The Loanable Funds Model and Efficient Investment as Another Source of Gains from Financial Globalization

These notes correspond to material covered in class on Monday April 20 and in Feenstra-Taylor Chapter 6/17 section 3 "gains from efficient investment."

The point of that section is to show that a high degree of financial openness allows a country to achieve a more efficient level of investment, which can increase the present value of the country's consumption.

These notes demonstrate this point in a simpler (I hope) way than the chapter.

I. The loanable funds model for a closed economy

We first model the financial system using simple supply-demand. Our simple model assumes there's only one financial asset, "loanable funds," which is the "good" being supplied and demanded. The "price" of loanable funds is the real interest rate. The demand for loanable funds comes from firms or entrepreneurs who need funds to finance investment projects. (Here, we use the macroeconomics definition of "investment," expenditures on capital goods, such as machines, factories, equipment to be used in production.) The supply of funds comes from national saving, which you'll recall equals private saving plus public saving.

The demand for loanable funds

We assume that firms finance every dollar of investment expenditure. Hence, the demand for loanable funds is exactly equal to total investment.

The shape of the demand curve

Does the demand curve for loanable funds slope downward, like most demand curves? To answer this, we must determine how investment responds to a change in the interest rate.

Firms use borrowed funds to pay for their investment projects. An increase in the interest rate makes borrowing more costly (it raises the "price" of "loanable funds," or makes it more expensive for firms to "take out loans"). Firms respond by cutting back on investment. As a result, investment and the demand for loanable funds depend negatively on the interest rate, so the demand curve is negatively sloped.

A deeper explanation of the relationship between investment and the interest rate

Firms have many potential investment projects available. Before choosing which investment projects to undertake, firms get an estimate of the rate of return of each project. Suppose a firm has four possible projects, as described in this table:

	description	*up-front cost*	*expected rate of return*
A	build a factory to produce solar panels	$5 million	3% per year
B	replace outdated computer networks with new ones	$1 million	7% per year
C	expand an existing factory	$2 million	5% per year
D	replacing the heating systems in all existing factories with new ones	$1 million	9% per year

Which of these projects should the firm undertake? The answer depends on the interest rate.

Suppose the interest rate is 4%. Then, project A is not worthwhile, because the project is expected to return less than the cost of the funds. (Or, if the firm already has the $5 million, it would be better off buying bonds that pay 4% than building a factory that returns only 3%.) However, at a 4% interest rate, the other 3 projects are worthwhile, since each of them has a rate of return greater than 4%. So, if r = 4%, then total investment = $4 million (which is $1 million for project B, plus $2 million for project C, plus $1 million for project D).

If the interest rate rises to 6%, then project C is no longer worthwhile. So the firm would only undertake projects B and D, and total investment would be $2 million.

If the interest rate rises to 8%, then project B is no longer worthwhile, so the firm would only undertake project D, and total investment would be 9%.

This example illustrates the general principle: as the interest rate rises, fewer and fewer investment projects will be worthwhile, so firms will reduce their total investment expenditure.

This negative relationship between investment spending and the real interest rate holds true whether the firm needs to borrow the money to pay for its investment projects or already has money it can use. The interest rate is either the cost to the firm of borrowing to pay for investment, or the opportunity cost of using the firm's own money to pay for the investment project, because the interest rate is what the firm could earn if it used its money to buy bonds instead of undertaking the project.

The supply of loanable funds

Private saving = Y – T – C = any income remaining after taxes and consumption spending. In the real world, households use their savings to buy bonds, stocks, mutual funds, and other assets. Households also keep some of their savings in bank accounts. In each case, households' savings become part of the supply of funds in the financial system.

Public saving = T – G = tax revenues collected by the government (which are the government's income) minus government expenditures. Note that the definition of public saving is the same as the definition of the government's budget surplus. Thus, if the government runs a budget surplus, T > G and public saving is positive, which adds to private saving to make national saving larger.

If the government runs a budget deficit, T < G and public saving is negative. This leads to a lower amount of national saving. Governments finance their deficits by borrowing – this borrowing is satisfied by selling government bonds to households, leaving less household saving remaining in the financial system.

Note: We are modeling a government budget deficit as a decrease in public saving, national saving, and the supply of loanable funds. An alternative would be to model a budget deficit as an increase in the demand for loanable funds, since governments finance their debt by borrowing. This alternative approach would yield the same results (namely, an increase in the real interest rate and decrease in investment). However, I strongly prefer the approach described in these notes (and in class) in which budget deficits reduce the supply rather than increase the demand for funds.

