1.3 Economic Models

Explain how economists use models to analyze economic events and government policies.

Economists develop economic models to analyze real-world issues.

Building an economic model often follows these steps:

1. Decide on the assumptions to use.
2. Formulate a testable hypothesis.
3. Use economic data to test the hypothesis.
4. Revise the model if it fails to explain the economic data well.
5. Retain the revised model to help answer similar economic questions in the future.

The Role of Assumptions in Economic Models

All models need assumptions and simplifications in order to be useful.

Economic models make **behavioral assumptions** about the motives of consumers and firms:

- Consumers will buy goods and services to maximize their well-being.
- Firms act to maximize their profits.

These assumptions may or may nor be correct; we can form hypotheses based on these assumptions, and test whether or not they are true.

Forming Hypotheses in Economic Models

In an economic model, a hypothesis is a statement about an economic variable that may be either correct or incorrect.

Economic variables: something measurable that can have different values, such as the number of people employed in manufacturing.

- **Ex: The increased use of industrial robots and information technology in U.S. factories has resulted in a decline in manufacturing employment.**

Most economic hypotheses are about **causal relationships.**

Testing Hypotheses in Economic Models

After collecting the relevant data, economists use statistical methods to evaluate the hypotheses.

It is often difficult to establish whether an effect is **causal**.

- **Ex: Employment in manufacturing did decline at the same time that the use of robots increased, but that doesn't prove one caused the other.**

Economists accept and use an economic model if it leads to hypotheses that are confirmed (or **not rejected**) by statistical analysis.

- New information may reject previously-believed hypotheses.

Positive and Normative Analysis

Economists try to mimic natural scientists by using the scientific method. But economics is a social science; studying the behavior of people is often tricky.

When analyzing human behavior, we can perform:

- **Positive analysis**: analysis concerned with what is.
- **Normative analysis**: analysis concerned with what ought to be.

Economists mostly perform positive analysis.

Economics as a Social Science

Social sciences study the actions of individuals; economics is a social science, like psychology, political science, and sociology.

Compared with other social sciences, economics puts more emphasis on how individuals' actions and decisions affect outcomes like prices, and how changes in conditions and policies affect those outcomes.

Economics considers the actions of individuals in every context, not just business.

Government policymakers have increasingly relied on economic analysis.

Apply the Concept: What Can Economics Contribute to the Debate over Tariffs?

Governments can impose tariffs (taxes on imports) to raise revenue or discourage imports.

Economic theory can identify the likely winners and losers from a particular tariff.

Economic analysis can use models and data to estimate the dollar amounts gained by the winners and lost by the losers.

- Typically, the losses outweigh the gains, so economists generally discourage tariffs.
- But policymakers may place higher value on the well-being of some groups—a normative judgment.

1.4 Microeconomics and Macroeconomics

Distinguish between microeconomics and macroeconomics.

Microeconomics is the study of

- how households and firms make choices,
- how they interact in markets, and
- how the government attempts to influence their choices.

Macroeconomics is the study of the economy as a whole, including topics such as inflation, unemployment, and economic growth.

Table 1.1 Issues in Microeconomics and Macroeconomics

Examples of Microeconomic Issues	Examples of Macroeconomic Issues
• How consumers react to changes in product prices • How firms decide what prices to charge for the products they sell • Which government policy would most efficiently reduce opioid addiction • The costs and benefits of the federal government's approving the sale of a new prescription drug • The most efficient way to reduce air pollution	• Why economies experience periods of recession and increasing unemployment • Why, over the long run, some economies have grown much faster than others • What determines the inflation rate • What determines the value of the U.S. dollar in exchange for other currencies • Whether government intervention can reduce the severity of recessions

1.5 Economic Skills and Economics as a Career

Describe economics as a career and the key skills you can gain from studying economics.

When buying a house, a home inspector can **describe** problems the house has, and **advise** how to fix the problems, and the likely cost.

Similarly, an economist can **describe** how individuals, businesses, and governments make choices, and what the consequences of those choices would be; and **advise** on how better decisions can be made.

Table 1.2 Applying Economics in a Career (1 of 2)

Company or Organization	What an Economist at the Company Might Do
Ford Motor Company	Forecast the demand for electric cars over the next 10 years.
Goldman Sachs, a Wall Street investment firm	Use economic models to forecast future values of interest rates.
McDonald's	Determine whether the firm should open additional restaurants in China.
Pfizer, a pharmaceutical company	Analyze the financial cost and benefits of a new treatment for cancer.
Wall Street Journal	Report on the Federal Reserve and interpret monetary policy for the paper's readers.

Table 1.2 Applying Economics in a Career (2 of 2)

Company or Organization	What an Economist at the Company Might Do
A college or university	Teach economics and do research on economic issues.
A regional Federal Reserve Bank	Forecast trends in employment and production in that region.
U.S. Federal Trade Commission	Gather and analyze data on whether two firms should be allowed to reduce competition in a market by merging to form a combined firm, as when A T&T proposed merging with Time Warner in 2018.
The World Bank, an international economic organization with the mission of reducing poverty and increasing economic growth	Write a report analyzing the effectiveness of a development program in a low-income country.

1.6 A Preview of Important Economic Terms

Define important economic terms.

Like all fields of study, economics uses terms or jargon with specific, precise meanings.

Sometimes these terms will be used in ways that differ even from closely related disciplines.

Examples:

- **Technology**: the processes a firm uses to produce goods and services
- **Capital**: manufactured goods that are used to produce other goods and services

Pay close attention to terms defined in class and in the textbook!

Appendix: Using Graphs and Formulas

Use graphs and formulas to analyze economic situations.

A map is a simplified model of reality, showing essential details only.

Economic models, with features like graphs and formulas, can help us understand economic situations just like a map helps us to understand the geographic layout of a city.

