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Principles of Economics

Modeling the Economy

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Our Models of the Economy

Now we begin a fun task of building models of the economy, each one successively more complex than the previous one. During the next few weeks we shall build a total of 5 models of the economy; the textbook does not number these models, but to keep track of them I shall number them model #1 through model #5. We shall begin construction of model #1 shortly, but before we do let's take a more general look at this model building process.

First, don't forget why we're doing this modeling stuff. We want to be able to forecast how events will affect our economy and its various parts, and we want to know if there's anything that we can do to improve our economy's performance. If we can build a model that is complex enough to represent our economy, then we will be able to do the appropriate forecasting and make policy recommendations. Model #5 will be our model that represents the U.S. economy.

So why bother with models #1-#4? Because model #5 is pretty complex, and we want to start out simpler, get some concepts straight, then build on our understanding as we construct more and more complex models.

General Structure of Our Models

Fortunately, all of our models share some of the same characteristics. Indeed each builds on the previous model. Here are characteristics common to all of the models:

1. We model the economy as though it's a giant market

As you may know, models of a market in which a product is bought/sold (such as the apple market) divide those who participate in the market into two groups—buyers and sellers. The buyers are said to **demand** the product—that is, they are willing to buy it. The sellers are said to **supply** the product—that is, they are willing to sell it. What ultimately happens in the market—that is, the amount of product sold and the price at which is sold—is said to be the market **equilibrium**. An event that affects the market—changing the product's price or the quantity of it sold—is represented by a change in demand or a change in supply (or both) that causes a new equilibrium to occur.

Well, we are going to model the whole economy as though it's a giant market. We will aggregate all buyers of final goods and services into a group, and we'll call the total amount that they are willing to buy **aggregate expenditures** or **aggregate demand**. Similarly, we will aggregate all producers into a group and call their total production (which, by the way, is the economy's GDP) **aggregate supply**. The size of the economy (and the values of lots of other important variables) will be represented by the economy in **equilibrium**—where aggregate expenditures equals aggregate supply. We forecast how an event changes things by figuring out if it affects aggregate expenditures or aggregate supply (or both); these changes will result in a new equilibrium in the economy (that we can compare to the original equilibrium).

2. *We'd like to examine two time frames: the short run and the long run.*

A **short run** forecast tells us how the economy will act over the next few months to a year. A **long run** forecast tells us how it will act in a year or two. Our first four models will only be able to do short run forecasts; these models are too simple to be able to do long run forecasts. Model #5 can handle short run and long run forecasts.

Simplifying Assumptions Made in All of Our Models

No model of the economy can be as complex as the economy itself, and who would want it to be, anyway? Not me, that's for sure. I'd rather be watching the Jerry Springer show. But I digress. Let's list some simplifying assumptions that we'll make in all of our models

Simplification #1:

Reality: GDP is not equal to national income

Simplification: **GDP equals national income**

Recall that a bunch of things separate GDP from national income (including depreciation and indirect business taxes). Well, we don't want to have to keep track of all of those things in our models, so we'll ignore them. This simplification does not reduce the power of our models very much.

Since we shall always assume that GDP equals national income, we can use a common symbol—**Y**—to represent GDP and national income simultaneously.

$Y = \text{gross domestic product} = \text{national income}$

Simplification #2:

Reality: There's a whole bunch of things separating national income from disposable personal income.

Simplification: **disposable personal income = national income – household taxes + transfer payments**

With this simplification, we don't need to keep track of things such as corporate profits and dividends in our models.

Note: we give a name to (household taxes - transfer payments); we call it **net taxes**. Let's represent net taxes with the symbol **T**

We represent disposable personal income with the symbol Y_d . So:

Sometimes a simplified model is more useful than a complex model. For example, if you want to drive to Austin, would you prefer a map that shows every single road between here and Austin (a complex model of the road structure) or a map with only the major roads between here and Austin?

$$Y_d = Y - T$$

Simplification #3:

Reality: People can do a bunch of things with their disposable personal income.

Simplification: **People can do only 2 things with their disposable personal income—spend it (on consumption) or save it.**

We shall use S to represent personal savings. So:

$$Y_d = C + S$$

And now, the Road Ahead

We shall build 5 models of the economy. Each one has fewer simplifying assumptions than the previous model. (Remember, though: all of the models have simplifying assumptions #1-#3 listed above.) Let's look at a table that shows the five models that we'll be building, along with a list of simplifying assumptions for each model:

	no government	no exports or imports	fixed interest rates	fixed prices	no long run
model 1	X	X	X	X	X
model 2			X	X	X
model 3				X	X
model 4					X
model 5					

With each successive model, we'll learn more about some principles of macroeconomics that will allow us to get rid of at least one simplifying assumption. Exciting, ain't it?

This whole process—going from model 1 to model 5—will take us several weeks. Let's begin now with model #1.

Model #1 of an Economy

Hey...ya gotta crawl before ya walk. This isn't the most realistic model around, but we'll get our feet wet with this one and be ready to move on to greener pastures.

Let's display the major attributes of the model before we delve into it:

1. Aggregate Expenditures: We will assume that there is neither a government nor any foreign countries in model #1; this leaves us with only two groups who do the buying in the economy—consumers and firms. Hence aggregate expenditures (AE) is the sum of consumption and investment:

$$AE = C + I$$

2. Aggregate Supply: We are fixing prices in this model; that is, we will not let firms raise or lower their prices. This leaves them with only 1 job—produce the right amount of stuff to satisfy buyers:

Production equals aggregate expenditures. If an event causes aggregate expenditures to rise, then firms increase production to meet the higher demand; the firms do NOT change prices. Using similar reasoning, if an event causes aggregate expenditures to fall, then firms reduce production; they do not change prices.

