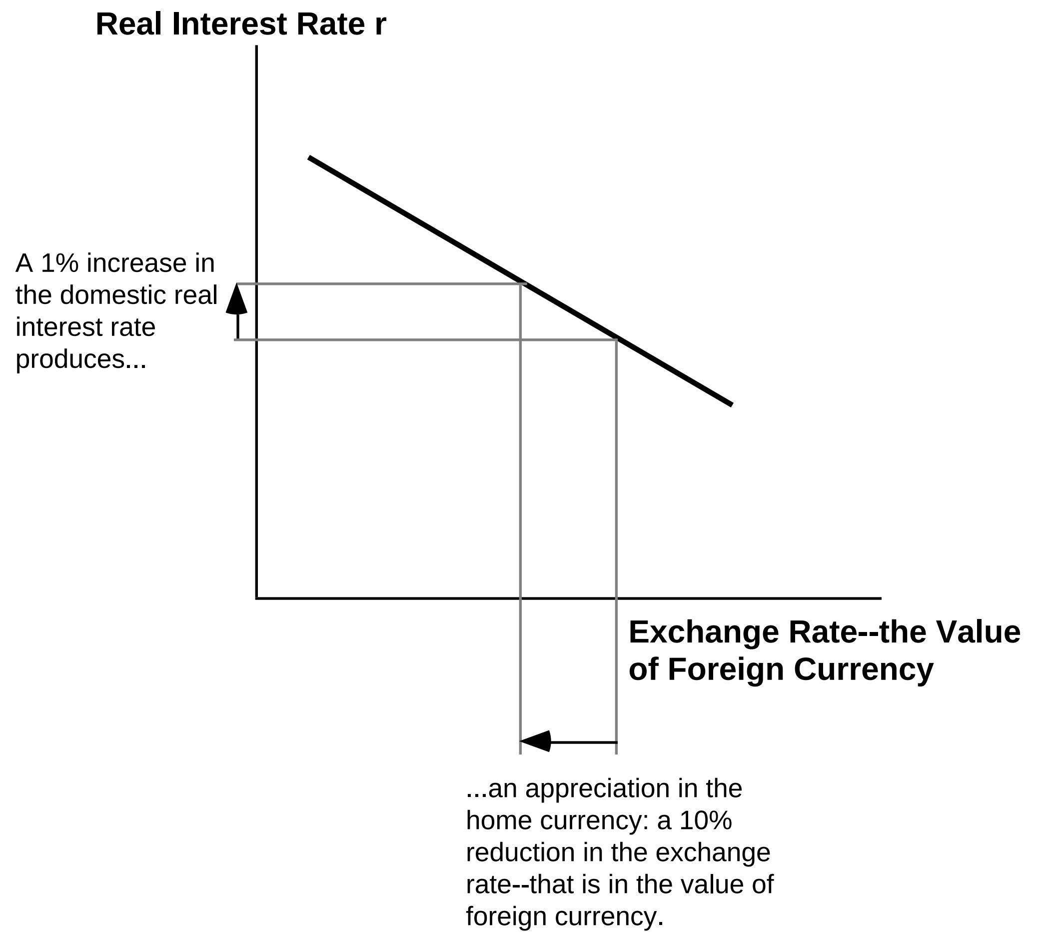
Some additional insight into this example can be gained by looking at the flow of funds diagram in Figure 7.7. The increase in government spending shifts the supply of loanable funds curve to the left by $150 billion. Given the slopes of the loanable funds supply and the investment demand curves, the result of this leftward shift is a $90 billion fall in annual investment--and a 1% point rise in the real interest rate.

Flow-of-Funds Diagram: An $150 Billion Increase in Government Purchases



Given this 1% point rise in the real interest rate, it is straightforward to determine the resulting change in the exchange rate, as shown in Figure 7.8, and thus the change in net exports.

The Impact of a Change in the Domestic Interest Rate on the Exchange Rate



Supply Shocks

So far we have assumed that the level of potential output is fixed. Whatever shocks have affected the economy, they have had no effect on *aggregate supply*, no effect on potential output. But there are shocks to a flexible-price full-employment economy that change aggregate supply. Supply shocks like the 1973 tripling of world oil prices reduce potential output. Inventions and innovations can be positive productivity shocks that increase the level of potential output.