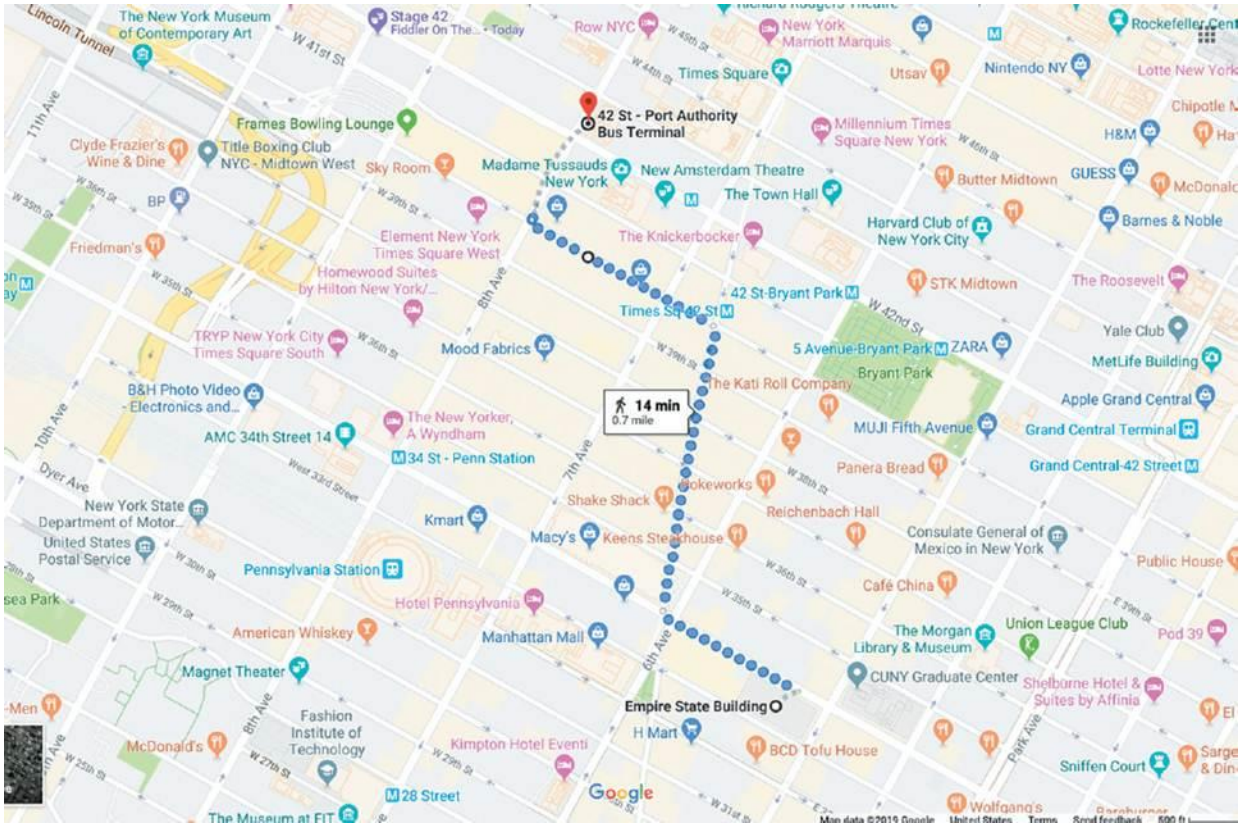
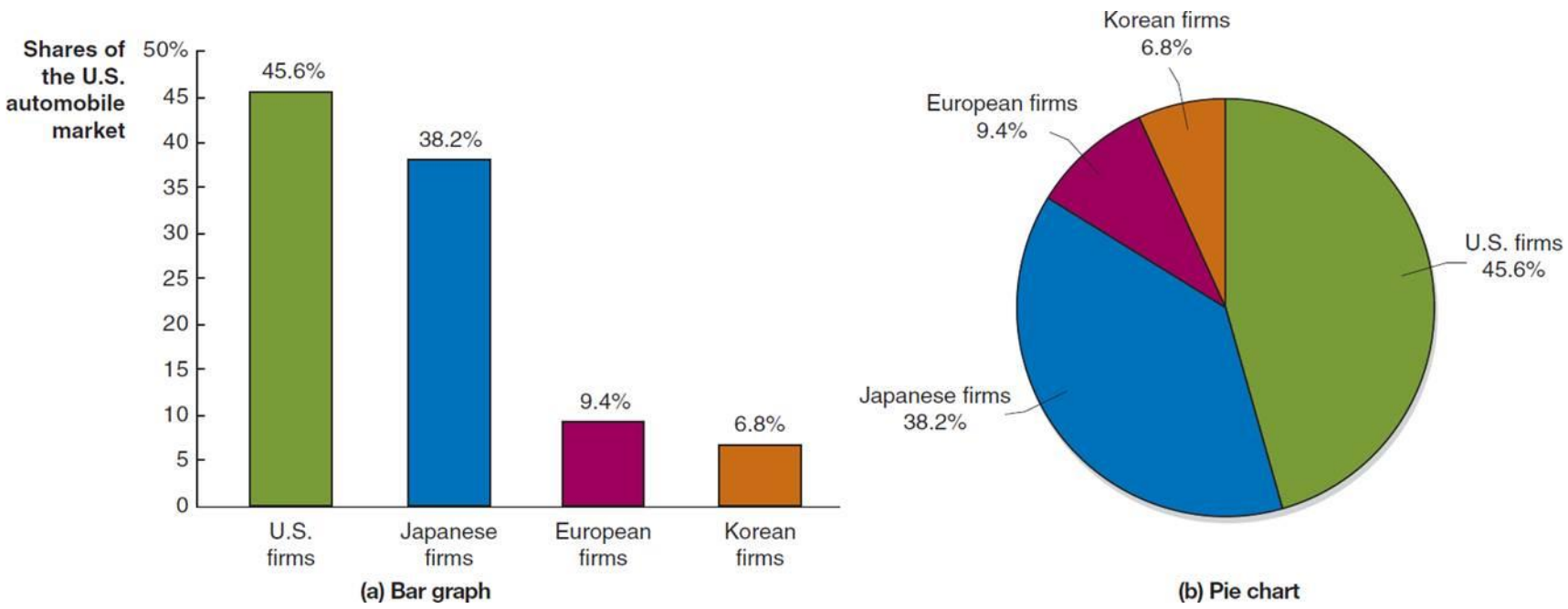


