

# ECO 202 Principles of Economics II

## *Lecture 7: Aggregate Expenditure and Output in the Short Run*

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# The Aggregate Expenditure Model

## Definition

Aggregate expenditure model is a macroeconomic model that focuses on the **short-run** relationship between **total spending** and **real GDP**, assuming that the price level is constant.

This model will focus on short-run determination of total output in an economy.

# Four Components of Aggregate Expenditure

Recall the four components in GDP:

$$Y = C + I + G + NX$$

- Consumption ( $C$ ): Spending by households on goods and services
- Planned investment ( $I$ ): Planned spending by firms on capital goods and by households on new homes
- Government purchases ( $G$ ): Spending on all levels of government on goods and services
- Net exports ( $NX$ ): The value of exports minus the value of imports

Aggregate expenditure is total spending in the economy: the sum of consumption, planned investment, government purchases, and net exports.

- Notice here we use **planned investment**, rather than **actual investment**.
- The difference is that planned investment spending does not include the build-up of inventories.
- 

Planned investment = Actual investment – unplanned change in inventories

Although the BEA measures actual investment, we will assume that their measurement is close enough to planned investment to use in our estimates of aggregate expenditures.

- Equilibrium in the economy occurs when spending on output is equal to the value of output produced; that is

$$\text{Aggregate expenditure} = GDP$$

- This should look “obvious”:

$$AE = C + I + G + NX$$

$$GDP = C + I + G + NX$$

- The difference is that in the first equation,  $I$  is planned investment, whereas in the second,  $I$  is actual investment.

<b>If...</b>	<b>then ...</b>	<b>and...</b>
aggregate expenditure is <b>equal</b> to GDP	inventories are <b>unchanged</b>	the economy is in <b>macroeconomic equilibrium.</b>
aggregate expenditure is <b>less</b> than GDP	inventories <b>rise</b>	GDP and employment <b>decrease.</b>
aggregate expenditure is <b>greater</b> than GDP	inventories <b>fall</b>	GDP and employment <b>increase.</b>



## Determining the Level of Aggregate Expenditure in the Economy

# Determining the Level of Aggregate Expenditure in the Economy

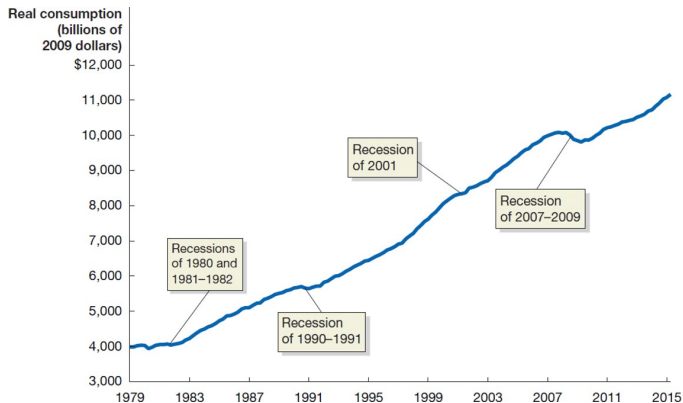
- Each of the components of aggregate expenditure plays a different role in the determination of equilibrium aggregate expenditure.
- Our main job is to define marginal propensity to consume and marginal propensity to save.
- Throughout this chapter, all values are in real terms rather than nominal (in billions of 2009 dollars).

# Components of Real Aggregate Expenditure, 2014

<b>Expenditure Category</b>	<b>Real Expenditure (billions of 2009 dollars)</b>
Consumption	\$10,876
Planned investment	2,718
Government purchases	2,838
Net exports	-443

- Consumption is the largest portion.
- Investment and government expenditures are similar.
- Net exports were negative in 2014.

# Real Consumption

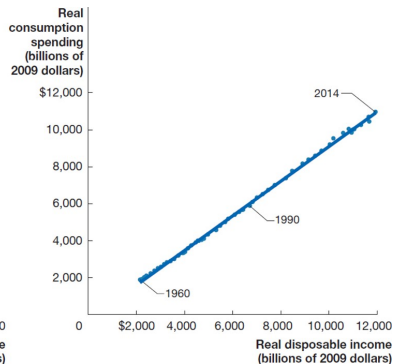
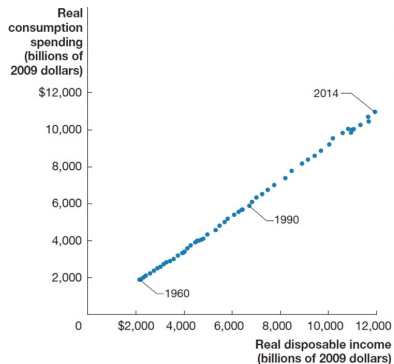


- Consumption tends to follow a relatively smooth, upward trend
- Consumption growth declines during periods of recession.
- Factors affect consumption: Current disposable income, household wealth, expected future income, the price level, the interest rate.

