

# AP<sup>®</sup> Economics

2006–2007

Professional Development  
Workshop Materials

**Special Focus:**  
**Mastering Economic**  
**Thinking Skills**

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## **Special Focus: Mastering Economic Thinking Skills**

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**Important Note:** The following set of materials is organized around a particular theme, or “special focus,” that reflects important topics in the AP Economics course. The materials are intended to provide teachers with resources and classroom ideas relating to these topics. The special focus, as well as the specific content of the materials, cannot and should not be taken as an indication that a particular topic will appear on the AP Exam.



### Introduction

Peggy Pride  
St. Louis University High School  
St. Louis, Missouri

As editor of the project that produced the lessons contained in this package, I was charged with the task of deciding which topics in microeconomics and macroeconomics to assign to my very capable writers. From my years of experience on the AP Economics Development Committee, I knew that a few topics in each area were new and perplexing to both students and teachers. From my years of experience as an AP Economics teacher, I also knew that some topics needed either a fresh look or more coverage.

The lessons included here are filled with ideas and activities to help develop the economic thinking skills of your students. A strong economics curriculum will include activities that help students see the connections between the concepts and feel comfortable with topics that are both easy and complex.

- The essays introducing the micro- and macroeconomics lessons provide key background information on the placement of the lesson topics in the curriculum and their importance to the course as a whole.
- The lesson plan on marginal thinking weaves the topic of marginal thinking into many aspects of your microeconomics course. It focuses on the role of marginalism in decision making for consumers, firms, and governments. Soon students will be chanting the mantra: MB, MU, MP, MC, MR, MRP, MRC, MSC, and MSB!
- The lesson plan on game theory, a relatively new topic for the microeconomics curriculum, will challenge students to think in new ways about how firms make decisions. Further, this lesson will help them to see decision making in their own lives in an altered way.
- The lesson plan on the Phillips curve, another challenging topic, provides a focused, specific set of materials to help you teach the topic in a clear, understandable way. Placing this lesson after the development of the AS/AD model will aid student understanding related to changes in AD and AS and how these changes affect the level of output, employment, and the price level.
- The lesson plan on foreign exchange will assist you in clearly showing that the foreign exchange market is a two-sided demand/supply concept. When one nation demands another's currency, the other nation must be willing to supply its own currency to trade. Sounds easy, but it is a complex idea to master.

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The authors of these lessons are expert economic educators representing both secondary schools and universities. They were selected for their in-depth knowledge and skillful methods of presentation. I am proud to share their excellent lessons and essays, and I thank these authors for their high-quality work. All of the authors have created multiple-choice and free-response questions different from those that have appeared on past AP Exams. These questions will challenge your students and help in their preparation for the AP Exams. You will be well served if you adopt these materials for use in your class.

The AP Economics Development Committee is ever vigilant in surveying representative colleges and updating the AP curriculum, when needed, with the most current topics and treatments taught at the university level. Committee members provide challenging yet pertinent questions each year that assess the skill levels of our students. I am hopeful that these lessons can bestow on both you and your students a renewed sense that economics is fun and worthwhile as a subject of study and enjoyment.

### Focusing on Marginal Thinking and Game Theory in Microeconomics

Eric Dodge  
Hanover College  
Hanover, Indiana

The study, practice, and teaching of microeconomics has been fairly straightforward for many years. When teaching the subject at its most basic level, we attempt to explain how individual decision makers allocate scarce resources in the most efficient possible manner. The theoretical technique used to explain the decision-making process, marginal analysis, has been a part of the AP curriculum since the beginning, but it never hurts to reemphasize such a critical tool in any economist's toolbox. This year, Dr. Pamela Schmitt of the United States Naval Academy has produced lesson plans and activities that stress the role that “marginal thinking” plays in economics. If your students can see how so many microeconomic decisions are made at the margin, success on the AP Exam will surely follow.

While most microeconomic models, and the tool of marginal analysis, have been with us for a while, the study of game theory is relatively new to the AP curriculum. Dr. Margaret Ray of the University of Mary Washington tackles this growing field of economics so that you can prepare your students for topic areas that are likely to see increased coverage on future AP Microeconomics Exams.

#### Marginal Thinking

Marginal thinking, or marginal analysis, has been a part of economics since the mid-1800s with the writings of British economist William Stanley Jevons.<sup>1</sup> Though certainly not the first to discuss utility or value, Jevons greatly advanced the study of utility theory, including a more formal development of the concept of marginal utility.<sup>2</sup> A more thorough distinction between total and marginal utility essentially explained Adam Smith's water-diamond paradox and led to a description of the equimarginal principle that is still taught today as the consumer's equilibrium. Though his writings were not

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<sup>1</sup> For more reading, see *A History of Economic Theory and Method*, 4th ed., by Robert B. Ekelund Jr. and Robert F. Hébert.

<sup>2</sup> Carl Menger, an Austrian economist working independently of Jevons, also pushed the frontiers of utility theory in the mid- to late-nineteenth century.

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widely read by his contemporaries, his work on marginal utility and value are the motivation for our current theory of demand.

So marginal thinking has been around for 150 years, and it has been a part of the AP curriculum since the beginning. Why spend time in the pages that follow, rehashing concepts that, for most economists, seem almost to be no-brainers? The reason is that mastery of marginal thinking is perhaps the single most effective way to prepare your students for the AP Exam and for the college curriculum.

Most college and university principles of economics courses teach the intuitive appeal of marginal thinking by stressing the idea that rational decision makers will not engage in the next unit of an activity if the additional costs outweigh the additional benefits. Working backward from what a rational person would not do, one can convince students that a person's best decision is to stop at the point where the marginal costs are exactly equal to the marginal benefits of the next unit. This intuition is then converted into a graphical device that illustrates both diminishing marginal benefit (or utility) and increasing marginal cost. The principles courses, like the AP course, use and reuse this intuitive/graphical technique in the production/cost framework, in coverage of resource markets, and often in the presentation of market failure and externalities. At the intermediate microeconomics theory level, this same intuition is typically reinforced with calculus and new graphical techniques, such as indifference curves and production isoquants. Beyond the intermediate level, colleges and universities offer economic elective courses in a variety of specialized fields (labor, environment, international trade, just to name a few), but the technique of marginal thinking runs throughout these very different areas of study. It is safe to say that if students are not well grounded in marginal thinking at the principles level, they will struggle mightily in future economics courses.

### Game Theory

An emerging area of microeconomics, game theory, has enjoyed growing popularity as a way to model cooperative and competitive behavior between oligopolies, and as a result game theory has gradually been added to the AP Microeconomics curriculum.

Early oligopoly theory was pioneered by Antoine-Augustin Cournot (1838) when he added one seller to his monopoly model. The Cournot duopoly laid the foundation for much of the work on imperfect competition that we continue to teach as game theory. A century later, mathematician John von Neumann and economist Oskar Morgenstern developed the formal theory of games, and since then both the theoretical and practical aspects of game theory have continued to be the focus of many economists. The 2005



Nobel Prize in Economic Sciences was awarded to Robert J. Aumann and Thomas C. Schelling for their work in game theory.<sup>3</sup> Modern advancements in game theory, including those of Aumann and Schelling, have been used to improve labor negotiations, mediate conflicts between nations, and model pricing and advertising strategies of competing firms.

In today's college principles classroom, like in the AP curriculum, game theory is typically limited to presentation of the prisoners' dilemma, which is both intuitively appealing and doable for students with limited mathematical backgrounds. With the prisoners' dilemma, we can teach dominant strategies and the pure Nash equilibrium, but the constraints of the calendar and the mathematical nature of game theory require that more advanced models be reserved for the intermediate microeconomics class or upper-level electives. One area of economics in which college students receive extensive coverage of game theory is industrial economics, or industrial organization. This course usually begins with the presumption that firms almost never operate in perfect markets, and so they are constantly engaged in strategic behavior with, or against, close rivals. The prisoners' dilemma is presented but with the acknowledgment that the game is repeated many, many times. The pure Nash equilibrium is expanded to the concept of a mixed equilibrium, where players, having no dominant strategy, can choose an optimal way to randomize actions. Some rigorous undergraduate courses use linear algebra to solve complicated game systems, but most rely upon calculus and algebra.

It is highly doubtful that the AP curriculum will, at least in the near future, move coverage of game theory too far beyond the prisoners' dilemma, dominant strategy, and the Nash equilibrium. The lesson provided in these materials offers a helpful glossary of those terms and practice with the tool of payoff matrices. So far, game theory questions have not been found on the free-response section of the AP Exam. However, if AP teachers begin to challenge their students with slightly more complex situations, those students may find themselves "ahead of the game" when future exams begin to cover this growing field of economics.

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<sup>3</sup> In 1994 three men—John F. Nash Jr., John C. Harsanyi, and Reinhard Selten—were awarded the Nobel Prize for their work in game theory.

### Marginal Thinking: Key Concepts and Questions

Pamela M. Schmitt  
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Annapolis, Maryland

A successful principles course in microeconomics will weave concepts of marginal thinking throughout the course design. The comparison between marginal cost and marginal benefits involves decision making at its heart. In making rational choices, individuals must choose based on the premise of the “extra” benefit being equal to the “extra” cost.

#### Outline of Concepts

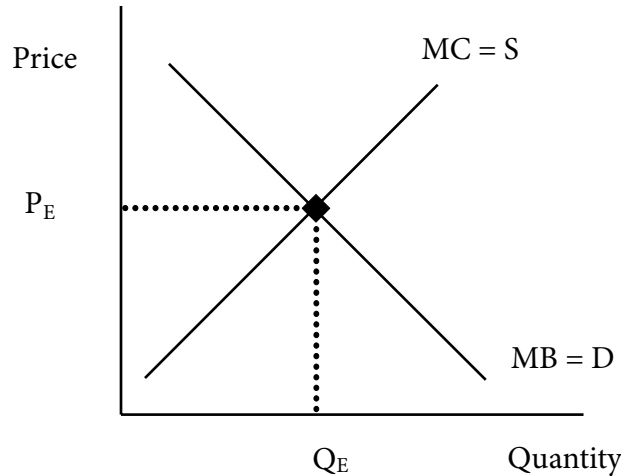
- I. Key principle: For allocative efficiency, markets should reach the point where  $MC = MB$ .
  - A. Let’s begin by reviewing the basic definition of marginal cost and marginal benefit.
    1. **Marginal cost (MC)** is defined as the additional cost incurred to produce one more unit of a good. Specifically, it is the change in total cost (TC) divided by the change in quantity (Q):

$$MC = \frac{\Delta TC}{\Delta Q}.$$

Therefore, marginal cost does not depend on fixed cost. In perfectly competitive markets, the marginal cost curve is an individual firm’s supply curve above the shutdown point (the minimum point on the average variable cost, where the firm no longer covers its variable costs).

2. **Marginal benefit (MB)** is defined as the additional value (utility or satisfaction) received from obtaining another unit of a good. The marginal benefit is therefore a consumer’s willingness and ability to pay for a good; this determines the demand for a product.

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II. Key principle: For profit maximization, firms choose the quantity where  $MC = MR$ .

A. Let's begin by reviewing the basic definition of marginal revenue. See above for the basic definition of marginal cost.

1. **Marginal revenue** (MR) is defined as the change in total revenues (TR) divided by the change in quantity:

$$MR = \frac{\Delta TR}{\Delta Q}.$$

Recall that the calculation of total revenue is the price a firm charges ( $P$ ) times the quantity that the firm sells at that price, assuming that the firm charges the same price for all units sold:

$$TR = P * Q.$$

B. To maximize profits, a firm chooses the quantity where  $MC = MR$ . Therefore, we should review a firm's profit.

1. **Profit** =  $TR - TC$ . Recall that economic profits consist of the amount of money the firm brings in from sales (TR) minus their costs (TC), which include opportunity costs.

C. However, MR depends on the type of industry the firm is in. For perfect competition,  $MR = P =$  demand for a firm. This is because perfectly competitive firms are price takers. For a monopoly,  $MR < P$ . This is because a monopolist must lower the price of all units of output to sell more.

