Circular Flows
Understanding the macroeconomy involves breaking it down into its separate parts.

These parts and their relationships in the standard model are shown below:

Households are just individual people who work for and buy things from firms and pay taxes.

Firms are businesses that hire households and sell things to households and the government, and buy and sell with the rest of the world.

The Government is the government, which buys things from firms and collects taxes from households.

The Rest of the World are people in other countries that buy and sell with firms.

Households, Firms, the Government and the Rest of the World may also participate in financial markets.

The money flows between these four sectors of the economy are as shown below:
Households have income (Y) coming in from firms. This income goes for consumption (C), taxes (T) or savings (S).

Firms pay out income (Y) to households, and have as income consumption (C), investment funds from financial markets (I), government spending (G) and net export cash (EX-IM).

GDP is national income, and is equal to Y.

Based on flows into and out of firms, we see that \( Y = C + I + G + (EX - IM) \), or national income is the sum of consumption, investment, government spending and net exports.

Put slightly differently, aggregate demand is the sum of consumption, investment, government spending and net exports.

- **Consumption (C)**: spending by households
- **Investment (I)**: spending by firms
- **Government spending (G)**: spending by the government
- **Net Exports (NX)**: net spending by the rest of the world
To discuss changes in aggregate demand, we need to discuss changes in each of these four things.

**Consumption**

Based on flows into and out of households, we can see that C=Y-T-S, or that consumption is equal to income minus taxes minus savings. Put differently, consumption equals disposable income \(Y_d = Y - T\) minus savings:

\[
C = Y_d - S
\]

Things that affect consumption are:
- income
- taxes
- wealth
- the price level
- the real interest rate (for two reasons)
- future income expectations

Why do tax cuts or tax rebates fail to stimulate consumption?

We can state a mathematical relationship between consumption and income, holding all other factors constant, as:

\[
C(Y) = AC + MPC*Y
\]

where
- \(C(Y)\) = consumption expressed as a function of income \(Y\)
- \(AC\) = autonomous consumption, consumption you would have if your income was zero
- \(MPC\) = the marginal propensity to consume out of income, or the portion of an extra dollar of income that a person spends
- \(Y\) = income

For example, if we had

\[
C(Y) = 1000 + 0.6*Y
\]

the marginal propensity to consume is 0.60, meaning that people generally spend $0.60 of any extra dollar they get in income, meaning that they save or are taxed at $0.40.

If income is $10,000, the consumption will be

\[
C(10000) = 1000 + 0.6 \times (10000) = 1000 + 6000 = 7000.
\]
In a graph, this relationship looks like:

![Graph showing consumption function with MPC = slope = 0.6](image)

**Investment**

Things that affect investment spending by businesses include:

- interest rates
- tax provisions
- existing capital stock
- technical change
- economic conditions
- expected economic conditions

You could graph out a relationship between income (Y) and investment (I), but it might look like:

![Graph showing investment function](image)
**Government Spending**

Good luck explaining this. Maybe governments spend a lot when elections are coming up, or in response to non-economic stimuli or something.

Perhaps I should just refer you to a Freudian psychologist or a primate anthropologist for explanations about government spending.

It might be nice to believe that a government would accumulate a surplus during good times and then spend it to try and stimulate the economy during bad times (yeah, sure), in which case a relationship between $G$ and $Y$ might look like this:

\[ G(Y) \]

\[ Y \]

**Net Exports**

Net exports, or exports minus imports, are determined by

- national income of the two countries – a good economy increases demand for the goods of foreign countries
- relative prices of foreign and domestic goods
- exchange rates – a strong dollar reduces exports and increases imports

Because net exports fall when GDP rises, the relationship between $Y$ and $NX$ probably looks something like
The book gives the following real numbers for the U.S. economy in 2003:

<table>
<thead>
<tr>
<th></th>
<th>Billions of Real 2000 Dollars</th>
<th>Percentage of GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>$7,362</td>
<td>71%</td>
</tr>
<tr>
<td>I</td>
<td>$1,635</td>
<td>16%</td>
</tr>
<tr>
<td>G</td>
<td>$1,899</td>
<td>18%</td>
</tr>
<tr>
<td>NX</td>
<td>-$505</td>
<td>-5%</td>
</tr>
<tr>
<td>EX</td>
<td>$1,034</td>
<td>10%</td>
</tr>
<tr>
<td>IM</td>
<td>$1,539</td>
<td>15%</td>
</tr>
<tr>
<td>Y</td>
<td>$10,397</td>
<td></td>
</tr>
</tbody>
</table>

**BB Chapter 8**

**Expenditures and Income**

The previous section discussed the various types of expenditures that make up aggregate demand.

