9 The Analysis of Competitive Markets

Read Pindyck and Rubinfeld (2009), Chapter 9

CHAPTER 9 OUTLINE

9.1 Evaluating the Gains and Losses from Government Policies—Consumer and Producer Surplus
9.2 The Efficiency of a Competitive Market
9.3 Minimum Prices
9.4 Price Supports and Production Quotas
9.5 Import Quotas and Tariffs
9.6 The Impact of a Tax or Subsidy
• Review of Consumer and Producer Surplus

Consumer and Producer Surplus

Consumer A would pay $10 for a good whose market price is $5 and therefore enjoys a benefit of $5. Consumer B enjoys a benefit of $2, and Consumer C, who values the good at exactly the market price, enjoys no benefit.

**Consumer surplus**, which measures the total benefit to all consumers, is the yellow-shaded area between the demand curve and the market price.

Producer surplus measures the total profits of producers, plus rents to factor inputs. It is the benefit that lower-cost producers enjoy by selling at the market price, shown by the green-shaded area between the supply curve and the market price. Together, consumer and producer surplus measure the welfare benefit of a competitive market.
9.1 EVALUATING THE GAINS AND LOSSES FROM GOVERNMENT POLICIES—CONSUMER AND PRODUCER SURPLUS

- Application of Consumer and Producer Surplus
  - **welfare effects** Gains and losses to consumers and producers.

  Figure 9.2
  **Change in Consumer and Producer Surplus from Price Controls**
  The price of a good has been regulated to be no higher than $P_{\text{max}}$, which is below the market-clearing price $P_0$.
  The gain to consumers is the difference between rectangle $A$ and triangle $B$.
  The loss to producers is the sum of rectangle $A$ and triangle $C$.
  Triangles $B$ and $C$ together measure the *deadweight loss* from price controls.

- **deadweight loss** Net loss of total (consumer plus producer) surplus.

  *Chapter 9 The Analysis of Competitive Markets. Economics I: 2900111. Chairat Aemkulwat*

---

**9.1 EVALUATING THE GAINS AND LOSSES FROM GOVERNMENT POLICIES—CONSUMER AND PRODUCER SURPLUS**

- Application of Consumer and Producer Surplus

  Figure 9.3
  **Effect of Price Controls When Demand Is Inelastic**
  If demand is *sufficiently inelastic*, triangle $B$ can be larger than rectangle $A$. In this case, consumers suffer a net *loss* from price controls.

  *Chapter 9 The Analysis of Competitive Markets. Economics I: 2900111. Chairat Aemkulwat*
example 9.1

price controls and natural gas shortages

supply: \( Q^s = 15.90 + 0.72P_G + 0.05P_O \)

demand: \( Q^d = -10.35 - 0.18P_G + 0.69P_O \)

the market-clearing price of natural gas is $6.40 per mcf, and the (hypothetical) maximum allowable price is $3.00.

a shortage of 29.1 – 20.6 = 8.5 Tcf results.

the gain to consumers is rectangle \( A \) minus triangle \( B \),
and the loss to producers is rectangle \( A \) plus triangle \( C \).

the deadweight loss is the sum of triangles \( B \) plus \( C \).

Effects of Natural Gas Price Controls

The market-clearing price of natural gas is $6.40 per mcf, and the (hypothetical) maximum allowable price is $3.00.

A shortage of 23.6 – 20.6 = 3.0 Tcf results.

The gain to consumers is rectangle \( A \) minus triangle \( B \),
and the loss to producers is rectangle \( A \) plus triangle \( C \).

The deadweight loss is the sum of triangles \( B \) plus \( C \).
E10. In Example 9.1 (page 314), we calculated the gains and losses from price controls on natural gas and found that there was a deadweight loss of $5.68 billion. This calculation was based on a price of oil of $50 per barrel.

\[
\begin{align*}
\text{Supply: } & Q^S = 15.90 + 0.72P_G + 0.05P_O \\
\text{Demand: } & Q^D = 0.02 - 1.8P_G + 0.69P_O
\end{align*}
\]

1. If the price of oil were $60 per barrel, what would be the free-market price of gas? How large a deadweight loss would result if the maximum allowable price of natural gas were $3.00 per thousand cubic feet?