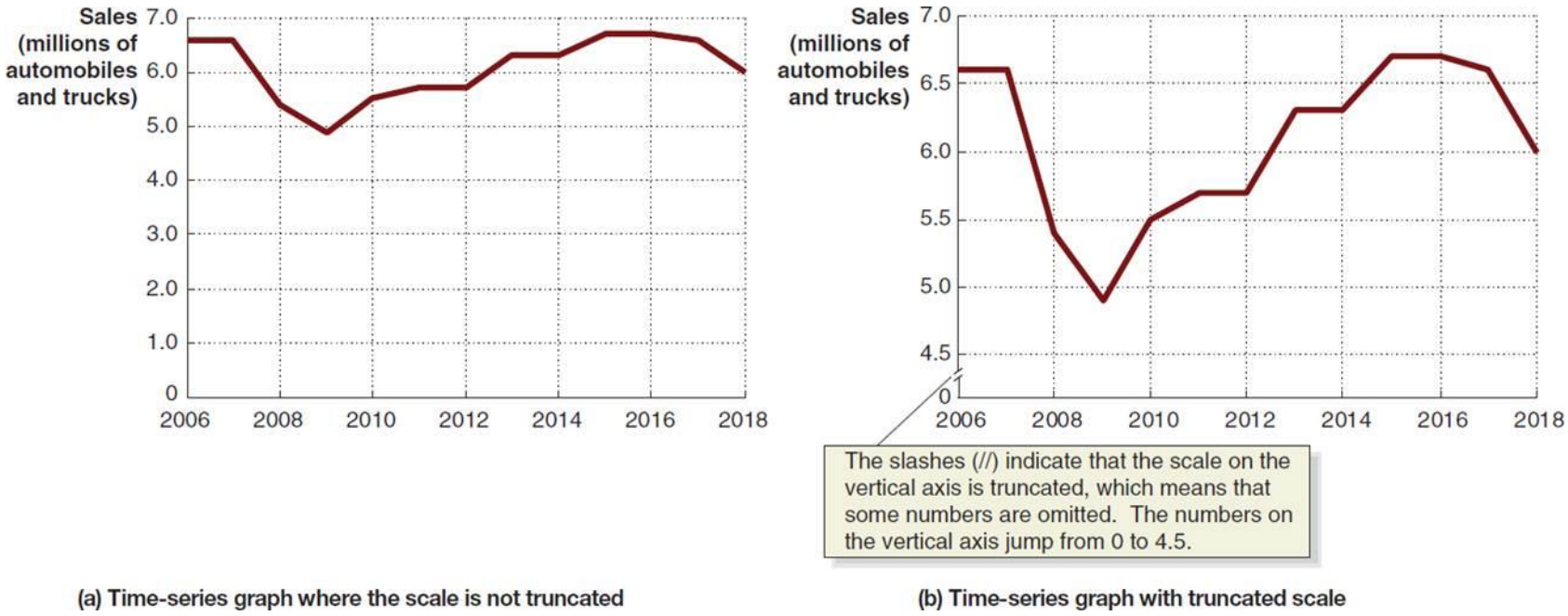
Figure 1A.1 Bar Graphs and Pie Charts



The left panel shows a bar graph of market share data for the U.S. automobile industry; market share is represented by the height of the bar.

The right panel shows a pie chart of the same data; market share is represented by the size of the “slice of the pie”.

Figure 1A.2 Time-Series Graphs



(a) Time-series graph where the scale is not truncated

(b) Time-series graph with truncated scale

Both panels present time-series graphs of Ford Motor Company's worldwide sales during each year from 2006 to 2018.

- The right panel has a truncated scale on the vertical axis, while the left panel does not.
- As a result, the fluctuations in Ford's sales appear smaller in the left panel than the right one.

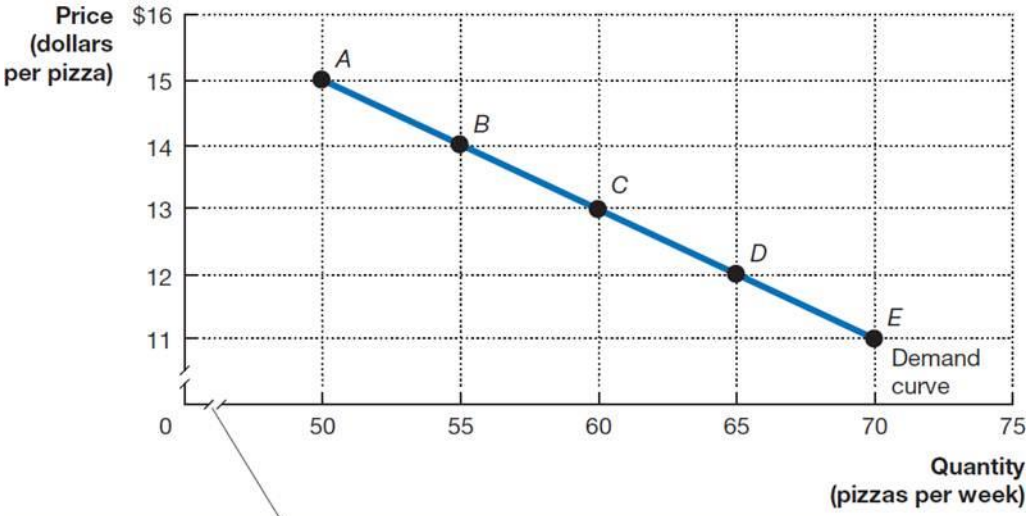
Figure 1A.3 Plotting Price and Quantity Points in a Graph

The figure shows a two-dimensional grid on which we measure the price of pizza along the vertical axis (or *y*-axis) and the quantity of pizza sold per week along the horizontal axis (or *x*-axis).

Each point on the grid represents one of the price and quantity combinations listed in the table.

By connecting the points with a line, we can better illustrate the relationship between the two variables.