However, in equilibrium, expenditures equal income.

That is, in equilibrium, \( C + I + G + NX = Y \).

Put a bit differently, one person’s expenditure is another person’s income.
There’s one small detail. What if a firm hires people and produces stuff that no one wants to buy? It’s employees will have income, even if the firm doesn’t generate any expenditures. In a case like this, the firm’s inventories will build up and eventually they’ll lower prices.

More generally, if $Y$ is greater than $C + I + G + NX$, then prices will fall and the quantity of stuff demanded in the economy will rise until things are in equilibrium.

So, in equilibrium, $Y = C + I + G + NX$. $C + I + G + NX$ is called aggregate expenditures. The picture of equilibrium looks like this:

Let’s do some arithmetic. The following examples lay out functions for $C$, $I$, $G$ and $NX$ in terms of $Y$ or $Y_d = Y - T$. In each case the marginal propensity to spend (MPSp) is shown, this is the slope of the AE line shown above. The point where AE=$Y$ is where the AE line crosses the 45° line, and represents equilibrium.

Example 1: No Taxes

$C = 1000 + 0.6Y$
$I = 200$
$G = 300$
$NX = 300$

In equilibrium, $Y = C + I + G + NX$, so

$Y = 1000 + 0.6Y + 200 + 300 + 300$
$Y = 1800 + 0.6Y$
$(1 - 0.6)Y = 1800$
$Y = 1800/0.4$
$Y = 4500$. 
So, equilibrium GDP is 4500.

Example 2: Fixed Taxes
C = 1200 + 0.75Yd
I = 300
G = 500
T = 400
NX = -200

In equilibrium, Y = C + I + G + NX, so

\[
Y = 1200 + 0.75(Y - 400) + 300 + 400 - 200 \\
Y = 1200 + 0.75Y - 300 + 500 \\
Y = 1400 + 0.75Y \\
(1 - 0.75)Y = 1400 \\
Y = 1400/0.25 \\
Y = 5600
\]

Example 3: Fixed Taxes and Variable NX
C = 1200 + 0.40Yd
I = 400
G = 600
T = 400
NX = 800 – 0.25Yd

In equilibrium, Y = C + I + G + NX, so

\[
Y = 1200 + 0.4(Y - 400) + 400 + 600 + 800 - 0.25(Y - 400) \\
Y = 1200 + 0.4Y - 160 + 400 + 600 + 800 - 0.25Y + 100 \\
Y = 2940 + 0.15Y \\
(1 - 0.15)Y = 2940 \\
Y = 2940/0.85 \\
Y = 3459
\]

Example 4: Proportional Taxes and Variable NX
C = 1500 + 0.8Yd
I = 400
G = 600
T = 0.25Y
NX = 800 – 0.1Yd

In equilibrium, Y = C + I + G + NX, so
\[ Y = 1500 + 0.8(Y(1-0.25)) + 400 + 600 + 800 - 0.1(Y(1-0.25)) \]
\[ Y = 3300 + 0.6Y - 0.075Y \]
\[ Y = 3300 + 0.525Y \quad \text{MPSp}=0.525 \]
\[ (1 - 0.525)Y = 3300 \]
\[ Y = \frac{3300}{0.475} = 6947 \]

The real value in this model is estimating the \textit{multiplier effect}. That is, what effect does an extra dollar in expenditure (due to an increase in government spending, perhaps) have on equilibrium GDP?

To see this, let’s consider a simple example:

\[ C = 1200 + 0.6Y \]
\[ I = 400 \]
\[ G = 100 \]
\[ NX = 200 \]

\[ Y = 1200 + 0.6Y + 400 + 100 + 200 \]
\[ Y = 1900 + 0.6Y \quad \text{MPSp}=0.6 \]
\[ Y = 4750. \]

Now, let’s increase government spending by $1, so that we get:

\[ Y = 1200 + 0.6Y + 400 + 101 + 200 \]
\[ Y = 1901 + 0.6Y \]
\[ Y = 4752.50 \]

an increase of $2.50. So, a $1 increase in government spending (although it could have been from any other source) lead to a $2.50 increase in equilibrium GDP.

The expenditure multiplier is then said to be \[ \frac{\$2.50}{\$1.00} = 2.5. \]

More generally, the expenditure multiplier is equal to \[ \frac{1}{1 - \text{MPSp}}. \]

Looking at Example 2 from above, the MPSp was 0.75, so the multiplier should be \[ \frac{1}{1 - 0.75} = \frac{1}{0.25} = 4. \]
To check this, re-do the calculations with net exports increased to –100 and note the change in equilibrium GDP.

