Lesson 6 - Basic Macroeconomic Relationships

Before developing the Keynesian Aggregate Expenditures model, we must understand the basic macroeconomic relationships that are the components of that model. The components of aggregate expenditures in a closed economy are Consumption, Investment, and Government Spending. Because government spending is determined by a political process and is not dependent on fundamental economic variables, we will focus in this lesson on an explanation of the determinants of consumption and investment.

Acknowledgement: Ed Sexton and Kerry Webb were the primary authors of the material contained in this lesson.

Section 1: Consumption and Savings

In the simplest model we can consider, we will assume that people do one of two things with their income: they either consume it or they save it.

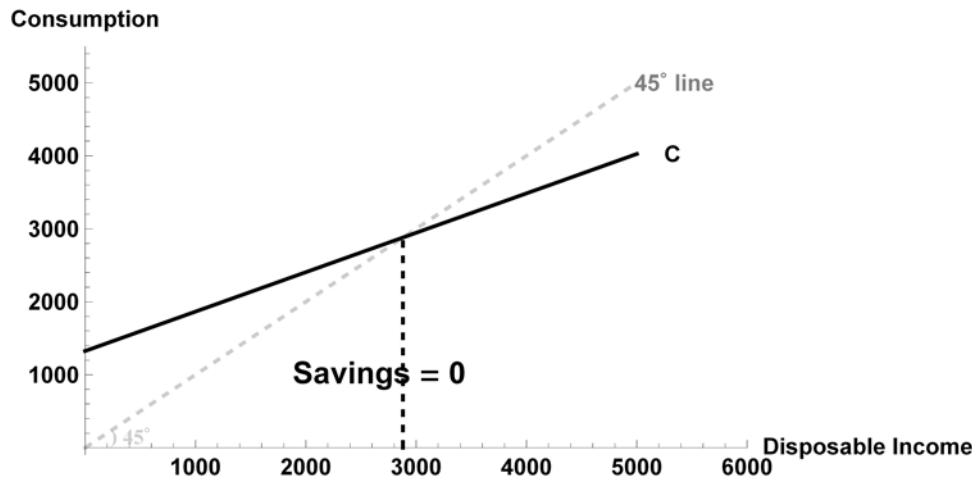
Income = Consumption + Savings

In this simple model, it is easy to see the relationship between income, consumption, and savings. **Consumption** is using goods and services that are purchased. In reality, goods and services do not have to be purchased to be consumed; however, we are assuming that there is a link between income and consumption in this model. Therefore, we will assume we use income to purchase goods and services that are consumed. **Savings** is the part of income that is not used for consumption purposes. If income goes up then consumption will go up and savings will go up. Consider the graph below, which shows consumption as a positive function of Income:

Consumption and Savings

This graph illustrates the relationship between savings and consumption. Income = Consumption + Savings. If someone is consuming more than their income, they are borrowing money. Therefore they have negative savings. Click on the button 'Savings < 0' to see how this is represented on the graph. If someone is consuming less than their income, they are saving a portion of their income. Click on the button 'Savings > 0' to see how this is represented on the graph. If someone is consuming at their income level, then they have no savings. Click on the 'Savings = 0' to see this represented on the graph.

Reset | Savings < 0 | Savings = 0 | Savings > 0



Notice the use of the 45° degree line to illustrate the point at which income is equal to consumption. The graph starts out at the point where income equals consumption (savings = 0). At income levels to the left of where “Savings = 0” (click on “Savings < 0”), savings is negative because consumption is above income, and at income levels to the right of “Savings = 0” (click on “Savings > 0”), savings is positive because consumption is below income. How can savings be negative? If you thought of borrowing, you are right. In economics we call this “dissavings.” The point where savings equals zero is called the break even point, because it is the point where there are no savings but there are also no dissavings. The graph below demonstrates the relationship between consumption and savings:

The Consumption Function

The **consumption function** shows the relationship between consumption and disposable income. **Disposable income** is that portion of your income that you have control over after you have paid your taxes (Y_d = Y - T; where T is taxes paid). To simplify our discussion, we will assume that consumption is a linear function of disposable Income, just as it was graphically shown below.

$$\textbf{Consumption} = a + MPC * Y_d$$

In the above equation, "a" is the intercept of the line and MPC is the slope. Let's explore their meanings in economics. The intercept is the value of C when Y_d is equal to zero. In other words, what would your consumption be if your disposable income were zero? Can there be consumption without income? People do this all the time. In fact, some of you students may have no income, and yet you are still consuming because of borrowing or transfers of

wealth from your parents or others to you. In any case, "a" is the amount of consumption when disposable income is zero and it is called "autonomous consumption," or consumption that is independent of disposable income.