The shape of the supply curve

What does the supply curve look like? Is it upward-sloping like most supply curves? To answer this, we need to figure out how national saving would respond to an increase in the real interest rate. Answering this, in turn, requires that we determine how private and public saving respond to an increase in r.

Let's start with public saving. This model assumes that G and T are exogenous variables. Thus, our model cannot answer questions like "why does G rise?" or "why does the government reduce taxes?". Instead, the model can answer questions like "what are the affects of an increase in G or a decrease in T?". As a result, an increase in r does not affect public saving.

What about private saving? As we discussed in class, an increase in r would cause an increase in private saving, for two reasons. First, r is the reward for saving (postponing consumption). An increase in r motivates people to save more, so they can have even greater consumption in the future. Second, consumption includes spending on big-ticket items (like cars, big-screen TV sets, furniture), and people buy many of these items on credit. An increase in the interest rate therefore raises the cost of buying these items, and motivates people to cut back on purchases of large items.

Therefore, an increase in r causes an increase in private saving – and an increase in national saving.

Digression: as we noted in class, there's one reason why an increase in r might actually reduce private saving rather than increase it: if r rises, then every dollar you save earns more interest, so your lifetime resources are higher. Higher lifetime resources would allow you to consume more in all periods – including the current one. Hence, we have the unexpected result that an increase in r causes C to rise (and hence private saving to fall). So, theoretically, we cannot be sure whether an increase in r would cause private saving to rise or fall. Economists have studied data on household behavior and have estimated that people do save more (though not much more) when the interest rate rises. In the formal jargon, the interest rate elasticity of saving is positive, but small.

We therefore conclude that private saving, national saving, and the supply of loanable funds all depend positively on the real interest rate, so the supply curve is upward-sloping.

Equilibrium in the financial system of a closed economy

In a closed economy, the real interest rate adjusts to equate the supply of loanable funds with the demand for loanable funds. Suppose the equilibrium interest rate is 5%. If the actual interest rate is higher than 5%, then the supply of funds (from national saving) will exceed the demand for funds (from investment), resulting in a surplus of funds. The interest rate will fall to eliminate this surplus. Conversely, if the actual interest rate less than 5%, then firms' demand for funds for investment will exceed the supply of funds from national saving.

In the equilibrium, supply = demand in the loanable funds market, which is the same as saying national saving equals investment.

In a closed economy, there are no exports or imports, and

$Y = C + I + G$

Solve the preceding equation for investment:

$I = Y - C - G$

The right-hand-side is national saving. In a closed economy, investment equals national saving, and the loanable funds model shows that the adjustment of the interest rate is what brings about the equality of investment and saving.

Practice with the closed economy loanable funds model

Before we open up our model, you should make sure you're comfortable with it by using it to conduct some experiments. Here are some suggested experiments. The answers appear in endnotes.

1. An increase in the government budget deficit.

2. A new technology makes capital more productive and motivates firms to increase investment spending

3. The baby boomers retire (and thus they stop earning and saving, and start dissaving)

4. The government alters the tax code to create more incentives for investment

5. The government replaces the income tax (which discourages saving) with a consumption tax (or national sales tax), while holding the total amount of tax revenue, T, constant.

II. The loanable funds model for an open economy

Suppose the country has a completely open economy with no capital controls and perfect capital mobility. Thus, anyone in the country can freely borrow or lend as much or as little as she wants in global financial markets. This opens up new opportunities for savers and for entrepreneurs with lucrative investment opportunities: the latter can borrow from foreigners (in addition to borrowing from domestic savers), while the former can use their saving to purchase foreign assets (in addition to buying domestic assets).

Let r^C denote the equilibrium interest rate if the economy were closed (thus, r^C occurs at the intersection of the S and D curves), and let r* denote the world interest rate.

We make one additional assumption: we assume the economy is a small open economy. Here, "small" means too small to affect the world interest rate r*. The country can borrow a huge amount from global financial markets without driving up r*, or it can lend a huge amount in global financial markets without driving down r*. The country takes r* as given. r* is an exogenous variable.

In an open economy, saving no longer need equal investment. As we saw in the previous chapter,

$S - I = CA$ (Review: $Y = C + I + G + CA$, so $CA = Y - C - G - I = S - I$.)

There are three possible cases, corresponding to whether r^C is greater than, less than, or equal to r*. It would help a lot if you drew a picture of the supply-demand diagram for each of these cases.