Price (dollars per pizza)	Quantity (pizzas per week)	Point
$15	50	*A*
14	55	*B*
13	60	*C*
12	65	*D*
11	70	*E*

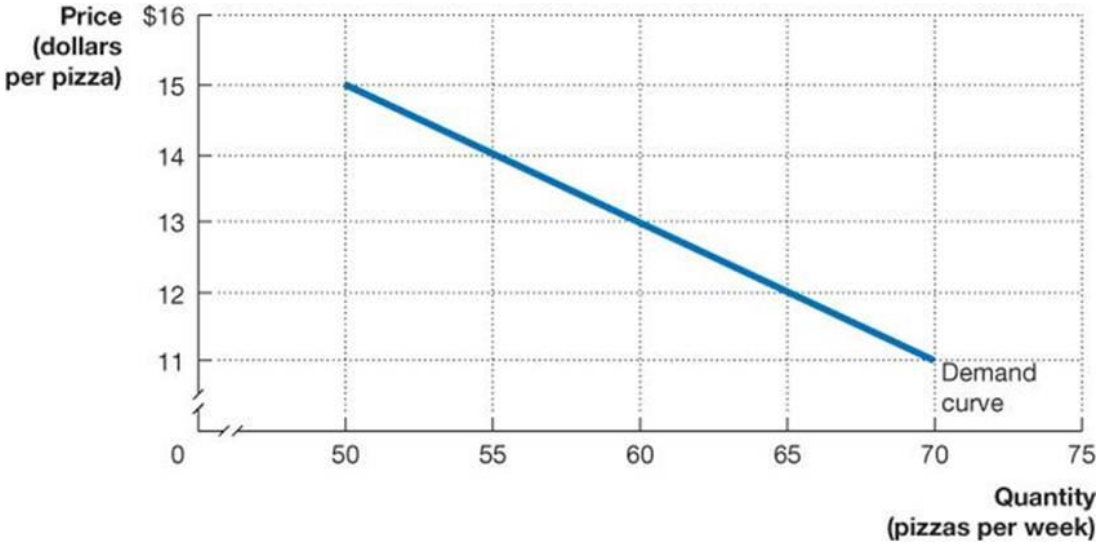


As you learned in Figure 1A.2, the slashes (//) indicate that the scales on the axes are truncated, which means that numbers are omitted: On the horizontal axis numbers jump from 0 to 50, and on the vertical axis numbers jump from 0 to 11.

Figure 1A.4 Calculating the Slope of a Line (1 of 2)

We can calculate the slope of a line as the change in the value of the variable on the *y*-axis divided by the change in the value of the variable on the *x*-axis.

Because the slope of a straight line is constant, we can use any two points in the figure to calculate the slope of the line.

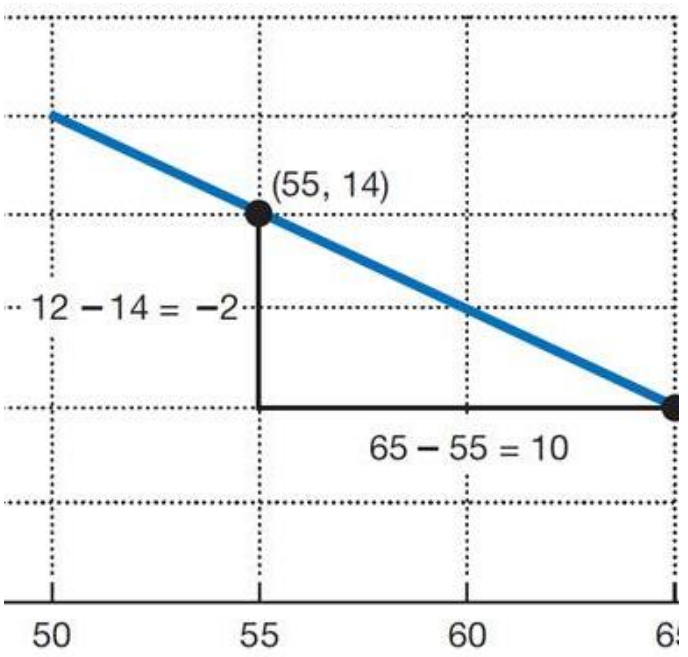


$$\text{Slope} = \frac{\text{Change in value on the vertical axis}}{\text{Change in value on the horizontal axis}} = \frac{\Delta y}{\Delta x} = \frac{\text{Rise}}{\text{Run}}$$

Figure 1A.4 Calculating the Slope of a Line (2 of 2)

For example, when the price of pizza decreases from $\$14$ to $\$12$, the quantity of pizza demanded increases from 55 per week to 65 per week.

So, the slope of this line equals -2 divided by 10, or -0.2.



$$\text{Slope} = \frac{\text{Change in value on the vertical axis}}{\text{Change in value on the horizontal axis}} = \frac{\Delta y}{\Delta x} = \frac{\text{Rise}}{\text{Run}}$$

$$\text{Slope} = \frac{\Delta\text{Price of pizza}}{\Delta\text{Quantity of pizza}} = \frac{(\$12 - \$14)}{(65 - 55)} = \frac{-2}{10} = -0.2$$

Figure 1A.5 Showing Three Variables on a Graph (1 of 3)

The demand curve for pizza shows the relationship between the price of pizzas and the quantity of pizzas demanded, holding constant other factors that might affect the willingness of consumers to buy pizza.

Quantity (pizzas per week)	
Price (dollars per pizza)	When the Price of Hamburgers = $1.50
$15	50
14	55
13	60
12	65
11	70