We can use the full-employment model of this chapter to analyze the effects on the economy of a supply shock. However, the effects of a supply shock are different in one important respect from the effects of the demand or international shocks we have analyzed above. In response to a supply shock the level of GDP *does* change--even in this, full-employment, chapter--because the level of potential GDP has changed. In each case, call the resulting supply-shock driven change in potential output ΔY*.

If we look at the changes in the national income identity:

$$\Delta C + \Delta I + \Delta G + \Delta NX = \Delta Y^*$$

we will find them more complex than in the case of the demand shocks considered in the section above because the change in real GDP is not zero. If we expand the changes form of the national income identity by substituting for each component of GDP the equation for its determinants, we produce:

$$\left(C_y(1-t)\Delta Y^*\right) - \left(I_r \Delta r\right) + \left(-X_\varepsilon \varepsilon_r \Delta r - IM_y \Delta Y^*\right) = \Delta Y^*$$

We can regroup and solve this equation for the change Δr in the equilibrium interest rate is:

$$\Delta r = -\left(\frac{1 - C_y(1-t) + IM_y}{I_r + X_\varepsilon \varepsilon_r} \Delta Y^*\right)$$

A negative value for ΔY*--an adverse supply shock, one that lowers the level of potential output and GDP--generates an *increase* in the domestic real interest rate. Why? Because a fall in GDP due to an oil price increase or other adverse supply shock reduces incomes, and so reduces the flow of private savings into financial markets. (It is true that a decline in incomes carries with it a decline in consumption, and in net exports, but these declines do not match the decline in income, so domestic savings falls.)

From the change in the level of GDP and the change in the interest rate, it is straightforward to calculate the effect of the supply shock on the other economic variables:

$$\Delta C = C_y(1-t)\Delta Y^*$$

$$\Delta I = I_r\left(\frac{1+IM_y - C_y(1-t)}{I_r + X_\varepsilon \varepsilon_r}\Delta Y^*\right)$$

$$\Delta G = 0$$

$$\Delta NX = X_\varepsilon \varepsilon_r\left(\frac{1+IM_y - C_y(1-t)}{I_r + X_\varepsilon \varepsilon_r}\Delta Y^*\right)$$

$$\Delta \varepsilon = \varepsilon_r\left(\frac{1+IM_y - C_y(1-t)}{I_r + X_\varepsilon \varepsilon_r}\Delta Y^*\right)$$

An adverse supply shock--a negative value for ΔY*--leads to declines in consumption, investment, and net exports; it leads to an appreciation of the home currency, and thus to a reduction in the value of foreign currency--in the exchange rate. It also leads to a rise in the price level, and an acceleration of inflation.

Real Business Cycles

The mid-twentieth century economist Joseph Schumpeter was the most powerful exponent of the belief that changes in technology were the principal force driving business cycles. Schumpeter saw technological progress as inherently lumpy. There were five-year periods during which a great deal of new technology diffused rapidly throughout the economy. These were booms. There were five-year periods during which the pace of technological innovation and diffusion was much slower. These were periods of relative stagnation. Schumpeter saw the key feature of the business cycle as the co-movements of output, employment, investment, and interest rates: all were high together in a boom, all were low together (relative to trend) in a recession.

It is easy to see how uneven invention and innovation patterns could generate such *real business cycles*—business cycles driven by the fundamental technological dynamic of the economy. Suppose that the most common shift in technology involves (a) a sudden step up in the efficiency of labor, accompanied by (b) a sudden rise in investment demand as it becomes more profitable for a business to enlarge its capital stock. Such a shock has a supply component--an increase ΔY* in this year's potential output--and an investment demand component--an increase ΔI_0 in this year's investment demand.