Producers are pretty passive in this model, aren't they? This model (along with models #2 and #3) are sometimes called **demand determined**; if we know the level of desired expenditures, then we know the level of production, since the passive producers simply produce that amount of stuff.

3. Equilibrium Condition: We have equilibrium when total spending (aggregate expenditures, symbol: AE) equals total production (GDP, symbol: Y):

$$\text{Equilibrium: } AE = Y$$

So, here's our mission. First, we'll model the things that affect household spending—consumption (C)—and we'll represent our consumption model with a graph and an equation. Next, we'll model the things that affect investment (I), and we'll represent our investment model with a graph and an equation. Then, we'll add the two models together to get a model of aggregate expenditures—in graph and equation form. Next, we'll find equilibrium in the economy by finding conditions where aggregate expenditures (demand) equals GDP (supply). Finally, we'll examine how events change equilibrium, and represent the changes with equations and graphs.

Consumption (and personal savings)

Think of consumption and savings as opposite sides of the same coin; any disposable income that is not spent on consumption must be saved. Hence if we figure out the things that affect consumption, we will also have figured out the things that affect personal savings.

Things that Affect Consumption and Personal Savings

Below are three things that affect C and S. First, they are listed; then they are explicated.

In brief:

1. Amount of disposable personal income
 - This is affected by:
 - amount of national income
 - amount of household taxes
 - amount of transfer payments
2. Amount of household wealth
3. Level of consumer confidence

In detail:

1. Amount of disposable personal income (Y_d)

Remember, disposable personal income is the amount of income that households have available for spending and saving. If this amount rises, then households will tend to both consume more and save more. Conversely, if this amount falls, then households will tend to both consume less and save less.

Disposable personal income depends upon how much households earn—their national income—and how the government affects it with household taxes and transfer payments:

National income: More national income means more disposable income (assuming that household tax rates and transfer payments remain constant). Less national income means less disposable income (assuming that household tax rates and transfer payments remain constant).

Household taxes: If the government raises household tax rates (and leaves total government spending constant), taking more of households' income away, then households will have less disposable income to spend and save. As a result, they will consume less and save less. Using the same logic, if the government lowers household tax rates, taking less of households' income away, then households will have more disposable income to spend and save. As a result, they will consume more and save more.

Transfer Payments: If the government lowers transfer payments (and leaves tax rates and government purchases constant), giving households less unearned income, then households will have less disposable income to spend and save. As a result, they will consume less and save less. Using the same logic, if the government increases transfer payments, giving households more unearned income, then households will have more disposable income to spend and save. As a result, they will consume more and save more.

Recall our assumption: disposable personal income equals national income minus household taxes plus transfer payments, or $Y_d = Y - T$

Note: When government cuts its tax rates, it does NOT have to change the amount that it spends, since it can borrow money. Similarly, if the government spends more, it does NOT have to raise taxes, since it can borrow money.

(By the way, here in model #1, we can ignore the effects of taxes and transfer payments on consumption and savings, since we are assuming that there's no government in this model. But don't forget about these things when we get to model #2! Oh, what a tragedy that would be!)

2. Amount of household wealth

A household's wealth is the total value of the assets that it owns (such as houses, stocks and bonds) minus the amount of money that it owes to others. Michael Dell, CEO of Dell Computer, has a lot of wealth, since he owns \$10 billion worth of Dell stock.

So how does wealth affect consumption and savings? Well, if households have more assets, they are wealthier, and they will consume more and save a smaller percentage of their disposable income. Think about it: if someone gave you \$1,000,000 worth of gold, would you spend more of your paycheck? Would you save a smaller percentage of your paycheck? You betcha—you'd do both! (And you'd have some dough left over to give your professor a nice big bribe—uh, I mean, gift.) *Example:* the stock market booms! Result: consumption rises and households save a smaller percentage of their income. This is known as the **wealth effect**.

Another example: the stock market crashes! Result: consumption falls and households save a larger portion of their income.

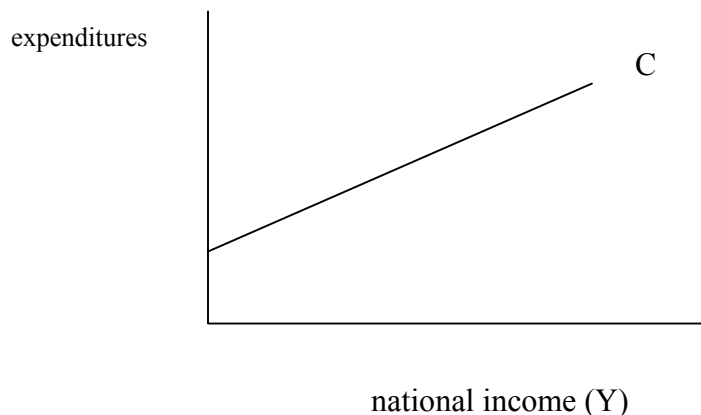
3. Level of consumer confidence

Who is likely to spend more and save a smaller percentage of her income—a person confident in her future (who knows that her job is secure), or a person with little confidence (who worries that she may be laid off)? Aw, you know the answer.

If consumer confidence rises, then consumption rises and households save a smaller percentage of their income. Using the same logic, if consumer confidence falls then consumption falls and households save a larger portion of their income.

Hey, we just modeled consumption and savings! Let's represent our model with a graph!

