Lesson 7 - The Aggregate Expenditure Model

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

Section 1: The Aggregate Expenditures Model

Aggregate Expenditure Model

Now we will build on your understanding of consumption and investment to form what is called the Aggregate Expenditures Model. The **aggregate expenditure model** (sometimes known as the **multiplier model** or **Keynesian cross model**) **assumes a constant price level,** and provides a graphical display of the effects of spending in the economy. The basic idea here is that when Person #1 spends money, it becomes the income of Person #2. Let's say that Person #2 saves 10% of his income, and spends the remaining 90%. His expenditure becomes the income for Person #3. This pattern then repeats with multiple spending, saving and income rounds. Thus total expenditures and total income are multiplied to be much greater than the initial change in spending by Person #1.

Aggregate income is the total amount income received in the economy, and is measured in real terms. If savings equals zero, then aggregate income will be fully spent and will always equal aggregate expenditures.

The aggregate expenditure model is used as a framework for determining equilibrium output, or GDP, in the economy. When we developed the consumption function in a previous lesson, we stated that consumption was a function of disposable income. In this model, we return to the assumption of the circular flow model that the production of the final goods and services in the economy (the GDP) results in a flow of income that is exactly equal to the value of that output. Since the GDP is equal to Income, we can model the spending (for now just consumption and investment) in the economy in terms of GDP instead of in terms of income.

Consumption

As discussed in the previous lesson, consumption is determined by a number of factors. Since **consumption (C)** plus savings must equal to a person's total income, then it necessarily follows that consumption and savings are both related to the same general factors. Thus, in general, the factors (except for taxes) that would cause people to consume more will also cause them to save less. These factors include wealth, price level, expectations, consumer borrowing, and income taxes. Remember that the slope of the consumption function is the marginal propensity to consume (MPC). The slope of the aggregate expenditure line is also the MPC.

Investment

Expenditures on or production of new plant and equipment (capital) in a given time period, plus changes in business inventories are called **gross private domestic investment** or **investment (I)**. Such expenditures 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 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.

Another way to look at investments impact on macroeconomic equilibrium is looking at savings and investment. Remember that when people save, they are withdrawing spending from the flow of income and expenditures. Savings is therefore called a **leakage**. When businesses invest, they are adding spending to the flow of income and expenditures so that Investment is called an **injection**.

Equilibrium output is achieved when:

Leakages = Injections

or

Savings = Investment

If savings is greater than investment, then GDP is too high and output will fall. If savings is less than investment, then GDP is too low and output will rise.

In the aggregate expenditure model we assume that investment does not change as real GDP changes. There are factors that will cause the investment to shift up and down. These were discussed in the previous lesson.

It is also important to know that there are more leakages than savings. For example, taxes and imports are leakages, while exports, government spending, and investment are injections. In a more complex theoretical model, leakages and injections make not be equal, but that is usually due to not accounting for one of the leakages and/or injections. For example, if taxes are not taken into account then savings may be higher than it should be. This will cause an inequality of savings and investment even at equilibrium. However, if taxes are taken into account then savings will decline and savings will be equal to investment.