2. What price of oil would yield a free-market price of natural gas of $3?
9.2 THE EFFICIENCY OF A COMPETITIVE MARKET

- **economic efficiency** Maximization of aggregate consumer and producer surplus.

- **Market Failure**
  - **market failure** Situation in which an unregulated competitive market is inefficient because prices fail to provide proper signals to consumers and producers.

There are two important instances in which market failure can occur:
1. Externalities
2. Lack of Information

- **externality** Action taken by either a producer or a consumer which affects other producers or consumers but is not accounted for by the market price.

---

**Figure 9.5**
Welfare Loss When Price is Held Above Market-Clearing Level

When price is regulated to be no lower than $P_2$, only $Q_3$ will be demanded.

If $Q_1$ is produced, the deadweight loss is given by triangles $B$ and $C$.

At price $P_3$, producers would like to produce more than $Q_2$. If they do, the deadweight loss will be even larger.
Suppose the market-clearing price is $20,000; at this price, about 24,000 kidneys per year would be supplied.

The law effectively makes the price zero. About 16,000 kidneys per year are still donated; this constrained supply is shown as $S'$.

The loss to suppliers is given by rectangle $A$ and triangle $C$.

If consumers received kidneys at no cost, their gain would be given by rectangle $A$ less triangle $B$.

In practice, kidneys are often rationed on the basis of willingness to pay, and many recipients pay most or all of the $40,000 price that clears the market when supply is constrained.

Rectangles $A$ and $D$ measure the total value of kidneys when supply is constrained.
EXAMPLE 8.2  THE MARKET FOR HUMAN KIDNEYS

Even at a price of zero (the effective price under the law), donors supply about 16,000 kidneys per year. It has been estimated that 8000 more kidneys would be supplied if the price were $20,000.

We can fit a linear supply curve to this data—i.e., a supply curve of the form $Q = a + bP$. When $P = 0$, $Q = 16,000$, so $a = 16,000$. If $P = 20,000$, $Q = 24,000$, so $b = (24,000 - 16,000)/20,000 = 0.4$.

Thus the supply curve is $Supply: Q^s = 16,000 + 0.4P$

Note that at a price of $20,000, the elasticity of supply is 0.33. It is expected that at a price of $20,000, the number of kidneys demanded would be 24,000 per year. Like supply, demand is relatively price inelastic; a reasonable estimate for the price elasticity of demand at the $20,000 price is $-0.33$. This implies the following linear demand curve:

$Demand: Q^d = 32,000 - 0.4P$

The market-clearing price is $20,000; at this price, about 24,000 kidneys per year would be supplied.

The law effectively makes the price zero. About 16,000 kidneys per year are still donated; this constrained supply is shown as $S'$.

The loss to suppliers is given by rectangle A and triangle C.

If consumers received kidneys at no cost, their gain would be given by rectangle A less triangle B.

Economics, the dismal science, shows us that human organs have economic value that cannot be ignored, and prohibiting their sale imposes a cost on society that must be weighed against the benefits.
MINIMUM PRICES

Figure 9.7

Price Minimum

Price is regulated to be no lower than \( P_{\text{min}} \).
Producers would like to supply \( Q_2 \),
but consumers will buy only \( Q_3 \).
If producers indeed produce \( Q_2 \),
the amount \( Q_2 - Q_3 \) will go unsold
and the change in producer surplus will be \( A - C - D \). In this case, producers as a group may be worse off.