A **consumption function**:



Note about the consumption function:

1. It has an upward slope because more national income causes more consumption.
2. It can shift: a shift up (higher) means more consumption, and a shift down (lower) means less consumption.
3. An upward shift is caused by lower tax rates, more transfer payments, more consumer confidence, and/or more wealth.
4. A downward shift is caused by higher tax rates, lower transfer payments, lower consumer confidence, and/or lower wealth.

Hey, let's use an equation now to represent our consumption model!

A **consumption function** is an equation representing aggregate consumption in an economy. It is usually an equation of a line with an upward slope. Here's an example that I'm making up out of the blue for a hypothetical economy:

$$C = 100 + .8(Y-T)$$

where C is consumption, Y is national income, T is net taxes

If we know net taxes, T, then we can graph this equation. Suppose we know that household taxes are 200 and transfer payments are 150.

Then $T = 200 - 150 = 50$. Let's plug this value for T into our equation:

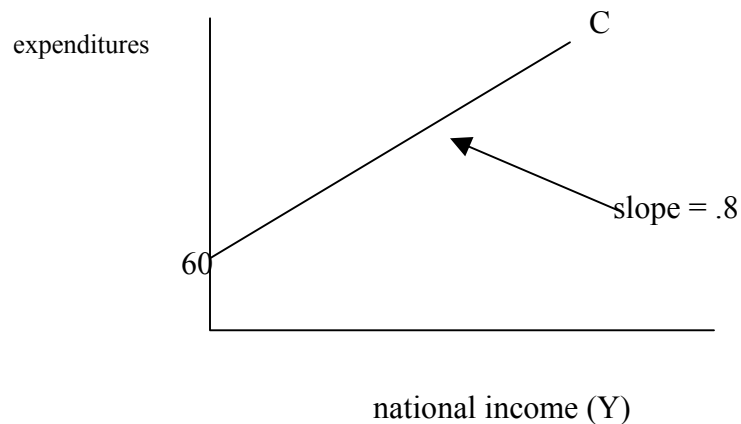
$$C = 100 + .8(Y - 50)$$

Recall: T equals household taxes minus transfer payments

Now simplify the equation

$$C = 100 + .8Y - 40 \quad \text{or} \quad C = 60 + .8Y$$

Our equation has a vertical intercept of 60 and a slope of .8, like so:



The consumption function is very handy. If we have a forecast for national income (or GDP—remember, we assume that the two are always equal), and we know net taxes, then we can get a forecast for C, disposable income, and personal savings. Here are some examples for various forecasts for national income that I am picking at random:

national income or GDP (Y)	net taxes (T)	disposable income Y - T	consumption $60 + .8Y$
1000	50	950	860
2000	50	1950	1660
2001	50	1951	1660.80

Notice what happens when Y rises by \$1, from \$2000 to \$2001—it causes C to rise by 80 cents, .80. Hey, this is the same as the slope of the consumption function! Guess what—there's a name for this thing—it's called the marginal propensity to consume:

The **marginal propensity to consume** (MPC) measures the increase in consumption caused by a \$1 increase in income. It equals the slope of the consumption function.

We've finished our model of consumption. Let's move to our second (and last in model #1) type of expenditure—investment.

The MPC cannot be greater than 1, since you can't increase spending by more than the whole \$1 of extra income. (This means, graphically, that the slope of the consumption function can't be greater than one.)

Investment

Recall that investment in macroeconomics includes purchases of physical capital (such as machinery and buildings) by firms and purchases of new houses. What types of things affect this stuff? Let's first list two things, then explain them.

Things that Affect Investment:

In brief:

1. Interest rates
2. Confidence of producers in their futures

In detail:

1. Interest rates

Recall that investment consists mainly of two types of purchases: purchases of physical capital by firms (such as machinery and buildings), and purchases of new houses. Higher interest rates reduce these types of purchases (thereby reducing investment). Lower interest rates increase these types of purchases (thereby increasing investment).

Why do interest rates have an inverse relationship with investment? Well, suppose that interest rates rise. This makes it more expensive for firms to borrow money to buy new machinery and for people to buy new homes. So these types of purchases fall, and investment falls.

The same logic, applies when interest rates fall—it becomes cheaper to borrow to buy physical capital and houses, so investment rises.

(By the way, here in model #1, we can ignore the effects of interest rates on investment, since we are assuming that interest rates are constant. But don't forget about the investment-interest rate link when we get to model #3! Oh, what a tragedy—like missing your date with Ernest Borgnine!)

2. Confidence of producers in their futures

If producers believe that they will have a lot of business in the future then they have to invest now to have the capacity to supply product in the future, and investment will be higher now. Consider Intel Corporation, maker of computer chips. If they think that demand for their chips will be higher in a couple of years, then they need to begin now to build the manufacturing capacity to supply the chips in a couple of years (since it takes quite a while to build a new chip-making plant).

The same logic applies if producer confidence falls. If producers believe that they will have little business in the future then there ain't much reason to invest now, since they will have little business in the future. Hence investment will be lower now. Consider General Motors Corporation, maker of autos. If they think that demand for their autos will be lower in a couple of years, then they have less need to maintain their manufacturing capacity since they will be supplying fewer cars in a couple of years.