Government Spending

Government spending (**G**) or **government expenditures** are measured by accumulating the spending from Federal, state and local governments. For example, when U.S. buys new airplanes from the Boeing Corporation it is counted as government expenditure. If the City of Rexburg spends money on a municipal park, that too, is counted as government expenditure. New freeway systems, school facilities, nuclear warheads, space shuttles, immunization programs, fire trucks, etc. are all various types of government expenditures because the various government units are buying products and services made in America.
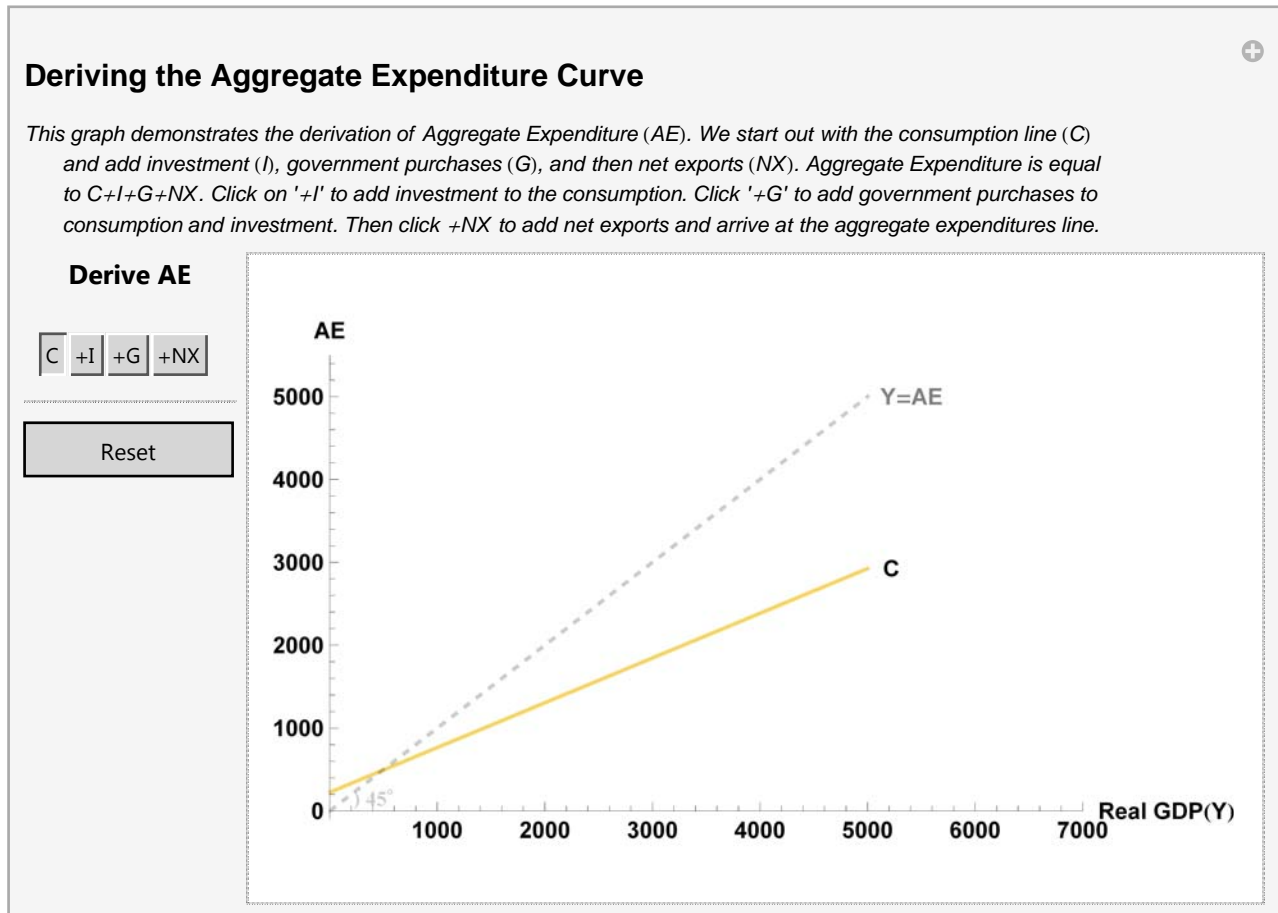
Net Exports

Net Exports (NX) are the last component of the Aggregate Expenditures model. **Net Exports (NX)** represents the purchase of American-made products by foreign individuals, companies or countries (i.e., **Exports**) minus the purchase of foreign-made products by American individuals, companies or government units (i.e., **Imports**).

Graphing Aggregate Expenditure Model

The amount of aggregate expenditures in the economy is found the same way as the expenditure approach to the GDP calculation—that is, spending from each sector (C, I, G, NX) is added to the spending from the other sectors to

build to the total spending in the economy. The graph below demonstrates how consumption, investment, government spending, and net exports are added together to form the **aggregate expenditures curve (AE)**. The **45 degree line** is where real GDP (Y) equals aggregate expenditures (AE). The slope of the AE line is the MPC. Notice that when investment (I) is added to consumption it is a parallel shift and that the slope of the line does not change. The same occurs when government spending (G) and Net Exports (NX) are added. This is because we assume that investment, government spending, and net exports are a fixed amount that does not vary with changes in real GDP. The level of investment, government spending, and net exports can change and it will cause a shift in the AE curve, but it will not change the slope of the AE line.

Deriving the Aggregate Expenditure Curve

This graph demonstrates the derivation of Aggregate Expenditure (AE). We start out with the consumption line (C) and add investment (I), government purchases (G), and then net exports (NX). Aggregate Expenditure is equal to C+I+G+NX. Click on '+I' to add investment to the consumption. Click '+G' to add government purchases to consumption and investment. Then click +NX to add net exports and arrive at the aggregate expenditures line.

Derive AE

| C | +I | +G | +NX |

Reset

Macroeconomic Equilibrium

Macroeconomic equilibrium occurs where the AE line crosses the 45 degree line. In the graph above, you will notice it when the "+NX" button is pushed. Knowing that someone's expenditure is someone else's income, allows us to derive the mathematical equations necessary to reach equilibrium (Y*) in this model. We mathematically solve for macroeconomic equilibrium below. (Note: Remember that C = a + MPC*Y_d and that Y_d = Y - T.)

