Lecture 9:
Supply in a Competitive Market

October 27, 2015
Overview

Course Administration

Ripped From Headlines

Market Structure and Perfect Competition in the Short Run

Profit Maximization in a Competitive Market

Perfect Competition in the Short Run

Perfect Competition in the Long Run
Course Administration

1. Return midterms at end of class – will post answers tomorrow
2. Problem Set 8 is posted
3. How many can make it to my office hours?
4. Your papers
   • Please come see me about your papers. If you can’t come during the day, we can set up a phone chat at an alternate time.
5. We are skipping section 8.5 due to lack of time
6. Office hours canceled 11/12 – out of town for conference
7. Monika is sick – no office hours today
Ripped from the Headlines

Next Week Afternoon

Finder | Presenter
------|-----------
Enoch Obeng | Erica Harvey
Mariah McConnell | Colette Tano

Evening

Finder | Presenter
------|-----------
Nayda Lakelieh | Arielle Atherly
Donna Iken | J. Ruari MacDonald
Big Questions for Today

- How does a firm choose how much to produce?
- How does long run behavior differ from short run behavior?
- Where does the market supply curve come from?
- Which firms get producer surplus?
Market Characteristics and Types

Key Characteristics of Markets

- Number of firms
- Substitutability of products
- Barriers to entry
Market Characteristics and Types

Key Characteristics of Markets

- Number of firms
- Substitutability of products
- Barriers to entry

Types of Markets

- Perfectly competitive
- Monopolistic competition
- Oligopoly
- Monopoly
## Market Characteristics by Type

<table>
<thead>
<tr>
<th>Type</th>
<th>No. of firms</th>
<th>Subst. of Products</th>
<th>Barriers to Entry</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perfectly Comp.</td>
<td>many</td>
<td>entirely</td>
<td>none</td>
</tr>
<tr>
<td>Monopolistic Comp.</td>
<td>many</td>
<td>not entirely</td>
<td>yes</td>
</tr>
<tr>
<td>Oligopoly</td>
<td>few</td>
<td>either</td>
<td>some</td>
</tr>
<tr>
<td>Monopoly</td>
<td>one</td>
<td>n/a</td>
<td>yes</td>
</tr>
</tbody>
</table>
Elements of a Perfectly Competitive Market

- Many firms in the market
- Products sold are perfect substitutes
- No barriers to entry
Elements of a Perfectly Competitive Market

- Many firms in the market
- Products sold are perfect substitutes
- No barriers to entry

Of course, this is very rare. We care about this case – a “best case scenario” – as a baseline.
Demand Curve as Seen By a Price-Taker

- Call a perfectly competitive firm a price-taker
- This firm can't impact price
- To this firm, demand is infinite at market price
- In other words, the firm perceives demand as perfectly elastic at the equilibrium market price
Market Demand vs Demand Perceived by Firm

Market Equilibrium

Industry

Representative Firm

$\begin{align*}
$ & \\
$ & \\
$ & \\
$ & \\
$
\end{align*}$

$\begin{align*}
S & \\
D & \\
\end{align*}$

$\begin{align*}
S & \\
D & \\
\end{align*}$

$\begin{align*}
S & \\
D & \\
\end{align*}$
Market Demand vs Demand Perceived by Firm

Firm’s View of Market Equilibrium
Recall and Define Key Terms

- Economic profit ≠ accounting profit
Recall and Define Key Terms

- Economic profit ≠ accounting profit
  - accounting profit ≡ total revenue - total cost
  - economic profit ≡ total revenue - total cost, including opportunity costs
Recall and Define Key Terms

- Economic profit $\neq$ accounting profit
  - accounting profit $\equiv$ total revenue - total cost
  - economic profit $\equiv$ total revenue - total cost, including opportunity costs
- Marginal revenue $\equiv$ additional revenue from an additional unit of output
- If the firm perceives the demand curve as constant, then $MR = P$
Profit Maximization in a Perfectly Competitive World

- Firm cannot affect $P$
- Additional revenue from an additional unit is $MR = P$
- Additional cost from an additional unit is $MC$
- If $MC > MR$...
Profit Maximization in a Perfectly Competitive World