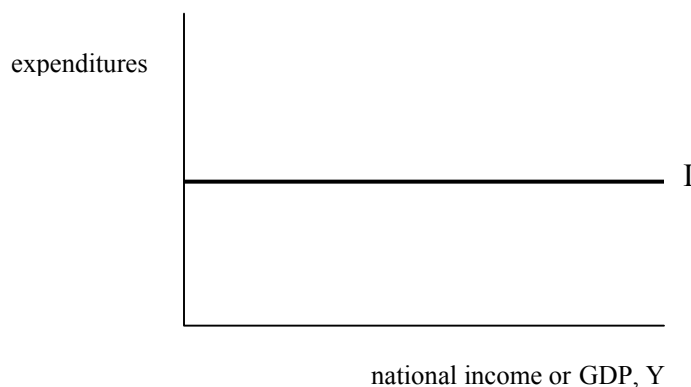
Investment does NOT mean buying stocks or bonds in macroeconomics lingo.

Hey...what about GDP (Y)? Doesn't investment rise when Y rises?

Well, over the longer term, this is true. Indeed, an economy needs higher investment to have the capacity to produce a high GDP, since high GDP requires a lot of physical capital. But over a shorter period of time, it ain't necessarily so. We shall keep a very simple assumption in this model: **changes in Y do not by themselves change Investment.**

Well, we've finished modeling investment using words. Let's draw a graph to represent investment:

The investment function shows how investment varies with Y :



Hey, that's a pretty dull function; it's horizontal. But over time, it can **shift**:

--It shifts when interest rates change. If interest rates fall, investment rises, so the investment function shifts up. Same logic: if interest rates rise, the investment function shifts down.

--It shifts when producer confidence changes. If producer confidence rises, then they will invest more, and the investment function shifts up. Same logic: if producer confidence falls, then the investment function shifts down.

How about an equation to represent investment? Here's an example of one:

$$I = 75$$

We would draw this equation as a horizontal line with vertical intercept at 75.

This **equation will change** if interest rates change or if producer confidence changes.

Example: If interest rates fall then the new equation might be $I = 85$. *Another*

example: if producer confidence falls then the new equation might be

$$I = 65.$$

Hey, we've finished modeling the two types of spending in model #1—consumption and investment. Let's add 'em up to get total spending—aggregate expenditures.

Aggregate Expenditures

Aggregate expenditures in model #1 is the sum of consumption and investment:

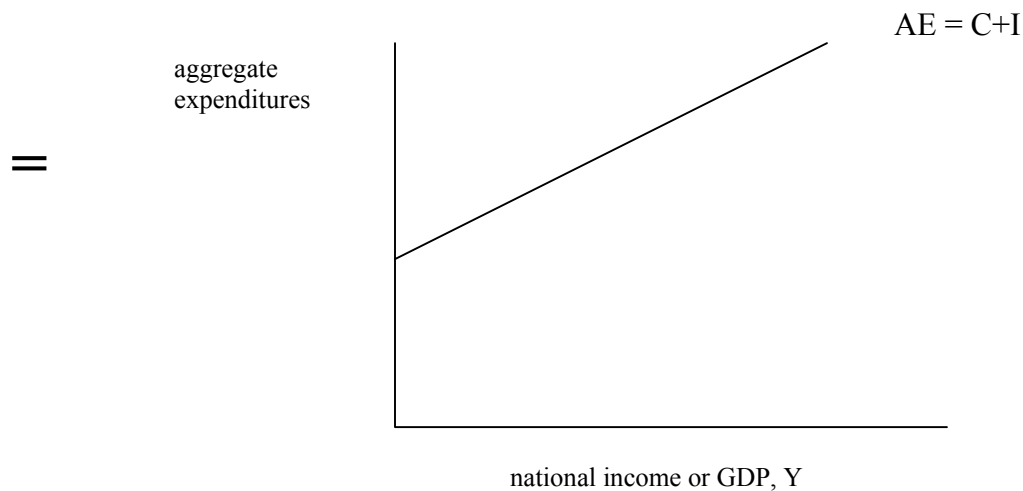
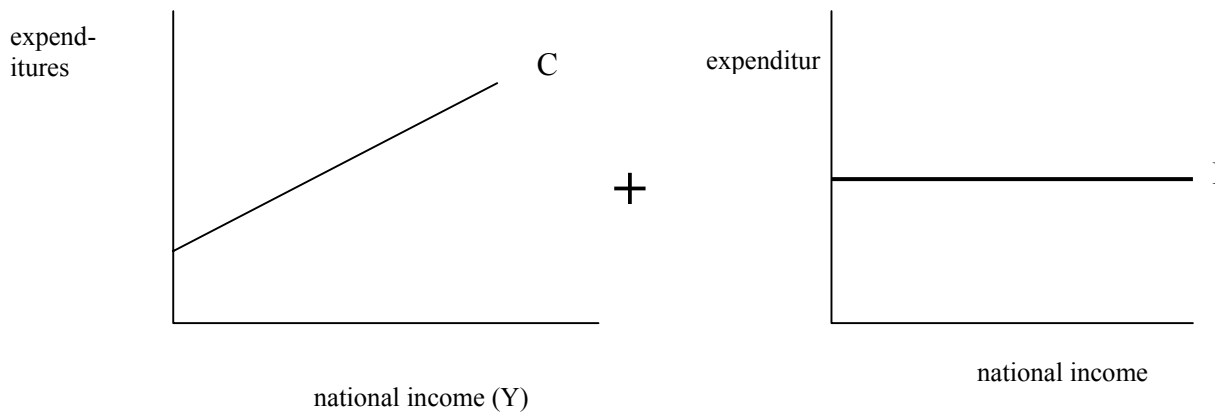
$$AE = C + I$$

The level of AE depends upon all of things that determine consumption and investment:

- level of disposable income
 - level of national income
 - level of household taxes
 - level of transfer payments
- level of consumer confidence
- level of household wealth
- level of interest rates
- level of producer confidence

Remember, we ignore G, EX, and IM in this model, since we assume no government or foreign countries. We'll add G and EX and IM in model #2.

