

Microeconomics Topic	Year and Form					
	2010	2010 Form B	2009	2009 Form B	2008	2008 Form B
perfect competition	1 a, 1 c					
monopoly model		1 a	1			
<b>monopolistic competition</b>				1		
oligopoly game theory			3		3	
change in S or D product market	1 c, 1 d	1 e				
<b>change in S or D factor market</b>		2 e				
<b>law of diminishing marginal returns</b>		2 b and c				
<b>lump-sum tax/subsidy</b>			1 b			
accounting profit	3 a	1 c	1 d			
break even Q		1 d (i)	1 c			
socially optimal Q	3 b		1 a (iv), 1 e			
per unit tax			2 b			
<b>price elasticity of D</b>	1 b	1 d (ii), 3 a (i)	2 c			
<b>cross-price elasticity of D</b>				2 b		
<b>income elasticity of D</b>		3 b				
<b>elasticity of S</b>		3 a (iii)				
substitution effect				2 c		
allocative efficiency		1 b	2 d	1 d		
economies of scale		1 f		1 e		
consumer utility maximization				2 a		
<b>factor market labor</b>						
<b>factor market capital</b>	2 a					
<b>mfp of labor or capital</b>	2 b (ii)					
<b>mfp labor or capital</b>	2 b (i)					
<b>cost minimizing combination</b>	2 c					
externalities	3 b, 3 c					
dead weight loss	3 c (ii)					
consumer surplus	3 a (i), 3 c (i)					
producer surplus	3 a (ii)		2 a, 2 b (iii)			

prepared by Joy L. Joyce (11/14/10)

## ***Microeconomics: Just the Facts (and a few opinions)***

2010 International Advanced Placement Economics Teacher Conference  
Federal Reserve Bank of Richmond and Powell Center for Economic Literacy

**Joy L. Joyce, University of Illinois at Chicago Center for Economic  
Education, [joyljoyce@gmail.com](mailto:joyljoyce@gmail.com)**

### **Teaching about Elasticity**

In addition to the resources in the packet, teachers may want to investigate the following additional resources:

To demonstrate “elastic” and “inelastic” as described in Charles Stull’s “How the Ball Bounces” obtain Happy/Sad balls from Flinn Scientific (1-800-452-1261) \$10.80 # AP1971 PO Box 219, Batavia, IL 60510, <http://www.flinnsci.com>

Watch a demonstration of Happy/Sad Balls on youtube at [www.youtube.com/watch?v=ciageLSYXUE](http://www.youtube.com/watch?v=ciageLSYXUE)

Complete instructions for “A Classroom Game for Developing Market Demand and Demand Elasticities: **The Snicker Effect**,” Cynthia Hill, Department of Economics Idaho State University.  
<http://www.marietta.edu/~delemeeg/exprenom/Fall2001/hill.html>

Additional games can be found at <http://www.marietta.edu/~delemeeg/games/>

“Price Elasticity: From Tires to Toothpicks” can be found at EconEdLink  
<http://www.econedlink.org/lessons/economic-lesson-search.php?type=educator>

## 5.1 How the Ball Bounces

Type :	In-Class demonstration
Topics:	elastic, inelastic
Textbook:	Chapter 5 Elasticity and Applications
Materials needed:	one rubber ball and one "dead" ball. The "dead" ball is made of shock-absorbing material and doesn't bounce. Museum stores and magic shops carry them.
Time:	1 minute
Class limitations:	works in any size class

### **PURPOSE**

This quick, but memorable, demonstration can be used to introduce the concepts of elastic and inelastic.

### **INSTRUCTIONS**

Bring two students to the front of the class. Give each of them a ball and ask them to bounce it off the floor and catch it. The student with the rubber ball can do this easily. The student with the "dead" ball will not be able to bounce it high enough to catch, no matter how hard they throw it.

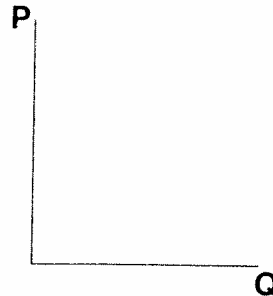
Explain that one ball is elastic; it is responsive to change. The other ball is inelastic; it responds very little to change. These physical properties of elastic and inelastic are analogous to the economic concepts of elastic and inelastic.



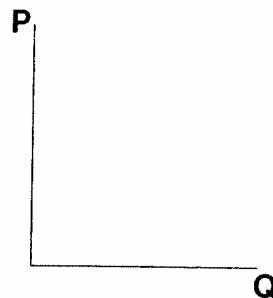
## Teams

Choose a spokesperson for your team. Brainstorm the answers to the following questions together. Make sure your spokesperson is ready to defend your answers.

1. Economists estimate that the price elasticity of demand for heroin is 0.4. What does that mean? Show the demand for heroin graphically.



2. Efforts to limit the supply of heroin has had little impact on the quantity demanded for heroin. Why? Show graphically.



3. Doubling federal law enforcement efforts to block heroin imports is estimated to raise its price by 13%. By what percentage would quantity sold fall? (Use the formula for elasticity in your textbook.)

4. If the price of heroin rises, given its inelastic demand, what happens to the incomes of heroin dealers?

5. The price elasticity of demand for marijuana is estimated to be 1.5. What does that mean? Why is demand for marijuana more price elastic than heroin?

