Consumer and Producer Surplus

- To determine the welfare effect of a governmental policy, we can measure the gain or loss in consumer and producer surplus.

- Welfare Effects
  - Gains and losses to producers and consumers.
Consumer and Producer Surplus

- When government institutes a *price ceiling (any real example?)*, the price of a good can’t go above that price.
- With a binding price ceiling, producers and consumers are affected.
- How much they are affected can be determined by measuring changes in consumer and producer surplus.
Consumer and Producer Surplus

- When price is held too low, the quantity demanded increases and quantity supplied decreases.
- Some consumers are worse off because they can no longer buy the good.
  - Decrease in consumer surplus
- Some consumers are better off because they can buy it at a lower price.
  - Increase in consumer surplus
Consumer and Producer Surplus

- Producers sell less at a lower price
- Some producers are no longer in the market
- Both of these producer groups lose and producer surplus decreases
- The economy as a whole is worse off since surplus that used to belong to producers or consumers is simply gone
The loss to producers is the sum of rectangle A and triangle C.

Consumers that can buy the good gain A.

Consumers that cannot buy, lose B.

The loss to producers is the sum of rectangle A and triangle C.

Triangles B and C are losses to society – dead weight loss.
Price Controls and Welfare Effects

- The total loss is equal to area B + C
- The **deadweight loss** is the inefficiency of the price controls – the total loss in surplus (consumer plus producer)
Price Controls and Natural Gas Shortages

- From example in Chapter 2, 1975 Price controls created a shortage of natural gas
- What was the effect of those controls?
  - Decreases in surplus and overall loss for society
  - We can measure these welfare effects from the demand and supply of natural gas
Price Controls and Natural Gas Shortages

- $Q^S = 14 + 2P_G + 0.25P_O$
  - Quantity supplied in trillion cubic feet (Tcf)
- $Q^D = -5P_G + 3.75P_O$
  - Quantity demanded (Tcf)
- $P_G$ = price of natural gas in $/thousand cubic feet (mcf)
- $P_O$ = price of oil in $/barrel
Price Controls and Natural Gas Shortages

- Using $P_O = $8/b and $Q_D^G = Q_S^G$ gives equilibrium values for natural gas
  - $P_G = $2/mcf and $Q_G = 20$ Tcf
- Price ceiling was set at $1/mcf
- Showing this graphically, we can see and measure the effects on producer and consumer surplus
The gain to consumers is rectangle A minus triangle B, and the loss to producers is rectangle A plus triangle C.
Price Controls and Natural Gas Shortages

● Measuring the Impact of Price Controls
  ○ $A = (18 \text{ billion mcf}) \times ($1/\text{mcf}) = $18 \text{ billion}$
  ○ $B = (1/2) \times (2 \text{ b. mcf}) \times ($0.40/\text{mcf}) = $0.4 \text{ billion}$
  ○ $C = (1/2) \times (2 \text{ b. mcf}) \times ($1/\text{mcf}) = $1 \text{ billion}$
Price Controls and Natural Gas Shortages

- Measuring the Impact of Price Controls in 1975 (You may want to check by yourself.)
  - Change in consumer surplus
    - \( A - B = 18 - 0.4 = $17.6 \) billion Gain
  - Change in producer surplus
    - \( A + C = 18 + 1 = $19.0 \) billion Loss
  - Dead Weight Loss
    - \( B + C = 0.4 + 1 = $1.4 \) billion Loss
The Efficiency of a Competitive Market

- In the evaluation of markets, we often talk about whether it reaches **economic efficiency**
  - Maximization of aggregate consumer and producer surplus
- Policies such as price controls that cause dead weight losses in society are said to impose an **efficiency cost** on the economy
The Efficiency of a Competitive Market

- If efficiency is the goal, then you can argue that leaving markets alone is the answer (*Invisible hands bring efficiency!*)
- However, sometimes market failures occur
  - Prices fail to provide proper signals to consumers and producers
  - Leads to inefficient unregulated competitive market
Types of Market Failures

