Chapter 11: Aggregate Expenditure and Output in the Short Run

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Learning Objectives

1. Understand how *macroeconomic equilibrium* is determined in *the aggregate expenditure model*.
2. Discuss the determinants of the four components of *aggregate expenditure* and define the marginal propensity to consume and the marginal propensity to save.
3. Use a 45° line diagram to illustrate *macroeconomic equilibrium*.
4. Define *the multiplier effect* and use it to calculate *changes in equilibrium GDP*.
5. Understand the relationship between *the aggregate demand curve* and *aggregate expenditure*. 
Output and Expenditure in the Short Run

- In this chapter, we explore the causes of the business cycle by examining the effect of *fluctuations in total spending* (i.e., aggregate expenditure) on *real GDP* (*total production*).
- *Aggregate expenditure (AE)* The total amount of *spending* in the economy: the sum of *consumption*, *planned investment*, *government purchases*, and *net exports*. 
(Cont.) During some years, AE increases about as much as does the production of goods and services:
  - Most firms sell about what they expected to sell and they will remain production and employment unchanged.

During other years, AE increases more than the production:
  - Firms will increase production and hire more workers.

However, during some year, AE didn’t increase as much as total production:
  - Firms cut back on production and laid off workers.
The Aggregate Expenditure Model?

- **Aggregate expenditure model** A macroeconomic model that focuses on the relationship between total spending and real GDP, assuming the price level is constant.
  - It is used to study the business cycle involving the interaction of many economic variables.
- The key idea of AE model: In any particular year, the level of GDP is determined mainly by the level of AE that have several components.
- Economists began to study the relationship bw fluctuations in AE and fluctuations in GDP during the Great depression of the 1930s:
  - In 1936, John M. Keynes systematically analyzed this relationship in his famous book ("The general theory of . . .") and identified four categories of AE that together equal to GDP (these are the same four categories).
Aggregate Expenditure

$$AE = C + I + G + NX$$  \hspace{1cm} (1)

1. Consumption ($C$): Spending by HHs on G&S such as furniture, food, etc.
2. Planned Investment ($I$): *Planned* spending by firms on capital goods, such as machinery, buildings, etc. or by HHs on new houses.
3. Government Purchases ($G$): Spending by local, state, and federal governments on G&S, such as building airport, highway, and salaries of gov. employees.
The Difference between Planned Investment and Actual Investment

- The amount of that firms *plan* to spend on investment can be different from the amount they *actually* spend.
- The reason is that we need to consider *inventories*:
  - *Inventories*: Goods that have been produced, but not yet sold.
- Changes in inventories are included as part of investment spending:
  - Assume that the amount businesses plan to spend on inventories may be different from the amount they actually spend.
(cont.) Changes in inventories depend on sales of goods, which firms cannot always forecast with perfect accuracy.

- E.g., an auto company may produce 15,000 cars and expect to sell them all. If it does sell all 15,000, its inventories will be unchanged, but if it sells only 10,000 it will have an unplanned increase in inventories.

- Hence, for the economy as a whole, we can say that actual investment spending (IS) will be greater (less) than planned IS when there is an unplanned increase (decrease) in inventories.

- Actual investment will equal planned investment only when there is no unplanned change in inventories.
Macroeconomic Equilibrium

- *Macroeconomic equilibrium* is similar to microeconomic equilibrium (demand = supply of a product), in which the quantity of apples produced and sold will not change unless the demand or supply of this good changes.

- For the economy as a whole, macro equilibrium occurs where *total spending equals to total production*, that is,