Step-by-Step Solving for Macroeconomic Equilibrium (Optional)

1. **Output (GDP) = Income (Y) = Aggregate Expenditures (AE)**   **(step 1)**

2. **Y = AE of all sectors**   **(step 2)**

3. **Y = C + I + G + NX**   **(step 3)**

4. **Y = a + MPC(Y-T) + I + G + NX** **(step 4)**

5. Collect like terms on one side: **Y- MPC(Y) = a - MPC(T) + I + G + NX** **(step 5)**

6. **Y(1- MPC) = a + I + G + NX - MPC(T)** **(step 6)**

7. **Y* =** $\left[\frac{1}{(1-\text{MPC})}\right]$**[a + I + G + NX - MPC(T)]** **(Equilibrium)** **(step 6)**

Try it out: Assume that C = 200 + 0.75*Y_d, I = 50, G = 30, Exports = 40, Imports = 20, and T = 10. What is Y*?

If we plug these numbers into the equation above then we get the following:

Y* = $\left[\frac{1}{(1-0.75)}\right]$[200 + 50 + 30 + (40-20) - 0.75*(10)] = $1,170
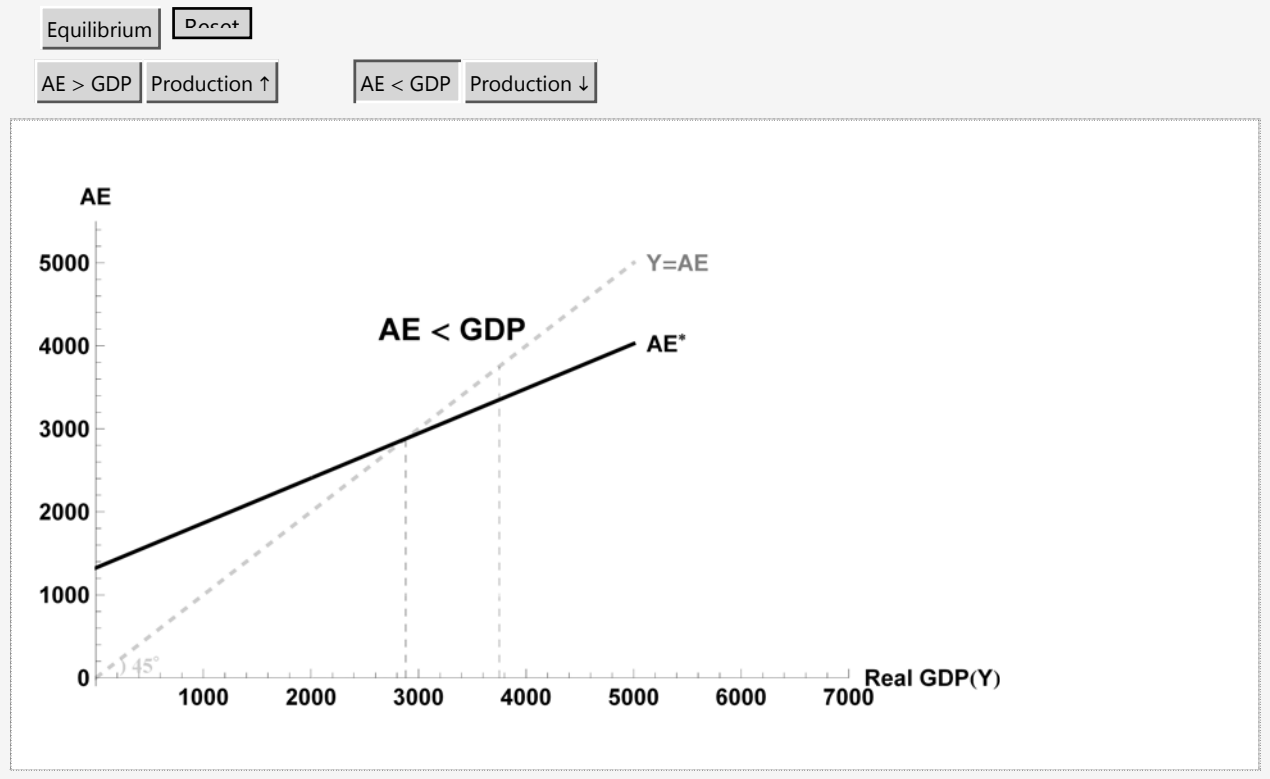
This graph demonstrates the role of inventories in an economy, and how the economy gets back to equilibrium when the economy is not in equilibrium. The graph starts out at macroeconomic equilibrium. Click on the button 'AE > GDP.' At this point spending (AE) is greater than production (GDP). Inventories unexpectedly decline. Firms order more goods and production increases. Click on the next button to the right. GDP increases and returns to equilibrium. Next, click on the button 'AE < GDP.' At this point spending (AE) is less than production (GDP). Inventories unexpectedly accumulate. Firms order less goods and production decreases. Click on the next button to the right. GDP decreases and returns to equilibrium.