In the consumption function, MPC is called the slope. MPC stands for marginal propensity (or inclination) to consume It represents the expected increase in consumption that results from a one unit increase in disposable income. If Income is measured in dollars, you might ask the question, "How much would your consumption increase if your income were increased by one dollar?" The slope, MPC, would provide the answer to that question. It is the change in consumption resulting from a change in income. (Remember the idea of a slope being the rise over the run? Go back to the graph of the consumption function and satisfy yourself that the rise is the change in Consumption and the run is the change in Income, and you will see that this definition of b is consistent with the definition of a slope.)

The **savings function** shows the relationship between savings and disposable income. As with consumption, we will assume that this relationship is linear:

$$\mathbf{S = e + MPS * Y_d}$$

In this equation the intercept is e, the autonomous level of savings. With savings, it is quite likely that "e" will be negative, which indicates that when disposable income is zero, savings on average are negative. The slope of the savings function is MPS and it represents the marginal propensity to save—the increase in savings that would be expected from any increase in disposable income.

The graph below shows the relationship of consumption and savings. When consumption equals disposable income, notice that savings is equal to zero.

Consumption and Savings

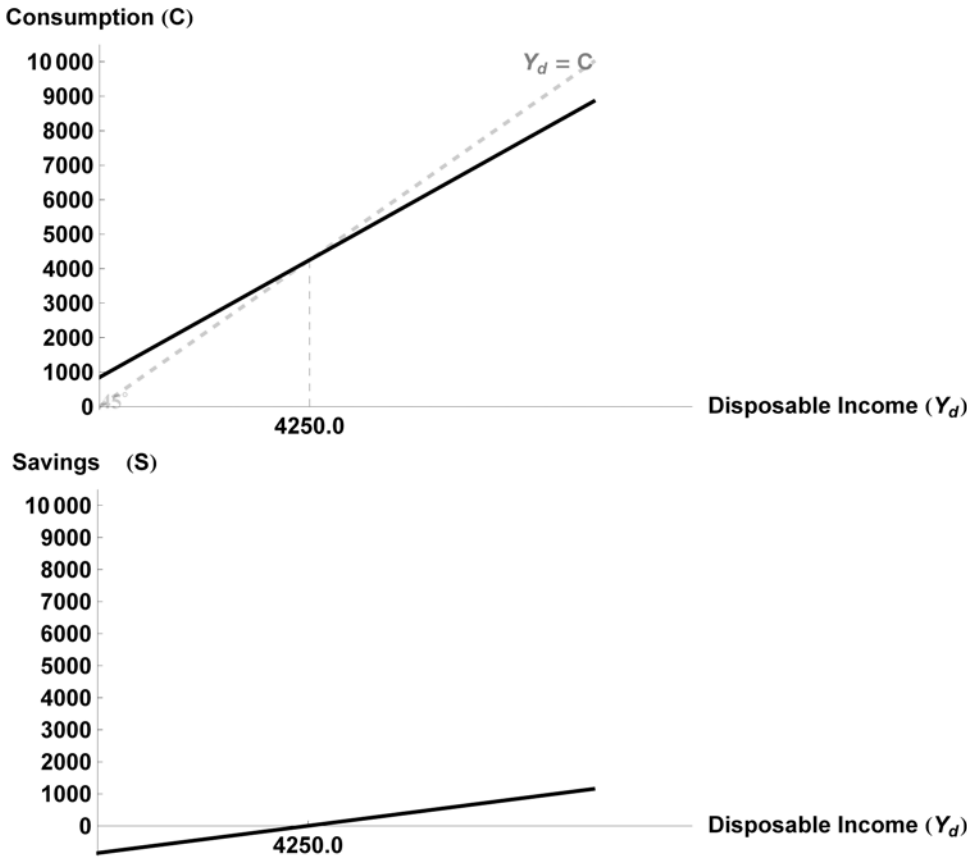
This graph demonstrates the relationship between consumption and savings. When all of the disposable income is consumed then savings equals zero. The slope of the consumption line is the marginal propensity to consume (MPC). The slope of the savings line is the marginal propensity to save (MPS). The MPC + MPS = 1.

MPC 0.8

MPS = 0.2

Savings = 0 when Y_d = 4250.