  \[ \text{Aggregate Expenditure} = GDP \]
### Solved Problem 11-1

**Ace Computers and Aggregate Expenditure**

<table>
<thead>
<tr>
<th>SCENARIO I</th>
<th>SCENARIO II</th>
<th>SCENARIO III</th>
</tr>
</thead>
<tbody>
<tr>
<td>$C$</td>
<td>$200 million</td>
<td>$250 million</td>
</tr>
<tr>
<td>$I$</td>
<td>$50 million</td>
<td>$50 million</td>
</tr>
<tr>
<td>$G$</td>
<td>$100 million</td>
<td>$100 million</td>
</tr>
<tr>
<td>$NX$</td>
<td>$100 million</td>
<td>$100 million</td>
</tr>
<tr>
<td><strong>Total expenditures</strong></td>
<td><strong>$450 million</strong></td>
<td><strong>$500 million</strong></td>
</tr>
<tr>
<td><strong>Change in inventories</strong></td>
<td><strong>+$50 million</strong></td>
<td><strong>$0 million</strong></td>
</tr>
<tr>
<td><strong>Contribution to GDP</strong></td>
<td><strong>$500 million</strong></td>
<td><strong>$500 million</strong></td>
</tr>
</tbody>
</table>

**YOUR TURN:** For more practice, do related problem 1.7 at the end of this chapter.
## The Aggregate Expenditure Model

### Adjustments to Macroeconomic Equilibrium

#### Table 11-1

<table>
<thead>
<tr>
<th>IF …</th>
<th>THEN …</th>
<th>AND …</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aggregate expenditure is equal to GDP</td>
<td>inventories are unchanged</td>
<td>the economy is in macroeconomic equilibrium.</td>
</tr>
<tr>
<td>Aggregate expenditure is less than GDP</td>
<td>inventories rise</td>
<td>GDP and employment decrease.</td>
</tr>
<tr>
<td>Aggregate expenditure is greater than GDP</td>
<td>inventories fall</td>
<td>GDP and employment increase.</td>
</tr>
</tbody>
</table>
Adjustments to Macro Equilibrium

- Increases and decreases in AE cause the year-to-year fluctuations in GDP.
- Economists forecast what will happen to each component of AE. If they forecast that AE will decline in the future, that is equivalent to forecasting that GDP will decline and that the economy will enter a recession.
- Individuals and firms closely watch these forecasts because fluctuations in GDP can have dramatic effects on wages, profits, and employment.
- When economists forecast that AE is likely to decline and the economy is headed for a recession, the gov. may implement macro policies to head off the decline in AE and avoid the recession.
### Determining the Level of Aggregate Expenditure in the Economy

#### Table 11-2

**Components of Real Aggregate Expenditure, 2008**

<table>
<thead>
<tr>
<th>EXPENDITURE CATEGORY</th>
<th>EXPENDITURE (BILLIONS OF 2005 DOLLARS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumption</td>
<td>$9,291</td>
</tr>
<tr>
<td>Planned investment</td>
<td>1,989</td>
</tr>
<tr>
<td>Government purchases</td>
<td>2,518</td>
</tr>
<tr>
<td>Net exports</td>
<td>−494</td>
</tr>
</tbody>
</table>

11.2 LEARNING OBJECTIVE

Discuss the determinants of the four components of aggregate expenditure and define marginal propensity to consume and marginal propensity to save.
Determining the Level of Aggregate Expenditure in the Economy

Consumption

FIGURE 11-1

Real Consumption

Consumption follows a smooth, upward trend, interrupted only infrequently by brief recessions.

11.2 LEARNING OBJECTIVE

Discuss the determinants of the four components of aggregate expenditure and define marginal propensity to consume and marginal propensity to save.
Consumption

The five most important variables that determine the level of consumption:

- *Current disposable income* is the most important determinant of consumption.
  - Disposable income (DI) is the income remaining to HHs after paying the personal income tax and receiving gov. transfer payments.
  - For most HHs, the higher (lower) their DI, the more (the less) they spend.
  - Aggregate (macro) consumption is the total of the consumption of US HHs. The main reason for the general upward trend in consumption is that DI has followed a similar upward trend.
Household wealth is the value of its assets minus the value of its liabilities.

- Assets include home, stock and bond holdings, and bank accounts.
- Liabilities include any loans that it owes.
- When the wealth of HHs increases (decreases), consumption increases (decreases).
- Since shares of stock are an important component of HHs’ wealth, consumption should increase with stock prices.
- A recent estimate of the effects of changes in wealth on consumption indicates a permanent one-dollar increase in wealth induces 4 – 5 cents increase in consumption.
(cont.) *Expected future income:* Most people prefer to keep their consumption fairly stable and smooth over time, even if their income fluctuates significantly. Both current income and expected future income need to be considered to determine current consumption.