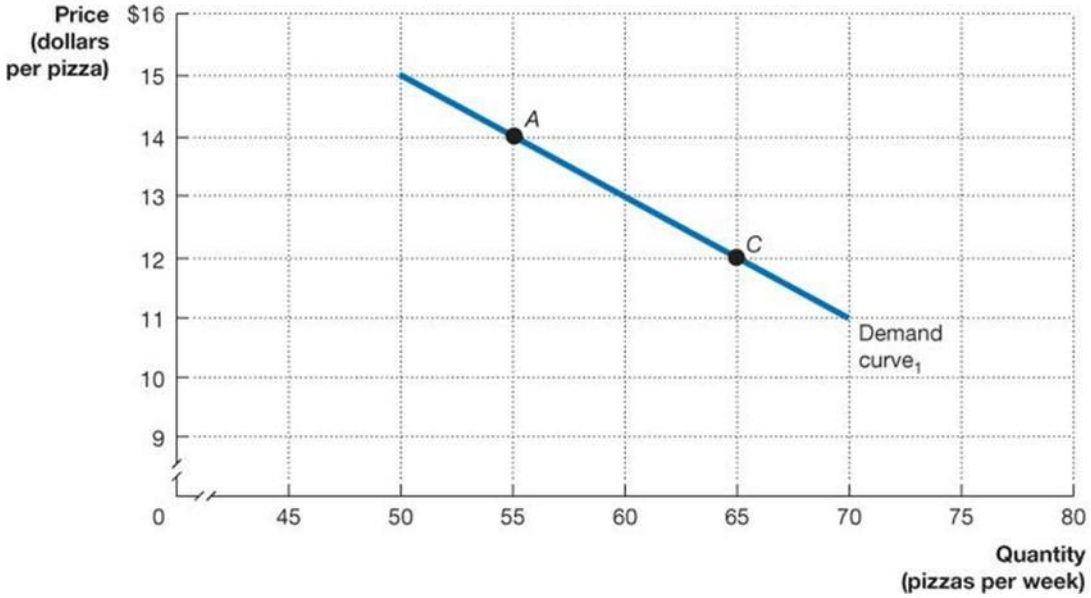


Figure 1A.5 Showing Three Variables on a Graph (2 of 3)

If the price of pizza is $14 (point A), an increase in the price of hamburgers from $1.50 to $2.00 increases the quantity of pizzas demanded from 55 to 60 per week (point B) and shifts us to Demand curve$_2$.

Price (dollars per pizza)	Quantity (pizzas per week) When the Price of Hamburgers = $1.50	When the Price of Hamburgers = $2.00
$15	50	55
14	55	60
13	60	65
12	65	70
11	70	75

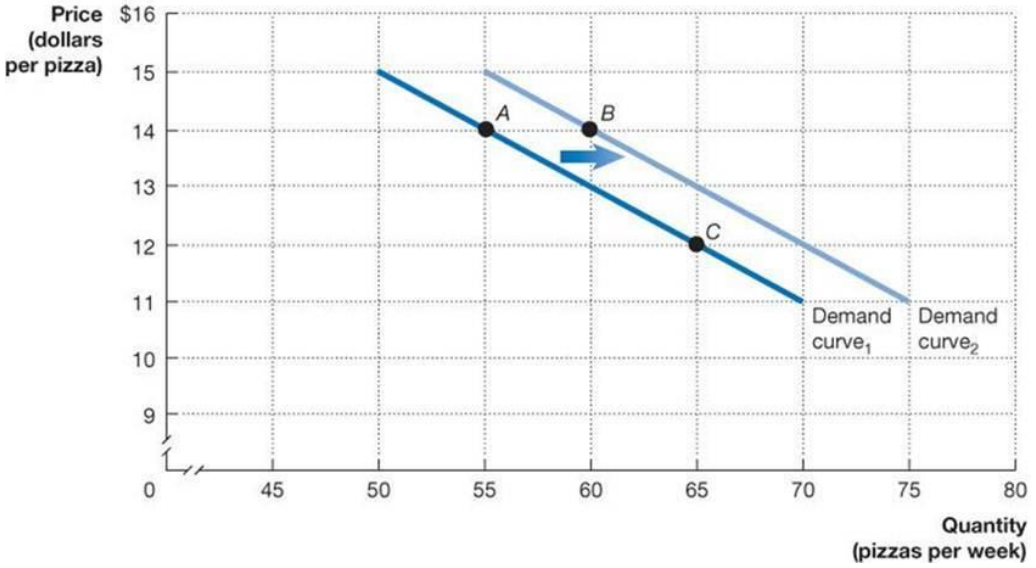


Figure 1A.5 Showing Three Variables on a Graph (3 of 3)

Or, if we start on Demand Curve$_1$ and the price of pizza is $12 (point C), a decrease in the price of hamburgers from $1.50 to $1.00 decreases the quantity of pizza demanded from 65 to 60 per week (point D) and shifts us to Demand Curve$_3$

	Quantity (pizzas per week)		
Price (dollars per pizza)	When the Price of Hamburgers = $1.00	When the Price of Hamburgers = $1.50	When the Price of Hamburgers = $2.00
$15	45	50	55
14	50	55	60
13	55	60	65
12	60	65	70
11	65	70	75

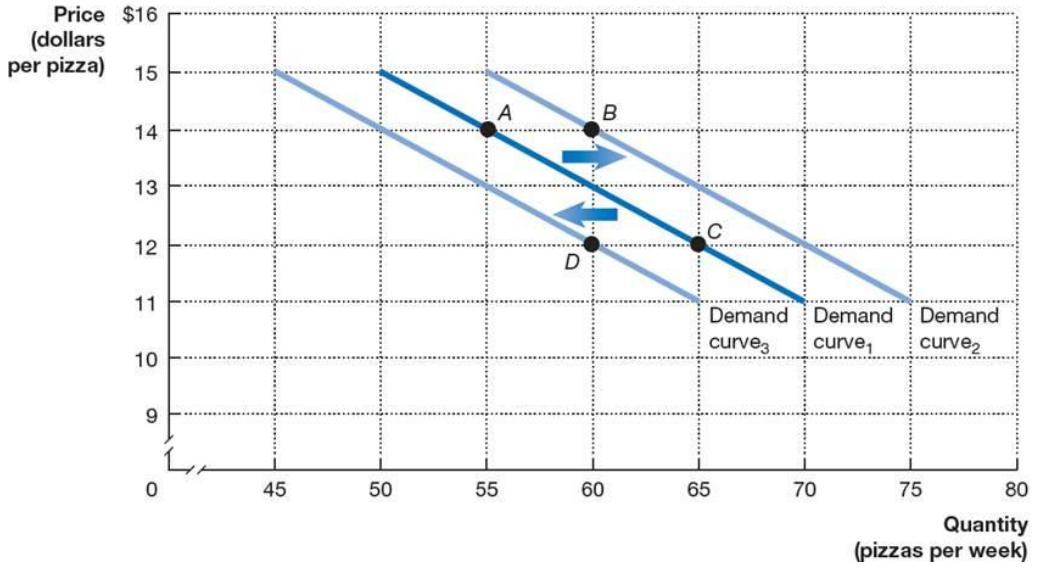


Figure 1A.6 Graphing the Positive Relationship between Income and Consumption

In a positive relationship between two economic variables, as one variable increases, the other variable also increases.