- Current disposable income
  - Consumer expenditure is largely determined by how much money consumers receive in a given year
  - Disposable means:  $\text{Personal income} - \text{Taxes} + \text{Transfer}$ .
  - Income expands most years; hence so does consumption.
- Household wealth
  - A household's wealth can be thought of as its assets (stocks, bonds, etc.) minus liabilities (mortgages, student loans, etc.)
  - Households with greater wealth spend more on consumption, an extra \$1,000 in wealth will result in \$40-\$50 in extra annual consumption spending, holding constant the effect of income.

- Expected future income
  - Most people prefer to keep their consumption fairly stable from year to year, a process known as consumption-smoothing
  - So consumption relates both to current and future income.
- The price level
  - As prices rise, household wealth falls. Consequently, higher prices result in lower consumption spending.
- The interest rate
  - Higher real interest rates encourage saving rather than spending, so they result in lower spending, especially on durable goods.

# Consumption Function



- Very strong relationship between consumption and income (households spend a consistent fraction of each extra dollar on consumption).
- Consumption function: the relationship between consumption spending and disposable income.

The graphs showed that consumers seem to have a relatively constant marginal propensity to consume.

## Definition

Marginal propensity to consume (MPC): the amount by which consumption spending changes when disposable income changes, i.e.

$$\text{MPC} = \frac{\text{Change in consumption}}{\text{Change in disposable income}} = \frac{\Delta C}{\Delta YD}$$

The marginal propensity to consume is the slope of the consumption function.



- 1 Macroeconomic equilibrium:  $AE = GDP$ .
- 2 Aggregate expenditure  $\Rightarrow$  inventories  $\Rightarrow GDP$  and employment change
- 3 Consumption is affected by...
- 4 Consumption function and MPC.

## Example

From 2013 to 2014, consumption increased by \$285 billion, while disposable income increased by \$313 billion:

$$\frac{\Delta C}{\Delta YD} = \frac{\$285}{\$313} = 0.91$$

Once we have marginal propensity to consume, we can estimate expected change in consumption given expected change in income, say \$10 billion:

$$\Delta C = \Delta YD \times MPC = \$10 \text{ billion} \times 0.91 = \$9.1 \text{ billion}$$

- The distinction between national income and GDP is relatively minor; we will assume they are equal and use the terms interchangeably.

$$\text{Disposable income} = \text{National income} - \text{Net taxes}$$

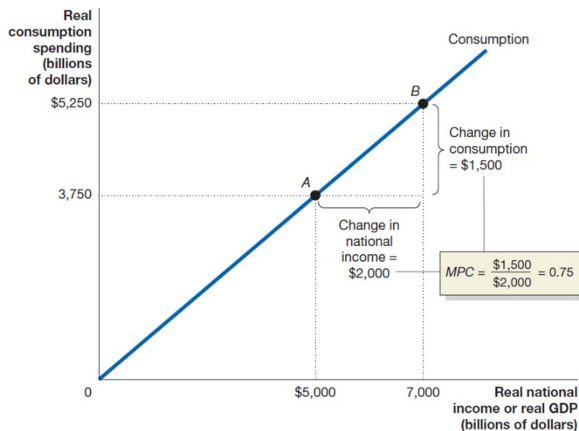
- If we assume that net taxes do not change as national income changes, we have the result that any change in disposable income is the same as the change in national income.

# Consumption and National Income

<b>National Income or GDP (billions of dollars)</b>	<b>Net Taxes (billions of dollars)</b>	<b>Disposabl e Income (billions of dollars)</b>	<b>Consumpt ion (billions of dollars)</b>	<b>Change in National Income (billions of dollars)</b>	<b>Change in Disposable Income (billions of dollars)</b>
\$1,000	\$1,000	\$0	\$750	—	—
3,000	1,000	2,000	2,250	\$2,000	\$2,000
5,000	1,000	4,000	3,750	2,000	2,000
7,000	1,000	6,000	5,250	2,000	2,000
9,000	1,000	8,000	6,750	2,000	2,000
11,000	1,000	10,000	8,250	2,000	2,000
13,000	1,000	12,000	9,750	2,000	2,000

The table shows the relationship between consumption and national income for an imaginary economy, keeping net taxes constant.

# Consumption and National Income



As national income rises by \$2,000 billion, consumption rises by \$1,500 billion. So the MPC is 0.75.