*The price level:* Changes in the price level affect consumption mainly through their effect on HHs’ wealth. As the price level rises, the real value of HHs wealth declines and so will HHs consumption.
The interest rate: When the interest rate (IR) is high, the reward to saving is increased and HHs are likely to save more and spend less.

- Note that consumption depends on the real IR that corrects the nominal IR for the impact of inflation.
- Spending on durable goods (such as autos, one category of consumption) is most likely to be affected by the interest rate because a high real IR increases the cost of spending financed by borrowing.
Many macroeconomic variables, such as GDP, housing prices, consumption spending, and investment spending, rise and fall at about the same time during the business cycle.
Determining the Level of Aggregate Expenditure in the Economy

Consumption

The Consumption Function

FIGURE 11-2

The Relationship between Consumption and Income, 1960–2008

Panel (a) shows the relationship between consumption and income. The points represent combinations of real consumption spending and real disposable income for the years between 1960 and 2008.

In panel (b), we draw a straight line through the points from panel (a). The line, which represents the relationship between consumption and disposable income, is called the consumption function. The slope of the consumption function is the marginal propensity to consume.

11.2 LEARNING OBJECTIVE

Discuss the determinants of the four components of aggregate expenditure and define marginal propensity to consume and marginal propensity to save.
The Consumption Function

- **Consumption function** The relationship between consumption spending and disposable income.

- **Marginal propensity to consume (MPC)**: The slope of the consumption function: the amount by which consumption spending increases when disposable income increases:

  \[
  MPC = \frac{\text{change in consumption}}{\text{change in disposable income}} = \frac{\Delta C}{\Delta YD}. \tag{2}
  \]

- We can also use the MPC to determine how much consumption will change as income changes:

  \[
  \Delta C = MPC \times \Delta YD.
  \]
The Relationship between Consumption and National Income

- Shift to discuss the relationship between aggregate consumption spending and \( GDP \), rather than disposable income because we are interested in using the AE model to explain fluctuations in real GDP.
- Note that GDP and national income are almost the same.
- Note that

\[
\text{Disposable income} = \text{National income} - \text{Net taxes} \tag{3}
\]

where Net taxes = taxes minus gov transfer payments. Or, rearranging the equation:

\[
\text{National income} = \text{GDP} = \text{Disposable income} + \text{Net taxes}. \tag{4}
\]
Determining the Level of Aggregate Expenditure in the Economy

The Relationship between Consumption and National Income

FIGURE 11-3

The Relationship between Consumption and National Income

Because national income differs from disposable income only by net taxes—which, for simplicity, we assume are constant—we can graph the consumption function using national income rather than disposable income.

We can also calculate the **MPC**, which is the slope of the consumption function, using either the change in national income or the change in disposable income and always get the same value.

The slope of the consumption function between point A and point B is equal to the change in consumption—$1,500 billion—divided by the change in national income—$2,000 billion—or 0.75.

11.2 LEARNING OBJECTIVE

Discuss the determinants of the four components of aggregate expenditure and define marginal propensity to consume and marginal propensity to save.
Income, Consumption, and Saving

- HHs either (1) spend their income, (2) save it, or (3) use it to pay taxes. For the economy as a whole,

\[ \text{National income} = \text{Consumption} + \text{Saving} + \text{Taxes}, \quad (5) \]

which means that

\[ \text{Change in national income} = \text{Change in consumption} \]
\[ + \text{Change in saving} + \text{Change in taxes} \quad (6) \]

- Using symbols, where \( Y \) represents national income (and GDP), \( C \) represents consumption, \( S \) represents saving, and \( T \) represents taxes,

\[ Y = C + S + T \text{ and } \Delta Y = \Delta C + \Delta S + \Delta T. \quad (7) \]
To simplify, we can assume that taxes are always a constant amount, in which case $\Delta T = 0$, so that:

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

**Marginal propensity to save (MPS)** The change in saving divided by the change in income:

$$1 = \frac{\Delta C}{\Delta Y} + \frac{\Delta S}{\Delta Y} \quad \text{or} \quad 1 = MPC + MPS$$
Solved Problem 11-2
Calculating the Marginal Propensity to Consume and the Marginal Propensity to Save

\[ MPC = \frac{\Delta C}{\Delta Y} \]

\[ MPS = \frac{\Delta S}{\Delta Y} \]

<table>
<thead>
<tr>
<th>NATIONAL INCOME AND REAL GDP (Y)</th>
<th>CONSUMPTION (C)</th>
<th>SAVING (S)</th>
<th>MARGINAL PROPENSITY TO CONSUME (MPC)</th>
<th>MARGINAL PROPENSITY TO SAVE (MPS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$9,000</td>
<td>$8,000</td>
<td>$1,000</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>10,000</td>
<td>8,600</td>
<td>1,400</td>
<td>0.6</td>
<td>0.4</td>
</tr>
<tr>
<td>11,000</td>
<td>9,200</td>
<td>1,800</td>
<td>0.6</td>
<td>0.4</td>
</tr>
<tr>
<td>12,000</td>
<td>9,800</td>
<td>2,200</td>
<td>0.6</td>
<td>0.4</td>
</tr>
<tr>
<td>13,000</td>
<td>10,400</td>
<td>2,600</td>
<td>0.6</td>
<td>0.4</td>
</tr>
</tbody>
</table>

YOUR TURN: For more practice, do related problem 2.10 at the end of this chapter.

11.2 LEARNING OBJECTIVE
Discuss the determinants of the four components of aggregate expenditure and define marginal propensity to consume and marginal propensity to save.
Planned Investment

- **Expectations on future profitability**
  - Investment goods (equipment, office buildings) are long-lived.
  - A firm is unlikely to make a new investment unless it is **optimistic** that the demand for its product will remain strong for several years.
  - The **optimism or pessimism** of firms is an important determinant of investment.

- **The interest rate**
  - A significant fraction of investment is financed by **borrowing**. HHs also borrow to finance most of their spending on new houses.
  - The higher the interest rate, the more expensive it becomes for firms or HHs to borrow.
  - Holding other factors constant, there is an **inverse** relationship bw the real IR and investment.
Determining the Level of Aggregate Expenditure in the Economy

Planned Investment

FIGURE 11-4

Real Investment


11.2 LEARNING OBJECTIVE

Discuss the determinants of the four components of aggregate expenditure and define marginal propensity to consume and marginal propensity to save.
Taxes

- Firms focus on the profits that remain after paying taxes.
- A reduction in the corporate income tax on the profits increases the after-tax profitability of investment.
- Investment tax incentives (it provides firms with a tax reduction when they spend on new investment goods) also increase investment spending.

Cash flow

- The difference between the cash revenues received by the firm and the cash spending by the firm.
- Most firms use their own funds to finance investment goods instead of borrowing outside.
- The largest contributor to CF is profit. The more profitable a firm is, the greater its CF and the greater its ability to finance investment.
Government Purchases

FIGURE 11-5

Real Government Purchases

Government purchases grew steadily for most of the 1979–2009 period, with the exception of the early 1990s, when concern about the federal budget deficit caused real government purchases to fall for three years, beginning in 1992.
Net Exports

- **The price level in US relative to the price levels in other countries:** If prices in US increase more slowly than the prices of other countries, the demand for US products increases relative to other countries.

- **The growth rate of GDP in US relative to the growth rates of other countries:** When incomes (GDP) rise faster in US than in other countries, US consumers’ purchases of foreign G&S will increase faster than foreign consumers’ purchases of US G&S.

- **The exchange rate between the dollar and other currencies:** An increase in the value of the US dollar will reduce exports and increase imports.
Determining the Level of Aggregate Expenditure in the Economy

Net Exports

FIGURE 11-6

Real Net Exports

Net exports were negative in most years between 1979 and 2009. Net exports have usually increased when the U.S. economy is in recession and decreased when the U.S. economy is expanding, although they fell during most of the 2001 recession.