Let's graph aggregate expenditures. This involves summing the consumption function graph and the investment function graph. I repeat those graphs here, and show the graph that represents their sum—the aggregate expenditures graph!



Over time, the AE curve in model #1 can shift, if any of these things change:

- level of disposable income
 - level of household taxes
 - level of transfer payments
- level of consumer confidence
- level of household wealth
- level of interest rates
- level of producer confidence

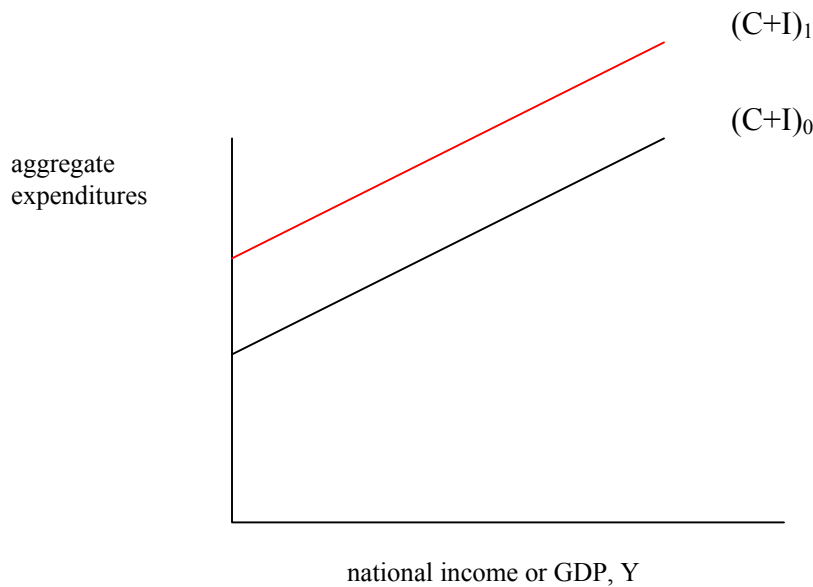
Notice that national income is NOT on the list of things that shift the AE curve. This is because national income is on the horizontal axis of the graph; if it changes we **move along** the AE curve—we don't shift it.

The AE curve in model #1 shifts **up** if:

- disposable income rises
 - household taxes fall
 - transfer payments rise
- consumer confidence rises
- household wealth rises
- interest rates fall
- producer confidence rises

Note also that in model #1, neither transfer payments nor taxes will ever change, since we assume that they are constant (or don't exist).

Here's an example of the AE curve shifting up



The shift need not be parallel; don't worry about the exact position of the new curve—just worry about the direction that it shifts.

The AE curve in model #1 shifts **down** if:

- disposable income falls
 - household taxes rise
 - transfer payments fall
- consumer confidence falls
- household wealth falls
- interest rates rise
- producer confidence falls

Here's an example of the AE curve shifting down



The shift need not be parallel; don't worry about the exact position of the new curve—just worry about the direction that it shifts.

Now that we've graphed aggregate expenditures in model #1, let's represent AE **algebraically**:

We must add $C + I$ to get AE. Here's an example:

Example: A hypothetical economy has consumption function $C = 500 + .9Y$ and investment function $I = 600$. What is its AE function?

$$AE = C + I = 500 + .9Y + 600 = 1100 + .9Y \rightarrow \mathbf{AE = 1100 + .9Y}$$

We graph this AE function with a straight line with vertical intercept of 1100 and slope of .9

What happens if an event changes AE? Well, the equation changes:

Example: Consider the hypothetical example in the box above. But now, higher producer confidence raises investment from $I = 600$ to $I = 650$. What's the new AE function?

$$AE = C + I = 500 + .9Y + \mathbf{650} = 1100 + .9Y \rightarrow \mathbf{AE = 1150 + .9Y}$$

We've finished modeling aggregate expenditures—the “demand” part of our model. Now, let's model the “supply” part—aggregate supply.

Aggregate Supply in Model #1

This model is quite easy, given our assumption that prices are fixed:

Producers will produce the amount of goods and services, Y, that buyers want.

If, over time, something happens that makes buyers want **more** stuff (i.e. if aggregate expenditures rises over time), then Y will **rise** over time to match the increase in demand.

Similarly, if, over time, something happens that makes buyers want **less** stuff (i.e. if aggregate expenditures falls over time), then Y will **fall** over time to match the reduction in demand.

This model is so simple that we have no graph or equation to represent it. Aggregate supply is simply represented by the symbol that represents GDP—Y

So, now that we've modeled aggregate expenditures and aggregate supply, how do they interact—that is, what determines the level of GDP—the size of the economy? Well, that's our next topic.

Equilibrium in Model #1

The economy is said to be in equilibrium when aggregate expenditures equals GDP. This is the point where producers are producing the exact of amount of goods and services that buyers want. At equilibrium, there is no unsold production building up in firms' inventories, and there are no shortages of production requiring firms to reduce inventories.