Reset



Marginal Propensities to Consume and Save

As discussed above, the **marginal propensity to consume (MPC)** is the extra amount that people consume when they receive an extra dollar of income. The **marginal propensity to save (MPS)** is the extra amount that people save when they receive an extra dollar of income. If in one year your income goes up by $1,000, your consumption goes up by $900, and you savings go up by $100, then your MPC = 0.9 and your MPS = 0.1. In general it can be said:

$$\textbf{MPC} = \frac{\textbf{Change in Consumption}}{\textbf{Change in Disposable Income}} = \frac{\Delta \text{ in } C}{\Delta \text{ in } Y_d}$$

$$\textbf{MPS} = \frac{\textbf{Change in Savings}}{\textbf{Change in Disposable Income}} = \frac{\Delta \text{ in } S}{\Delta \text{ in } Y_d}$$

It is also important to notice that: **MPC + MPS = 1**

Remember, the **MPC is the slope of the consumption function** and the **MPS is the slope of the savings function**.

Average Propensities to Consume and Save

The **average propensity to consume (APC)** is equal to the fraction of total income that is spent. **Average propensity to save (APS)** is equal to the fraction of total income that is saved.

$$\text{APC} = \frac{\text{Consumption}}{\text{Disposable Income}} = \frac{C}{Y_d}$$

$$\text{APS} = \frac{\text{Savings}}{\text{Disposable Income}} = \frac{S}{Y_d}$$

It is also important to notice that: **APC + APS = 1**

If in one year your income is $20,000 and your consumption is $16,000 then your APC is $16,000 divided by $20,000 or 0.80. This means that your savings is $4,000, and therefore your APS is $4,000 divided by $20,000 or 0.20.

Example

Let's do an example using data for a hypothetical economy. The data is presented in the table below. The consumption and the savings was computed using the graph below the table.

Consumption and Savings – Example

The table below lists the disposable income, consumption, and savings. We will use the formulas at the left to calculate the MPC and MPS.

$$\text{MPC} = \frac{\Delta C}{\Delta Y_d}$$

$$\text{MPS} = \frac{\Delta S}{\Delta Y_d}$$

MPC + MPS = 1

Disposable Income	Consumption	Savings
$1,400	$1,900	–$500
$2,400	$2,650	–$250
$3,400	$3,400	$0
$4,400	$4,150	$250
$5,400	$4,900	$500
$6,400	$5,650	$750

Consumption and Savings

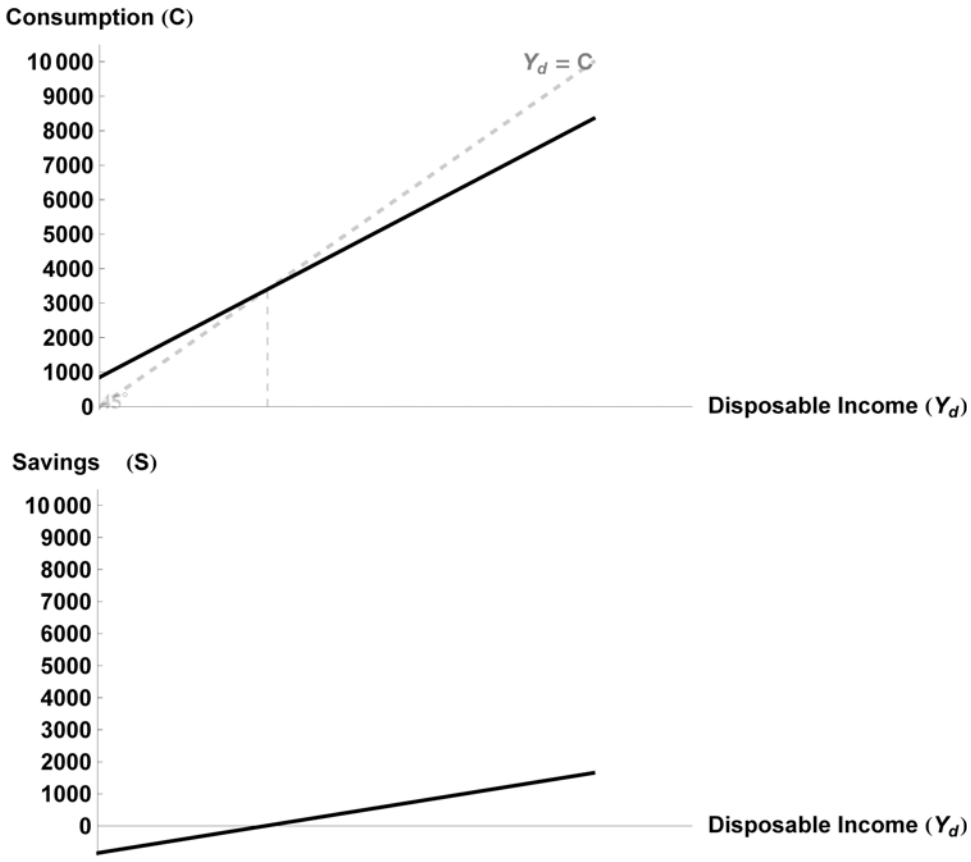
This graph demonstrates the relationship between consumption and savings. When all of the disposable income is consumed then savings equals zero. The slope of the consumption line is the marginal propensity to consume (MPC). The slope of the savings line is the marginal propensity to save (MPS). The MPC + MPS = 1.