11.2 LEARNING OBJECTIVE

Discuss the determinants of the four components of aggregate expenditure and define marginal propensity to consume and marginal propensity to save.
Graphing Macroeconomic Equilibrium

FIGURE 11-7

An Example of a 45°-Line Diagram

The 45° line shows all the points that are equal distances from both axes.

Points such as A and B, at which the quantity produced equals the quantity sold, are on the 45° line.

Points such as C, at which the quantity sold is greater than the quantity produced, lie above the line.

Points such as D, at which the quantity sold is less than the quantity produced, lie below the line.
Graphing Macroeconomic Equilibrium

FIGURE 11-8
The Relationship between Planned Aggregate Expenditure and GDP on a 45°-Line Diagram

Every point of macroeconomic equilibrium is on the 45° line, where planned aggregate expenditure equals GDP.

At points above the line, planned aggregate expenditure is greater than GDP.

At points below the line, planned aggregate expenditure is less than GDP.
Graphing Macroeconomic Equilibrium

**FIGURE 11-9**

Macroeconomic Equilibrium on the 45°-Line Diagram

Macroeconomic equilibrium occurs where the aggregate expenditure (AE) line crosses the 45° line.

The lowest upward-sloping line, C, represents the consumption function.

The quantities of planned investment, government purchases, and net exports are constant because we assumed that the variables they depend on are constant. So, the total of planned aggregate expenditure at any level of GDP is the amount of consumption at that level of GDP plus the sum of the constant amounts of planned investment, government purchases, and net exports.

We successively add each component of spending to the consumption function line to arrive at the line representing aggregate expenditure.

11.3 LEARNING OBJECTIVE

Use a 45°-line diagram to illustrate macroeconomic equilibrium.
Graphing Macroeconomic Equilibrium

**FIGURE 11-10**

**Macroeconomic Equilibrium**

Macroeconomic equilibrium occurs where the $AE$ line crosses the 45° line. In this case, that occurs at GDP of $10$ trillion.

If GDP is less than $10$ trillion, the corresponding point on the $AE$ line is above the 45° line, planned aggregate expenditure is greater than total production, firms will experience an unplanned decrease in inventories, and GDP will increase.

If GDP is greater than $10$ trillion, the corresponding point on the $AE$ line is below the 45° line, planned aggregate expenditure is less than total production, firms will experience an unplanned increase in inventories, and GDP will decrease.
Graphing Macroeconomic Equilibrium

Showing a Recession on the 45°-Line Diagram

11.3 LEARNING OBJECTIVE
Use a 45°-line diagram to illustrate macroeconomic equilibrium.

Learning Objective
23.3 Use a 45°-line diagram to illustrate macroeconomic equilibrium.

When the aggregate expenditure line intersects the 45° line at a level of GDP below potential real GDP, the economy is in recession.

The figure shows that potential real GDP is $10 trillion, but because planned aggregate expenditure is too low, the equilibrium level of GDP is only $9.8 trillion, where the AE line intersects the 45° line. As a result, some firms will be operating below their normal capacity, and unemployment will be above the natural rate of unemployment.

We can measure the shortfall in planned aggregate expenditure as the vertical distance between the AE line and the 45° line at the level of potential real GDP.
The Important Role of Inventories

- Whenever aggregate expenditure is less than real GDP, some firms will experience an *unplanned* increase in inventories.
- If firms don’t cut back on their production promptly, they will accumulate excess inventories. As a result, even if spending quickly returns to its normal levels, firms will have to sell their excess inventories before they can return to producing at normal levels.
- This possibility can explain why a brief decline in AE can result in a fairly long recession. Hence, efficient systems of inventories control help make recessions shorter and less severe.
Graphing Macroeconomic Equilibrium