- Firm cannot affect \( P \)
- Additional revenue from an additional unit is \( MR = P \)
- Additional cost from an additional unit is \( MC \)
- If \( MC > MR \)… it’s a bad idea for the firm to produce
- If \( MC < MR \)...
Profit Maximization in a Perfectly Competitive World

- Firm cannot affect $P$
- Additional revenue from an additional unit is $MR = P$
- Additional cost from an additional unit is $MC$
- If $MC > MR$... it’s a bad idea for the firm to produce
- If $MC < MR$... the firm should produce more and make more money
- → profit is maximized where $MR = MC$
- And since $MR = P$, firm maximizes profits where $MR = P = MC$
\( MR = MC \) in Pictures

Firm’s View of Demand
MR = MC in Pictures
Intersecting with Firm’s Costs
What are Profits at this Point?

Profits = total revenue - total cost

\[ \pi = TR - TC \]
What are Profits at this Point?

Profits = total revenue - total cost

\[ \pi = TR - TC \]

\[ = (P \times Q) - (ATC \times Q) \]
What are Profits at this Point?

Profits = total revenue - total cost

\[ \pi = TR - TC \]

\[ = (P \times Q) - (ATC \times Q) \]

\[ = Q(P - ATC) \]
Finding Profit

What is the Profit-Maximizing Q?

$\text{MC} = \text{d = MR}$
Finding Profit

Where is total revenue?

Quantity

MC

d = MR

ATC

Q*

Quantity
Finding Profit

Where are total costs?

\[
\text{Total Revenue} = P \times Q
\]
Finding Profit

How do you find profit?

Total Costs = $ATC*Q$
Finding Profit

Is \( \pi > 0 \) or \( < 0 \)?

\[
\begin{array}{c|c|c}
\text{Quantity} & \text{MC} & \text{ATC} \\
\hline
\text{Q}^* & \text{d = MR} & \ \\
\end{array}
\]
Finding Profit

\[ \pi > 0 \]
Finding Profit

Profits Now? First find revenues

\[ Q^* \]

$\text{Quantity}$

$\text{MC}$

$\text{ATC}$

$\text{d} = \text{MR}$
Finding Profit

Profits Now? Now find costs

$\begin{array}{c|c|c}
\text{Quantity} & \text{MC} & \text{ATC} \\
\hline
\text{d} & \text{MR} & \text{Q}^* \\
\hline
\text{Total Revenue}
\end{array}$
Finding Profit

Profits Now?

\begin{align*}
\text{Total Costs} & \quad \text{MC} \\
Q^* & \quad d = MR
\end{align*}
Finding Profit

No Profits to Be Found

\[ \pi = 0 \]

$\pi = 0$

$Q^*$

MC

ATC

$\text{d} = \text{MR}$

Quantity
Finding Profit

Price Falls. Profits Now? What is profit maximizing $Q$?

$\begin{array}{|c|c|c|}
\hline
\text{Quantity} & \text{MC} & \text{ATC} \\
\hline
\end{array}$

$d = MR$
Finding Profit

Profits Now? Find total revenue

\[ Q^* \]

\[ d = MR \]
Finding Profit

Profits Now? Find total costs

<table>
<thead>
<tr>
<th>Quantity</th>
<th>MC</th>
<th>ATC</th>
<th>d = MR</th>
<th>Q*</th>
<th>Total Revenue</th>
</tr>
</thead>
</table>

$
Finding Profit

\[ \pi > 0? \text{ or } \pi < 0? \]
Finding Profit

Profits are negative

\[
\begin{align*}
\pi & < 0 \\
Q^* & = \text{d} = \text{MR}
\end{align*}
\]
In the Short Run, Should the Firm Shut Down if $\pi < 0$?

- In the short run, what does the firm have to pay if it runs or not?
In the Short Run, Should the Firm Shut Down if $\pi < 0$?

- In the short run, what does the firm have to pay if it runs or not? fixed costs
In the Short Run, Should the Firm Shut Down if $\pi < 0$?

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- So profits in the short run, with no output is $\pi_{\text{shutdown}} = -FC$
- Profits in the short run, with output is
  \[ \pi_{\text{operate}} = TR - TC = TR - FC - VC \]
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$$TR - FC - VC > -FC$$
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  \[
  TR - VC > 0
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In the Short Run, Should the Firm Shut Down if $\pi < 0$?