Inventories

Inventories can be an important indicator of future economic expansion or contraction. **Inventories** are goods that a business has on hand but they have not sold. The graph demonstrates the role of inventories in an economy, and how the economy gets back to equilibrium when the economy is not in equilibrium.

Inventories and Macroeconomic Equilibrium

This graph demonstrates the role of inventories in an economy, and how the economy gets back to equilibrium when the economy is not in equilibrium. The graph starts out at macroeconomic equilibrium. Click on the button 'AE > GDP.' At this point spending (AE) is greater than production (GDP). Inventories unexpectedly decline. Firms order more goods and production increases. Click on the next button to the right. GDP increases and returns to equilibrium. Next, click on the button 'AE < GDP.' At this point spending (AE) is less than production (GDP). Inventories unexpectedly accumulate. Firms order less goods and production decreases. Click on the next button to the right. GDP decreases and returns to equilibrium.

Equilibrium	Reset

AE > GDP	Production ↑		AE < GDP	Production ↓

If the economy were for some reason producing at GDP = 2,000 (click on "AE > GDP") instead of GDP* = 2,850 (Equilibrium), what would be the result and what market forces might induce the economy to return to GDP* = 2,850? Notice that at GDP = 2,000, total spending (AE) is greater than output (GDP). The aggregate expenditure line is above the 45 degree line, indicating that spending is above output. This economy is producing 2,000 units of output (GDP) each month, but that consumers and businesses together are purchasing more than 2,000 units of output (AE). How would it be possible for more to be bought than what is produced in any given time period? It would be possible if businesses have unsold inventories on hand. But if a business has an ideal level for their inventories that they want to maintain, and purchases exceed production, inventories will be drawn down or depleted. What would naturally happen in an economy if spending were greater than production and inventories were falling? Businesses would begin to produce more, and the output or GDP of the economy would rise from GDP = 2,000 to GDP* = 2850 (Click on "Production ↑").

If the economy were for some reason producing at GDP = 3,750 (click on "AE < GDP") instead of GDP* = 2,850 (Equilibrium), what would be the result and what market forces might induce the economy to return to GDP* = 2,850? Notice that at GDP = 3,750, total spending (AE) is less than output (GDP). We know that spending is greater than output because at this level of GDP the Aggregate Expenditures line is below the 45 degree line, which is the line where spending is equal to output. Imagine you are running the economy. Each month, you are producing 3,750 units of output (GDP) and people are buying around 3,200 units of output (AE). Each month, you would be adding 550 units of output to your inventories and over the course of the year, inventories would be piling up. Imagine that

producers have a certain level of inventories that they desire to have on hand, but that they do not want the stock of inventories to substantially grow or depleted. At GDP = 3,750, inventories would be piling up at the rate of 550 extra units of inventory each month! What would you do if you were running the economy and unwanted inventories were building up? Wouldn't that be a signal to you to reduce production? As you reduce production, output or the GDP, falls from GDP = 3,750 to GDP* = 2,850 (Click on "Production ↓").

To summarize, notice that in this model:

1. If spending is greater than production, inventories will be depleted and production will rise, and
2. If spending is less than production, inventories will accumulate and production will fall, SO ...
3. Equilibrium is achieved where production exactly equals spending:

$$\text{Output (GDP)} = \text{Spending (AE)}$$

Section 2: Gaps and Multipliers

Recessionary Gaps

The reason the Aggregate Expenditures model is important to economists is that it demonstrates Keynes' assertion that an economy can settle into an equilibrium position and stay there. Such an equilibrium position may or may not be at the level of real GDP where **full employment** exists, or in other words, at the level of real GDP where cyclical unemployment is zero. Thus, Keynes would assert that during the Great Depression, the economy had reached an equilibrium position far below its full employment level. Further, he would argue that since consumers were not spending, and since businesses would not hire and produce more output when their inventories were already high, the only other possible solution was to have government step in and create additional spending programs, even if the government had to borrow money to do so.