Figure 9.8

The Minimum Wage

Although the market-clearing wage is \( w_0 \),
firms are not allowed to pay less than \( w_{\text{min}} \).
This results in unemployment of an amount \( L_2 - L_1 \)
and a deadweight loss given by triangles \( B \) and \( C \).
At price $P_{\text{min}}$, airlines would like to supply $Q_2$, well above the quantity $Q_1$ that consumers will buy. Here they supply $Q_3$. Trapezoid $D$ is the cost of unsold output. Airline profits may have been lower as a result of regulation because triangle $C$ and trapezoid $D$ can together exceed rectangle $A$. In addition, consumers lose $A + B$.

By 1981, the airline industry had been completely deregulated. Since that time, many new airlines have begun service, others have gone out of business, and price competition has become much more intense. Because airlines have no control over oil prices, it is more informative to examine a “corrected” real cost index which removes the effects of changing fuel costs.
EXAMPLE 8.2 AIRLINE REGULATION

Airline deregulation in 1981 led to major changes in the industry. Some airlines merged or went out of business as new ones entered. Although prices fell considerably (to the benefit of consumers), profits overall did not fall much.

FIGURE 9.9 EFFECT OF AIRLINE REGULATION BY THE CIVIL AERONAUTICS BOARD

At price $P_{\text{min}}$, airlines would like to supply $Q_2$, well above the quantity $Q_1$ that consumers will buy.

Here they supply $Q_3$. Trapezoid $D$ is the cost of unsold output.

Airline profits may have been lower as a result of regulation because triangle $C$ and trapezoid $D$ can together exceed rectangle $A$.

In addition, consumers lose $A + B$.

EXAMPLE 8.2 AIRLINE REGULATION

Because airlines have no control over oil prices, it is more informative to examine a “corrected” real cost index which removes the effects of changing fuel costs.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of U.S. carriers</td>
<td>36</td>
<td>63</td>
<td>70</td>
<td>94</td>
<td>63</td>
</tr>
<tr>
<td>Passenger Load Factor (%)</td>
<td>54.0</td>
<td>58.0</td>
<td>62.4</td>
<td>72.1</td>
<td>82.1</td>
</tr>
<tr>
<td>Passenger-Mile Rate (constant 1995 dollars)</td>
<td>0.218</td>
<td>0.210</td>
<td>0.149</td>
<td>0.118</td>
<td>0.094</td>
</tr>
<tr>
<td>Real Cost Index (1995 = 100)</td>
<td>101</td>
<td>145</td>
<td>119</td>
<td>89</td>
<td>148</td>
</tr>
<tr>
<td>Real Fuel Cost Index (1995 = 100)</td>
<td>249</td>
<td>300</td>
<td>163</td>
<td>125</td>
<td>342</td>
</tr>
<tr>
<td>Real Cost Index w/o Fuel Cost Increases (1995 = 100)</td>
<td>71</td>
<td>87</td>
<td>104</td>
<td>85</td>
<td>76</td>
</tr>
</tbody>
</table>
E1. In 1996, Congress raised the minimum wage from $4.25 per hour to $5.15 per hour, and then raised it again in 2007. (See Example 1.3 [page 13].) Some people suggested that a government subsidy could help employers finance the higher wage. This exercise examines the economics of a minimum wage and wage subsidies. Suppose the supply of low-skilled labor is given by \( L^S = 10w \), where \( L^S \) is the quantity of low-skilled labor (in millions of persons employed each year), and \( w \) is the wage rate (in dollars per hour). The demand for labor is given by \( L^D = 80 - 10w \).

1. What will be the free-market wage rate and employment level? Suppose the government sets a minimum wage of $5 per hour. How many people would then be employed?

---

9.4 PRICE SUPPORTS AND PRODUCTION QUOTAS

- Price Supports
  - price support Price set by government above free market level and maintained by governmental purchases of excess supply.

![Figure 9.10](image)

To maintain a price \( P_s \) above the market-clearing price \( P_0 \), the government buys a quantity \( Q_g \).

- The gain to producers is \( A + B + D \). The loss to consumers is \( A + B \).
- The cost to the government is the speckled rectangle, the area of which is \( P_s(Q_2 - Q_1) \).