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As a suggestion for how to teach this key principle in economics:

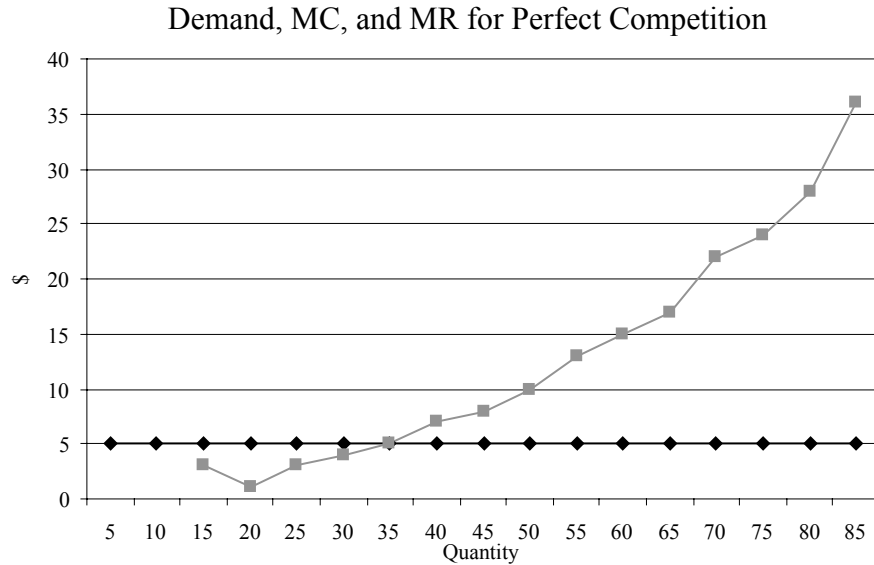
1. Provide a numerical example illustrating that the optimal quantity for a firm to produce is where  $MC = MR$ .
2. Show the concepts graphically.
3. Illustrate how MR varies with industry structure (focusing on the numerical and graphical differences between perfect competition and monopoly).

For example, the following table illustrates the calculation of MC and MR for a perfectly competitive firm.

Price	Quantity	Total Revenue (TR) $P * Q$	Marginal Revenue (MR) $TR/Q$	Total Fixed Cost (FC)	Total Variable Cost (TVC)	Total Cost (TC) = (FC + TVC)	Marginal Cost (MC) = (TC/Q)	Profit = (TR - TC)
5	10	50		50	20	70		-20
5	15	75	5	50	35	85	3	-10
5	20	100	5	50	40	90	1	10
5	25	125	5	50	55	105	3	20
5	30	150	5	50	75	125	4	25
<b>5</b>	<b>35</b>	<b>175</b>	<b>5</b>	<b>50</b>	<b>100</b>	<b>150</b>	<b>5</b>	<b>25</b>
5	40	200	5	50	135	185	7	15
5	45	225	5	50	175	225	8	0
5	50	250	5	50	225	275	10	-25
5	55	275	5	50	290	340	13	-65
5	60	300	5	50	365	415	15	-115
5	65	325	5	50	450	500	17	-175
5	70	350	5	50	560	610	22	-260
5	75	375	5	50	680	730	24	-355
5	80	400	5	50	820	870	28	-470
5	85	425	5	50	1000	1050	36	-625

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Graphically:



This next example shows the calculation of MC and MR for a **single-price monopolist**.

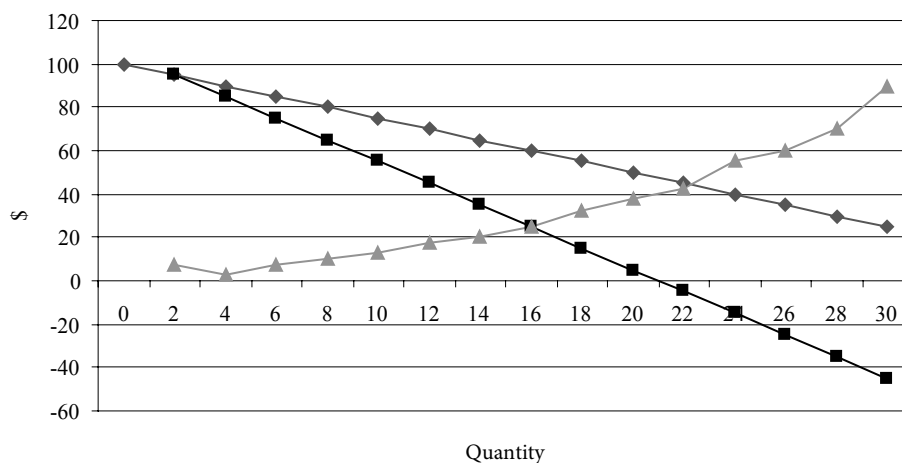
Price	Quantity	Total Revenue (TR) $P * Q$	Marginal Revenue (MR) $TR/Q$	Total Fixed Cost (FC)	Total Variable Cost (TVC)	Total Cost (TC) = (FC + TVC)	Marginal Cost (MC) = (TC/Q)	Profit = (TR - TC)
100	0	0		35	20	40		-40
95	2	190	95	35	35	55	7.5	135
90	4	360	85	35	40	60	2.5	300
85	6	510	75	35	55	75	7.5	435
80	8	640	65	35	75	95	10	545
75	10	750	55	35	100	120	12.5	630
70	12	840	45	35	135	155	17.5	685
65	14	910	35	35	175	195	20	715
<b>60</b>	<b>16</b>	<b>960</b>	<b>25</b>	<b>35</b>	<b>225</b>	<b>245</b>	<b>25</b>	<b>715</b>
55	18	990	15	35	290	310	32.5	680
50	20	1000	5	35	365	385	37.5	615
45	22	990	-5	35	450	470	42.5	520

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Price	Quantity	Total Revenue (TR) $P * Q$	Marginal Revenue (MR) $TR/Q$	Total Fixed Cost (FC)	Total Variable Cost (TVC)	Total Cost (TC) = (FC + TVC)	Marginal Cost (MC) = (TC/Q)	Profit = (TR - TC)
40	24	960	-15	35	560	580	55	380
35	26	910	-25	35	680	700	60	210
30	28	840	-35	35	820	840	70	0
25	30	750	-45	35	1000	1020	90	-270

Graphically:

Demand, MC, and MR for Monopoly



III. Key principle: When externalities are present, the efficient quantity is where  $MSC = MSB$ .

- A. Let's begin by reviewing the basic definition of an externality. We will then review the definitions of marginal social cost and marginal social benefit.
  1. An **externality** is defined as a cost or benefit that is imposed on a third party—someone not pursuing the action. Externalities can be positive (an external benefit is received by the third party) or negative (an external cost is imposed on the third party).

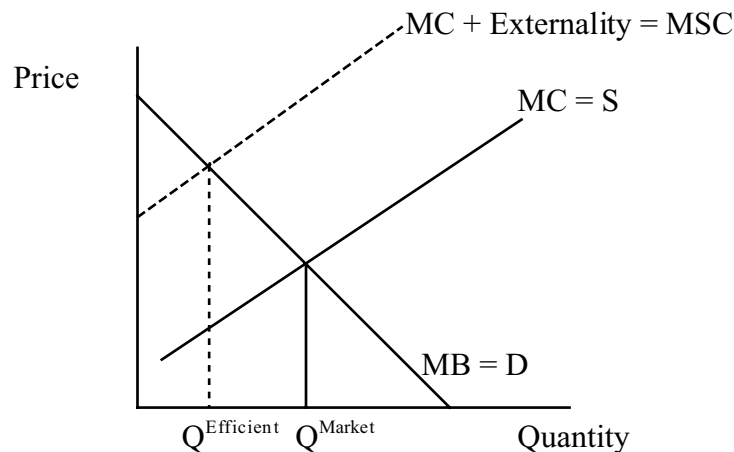
2. **Marginal social cost (MSC)** is defined as the marginal cost plus the marginal external cost to the third party. Therefore, the marginal social cost is higher than the marginal cost faced by the firm alone.
3. **Marginal social benefit (MSB)** is defined as the marginal benefit plus the marginal external benefit to the third party. Therefore, the marginal social benefit is higher than the marginal benefit of the consumer (the demand curve) alone.

B. In markets in which externalities are present, the efficient level of production is where  $MSC = MSB$ .

To teach this key principle in economics, I would provide real-world examples of negative externalities (such as pollution) and positive externalities (such as education). Then I would show graphically how these external costs and benefits affect a standard supply-and-demand graph.

### 1. Negative externalities

Graphically:

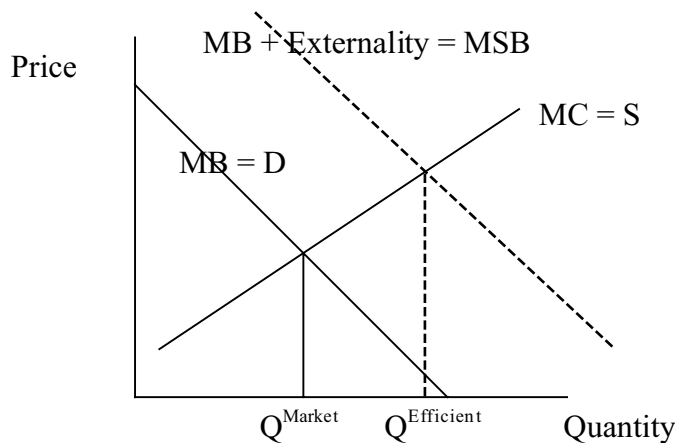


**Summary of negative externalities:** We find that the socially optimal quantity is **lower** than what the market produces at a competitive equilibrium. Optimal prices are also **higher** than what the market produces.

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### 2. Positive externalities

Graphically:



**Summary of positive externalities:** We find that the socially optimal quantity is **higher** than what the market produces at a competitive equilibrium, and optimal prices the consumers pay are **lower** than what the market produces.

- C. For efficient production to occur in markets in which externalities are present, government intervention may be necessary.
1. In the case of a **negative externality**, the government would wish to impose a **per-unit tax** on designers (thereby reducing supply because production is more costly). The tax should be equal to the externality at the efficient quantity.
  2. In the case of a **positive externality**, the government would wish to **subsidize** consumers (thereby increasing demand because the good is relatively less expensive). Another scheme could subsidize the producers (thereby increasing supply since marginal cost is now reduced). Either way, the subsidy should be equal to the positive externality at the efficient quantity.

IV. Key principle: In resource markets (such as the labor market), the efficient level for employing resources is found where  $MRP = MRC$ .

- A. Let's begin by reviewing the basic definition of a marginal revenue product and marginal revenue cost.
1. **Marginal revenue product (MRP)** is the change in total revenues that results when one more unit of an output is employed. Specifically, it is found by



multiplying the **marginal product** (MP) of an input and the price (P) of the product:

$$\text{MRP} = \text{MP} * P .$$

The MRP curve is basically the firm's demand curve for employing an input in a competitive market.

2. **Marginal product** is defined as the additional output produced when the firm employs another unit of an input. Specifically, the marginal product of labor ( $\text{MP}_L$ ) is the change in output (Q) divided by the change in labor (L); the marginal product of capital ( $\text{MP}_K$ ) is the change in output divided by the change in capital (K). Note that output is the same thing as total product (TP):

$$\text{MP}_L = \frac{\Delta Q}{\Delta L} = \frac{\Delta \text{TP}}{\Delta L} ,$$

$$\text{MP}_K = \frac{\Delta Q}{\Delta K} = \frac{\Delta \text{TP}}{\Delta K} .$$

3. **Marginal resource cost** (MRC) is defined as the additional cost that occurs when an additional unit of an input is employed. Specifically, this is the wage rate (w) when employing labor and the rental rate of capital (r) when employing capital.

### Problems to Test Core Concepts: Marginal Thinking

#### Sample Multiple-Choice Questions

1. A perfectly competitive firm is currently producing 10 units of output at a price of \$5. If, at the quantity of 10 units of output, marginal cost is less than marginal revenue, what would you advise the firm to do?
  - a. Increase production
  - b. Decrease production
  - c. Increase production and lower price
  - d. Decrease production and raise price
  - e. Continue producing 10 units of output

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**Answer:** The correct answer is (a). A firm's profit maximizes by choosing the quantity where  $MC = MR$ ; when  $MC < MR$ , the firm can increase profits by increasing its production. In addition, because this is a perfectly competitive firm, the firm cannot change the price.

2. A monopolist is currently producing 55 units of output at a price of \$30. If at the quantity of 55 units of output marginal cost is greater than marginal revenue, what would you advise the firm to do?
  - a. Increase production
  - b. Decrease production
  - c. Increase production and lower price
  - d. Decrease production and raise price
  - e. Continue producing 55 units of output

**Answer:** The correct answer is (d). A firm's profit maximizes by choosing the quantity where  $MC = MR$ ; when  $MC > MR$ , the firm can increase profits by decreasing its production. A monopolist can set the price; therefore, when decreasing production the firm should also increase its price.