Y_d 0

Consumption = 850.

Savings = −850.

Reset



Notice that as you move from an income of 3,400 to an income of 4,400, consumption goes from 3,400 to 4,150 and savings goes from 0 to 250. The MPC and MPS are therefore:

$$\text{MPC} = \frac{\Delta \text{ in } C}{\Delta \text{ in } Y_d} = \frac{4{,}150-3400}{4{,}400-3400} = \frac{750}{1000} = 0.75$$

$$\text{MPS} = \frac{\Delta \text{ in } S}{\Delta \text{ in } Y_d} = \frac{250-0}{4{,}400-3400} = \frac{250}{1000} = 0.25$$

Calculating APC and APS at the income level of $4,400

$$\text{APC} = \frac{C}{Y_d} = \frac{4{,}150}{4{,}400} = 0.94$$

$$\text{APS} = \frac{S}{Y_d} = \frac{250}{4{,}400} = 0.06$$

Since the consumption function and the savings function are both straight lines in this example, and since the slope of a straight line is constant between any two points on the line, it will be easy for you to verify that the MPC and the MPS are the same between any two points on the line. You can also see that MPC + MPS = 1 as was stated earlier. Also you can notice that APC + APS = 1.

Some of the Non-Income Determinants of Consumption and Savings

Notice that when we graph the consumption function, consumption is measured on the vertical axis and disposable income is measured on the horizontal axis. As disposable income goes up, consumption goes up and this is shown by movement along a single consumption function. But there are other things that influence consumption besides disposable income. What if one of these non-income determinants of consumption changes? Since they are not measured on either axis, we should note that a change in a non-income determinant of consumption will shift the entire consumption function not merely move you along a fixed consumption function. The graph below illustrates what these shifts look like. Let's look at several of these non-income determinants of consumption and savings:

1. Wealth—In economics wealth and income are two separate variables. A simple example will illustrate the difference. Let's say that you have a job earning $50,000 a year. If your great aunt Maude dies and leaves you $100,000 in an inheritance, your income is still $50,000 a year, but your wealth has just gone up. The same could be said about sudden increases in the value of a piece of art that you own, the discovery of oil on your property, or increases in the value of your stock portfolio. None of these occurrences increases your income, but they all increase your wealth. An increase in wealth will increase your consumption even at the same income level, and can be illustrated by an upward shift in the consumption function and a downward shift in the savings function. Obviously, a decrease in wealth will have the opposite effect (consumption shifts downward and savings function shifts upward).

2. Price Level—As the price level increases consumption decreases because household wealth becomes less valuable. Therefore there is less consumption and more savings to try and counteract the increase in prices. When the price level decreases then consumption increases. It is important to note that the change in the price level will cause a shift of the consumption function, and it causes the change in consumption because wealth has become less (increase in price level) or more (decrease in price level) valuable.

3. Expectations—There are times when consumers adjust their spending, based not on their actual income but rather on their expectations of future changes in their income. Changes in expectations will cause a shift in the curve, because consumption has changed without an actual chance in income. For example, if you think your income is going to go up in the future, you may consume more today. Not that we suggest this as a wise course of action, but it has been observed that some college seniors start to spend more once they have secured a job, even though that job (and its attendant income) will not start for a month or two. This behavior would be illustrated by an upward shift in the consumption function showing that your consumption has increased even though your actual disposable income has not. Likewise, if for some reason you were pessimistic about your future income (rumors floating around the company that layoffs were eminent) you might decrease your consumption, even though your actual current income had not changed.

4. Consumer Borrowing—Consumers adjust their consumption by borrowing more or less money. We observe in the aggregate economy that when borrowing goes up, consumption increases today and savings decreases today. However, this borrowing can lead to less consumption in the future when the debt is paid down. Even if income has stayed the same, if too much debt accumulates, consumers, in the future, will start to spend less and pay off debt. This is illustrated by a downward shift in the consumption function and an upward shift in the savings function (remember that paying off debt is the same thing as increasing savings).

Also related to consumer borrowing is the **real interest rate**. If the real interest rate increases, it makes borrowing more expensive and consumers will borrow less money and consume less. Increases in the real interest rates lead to less consumptions. When the real interested rate decreases, the cost of borrowing is less expensive and consumers borrow more money. This leads to higher levels of consumption.