Total change in welfare: \( \Delta CS + \Delta PS - \text{Cost to Govt.} = D - (Q_2 - Q_1)P_s \)
9.4 PRICE SUPPORTS AND PRODUCTION QUOTAS

• Production Quotas

Supply Restrictions

To maintain a price $P_s$ above the market-clearing price $P_0$, the government can restrict supply to $Q_1$, either by imposing production quotas (as with taxicab medallions) or by giving producers a financial incentive to reduce output (as with acreage limitations in agriculture).

For an incentive to work, it must be at least as large as $B + C + D$, which would be the additional profit earned by planting, given the higher price $P_s$. The cost to the government is therefore at least $B + C + D$.

$$\Delta CS = -A - B$$
$$\Delta PS = A - C + \text{Payments for not producing (or at least } B + C + D)$$
$$\Delta Welfare = -A - B + A + B + D - B - C - D = -B - C$$

Example 9.4

Supporting the Price of Wheat

1981 Supply: $Q_s = 1800 + 240P$

1981 Demand: $Q_D = 3550 - 266P$

To increase the price to $3.70, the government must buy a quantity of wheat $Q_g$.

By buying 122 million bushels of wheat, the government increased the market-clearing price from $3.46 per bushel to $3.70.

1981 Total demand: $Q_{DT} = 3550 - 266P + Q_g$

$Q_g = 506P - 1750$

$Q_g = (506)(3.70) - 1750 = 122$ million bushels

Loss to consumers = $-A - B = $624 million

Cost to the government = $3.70 \times 112$ million = $451.4$ million

Total cost of the program = $624$ million + $451.4$ million = $1075.4$ million

Gain to producers = $A + B + C = $638$ million
In 1985, the demand for wheat was much lower than in 1981, because the market-clearing price was only $1.80.

To increase the price to $3.20, the government bought 466 million bushels and also imposed a production quota of 2425 million bushels.

\[ 2425 = 2580 - 194P + Q_g \]
\[ Q_g = -155 + 194P \]
\[ Q_g = -155 + 194(3.20) = 466 \text{ million bushels} \]
\[ \text{Cost to the government} = 3.20 \times 466 \text{ million} = 1491 \text{ million} \]

In 1981, the demand for wheat was much lower than in 1981, because the market-clearing price was only $3.46 per bushel. To increase the price to $3.70, the government must buy a quantity of wheat \( Q_g \).

By buying 122 million bushels of wheat, the government increased the market-clearing price from $3.46 per bushel to $3.70.

\[ 1981 \text{ Total demand: } Q_d = 3550 - 266P + Q_g \]
\[ Q_g = 506P - 1750 \]
\[ Q_g = (506)(3.70) - 1750 = 112 \text{ million bushels} \]
\[ \text{Loss to consumers} = -A - B = 624 \text{ million} \]
\[ \text{Cost to the government} = 3.70 \times 112 \text{ million} = 451.4 \text{ million} \]
\[ \text{Total cost of the program} = 624 \text{ million} + 451.4 \text{ million} = 1075 \text{ million} \]
\[ \text{Gain to producers} = A + B + C = 638 \text{ million} \]
EXAMPLE 9.4 SUPPORTING THE PRICE OF WHEAT

In 1996, the U.S. Congress passed a new farm bill, nicknamed the “Freedom to Farm” law. The law eliminated production quotas (for wheat, corn, rice, and other products) and gradually reduced government purchases and subsidies through 2003.

In Example 2.5, we saw that the market-clearing price of wheat in 2007 had increased to about $6.00 per bushel. The supply and demand curves in 2007 were as follows:

\[
\text{Supply: } Q_S = 2900 + 125P \\
\text{Demand: } Q_D = 1460 - 115P
\]

You can check to see that the market-clearing quantity is 2150 million bushels.

In 2002, the Farm Security and Rural Investment Act reinstated subsidies for most crops, in particular grain and cotton. It called for the government to issue “fixed direct payments” to producers. Congress revisited agricultural subsidies in 2007, and the subsidies were either maintained or increased, thus making the burden on U.S. taxpayers even higher.

