Consumers, Producers, and the Efficiency of Markets
In this chapter, look for the answers to these questions:

- What is consumer surplus? How is it related to the demand curve?
- What is producer surplus? How is it related to the supply curve?
- Do markets produce a desirable allocation of resources? Or could the market outcome be improved upon?
Welfare Economics

- Recall, the allocation of resources refers to:
  - how much of each good is produced
  - which producers produce it
  - which consumers consume it

- Welfare economics studies how the allocation of resources affects economic well-being.

- First, we look at the well-being of consumers.
Willingness to Pay (WTP)

A buyer’s **willingness to pay** for a good is the maximum amount the buyer will pay for that good.

WTP measures how much the buyer values the good.

<table>
<thead>
<tr>
<th>name</th>
<th>WTP</th>
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<tbody>
<tr>
<td>Anthony</td>
<td>$250</td>
</tr>
<tr>
<td>Chad</td>
<td>175</td>
</tr>
<tr>
<td>Flea</td>
<td>300</td>
</tr>
<tr>
<td>John</td>
<td>125</td>
</tr>
</tbody>
</table>

Example: 4 buyers’ WTP for an iPod
WTP and the Demand Curve

**Q:** If price of iPod is $200, who will buy an iPod, and what is quantity demanded?

**A:** Anthony & Flea will buy an iPod, Chad & John will not.

Hence, $Q^d = 2$

when $P = $200.

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WTP and the Demand Curve

Derive the demand schedule:

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<td>John</td>
<td>125</td>
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</table>

<table>
<thead>
<tr>
<th>$P$ (price of iPod)</th>
<th>who buys</th>
<th>$Q^d$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$301 &amp; up$</td>
<td>nobody</td>
<td>0</td>
</tr>
<tr>
<td>251 – 300</td>
<td>Flea</td>
<td>1</td>
</tr>
<tr>
<td>176 – 250</td>
<td>Anthony, Flea</td>
<td>2</td>
</tr>
<tr>
<td>126 – 175</td>
<td>Chad, Anthony, Flea</td>
<td>3</td>
</tr>
<tr>
<td>0 – 125</td>
<td>John, Chad, Anthony, Flea</td>
<td>4</td>
</tr>
</tbody>
</table>
WTP and the Demand Curve

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<th>$P$</th>
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<td>3</td>
</tr>
<tr>
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<td>4</td>
</tr>
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About the Staircase Shape...

This $D$ curve looks like a staircase with 4 steps – one per buyer.

If there were a huge # of buyers, as in a competitive market, there would be a huge # of very tiny steps, and it would look more like a smooth curve.
WTP and the Demand Curve

At any $Q$, the height of the $D$ curve is the WTP of the *marginal buyer*, the buyer who would leave the market if $P$ were any higher.
Consumer Surplus (CS)

**Consumer surplus** is the amount a buyer is willing to pay minus the amount the buyer actually pays:

\[
CS = WTP - P
\]

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Suppose \( P = $260 \).

Flea’s CS = $300 – 260 = $40.

The others get no CS because they do not buy an iPod at this price.

Total CS = $40.
CS and the Demand Curve

Flea’s WTP

$P = $260$

Flea’s CS = $300 - 260 = $40$

Total CS = $40$
Instead, suppose \( p = \$220 \)

Flea’s CS = \$300 - 220 = \$80

Anthony’s CS = \$250 - 220 = \$30

Total CS = \$110
CS and the Demand Curve

The lesson:
Total CS equals the area under the demand curve above the price, from 0 to $Q$. 

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At $Q = 5$ (thousand), the marginal buyer is willing to pay $50 for pair of shoes.

Suppose $P = $30.

Then his consumer surplus = $20.
CS with Lots of Buyers & a Smooth D Curve

CS is the area b/w \( P \) and the \( D \) curve, from 0 to \( Q \).