- Disposable income not spent is saved.
- National income = Consumption + Saving + Taxes.

$$Y = C + S + T$$

- Any change in national income can be decomposed into changes in the three categories

$$\Delta Y = \Delta C + \Delta S + \Delta T$$

- Assume net taxes do not change, so  $\Delta T = 0$ .

$$\Delta Y = \Delta C + \Delta S$$

- Dividing through by  $\Delta Y$  gives:

$$\frac{\Delta Y}{\Delta Y} = \frac{\Delta C}{\Delta Y} + \frac{\Delta S}{\Delta Y}$$

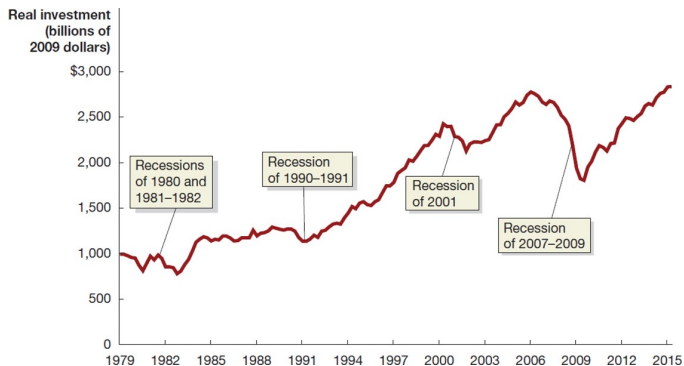
$$\frac{\Delta Y}{\Delta Y} = \frac{\Delta C}{\Delta Y} + \frac{\Delta S}{\Delta Y}$$

- $\frac{\Delta S}{\Delta Y}$  is the amount by which savings changes, when (disposable) income changes.
- This is known as the **marginal propensity to save**.
- Rewrite the above equation,

$$1 = MPC + MPS.$$

- The marginal propensity to consume plus the marginal propensity to save must equal 1.

# Real Investment



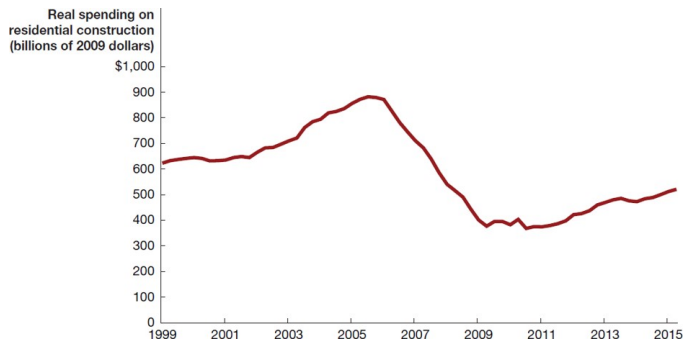
- Investment has increased over time; but unlike consumption, it has not increased smoothly, and recessions decrease investment more.
- Factors affect investment: Expectations of future profitability, interest rate, taxes, and cash flow.



- Expectations of future profitability
  - Investment goods, such as factories, office buildings, machinery, and equipment, are long-lived. Firms build more of them when they are optimistic about future profitability.
  - Purchases of new housing are included in planned investment. In recessions, households have reduced wealth and hence less incentive to invest in new housing.
- Interest rate
  - Since business investment is sometimes financed by borrowing, the real interest rate is an important consideration for investing.
  - Higher real interest rates result in less investment spending, and lower real interest rates result in more investment spending.

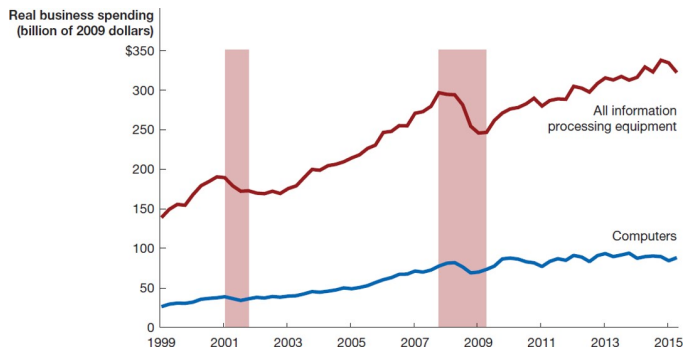
- Taxes
  - Higher corporate income taxes on profits decrease the money available for reinvestment and decrease incentives to invest by diminishing the expected profitability of investment.
  - Similarly, investment tax incentives tend to increase investment.
- Cash flow
  - Firms often pay for investments out of their own cash flow, the difference between the cash revenues received by a firm and the cash spending by the firm.
  - The largest contributor to cash flow is profit. During recessions, profits fall for most firms, decreasing their ability to finance investment.