3. In the market for flu shots, even people who do not receive a flu shot benefit from those who receive a flu shot because their chance of coming down with the flu decreases. If the government does not intervene in this market, then the market will \_\_\_\_\_ the good. To internalize this externality, the government should \_\_\_\_\_ flu shots.
  - a. Overproduce, tax
  - b. Overproduce, subsidize
  - c. Overproduce, do nothing
  - d. Underproduce, subsidize
  - e. Underproduce, do nothing

**Answer:** The correct answer is (d). This is an example of a positive externality; to internalize the externality (and reach the efficient level of production) the government would need to subsidize flu shots.

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4. Widgets are produced in a perfectly competitive market. If the firm is able to charge \$10 for each widget, and the firm has to pay a wage rate of \$50 per day, use the following information to determine an efficient number of workers to hire.

Labor	Quantity	$MP_L$	$MRP_L$	MPC
0	0	—		
5	60			
10	100			
15	125			
20	140			

- a. 5 workers
- b. 10 workers
- c. 15 workers
- d. 20 workers
- e. Cannot be determined with the information given

**Answer:** The correct answer is (c) 15 workers. To determine this, you need to complete the chart:

Labor	Quantity	$MP_L$	$MRP_L$	MPC
<b>Given</b>	<b>Given</b>	<b>Q/L</b>	<b>= <math>MP_L * P</math></b>	<b>= Wage per Worker</b>
0	0	—		
5	60	12	120	50
10	100	8	80	50
<b>15</b>	<b>125</b>	<b>5</b>	<b>50</b>	<b>50</b>
20	140	3	30	50

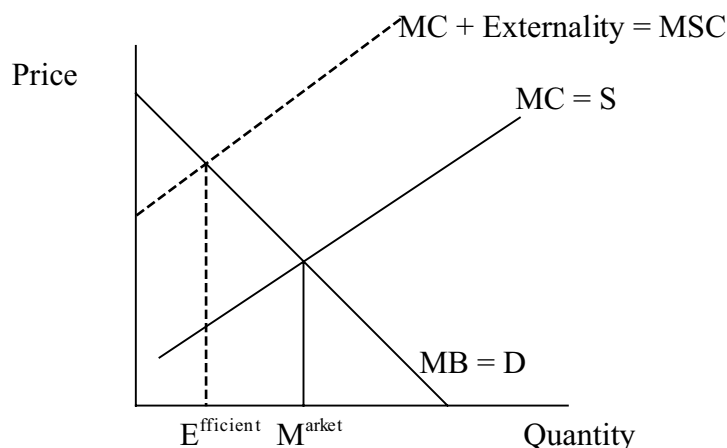
Because  $MRP_L = MPC$  at 15 workers, this is the efficient number of workers to hire.

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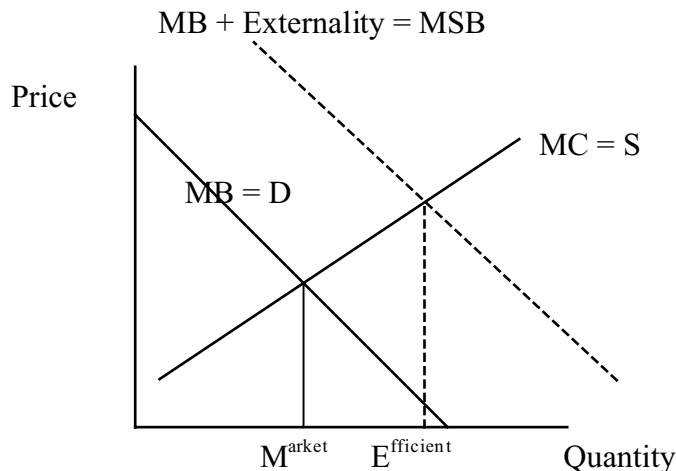
### Sample Free-Response Questions

- Some cities ban smoking in restaurants and have laws requiring households to shovel the sidewalk in front of their houses when it snows. Identify the problem and then draw correctly labeled graphs for each law to show why these laws are necessary.

**Answer:** Smoking presents a negative externality (others are harmed by the effects of secondhand smoke). To reach the efficient level of output, the government restricts restaurants from allowing patrons to smoke.



Shoveling snow presents a positive externality (people other than those living in the house receive benefits from having a shoveled walkway; they can pass the walkway without falling). To reach the efficient level of output, the government requires households to shovel.



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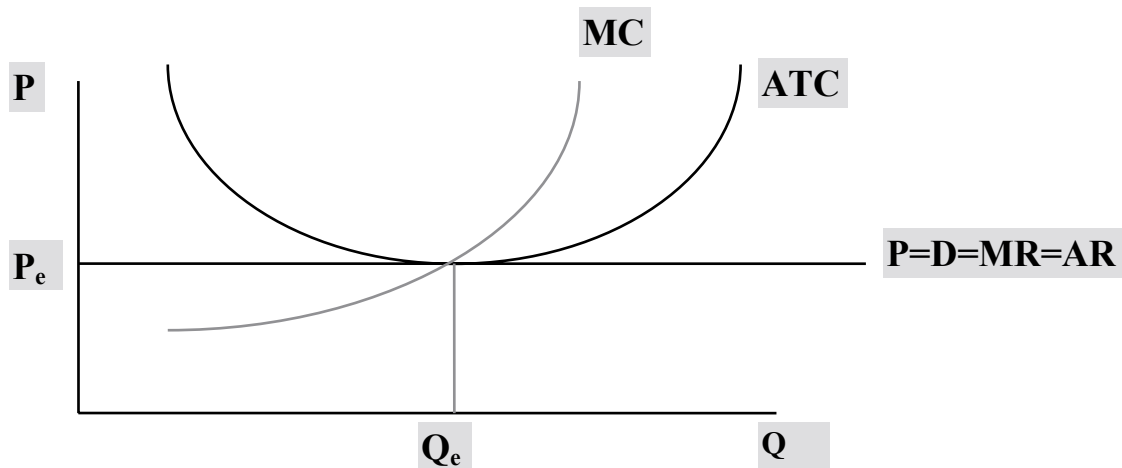
### Scoring Rubric

10 points maximum

Award 1 point for each of the following:

- Identifying the negative externality
- Setting up the graph with a downsloping MB and an upsloping MC curve
- Labeling the market quantity
- Sloping the shift of the MC curve to the left with the label of MSC
- Labeling the efficient quantity
- Identifying the positive externality
- Setting up the graph with a downsloping MB and an upsloping MC curve
- Labeling the market quantity
- Sloping the shift of the MB curve to the right with the label of MSB
- Labeling the efficient quantity

2. Draw a correctly labeled graph of a purely competitive firm in the long run. Show the price and quantity at equilibrium.
- a. How does this firm find the profit-maximizing level of output?
  - b. Explain why the price is equal to the marginal revenue for this firm.
  - c. Explain why this firm earns zero economic profit.



### Answer:

- a. The firm will determine its profit-maximizing level of output using the  $MR = MC$  equation since firms should produce at the point where the marginal revenue of the last unit is just equal to the marginal cost of the last unit.

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- b. The price is equal to the marginal revenue since this firm gets its price from the market, so it has no control over price. It sells as many of the units it wishes at the market price. Since it is paid the market price for each unit, the marginal revenue from each sale is the price.
- c. In the long run, the firm produces where  $MR = MC$  at minimum ATC since economic profits are zero. Economic profits in the short run attract new firms, and they enter the industry until the economic profits are zero. In the loss scenario, economic losses in the short run cause firms to exit the industry, and losses are eliminated as fewer firms make up the market.

### Scoring Rubric

6 points maximum

Drawing the correctly labeled graph is worth 3 points, giving 1 point for each of the following:

- Perfectly elastic  $MR = P = D = AR$
- ATC at the tangent point with MC and MR
- Correct labeling of P and Q

Award 1 point each for correct explanations to parts (a), (b), and (c).

### Teaching About Game Theory

Margaret Ray  
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#### Introduction

The key difference that distinguishes oligopolies from monopolistic competitors is interdependence. This is when the payoff to a firm's action depends not only on the action of the firm but also on the actions taken by other firms. The success of firms in an oligopoly industry depends on the actions of other firms in the industry. This is called a **strategic** situation, and in these situations firms must use **strategic** decision making.

Since an oligopoly firm does not operate in a fixed environment (its environment changes each time one of its competitors makes a decision or responds to its decision), the analysis of oligopoly markets must consider the firms' interdependence. To analyze this kind of market, economists use a method called **game theory**.

Mathematicians John von Neumann and Oskar Morgenstern contributed the new approach to oligopoly analysis in 1944. Since the 1994 Nobel Prize in economics was awarded to John F. Nash Jr., John C. Harsanyi, and Reinhard Selten for their contributions to game theory, the theory has been increasingly applied to a widening range of topics in economics. As a result, the 2005 Nobel Prize in economics was again awarded for work in game theory. Robert J. Aumann and Thomas C. Schelling were awarded the prize for "having enhanced our understanding of conflict and cooperation through game-theory analysis." Modern principles of economics textbooks include coverage of game theory. It is generally introduced in the chapter that covers oligopoly and may be applied to other topics discussed later in the book (e.g., the economics of information). In the past, college principles courses taught about oligopoly using the kinked demand curve model. However, changes in principles courses eventually reflect changes in the discipline, and over time the work of John Nash and others has replaced the kinked demand curve and other approaches to oligopoly. The AP Microeconomics syllabus has also evolved to incorporate the basics of game theory.

Game theory is an approach to studying strategic decision making. A strategic decision is one for which the results of a person's choice depend on the choice of someone else. That is, you don't know the results of a decision you make until you find out what decision another person makes. Think of a chess game. You don't know how good your move was

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until you see how the other person responds to your move. Or consider two gas stations on opposite sides of the street. One station owner is thinking about raising the price of gas. That owner doesn't know the result of the price increase until the owner across the street decides whether or not to raise the price of gas.

### Game Theory Concepts

**Cartel:** A group of firms that agrees to restrict output and raise prices to earn a higher economic profit.

**Decision tree:** An alternative way to illustrate the possible outcomes in a game. A decision tree presents the outcomes in an if-then format.

**Dominant strategy:** A strategy that yields a higher payoff in the game, regardless of what choices the other players make.

**Equilibrium:** A combination of player strategies from which there is no tendency to change.

**Game theory:** A method used by economists to study strategic situations.

**Interdependence:** This is when the payoff to a firm's action depends not only on the action of the firm but also on the actions taken by other firms.

**Nash equilibrium:** Any combination of strategies in which each player's strategy is best, given the other players' choices.

**Oligopoly:** A market structure in which firms compete with a few rival firms producing close substitutes.

**Payoff matrix:** A matrix showing all possible outcomes for all participants in a game. This is a two-by-two matrix in the simplest game.

**Payoffs:** The return to each player for each possible choice, given the other players' possible choices.

**Players:** The decision-makers in a game (for example, rival oligopoly firms). In the simplest form, a duopoly has two players.



**Prisoner's dilemma:** A game in which each player has a dominant strategy, and when each player chooses the dominant strategy, the resulting payoffs are smaller than if each had not chosen the dominant strategy.

**Strategic decision making:** The success of firms in an oligopoly industry depends on the actions of other firms in the industry. This is called a **strategic** situation, and in these situations firms must use **strategic** decision making.

**Strategies:** The players' operational plans. In the simplest game, two players have two possible choices (strategies).