Recently, however, the pendulum has swung back toward eliminating subsidies, and new cuts were approved as part of the deal to resolve the 2011 budget crisis.

E4. In 1983, the Reagan Administration introduced a new agricultural program called the Payment-in-Kind Program. To see how the program worked, let’s consider the wheat market.

1. Suppose the demand function is \( Q^D = 28 - 2P \) and the supply function is \( Q^S = 4 + 4P \), where \( P \) is the price of wheat in dollars per bushel, and \( Q \) is the quantity in billions of bushels. Find the free-market equilibrium price and quantity.

2. Now suppose the government wants to lower the supply of wheat by 25 percent from the free-market equilibrium by paying farmers to withdraw land from production. However, the payment is made in wheat rather than in dollars – hence the name of the program. The wheat comes from vast government reserves accumulated from previous price support programs. The amount of wheat paid is equal to the amount that could have been harvested on the land withdrawn from production. Farmers are free to sell this wheat on the market. How much is now produced by farmers? How much is indirectly supplied to the market by the government? What is the new market price? How much do farmers gain? Do consumers gain or lose?

3. Had the government not given the wheat back to the farmers, it would have stored or destroyed it. Do taxpayers gain from the program? What potential problems does the program create?
9.5 IMPORT QUOTAS AND TARIFFS

- import quota  Limit on the quantity of a good that can be imported.
- tariff  Tax on an imported good.

Figure 9.14
Import Tariff or Quota That Eliminates Imports

In a free market, the domestic price equals the world price $P_w$.
A total $Q_d$ is consumed, of which $Q_s$ is supplied domestically and the rest imported.

When imports are eliminated, the price is increased to $P_0$.
The gain to producers is trapezoid $A$.
The loss to consumers is $A + B + C$, so the deadweight loss is $B + C$.

When imports are reduced, the domestic price is increased from $P_w$ to $P^*$.

This can be achieved by a quota, or by a tariff $T = P^* - P_w$.

Trapezoid $A$ is again the gain to domestic producers.
The loss to consumers is $A + B + C + D$.

If a tariff is used, the government gains $D$, the revenue from the tariff. The net domestic loss is $B + C$.

If a quota is used instead, rectangle $D$ becomes part of the profits of foreign producers, and the net domestic loss is $B + C + D$.
9.5 IMPORT QUOTAS AND TARIFFS

EXAMPLE 9.5

The Sugar Quota

Figure 9.16

Sugar Quota in 2005

At the world price of 12 cents per pound, about 23.9 billion pounds of sugar would have been consumed in the United States in 2005, of which all but 21.3 billion pounds would have been imported.

Restricting imports to 5.3 billion pounds caused the U.S. price to go up by 15 cents.

Sugar Quota in 2005 (continued)

The gain to domestic producers was trapezoid A, about $1.3 billion.

Rectangle D, $795 million, was a gain to those foreign producers who obtained quota allotments.

Triangles B and C represent the deadweight loss of about $1.2 billion.

The cost to consumers, A + B + C + D, was about $3.3 billion.
EXAMPLE 9.6  THE SUGAR QUOTA

In recent years, the world price of sugar has been between 10 and 28 cents per pound, while the U.S. price has been 30 to 40 cents per pound. Why? By restricting imports, the U.S. government protects the $4 billion domestic sugar industry, which would virtually be put out of business if it had to compete with low-cost foreign producers. This policy has been good for U.S. sugar producers, but bad for consumers.

| U.S. production: | 15.9 billion pounds |
| U.S. consumption: | 22.8 billion pounds |
| U.S. price: | 36 cents per pound |
| World price | 24 cents per pound |

U.S. supply: \( Q_S = -7.95 + 0.66P \)

U.S. demand: \( Q_D = 29.73 - 0.19P \)

At the 24-cent world price, U.S. production would have been only about 7.9 billion pounds and U.S. consumption about 25.2 billion pounds, of which 25.2 - 7.9 = 17.3 billion pounds would have been imported. But fortunately for U.S. producers, imports were limited to only 6.9 billion pounds.