Recall: area of a triangle equals \( \frac{1}{2} \times \text{base} \times \text{height} \)

Height = $60 - 30 = $30.
So, \( \text{CS} = \frac{1}{2} \times 15 \times $30 = $225. \)
How a Higher Price Reduces CS

If $P$ rises to $40,$

$$CS = \frac{1}{2} \times 10 \times $20 = $100.$$ 

Two reasons for the fall in CS.

1. Fall in CS due to buyers leaving market

2. Fall in CS due to remaining buyers paying higher $P$
A. Find marginal buyer’s WTP at $Q = 10$.

B. Find CS for $P = $30.

Suppose $P$ falls to $20$. How much will CS increase due to...

C. buyers entering the market

D. existing buyers paying lower price

E. What is the total CS
Answers

A. At $Q = 10$, marginal buyer’s WTP is $30$.

B. $CS = \frac{1}{2} \times 10 \times $10 = $50$

$P$ falls to $20$.

C. CS for the additional buyers = $\frac{1}{2} \times 10 \times $10 = $50$

D. Increase in CS on initial 10 units = $10 \times $10 = $100$

E. Total CS = $50 + 50 + $100 = $200$

Or = $\frac{1}{2} \times 20 \times $20 = $200$
Cost and the Supply Curve

- **Cost** is the value of everything a seller must give up to produce a good (*i.e.*, opportunity cost).
- Includes cost of all resources used to produce good, including value of the seller’s time.
- Example: Costs of 3 sellers in the lawn-cutting business.

<table>
<thead>
<tr>
<th>name</th>
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<tbody>
<tr>
<td>Jack</td>
<td>$10</td>
</tr>
<tr>
<td>Janet</td>
<td>20</td>
</tr>
<tr>
<td>Chrissy</td>
<td>35</td>
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A seller will produce and sell the good/service only if the price exceeds his or her cost.

Hence, cost is a measure of willingness to sell.
Cost and the Supply Curve

Derive the supply schedule from the cost data:

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<td>35</td>
</tr>
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</table>

\[
\begin{array}{|c|c|}
\hline
P & Q_s \\
\hline
$0 – 9 & 0 \\
10 – 19 & 1 \\
20 – 34 & 2 \\
35 & up \\& up & 3 \\
\hline
\end{array}
\]
At each $Q$, the height of the $S$ curve is the cost of the *marginal seller*, the seller who would leave the market if the price were any lower.
Producer surplus (PS): the amount a seller is paid for a good minus the seller’s cost

\[ PS = P - \text{cost} \]
Producer Surplus and the S Curve

PS = \( P - \text{cost} \)

Suppose \( P = $25 \).

Jack’s PS = $15
Janet’s PS = $5
Chrissy’s PS = $0
Total PS = $20

Total PS equals the area above the supply curve under the price, from 0 to \( Q \).
PS with Lots of Sellers & a Smooth S Curve

Suppose $P = $40.
At $Q = 15$ (thousand), the marginal seller’s cost is $30, and her producer surplus is $10.
PS with Lots of Sellers & a Smooth S Curve

PS is the area b/w $P$ and the $S$ curve, from 0 to $Q$.

The height of this triangle is $40 - 15 = 25$.

So,

$PS = \frac{1}{2} \times b \times h$

$= \frac{1}{2} \times 25 \times 25$

$= 312.50$
How a Lower Price Reduces PS

If \( P \) falls to $30,

\[
PS = \frac{1}{2} \times 15 \times $15 = $112.50
\]

Two reasons for the fall in PS:

1. Fall in PS due to sellers leaving market

2. Fall in PS due to remaining sellers getting lower \( P \)
A. Find marginal seller’s cost at $Q = 10$.

B. Find total PS for $P = $20.

Suppose $P$ rises to $30$. Find the increase in PS due to...

C. selling 5 additional units

D. getting a higher price on the initial 10 units

E. Total PS
A. At $Q = 10$, marginal cost = $20

B. $PS = \frac{1}{2} \times 10 \times $20 = $100$

$P$ rises to $30$.