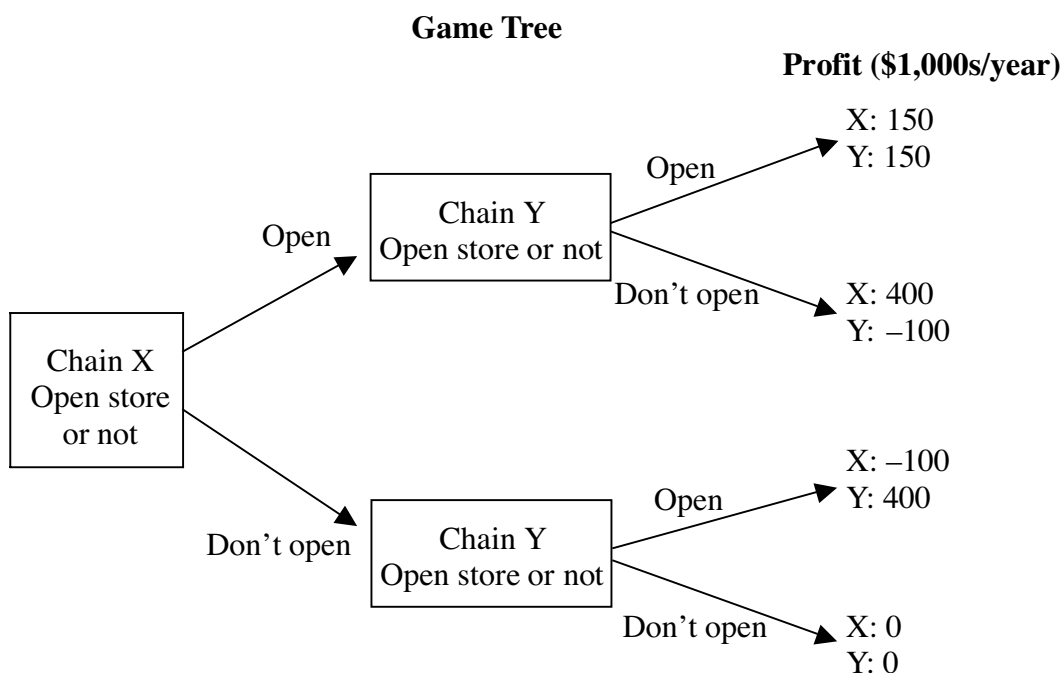
### Game Theory Models

Before studying game theory, economics students spend a lot of time studying economic models. For example, they study supply and demand, perfect competition, and monopoly. Until they get to oligopoly, the economic theories considered are presented using graphs. But with oligopoly, interdependence necessitates a new approach. Since a firm does not know the result of any decision until it knows the decisions of other firms in the market, it is impossible to illustrate an oligopoly using graphs. For example, an oligopoly firm does not know the result of the price it chooses (i.e., the quantity it will sell) until it knows the prices other firms choose to charge. Therefore, an oligopoly firm cannot draw a demand curve for its product (showing the quantity demanded at various prices) because its demand curve changes any time a competitor changes its price. This unique characteristic of oligopoly means that graphs are not the model of choice for studying oligopoly (something your graph-weary students may applaud). However, it also means a new approach (game theory) must be developed.

### Basic Game Theory

A game has three elements: the **players**, the possible **actions** the players may take, and the **payoffs** from each possible action. For example, imagine two grocery store chains are deciding whether to open a new store in a town. The two grocery chains are the players, opening a new store or not opening a new store are the possible actions, and the payoffs from opening a new store depend on whether or not the other chain also opens a new store. If neither chain opens a new store, each will earn \$0. If one chain opens a new store and the other does not, the new store will have no new competition and will earn \$400,000, while the other chain will lose \$100,000 by not competing. If both chains open new stores, the stores will compete with each other and earn \$150,000 each. This situation is represented below using a **payoff matrix** and a **game tree**.

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### Payoff Matrix

		Chain X	
		Open	Don't Open
Chain Y	Open	X: 150 Y: 150	X: -100 Y: 400
	Don't Open	X: 400 Y: -100	X: 0 Y: 0

### Best Ways to Teach Game Theory

#### 1. Grade Exercise

A great way to help students really understand strategic decision making and interdependence is to put them in a strategic situation and have them make a choice. Since students are familiar with grades and grading, use the simple example described below as a quick yet dramatic way to have them experience game theory.

Tell students you are giving them a quiz. However, the only thing they need to do for the quiz is to tell you what grade they would like to receive for it. You will then

randomly pair them with another student, and the grade they receive for the quiz will be determined by what choice the other student makes. Grades will be assigned using the payoff matrix given below.

		<b>Them</b>	
		A	C
<b>You</b>	A	You: F Them: F	You: A Them: F
	C	You: F Them: A	You: D Them: D

**Directions**

1. Have students write their name and their choice (A or C) on a small scrap of paper.
2. Collect all papers in a hat.
3. Draw out two at a time and announce the grade each student will receive. You will get many hoorays, groans, comments, and proclamations of unfairness. These lead to a great discussion of the nature of oligopoly, interdependence, and strategic decision making. It is a good idea to let students believe you will truly assign grades this way, but most instructors don't actually do it.

This exercise is very quick and can be done as a **repeated game** (a game that confronts players repeatedly). You can also change the environment. For example, you can tell the students who they will be paired with in advance. Finally, you can alter the payoffs and see how the game is affected.

**2. Nash Movie**

The popular 2001 film, *A Beautiful Mind*, is about the life of John Nash. Since John Nash won the Nobel Prize in economics for his work in game theory, this movie is a great way to put a face on economics and economists. Rent the movie and have the students watch it, perhaps at an after-school showing (maybe with popcorn?). Then discuss John Nash's work and how it became part of their course work. Students will enjoy the entertaining break from economic theory.

**3. Prisoner's Dilemma**

One type of game is commonly known as a "prisoner's dilemma." In this game, each player has a dominant (or best) strategy. However, when each player chooses their dominant strategy, the outcome is worse for the players combined. The situation is called

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a prisoner's dilemma because the original example was of two partners in a crime being interrogated in separate rooms. The prosecutor has only enough evidence to convict the two of a lesser crime, unless one prisoner confesses and turns in the other. Each prisoner is told they can go free if they confess and send the other to prison for the greater offense. But if both confess, both will be convicted for an intermediate-level crime.

### Directions

The prisoner's dilemma game is an excellent way to dramatize game theory for your students.

1. Start by describing a TV crime drama in which the police catch two criminals and bring them back to the station for questioning.
2. The TV crime drama you use can change with the current hit show (those in my generation think of *Hill Street Blues*, but now *Law and Order* is the hit).
3. You can even select two students and interview them separately in front of the class, informing them of their rights, their choices, and their potential payoffs.

### Problem Set 1

#### Directions

1. You are in a class with one other student. It is the end of the semester, and final exams are in a week.
2. Your teacher has said that the final exam will be graded so that anyone scoring the class average on the final exam will receive a B in the class. Anyone scoring above the average will receive an A in the class, and anyone scoring below the average will fail the class. You would certainly score higher on the exam than the other student.
3. You and the other student have made an agreement not to take the final exam so that the class average is 0 and you both receive B grades.
  - a. Identify the players, actions, and payoffs in this game.
  - b. Construct a game tree and a payoff matrix illustrating this situation.
  - c. Using a 4-point grade scale, which choice maximizes the class GPA?
  - d. If the other student takes the exam, what is your dominant strategy? If they do not?
  - e. If you take the exam, what is the other student's dominant strategy? If you do not?

**Problem Set 2**

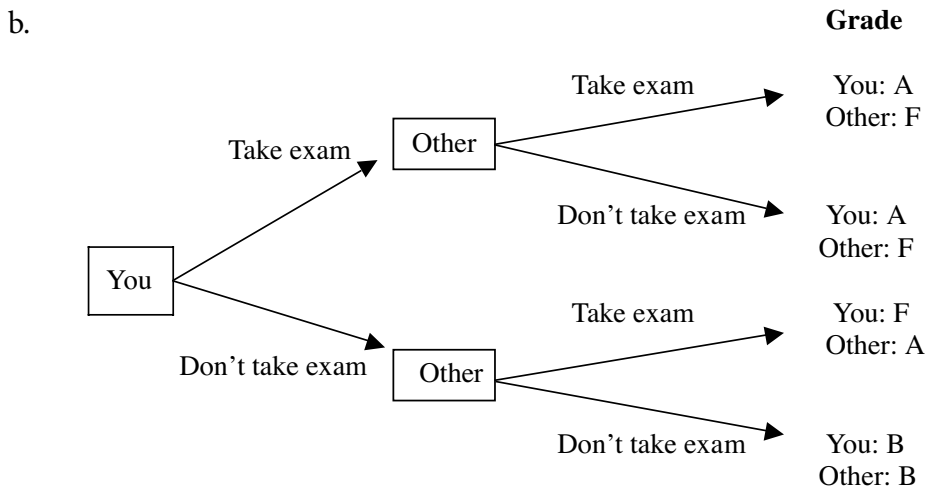
The payoff matrix below shows the prisoner's dilemma for two criminals, Jack and Jill.

		<b>Jack</b>	
		Confess	Don't Confess
<b>Jill</b>	Confess	10 years each	Jack: Life in prison Jill: Go free
	Don't Confess	Jack: Go free Jill: Life in prison	Two years each

- Which combination of actions results in the least combined jail time?
- What is Jack's dominant strategy if Jill confesses? If Jill does not confess?
- What is Jill's dominant strategy if Jack confesses? If Jack does not confess?
- What is the result if each player follows his or her own dominant strategy? How does this compare to the "socially optimal" strategy (that is, the optimal strategy for Jack and Jill combined) from part (a)?
- What could Jack and Jill agree to before committing the crime that would minimize their jail time if caught? What problem makes the agreement difficult once they are caught?

**Answers to Problem Set 1**

- Players: You and the other student  
 Actions: Take the exam or not take the exam  
 Payoffs: Grades (A, B, or F)



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		You	
		Take Exam	Don't Take Exam
Other	Take Exam	You: A Other: F	You: F Other: A
	Don't Take Exam	You: A Other: F	You: B Other: B

- Both don't take the exam and both receive Bs, a 3.0 class GPA.
- To take the exam (an A versus an F). To take the exam (an A versus a B).
- No dominant strategy, an F either way. To take the exam (an A versus an F).

### Answers to Problem Set 2

- If both confess, they serve only four years of jail time combined.
- If Jill confesses, Jack can receive either 10 years or life in prison. The dominant strategy is to confess and receive 10 years. If Jill does not confess, Jack can receive either two years in prison or go free. The dominant strategy is to confess and go free.
- If Jack confesses, Jill can receive either 10 years or life in prison. The dominant strategy is to confess and receive 10 years. If Jack does not confess, Jill can receive either two years in prison or go free. The dominant strategy is to confess and go free.
- Both receive 10 years. This is a total of 20 years, more than the four years with the "socially optimal" strategy.
- They could agree to remain silent. However, since they are in separate rooms, they could not be sure the other partner keeps his or her word. There is an enforcement problem (and who can trust a criminal, after all!).

### Sample Multiple-Choice Questions

- Which of the following best characterizes the firms in an oligopoly industry?
  - There are more than two but less than 10.
  - There are more than in a monopolistically competitive industry.
  - They are independent.
  - They collude to increase profits.
  - They use strategic decision making.

Answer: e

2. In a “prisoner’s dilemma” game, the players:
- Do not have a dominant strategy
  - Combined are worse off if each chooses the dominant strategy
  - Go free if they agree, before they are caught, to keep silent
  - Achieve the best outcome if they confess
  - Can discuss their choices before making their final decisions

Answer: b

Questions 3 through 5 refer to the payoff matrix below.

**Payoff Matrix**

**Acme**

		Advertise	Don't Advertise
AAA	Advertise	Acme: 150 AAA: 150	Acme: -100 AAA: 400
	Don't Advertise	Acme: 400 AAA: -100	Acme: 0 AAA: 0

Acme and AAA are the two major firms in the industry. Each must decide whether to conduct a television advertising campaign. The returns from each firm’s decision depend on the decision of the other. The profits resulting from each possible combination of the firms’ decisions are given in the payoff matrix above.

3. If AAA advertises and Acme does not, Acme will make how much as a result of their advertising?
- \$100
  - \$0
  - \$150
  - \$300
  - \$400

Answer: a

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4. If AAA advertises, Acme:
- Will decide not to advertise because that is its dominant strategy
  - Will advertise because that is its dominant strategy
  - Does not have a dominant strategy
  - Loses money
  - Will increase its profits by \$400 if it advertises

Answer: a

5. Which of the following statements is true?
- If AAA advertises, Acme's dominant strategy is to advertise.
  - If Acme advertises, AAA's dominant strategy is **not** to advertise.
  - The two firms are in a "prisoner's dilemma" game.
  - The two firms would be better off to agree to save their money and **not** advertise.
  - A collusive agreement to advertise would benefit both firms.

Answer: a

### Sample Free-Response Questions

#### Question 1

Consider two firms in a market. Each firm must decide whether to market a new product. The profit earned from marketing the new product depends on whether the product is marketed by one or both firms. If one firm markets the product, the firm will earn a profit of \$2 million. If both firms market the product, they split profits of \$3 million.

- Identify the players, strategies, and payoffs in this game.
- Construct a payoff matrix for this situation.
- Do the firms have a dominant strategy in this game? If so, what is it?

#### Answer

- The players are the two firms; the strategies are to introduce a new product or not. The payoffs for each firm are \$2 million, \$1.5M, or \$0.



b. Payoff matrix:

		<b>Firm A</b>	
		Introduce	Don't Introduce
<b>Firm B</b>	Introduce	A: \$1.5M B: \$1.5M	A: \$0 B: \$2M
	Don't Introduce	A: \$2M B: \$0	A: \$0 B: \$0

c. Yes, the dominant strategy is to market the product since both do the best they can regardless of what the other firm decides.