How does the economy's full-employment equilibrium shift in response to such a combined shock? We simply add together the effects of a supply shock, outlined immediately above, and the effects of an investment boom driven by investors' increasing optimism, outlined in the previous section. The change in the equilibrium domestic real interest rate from a supply shock is:

$$\Delta r = -\left(\frac{1 - C_y(1-t) + IM_y}{I_r + X_\varepsilon \varepsilon_r} \Delta Y^* \right)$$

The change from an investment demand shock is:

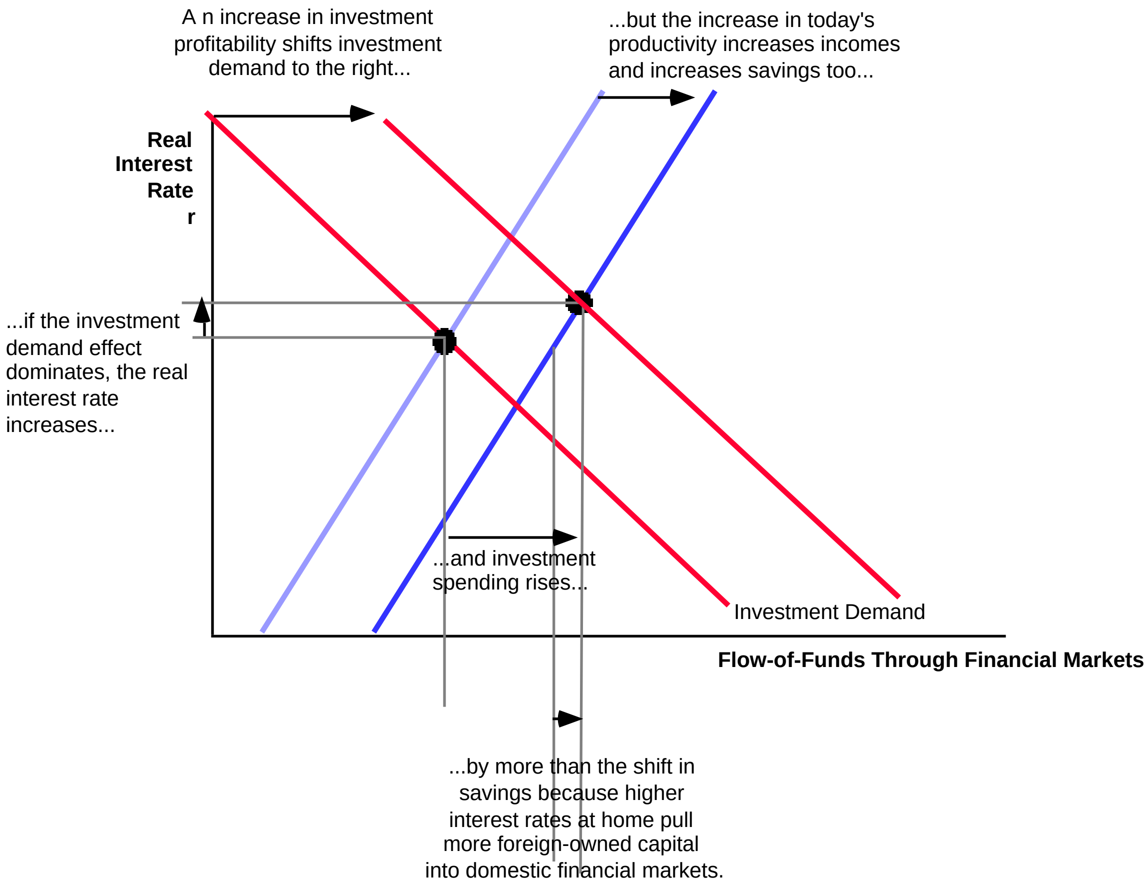
$$\Delta r = \frac{\Delta I_0}{I_r + X_\varepsilon \varepsilon_r}$$

Adding them together, the change in the equilibrium interest rate from this Schumpeterian technology shift is:

$$\Delta r = -\frac{\left(1 - C_y(1-t) + IM_y\right)}{I_r + X_\varepsilon \varepsilon_r} \Delta Y^* + \frac{\Delta I_0}{I_r + X_\varepsilon \varepsilon_r}$$

The increased profitability of investment expands investment demand, shifting the red investment demand curve to the right. But the positive technology shock does more than just make investment more profitable: it boosts the current efficiency of labor as well. Higher productivity means higher incomes, which means more savings, which shifts the total savings line to the right as well. The increase in investment demand tends to raise the interest rate. The increase in savings caused by higher incomes tends to lower it. Which dominates? Suppose that the investment demand term dominates. Then the domestic real interest rate will rise.