## Example: Is Student Loan Debt Causing Fewer Young People to Buy Houses?



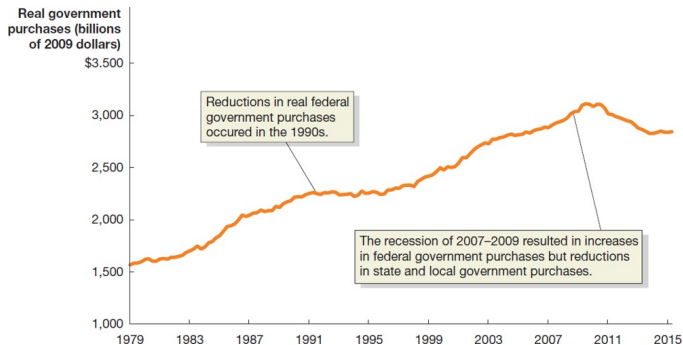
- In 2014, homeownership rates among < 35 year olds were the lowest in 25 years.
- Harvard economist Larry Summers argues many college graduates have trouble saving a down payment, and mortgage guidelines are stricter now than before.
- Whatever the reason, spending on new houses is down overall.

# Spending on Information Processing Equipment, 1999-2015



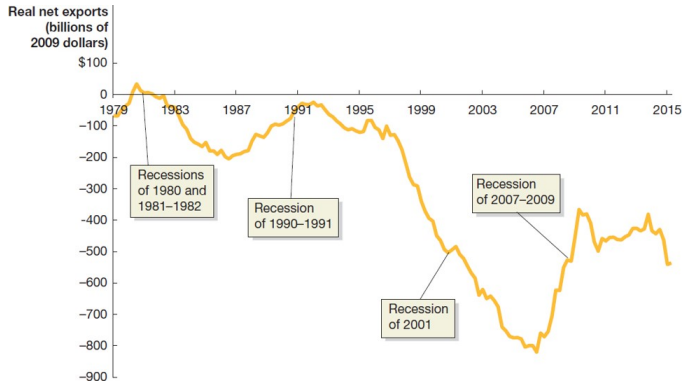
- Firms have increased their use of information technology, but spending doesn't reflect this.
- Appears to be a decrease in planned investment in information technology from previous trends.
- But the real reason is that the frontier of development in information technology is software rather than hardware.

# Real Government Purchases



- Real government purchases include purchases at all levels of government: federal, state, and local.
- Not transfer payments; only purchases for which the government receives some good or service.
- Government purchases have generally, though not consistently, increased over time; exceptions include the early 1990s (end of Cold War) and after the recession of 2007-2009.

# Real Net Exports



- Net exports equals exports minus imports.
- It is affected by: price levels in different countries, growth rate in different countries, and exchange rate.
- U.S. net exports have been negative for the last few decades. The value typically becomes higher (less negative) during a recession, as spending on imports falls.

# Determinants of Net Exports

<b>If...</b>	<b>U.S. Net Exports will...</b>	<b>...because...</b>
...U.S. price level rises faster than foreign price levels...	decrease	U.S. goods become more expensive relative to foreign goods, so imports rise and exports fall.
... <b>slower</b> ...	increase	The opposite is true.
...U.S. GDP grows <b>faster</b> than foreign GDP...	decrease	U.S. demand for imports rises faster than foreign demand for our exports.
... <b>slower</b> ...	increase	The opposite is true.
...\$US <b>rises</b> in value relative to other currencies...	decrease	Imports are cheaper, and our exports are more expensive. So imports rise and exports fall.
... <b>falls</b> ...	increase	The opposite is true.

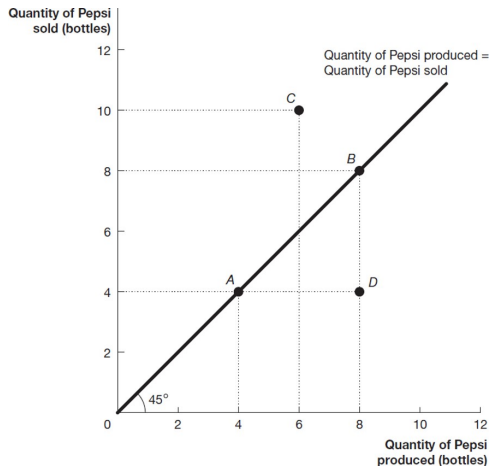
- Marginal propensity to save
- $1 = MPC + MPS$
- Real investment (more fluctuated than consumption) and factors affecting it.
- Government purchases
- Net exports and factors affecting it.