CASE 1: $r^C > r^*$

In this case, investment will exceed saving, meaning the country's demand for funds (from firms and entrepreneurs who need funds to finance investment projects) exceeds the country's supply of funds (from national saving). The excess demand is satisfied by net borrowing from abroad, so the country runs a financial account surplus and current account deficit. In your diagram, draw r* below r^C and show that investment is greater than saving. The difference between investment and saving at r* equals the current account deficit, or net capital inflows.

CASE 2: $r^C < r^*$

Now, saving will exceed investment. The country's supply of funds (desire to save and lend) is greater than its demand for funds (desire to borrow to fund investment projects). The excess supply of funds flows abroad in the form of capital outflows and a current account surplus (and financial account deficit). In your diagram, draw r* above r^C. The gap between saving and investment at r* equals CA.

CASE 3: $r^C = r^*$

In this case, saving happens to equal investment, so the country will neither be a net lender or a net borrower, and the current and financial accounts will be balanced (CA = FA = 0). This does not mean there's no international trade in goods or in assets. In fact, it is possible (and likely) that some of the country's savings will flow abroad if domestic savers wish to purchase foreign assets, and that some firms will fund their investment projects by borrowing from foreign lenders. What It does mean, however, is that NET capital inflows or outflows will equal zero, so the country's total lending to

foreigners (when savers buy foreign bonds or other assets) will equal the country's borrowing from abroad (when domestic firms sell bonds to foreign savers).

A government budget deficit in the open economy

To keep things simple, let's assume the economy begins in Case 3 and the government budget begins in balance (so G = T, public saving = 0, and national saving = private saving).

Now suppose the government runs a budget deficit. This deficit means public saving is now negative, which causes national saving to fall and reduces the supply of loanable funds. Intuitively, the government borrows to finance its deficit (by selling Treasury bonds), and this borrowing reduces the net amount of funds available in the financial system to firms for investment projects. The supply of loanable funds curve shifts to the left.

So far, everything is as in the closed economy. But in the open economy, the real interest rate equals the exogenous world interest rate r*. The government budget deficit will not affect r*. And since investment depends on r*, investment will also be unaffected.

However, the budget deficit reduces national saving, which falls below investment, so now investment must be partially funded by borrowing from abroad:

$S - I = CA$

$\Delta S - \Delta I = \Delta CA$

Since $\Delta I = 0$, $\Delta S = \Delta CA$, and since $\Delta S < 0$, then $\Delta CA < 0$.

The country runs a current account deficit (and financial account surplus) in response to the government's budget deficit.

In summary, the budget deficit does not crowd out investment (as in a closed economy). But it does crowd out net exports and turn the country into a net borrower. As a result, the country acquires some external debt, which it must service (by paying interest/dividends/other income) until that debt is someday retired.

In either case (closed or open economy), the budget deficit has negative effects. In a closed economy, the deficit crowds out investment, which we learn from macroeconomics is important for long-run economic growth and future living standards. In a small open economy, the deficit adds to the country's external debt, which the country must service (pay interest on) using some of its future GDP. As a result, there is less of the country's future GDP remaining for the country's citizens to enjoy.

Practice with the small open economy loanable funds model

Try these experiments. For each, determine which curve shifts and in which direction. Determine what happens to saving, investment, and the current account deficit or surplus, and explain your answers. The solutions appear as endnotes.

6. A new technology makes capital more productive and motivates firms to increase investment spending

7. The government replaces the income tax (which discourages saving) with a consumption tax (or national sales tax), while holding the total amount of tax revenue, T, constant.

III. Efficient investment

First, some review of microeconomics:

The marginal product of capital (MPK) is the extra output a firm or country can produce if it has one more unit of capital, holding all other inputs constant. If the country acquires 1 more unit of capital and, as a result, it produces 5 more units of output, then MPK = 5. If the country gets 3 more units of capital and, as a result, produces 12 more units of output, then MPK = 12/3 = 4. If the country gets ΔK units of additional capital, and this extra capital allows the country to product ΔY units of output, then

$MPK = \Delta Y/\Delta K$

It is period 0. Suppose a country's entrepreneurs and firms have some potentially lucrative investment projects. If the economy is closed, these projects can only be financed from domestic saving, which means either C or G will have to fall in period 0. If the country undertakes these projects in period 0, then output will be higher in period 1 and all future periods (because extra capital adds to the country's productive capacity, i.e. because an increase in K causes an increase in Y). The country's residents prefer smooth consumption, so the country would be better off if it could help pay for the investment in period 0 by borrowing against the higher future income. The country cannot do this if it is closed, but it can if it is open.