## Elasticity and the demand for drugs

6. If the price of marijuana rises by 10%, by what percentage would quantity sold fall?

7. Efforts to raise the price of drugs to discourage use would be most effective against heroin or marijuana?

8. Brainstorm a list of all possible methods to reduce drug use in the U.S.

**Methods to Reduce Demand**

**Methods to Restrict Supply**


In your team's opinion, which approach would be most effective? Why?

## Teams

Your group will be assigned one good or service. Your goal is to estimate the price elasticity of demand for it.

### Step 1

Write out the formula for elasticity of demand:

### Step 2

In your own group, find out what is the highest price at which **only** one person will buy this product?

(Write down  $P1 = \underline{\hspace{2cm}}$   $Qd1 = \underline{1}$ )

Lower the price so that **at least** one more person in your group will buy this product.

(Write down  $P2 = \underline{\hspace{2cm}}$   $Qd2 = \underline{\hspace{2cm}}$ )

### Step 3

Using these two prices, survey students in one other group as to their willingness to buy. Total the quantity demanded at these prices, *including your group as well as the other students you surveyed.*

$P1 = \underline{\hspace{2cm}}$   $Qd1 = \underline{\hspace{2cm}}$   $P2 = \underline{\hspace{2cm}}$   $Qd2 = \underline{\hspace{2cm}}$

### Step 4

1. Now calculate the price elasticity of demand.
2. Is demand in this case elastic or inelastic?
3. What factors might explain why it is elastic or inelastic?
4. How does it compare with other elasticities listed in your textbook?

Elasticity



Activity #10

# Estimating Elasticity of Demand

**Taxes**



**Activity #27**

**Tax incidence and elasticity**

**Step 1**

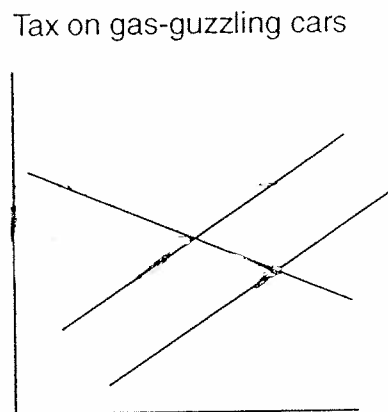
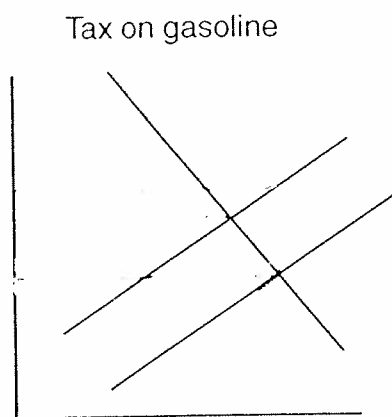
Select one of the roles below. If there are three students in the group, then work on number 4 together after you finish step 2. If there are more than four students in the group, double up on one or more roles.

Group	Your concern
1. US consumers -----	Worry about prices
2. US government -----	Worry about collecting tax revenue
3. US environmental group -----	Worry about pollution caused by emissions
4. US business group -----	Worry about higher costs reducing profits

**Step 2**

The government is considering a tax on gasoline, or a tax on gas-guzzling cars. The effect of each tax on costs is shown in the diagrams below.

1. Label each diagram to show the impact of the tax on *your* group.



2. Determine whether your group would prefer a tax on gas or gas-guzzling cars.

**Step 3**

As a team, answer the following.

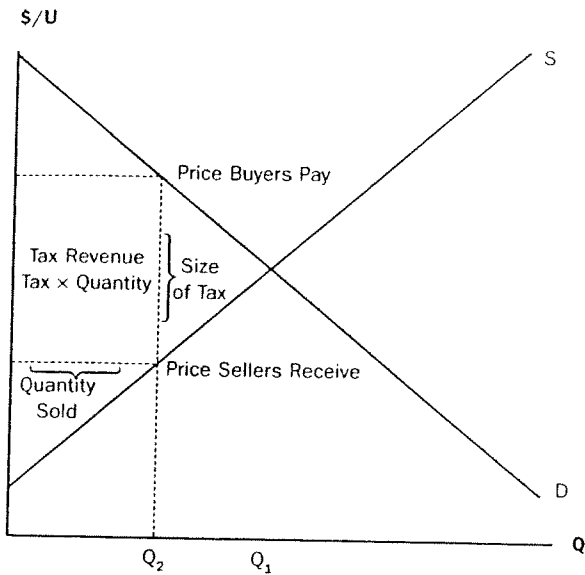
1. Make certain that you have shown the effect for all four groups listed above. Explain which type of tax each group would favor.

2. Why do the demand curves differ for the two products? How does this difference affect the impact of a tax?

3. Thinking as an economist with the welfare of the entire society in mind, which tax would you prefer? Why?

Keenan and Maier  
Economics  
LIVE / 50  
Learning Economics the Collaborative Way  
3rd Ed.