A Numerical Example of Macroeconomic Equilibrium

Table 11-3

<table>
<thead>
<tr>
<th>REAL GDP (Y)</th>
<th>CONSUMPTION (C)</th>
<th>PLANNED INVESTMENT (I)</th>
<th>GOVERNMENT PURCHASES (G)</th>
<th>NET EXPORTS (NX)</th>
<th>PLANNED AGGREGATE EXPENDITURE (AE)</th>
<th>UNPLANNED CHANGE IN INVENTORIES</th>
<th>REAL GDP WILL ...</th>
</tr>
</thead>
<tbody>
<tr>
<td>$8,000</td>
<td>$6,200</td>
<td>$1,500</td>
<td>$1,500</td>
<td>– $500</td>
<td>$8,700</td>
<td>–$700</td>
<td>increase</td>
</tr>
<tr>
<td>9,000</td>
<td>6,850</td>
<td>1,500</td>
<td>1,500</td>
<td>–500</td>
<td>9,350</td>
<td>–350</td>
<td>increase</td>
</tr>
<tr>
<td>10,000</td>
<td>7,500</td>
<td>1,500</td>
<td>1,500</td>
<td>–500</td>
<td>10,000</td>
<td>0</td>
<td>be in equilibrium</td>
</tr>
<tr>
<td>11,000</td>
<td>8,150</td>
<td>1,500</td>
<td>1,500</td>
<td>–500</td>
<td>10,650</td>
<td>+350</td>
<td>decrease</td>
</tr>
<tr>
<td>12,000</td>
<td>8,800</td>
<td>1,500</td>
<td>1,500</td>
<td>–500</td>
<td>11,300</td>
<td>+700</td>
<td>decrease</td>
</tr>
</tbody>
</table>

Don’t Let This Happen to YOU!

Don’t Confuse Aggregate Expenditure with Consumption Spending

YOUR TURN: Test your understanding by doing related problem 3.10 at the end of this chapter.
Describe the multiplier effect and use the multiplier formula to calculate changes in equilibrium GDP.

The economy begins at point A, at which equilibrium real GDP is $9.6 trillion. A $100 billion increase in planned investment shifts up aggregate expenditure from $AE_1$ to $AE_2$. The new equilibrium is at point B, where real GDP is $10.0 trillion, which is potential real GDP. Because of the multiplier effect, a $100 billion increase in investment results in a $400 billion increase in equilibrium real GDP.
The Multiplier Effect

- **Autonomous expenditure**: Expenditure that does *not* depend on the level of GDP.
  - Planned investment, gov. spending, and net exports are all autonomous expenditures.
  - Note that consumption also includes an autonomous component. E.g., if HHs decide to spend more of their incomes and save less *at every level of income* there will be an autonomous increase in consumption.

- **Multiplier**: The increase *in equilibrium* real GDP divided by the increase in autonomous expenditure.

- **Multiplier effect**: The process by which an increase in autonomous expenditure leads to a *larger increase* in real GDP.
The Multiplier Effect

Table 11-4
The Multiplier Effect in Action

<table>
<thead>
<tr>
<th>ROUND 1</th>
<th>$100 billion</th>
<th>$0</th>
<th>$100 billion</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROUND 2</td>
<td>0</td>
<td>75 billion</td>
<td>175 billion</td>
</tr>
<tr>
<td>ROUND 3</td>
<td>0</td>
<td>56 billion</td>
<td>231 billion</td>
</tr>
<tr>
<td>ROUND 4</td>
<td>0</td>
<td>42 billion</td>
<td>273 billion</td>
</tr>
<tr>
<td>ROUND 5</td>
<td>0</td>
<td>32 billion</td>
<td>305 billion</td>
</tr>
<tr>
<td>ROUND 10</td>
<td>0</td>
<td>8 billion</td>
<td>377 billion</td>
</tr>
<tr>
<td>ROUND 15</td>
<td>0</td>
<td>2 billion</td>
<td>395 billion</td>
</tr>
<tr>
<td>ROUND 19</td>
<td>0</td>
<td>1 billion</td>
<td>398 billion</td>
</tr>
</tbody>
</table>

\[ \text{TOTAL ADDITIONAL EXPENDITURE} = \text{TOTAL ADDITIONAL GDP} \]