C. $PS$ on additional units $= \frac{1}{2} \times 5 \times $10 = $25$

D. Increase in $PS$ on initial 10 units $= 10 \times $10 = $100$

E. Total $PS = $100 + $25 + $100 = $225$

OR $= \frac{1}{2} \times 30 \times $15 = $225$
CS, PS, and Total Surplus

CS  = (value to buyers) – (amount paid by buyers)
    = buyers’ gains from participating in the market

PS  = (amount received by sellers) – (cost to sellers)
    = sellers’ gains from participating in the market

Total surplus = CS + PS
    = total gains from trade in a market
    = (value to buyers) – (cost to sellers)

Why do we care about total surplus?

(Note: in a world without taxes, the amount paid by buyers equals the amount received by sellers)
The Market’s Allocation of Resources

- In a market economy, the allocation of resources is decentralized, determined by the interactions of many self-interested buyers and sellers.

- Is the market’s allocation of resources desirable? Or would a different allocation of resources make society better off?

- To answer this, we use total surplus as a measure of society’s well-being, and we consider whether the market’s allocation is efficient. (Policymakers also care about equality, though are focus here is on efficiency.)
Efficiency

An allocation of resources is **efficient** if it maximizes total surplus. Efficiency means:

- The goods are consumed by the buyers who value them most highly.
- The goods are produced by the producers with the lowest costs.
- Raising or lowering the quantity of a good would not increase total surplus.

Total surplus  =  (value to buyers)  −  (cost to sellers)
Evaluating the Market Equilibrium

Market eq’m:

\[ P = $30 \]
\[ Q = 15,000 \]

Total surplus

\[ = CS + PS \]

Is the market eq’m efficient?
Which Buyers Consume the Good?

Every buyer whose WTP is $\geq$ $30 will buy.

Every buyer whose WTP is $< $30 will not.

So, the buyers who value the good most highly are the ones who consume it.
Which Sellers Produce the Good?

Every seller whose cost is $\leq 30$ will produce the good.

Every seller whose cost is $> 30$ will not.

So, the sellers with the lowest cost produce the good.
At $Q = 20$, cost of producing the marginal unit is $35$
value to consumers of the marginal unit is only $20$
Hence, can increase total surplus by reducing $Q$.

This is true at any $Q$ greater than 15.
At $Q = 10$, cost of producing the marginal unit is $25$
value to consumers of the marginal unit is $40$
Hence, can increase total surplus by increasing $Q$.

*This is true at any $Q$ less than 15.*
Does Eq’m Q Maximize Total Surplus?

The market eq’m quantity maximizes total surplus.

At any other quantity, we can increase total surplus by moving toward the market eq’m quantity.
The Free Market vs. Govt Intervention

- The market equilibrium is efficient. No other outcome achieves higher total surplus.
- Govt cannot raise total surplus by changing the market’s allocation of resources.
The Free Market vs. Central Planning

- Suppose resources were allocated not by the market, but by a central planner who cares about society’s well-being.

- To allocate resources efficiently and maximize total surplus, the planner would need to know every seller’s cost and every buyer’s WTP for every good in the entire economy (lack of crucial information).

- This is impossible, and why centrally-planned economies are never very efficient.
CONCLUSION

- This chapter used welfare economics to demonstrate one of the Ten Principles: *Markets are usually a good way to organize economic activity.*

- Important note: We derived these lessons assuming perfectly competitive markets.

- In other conditions we will study in later chapters, the market may fail to allocate resources efficiently…
CONCLUSION

- Such market failures occur when:
  - a buyer or seller has market power – the ability to affect the market price.
  - transactions have side effects, called externalities, that affect bystanders. (example: pollution)

- We’ll use welfare economics to see how public policy may improve on the market outcome in such cases.

- Despite the possibility of market failure, the analysis in this chapter applies in many markets, and the invisible hand remains extremely important.