Suppose an investment project undertaken in period 0 requires an investment of ΔK. This is a one-time expenditure. The project will increase the country's capital stock and hence increase its future output. In particular, output will rise by ΔY in period 1 and all future periods.

If the economy is open, it can borrow in global capital markets at interest rate r*, so it could fund this project while maintaining smooth consumption. Moreover, the investment project would raise future income, so it would increase the present value of the country's lifetime resources, which would allow the country to enjoy permanently higher consumption.

Should the economy undertake this project? As in the loanable funds framework above, the answer depends on r*.

If the country borrows ΔK in period 0, its external debt will grow by ΔK, and servicing this debt will require interest payments of $r^*\Delta K$ in all future periods. This is the cost of the investment.

The benefit is that output will be higher by ΔY in period 1 and all future periods.

So, the country should undertake the investment project if the benefit is greater than or at least equal to the cost:

Undertake the investment project if: $\Delta Y \geq r^* \Delta K$

Rearranging, the decision rule for investment projects becomes:

Undertake the investment project if: $\Delta Y/\Delta K \geq r^*$ or $\boxed{MPK \geq r^*}$

The project is worthwhile only if the return to capital exceeds the cost of capital. The textbook proves that a project that meets this criteria will raise the present value of output and resources, allowing a net increase in the present value of consumption. (You do not need to know this proof – you may trust me on this point.)

You may recall the law of diminishing returns from other economics courses: as more and more of an input is used, the return to that input (its marginal product) falls.

As a country undertakes more investment projects, K grows, so MPK falls.

The efficient level of investment is the amount of investment that causes MPK to equal r*. Why is it efficient?

If MPK > r*, then the country should do more investment, because the return to capital exceeds the cost of borrowing.

If MPK < r*, the return to the last dollar of capital stock is less than the cost of borrowing that dollar, so the country should disinvest (to reduce its capital stock) rather than invest (to increase it).

Compared to a closed economy, an open economy has many more opportunities to fund investment projects and achieve the efficient level of investment, which boosts the present value of consumption in the country while allowing consumption smoothing.

Solutions to experiments

1. Public saving falls. At each interest rate, national saving will be lower than before, the S curve shifts to the left. At the original interest rate, the supply of funds is now less than demand for funds, the interest rate must rise to restore equilibrium. As the interest rate rises, the supply increases (because households saving more when r rises) and the demand decreases (because it costs more for firms to borrow to finance their investment projects). In the new equilibrium, r is higher, S and I are lower than in the initial equilibrium. This is a very important result in macroeconomics: we say that the increase in the budget deficit crowds out investment. Remember, this result was obtained under the assumption that the economy is closed. We will see shortly that the effects of a budget deficit in an open economy can be quite different.
2. At each interest rate, firms would like to do more investment than before – if you look at the table of possible investment projects, a technological improvement would raise the expected return on some or all of these projects, so the firm would likely undertake more of these projects at any interest rate than before. The demand curve for loanable funds shifts to the right, causing r and S to rise. In the new equilibrium, S and I are higher than before. Note, though, that the final increase in I is somewhat smaller because the rise in r partially offsets the benefit of the higher productivity of capital.
3. Private saving falls, the S curve shifts left. At the initial value of r, there's now a shortage in the loanable funds market. r rises, causing investment to fall. In the new equilibrium, r is higher and S and I are lower than in the initial equilibrium.
4. The results here are identical to those in experiment 2.
5. The effects here are the opposite of those in experiment 3: private saving rises, causing national saving and the supply of loanable funds to expand. The S curve shifts right. At the initial interest rate, there is now a surplus of funds in the financial system. The interest rate falls to restore equilibrium. In the new equilibrium, r is lower while S and I are higher than in the initial equilibrium.
6. This is like Experiment 2 in the closed economy. As there, the demand for loanable funds increases at each interest rate, and the D curve shifts right. But in a small open economy, r* is exogenous. Firms simply borrow in international financial markets the money they need to pay for the new investment projects they wish to undertake. Since I increases but S does not, CA falls. If, initially, CA = 0 (as in Case 3), then the country will now have a current account deficit, meaning the country will be borrowing to pay for this new investment.
7. This is like Experiment 5 from the closed economy. As there, the S curve shifts right. However, the increase in supply of funds does not depress the interest rate in a small open economy – r* is exogenous. Rather, the excess supply of funds flows abroad in the form of net lending to ROW. The current account rises, external assets increase, and external wealth rises. The country then will derive income from this additional wealth, which will add to the country's disposable income in all future periods.