Chapter 9: The Analysis of Competitive Markets

9.1 Evaluating the Gains and Losses from Government Policies—Consumer and Producer Surplus

Review of 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.
EVALUATING THE GAINS AND LOSSES FROM GOVERNMENT POLICIES—CONSUMER AND PRODUCER SURPLUS

9.1 Review of Consumer and Producer Surplus

Producer surplus measures the total profits of producers, plus rents to factor inputs. It is 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.

Consumer and Producer Surplus

9.1 Application of Consumer and Producer Surplus

● welfare effects

Gains and losses to consumers and producers.

The price of a good has been regulated to be no higher than $P_{max}$, 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.

Change in Consumer and Producer Surplus from Price Controls

● deadweight loss

Net loss of total (consumer plus producer) surplus.

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

**Example 9.1**

Price Controls and Natural Gas Shortages

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 $C$.

**Figure 9.4**

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**9.2 THE EFFICIENCY OF A COMPETITIVE MARKET**

1. Economic efficiency: Maximization of aggregate consumer and producer surplus.

**Market Failure**

1. 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**

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**9.2 THE EFFICIENCY OF A COMPETITIVE MARKET**

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

- If $Q_3$ is produced, the deadweight loss is given by triangles $B$ and $C$.

- At price $P_2$, producers would like to produce more than $Q_3$. If they do, the deadweight loss will be even larger.
9.2 THE EFFICIENCY OF A COMPETITIVE MARKET

EXAMPLE 9.2
The Market for Human Kidneys

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 $C$.

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.

9.3 MINIMUM PRICES

Figure 9.7
Price Minimum

Price is regulated to be no lower than $P_{min}$. 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.
MINIMUM PRICES

Although the market-clearing wage is \( w_0 \), firms are not allowed to pay less than \( w_{min} \). This results in unemployment of an amount \( L_2 - L_1 \) and a deadweight loss given by triangles \( B \) and \( C \).

**Figure 9.8**

**Table 9.1**  Airline Industry Data

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Number of Carriers</td>
<td>36</td>
<td>63</td>
<td>102</td>
<td>70</td>
<td>96</td>
<td>94</td>
<td>80</td>
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<tr>
<td>Passenger Load Factor (%)</td>
<td>54</td>
<td>56</td>
<td>61</td>
<td>62</td>
<td>67</td>
<td>72</td>
<td>78</td>
</tr>
<tr>
<td>Passenger Mile Rate (Constant 1995 dollars)</td>
<td>.218</td>
<td>.210</td>
<td>.165</td>
<td>.150</td>
<td>.129</td>
<td>.118</td>
<td>.092</td>
</tr>
<tr>
<td>Real Cost Index (1995 = 100)</td>
<td>101</td>
<td>122</td>
<td>110</td>
<td>100</td>
<td>101</td>
<td>100</td>
<td>93</td>
</tr>
<tr>
<td>Real Fuel Cost Index (1995 = 100)</td>
<td>249</td>
<td>300</td>
<td>234</td>
<td>163</td>
<td>100</td>
<td>125</td>
<td>237</td>
</tr>
<tr>
<td>Real Cost Index Corrected for Fuel Cost Changes</td>
<td>71</td>
<td>73</td>
<td>98</td>
<td>95</td>
<td>100</td>
<td>96</td>
<td>67</td>
</tr>
</tbody>
</table>

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.
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.

\[ P_s \]

Figure 9.10

- Price support
  - 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: \( \Delta CS + \Delta PS - \text{Cost to Govt } = D - (Q_2 - Q_1)P_s \)

Price Supports

Figure 9.10

Supply Function

\[ Q_s = 1800 + 240P \]

Demand Function

\[ Q_d = 3550 - 266P \]

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: \( Q_d = 3550 - 266P \)

\( Q_d = 3550 - 266(3.70) = 1750 \)

\( Q_d = 1750 + 122 \text{ million bushels} \)

Loss to consumers = \( A + B = \$624 \text{ million} \)

Cost to the government = $3.70 x 122 million = $451.4 million

Total cost of the program = $624 million + $451.4 million = $1075 million

Gain to producers = \( A + B + C = \$638 \text{ million} \)

Production Quotas

- 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 \( B + C + D \).

Total change in welfare:

\[ \Delta CS = A - B \]

\[ \Delta PS = A - C + \text{Payments for not producing} \]

\[ \Delta \text{Welfare} = A - B - A + B = D - B - C \]

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: \( Q_d = 3550 - 266P \)

\( Q_d = 3550 - 266(3.70) = 1750 \)

\( Q_d = 1750 + 122 \text{ million bushels} \)

Loss to consumers = \( A + B = \$824 \text{ million} \)

Cost to the government = $3.70 x 122 million = $451.4 million

Total cost of the program = $824 million + $451.4 million = $1275 million

Gain to producers = \( A + B + C = \$838 \text{ million} \)
### 9.4 Price Supports and Production Quotas

**Example 9.4** Supporting the Price of Wheat (continued)

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.

**Wheat Market in 1985**

\[
\begin{align*}
\text{Supply: } Q_S &= 1800 + 240P \\
\text{Demand: } Q_D &= 2580 - 194P \\
\end{align*}
\]

To find the government's purchase, we set the supply equal to the demand:

\[
2425 = 2580 - 194P + Q_g
\]

Solving for \(Q_g\):

\[
Q_g = -155 + 194P
\]

At the price of $3.20, the government purchase is:

\[
Q_g = -155 + 194(3.20) = 466 \text{ million bushels}
\]

Cost to the government:

\[
(3.20)(466) = 1491 \text{ million}
\]

### 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.

**Import Tariff or Quota (General Case)**

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**

At the world price of 12 cents per pound, about 23.0 billion pounds of sugar would have been consumed in the United States in 2005, of which all but 2.6 billion pounds would have been imported. Restricting imports to 5.3 billion pounds caused the U.S. price to go up by 15 cents.

**Figure 9.16**

The gain to domestic producers was triangular 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.

**Figure 9.16 (continued)**

**The Impact of a Tax or Subsidy**

A tax of a certain amount of money per unit sold.

**Figure 9.17**

Specific tax: Tax of a certain amount of money per unit sold. Market clearing requires four conditions to be satisfied after the tax is in place:

1. \( Q^D = Q^D(P_b) \)  
2. \( Q^S = Q^S(P_s) \)  
3. \( Q^D = Q^S(P_b) \)  
4. \( P_b - P_s = t \)
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:

\[ Q^D = Q^D(P_b) \]  
\[ Q^S = Q^S(P_s) \]  
\[ P_b - P_s = s \]

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.

9.6 THE IMPACT OF A TAX OR SUBSIDY

Example 9.2
A Tax on Gasoline

Effect of a $1-per-gallon tax:

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

Annual revenue from the tax \( tQ = (1.00)(89) = 89 \text{ billion per year} \)
Deadweight loss: \( (1/2) \times (1.00/\text{gallon}) \times (11 \text{ billion gallons/year}) = 5.5 \text{ billion per year} \)
9.6 THE IMPACT OF A TAX OR SUBSIDY

Example 9.6 A Tax on Gasoline (continued)

Gasoline demand: \( Q_D = 150 - 25P \)

Gasoline supply: \( Q_S = 60 + 20P \)

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.