5. Income Taxes—In all of the cases above, when consumption goes up savings goes down and vice versa. In this case, when income taxes increase both savings and consumption decrease and vice versa. Taxes decrease the amount of disposable income available. This results in a decrease of consumption and a decrease in savings

because there is less income to use for consumption and savings. This shift will NOT be illustrated on the graph below, but it is important to remember that it causes both to decrease or increase.

Shifts in Consumption and Savings

This graph demonstrates the impact of the shifts of consumption and savings. When the three factors listed below shift the consumption function upward and the savings function downward, consumers are consumption more goods and services at the same income level. However, they are saving less at the same income levels. The reverse is true when the factors cause the consumption function to shift down.

Shift in Consumption

↓ in C.....↑ in C

850

Factors

1. Wealth
1A. Wealth ↑, ↑ in C
1B. Wealth ↓, ↓ in C

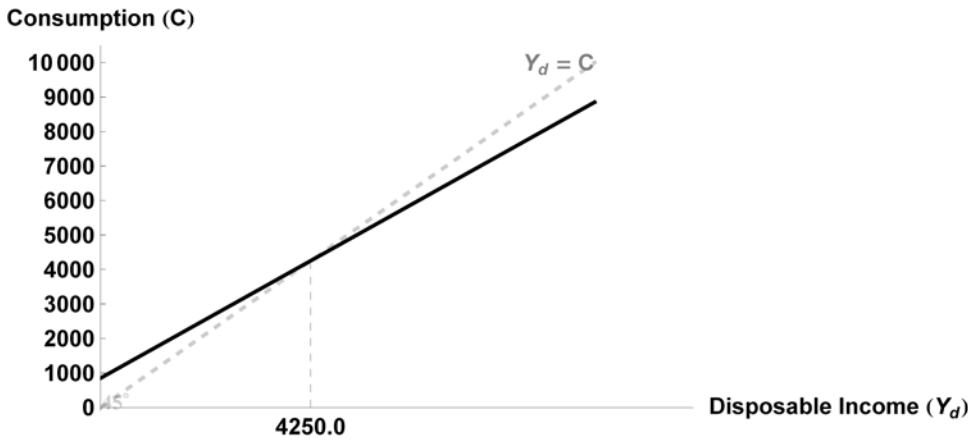
2. Price Level
2A. Price Level ↑, ↓ in C
2B. Price Level ↓, ↑ in C

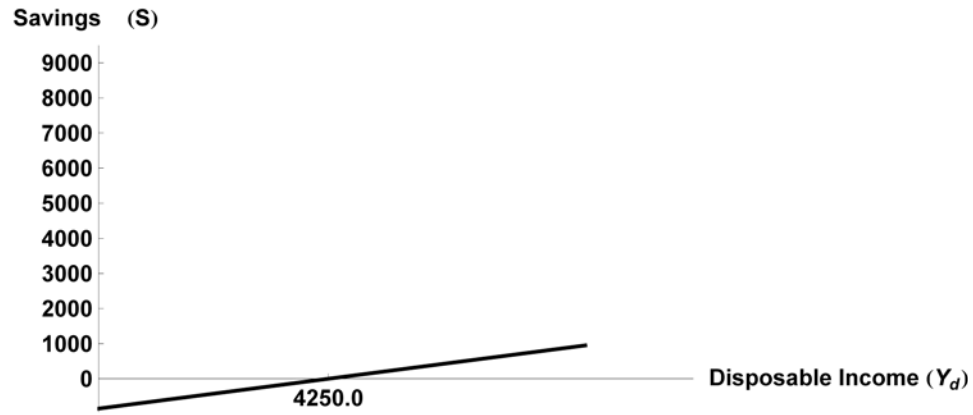
3. Expectations
3A. Expectations ↑, ↑ in C
3B. Expectations ↓, ↓ in C

4. Borrowing
4A. Borrowing ↑, ↑ in today C
4B. Borrowing ↓, ↓ in today C
4A. Borrowing ↑, ↓ in future C
4B. Borrowing ↓, ↑ in future C

5. Income Taxes
5A. Income Taxes ↑, ↓ in C & S
5B. Income Taxes ↓, ↑ in C & S

Reset





You can likely think of other factors that are unrelated to income that could shift the consumption and savings functions such as the stock of durable goods held by consumers. In general, anything that influences consumption or savings that is NOT disposable income will shift the functions upward or downward. Any change in disposable income will move you along the functions.