A **GDP gap** exists when the equilibrium GDP is not equal to the level of full-employment GDP. These gaps take two forms. The first is called a **Recessionary Gap**, and is the amount of spending increase necessary to raise the AE curve in order to get an equilibrium position at the full employment level. As indicated by the name of the gap, the economy is often producing below its capabilities, and is usually in a recession when real GDP growth is negative or slowly growing in the 0-2 percent per year range. In the graphic below click on "1. Recessionary Gap." This will illustrate the recessionary gap. Notice that real GDP is at a level that is below full employment or **potential GDP**. If government spending were increased (click on "↑ Government Spending") it could shift the AE_1 curve back to the AE* curve, then the economy's equilibrium output level would increase from GDP = 2,000 to GDP* = 2,850, where full employment could be achieved.

Recessionary and Inflationary Gaps

This graph demonstrates recessionary and inflationary gaps. The graph starts out at full employment which is also potential GDP. Click on '1. Recessionary Gap.' This shows the economy in equilibrium below full employment. The government can increase spending to move the economy back to full employment. Click the next button to the right to show this. On the other hand if the economy is performing beyond full employment there is an inflationary gap. Click on '2. Inflationary Gap.' To contract the economy, government spending will decrease. Click the next button to the right, and the economy moves back to full employment.

Full Employment		Reset			
Recessionary Gap	1. Recessionary Gap	↑ Govt Spending	Inflationary Gap	2. Inflationary Gap	↓ Govt Spending
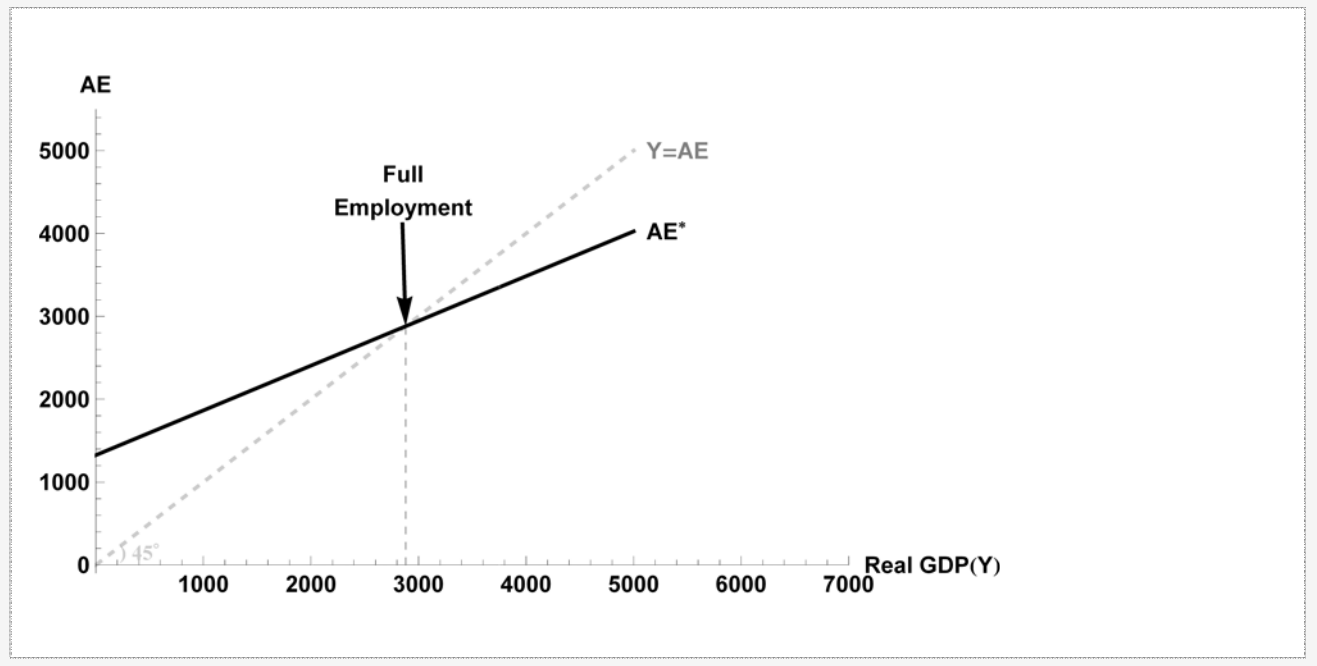
Inflationary Gaps

A second type of gap exists when equilibrium real GDP actually exceeds the full employment level. This type of gap is known as an **Inflationary Gap**. In this situation, the economy is producing at very high levels, using its full capacity. For example, companies could be employing two or three shifts, many workers may be working weekends in addition to regular hours, and income levels would be very high. Further, capital equipment is fully utilized. In such a situation, there is tremendous pressure for prices to rise because income and spending levels are very high. In the graphic above click on "2. Inflationary Gap." This will illustrate the inflationary gap. Notice that real GDP is at a level that is above full employment or potential GDP. If government spending were decreased (click on "↓ Government Spending") it could shift the AE_2 curve back to the AE* curve, then the economy's equilibrium output level would decrease from GDP = 3,750 to GDP* = 2,850, where full employment could be achieved. Thus the inflationary gap is the amount of spending reduction necessary to lower the AE curve in order to get an equilibrium position at the full employment level.