**COST OF TAXATION SOLUTIONS**



1. Figure 1 (above) shows the supply and demand for a product and the resulting equilibrium price of  $P_e$  before the imposition of a tax. Figure 1 also shows the result of imposing a tax which acts as a wedge between buyers and sellers of the product. The size of the tax is indicated on Figure 1. Show the price that buyers will now pay and the price that sellers will now receive. Show the quantity with the tax.

*See graph*

2. Calculate and show on the graph the amount of revenue generated from the imposition of this tax.

*See graph*

**Appendix A: Market Demand Experiment Instructions****Situation 1**

The full lesson can be down-loaded from

<http://www.marietta.edu/~delemeeg/expnom/Fall2001/hill.html>

You are a consumer of goods for sale in our classroom "store". You have a total income of \$5 to spend on goods. You may buy any number of the products that you desire (as long as you spend only \$5) and you certainly don't have to purchase all of the products, but you must spend all of your income. The prices of the products for sale are listed below.

Write down the number of each product you decide to buy next to the product price in the "Individual Quantities" column (the "Market Quantities" column will be dealt with later).

	Individual Quantities	Market Quantities
Can of Coke =\$1		
Snickers Bar =\$1		
Twinkie =\$1		
Carton of Milk =\$1		

**Situation 2- "A New Day"**

Due to a peanut production catastrophe the price of Snickers Bars increases to \$2, and all of the other product prices remain unchanged. Once again write down the number of each product you decide to buy next to the product price (below) allowing only for the change in the price of Snickers Bars, your income is still \$5.

**Individual Quantities Market Quantities**

	Individual Quantities	Market Quantities
Can of Coke =\$1		
Snickers Bar =\$2		
Twinkie =\$1		
Carton of Milk =\$1		

**Situation 3 - "Another New Day"**

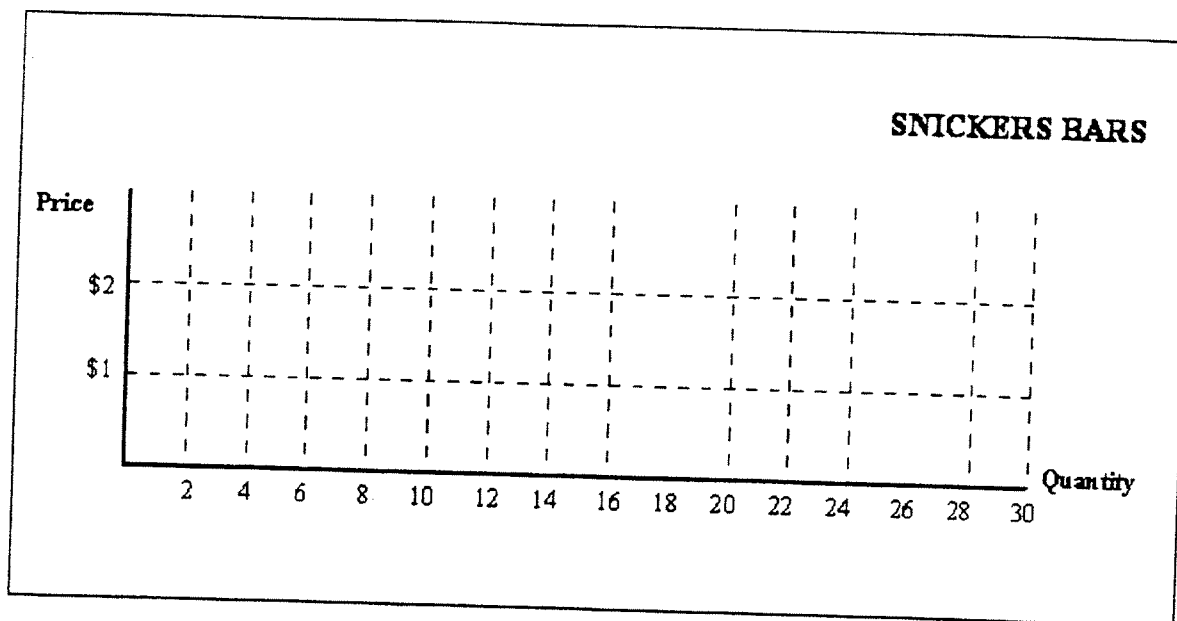
The peanut production catastrophe gets all straightened out (i.e., the price of Snickers Bars decreases to its original market price of \$1). Further, a university donor has offered more scholarship support to students, leading to increased income for all. Once again, log your purchases next to the product price (below) remembering to spend all of your income (\$8).

	Individual Quantities	Market Quantities
Can of Coke =\$1		
Snickers Bar =\$1		
Twinkie =\$1		
Carton of Milk =\$1		

As an Economist, you (yes you!) are interested in how these various factors impact the **Market Demand** for these products. Therefore, you need to develop a market demand curve. Get in a group of 5 – 8 people, and determine the "Market Quantities" for **situation 1** and **situation 2** only (simply sum the quantities demanded for each product at each price level over all individuals) and log the values in the spaces provided above. We will deal with situation 3 later.

You now have the ability to develop a demand curve for Snickers bars (remember that a market demand curve is simply the summation of individual demands at various prices).