Section 2: Investment

Investment

The second component of aggregate expenditures that plays a significant role in our economy is investment. Remember from our lesson on National Income Accounting that investment only occurs when real capital goods are created. Investment is such an important part of our economy because it affects both short-run aggregate demand and long-run economic growth. **Investment** or **Gross Private Domestic Investment** is a component of aggregate expenditures, so when a company buys new equipment or builds a new plant/office building, it has an immediate short-run impact on the economy. The dollars spent on the investment have the immediate impact of increasing spending in the current time period. But because of the nature of investment, it has a long-term impact on the economy as well. If a company buys a new machine, that machine is going to operate, continue to produce, and will have an impact on the productive capacity of the economy for years to come. This is in contrast to consumption purchases that do not have the same impact. If you buy and eat an apple today, that apple does not continue to provide consumption benefits into the future.

Expenditures on or production of new plant and equipment (capital) in a given time period, plus changes in business inventories are affected by expectations of business conditions and interest rates in the future. The aggregate expenditure model is largely based on the idea that disruptions to the economy occur because investment expenditures by businesses are largely unpredictable and vary from year to year. This occurs because the amount of planned spending (**planned investment**) by businesses is not necessary equal to the amount of realized spending by businesses. For example, suppose you are running a business, and based on your past sales, you plan to spend $1 million this year to produce 1,000 units of your product. Suppose also that you still have 100 units left in inventory from last year. You believe you will be able to sell a thousand units, and still have an inventory of 100 at the end of the year.

However, what if you're wrong? What if many consumers are thinking that they could possibly lose their jobs this year and they decide not to purchase your product as a result? What if you spend the $1 million and make 1,000 new units as you planned, but you only sell a total of 400 units the entire year? You will end the year with 700 units on hand—and an **unplanned inventory** of 600 units more than you expected. **Realized investment** is the sum of planned investment plus any unplanned changes in inventories. Note also that the amount of unplanned investment correlates strongly to the amount that consumers decide to spend or save in any given year. If enough consumers decide to save rather than spend, then many businesses will experience high levels of unplanned inventories. As a result, businesses will begin to cutback their production, and lay workers off. This will in turn drive income and spending levels down further, creating even higher levels of unplanned inventories, and a recession is born.

Relationships Surrounding Investment

There are some important relationships surrounding investment.

Gross Private Domestic Investment (I) = Planned Investment Expenditures

Realized Investment = Actual Savings (S)

Unintended Investment = Realized Investment > Planned Investment. In this case, business inventories are growing and businesses will need to reduce prices or cutback back their operations by reducing staff in order to diminish the over-supply. Unintended investment is a frequent occurrence during recessionary periods.

Unintended Disinvestment = Realized Investment < Planned Investment. In this case, business inventories are being depleted, and businesses will need to expand output or raise prices to keep up with the demand for their products. Businesses are scrambling to hire people, employ additional work shifts, and produce as much as possible to meet the demands for their products. Unintended disinvestment often occurs at the beginning of a sharp expansion in the overall economy.

Expected Rate of Return

An important question in the study of investment is, "Why do firms invest?" Investment is guided by the profit motive—firms invest expecting a return on their investment. Before the investment takes place, firms only know their **expected rate of return**. Therefore, investment almost always involves some risk.

Consider the following scenario. Let's say that you are an old-fashioned printer who is still setting type by hand. You know that your equipment is slow and outdated. You also know that investing in modern computerized printing presses will yield a positive return for your business, but that they will be very expensive. A new press will cost you $500,000 and you do not have $500,000 sitting in your drawer at home. In order to undertake the investment in new equipment, you will have to borrow the money. Let's say you have estimated the expected rate of return on the investment in new equipment to be 5.5%. Should you borrow the money and buy the new equipment? What will influence you decision?

The key variable that will help you to decide whether the investment makes sense for you is the **real interest rate** (nominal interest rate - inflation rate) that you will have to pay on the loan. If the **expected rate of return in greater than the real interest rate**, the investment makes sense. If it is not, then the investment will not be profitable. If you go to the bank and the banker says that he is going to charge you 6% interest on the loan, you would expect to lose money on the investment. You cannot pay 6% on the loan if you only expect to earn 5.5% on the investment. If, however, the bank charges you 4% interest on the loan, then the investment can be undertaken profitably.