The Expenditure Multiplier

The model of Aggregate Expenditures that we are currently considering is often called a Keynesian Model because it was first formulated by British economist John Maynard Keynes in his *General Theory of Employment, Interest, and Money*, published in 1936—at the height of the Great Depression. One of the central premises of Keynesian economics is the idea of a multiplier. Keynes hypothesized that a given increase in spending would cause output to

increase by a multiple of the increase in spending.

The multiplier plays an important role in the next step of our model which is to take the appropriate action in order to eliminate a GDP gap and restore equilibrium at the full employment level. As noted at the beginning of this topic, one person's expenditure becomes another person's income. The second person may save some of that income, but then spend the rest, which in turn becomes the income of the third person. To see how this concept can be applied to the elimination of a recessionary gap, we need to understand the **Expenditure Multiplier**. The expenditure multiplier is simply the multiple by which an initial change in aggregate spending will alter total output after all spending/income rounds.

Deriving the Expenditure Multiplier

Deriving the expenditure multiplier requires some math. When a business spends $1 on new plant or equipment it injects $1 into the economy. That $1 becomes income to someone (whoever built the machine or constructed the new plant) who spends a portion of it and saves the rest. The portion they spend and the portion they save depends on their MPC and their MPS. The portion that is spent becomes income to someone else who likewise spends a portion, which becomes income to another, who spends a portion, and so on. The spending stream can be characterized in the following way:

$$\$1 + \$1(MPC) + \$1(MPC)(MPC) + \$1(MPC)(MPC)(MPC) + \ldots$$

Or

$$\$1 + \$1(MPC) + \$1(MPC)2 + \$1(MPC)3 + \ldots$$

Which can be shown in its limit to equal $\frac{1}{1-MPC}$. This is called the expenditure multiplier. As long as the MPC is less than 1, the multiplier will be greater than one. In fact, we can show that

When the MPC is .9, the multiplier is 10
When the MPC is .8, the multiplier is 5
When the MPC is .75, the multiplier is 4
When the MPC is .6, the multiplier is 2.5
When the MPC is .5, the multiplier is 2

Therefore the formula for the multiplier is:

Expenditure Multiplier $= \frac{1}{1-MPC} = \frac{1}{MPS}$

Example using the Expenditure Multiplier

Let's look at an example on how the expenditure multiplier can be used. Suppose the MPC = 0.8, and there is a recessionary gap such that the difference between GDP_1^* and GDP^* at full employment and that this gap is $300 billion dollars. We want to get from GDP_1^* to the full employment GDP. In this case we want to see how much investment has to change to move the economy up to full employment equilibrium.

Question: How much of an increase in gross private domestic investment (I) is required to close this gap?

Answer: Since the multiplier is equal to $\frac{1}{1-MPC} = \frac{1}{MPS}$, which is equal to $\frac{1}{0.8} = \frac{1}{0.2}$, the multiplier is equal to 5.

Thus, the change in investment that is needed to bring about a $300 billion change in real income is $60 billion. In other words, when a business spends just $1, this expenditure becomes the income of someone else. Part of that income is saved—in this case 20¢ for every dollar of income received—while 80¢ is spent and becomes the income of person #3. Person #3 saves 16¢ and spends 64¢, creating more income for person #4, and so on. This same process happens for every one of the $60 billion initial spent by business firms. Thus the initial investment spending

by the business firms multiplies throughout the economy, and grows it beyond the initial $60 billion spending to where real incomes increase by $300 billion bringing the economy into equilibrium at its full employment level.