**Draw the demand curve below.**



We also now have information regarding the *responsiveness* of quantity to a given change in price. This is known as "elasticity" or more specifically "price elasticity of demand" which can be computed by dividing the percentage change in quantity demanded by the percentage change in price:

$$E_d = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in price}}$$

*Note: A simple way to compute the percentage change in a variable is to divide the change in the value of the variable by the initial value.*

**Compute the price elasticity of demand for Snickers Bars.**

You know that income also impacts the demand for a product. Go back and fill in the Market Quantities column in situation 3. Examine specifically how the market quantities of Snickers Bars changed when income increased. Graph this new point (comparing situations 1 and 3). An increase in income leads to a shift in demand (in our case since we have only one point on our new demand curve, we will assume that it is a parallel shift). Draw the new demand curve below. We also have information regarding the *responsiveness* of quantity to a given change in income. This is known as income elasticity which can be computed by dividing the percentage change in quantity demanded by the percentage change in income.

$$E_I = \frac{\text{Percentage change in quantity demanded}}{\text{Percentage change in income}}$$

**Compute the income elasticity for Snickers Bars.**

## ***Microeconomics: Just the Facts (and a few opinions)***

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**Joy L. Joyce, University of Illinois at Chicago Center for Economic  
Education, [joyljoyce@gmail.com](mailto:joyljoyce@gmail.com)**

### **Teaching about Monopolistic Competition**

In addition to the resources in the packet, teachers may want to investigate the following additional resources/ideas:

For an updated 2010 list of brand names based on the work of Charles Stull, see “Brand Name Quiz and Incentive Behind Product Differentiation,” Xin Fang (to be posted in late 2010) at <http://cee.econ.uic.edu/workingpapers.html>

Use a blind taste test of similar products to assess the impact of advertising and marketing to develop brand loyalty.

*Using the Case Studies in the Text*

**Bagels from Boom to Bust** (text page 397)

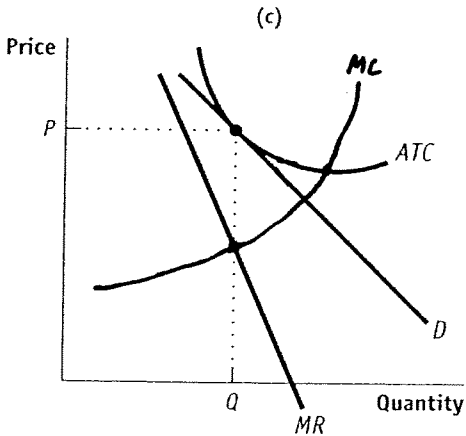
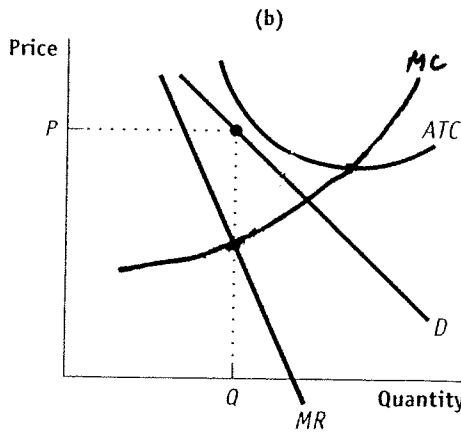
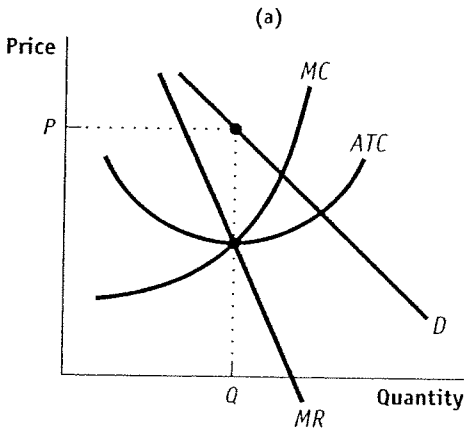
Ask students:

1. Why is the bagel market an example of monopolistic competition? (There are many sellers and products are differentiated. There are no barriers to entry and exit.)
2. Why did sales boom in the 1990s? (A change in consumer tastes or perhaps the popularity of New York-based TV shows.)
3. What happened to profits of previously existing bagel firms? (They were eroded due to the entry of new firms.)

**Activity**

**Who's Profitable?** (3-5 minutes)

Put the following three graphs on the board or on an overhead. Ask students to characterize the firm as earning economic profits, having break-even profit, or bearing losses.



Adapted from Krugman Wells 2nd Ed.

### *Creative Teaching Example 3*

## **TOOTHPASTE: REAL OR PERCEIVED PRODUCT DIFFERENTIATION?**

### **OVERVIEW<sup>1</sup>**

This demonstration can be used to discuss the difference between real and perceived product differentiation, and can be used in the section on Monopolistic competition. It is also a useful springboard for a discussion of advertising and the role of information in markets.

### **WHAT TO DO**

Collect a variety of toothpaste boxes. I use both national brands and generic, and include different varieties of the same brand (gel, mint flavor, tartar control, etc.). Distribute the toothpaste boxes randomly to students in class. Ask them to alternate reading the ingredients from the side of the boxes. Many brands will have identical ingredients, even down to the same coloring agents and artificial flavors.