Copyright © 2009 Pearson Education, Inc. Publishing as Prentice Hall • Microeconomics • Pindyck/Rubinfeld, 7e.

EXAMPLE 9.6  THE SUGAR QUOTA

FIGURE 9.16  SUGAR QUOTA IN 2010

At the world price of 24 cents per pound, about 25.2 billion pounds of sugar would have been consumed of which all but 17.3 billion pounds would have been imported. Restricting imports to 6.9 billion pounds caused the U.S. price to go up by 12 cents. The cost to consumers, \( A + B + C + D \), was about $2.9 billion. The gain to domestic producers was trapezoid \( A \), about $1.4 billion. Rectangle \( D \), $836 million, was a gain to those foreign producers who obtained quota allotments. Triangles \( B \) and \( C \) represent the deadweight loss of about $614 million.

Copyright © 2009 Pearson Education, Inc. Publishing as Prentice Hall • Microeconomics • Pindyck/Rubinfeld, 7e.
E12. The domestic supply and demand curves for hula beans are as follows:

Supply: \( P = 50 + Q \)
Demand: \( P = 200 - 2Q \)

where \( P \) is the price in cents per pound and \( Q \) is the quantity in millions of pounds. The U.S. is a small producer in the world hula bean market, where the current price (which will not be affected by anything we do) is 60 cents per pound. Congress is considering a tariff of 40 cents per pound. Find the domestic price of hula beans that will result if the tariff is imposed. Also compute the dollar gain or loss to domestic consumers, domestic producers, and government revenue from the tariff.

9.6 THE IMPACT OF A TAX OR SUBSIDY

- **specific tax**  Tax of a certain amount of money per unit sold.

![Incidence of a Tax](image)

- \( P_b \) is the price (including the tax) paid by buyers. \( P_s \) is the price that sellers receive, less the tax.
- Here the burden of the tax is split evenly between buyers and sellers.
- **Buyers lose** \( A + B \).
- **Sellers lose** \( D + C \).
- The government earns \( A + D \) in revenue.
- The deadweight loss is \( B + C \).

Market clearing requires four conditions to be satisfied after the tax is in place:

\[
Q^D = Q^D(P_b) \quad (9.1a) \\
Q^S = Q^S(P_s) \quad (9.1b) \\
Q^D = Q^S \quad (9.1c) \\
P_b - P_s = t \quad (9.1d)
\]
If demand is very inelastic relative to supply, the burden of the tax falls mostly on buyers. If demand is very elastic relative to supply, it falls mostly on sellers.

9.6 THE IMPACT OF A TAX OR SUBSIDY

The Effects of a Subsidy
- **subsidy** Payment reducing the buyer’s price below the seller’s price; i.e., a negative tax.

Conditions needed for the market to clear with a subsidy:

\[ Q^D = Q^D(P_b) \quad (9.2a) \]
\[ Q^S = Q^S(P_s) \quad (9.2b) \]
\[ Q^D = Q^S \quad (9.2c) \]
\[ P_s - P_b = s \quad (9.2d) \]

9.6 THE IMPACT OF A TAX OR SUBSIDY

A subsidy can be thought of as a negative tax. Like a tax, the benefit of a subsidy is split between buyers and sellers, depending on the relative elasticities of supply and demand.
THE IMPACT OF A TAX OR SUBSIDY

**EXAMPLE 9.6**  
A Tax on Gasoline

Effect of a $1.00-per-gallon tax:

\[ Q^D = 150 - 25P_b \]  
(Demand)

\[ Q^S = 60 + 20P_s \]  
(Supply)

\[ Q^D = Q^S \]  
(Supply must equal demand)

\[ P_b - P_s = 1.00 \]  
(Government must receive $1.00/gallon)

\[
150 - 25P_b = 60 + 20P_s \\
P_b = P_s + 1.00 \\
150 - 25P_b = 60 + 20P_s \\
20P_s + 25P_s = 150 - 25 - 60 \\
45P_s = 65, \text{ or } P_s = 1.44 \\
Q = 150 - (25)(2.44) = 150 - 61, \text{ or } Q = 89 \text{ bg/yr} \\
\]