A Schumpeterian Combined Productivity and Investment Shock as Seen in the Flow-of-Funds



Legend: Higher productivity today and optimism about future technological developments affect both the supply and demand curves in the market for loanable funds. It is plausible to conclude that the economy will boom, with real GDP and investment rising, domestic real interest rates rising, the exchange rate falling, and capital flowing in to finance domestic investment. This pattern is the standard pattern seen in a business-cycle boom.

It is then straightforward to calculate the changes in the components of aggregate demand:

$$\Delta C = C_y(1-t)\Delta Y^*$$

$$\Delta I = \frac{X_\varepsilon \varepsilon_r}{I_r + X_\varepsilon \varepsilon_r}\Delta I_0 + I_r \frac{\left(1 - C_y(1-t) + IM_y\right)}{I_r + X_\varepsilon \varepsilon_r}\Delta Y^*$$

$$\Delta G = 0$$

$$\Delta NX = \left(X_\varepsilon \varepsilon_r \frac{\left(1 - C_y(1-t) + IM_y\right)}{I_r + X_\varepsilon \varepsilon_r} - IM_y \right)\Delta Y^* - \frac{X_\varepsilon \varepsilon_r \Delta I_0}{I_r + X_\varepsilon \varepsilon_r}$$

And the change in the equilibrium level of the exchange rate is:

$$\Delta \varepsilon = \left(\varepsilon_r \frac{\left(1 - C_y(1-t) + IM_y\right)}{I_r + X_\varepsilon \varepsilon_r} - IM_y \right)\Delta Y^* - \frac{\varepsilon_r \Delta I_0}{I_r + X_\varepsilon \varepsilon_r}$$

As long as the shock shifts the investment demand curve in Figure 7.15 to the right by more than it shifts the total savings line, the value of the exchange rate will fall.

Thus this combination positive technology shock to the efficiency of labor and the profitability of investment has produced:

- A rise in output.
- A sharp rise in investment.
- A decline in the exchange rate: an decrease in the value of foreign currency, and an increase in the value of domestic currency.
- A decrease in net exports: an increase in the flow of foreign capital into the country to finance domestic investment.

These shifts in the economy are those that are typically found in a business cycle boom. Perhaps these Schumpeterian forces are the principal cause of the booms and recessions that we see in our economy.

Most economists, however, would be skeptical of the claim that most of our business cycles are such *real business cycles.* There is one characteristic feature of the "boom" phase of the business cycle as defined by Schumpeter that the model cannot produce: a fall in unemployment. It cannot do so: this chapter's model, after all, is one in which the economy is always at full employment, so how could the model produce an increase in employment correlated with its technology-driven boom?

Some economists speculate that the pattern of unemployment found in the business cycle is due to movements in the level of real wages.. When real wages are higher than expected or than average, more people will be willing to work for wages. When real wages are temporarily lower than their average trend, some workers will choose to forego working for a month or a season or a year. According to this approach, unemployment is high whenever a significant fraction of the labor force have looked at their employment opportunities, found that they were being offered unusually low wages, and decided to do something other than work for a while.

There is, however, a serious problem with this approach. Few of the cyclically unemployed in a business cycle slump choose to describe themselves as "voluntarily unemployed." They see themselves not as people making a rational economic decision to spend a lot more time being leisurely, but as people who want to work--who would be eager to work if only someone would hire them at the wages others are being paid--but who can't find work because there is excess supply in the labor market.

A second problem is that real business cycle theory explains booms--rapid rises in output--as the result of the rapid diffusion of technology and a sharp increase in the efficiency of labor. But how is it to describe a recession or a depression--a time when production does not grow at all, but declines? Does the efficiency of labor decline because of technological regress? Are we supposed to believe that production was lower in 1991 than in 1990 because businesses had forgotten how to use their most productive modes of operation? It seems unlikely

Thus the Schumpeterian approach may well provide a correct theory of booms, or of some booms. It is harder to see how it could provide an accurate account of recessions and depressions, or of the high levels of cyclical unemployment found in times of recession and depression.