In a negative relationship, as one variable increases, the other decreases.

This figure shows the positive relationship between disposable personal income and consumption spending.

Year	Disposable Personal Income (billions of dollars)	Consumption Spending (billions of dollars)
2015	$13,784	$12,295
2016	14,171	12,767
2017	14,796	13,321
2018	15,532	13,949

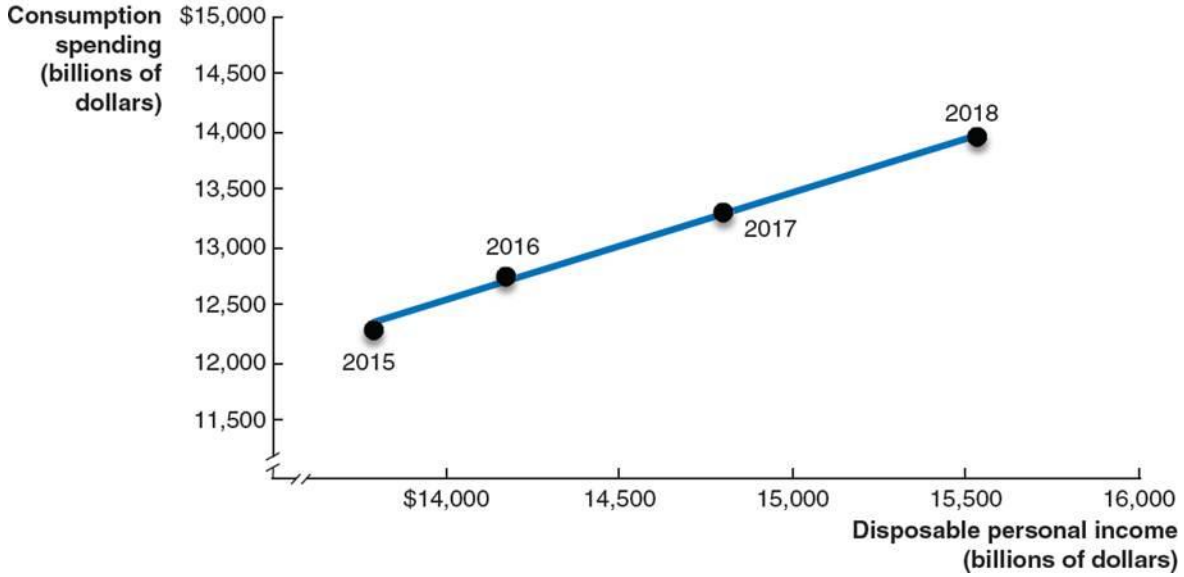
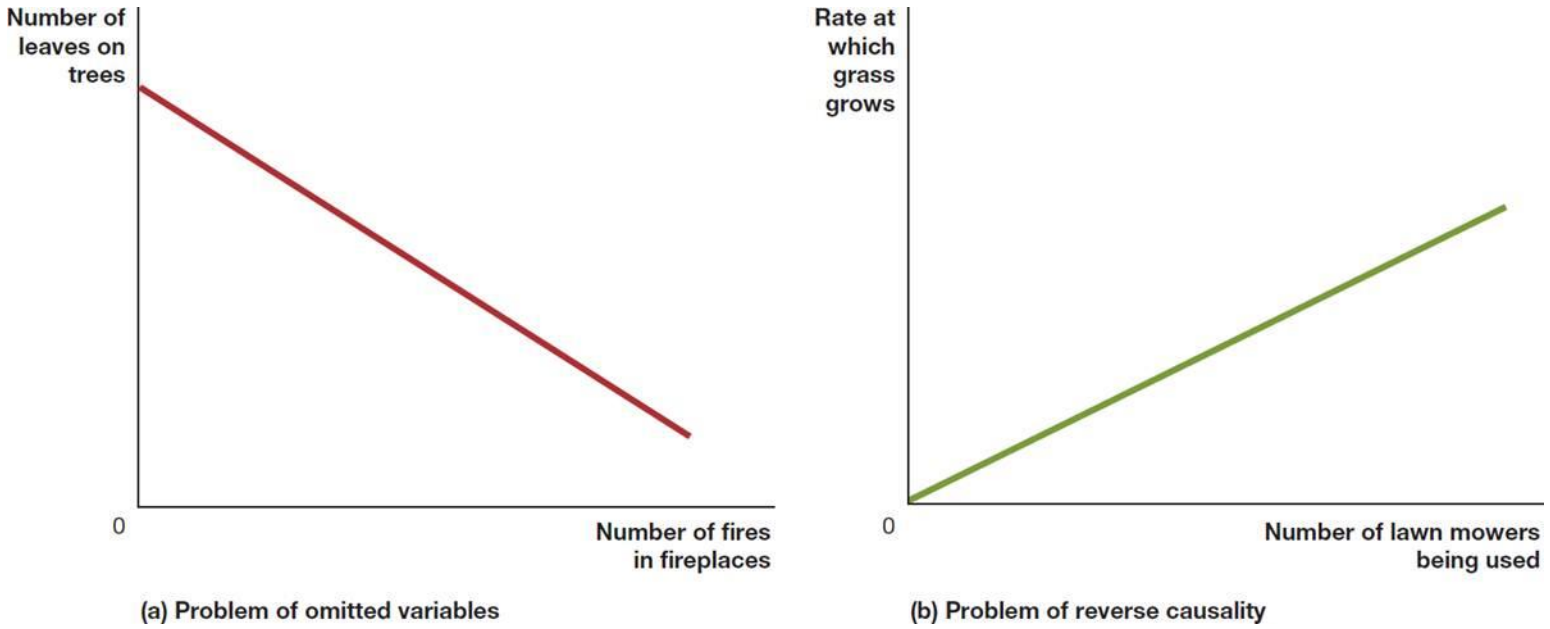


Figure 1A.7 Determining Cause and Effect



Using graphs to draw conclusions about cause and effect is hazardous.