## Graphing Macroeconomic Equilibrium

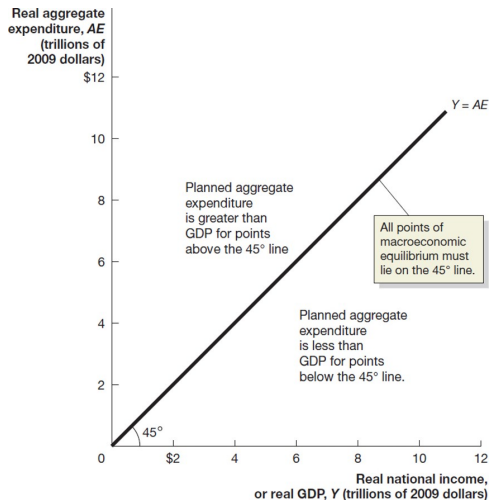
- Use a  $45^\circ$ -line diagram to illustrate macroeconomic equilibrium.
- Suppose in the whole economy there is a single product: Pepsi.
- For the Pepsi economy to be in equilibrium, the amount of Pepsi produced must equal the amount of Pepsi sold.
- Otherwise, inventories of Pepsi rise or fall.

# Graphing Macroeconomic Equilibrium



- Any point on the 45° line could be an equilibrium-like points A or B.
- At point C, the economy's inventories of Pepsi are being depleted, and production must rise to restore equilibrium.
- At point D, inventories of Pepsi are growing, so production must fall.

# Graphing Macroeconomic Equilibrium



- We can apply this model to a real economy, with real national income (GDP) on the x-axis and real aggregate expenditure on the y-axis.
- This model is also known as the Keynesian cross.
- Only points on the 45°-line can be a macroeconomic equilibrium, with planned aggregate expenditure equal to GDP.

## Determine Macroeconomic Equilibrium

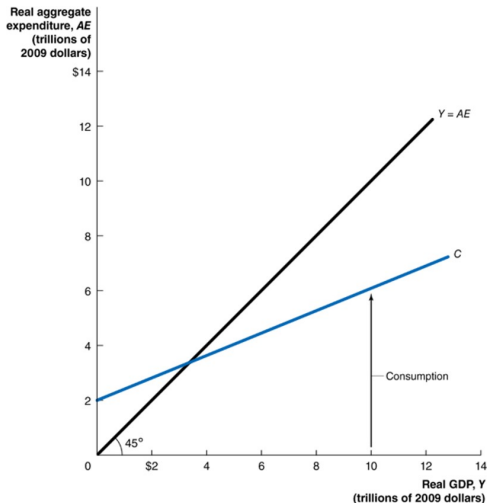
Any point on the  $45^\circ$ -line could be an equilibrium, but how do we know which one will be the equilibrium in a given year?

- To determine this, recall that when they receive additional income, households consume some of it and save some of it.
- The resulting consumption function tells us how much consumers will spend (real expenditure) when they have a particular income (real GDP).
- This will determine Consumption ( $C$ ) in the equation

$$Y = C + I + G + NX$$

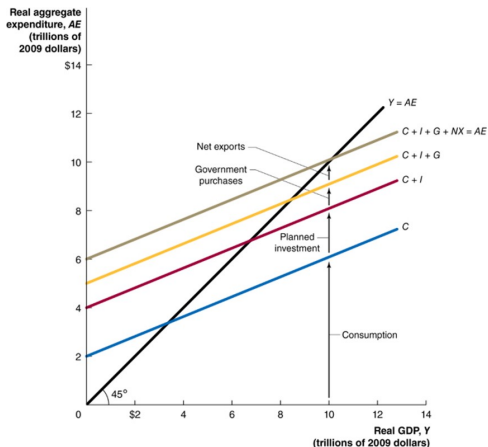
- Macroeconomic equilibrium simply means the left side (real GDP) must equal the right side (planned aggregate expenditure).
- The trick is to find the “right” level of  $C$ . For that, we use the  $45^\circ$  line diagram.

# Graphing Macroeconomic Equilibrium



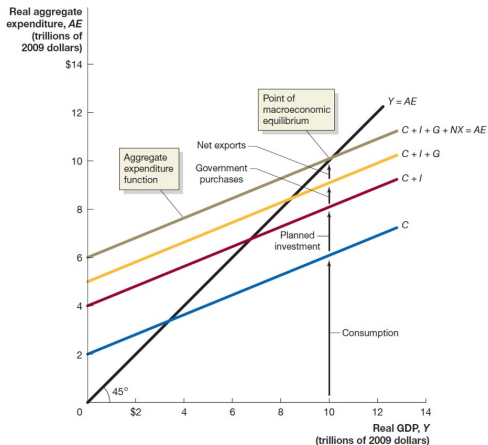
- We start by placing the consumption function on the diagram.
- If there was no other expenditure in the economy, then the macroeconomic equilibrium would be where the consumption function crossed the  $45^\circ$  line; there, income (GDP) equals expenditure.