**Scoring Rubric**

7 points maximum:

- 1 point each for identifying the players, strategies, and payoffs in the game
- 1 point for a correctly labeled matrix, 1 point for correctly entered payoffs
- 1 point for “yes,” 1 point for “market the product”

**Question 2**

Two firms in a market can choose whether to set prices high or low. If both firms keep prices high, the firms earn more than if both firms keep prices low. However, if one firm can lower prices while the other keeps prices high, the low-price firm will get all of the market’s sales and will make higher profits than when both firms keep prices high.

- a. Is this a “prisoner’s dilemma” situation? Explain why or why not (i.e., define a prisoner’s dilemma and then show why this situation does or does not fit the definition).
- b. If the two firms were to enter a voluntary agreement to keep their prices high, is it likely to result in higher prices for the two firms? Why or why not?

**Answer**

- a. This is a “prisoner’s dilemma” case. In this game, each player has a dominant (or best) strategy. However, when each player chooses their dominant strategy, the outcome is worse for the players combined. So here, if both sell high, they earn the greatest income. If they sell low, they earn less. If Firm A sells high, Firm B can either split the profits or gain more than Firm A. The dominant strategy is to sell low and gain more. If Firm A sells low, Firm B can receive either lower profits to share or lose all of the market. The dominant strategy is to sell low. The same is true for Firm B. So the two dominant strategies to sell low result in a less-than-desirable outcome combined.

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- b. No, enforcement of the arrangement will be difficult or impossible since one firm may choose to sell low and gain the market. Who can you trust?

### Scoring Rubric

5 points maximum:

- 1 point for “yes,” 1 point for definition, 1 point for explanation of why
- 1 point for “no,” 1 point for explanation of why not

## **Focusing on the Phillips Curve and Exchange Rates in Macroeconomics**

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Macroeconomics grew out of the study of business cycles and is an exciting field of study because it continues to refine the explanations for how an economy works and the effects of policy on the economy. Two concepts that receive major emphasis in the study of macroeconomics are the Phillips curve and exchange rates.

### **The Phillips Curve—Long and Short Run**

Economists have discussed the Phillips curve in terms of the aggregate supply curve, policy analysis, and the impact that the interdependence of economies has on exchange rates. In 1958 A. W. Phillips first described the relation between changes in nominal wages and unemployment in the United Kingdom for the period from 1861 to 1957. This became known as the Phillips curve.<sup>1</sup> He found the relationship to be very stable during that time period except immediately following a rapid increase in import prices, usually as a result of war. He concluded that if policymakers wanted a stable wage rate, the associated level of unemployment would be about 5.5 percent.

In 1960 Paul Samuelson and Robert Solow, both recipients of the Nobel Prize in Economic Sciences, looked at U.S. data and found that the Phillips curve relationship held, although they identified some shifts over time in the U.S. Phillips curve.<sup>2</sup> They described the translation of the original Phillips curve in terms of wage change and unemployment to our current definition of the Phillips curve in terms of inflation and unemployment. Samuelson and Solow drew the conclusion that, in the post–World War II period, if we wanted to have a 3 percent unemployment rate, inflation would be 4 to 5 percent per year. The short-run Phillips curve shows an inverse relation between inflation and unemployment. The logic behind this relation is that to achieve

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<sup>1</sup> A. W. Phillips, “The Relationship Between Unemployment and the Rate of Change of Money Wage Rates in the United Kingdom, 1861–1957,” *Economica* (November 1958).

<sup>2</sup> Paul A. Samuelson and Robert M. Solow, “Analytical Aspects of Anti-Inflation Policy,” *The American Economic Review* (May 1960)

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a lower unemployment rate, more people have to be willing to take a job, and that is accomplished by offering a higher nominal wage rate. The higher nominal wage rate leads to higher costs, which leads to price increases, or inflation.

Initially, the Phillips curve seemed to offer policymakers the ability to trade inflation and unemployment. Policymakers saw the Phillips curve as a menu from which they could choose a combination of unemployment and inflation rates. It was argued by some economists that macroeconomics policymakers could keep unemployment rates low, indefinitely, by accepting some inflation. However, data from the late 1960s and early 1970s show that the Phillips curve disappeared. By the middle of the 1970s, the United States and other countries experienced high inflation and high unemployment. In 1975, for example, the unemployment rate was 8.5 percent of the labor force, and the annual inflation rate was 9.1 percent.

The short-run Phillips curve disappeared in the 1970s for two reasons. First, most developed countries experienced significant increases in oil prices due to decisions by the Organization of Petroleum Exporting Countries (OPEC). Thus nonlabor costs for firms rose relative to wages; these increases in nonlabor costs pushed inflation up without changing the unemployment rate. Second, people changed how they formed expectations about inflation. Before the 1960s, people assumed that prices in the following year would be the same as prices during the current year, or that expected inflation would be zero. This seemed reasonable at the time, since data from the 1950s show the inflation rate was very low, ranging from close to zero to less than 2 percent. Further, real incomes were rising in the 1950s, and people were not focused on the inflation rate. However, starting in the late 1960s, inflation was consistently positive and rising. Thus people started assuming a positive level of inflation and incorporated that view into their wage-determination process. With a positive expectation about inflation, the nominal wage rate must be increased to maintain the level of real wages. The one conclusion that comes from all of the study is that the relation between unemployment and inflation varies over time and by country because it depends on inflationary expectations and wage-determination processes.

The Phillips curve receives increased attention today because it comes from the positively sloped short-run aggregate supply curve. The relation between the short-run Phillips curve and the short-run aggregate supply curve is shown in the lesson prepared by Peggy Pride of St. Louis University High School in St. Louis, Missouri, and Sue Weaver of Ramona High School in Ramona, California. From this relation it is clear that shifts in the short-run aggregate supply curve will result in shifts in the short-run Phillips curve. If the short-run aggregate supply curve shifts to the left as a result of supply shocks, such

as natural disasters or increases in input prices, the short-run Phillips curve will shift to the right. The rightward shift of the Phillips curve results in higher unemployment for a given inflation rate. Conversely, rightward shifts in the short-run aggregate supply curve result in a leftward shift of the Phillips curve. This allows lower unemployment rates for a given inflation rate. Rightward shifts of the short-run aggregate supply curve, or increases in aggregate supply, could be a result of increases in productivity or decreases in nominal wage rates.

Economists agree that policymakers cannot keep the unemployment rate permanently below the natural rate of unemployment by maintaining a high rate of inflation. Expectations about inflation shift the short-run aggregate supply. Eventually expectations adjust until the expected and actual inflation rates are equal. This will occur in the long run at the point where the actual unemployment rate equals the natural unemployment rate, and we arrive at the vertical long-run Phillips curve, which is analogous to the long-run vertical aggregate supply curve.

The Phillips curve, both short run and long run, is important in a principles class because of the relationship with the aggregate supply curve and policy discussions. We know from our macro models that changes in the money supply will have no long-run effects on real variables, including real output and unemployment. The vertical long-run Phillips curve and long-run aggregate supply curve demonstrate this result.

### Foreign Exchange Rates

The world economic system makes national economies increasingly interdependent. The international trade in goods and services has steadily increased since World War II. The extension and expansion of trade permits greater specialization and thus increases in productivity worldwide. The result is that national economies are more dependent on what occurs in other national economies. In conjunction with the continued growth in trade, there is an increase in the integration of financial markets worldwide. Money flows to the point of highest return without concern for the location of savers and investors. The integration of financial markets has yielded an increase in international productivity and increased the sensitivity of domestic markets to international events. The study of international trade and exchange rates is important to understanding the effects of domestic policy on other economies and how trade and borrowing serve as a mechanism for transmitting the business cycle from one country to another.

We can see the importance of exchange rates and the interaction with domestic policy in the following example. If the U.S. central bank determines that domestic interest rates

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must rise to curb rising inflation, it will decrease the growth of the money supply. The increase in U.S. interest rates will cause a capital inflow, in turn raising interest rates in other economies. This increase in interest rates in other economies could lead to recession in those economies. Recessions abroad would decrease the demand for U.S. exports, potentially leading to a recession in the United States. The U.S. would have to depreciate the U.S. dollar to return to full employment. The lesson on foreign exchange prepared by Mary Kohelis of Brooke High School in Wellsburg, West Virginia, provides additional explanation and questions on the relation between domestic policy and exchange rates.

A second example of the importance of understanding exchange rates is the effect of exchange-rate crises. Financial market participants, expecting a devaluation of the currency of a country that follows a fixed exchange-rate system, usually trigger these crises. The financial market participants sell off their holdings of the country's currency, thus putting downward pressure on the currency. The central bank and the government of the country have two choices: (1) they can "give in" and devalue their currency, or (2) they can attempt to maintain the existing parity at the cost of rising interest rates and the possibility of creating a recession. In exchange-rate crises, exchange-rate problems are driving the domestic policy.

### Summary

The study of the short-run and long-run Phillips curves and international economics are well embedded in the college principles classroom. The Phillips curve and the reasons for shifts in the short run and the implications of the vertical Phillips curve will continue to appear on the AP Macroeconomics Examination. Exchange rates and international trade will continue to grow in importance in the college curriculum and thus on the AP Exam simply because of the recognition of the growing economic interdependence of nations. Students will be well served if teachers include these two topics in their course design.

## **Teaching About Foreign Exchange**

Mary Kohelis  
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Wellsburg, West Virginia

Financing international trade involves the exchange of different national currencies. The foreign currency market facilitates this trade. This article discusses the concepts to teach about foreign exchange and provides a problem set and sample multiple-choice questions to use in the classroom.

### **Concepts to Be Covered**

- I. What is the foreign exchange market?
  - A. The market in which the currencies of foreign countries are traded with one another
  - B. The market that determines the exchange rate through the use of supply of and demand for one currency in terms of another currency
  - C. Not a single market but rather the interactions of thousands of people and institutions such as exporters and importers, banks, and foreign exchange brokers throughout the world
  
- II. What is the purpose of the foreign exchange market?
  - A. To facilitate trade
    1. People using one country's currency (e.g., dollars) want to buy goods and services from another country, but they do not have the currency used in that country (e.g., euros).
    2. People using one country's currency (e.g., dollars) want to purchase assets such as stocks, bonds, or real estate from another country, but they do not have the currency used in that country (e.g., euros).
  - B. To allow for the trade of one currency for another
  
- III. How are foreign exchange rates determined?
  - A. Supply and demand
    1. Supply
      - a. Supply represents anyone holding a currency who is willing and able to offer it in exchange for another currency.
      - b. Since the quantity supplied of a currency will increase as the exchange rate increases, the supply curve is upward sloping.

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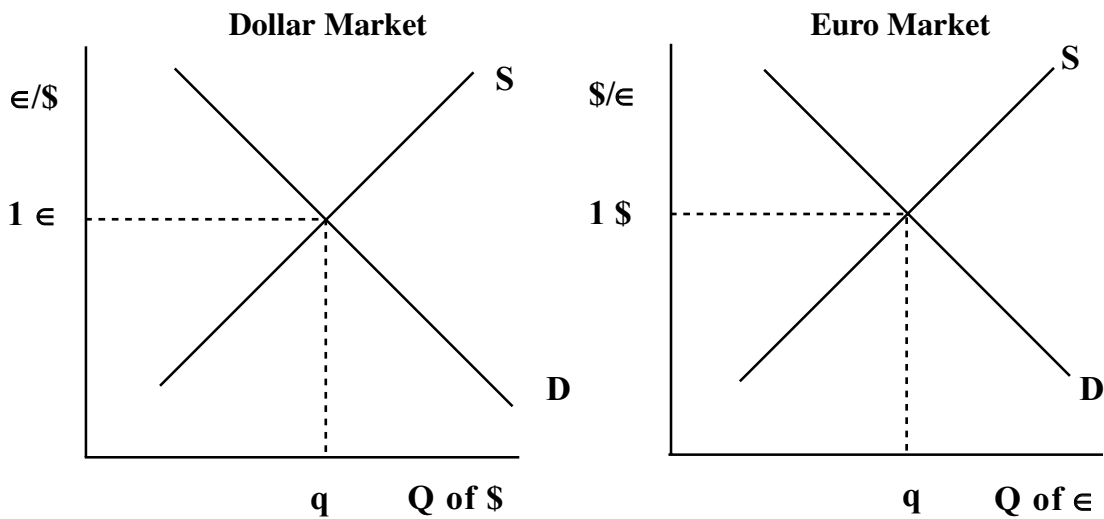
2. Demand
  - a. Demand represents anyone who is willing and able to buy one currency in exchange for another.
  - b. Since the quantity demanded of a currency decreases as the exchange rate increases, the demand curve is downward sloping.
  - c. For currencies, demand is considered a derived demand, since it represents demand for goods, services, or assets.
  - d. Demand for currency is also related to speculation.
3. Equilibrium
  - a. Equilibrium is the rate at which the quantity supplied of one currency equals the quantity demanded of the same currency.
  - b. The definition assumes a floating exchange rate, with rates changing with fluctuations in the supply of or demand for the currency.
- IV. What causes changes to the exchange rate?
  - A. An increased/decreased preference for one country's goods
  - B. An increase/decrease in real GDP in one country, which will increase/decrease incomes—affecting demand for imports/exports
  - C. An increase/decrease in real interest rates in one country relative to another
  - D. Speculation on the expected future exchange rate
  - E. An increase in the price level of one country relative to another
- V. How do changes in the foreign exchange rate affect exports and imports, *ceteris paribus*?
  - A. When a currency appreciates, the relative price of a foreign good decreases, so imports increase and exports decrease.
  - B. When a currency depreciates, the relative price of a foreign good increases, so imports decrease and exports increase.
- VI. How do changes in a country's monetary policy affect the foreign exchange rate?
  - A. Changes will affect relative real interest rates.
  - B. Higher/lower relative real interest rates will increase/decrease demand for a currency in the foreign exchange market.
  - C. Higher/lower relative real interest rates will increase supply/demand of the other currency in the foreign exchange market.