Although the ingredients are essentially the same, the price of Crest is not the same as the price of the generic fluoride toothpaste. This exercise will lead to a lively discussion of the differences between real and perceived product differentiation, the role of advertising, consumer tastes, and brand loyalty. For an interesting variation, use different packages from pain reliever products.

<b>Regular Flavor Crest® Toothpaste</b>	<b>Generic Regular Flavor Fluoride Toothpaste</b>
Ingredients:  “ <b>Active:</b> Sodium Fluoride (0.15% w/v fluoride ion) <b>Inactives:</b> Sorbitol, Water, Hydrated Silica, Trisodium Phosphate, Sodium Lauryl Sulfate, Flavor, Sodium Phosphate, Xanthan Gum, Carbomer 956, Sodium Saccharin, Titanium Dioxide, FD&C Blue No. 1.”	Ingredients:  “Sodium Fluoride in a Dentifrice Base of Sorbitol, Water, Hydrated Silica, Trisodium Phosphate, Sodium Lauryl Sulfate, Flavor, Sodium Phosphate, Xanthan Gum, Carbomer-940, Sodium Saccharin, Titanium Dioxide, and FD&C Blue No. 1.”

*Dirk Vandell.*  
*Using Experiments, Cases, and Activities in the Classroom*  
*2<sup>nd</sup> ed. 2002 Prentice Hall*

<sup>1</sup> I thank Alan Gin, my colleague at the University of San Diego, for sharing this idea.

### 17.1 Brand Names

Type :	In-Class assignment
Topics:	product differentiation
Textbook:	Chapter 17 Monopolistic Competition
Materials needed:	enough copies of the questions for each student
Time:	10 minutes
Class limitations:	works in any size class

#### **PURPOSE**

This activity illustrates the importance of product differentiation in consumer products.

#### **INSTRUCTIONS**

Give the students the following quiz. Ask them to make their best guess if they are not certain about a particular product. Assure them their grades will not be affected by their scores on these questions. After they finish, go through the questions product by product, asking the class to raise their hands if they circled that product.

#### **COMMON ANSWERS AND POINTS FOR DISCUSSION**

Student answers will be spread across the various brands for each company. All their answers are correct. In each case, the company makes every brand listed.

This illustrates the importance of product differentiation in consumer markets. These firms go to great expense to establish and maintain separate brand identities for products that essentially serve the same function.

This quiz can be a good way to introduce the effect of product differentiation on demand, or to introduce the impact of advertising.

*Classroom Activities, Demonstrations and Games Manual  
2nd Ed, Charles A. Stull*

Harcourt, Inc.

*to accompany N. Gregory Mankiw's Principles of Economics*

Name \_\_\_\_\_

Course \_\_\_\_\_

## BRAND NAMES

Identify the brands made by each company

1. Margarine. Unilever makes:  
a. Imperial b. Promise c. Country Crock d. Shedd's  
e. Krona f. Mrs Filbert's g. I Can't Believe It's Not Butter
2. Bottled water. Nestle' makes:  
a. Perrier b. Arrowhead c. Poland Spring  
d. Calistoga e. Vittel f. Contrex
3. Pet Food. Quaker makes:  
a. Gravy Train b. Gaines Burgers c. Cycle  
d. Kibbles 'n Bits e. Top Choice f. Ken-L-Ration
4. Soap. Proctor and Gamble makes:  
a. Safeguard b. Zest c. Ivory d. Camay
5. Jeans. V.F. Corporation makes:  
a. Lee b. Wrangler c. Rustler d. Girbaud
6. Pasta. Borden makes:  
a. Creamette b. Prince c. Bravo  
d. Dutch Maid e. Gioia f. Anthony's
7. Coffee. Phillip Morris makes:  
a. Yuban b. Maxim c. Sanka  
d. Maxwell House
8. Consumer Electronics. Matsushita makes:  
a. Panasonic b. Technics c. Quasar d. National
9. Gin. Diageo PLC makes:  
a. Gilbey's b. Gordon's c. Tanqueray

## 17.2 Equilibrium Price for Blue Jeans

Type :	In-Class demonstration
Topics:	product differentiation
Textbook:	Chapter 17 Monopolistic Competition
Materials needed:	none
Time:	5 minutes
Class limitations:	works in any size class

### **PURPOSE**

This assignment shows that market supply and demand graphs give an oversimplified picture of price when products are differentiated.

### **INSTRUCTIONS**

Ask the students to draw a supply and demand graph illustrating the market for blue jeans. After they have drawn the graph, have them label the equilibrium price with a real dollar figure. This dollar amount should reflect the price of jeans as accurately as possible.

Draw a standard supply and demand graph on the board. Ask a student for the equilibrium price. Ask several more students for their prices.

Common answers and points for discussion

The class will have a whole range of prices for blue jeans, reflecting the range of blue jeans in the real world. Recent prices at one shopping mall varied from \$14 to over \$100 for a pair of blue jeans.

The price differences reflect product differentiation. Quality, style, and reputation all effect the price of jeans. The same jeans sold by different retailers are likely to be priced differently.