For example, in panel (a), as the number of fires in fireplaces increases, the number of leaves on trees falls; but the fires don't cause the leaves to fall.

In panel (b), as the number of lawn mowers being used increases, so does the rate at which grass grows.

Are Graphs of Economic Relationships Always Straight Lines?

The relationship between two variables is linear when it can be represented by a straight line.

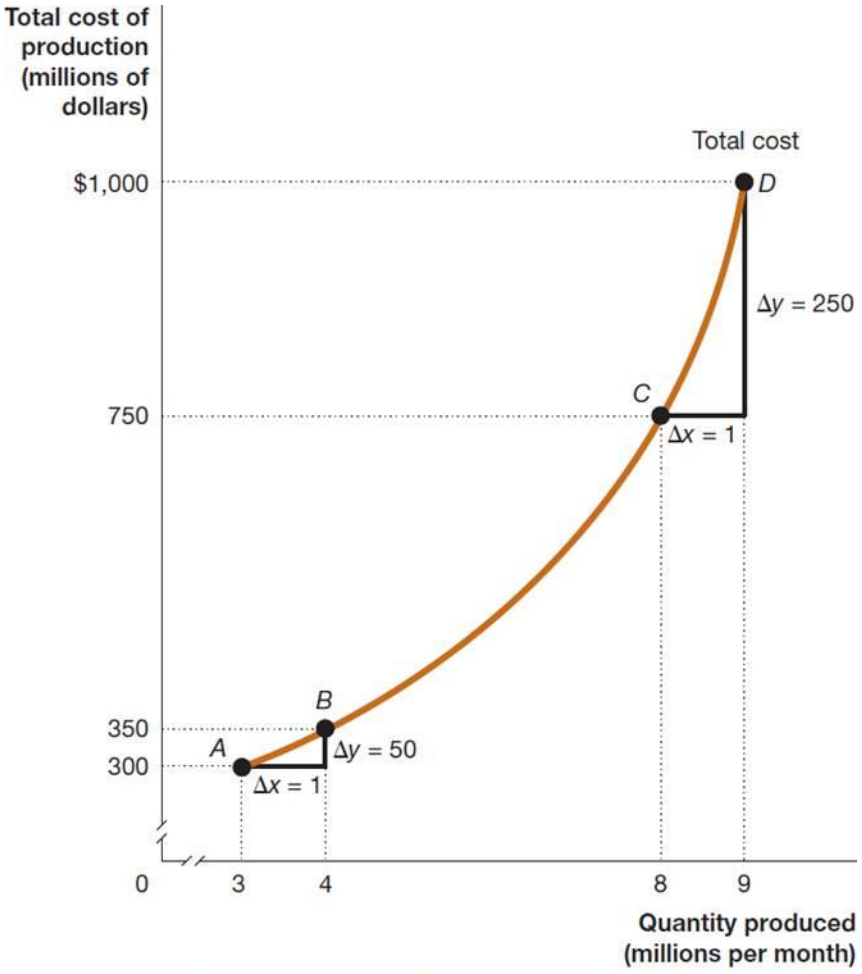
Few economic relationships are actually linear. However linear approximations are simpler to use and are often “good enough” in modeling.

Figure 1A.8 The Slope of a Nonlinear Curve (Panel (a))

A non-linear curve has different slopes at different points. This curve shows the total cost of production for various quantities of Apple iPhones.

We can approximate its slope over a section by measuring the slope as if that section were linear.

Between C and D, the slope is greater than between A and B; so we say the curve is steeper between C and D than between A and B.



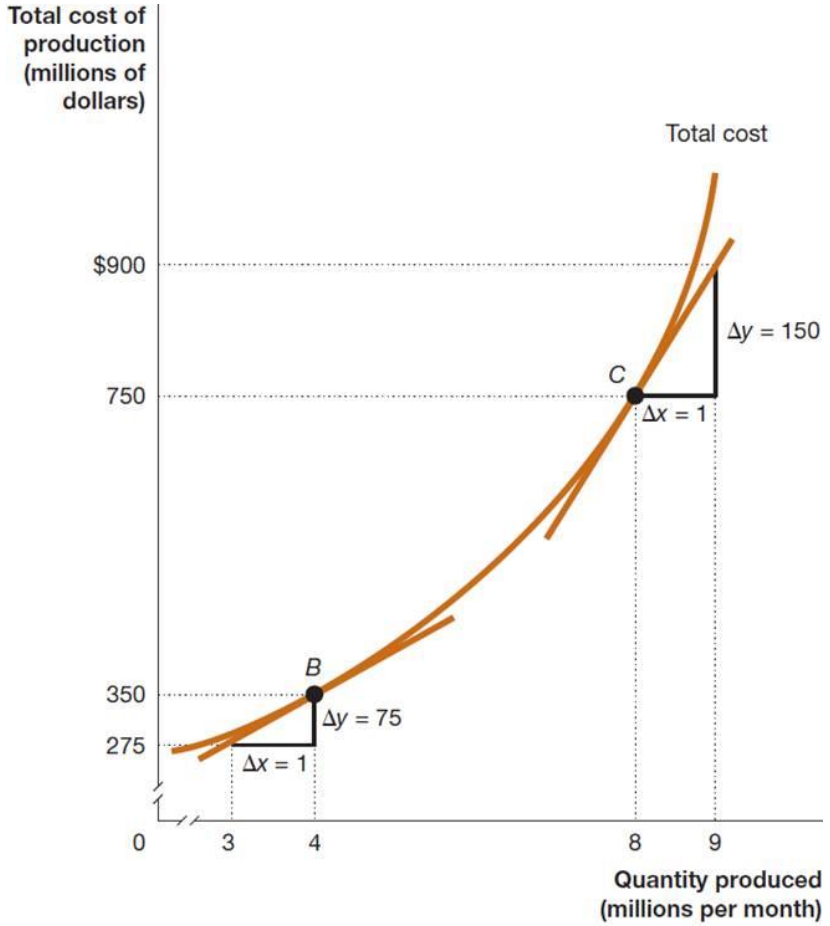
(a) The slope of a nonlinear curve is not constant

Figure 1A.8 The Slope of a Nonlinear Curve (Panel (b))

Another way to measure the slope of a non-linear curve is to measure the slope of a tangent line to the curve, at the point we want to know the slope.

$$\frac{\Delta \text{Cost}}{\Delta \text{Quantity}} = \frac{75}{1} = 75$$

$$\frac{\Delta \text{Cost}}{\Delta \text{Quantity}} = \frac{150}{1} = 150$$



(b) The slope of a nonlinear curve is measured by the slope of the tangent line

Formula for a Percentage Change

One important formula is the **percentage change**, which is the change in some economic variable, usually from one period to the next, expressed as a percentage.