That’s great, Allen. So what?
The whole point of the expenditure multiplier is to demonstrate what things make an economy more or less sensitive to expenditure shocks. That is, how much will GDP change when, say, taxes rise or the government cuts spending or foreigners decide that they don’t want to buy your stuff anymore? The bigger the multiplier, the more sensitive your economy will be.

Things like proportional (or even progressive) taxes, counter-cyclical government spending and a fairly low marginal propensity to consume tend to make an economy less sensitive to shocks.

To see this, consider the first example from above:

Example 1: Previously no taxes, but let’s make taxes 10% of income
\[ C = 1000 + 0.6Y_d \]
I = 200
G = 300
T = 0.10Y, so that \( Y_d = (1-t)Y = (1-0.10)Y = 0.90Y \)
NX = 300

In equilibrium, \( Y = C + I + G + NX \), so
\[ Y = 1000 + 0.6(0.90)Y + 200 + 300 + 300 \]
\[ Y = 1800 + 0.54Y \]
MPSp=0.54

The MPSp was previously 0.60 and the expenditure multiplier was 2.5. With the new multiplier of 0.54, the multiplier is reduced to 2.17. Adding a tax that is a flat percentage of income reduces the multiplier, helping to stabilize an economy.

Now Some Graphs
A few basic relationships.

First, MPSp is also the slope of the AE function. When MPSp is bigger, the AE line is steeper.

Second, because the expenditure multiplier is equal to \( \frac{1}{1 - \text{MPSp}} \), when MPSp is bigger, the multiplier is bigger.
So, when the AE line is steeper, the multiplier should be bigger, as shown in the picture below:

**Now, to Tie This Back to the AS/AD Model**

In effect, aggregate expenditures (AE) are equal to aggregate demand (AD). The difference is that the AE curve shown above assumes that prices are held constant. To tie this into the AS/AD model, we pile one graph on top of the other to get this:
Of course, in the AS/AD model, the AS curve is upward sloping, so an increase in AD will cause an increase in the price level.

An increase in the price level will tend to decrease AE, or shift the AE curve down.

The whole picture looks something like this:
The important points for the real world are the following.

1. The magnitude of the effects of an expenditure shock to the economy depends on the size of the expenditure multiplier. This depends on the marginal propensity to spend, the marginal tax rate, the marginal propensity to import, whether or not government spending will increase if GDP falls, and other things like that. If the expenditure multiplier is big, then small shocks may have large impacts. If the expenditure multiplier is small, then even large shocks will have only a small impact on the economy.

2. The extent to which a change in expenditures is translated into a change in real GDP or a change in the price level depends on the slope of the AS curve. If AS is steep (when unemployment is low or the economy is running at or above full employment), the impact will be primarily felt in the form of a change in the price level. If AS is flat (when unemployment is high or the economy has a lot of excess capacity), the impact will be primarily felt in the form of a change in real GDP.
Some Examples of Calculating Equilibrium GDP

-A numerical example of calculating equilibrium GNP

\[ Y = 1000 + 0.6(Y) \]
\[ I = 500 \]
\[ G = 300 \]
\[ NX = 200 - 0.1(Y) \]

\[ Y^* = 1000 + 0.6(Y) + 500 + 300 + 200 - 0.1(Y) \]
\[ Y^* = 2000 + 0.5(Y) \] \[ \text{[MPSp = 0.5]} \]
\[ (1 - 0.5)Y^* = 2000 \]
\[ Y^* = 4000. \]

-A numerical example with T=250

\[ Y = 1000 + 0.6(\text{Yd}) \]
\[ I = 500 \]
\[ G = 300 \]
\[ NX = 200 - 0.1(\text{Yd}) \]

\[ Y^* = 1000 + 0.6(Y - 250) + 500 + 300 + 200 - 0.1(Y - 250) \]
\[ Y^* = 2000 + 0.5(Y^*) - 125 \]
\[ Y^* = 1875 + 0.5(Y^*) \] \[ \text{[MPSp = 0.5]} \]
\[ Y^* = 3750. \]

-A numerical example with t = 0.30

\[ Y = 1000 + 0.6(\text{Yd}) \]
\[ I = 500 \]
\[ G = 300 \]
\[ NX = 200 - 0.1(\text{Yd}) \]

\[ Y^* = 1000 + 0.6(0.7Y) + 500 + 300 + 200 - 0.1(0.7Y) \]
\[ Y^* = 2000 + 0.42(Y) - 0.07(Y) \]
\[ Y^* = 2000 + 0.35(Y) \] \[ \text{[MPSp = 0.35]} \]
\[ Y^* = 3076.92. \]