1. **Externalities**
   - Costs or benefits that do not show up as part of the market price (e.g. pollution, elementary education)
   - *Costs or benefits are external to the market*

2. **Lack of Information**
   - Imperfect information prevents consumers from making utility-maximizing decisions
   - Government intervention may be desirable in these cases---*e.g.*, imposing emission regulations, compulsory education
The Efficiency of a Competitive Market

- Other than market failures, unregulated competitive markets lead to economic efficiency
The Market for Human Kidneys
(pp. 307-9)

- The 1984 National Organ Transplantation Act prohibits the sale of organs for transplantation
- What has been the impact of the Act?
- We can measure this using the supply and demand for kidneys from estimated data (P: the price of a kidney)
  - Supply: \( Q^S = 8,000 + 0.2P \)
  - Demand: \( Q^D = 16,000 - 0.2P \)
The Market for Human Kidneys
(pp. 307-9)

- Since the sale of organs is not allowed, the amount available depends on the amount donated
  - Supply of donated kidneys is limited to 8,000
- The welfare effect of this supply constraint can be analyzed using consumer and producer surplus in the kidney market
The Market for Kidneys (pp. 307-9)

A and D measure the total value of kidneys when supply is constrained.

If kidneys are zero cost, recipients gain would be A minus B.

The loss to suppliers is seen in areas A + C.

A and D measure the total value of kidneys when supply is constrained.
The Market for Human Kidneys
(pp. 307-9)

- Suppliers:
  - Those who supply them are not paid the market price, estimated at $20,000
    - Loss of surplus equal to area A = $160 million
  - Some who would donate for the equilibrium price do not donate in the current market
    - Loss of surplus equal to area C = $40 million
  - Total loss of A + C in producers’ surplus = $200 million
The Market for Human Kidneys

(pp. 307-9)

- Recipients:
  - Since they do not have to pay for the kidney, they gain rectangle A ($140 million) since price is $0
  - Those who cannot obtain a kidney lose surplus equal to triangle B ($40 million)
  - Net increase in surplus of recipients of $160 - $40 = $120 million
- Dead Weight Loss of C + B = $80 million
Other Inefficiency Costs

- Allocation is not necessarily to those who value the kidneys the most
- Price may increase to $40,000, the equilibrium price, with hospitals getting the price
Arguments in favor of prohibiting the sale of organs:

1. Imperfect information about donor’s health and screening

2. Unfair to allocate according to the ability to pay
   - Holding price below equilibrium will create shortages
   - Organs versus artificial substitutes
Minimum Prices

- Periodically, government policy seeks to raise prices above market-clearing levels
  - Minimum wage law
  - Regulation of airlines
  - Agricultural policies
- We will investigate this by looking at the minimum wage legislation
Minimum Prices

- When price is set above the market clearing price:
  - Quantity demanded falls
  - Suppliers may, however, choose to increase quantity supplied in face of higher prices
  - This causes additional producer losses equal to the total cost of production above quantity demanded
The change in producer surplus will be $A - C - D$. Producers may be worse off.

If producers produce $Q_2$, the amount $Q_2 - Q_3$ will go unsold.

$D$ measures total cost of increased production not sold.

The change in producer surplus will be $A - C - D$. Producers may be worse off.
Minimum Prices

- Losses in consumer surplus are still the same \[-(A+B)\]
  - Increased price leading to decreased quantity equals area A
  - Those priced out of the market lose area B

- Producer surplus similar
  - Increases from increased price for units sold equal to A
  - Losses from drop in sales equal to C
Minimum Prices

- What if producers expand production to Q₂ from the increased price?
  - Since they only sell Q₃, there is no revenue to cover the additional production (Q₂-Q₃)
  - Supply curve measures MC of production so total cost of additional production is area under the supply curve for the increased production (Q₂-Q₃) = area D
  - *Total change in producer surplus* = A – C – D
Minimum Wages

- Wage is set higher than market clearing wage
- Decreased quantity of workers demanded
- Those workers hired receive higher wages
- Unemployment results, since not everyone who wants to work at the new wage can
The deadweight loss is given by triangles $B$ and $C$.