In equilibrium:

Amount of goods and services demanded = amount of goods and services produced

In other words:

aggregate expenditures = aggregate supply

Using Symbols, for model #1:

Equilibrium condition:	AE = Y
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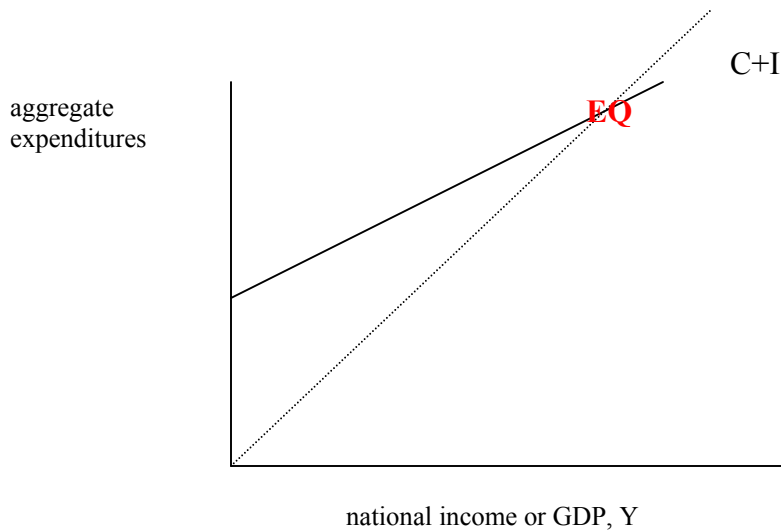
Equilibrium condition graphed

I shall redraw an aggregate demand function on the graph below. There is only one point on the AE curve where aggregate expenditures equals GDP. Where is it?



Hmmm...we're looking for the point at which aggregate expenditures, which are measured on the vertical axis, equal GDP, measured on the horizontal axis. Where is this point? We find it by adding a 45-degree line to the graph. The point at which the AE curve crosses the 45-degree line is the point where aggregate expenditures = Y!!!!!!

Voila:



The dashed line is the 45 degree line, and the point labeled 'EQ,' where the 45 degree line crosses the AE curve, represents equilibrium in our economy.

Big deal, you say. Yes , it is a big deal! Because now we know how big the economy is and how much consumption and savings there are in the economy!!!! Wowie!

Don't believe me? Well, let's figure out equilibrium using algebra, and you'll see. Gosh, this is more fun than rollerblading with Hillary Clinton!

Example:

A hypothetical economy has consumption $C = 200 + .6Y$ and investment $I = 300$. (Also, this economy has no government, no exports, no imports, and fixed interest rates and prices.)

a) What is the equilibrium level of GDP?

Here's the equilibrium condition:

$$AE = Y$$

We know that in model 1, $AD = C + I$:

$$C + I = Y$$

We have equations for C and I:

$$(200 + .6Y) + 300 = Y$$

$200 + 300 = 500$:

$$500 + .6Y = Y$$

Subtract $.6Y$ from both sides:

$$500 = .4Y$$

Divide both sides by $.4$:

$$1250 = Y$$

This is the equation representing aggregate expenditures

b) What is the equilibrium level of consumption?

Here's the consumption function:

$$C = 200 + .6Y$$

We know that Y is 1250:

$$C = 200 + .6(1250) = 950$$

c) What is the equilibrium level of personal savings?

Disposable income equals Consumption + Savings:

$$Y_d = C + S$$

Recall that disposable income = national income minus net taxes:

$$Y - T = C + S$$

Wait! There's no net taxes in this model (no government)

$$Y = C + S$$

We calculated Y and C earlier:

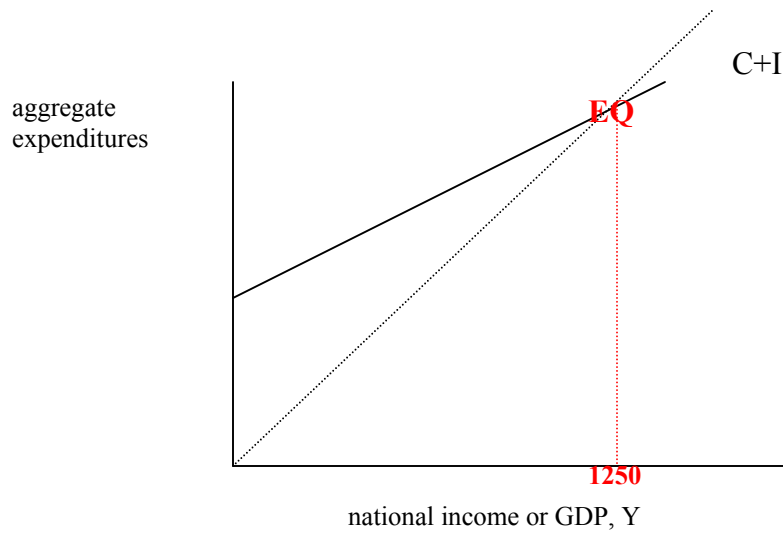
$$1250 = 950 + S$$

Do the math:

$$S = 300$$

d) Show the equilibrium size of the economy on a graph

No problem, dude! Look below.



Events Changing Equilibrium in Model #1:

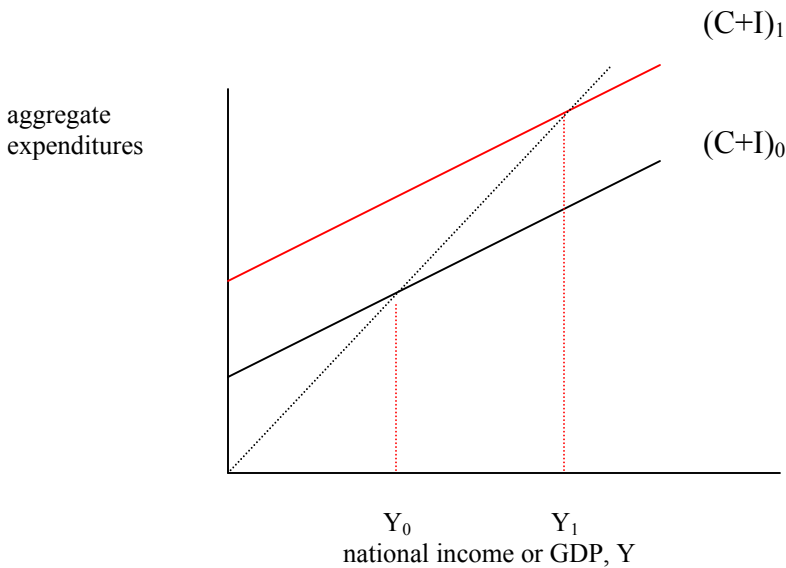
We've seen how to graph and calculate equilibrium in the economy using model #1. But clearly the economy doesn't stay at one equilibrium for long; events occur that change equilibrium. When that happens, we might expect output, consumption and savings to change.