This is given mathematically as: **ΔY or ΔRGDP = ΔInvestment x Multiplier**

For the example above, the math would be as follows:

ΔY or ΔRGDP = $300 billion
ΔInvestment = ?
Multiplier = 5

300 = ΔInvestment x 5
300/5 = ΔInvestment = $60 billion

Changes in GDP (Y)

Previously we determined that equilibrium GDP or Y was found as follows.

$$Y^* = \left[\frac{1}{(1-\textbf{MPC})}\right][a + I + G + NX - MPC(T)]$$

You should notice that the term on front $\left[\frac{1}{(1-\textbf{MPC})}\right]$ is the multiplier. If you convert this equation to find the change in GDP or change in Y the equation looks as follows:

$$\Delta Y^* = \left[\frac{1}{(1-\textbf{MPC})}\right][\Delta a + \Delta I + \Delta G + \Delta NX - MPC(\Delta T)]$$

If you multiply the multiplier through the equation it looks as follows:

$$\Delta Y^* = \left[\frac{1}{(1-\textbf{MPC})}\right]\Delta a + \left[\frac{1}{(1-\textbf{MPC})}\right]\Delta I + \left[\frac{1}{(1-\textbf{MPC})}\right]\Delta G + \left[\frac{1}{(1-\textbf{MPC})}\right]\Delta NX - \left[\frac{1}{(1-\textbf{MPC})}\right]MPC(\Delta T)$$

Remember that "a" was the y-intercept for the consumption function. So a change in "a" is a change in consumption.

For purposes of this model, we assume that we are changing only one of the elements at a time. If we are changing investment spending then changes in consumption (Δa) will equal zero, changes in government spending (ΔG), and so on and so forth. Therefore we will be left with only:

$$\Delta Y^* = \left[\frac{1}{(1-\textbf{MPC})}\right]\Delta I$$

We will be doing this with all the rest of the elements below.

Changes in Consumption

Autonomous changes in consumption, or changes in consumption not resulting from changes in GDP, can also close recessionary and inflationary gaps. Using the formula just explained we see that a change in consumption can mathematically close recessionary and inflationary GDP gaps as follows:

$$\Delta Y^* = \left[\frac{1}{(1-\textbf{MPC})}\right]\Delta a = \textbf{Δreal GDP = Multiplier x ΔConsumption}$$

In this case the multiplier is the expenditure multiplier = $\frac{1}{1-MPC}$.

Changes in Investment

In the example above there was a change in investment spending. At times the expenditure multiplier is called the **investment multiplier**. This is because there was an **autonomous change in investment**, or changes in investment not resulting from changes in GDP, that can help close the recessionary or inflationary gap. Using the formula just explained we see that a change in investment can mathematically impact GDP as follows:

$$\Delta Y^* = \left[\frac{1}{(1-\textbf{MPC})}\right]\Delta I = \Delta \textbf{real GDP} = \textbf{Multiplier x } \Delta\textbf{Investment}$$

In this case the multiplier is the expenditure multiplier = investment multiplier = $\frac{1}{1-\text{MPC}}$.

Changes in Government Spending

Autonomous changes in government spending, or changes in government spending not resulting from changes in GDP, can also close recessionary and inflationary gaps. When government spending is involved the multiplier is also called the **government spending multiplier.** Using the formula just explained we see that a change in government spending can mathematically impact GDP as follows:

$$\Delta Y^* = \left[\frac{1}{(1-\textbf{MPC})}\right]\Delta G = \Delta \textbf{real GDP} = \textbf{Multiplier x } \Delta\textbf{Government Spending}$$

In this case the multiplier is the expenditure multiplier = government spending multiplier = $\frac{1}{1-\text{MPC}}$.

Changes in Net Exports

Autonomous changes in net exports, or changes in net exports not resulting from changes in GDP, can also close recessionary and inflationary gaps. Using the formula just explained we see that a change in net exports can mathematically impact GDP as follows:

$$\Delta Y^* = \left[\frac{1}{(1-\textbf{MPC})}\right]\Delta NX = \Delta \textbf{real GDP} = \textbf{Multiplier x } \Delta\textbf{Net Exports}$$

In this case the multiplier is the expenditure multiplier = $\frac{1}{1-\text{MPC}}$.

Changes in Taxes

As mentioned before, the expenditure multipliers are all the same, even if they are called different names: $\frac{1}{1-\text{MPC}}$.

There is also a multiplier that is associated with a change in taxes. It is called the **tax multiplier**, and it is NOT the same as the spending multipliers. In fact, it is smaller than the spending multipliers. Why would the tax multiplier be smaller than the government spending multiplier? The answer lies in the fact that when a business or the government undertakes new spending, they inject the initial amount of that spending into the income stream and then it multiples through the economy. When the government decides to lower taxes, they are not injecting new money into the economy; they are simply deciding not to take money out of the economy that was already in the income stream. Individuals will then spend some portion of the money that they get to keep. So, if the government increases spending by $1 billion, the entire $1 billion is injected into the income stream. If they reduce taxes by $1 billion, only the MPC x $1 billion is injected into the income stream. Therefore, the impact of the tax multiplier is:

$$\$1(\text{MPC}) + \$1(\text{MPC})(\text{MPC}) + \$1(\text{MPC})(\text{MPC})(\text{MPC}) + \ldots$$

This progression can be shown to be equal to the spending multiplier times the MPC, or

$$\text{MPC} \times \frac{1}{(1 - \text{MPC})}$$

Which is simplified as

$$\frac{\text{MPC}}{(1 - \text{MPC})}$$

Since reducing taxes increases income and vice versa, the tax multiplier is negative, i.e.

$$-\frac{\text{MPC}}{(1 - \text{MPC})}$$

Let's look at some common values of the MPC and determine the tax multiplier for each.