# Graphing Macroeconomic Equilibrium



- But there are other expenditures. We will assume they are **not** affected by income, that they are predetermined.
- Then we add the other expenditures: planned investment, government purchases, and net exports.
- These are vertical shifts in real expenditure, because their values do not depend on real GDP.

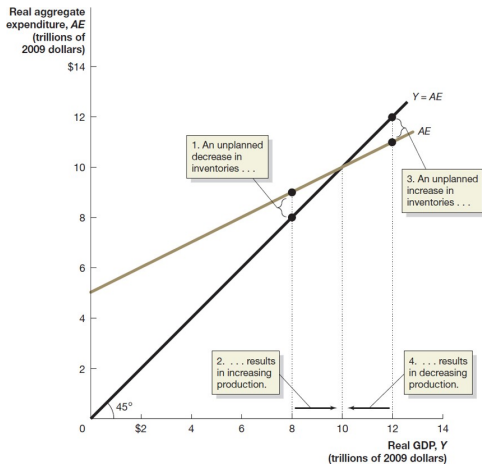
# Graphing Macroeconomic Equilibrium



- At last, we have macroeconomic equilibrium: the point at which:
  - Income equals expenditure, i.e.  
 $Y = C + I + G + NX$
  - The level of consumption is consistent with the level of income, according to the consumption function.
- We call this top most line the aggregate expenditure function.

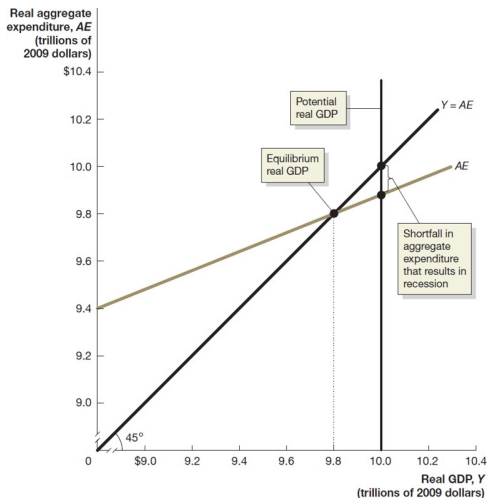


# Macroeconomic Equilibrium



- In this economy, macroeconomic equilibrium occurs at \$10 trillion.
- What if real GDP were lower, say \$8 trillion?
  - 1 Aggregate expenditure would be higher than GDP, so inventories would fall.
  - 2 This would signal firms to increase production, increasing GDP.
- The reverse would occur if real GDP were above \$10 trillion.

# Application: Showing a Recession on the 45°-Line Diagram



- Macroeconomic equilibrium can occur anywhere on the 45°-line. Ideally, we would like it to occur at the level of potential GDP.
- If equilibrium occurs at this level, unemployment will be low-full employment.
- But this might not occur; maybe firms are pessimistic and reduce investment spending.
- Then the equilibrium will occur below potential GDP—a recession.

Inventories play a critical role in this model of the economy.

- When planned aggregate expenditure is less than real GDP, firms will experience unplanned increases in inventories.
- Then even if spending returns to normal levels, firms have excess inventories to sell, and they will do this instead of increasing production to normal levels.

## Example

In 2009, the “Great Recession” was about to end. But real GDP fell sharply in the first quarter of 2009—at a 6.7 percent annualized rate. Economists estimate that almost half of this decline was due to firms cutting production as they sold off their unintended accumulation of inventories.

Real GDP (Y)	Consumption (C)	Planned Investment (I)	Government Purchases (G)	Net Exports (NX)	Planned Aggregate Expenditure (AE)	Unplanned Change in Inventories	Real GDP Will...
\$8,000	\$6,200	\$1,500	\$1,500	-\$500	\$8,700	-\$700	increase
9,000	6,850	1,500	1,500	-500	9,350	-350	increase
10,000	7,500	1,500	1,500	-500	10,000	0	be in equilibrium
11,000	8,150	1,500	1,500	-500	10,650	+350	decrease
12,000	8,800	1,500	1,500	-500	11,300	+700	decrease

The table shows several hypothetical combinations of real GDP and planned aggregate expenditure.

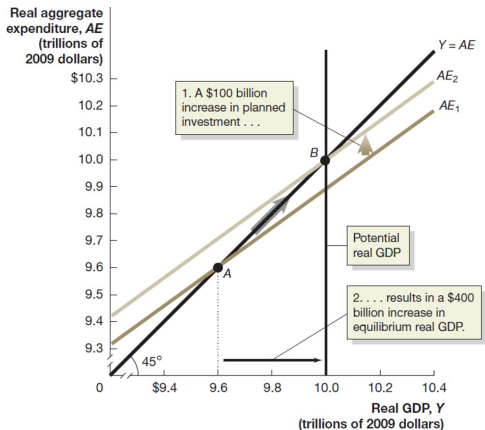
- As real GDP changes, consumption changes but planned investment, government purchases, and net exports stay constant.
- Macroeconomic equilibrium can occur only at \$10,000 billion;
- Otherwise, the unplanned change in inventories will cause firms to change production and hence real GDP will change.