U.S. real GDP increased from $\$18,051$ billion in 2017 to $\$18,566$ billion in 2018. This was a 2.9% increase.

$$\text{Percentage change} = \left(\frac{\text{Value in the second period} - \text{Value in the first period}}{\text{Value in the first period}} \right) * 100\%$$

$$\left(\frac{\$18,566 \text{ billion} - \$18,051 \text{ billion}}{\$18,051 \text{ billion}} \right) * 100\% = 2.9\%$$

Figure 1A.9 Showing a Firm's Total Revenue on a Graph

The area of a rectangle is equal to its base multiplied by its height; total revenue is equal to quantity multiplied by price.

Here, total revenue is equal to

the quantity of 125,000 bottles

times the price of $\$2.00$

per bottle, or $\$250,000$.

The area of the green-shaded rectangle shows the firm's total revenue.

$$\text{Area of a rectangle} = \text{Base} \times \text{Height}.$$

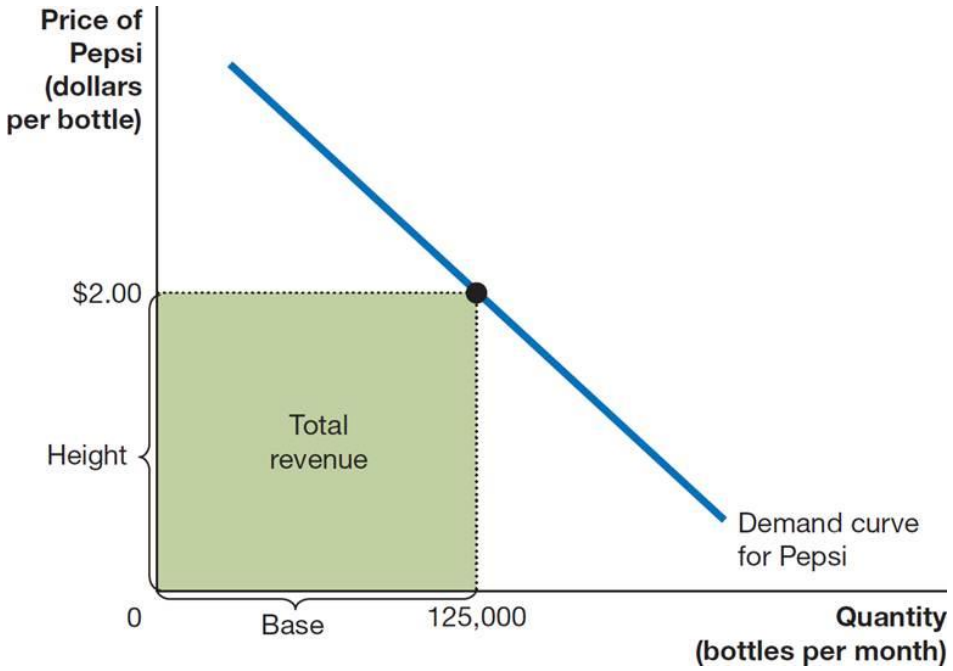


Figure 1A.10 The Area of a Triangle

The area of a triangle is equal to

$\frac{1}{2}$ multiplied by its base

multiplied by its height.

The area of the blue-shaded triangle has a base equal to

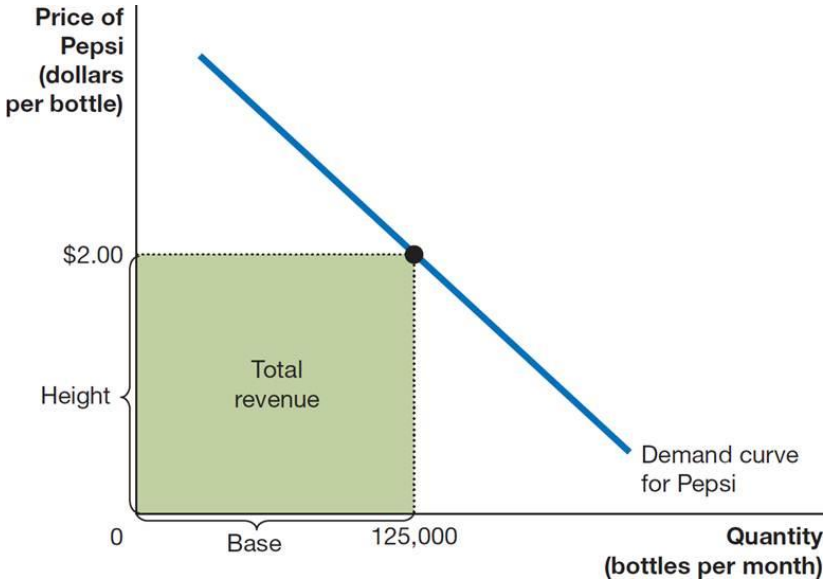
$150,000 - 125,000$, or $25,000$,

and a height equal to

$\$2.00 - \$1.50$, or $\$0.50$.

Therefore, its area equals

$\frac{1}{2} \times 25,000 \times \$0.50$, or $\$6,250$



Summary of Using Formulas

Whenever you must use a formula, you should follow these steps:

1. Make sure you understand the economic concept the formula represents.
2. Make sure you are using the correct formula for the problem you are solving.
3. Make sure the number you calculate using the formula is economically reasonable. For example, if you are using a formula to calculate a firm's revenue and your answer is a negative number, you know you made a mistake somewhere.