When the MPC is .9, the tax multiplier is -9
When the MPC is .8, the tax multiplier is -4
When the MPC is .75, the tax multiplier is -3
When the MPC is .6, the tax multiplier is -1.5
When the MPC is .5, the tax multiplier is -1

Another way to look at this is using the equilibrium GDP formula we used when discussing changes in consumption, investment, government spending, and net export.

When there is a change in taxes, note that the MPC is multiplied by that change. Also note that it is subtracting off of the other components of GDP. Therefore, increasing taxes will put downward pressure on GDP. We can see that when there is a change in taxes it is multiplied by the tax multiplier which is different than the expenditure multiplier.

$$\Delta Y^* = -\left[\frac{\text{MPC}}{(1 - \text{MPC})}\right](\Delta T)$$

$$\text{Tax Multiplier} = -\frac{\text{MPC}}{(1 - \text{MPC})}$$

In later lessons, we will discus what actions policy makers should take when facing a recession. Should they increase government spending or decrease taxes or do a combination of both? We will be incorporating discussions of the multipliers in that discussion.

The Balanced-Budget Multiplier

The final multiplier we want to consider in the Keynesian Model is called the **balanced-budget multiplier**. Essentially, this multiplier tells us what the impact will be on the GDP if you increase both government spending and taxes equally. For example, if the government wanted to increase government spending by, let's say, $2 billion, but did not want to run a deficit, and therefore also increased taxes by $2 billion. We'll look at each of these actions independently and then put them together to find a generalized answer.

The equation for the balanced-budget multiplier is as follows:

$$\text{Balanced-budget multiplier} = \frac{1}{1 - \text{MPC}} - \frac{\text{MPC}}{1 - \text{MPC}}$$

If the increase (decrease) in government spending is exactly equal to the increase (decrease) in taxes then the formula above simplifies as follows:

$$\frac{1 - \text{MPC}}{1 - \text{MPC}} = 1$$

Therefore, if government spending and taxes go up by the exact same amount then GDP will go up by only that amount. The formula below can be used to show this.

$$\Delta Y^* = \left[\frac{1}{(1-MPC)}\right]\Delta G - \left[\frac{MPC}{(1-MPC)}\right](\Delta T)$$

Assume the MPC is equal to 0.8. With an MPC of 0.8, the government spending multiplier is 5. If the government increases spending by $2 billion, output will go up by $10 billion. If the MPC is 0.8, the tax multiplier is -4. If the government increases taxes by $2 billion, output will go down by $8 billion. When these two things happen simultaneously, the net effect is to increase output by $2 billion ($10 billion - $8 billion = $2 billion). So an increase in government spending by $2 billion and a simultaneous increase in taxes by $2 billion will increase output by $2 billion.

In this case the balanced-budget multiplier is equal to 1 and can be summarized as follows: when the government increases spending and taxes by the same amount, output will go up by that same amount. We can generally show that the balanced budget multiplier is equal to one, and that it is not dependent on the size of the MPC: when you sum the spending multiplier and the tax multiplier, you always get one, regardless of the MPC.

Summary

Key Terms

45 Degree Line
AE
Aggregate Expenditure Model
Aggregate Expenditures Curve
Aggregate Income
Autonomous Changes in Consumption
Autonomous Changes in Investment
Autonomous Changes in Government Spending
Autonomous Changes in Net Exports
Balanced-Budget Multiplier
Balanced-Budget Multiplier Formula
C
Constant Price Level Assumption
Consumption
Expenditure Multiplier
Expenditure Multiplier Formula
Exports
Full Employment
G
GDP Gap
Government Expenditures
Government Spending
Government Spending Multiplier
Gross Private Domestic Investment
I
Imports
Inflationary Gap
Injection
Inventories
Investment

Investment Multiplier
Keynesian Cross Model
Leakage
Macroeconomic Equilibrium
Multiplier Model
Net Exports
NX
Potential GDP
Recessionary Gap
Tax Multiplier
Tax Multiplier Formula
Y