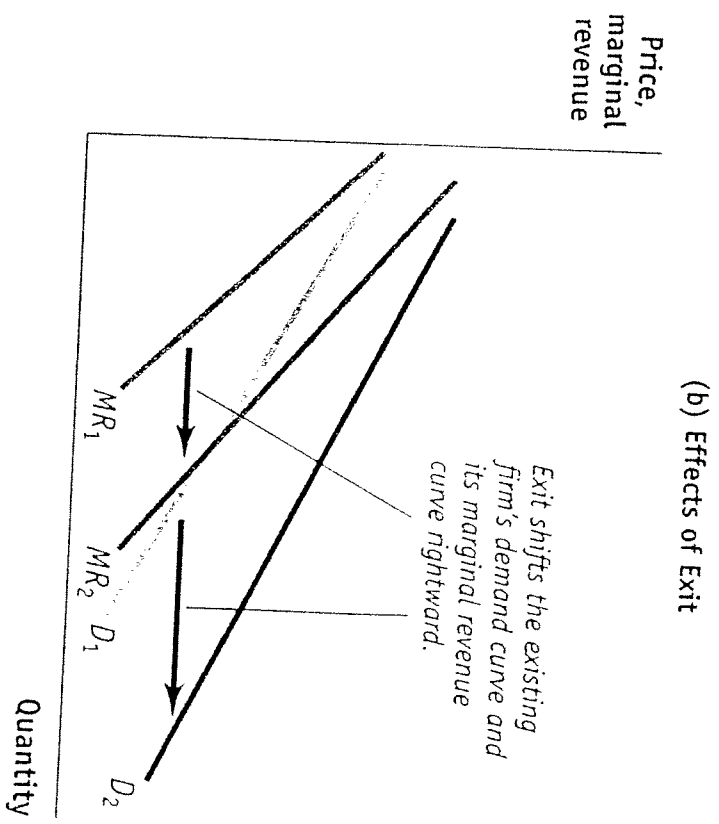
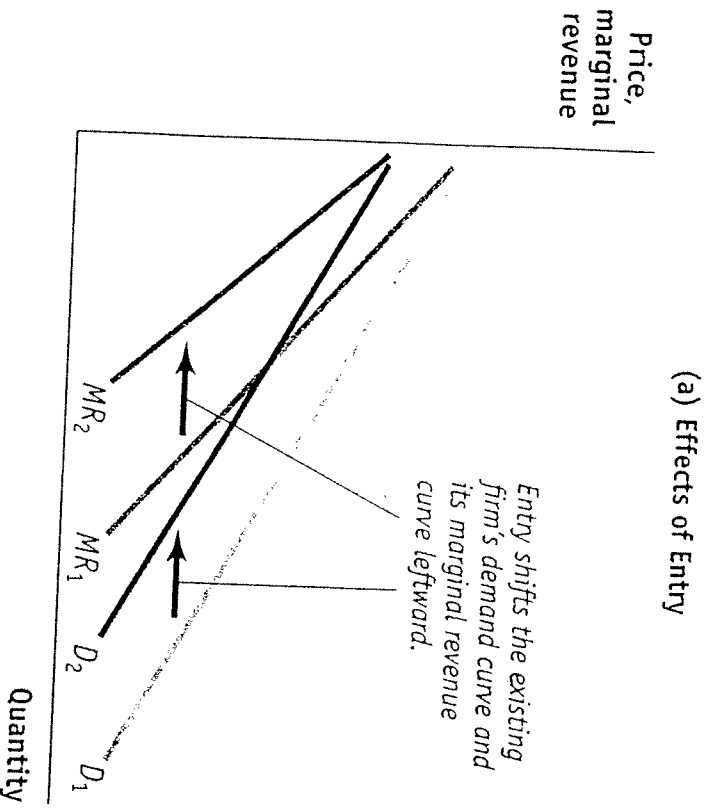
The simple supply and demand graph can be useful for broad analysis of the market for jeans, but individual prices and quantities are determined by the demand and cost curves of the individual products.

*Stull*

Harcourt, Inc.

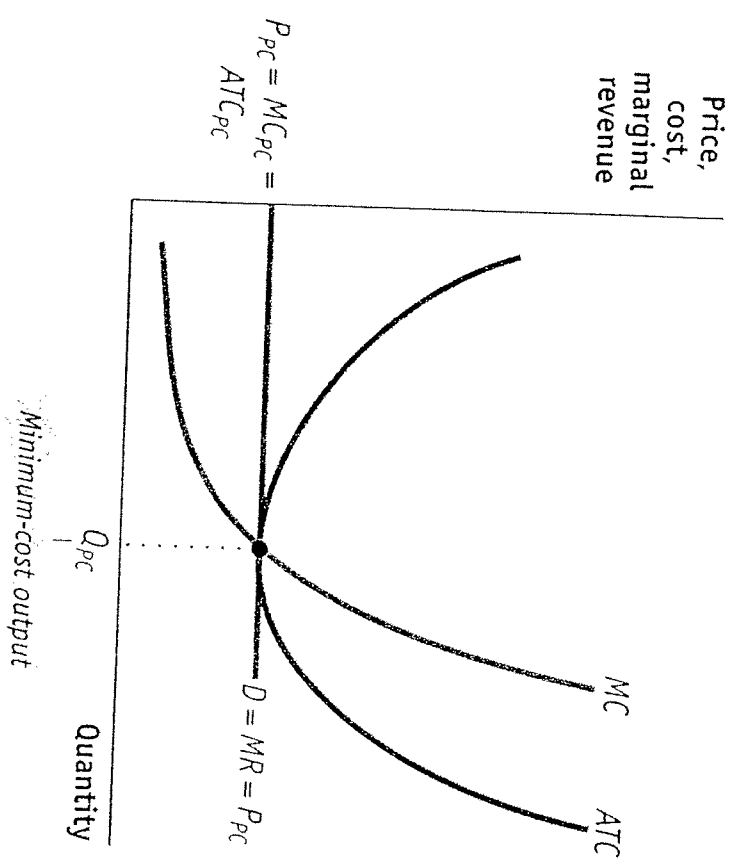
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*Classroom Activities*