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\[
\pi_{\text{operate}} > \pi_{\text{shutdown}}
\]

\[
TR - FC - VC > -FC
\]

\[
TR - VC > 0
\]

\[
TR > VC
\]
Review: Keeping the Short-Run Curves Straight

- Maximize profit where $MR = MC$
- Profit is $Q \times (P - ATC)$
- Operate if $P > AVC$
Describing Supply from First Principles

In the short run

- Firm’s supply curve
- Industry’s supply curve
- Producer surplus for a firm
- Producer surplus for the industry
Finding a Firm’s Short Run Supply Curve

- We now know that the firm supplies only when $TR > VC$
- What does this imply about $MC$?

\[
TR > VC \\
P \cdot Q > VC \\
MC \cdot Q > VC \\
MC > VC/Q \\
MC > (AVC \cdot Q)/Q \\
MC > AVC
\]

→ Firm supplies only when $MC > VC/Q$
Finding a Firm’s Short Run Supply Curve

What Quantities Would the Firm Produce?
Finding a Firm’s Short Run Supply Curve

An Individual Firm’s Supply Curve

<table>
<thead>
<tr>
<th>Quantity</th>
<th>MC</th>
<th>ATC</th>
<th>AVC</th>
</tr>
</thead>
</table>

Graph showing $MC$, $ATC$, and $AVC$ curves.
Finding Industry Supply

- Recall that we found market demand by summing individual demands
- Now we find market supply by adding firm supply, given prices
- Find market supply
  - Firm A: $Q_A = f(P)$
  - Firm B: $Q_B = g(P)$
  - Market supply: $Q_M = f(P) + g(P)$
Finding Industry Supply in Pictures

When Firms Have the Same Supply Curve

![Graph showing supply curves for firms and industries.](image)
Finding Industry Supply in Pictures

When Firms Have Different Supply Curves
Adding Up Market Supply

- Supply starts at lowest price is that offered by any firm
- Total quantity at any price is $Q$ offered by all firms
**Producer Surplus from a Competitive Firm**

- Like before, the sum of the benefit from each unit
- Two equivalent ways to think about this
  - The difference between market price and supply
  - The difference between \( Q \times AVC \) and \( PQ \)
Producer Surplus for a Firm: Pictures

(a) Producer Surplus: Adding All of the Price-Marginal Cost Markups

(b) Producer Surplus: Total Revenue Minus Variable Costs
Producer Surplus vs. Profit

- Profit: $\pi = TR - (FC + VC)$

Remember, $\pi \neq PS$
Producer Surplus vs. Profit

- **Profit:** \( \pi = TR - TC = TR - (FC + VC) \)
Producer Surplus vs. Profit

- Profit: \( \pi = TR - TC = TR - (FC + VC) \)
- Surplus: \( PS = TR - VC \)

Remember, \( \pi \neq PS \)
Producer Surplus for a Competitive Industry
Entry in the Long Run

- Free entry ≡ when firms can easily enter the market
  - No legal barriers
  - No technical barriers
- Long run profits
  - Difference between price and long-run total cost
  - \( \pi = P \times Q - LATC \times Q = Q \times (P - LATC) \)
Entry in the Long Run

- Free entry \( \equiv \) when firms can easily enter the market
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- When \( \pi > 0 \), we anticipate entry by new firms, until \( \pi = 0 \)
Entry in the Long Run

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- Long run profits
  - Difference between price and long-run total cost
  - $\pi = P \times Q - LATC \times Q = Q \times (P - LATC)$
- When $\pi > 0$, we anticipate entry by new firms, until $\pi = 0$
- Long-run competitive equilibrium $\equiv$ point at which $P = LATC$, and there are no gains to entry for additional firms
Profits and Entry

What is the long-run profit-maximizing $Q$?

If economic profit exists, what should other firms do?
Profits and Entry
And where are total revenues?

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Profits and Entry
Positive profits: Stay in business

If economic profit exists, what should other firms do?
Long-Run Exit

• Free exit $\equiv$ ability of firm to exit an industry without legal or technical barriers
• When should a firm exit the market? When $P < LATC$
What Happens When Demand Increases?