- $Y = AE$  Line.
- Aggregate expenditure function and intersection with  $Y = AE$  line.
- Equilibrium.
- The role of inventory.

## The Multiplier Effect

- In our model, planned investment, government purchases, and net exports are autonomous expenditures: their level does not depend on the level of GDP.
- But consumption has both an autonomous and induced effect.
- So its level does depend on the level of GDP, and this produces the upward-sloping  $AE$  line.

# The Multiplier Effect



- An increase in an autonomous expenditure shifts the aggregate expenditure line upward.
- When this happens, real GDP increases by **more** than the change in autonomous expenditures; this is the **multiplier effect**.
- The value of the increase in equilibrium real GDP divided by the increase in autonomous expenditures is the **multiplier**.



# The Multiplier Effect

Round	Additional Autonomous Expenditure (investment)	Additional Induced Expenditure (consumption)	Total Additional Expenditure = Total Additional GDP
Round 1	\$100 billion	\$0	\$100 billion
Round 2	0	75 billion	175 billion
Round 3	0	56 billion	231 billion
Round 4	0	42 billion	273 billion
Round 5	0	32 billion	305 billion
.	.	.	.
.	.	.	.
Round 10	0	8 billion	377 billion
.	.	.	.
.	.	.	.
Round 15	0	2 billion	395 billion
.	.	.	.
.	.	.	.
Round 19	0	1 billion	398 billion
.	.	.	.
.	.	.	.
Round n	0	0	400 billion

- Initially, real GDP rises by the amount of the increase in autonomous expenditure.
- This causes an increase in real GDP, which causes an increase in production, which causes an increase in real GDP, ...

- We cannot say how long this adjustment to macroeconomic equilibrium will take-how many “rounds”, back and forth.
- But we can calculate the value of the multiplier, as the eventual change in real GDP divided by the change in autonomous expenditures (planned investment, in this case):

$$\frac{\Delta Y}{\Delta I} = \frac{\text{Change in real GDP}}{\text{Change in investment spending}} = \frac{\$400 \text{ billion}}{\$100 \text{ billion}} = 4$$

- With a multiplier of 4, each \$1 increase in planned investment (or any other autonomous expenditure) eventually increases equilibrium real GDP by \$4.

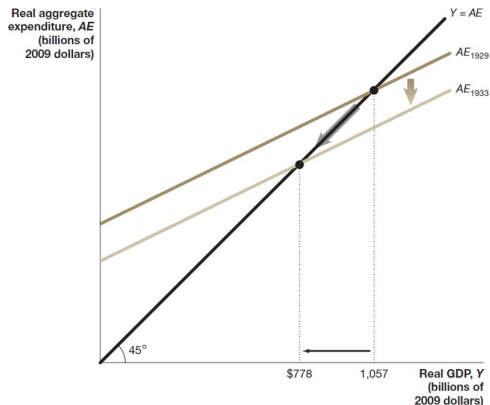
# Example: The Great Depression



- The multiplier can work in reverse too, like it did during the Great Depression of the 1930s.
- Several events, including the stock market crash of October 1929, led to reductions in investments by firms.
- Real GDP fell, so consumers cut back on spending, prompting firms to reduce production more, so consumers spent even less . . .

Year	Consumption	Investment	Exports	Real GDP	Unemployment Rate
1929	\$781 billion	\$124 billion	\$41 billion	\$1,057 billion	2.90%
1933	\$638 billion	\$27 billion	\$22 billion	\$778 billion	20.90%

# Example: The Great Depression



The 45°-line diagram can help to illustrate this process.

- Aggregate expenditures fell initially, due to the decrease in investment.
- This prompted a multiplied effect on equilibrium real GDP.
- Recovery from the Great Depression took many years; unemployment remained above 10 percent until WWII.

# The Multiplier and the Marginal Propensity to Consume

How can we know the eventual value of the multiplier?

- In each “round”, the additional income prompts households to consume some fraction (the marginal propensity to consume).
- The total change in equilibrium real GDP equals:

The initial increase in planned investment spending = \$100 billion

Plus the first induced increase in consumption =  $MPC \times \$100$  billion

Plus the second induced increase in consumption =  $MPC \times (MPC \times \$100 \text{ billion})$   
=  $MPC^2 \times \$100$  billion

Plus the third induced increase in consumption =  $MPC \times (MPC^2 \times \$100 \text{ billion})$   
=  $MPC^3 \times \$100$  billion

And so on...