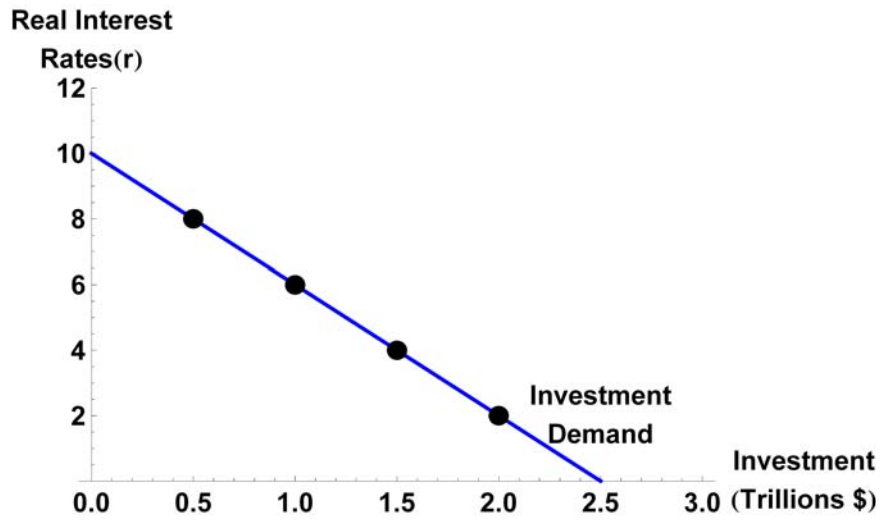
The real interest rate determines the level of investment, even if you do not have to borrow the money to buy the equipment. What if you did have $500,000 sitting in your drawer, and you had to decide whether to buy machines that would yield an expected rate of return for your company of 5.5%. If the real interest rate at the bank is 6%, you would not buy the machines. You would instead put the money in the bank and earn 6%. If the interest rate at the bank were 4%, you would buy the machines because they will yield a higher return than the next best alternative available to you.

The Investment Demand Curve

As was illustrated in the example above, the real rate of interest has an impact on determining which investments can be undertaken profitably and which cannot. The higher the real rate of interest, the fewer investment opportunities will be profitable. When the real rate of interest is at 8%, only those investments that have an expected rate of return higher than 8% will be undertaken. If the interest rate is 4%, all investments with an expected rate of return higher than 4% will be undertaken. There are more investments with an expected rate of return higher than 4% than there are with an expected rate of return higher than 8%, so there is more investment at a lower rather than a higher real rate of interest. This inverse relationship between the real rate of interest and the level of investment is illustrated in the investment demand curve shown below.

Investment Demand

The investment demand curve shows the relationship between real interest rates and the level of investment in trillions of dollars. Notice, that as the real interest rate declines the level of investment increases. This is because some firms will realize that the rate of return on investment is higher than the real interest rate so they are incentivized to make more capital investments.Also, as the interest rate increases the level of investment will fall. This is because some firms will realize that the rate of return on investment is lower than the real interest rate so they no longer make capital investments.



In the aggregate expenditure model, we assume that the relationship between investment and real GDP is constant at any interest rate. This means that as real GDP is increasing then the level of investment will be the same as illustrated in the graph below. As the real interest rate changes, then the level of investment will change (as illustrated in the graph above and below). It is important to remember for the aggregate expenditure model that there is a constant relationship between investment and real GDP. In real life, there is a non-constant relationship, but for the purposes of this model we will assume that it is constant. This will be discussed more in the next unit.

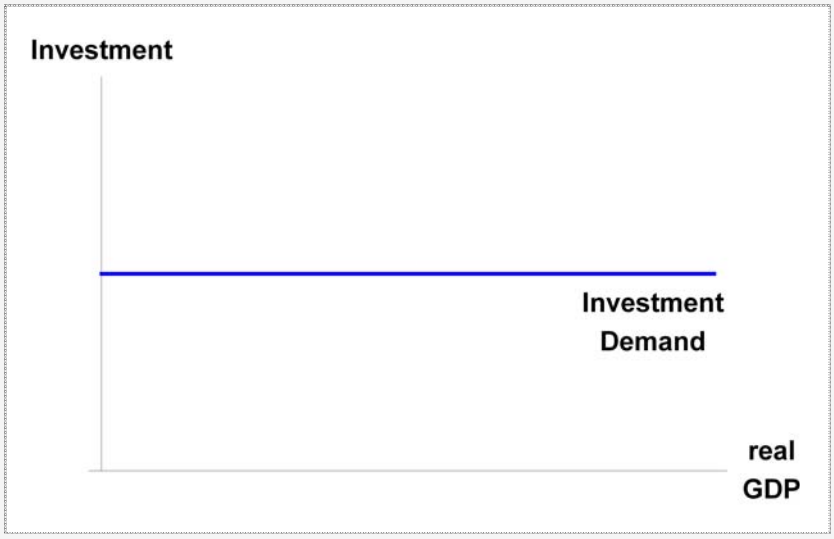
Investment and GDP

Use the slider bar to change the interest rates. As the interest rate increases from 6% to 8% then the investment curve shifts down. As the interest rate decreases from 6% to 4% then the investment curve shifts up.Notice, that since the investment curve is flat investment does not change as GDP changes.