- VII. How do changes in the exchange rate affect aggregate demand and equilibrium GDP in the short run? Assuming an upward-sloping aggregate supply curve, since exchange rate changes affect the demand for exports and imports:
- With a depreciated currency, exports will increase and imports will decrease, causing an increase in aggregate demand and equilibrium GDP.
  - With an appreciated currency, exports will decrease and imports will increase, causing a decrease in aggregate demand and equilibrium GDP.

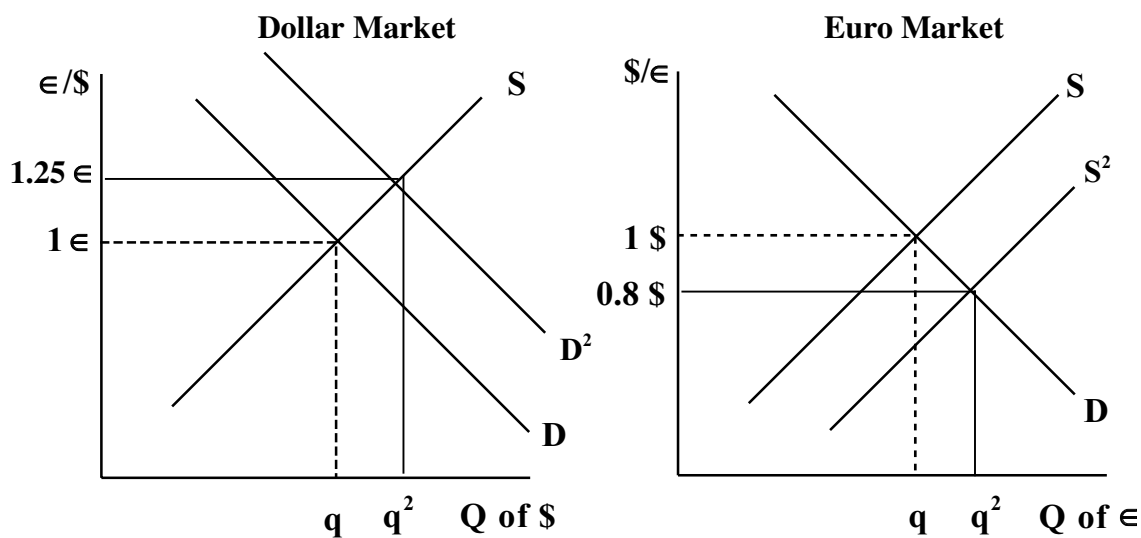
**Graphs to Be Used**

- Supply-and-demand graphs for currency
  - Assuming only two currencies, the dollar and the euro, the following supply-and-demand graphs indicate both a market for dollars and a market for euros to show the relationship between the two.



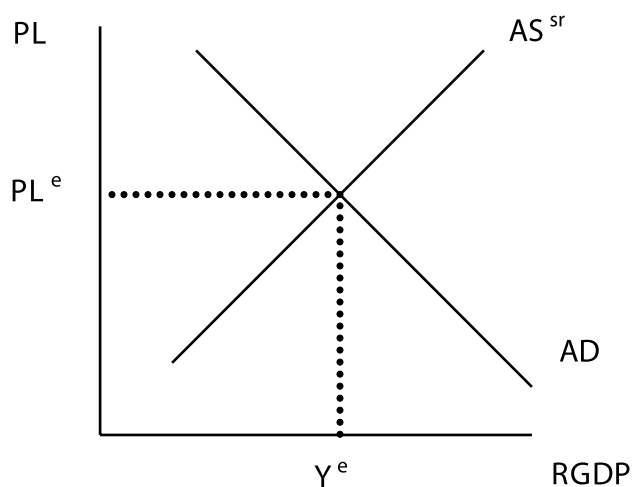
- In these graphs, the exchange rate is considered to be one euro = one dollar.
- Using both graphs, you can see what will happen to the value of a currency. For example, if there is an increased demand for goods from the United States, then there will be an increase in the demand for the dollar. At the same time, in the euro market there will be an increase in the supply of euros. Demanders of dollars are supplying their euros. In the dollar market, the dollar appreciates. It takes more euros to buy a dollar. In the euro market, the euro depreciates because the dollar price of a euro has decreased

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### II. Aggregate demand/aggregate supply graphs

- Using the AD/AS graph, you can illustrate the effects of appreciation/depreciation on aggregate demand.
- The graphs show the corresponding changes to equilibrium price level and real GDP.



### Methodologies to Use

- Lecture and encourage discussion, using the outline and your course textbook.
- Use newspapers or the Internet to show the value of the dollar and how it has changed over a period of time.
- Assign groups to work on the following problem set on foreign exchange rates.
- Illustrate the solutions to the problem set on the board.
- Have students work on the sample multiple-choice and free-response questions presented at the end of this lesson.

### Problem Set on Foreign Exchange Rates

1. Divide students into groups of two or three students.
2. Distribute the following cards that describe situations to each group.
3. Each group will:
  - a. Indicate the effect of the situation on demand and supply for dollars and euros
  - b. Using the board or flip-chart paper, draw graphs of the foreign exchange market, using both the dollar market and the euro market, showing the effect on the exchange rate
  - c. Explain to classmates how imports and exports will be affected

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1. The income of workers in the United States is increasing, and more people are buying goods and services produced in Europe.

2. The Federal Reserve has decreased interest rates so that the interest rates in the United States are now relatively lower than the interest rates in countries of the European Union.

3. The number of tourists visiting the United States from countries of the European Union has greatly increased.

4. The central bank of the European Union raises interest rates that are now relatively higher than the interest rates in the United States.

5. As an economic advisor, you are predicting that the interest rates in the United States will be increasing significantly in the near future. What advice do you have for speculators in the foreign exchange market?

6. The price level in the United States is not rising as quickly as the price level of the European Union countries.

7. The GDP of the European Union countries increases, increasing the incomes of its population.

8. United States buyers are increasing their purchases of goods from the European Union, while the purchases from the European Union are unchanged.

**Answer Key**

**Card 1**

The income of workers in the U.S. is increasing, and more people are buying goods and services produced in Europe.

**Answer:** As the income of U.S. workers rises, their prosperity allows them to buy more European goods. The supply of dollars in the dollar market increases, and the demand for euros in the euro market increases, causing the value of the dollar to depreciate as the value of the euro appreciates. U.S. exports should increase, and U.S. imports should decrease.

**Card 2**

The Federal Reserve has decreased interest rates so that the interest rates in the U.S. are now relatively lower than the interest rates in countries of the European Union.

**Answer:** Since the interest rates in the U.S. are now relatively lower than the interest rates in the European Union countries, investors will increase their demand for European government bonds, leading to an increase in the demand for euros in the euro market and an increase in the supply of dollars in the dollar market. This will cause the euro to appreciate and the dollar to depreciate. U.S. exports should increase, and U.S. imports should decrease.

**Card 3**

The number of tourists visiting the U.S. from countries of the European Union has greatly increased.

**Answer:** With an increased number of tourists visiting the U.S, they will increase their demand for U.S. goods and services. In order to purchase those goods and services in the U.S., euros must be exchanged for dollars. There will be an increase in the demand for dollars in the dollar market and an increase in the supply of euros in the euro market. This will lead to an appreciation of the dollar and a depreciation of the euro. U.S. imports should increase, and U.S. exports should decrease.

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### Card 4

The central bank of the European Union raises interest rates that are now relatively higher than the interest rates in the U.S.

**Answer:** Since the interest rates in the U.S. are now relatively lower than the interest rates in the European Union countries, investors will increase their demand for European government bonds, leading to an increase in the demand for euros in the euro market and an increase in the supply of dollars in the dollar market. This will cause the euro to appreciate and the dollar to depreciate. U.S. exports will increase, and U.S. imports will decrease.

### Card 5

As an economic advisor, you are predicting that the interest rates in the U.S. will be increasing significantly in the near future. What advice do you have for speculators in the foreign exchange market?

**Answer:** The advice is to buy dollars now. Since the expectation is that interest rates will be higher in the future, foreign investors will want to increase their holdings of dollars now. This will increase the demand for dollars and increase the supplies of the foreign currency. The increased interest rates will also increase the demand for dollars. Both actions will lead to an appreciation of the dollar and a depreciation of the foreign currency.

### Card 6

The price level in the U.S. is not rising as quickly as the price level of the European Union countries.

**Answer:** With a price level that is not rising as quickly in the U.S., consumers in European Union countries will want to increase their purchases of the relatively less expensive U.S. goods. This will lead to an increase in the demand for dollars in the dollar market and an increase in the supply of euros in the euro market. U.S. imports should increase, and U.S. exports should decrease.

### Card 7

The GDP of the European Union countries increases, increasing the incomes of its population.

**Answer:** As the GDP and incomes of the European Union countries rise, their prosperity allows them to buy more U.S. goods. The demand for dollars in the dollar market increases, and the supply of euros in the euro market increases, causing the value of the dollar to appreciate as the value of the euro depreciates. U.S. exports should decrease, and U.S. imports should increase.

### Card 8

U.S. buyers are increasing their purchases of goods from the European Union, while the purchases from the European Union are unchanged.

**Answer:** As the U.S. buyers increase their demand for goods from the European Union, they will also increase their demand for euros in the euro market and increase the supply of dollars in the dollar market, causing the value of the dollar to depreciate as the value of the euro appreciates. U.S. exports should increase, and U.S. imports should decrease.

### Sample Multiple-Choice Questions

1. Flexible exchange rates are determined by:
  - a. Central banks of the nations
  - b. Governments of the nations
  - c. International agreements
  - d. Forces of supply and demand
  - e. Businesses of the nations

Answer: d

2. If U.S. citizens decide to increase their purchases of Japanese cars, this will lead to:
  - a. Increase in the value of the dollar
  - b. Decrease in the value of the dollar
  - c. Decrease in the value of the yen
  - d. Stronger dollar
  - e. Weaker yen

Answer: b

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3. The appreciation of a currency will lead to:
- Increase in exports
  - Increase in imports
  - Decrease in imports
  - Increase in the balance of trade
  - Any of the above is likely.

Answer: b

4. Assume that originally 1 U.S. dollar = 1 euro. Which of the following may explain a change to 1 U.S. dollar = 1.3 euros?
- U.S. buyers prefer European products.
  - U.S. GDP increases, increasing U.S. incomes.
  - European banks increase their interest rates relative to the U.S. rates.
  - U.S. banks increase their interest rates relative to the European rates.
  - The price level in the countries of the European Union increases.

Answer: d

### Sample Free-Response Questions

1. Assume that the U.S. and Japan operate under a flexible exchange rate system and that the interest rate in both nations is the same.
- Using a correctly labeled graph of the foreign exchange market for yen, indicate the equilibrium exchange rate of the yen in terms of the dollar.
  - If the Federal Reserve sells bonds on the open market:
    - Explain how this will affect interest rates.
    - Indicate on the graph how the change in the interest rates will affect the value of the yen.
    - How will imports of U.S. products by the Japanese be affected?