Example: Consumer confidence rises

Effects:

- 1st: Households consume more (and save a smaller percentage of their income).
- 2nd: Aggregate expenditures rise, since C is a big part of AE
- 3rd: Producers respond to the higher spending by increasing production: Y rises
- 4th: Producers need more workers to produce the higher level of GDP: cyclical unemployment falls.

On a graph, we'd have the AE curve shifting up and a higher level of Y established at the intersection of the new AE curve and the 45-degree line:

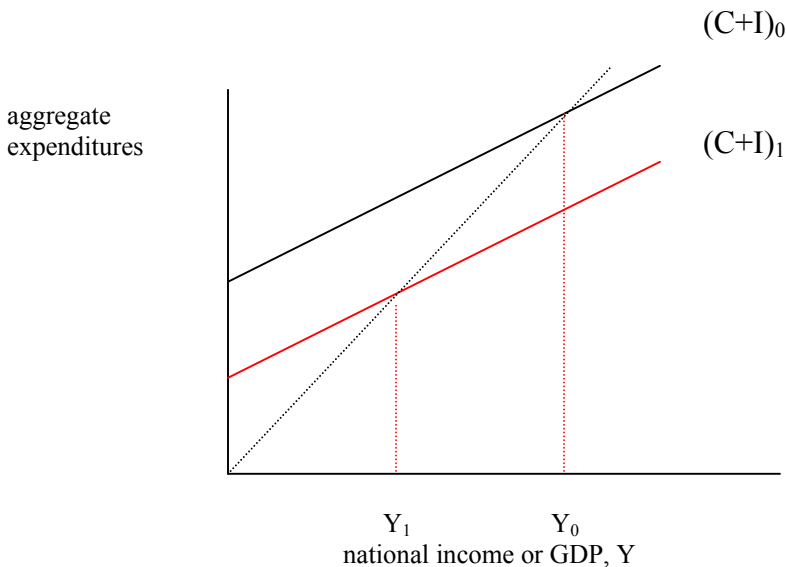


Example: Producer confidence falls

Effects:

- 1st: Firms invest less.
- 2nd: Aggregate expenditures fall, since I is a big part of AE
- 3rd: Producers respond to the lower expenditures by reducing production: Y falls
- 4th: Producers need fewer workers to produce the lower level of GDP: cyclical unemployment rises.

On a graph, we'd have the AE curve shifting down and a lower level of Y established at the intersection of the new AE curve and the 45-degree line:

The Algebra of Events Changing Equilibrium

Recall our algebraic example from earlier in these notes:

$$C = 200 + .6Y \text{ and } I = 300 \rightarrow Y = 1250, C = 950, S = 300 \text{ and } I = 300$$

Well, let's simulate an event that changes aggregate expenditures and see what happens:

Event: Lower producer confidence reduces Investment to $I = 200$

a) What is the **new** equilibrium level of GDP?

Here's the equilibrium condition: $AE = Y$

We know that in model 1, $AD = C + I$: $C + I = Y$

This is the new equation representing aggregate expenditures

We have equations for C and I:

$$(200 + .6Y) + 200 = Y$$

$$200 + 200 = 400:$$

$$400 + .6Y = Y$$

Subtract .6Y from both sides:

$$400 = .4Y$$

Divide both sides by .4:

$$1000 = Y_{\text{new}}$$

Y was 1250 and it dropped to 1000.

b) What is the equilibrium level of consumption?

Here's the consumption function:

$$C = 200 + .6Y$$

We know that Y is 1250:

$$C_{\text{new}} = 200 + .6(1000) = 800$$

C fell from 950 to 800.

c) What is the equilibrium level of personal savings?

Disposable income equals Consumption + Savings:

$$Y_d = C + S$$

Recall that disposable income = national income minus net taxes:

$$Y - T = C + S$$

Wait! There's no net taxes in this model (no government)

$$Y = C + S$$

We calculated Y and C earlier:

$$1000 = 800 + S$$

Do the math:

$$S_{\text{new}} = 200$$

S fell from 300 to 200

Let's summarize what happened to the economy in the table below; then we'll comment on it.

	I	Y	C	S
old value	300	1250	950	300
new value	200	1000	800	200

Comments:

Comment #1.

Investment only fell by \$100 (from 300 to 200) due to the drop in producer confidence, yet GDP and national income fell by a much larger amount--\$250 (from \$1250 to \$1000). Why? Well, notice that C fell by \$150:

$$\text{reduction in I} + \text{reduction in C} = \text{reduction in Y} \quad \leftarrow \text{here in model \#1}$$

Somehow, the drop in I also caused a drop in C, which made Y fall by a larger amount. This effect—the ripple effect of a drop in I on the rest of aggregate expenditures (in this case, C) is known as the investment multiplier effect:

The **investment multiplier effect** causes the short run change in Y to be larger than the short run change in investment.