Change in Interest Rate

Interest Rate (r) = 6%

Reset



What Might Cause Shifts in the Investment Demand Curve?

As with the consumption function, there are factors that will shift the entire investment demand curve. These are non-interest rate determinants of Investment. While there are many things that can influence the level of investment in the economy other than the real interest rate, we will discuss only three.

Shifts in Investment Demand

Use the slider bar to shift the demand curve from left to right.

Shifts in the Demand Curve

↓ Inv. Demand.....↑ Inv. Demand

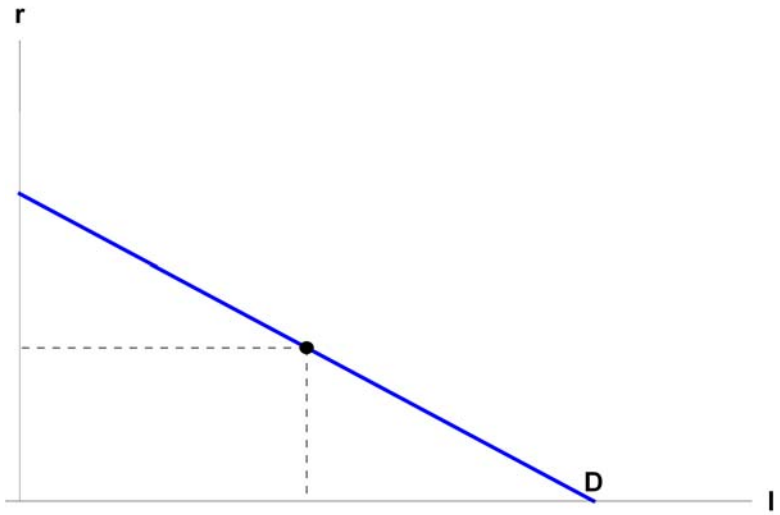
Factors

1. Business Taxes
1A. Taxes Incentives ↑, Inv. Dem. ↑ (right)
1B. Taxes Incentives ↓, Inv. Dem. ↓ (left)
1C. Taxes ↑, Inv. Dem. ↓ (left)
1D. Taxes ↓, Inv. Dem. ↑ (right)

2. Technology
2A. Technology ↑, Inv. Dem. ↑ (right)
2B. Technology ↓, Inv. Dem. ↓ (left)

3. Stock of Capital Goods
1A. Stock Cap. G. ↑, Inv. Dem. ↓ (left)
1B. Stock Cap. G. ↓, Inv. Dem. ↑ (right)

Reset



1. Business Taxes —The government can influence the level of investment by the tax structure they impose on businesses. When the government gives tax incentives for investing in new capital (such as allowing businesses to depreciate new capital at a faster rate, or giving tax credits for new “green” investments), this encourages additional investment at all levels of the real interest rate and shifts the investment demand curve to the right. For example, in the graph below, if the government gives tax incentives that encourage investment. This will cause the even at the same interest rate we might expect the level of investment to increase. Shift the curve to the right and notice that the interest rate has stayed the same, but the level of investment (I) has increased. If the government withdraws these tax incentives, then the investment demand curve shifts to the left.

If the government increases taxes on the firms, then their after tax rate of return will be expected to be lower. Therefore, this could lead to a decrease in investment. On the other hand, a decrease in the tax rate increases the rate of return and firms could investment more.

2. Changes in Technology—A business will be more likely to increase investment in an industry where technology is changing than in an industry with a more fixed technology. Businesses recognize the need to keep up with competitors' utilization of modern technology. At any given level of the real interest rate you would expect investment Demand to be higher the more technology is advancing.

3. Stock of Capital Goods on Hand—Businesses that already have a significant stock of capital on hand are less likely to invest in additional capital. For instance, a company that has excess office space or idle plants is not as likely to invest in additional capital as a business that is operating at or beyond capacity. At any given level of the real interest rate, you would expect more investment by a firm that is short on capital goods than by a firm that has an adequate stock of capital on hand.

Summary

Key Terms

APC
APS
Average Propensity to Consume
Average Propensity to Save
Business Tax Incentives
Business Taxes
Changes in Technology
Consumer Borrowing
Consumption
Consumption Function
Disposable Income
Expectations
Expected Rate of Return
Gross Private Domestic Investment
Income Taxes
Investment
Investment Demand Curve
Marginal Propensity to Consume
Marginal Propensity to Save
MPC
MPS
Planned Investment
Price Level
Real Interest Rate - Consumption
Real Interest Rate - Investment
Realized Investment
Savings
Savings Function
Slope of Consumption Function
Slope of Savings Function
Stock of Capital Goods on Hand
Unintended Disinvestment
Unintended Investment
Unplanned inventory
Wealth