\[
\begin{align*}
\text{ROUND 1} & : & \text{ADDITIONAL AUTONOMOUS EXPENDITURE (INVESTMENT)} & = & \text{ADDITIONAL INDUCED EXPENDITURE (CONSUMPTION)} & = & \text{TOTAL ADDITIONAL EXPENDITURE} = \text{TOTAL ADDITIONAL GDP} \\
\text{ROUND 2} & : & 0 & = & 75 billion & = & 175 billion \\
\text{ROUND 3} & : & 0 & = & 56 billion & = & 231 billion \\
\text{ROUND 4} & : & 0 & = & 42 billion & = & 273 billion \\
\text{ROUND 5} & : & 0 & = & 32 billion & = & 305 billion \\
\text{ROUND 10} & : & 0 & = & 8 billion & = & 377 billion \\
\text{ROUND 15} & : & 0 & = & 2 billion & = & 395 billion \\
\text{ROUND 19} & : & 0 & = & 1 billion & = & 398 billion \\
\text{n} & : & 0 & = & 0 & = & $400 billion
\end{align*}
\]

11.4 LEARNING OBJECTIVE
Describe the multiplier effect and use the multiplier formula to calculate changes in equilibrium GDP.
## The Multiplier in Reverse: The Great Depression of the 1930s

### Making the Connection

The multiplier effect contributed to the very high levels of unemployment during the Great Depression.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>CONSUMPTION (billions of dollars)</th>
<th>INVESTMENT (billions of dollars)</th>
<th>NET EXPORTS (billions of dollars)</th>
<th>REAL GDP (billions of dollars)</th>
<th>UNEMPLOYMENT RATE (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1929</td>
<td>$737 billion</td>
<td>$102 billion</td>
<td>-$11 billion</td>
<td>$977 billion</td>
<td>3.2%</td>
</tr>
<tr>
<td>1933</td>
<td>$601 billion</td>
<td>$19 billion</td>
<td>-$12 billion</td>
<td>$716 billion</td>
<td>24.9%</td>
</tr>
</tbody>
</table>

### 11.4 LEARNING OBJECTIVE

Describe the multiplier effect and use the multiplier formula to calculate changes in equilibrium GDP.

**YOUR TURN:** Test your understanding by doing related problem 4.9 at the end of this chapter.
A Formula for the Multiplier

The total change in GDP

\[ \text{The total change in GDP} = 100 + MPC \times 100 + \cdots \]

\[ \Rightarrow \frac{1}{1 - MPC}. \]

Multiplier

\[ \text{Multiplier} = \frac{\text{Change in real GDP}}{\text{Change in autonomous expenditure}} = \frac{1}{1 - MPC}. \]
## Solved Problem 11-4

### Using the Multiplier Formula

Describe the multiplier effect and use the multiplier formula to calculate changes in equilibrium GDP.

<table>
<thead>
<tr>
<th>REAL GDP (Y)</th>
<th>CONSUMPTION (C)</th>
<th>PLANNED INVESTMENT (I)</th>
<th>GOVERNMENT PURCHASES (G)</th>
<th>NET EXPORTS (NX)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$8,000</td>
<td>$6,900</td>
<td>$1,000</td>
<td>$1,000</td>
<td>−$500</td>
</tr>
<tr>
<td>9,000</td>
<td>7,700</td>
<td>1,000</td>
<td>1,000</td>
<td>−500</td>
</tr>
<tr>
<td>10,000</td>
<td>8,500</td>
<td>1,000</td>
<td>1,000</td>
<td>−500</td>
</tr>
<tr>
<td>11,000</td>
<td>9,300</td>
<td>1,000</td>
<td>1,000</td>
<td>−500</td>
</tr>
<tr>
<td>12,000</td>
<td>10,100</td>
<td>1,000</td>
<td>1,000</td>
<td>−500</td>
</tr>
</tbody>
</table>
Solved Problem 11-4

Using the Multiplier Formula (continued)

Describe the multiplier effect and use the multiplier formula to calculate changes in equilibrium GDP.