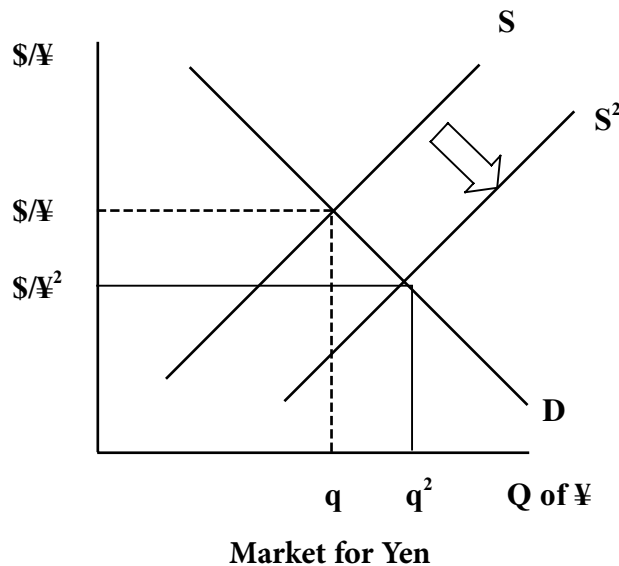


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### Scoring Rubric

7 points maximum, as follows:

Graph for parts (a) and (b)(ii): 2 points



Part (b)(i): 4 points—If the Federal Reserve sells bonds, the excess reserves in banks will decrease, decreasing the supply of money and increasing interest rates. Japanese investors will want to increase their holdings of U.S. securities. This will lead to an increase in the supply of yen in the foreign exchange market, shifting the supply curve to the right. This will lower the value of the Japanese yen and increase the value of the U.S. dollar.

Part (b)(iii): 1 point—Japanese imports of U.S. products will decrease due to the depreciation of the yen.

2. Interest rates in the countries of the European Union have not risen, but interest rates in the U.S. have risen and are now higher than the rates in the EU.
  - a. Explain the change in the international value of the dollar.
  - b. Explain the change in the international value of the euro.
  - c. Explain the effect on the U.S. exports to the member countries of the European Union.
  - d. Explain the effect on the European Union exports to the U.S.

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### Scoring Rubric

8 points maximum: Answers to parts (a) through (d) are worth 2 points each

- a. The value of the dollar will appreciate since capital will flow into the U.S. to earn the higher interest rate returns. Those people in the European Union wanting to invest in the U.S. will demand dollars and supply euros to the foreign exchange market.
- b. The value of the euro will depreciate since funds will flow from the member countries in search of better returns on their investment. Those people in the European Union wanting to invest in the U.S. will demand dollars and supply euros to the foreign exchange market.
- c. Exports from the U.S. will now be more expensive since citizens in the member countries will need to give up more euros to get a dollar for an export good. Exports from the U.S. will decline.
- d. Exports from the European Union are really U.S. imports. We must give up fewer dollars to obtain euros to buy their goods. Exports coming from the European Union will increase; U.S. imports will rise.

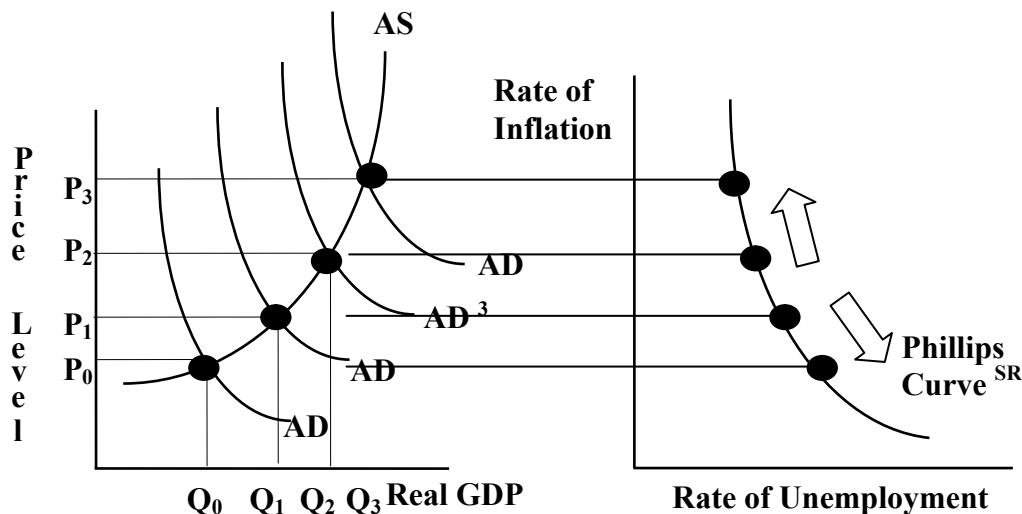
## The Short-Run and Long-Run Phillips Curves

Sue Weaver  
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 Ramona, California  
 and  
 Peggy Pride  
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 St. Louis, Missouri

Two important economic goals are low inflation with price stability and high employment. Are these goals compatible? Are they contrary? Beginning with the initial work by A. W. Phillips, the macroeconomic theory known as the Phillips curve has evolved to explain how these two goals of economic activity operate together.

### Short-Run Phillips Curve

1. Under normal conditions, there is a short-run trade-off between unemployment and inflation, and the Phillips curve shows this trade-off.
2. The Phillips curve demonstrates an inverse relationship between inflation and unemployment. **In the short run**, changes in aggregate demand are movements along the short-run aggregate supply curve:



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3. Expansionary fiscal policies will increase aggregate demand, causing unemployment to fall and price levels to rise. Contractionary fiscal policies will cause aggregate demand to decrease, causing price levels to fall and unemployment to rise.
  - a. As AD increases, both the price level and the real GDP increase.
  - b. The real GDP and the unemployment rate are inversely related, so the opportunity cost of reducing unemployment is higher inflation, and the opportunity cost of reducing inflation is higher unemployment.
  - c. In the short run, changes in AD are movements along the short-run aggregate supply curve.
  - d. If aggregate demand moves upward, the price level rises and the real GDP rises. This is reflected as a new point on the short-run Phillips curve showing a higher rate of inflation and higher unemployment. There will be a movement **up** the Phillips curve.
  - e. If AD moves down, the price level falls and the real GDP falls. This is reflected as a new point on the short-run Phillips curve showing a lower rate of inflation and lower unemployment. Movement will be **down** the Phillips curve.
4. Given AS, high rates of inflation should be accompanied by low rates of unemployment. This is the work of A. W. Phillips, who looked at data for the 1960s, which reinforced his Phillips curve idea.
5. In the last 25 years, there has been a changing interpretation of the short-run Phillips curve.
  - a. Most economists today accept the idea of a short-run trade-off, perhaps lasting a few years.
  - b. Many economists believe that adverse supply shocks can cause periods of rising unemployment and rising inflation. Rapid and significant increases in resource prices push AS to the left.
  - c. The OPEC-induced price increases for oil in the 1970s are an example. Agricultural problems, a depreciated dollar, and a rise in wages following the wage-price control of mid-1970s, combined with declining productivity, also contributed to the situation.
6. Stagflation was the term defined in the 1970s and early 1980s, which suggested that the Phillips curve shifted to a less desirable position, negating the trade-off between inflation and unemployment. High inflation was matched with high levels of unemployment. The short-run relationship was dispelled.
  - a. In the later 1980s and through the 1990s, the effect of high unemployment and hence smaller increases in wages was coupled with foreign competition that held down prices and wages. This seemed to be the demise of stagflation. Deregulation and the decline of OPEC's power pushed the rates back closer to the earlier tradeoff picture. The  $AS^{SR}$  shifted back to its old position, and the  $AS^{LR}$  adjusted.

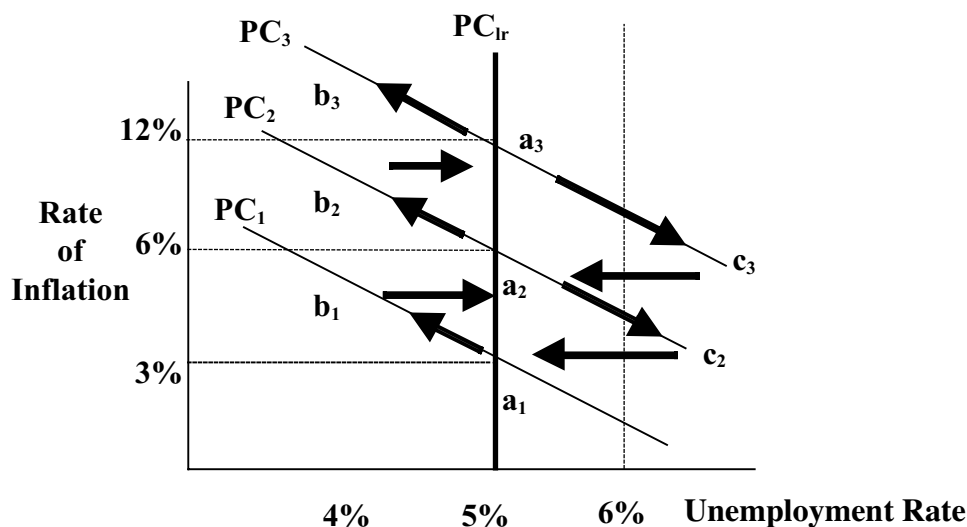
- b. During the decade of the 1990s, unemployment reached a 30-year low of 3.7 percent, a figure well below what most judge as the “natural rate.” Some economists suggest that the surplus budgets of the later 1990s, coupled with gains in productivity, helped the economy to grow at low rates of inflation and higher rates of employment.

### Long-Run Phillips Curve

1. In the long run, the Phillips curve is vertical at full employment because the actual inflation rate is equal to the expected inflation rate.
2. In the long run, the actual price level equals the expected price level, and output is at potential output with unemployment at its natural rate.
3. To compensate for a higher-than-expected price level (expansionary gap), labor shortages and dissatisfaction with lower **real** wages will lead to higher wages in the next round of negotiation.
  - a. The  $AS^{SR}$  curve will shift to the left (due to higher costs), returning the economy to its potential output.
  - b. The higher AD will have no lasting effects since the price level increase is not matched by a decline in employment.
4. To compensate for a lower-than-expected price level (recessionary gap), labor surpluses and firms gaining advantage in labor negotiations will force lower wage rates.
  - a. The  $AS^{SR}$  curve will shift to the right (due to lower costs), returning the economy to its potential output.
  - b. Both the price level and unemployment will fall.
5. Following the graph shown below, increases in AD beyond full employment (5 percent) temporarily boost profits, output, and employment ( $a_1$  to  $b_1$ ).
6. Nominal wages eventually catch up to sustain real wages.
  - a. AS decreases and the price level rises while real GDP falls.
  - b. Profits fall, canceling the short-run effect, with employment returning to its full employment level ( $b_1$  to  $a_2$ ) but at higher inflation.
7. The cycle starts again as AD grows, profits grow, and employment rises ( $a_2$  to  $b_2$ ).
  - a. Again, in time, nominal wages catch up, and employment returns to its natural rate.
  - b. The reward is a higher inflation rate.
8. There is not a stable relationship between unemployment and inflation as shown.
9. The long-run Phillips curve is the vertical line through  $a_1$ ,  $a_2$ , and  $a_3$ . Any rate of inflation is consistent with the 5 percent rate of unemployment.

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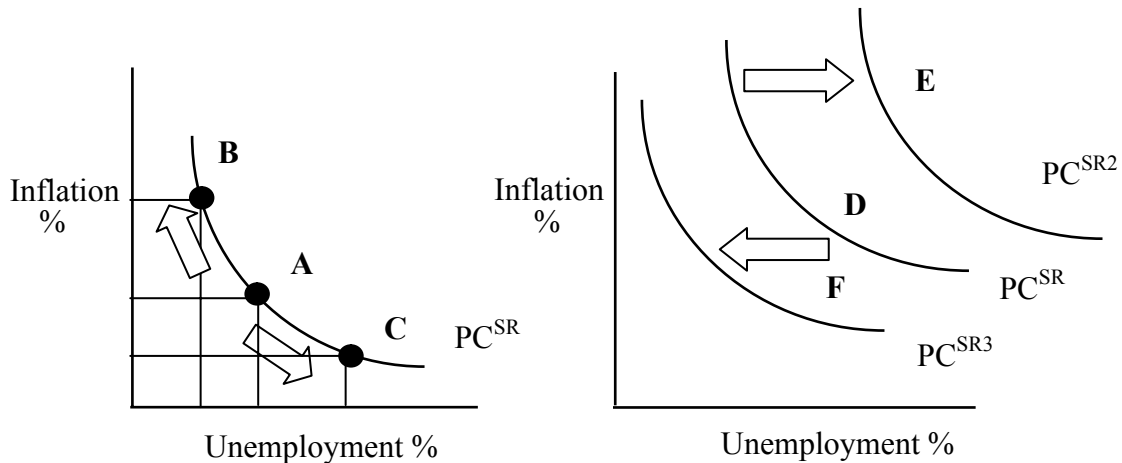
10. When there are changes in the natural rate of unemployment, both the short-run and long-run Phillips curves shift.