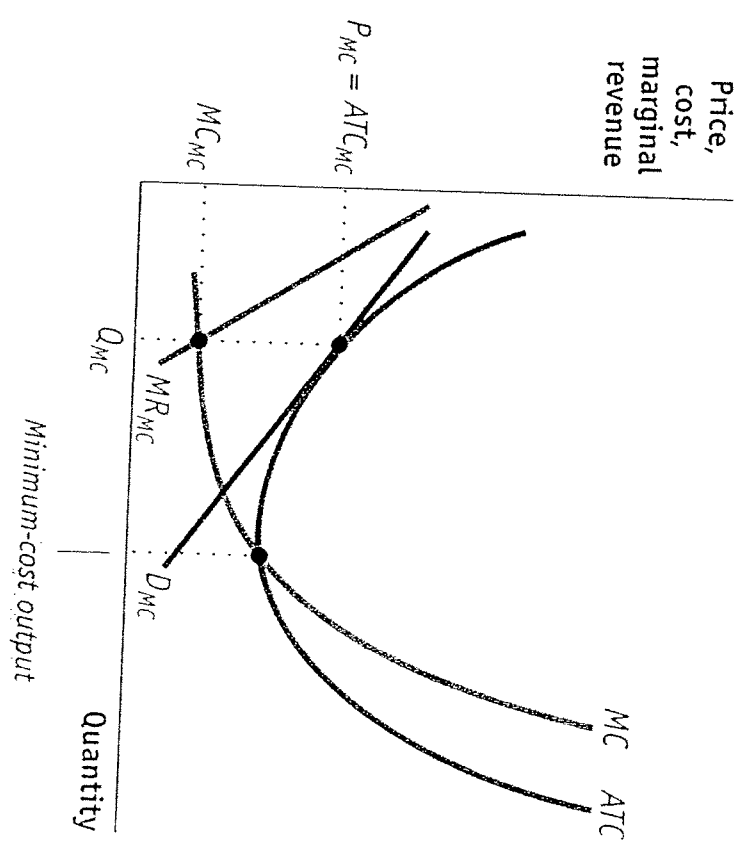


**Figure 16.2** Entry and Exit Shift Existing Firm's Demand Curve and Marginal Revenue Curve  
 Krugman and Wells: Microeconomics, Second Edition  
 Copyright © 2009 by Worth Publishers

(a) Long-Run Equilibrium in Perfect Competition



(b) Long-Run Equilibrium in Monopolistic Competition



**Figure 16.4** Comparing Long-Run Equilibrium in Perfect Competition and Monopolistic Competition  
 Krugman and Wells: Microeconomics, Second Edition  
 Copyright © 2009 by Worth Publishers

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### **Teaching about Factor Markets**

In addition to the resources in the packet, teachers may want to investigate the following additional resources:

To investigate ideas behind marginal revenue product, adapt the lesson “Deserted Island” found in *Mathematics and Economics: Connections for Life*, NCEE (Virtual Economics 3.0 CD). This lesson examines the market value of different skills.

To further demonstrate issues surrounding labor supply and unemployment rates see “A Classroom Unemployment Compensation Experiment,” Denise Hazlett, *Southern Economic Journal*, 2004, Volume 70, Number 3, pp. 694-704.

For supply and demand in the factor market, there is an online simulation for labor, “Price Discovery through Auction Simulation” developed through the Office of Economic Education at the University of Arizona by Cathleen Johnson  
<http://www.teacheconomicfreedom.org/lessons/>

### 13.1 Growing Rice on a Chalkboard

Type :	In-Class Demonstration
Topics:	diminishing returns and increasing costs
Textbook:	Chapter 13 The Costs of Production
Materials needed:	2 volunteers, chalkboard, chalk, 2 "loans"
Time:	25 minutes
Class limitations:	works in classes with more than 15 students

#### **PURPOSE**

Students often have difficulty understanding why diminishing returns exist in short-run production. This activity vividly demonstrates how fixed factors constrain the returns to variable inputs. Then the cause of increasing marginal cost is obvious.

#### **INSTRUCTIONS**

Each "loan" is a sheet of paper with a large dollar sign (\$) written on one side and the word "LOAN" on the other. Prepare the game by selecting two volunteers and outlining two rectangular areas on the chalkboard, approximately 2 x 3 feet. Next to each area, label a column "Labor" and another "Total Output." Give each volunteer one piece of chalk and hide any other pieces. The chalk is a fixed factor of production.

The volunteers are farmers and the outlined areas are their farm fields. They produce rice by writing the word "RICE" in large letters inside their own field. The letters need to be at least 3 inches high. They want to produce as much rice as possible in each 15 second time period.