<table>
<thead>
<tr>
<th>REALGDP (Y)</th>
<th>CONSUMPTION (C)</th>
<th>PLANNED INVESTMENT (I)</th>
<th>GOVERNMENT PURCHASES (G)</th>
<th>NET EXPORTS (NX)</th>
<th>PLANNED AGGREGATE EXPENDITURE (AE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$8,000</td>
<td>$6,900</td>
<td>$1,000</td>
<td>$1,000</td>
<td>$-500</td>
<td>$8,400</td>
</tr>
<tr>
<td>9,000</td>
<td>7,700</td>
<td>1,000</td>
<td>1,000</td>
<td>$-500</td>
<td>9,200</td>
</tr>
<tr>
<td>10,000</td>
<td>8,500</td>
<td>1,000</td>
<td>1,000</td>
<td>$-500</td>
<td>10,000</td>
</tr>
<tr>
<td>11,000</td>
<td>9,300</td>
<td>1,000</td>
<td>1,000</td>
<td>$-500</td>
<td>10,800</td>
</tr>
<tr>
<td>12,000</td>
<td>10,100</td>
<td>1,000</td>
<td>1,000</td>
<td>$-500</td>
<td>11,600</td>
</tr>
</tbody>
</table>

\[ MPC = \frac{\Delta C}{\Delta Y} \]

YOUR TURN: For more practice, do related problem 4.3 at the end of this chapter.
Summarizing the Multiplier Effect

- The multiplier effect occurs both when autonomous expenditure increases and when it decreases.
- The multiplier effect makes the economy more sensitive to changes in autonomous expenditure than it would otherwise be.
- *The larger the MPC, the larger the value of the multiplier.*
- The formula for the multiplier, \( \frac{1}{1-MPC} \), is oversimplified because it ignores some real world complications, such as the effect that an increasing GDP can have on imports, inflation, and interest rates.
The Aggregate Demand Curve

- When demand for a product increases, firms will usually respond by *increasing production*, but they are also likely to increase *prices*. So far, we have fixed the price level (PL).
- In fact, as we will see, increases (decreases) in the PL will cause AE decrease (rise). There are 3 reasons for this *inverse* relationship between changes in the PL and changes in AE.
1. A rising PL decreases consumption by decreasing the real value of household wealth.
2. If the PL in US rises relative to the PLs in other countries, US exports will become relatively more expensive and foreign imports will become relatively less expensive, causing net exports to fall.
3. When prices rise, firms and HHs need more money to finance buying and selling. If the central bank doesn’t increase money supply, the result will increase the IR and then reduce investment as firms and HHs borrow less to build new factories, etc., and new houses, respectively.

Aggregate demand curve (AD) A curve showing 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.
The Aggregate Demand Curve

Understand the relationship between the aggregate demand curve and aggregate expenditure.

**FIGURE 11-13**

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

In panel (a), an increase in the price level results in declining consumption, planned investment, and net exports and causes the aggregate expenditure line to shift down from $AE_1$ to $AE_2$. As a result, equilibrium real GDP declines from $10.0$ trillion to $9.8$ trillion.

In panel (b), a decrease in the price level results in rising consumption, planned investment, and net exports and causes the aggregate expenditure line to shift up from $AE_1$ to $AE_2$. As a result, equilibrium real GDP increases from $10.0$ trillion to $10.2$ trillion.
The Aggregate Demand Curve

**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.

**FIGURE 11-14**

The aggregate demand curve, labeled $AD$, shows the relationship between the price level and the level of real GDP in the economy.

When the price level is 97, real GDP is $10.2$ trillion.

An increase in the price level to 100 causes consumption, investment, and net exports to fall, which reduces real GDP to $10.0$ trillion.

<table>
<thead>
<tr>
<th>Price level</th>
<th>Equilibrium real GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>97</td>
<td>$10.2$ trillion</td>
</tr>
<tr>
<td>100</td>
<td>$10.0$ trillion</td>
</tr>
<tr>
<td>103</td>
<td>$9.8$ trillion</td>
</tr>
</tbody>
</table>
Key Terms in Chapter 11

- Aggregate expenditure (AE); aggregate expenditure model
- Consumption function
- Marginal propensity to consume (MPC); marginal propensity to save (MPS)
- Inventories; cash flow
- Autonomous expenditure
- Multiplier; multiplier effect