Firms are not allowed to pay less than $w_{min}$. This results in unemployment.

A is gain to workers who find jobs at higher wage.

The deadweight loss is given by triangles $B$ and $C$.

Unemployment
Before 1970, the airline industry was heavily regulated by the Civil Aeronautics Board (CAB).

During 1976-1981, the airline industry in the U.S. changed dramatically as deregulation led to major changes.

Some airlines merged or went out of business as new airlines entered the industry.
Airline Regulation

- Although prices in the industry fell considerably (helping consumers), profits did not.
  - Regulation caused significant inefficiencies and artificially high costs
- We can show the effects of this regulation by looking at the effects on surplus from the controlled prices
Prior to deregulation, the price was at $P_{\text{min}}$. Production was $Q_3$ hoping to outsell competitors.

Area $D$ is the cost of unsold output.

After deregulation: Prices fell to $P_0$. The change in consumer surplus is $A + B$. 

After deregulation, prices fell to $P_0$. The change in consumer surplus is $A + B$. 

**Effect of Airline Regulation**

- Prior to deregulation, the price was at $P_{\text{min}}$. Production was $Q_3$ hoping to outsell competitors.
- Area $D$ is the cost of unsold output.
- After deregulation, prices fell to $P_0$. The change in consumer surplus is $A + B$. 

**Diagram Notes:**
- $P_{\text{min}}$: Minimum price before deregulation.
- $P_0$: Price after deregulation.
- $Q_0$: Quantity demanded at $P_0$.
- $Q_3$: Production before deregulation.
- $Q_2$: Quantity supplied after deregulation.
- $Q_1$: Quantity supplied before deregulation.

**Key Points:**
- Prior to deregulation, the price was at $P_{\text{min}}$.
- Production was $Q_3$ hoping to outsell competitors.
- Area $D$ represents the cost of unsold output.
- After deregulation, prices fell to $P_0$.
- The change in consumer surplus is $A + B$. 

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**Diagram Details:**
- The diagram illustrates the impact of deregulation on the airline industry.
- The price and quantity axes are clearly labeled.
- The areas $A$, $B$, and $D$ are shaded to indicate cost and surplus changes.
- The graph shows the transition from regulated to deregulated pricing and production levels.
## Airline Industry Data

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<tbody>
<tr>
<td>Number of carriers</td>
<td>33</td>
<td>72</td>
<td>86</td>
<td>60</td>
<td>86</td>
<td>94</td>
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<tr>
<td>Passenger load factor (%)</td>
<td>54</td>
<td>59</td>
<td>61</td>
<td>62</td>
<td>67</td>
<td>72</td>
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<tr>
<td>Passenger-mile rate (constant 1995 dollars)</td>
<td>.218</td>
<td>.210</td>
<td>.166</td>
<td>.150</td>
<td>.129</td>
<td>.118</td>
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<tr>
<td>Real cost index (1995 = 100)</td>
<td>101</td>
<td>122</td>
<td>111</td>
<td>107</td>
<td>100</td>
<td>101</td>
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<tr>
<td>Real cost index corrected for fuel increases</td>
<td>94</td>
<td>98</td>
<td>98</td>
<td>100</td>
<td>100</td>
<td>98</td>
</tr>
</tbody>
</table>
Airline Industry Data

Airline industry data show:

1. Long-run adjustment as the number of carriers increased and prices decreased
2. Higher load factors indicating more efficiency
3. Falling rates
4. Real cost increased slightly (adjusted fuel cost)
5. Large welfare gain
Effect of Airline Regulation

1. Large welfare gain
   Consumers’ gain = A + B
   Producers’ gain = C + D - A
   Net welfare gain = B + C + D