Of course, it takes big bucks to farm (show the class the large \$) and the money comes in the form of a loan (show them the other side of the paper). Tell the volunteers, "Before you can start producing, you will need to run to the back of the classroom and get a loan from me."

The variable input in this example is labor. The game is played repeatedly, adding another student each period. Eventually 5 students will be crowded around each "field" trying to write with a tiny piece of chalk.

The constraints from the fixed factors are physically demonstrated.

Start the game with zeros in both the labor and total output columns; with no labor, no rice is produced. Then have the 2 volunteers race to see how much they can produce in 15 seconds. Record their production under "Total Output" with 1 "Labor."

Now have each volunteer choose a classmate as a farm worker and replay the game. The students will need to share the piece of chalk, but only one student needs to run for the loan. The other can start writing immediately. At the end of 15 seconds record their output.

Repeat the game until there are 5 students on each farm. By this point, diminishing and perhaps negative returns will be exhibited. Thank the students and have them return to their seats.

A typical result would look like this

Labor	Total Output
0	0
1	3
2	15
3	25
4	32
5	33

### POINTS FOR DISCUSSION

Marginal product can be calculated to show the contribution of additional workers.

Labor	Total Output	Marginal Product
0	0	—
1	3	3
2	15	12
3	25	10
4	32	7
5	33	1

The cost of producing additional units depends on labor costs and marginal productivity. Initially, marginal costs fall. Then as the constraints of the fixed factors become limiting, marginal costs will rise.

Favorite Ways to Learn Economics

2nd Ed 2006

Anderson and Chasey

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Chapter 6/Factor Markets

3. Indicate what (if anything) would happen to the demand for labor after each of the following.
  - a. An increase in worker productivity
  - b. An increase in the popularity of the product
  - c. A decrease in worker motivation and interest in the job
  - d. The introduction of new technology that makes workers able to produce more in a given amount of time
  - e. A decrease in the price of the product

**Problem Set 6.5**

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*The Optimum Resource Mix*

As a recent graduate of the Graduate School of Business at the University of Northern Freshwater, you have been hired as a consultant. Your first project is to organize production for a manufacturing firm at each of its five plants. Your project goal is to reach targeted amounts of production while achieving minimum resource cost. The figures provided are the amounts of various inputs presently used in the production process at each plant.

The inputs used are priced as follows:

Land: \$5 per hour

Labor: \$10 per hour

Capital: \$25 per hour

	MARGINAL PHYSICAL PRODUCT OF LAND	MARGINAL PHYSICAL PRODUCT OF LABOR	MARGINAL PHYSICAL PRODUCT OF CAPITAL
Facility A	15	50	100
Facility B	40	40	75
Facility C	10	20	125
Facility D	20	40	100
Facility E	40	20	75

1. Which facility or facilities (if any) are presently producing using the least-cost combination of inputs?

2. What specific recommendation would you make for each facility to help them achieve the least-cost combination of resource use?

a. Recommendation for Facility A

c. Recommendation for Facility C

b. Recommendation for Facility B

d. Recommendation for Facility D

e. Recommendation for Facility E

**OPTIMUM RESOURCE MIX  
SOLUTIONS**

1. Which plant(s) (if any) are presently producing using the least-cost-combination of inputs?

*Plant D is presently using the least-cost-combination of resources. Land  $MPP/P = 20/\$5 = 4$ , Labor  $MPP/P = 40/\$10 = 4$ , Capital  $MPP/P = 100/\$25 = 4$ .*

2. What specific recommendation would you make for each plant to help them achieve the least-cost-combination of resource use at each plant?

A. Recommendation for Plant A

*Land  $MPP/P = 15/\$5 = 3$ , Labor  $MPP/P = 50/\$10 = 5$ , Capital  $MPP/P = 100/\$25 = 4$ . Too much land is being used and not enough labor is being used. Resources should be employed in a different combination to achieve the least-cost-combination.*

B. Recommendation for Plant B

*Land  $MPP/P = 40/\$5 = 8$ , Labor  $MPP/P = 40/\$10 = 4$ , Capital  $MPP/P = 75/\$25 = 3$ . Too much capital is being used and not enough land is being used. Resources should be employed in a different combination to achieve the least-cost-combination.*

C. Recommendation for Plant C

*Land  $MPP/P = 10/\$5 = 2$ , Labor  $MPP/P = 20/\$10 = 2$ , Capital  $MPP/P = 125/\$25 = 5$ . Too much land and labor is being used and not enough capital is being used. Resources should be employed in a different combination to achieve the least-cost-combination.*

D. Recommendation for Plant D

*Land  $MPP/P = 20/\$5 = 4$ , Labor  $MPP/P = 40/\$10 = 4$ , Capital  $MPP/P = 100/\$25 = 4$ . The correct amounts of resources are being used to achieve the least-cost-combination.*

E. Recommendation for Plant E

*Land  $MPP/P = 40/\$5 = 8$ , Labor  $MPP/P = 20/\$10 = 2$ , Capital  $MPP/P = 75/\$25 = 3$ . Too much labor is being used and not enough land is being used. Resources should be employed in a different combination to achieve the least-cost-combination.*