### Problem Set: Short- and Long-Run Phillips Curves

1. Draw a correctly labeled graph showing the short-run Phillips curve for Country Z. Label the graph  $PC^{SR}$ .
2. Amend the graph to show the effect of an expansionary fiscal policy. Use a label to identify the change. Explain your amendment to the graph.
3. Amend the graph to show the effect of a contractionary fiscal policy. Use a label to identify the change. Explain your amendment to the graph.
4. Draw a new correctly labeled graph showing the short-run Phillips curve for Country Z. Label the graph  $PC^{SR2}$ .
5. Amend the graph to show the effect of an aggregate supply shock. Use a label to identify the change. Explain your amendment to the graph.
6. Amend the graph to show the effect of a lower price for oil worldwide. Use a label to identify the change. Explain your amendment to the graph.
7. Why is the long-run Phillips curve vertical?
8. What causes a long-run Phillips curve to shift?

### Problem Set Answer Key



1. Note on the Phillips curve shown on the left, A is the original position before any amendment.
2. An expansionary fiscal policy will increase the AD, increasing both the price level and the real GDP. The inflation rate increases while the unemployment rate decreases. This is movement up the Phillips curve, noted by B.
3. A contractionary fiscal policy will decrease the AD, decreasing both the price level and the real GDP. The inflation rate decreases while the unemployment rate increases. This is movement down the Phillips curve, noted by C.
4. Note on the Phillips curve shown on the right, D is the original position before any amendment.
5. An aggregate supply shock will decrease the AS. This causes the price level to rise and the real GDP to fall. The trade-off between unemployment and inflation is still true, but the curve must shift upward to reflect higher rates of unemployment and inflation.
6. Lower prices for oil will increase the AS. This causes the price level to decrease and the real GDP to increase. The trade-off between unemployment and inflation is still true, but the curve must shift downward to reflect lower rates of unemployment and inflation.
7. In the long run, the Phillips curve is vertical at full employment because the actual inflation rate is equal to the expected inflation rate. In the long run, the actual price level equals the expected price level, and output is at potential output with unemployment at its natural rate.
8. The long-run Phillips curve will shift when there are changes in the natural rate of unemployment.

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### Sample Multiple-Choice Questions

1. The traditional Phillips curve shows the:
  - a. Direct relationship between the rate of inflation and the unemployment rate
  - b. Inverse relationship between the rate of inflation and the unemployment rate
  - c. Direct relationship between the short-run and the long-run aggregate supply
  - d. Inverse relationship between the short-run and the long-run aggregate supply
  - e. No relationship between the rate of inflation and the unemployment rate

Answer: b

2. Negative supply shocks will:
  - a. Move the economy along the Phillips curve toward less unemployment
  - b. Move the economy along the Phillips curve toward less inflation
  - c. Shift the Phillips curve to the left
  - d. Shift the Phillips curve to the right
  - e. Not move the Phillips curve at all

Answer: c

3. A vertical long-run Phillips curve would most likely be associated with:
  - a. A rate of inflation that is zero
  - b. A rate of unemployment that is low
  - c. The natural rate of unemployment
  - d. An aggregate demand increase
  - e. An aggregate demand decrease

Answer: c

4. Given a fixed Phillips curve with stable inflation and unemployment trade-offs, it appears that:
  - a. An expansionary fiscal policy can shift the curve to the right.
  - b. A contractionary fiscal policy can shift the curve to the right.
  - c. Manipulating aggregate demand through fiscal policy has the effect of causing movement along the curve.
  - d. Manipulating aggregate demand through fiscal policy has the effect of shifting the curve.
  - e. Fiscal policy has no effect on the Phillips curve.

Answer: c



5. A rightward shift of the short-run Phillips curve suggests that:
- A lower rate of unemployment is associated with each inflation rate.
  - The aggregate supply has moved to the left, and the aggregate demand has moved to the right.
  - The aggregate supply curve has shifted to the left.
  - The aggregate demand curve has shifted to the left.
  - The aggregate demand curve has shifted to the right.

Answer: c

### Sample Free-Response Questions

Questions 1 and 2 refer to this table:

Year	Inflation Rate	Unemployment Rate
2001	4%	6%
2002	6%	5%
2003	7%	4%

- Based on the above data, draw a correctly labeled short-run Phillips curve for Country X. Label the curve  $PC^{SR}$ .
  - Identify how each of the following affects inflation, unemployment, and the short-run Phillips curve:
    - Increase in taxes
    - Increase in costs of production
  - Assume that the natural rate of unemployment in Country X is 5 percent. Draw the long-run Phillips curve on the graph drawn in part (a) and label it  $PC^{LR}$ .
  - What is the relationship between the rate of inflation and the unemployment rate in the long run?
- Draw a correctly labeled graph showing the short-run and long-run Phillips curves for Country X.
  - Identify how each of the following affects inflation, unemployment, and the short-run Phillips curve:
    - Expansionary fiscal policy
    - Drop in the cost of a resource used across the economy

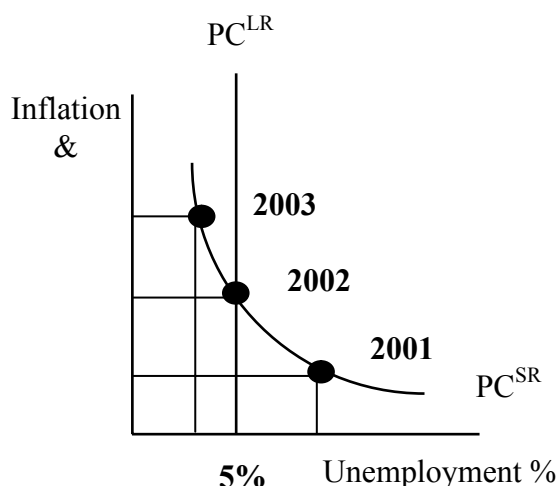
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### Scoring Rubric

1. 8 points maximum

a. 2 points

An accurate Phillips curve, inflation labeled on the vertical axis and unemployment labeled on the horizontal axis, and a downward sloping short-run Phillips curve.



b. 4 points

i. An increase in taxes will shift the aggregate demand curve to the left, which causes the inflation rate to decrease and unemployment to increase. This causes movement down a short-run Phillips curve. Award 1 point for each of the following:

- Correctly identifying inflation decreases and unemployment rate increases
- Correctly identifying movement down the short-run Phillips curve

ii. An increase in costs of production will cause a leftward shift of the aggregate supply curve, which causes inflation and unemployment to rise. This will cause an outward shift to the right of the short-run Phillips curve. Award 1 point for each of the following:

- Correctly identifying that inflation increases and unemployment increases
- Correctly identifying that the Phillips curve shifts to the right

c. 1 point

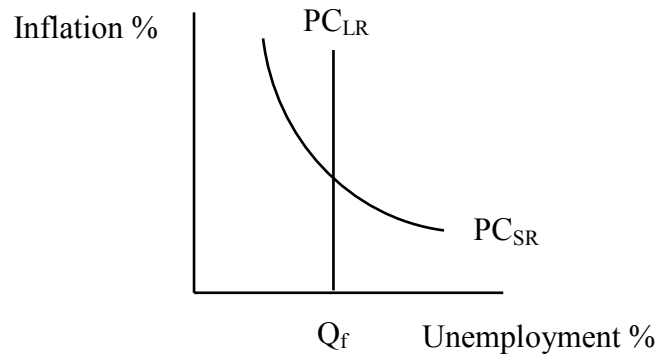
The long-run Phillips curve will be vertical at the 5 percent natural rate of unemployment, as shown above in part (a).

d. 1 point

There is no trade-off between unemployment and inflation in the long run.

## Special Focus: Mastering Economic Thinking Skills

2. 7 points maximum



a. 3 points

An accurate short-run Phillips curve, inflation labeled on the vertical axis and unemployment labeled on the horizontal axis; a downward-sloping short-run Phillips curve; and a vertical long-run Phillips curve with  $Q$  at full employment labeled.

b. 4 points

- i. An expansionary fiscal policy will shift the aggregate demand curve to the right, which causes the inflation rate to increase and unemployment to decrease. This causes movement up a short-run Phillips curve. Award 1 point for each of the following:
  - Correctly identifying inflation increases and unemployment decreases
  - Correctly identifying movement up the short-run Phillips curve
- ii. A decrease in costs of production will cause a rightward shift of the aggregate supply curve, which causes inflation and unemployment to fall. This will cause an inward shift to the left of the short-run Phillips curve. Award 1 point for each of the following:
  - Correctly identifying that inflation decreases and unemployment decreases
  - Correctly identifying that the Phillips curve shifts to the left

### Contributors

#### About the Editor

**Peggy Pride** received both an undergraduate degree in history and economics (1971) and a master's degree in business education (1986) from Southern Illinois University at Edwardsville. She has taught at St. Louis University High School since August of 1981 and currently teaches four sections of AP Microeconomics and Macroeconomics. She was given the Teacher of the Year award by the Global Association of Teachers of Economics in 2005. She has been the Micro Question Leader at the annual Reading for the past four years, served for five years on the AP Economics Development Committee, and is the current content adviser for economics on AP Central. She lives in Swansea, Illinois, with her husband, David. They enjoy spending time with their two sons, who live and work in Chicago and St. Louis. They benefit from traveling to wonderful places worldwide and sharing their experiences with family and friends.

**Eric Dodge** received his bachelor's degree in business administration from the University of Puget Sound and his master's and doctoral degrees in economics from the University of Oregon. While at the University of Oregon he taught both micro and macro principles as well as industrial organization. Since 1995, he has taught at Hanover College, a small, private, liberal arts college in Indiana, where he teaches courses in micro and macro principles, intermediate micro theory, environmental economics, industrial organization, labor economics, applied statistics, and econometrics. He is the author of *5 Steps to a 5: AP Microeconomics/Macroeconomics* (McGraw-Hill, 2005).

**Rae Jean Goodman** earned her Ph.D. in economics from Washington University in St. Louis in 1976. Her areas of expertise in economics include monetary policy and institutions, economic education, and econometrics. She is the director of teaching and learning and a professor of economics, and she has had more than 30 years of teaching and administrative experience at the United States Naval Academy. In addition to faculty workshops and seminars, she initiated the use of teaching portfolios at the Naval Academy and a series of new faculty teaching and learning workshops. She also helped to create the Instructional Development Support Center, a centralized, client-oriented support facility intended to introduce emerging educational technologies and to help faculty integrate appropriate technology into the teaching, learning, and assessment process. She helped revise the third edition of *Advanced Placement Economics* (NCEE) and recently presented a paper at the Lilly Conference on College Teaching at Miami University of Ohio.

## Special Focus: Mastering Economic Thinking Skills

**Mary Kohelis** teaches AP Economics and world history at Brooke High School in Wellsburg, West Virginia. She received her B.S. from Ohio State University and her M.S. from Marshall University. Serving as a faculty consultant, she has presented AP Economics workshops for the College Board and the West Virginia Center for Professional Development. In 1990 she was named the Economics Teacher of the Year by the West Virginia Council on Economic Education and the West Virginia Enterprise and Education Foundation and in 2004 she was named the Brooke County Teacher of the Year. She has served as an AP Economics Reader for the past 13 years and also currently serves as a member of the AP Economics Development Committee.

**Margaret Ray** is a professor of economics at the University of Mary Washington. She received her Ph.D. in economics from the University of Tennessee. She has taught economics at both the college and high school level. She is actively involved in AP Economics as a College Board certified consultant, conducting professional development workshops and writing curriculum. She has written questions for the AP Economics Exam and been a Reader and Table Leader at the AP Reading for the past 14 years.

**Pamela M. Schmitt** received her B.S. from Villanova University and her M.A. and Ph.D. in economics from Indiana University. The author of several articles on marginal theory and bargaining games, she has taught at Indiana University and the United States Naval Academy. She has been a Reader and Table Leader for the AP Microeconomics Exam Reading.

**Sue Weaver** is a teacher at Ramona High School in Ramona, California, and at Palomar College. She received her M.A. in economic education from the University of Delaware. She is a consultant for the College Board and the Foundation for Teaching Economics. She has been the San Diego County Economics Teacher of the Year, California State Economics Teacher of the Year, and the FTE National Teacher of the Year. She is also the cofounder of the California Association of School Economics Teachers.

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