Original Equilibrium

**Industry**

![Graph showing supply (S) and demand (D) curves.]

**Representative Firm**

![Graph showing marginal cost (MC) and average total cost (ATC) curves.]

-$Q-$ $Q$
What Happens When Demand Increases?

Note Zero Profits
What Happens When Demand Increases?

Demand Increases. Profits?

Industry

Representative Firm

$P_1^*$

$D_2$

$D$

$MC$

$ATC$

$d = MR$

$Q$

$Q$

$\$
What Happens When Demand Increases?
Firms Enter, Prices and Profits Fall
What Happens When Demand Increases?
But Firm Produces More
Finding the Long-Run Supply Curve

Recap: Suppose demand increases. What happens

• in the short run to prices?
Finding the Long-Run Supply Curve

Recap: Suppose demand increases. What happens

- in the short run to prices? increase
- in the long run to firm entry?
Finding the Long-Run Supply Curve

Recap: Suppose demand increases. What happens

• in the short run to prices? increase
• in the long run to firm entry? increases
• and in the long run to prices?
Finding the Long-Run Supply Curve

Recap: Suppose demand increases. What happens

- in the short run to prices? increase
- in the long run to firm entry? increases
- and in the long run to prices? return to market equilibrium
Finding the Long-Run Supply Curve

Recap: Suppose demand increases. What happens

• in the short run to prices? increase
• in the long run to firm entry? increases
• and in the long run to prices? return to market equilibrium

→ the long-run supply curve is perfectly elastic
Finding the Long-Run Supply Curve

Suppose costs fall. What happens

- in the short run to prices?
Finding the Long-Run Supply Curve

Suppose costs fall. What happens

• in the short run to prices? decrease
• in the short run to firm profits?
Finding the Long-Run Supply Curve

Suppose costs fall. What happens

- in the short run to prices? decrease
- in the short run to firm profits? possibly increase, if lower costs not passed to consumers
- in the long run to firm entry?
Finding the Long-Run Supply Curve

Suppose costs fall. What happens

- in the short run to prices? decrease
- in the short run to firm profits? possibly increase, if lower costs not passed to consumers
- in the long run to firm entry? increases, if lower costs not passed to consumers
- and in the long run to prices?
Finding the Long-Run Supply Curve

Suppose costs fall. What happens

• in the short run to prices? decrease
• in the short run to firm profits? possibly increase, if lower costs not passed to consumers
• in the long run to firm entry? increases, if lower costs not passed to consumers
• and in the long run to prices? be a function of the new, lower costs
Finding the Long-Run Supply Curve

Suppose costs fall. What happens

• in the short run to prices? decrease
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→ the long-run supply curve is perfectly elastic
When Costs Fall

(a) Industry

(b) Representative firm

(c) Industry adjustments over time
In Sum, In the Long Run

- Firms can enter
- Firms can exit
- Profits are zero
- \( P = LATC \)
- Supply is perfectly elastic
Suppose the market for the pain reliever aspirin is in long-run equilibrium at a price of $3/bottle. New scientific research links aspirin with a reduced risk of heart disease.

1. In the short run, what happens to the price of aspirin? Explain using a diagram for both the industry and the representative firm.

2. In the short run, how do firms respond to the change in price described in (1)? What will happen to profits? Explain using the same diagrams.

3. Given the situation described in (2), what can we expect to happen to the number of aspirin producers in the long run?
Recap of Today

- Market structure and perfect competition in the short run
- Profit maximization in a competitive market
- Perfect competition in the short run
- Perfect competition in the long run
Next Class

- Turn in Problem Set 8
- Market Power and Monopoly
# Midterm Results Distribution

<table>
<thead>
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<th>Grade Range</th>
<th>Both</th>
<th>Afternoon</th>
<th>Evening</th>
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Grades are
- 84 to 100 A
- 75 to 83 A-
- 66 to 74 B+
- 60 to 65 B
- 50 to 59 B-
- 40 to 49 C+

Notes
- If you are on the border of a letter grade, I round up.
- If you got a A and are willing to volunteer to help a student, send me an email
- If you got below a B+ and would like help from a student volunteer, send me an email