Here's the intuition behind the investment multiplier effect. When Investment dropped by \$100, this meant that there was a drop of \$100 in spending on investment goods—lets' say on machinery. Well, the machinery producers will have to reduce production by \$100 worth of stuff. The producers will lay off workers, and these workers will have less income to spend, *causing consumption to fall*. Hence the drop in investment causes a drop in consumption.

Consider this equation:

change in investment \times the investment multiplier = change in Y

Some tricky math would let us actually derive the size of the investment multiplier, but we'll skip that math and I'll just tell you what it is:

$$\text{investment multiplier} = 1 / (1 - \text{slope of AE curve})$$

Investment multiplier example:

In our algebraic example from above, the slope of the AE curve is .6 so:

$$\text{investment multiplier} = 1 / (1 - .6) = 2.5$$

This is useful information. It's a shortcut to tell us how much Y will change for any change in I. Let's do two examples using our algebraic example from above.

Example: If I rises by 200, then Y will rise by $200 \times 2.5 = 500$

Example: I falls by 40 then Y will fall by $40 \times 2.5 = 100$

Comment #2:

Notice that personal savings = investment in the old equilibrium (both at \$300), and they're also equal in the new equilibrium ($S = I = 200$). Indeed, **in model #1 savings will equal investment when the economy is in equilibrium**. Here's why:

We know that when the economy is in equilibrium, output = expenditures:

$$Y = C + I$$

We also know that disposable income equals consumption plus savings:

$$Y - T = C + S$$

Recall that in model #1 there's not net taxes:

$$Y = C + S$$

So: $Y = C + I$ and
 $Y = C + S$

$\rightarrow S = I$!!!!!!! Hokey smokes, Batman!

The Paradox of Thrift

Suppose households en masse decide to save a larger percentage of their income. You'd think that the total amount of personal savings in the economy would rise, wouldn't you? Well, phooey phooey quick and chewy to you! Actually, the total level of personal savings will not rise!

The Paradox of Thrift: Attempts to save more income may not result in a higher level of personal savings.

Don't believe me? Let's demonstrate, using the original equilibrium from our algebraic example. Recall from our original example:

$$C = 200 + .6Y \text{ and } I = 300 \rightarrow Y = 1250, C = 950, S = 300 \text{ and } I = 300$$

Notice that the marginal propensity to consume is .6; that is, households are spending 60 cents of every extra dollar of income, and *saving 40 cents* of it. The resulting level of personal savings is 300.

Now, let's force consumers to spend only 30 cents of every extra dollar—reducing the MPC to .3. This means that households *save 70 cents* of each extra dollar in income. Will total savings rise? Let's find out.

The new consumption function is $C = 200 + .3Y$

The new equilibrium is where $C + I = Y$

Lets' substitute our economy's equations $(200 + .3Y) + 300 = Y$

$$500 + .3Y = Y$$

Subtract .3Y from both sides $500 = .7Y$

Divide both sides by .7 $714.2857 = Y$

Now we can substitute our value of Y into the consumption function, to get C:

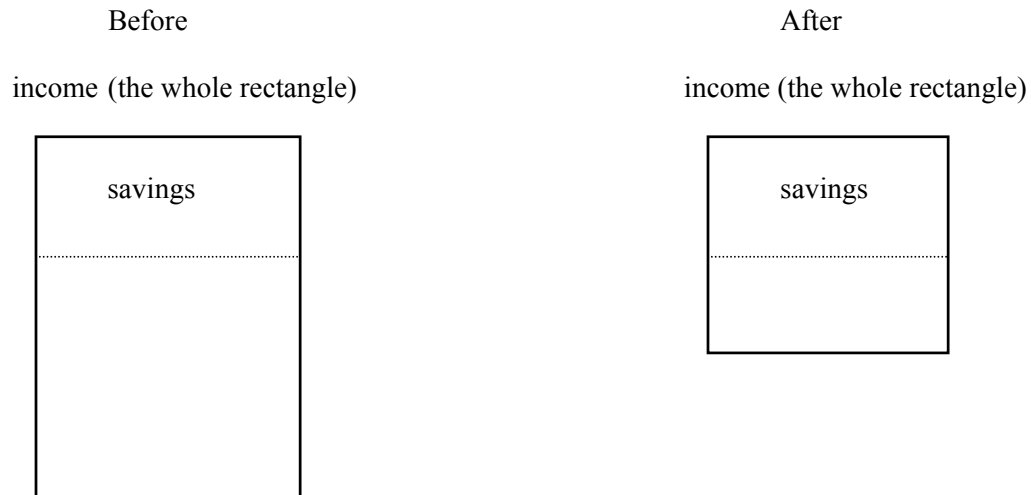
$$C = 200 + .3(714.2857) = 414.2857$$

We know that $Y = C + S$ in this economy, so now we can calculate S, savings:

$$Y = C + S \rightarrow 714.2857 = 414.2857 + S \rightarrow S = 300$$

Savings has remained constant at 300, despite efforts to save more by households. Why do they fail? Because by trying to save more, households reduce consumption. This reduction in consumption reduces aggregate expenditures—buyers are buying less stuff in the economy. As a result, producers reduce production; they need fewer workers, so they lay people off. Fewer workers in the economy means less total earned income—less income to save!

Picture this:



After, people are saving a larger *percentage* of income, but income has shrunk, so the total dollar amount of savings has not increased.

Well, we've finished model #1. What fun! Next, we'll construct model #2, in which we'll add government taxes and spending as well as exports and imports to them model.