Annual revenue from the tax \( tQ = (1.00)(89) = $89 \text{ billion per year} \)

Deadweight loss: \( (1/2) \times ($1.00/\text{gallon}) \times (11 \text{ billion gallons/year} = $5.5 \text{ billion per year} \)

---

**Figure 9.20**

**Impact of $1 Gasoline Tax**

The price of gasoline at the pump increases from $2.00 per gallon to $2.44, and the quantity sold falls from 100 to 89 bg/yr.

Annual revenue from the tax is \( (1.00)(89) = $89 \text{ billion (areas } A + D) \).

The two triangles show the deadweight loss of $5.5 billion per year.
EXAMPLE 9.7  A TAX ON GASOLINE

\[ Q^D = 150 - 25P_b \]  \hspace{1cm} \text{(Demand)}
\[ Q^S = 60 + 20P_s \]  \hspace{1cm} \text{(Supply)}
\[ Q^D = Q^S \]  \hspace{1cm} \text{(Supply must equal demand)}
\[ P_b - P_s = 1.00 \]  \hspace{1cm} \text{(Government must receive $1.00/gallon)}

\[ 150 - 25P_b = 60 + 20P_s \]
\[ P_b = P_s + 1.00 \]
\[ 150 - 25P_b = 60 + 20P_s \]
\[ 20P_s + 25P_s = 150 - 25 - 60 \]
\[ 45P_s = 65, \text{ or } P_s = 1.44 \]
\[ Q^D = 150 - (25)(2.44) = 150 - 61, \text{ or } Q = 89 \text{ bg/yr} \]

Annual revenue from the tax \( tQ = (1.00)(89) = $89 \) billion per year

Deadweight loss: \((1/2) \times ($1.00/gallon) \times (11 \text{ billion gallons/year} = $5.5 \) billion per year

Copyright © 2009 Pearson Education, Inc. Publishing as Prentice Hall • Microeconomics • Pindyck/Rubinfeld, 7e.

EXAMPLE 9.7  A TAX ON GASOLINE

FIGURE 9.20
IMPACT OF $1 GASOLINE TAX

The price of gasoline at the pump increases from $2.00 per gallon to $2.44, and the quantity sold falls from 100 to 89 bg/yr.

Annual revenue from the tax is \((1.00)(89) = $89 \) billion (areas \( A + D \)).

The two triangles show the deadweight loss of $5.5 billion per year.

Copyright © 2009 Pearson Education, Inc. Publishing as Prentice Hall • Microeconomics • Pindyck/Rubinfeld, 7e.
E1. In 1996, Congress raised the minimum wage from $4.25 per hour to $5.15 per hour, and then raised it again in 2007. (See Example 1.3 [page 13].) Some people suggested that a government subsidy could help employers finance the higher wage. This exercise examines the economics of a minimum wage and wage subsidies. Suppose the supply of low-skilled labor is given by \( L^S = 10w \), where \( L^S \) is the quantity of low-skilled labor (in millions of persons employed each year), and \( w \) is the wage rate (in dollars per hour). The demand for labor is given by \( L^D = 80 - 10w \).

1. What will be the free-market wage rate and employment level? Suppose the government sets a minimum wage of $5 per hour. How many people would then be employed?
2. Suppose that instead of a minimum wage, the government pays a subsidy of $1 per hour for each employee. What will the total level of employment be now? What will the equilibrium wage rate be?

Recap CHAPTER 9

9.1 Evaluating the Gains and Losses from Government Policies—Consumer and Producer Surplus
9.2 The Efficiency of a Competitive Market
9.3 Minimum Prices
9.4 Price Supports and Production Quotas
9.5 Import Quotas and Tariffs
9.6 The Impact of a Tax or Subsidy