## A Formula for the Multiplier

This becomes the infinite sum

$$\begin{aligned}\text{Total change in GDP} &= 100 + MPC \times 100 + MPC^2 \times 100 + MPC^3 \times 100 + \dots \\ &= 100 \times (1 + MPC + MPC^2 + MPC^3 + \dots) \\ &= 100 \times \frac{1}{1 - MPC}\end{aligned}$$

In our case,  $MPC = 0.75$ , so the multiplier is

$$\frac{1}{1 - 0.75} = 4$$

A \$100 billion increase in investment eventually results in a \$400 billion increase in equilibrium real GDP.

The general formula for the multiplier is

$$\text{Multiplier} = \frac{\text{Change in equilibrium real GDP}}{\text{Change in autonomous expenditure}} = \frac{1}{1 - MPC}$$

# Summary on the Multiplier Effect

- 1 The multiplier effect occurs both for an increase and a decrease in planned aggregate expenditure.
- 2 Because the multiplier is greater than 1, the economy is sensitive to changes in autonomous expenditure.
- 3 The larger the MPC, the larger the value of the multiplier.
- 4 Our model is somewhat simplified, omitting some real-world complications. For example, as real GDP changes, imports, inflation, interest rates, and income taxes will change.

The last point generally means that the value we estimate for the multiplier, from the MPC, is too high. In the next chapter, we will address some of these shortcomings.

- Recall the savings identity: savings equals investment, which also shows up in the long-run growth chapter that it is key to long-run growth.
- What happens in the short-term if people save more: consumption decreases, and hence incomes decrease, so consumption decreases . . . potentially pushing the economy into recession.
- John Maynard Keynes referred to this as the paradox of thrift: what appears to be favorable in the long-run may be counterproductive in the short-run.
- Economists debate whether this paradox of thrift really exists; increasing savings decreases the real interest rate; the consequent increase in investment spending may offset the decrease in consumption spending.

We cannot settle this with our simple model.



# The Aggregate Demand Curve

# How Does the Price Level Affect Aggregate Expenditures?

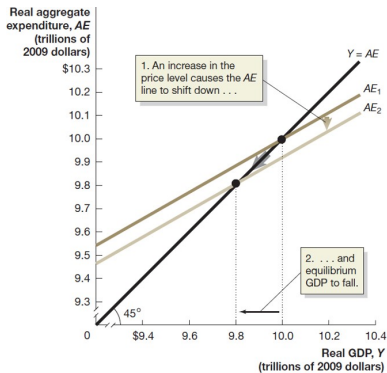
As demand for a product rises, we expect that two things will occur:

- Production will increase.
- Price will go up.

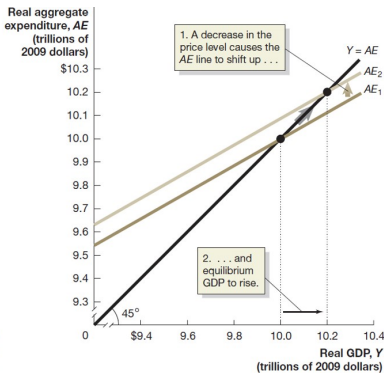
Our model has concentrated on the first of these, but what about price changes? In the larger economy, we also expect that an increase in aggregate expenditure would increase the price level, which will in turn have a feedback effect on aggregate expenditures

- increases in the price level will cause aggregate expenditure to fall, and decreases in the price level will cause aggregate expenditures to rise.

# The Effect of a Change in the Price Level on Real GDP



(a) The effect of a higher price level on real GDP

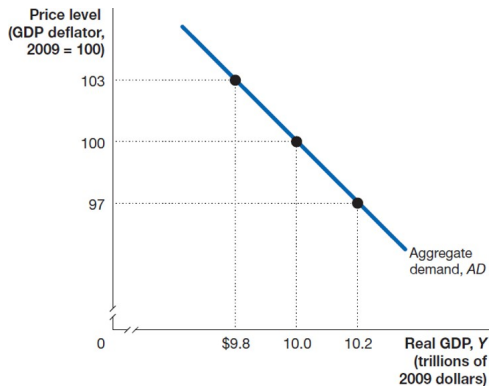


(b) The effect of a lower price level on real GDP

The diagrams show the effects described on the previous slide:

- (a) Increases in the price level cause AE and real GDP to fall.
- (b) Decreases in the price level cause AE and real GDP to rise.

# The Aggregate Demand Curve



- Consequently, there is an inverse relationship between the price level and real GDP.
- Aggregate demand (AD) curve: A curve that shows the relationship between the price level and the level of planned aggregate expenditure in the economy, holding constant all other factors that affect aggregate expenditure.