Monopoly
Chapter 24
About Midterm 1

Clicker vote: The MC questions were

A) Too easy/short
B) Just right
C) Too difficult/long
About Midterm 1

Clicker vote: Regarding the interruptions, announcements, & incentives encouraging you to write/bubble your name, perm, version, TA:

A) Please do more, I might forget to write my name, version, etc. otherwise
B) Just right
C) We’re adults and should take responsibility if we forget to write our name, etc. Please cut down on the interruptions. They make it hard to concentrate.
About Midterm 1

- MC score report available now from TA in OH or section
- Blue-books available by Monday
- Score look-up tool on class website
  - Enter ID number from section
  - View recorded score for any exam or quiz
- See syllabus for approximate letter grade distribution. I will post histogram of total scores w/ rough cutoffs for letter grades.
- Results known so far: good performance on MC part (out of 8 questions: 1/3 got 8, 2/3 got at least 7, 4/5 got at least 6)
- Warning: topics get more complex as we go along!
Motivating Questions

• What price and quantity does a monopoly choose?

• What are the welfare effects of monopoly?

• What are the effects of taxes on monopolies?

• Is monopoly every justified/efficient?
What is a monopoly?

- A monopoly is a sole supplier of a good.
- The monopolist’s demand curve is the market demand curve.
- *Price maker* not a price taker
- Can set price (quantity is constrained by demand curve relationship)
- Or: chooses quantity, which determines price
What causes monopolies?

- Legal fiat: US Postal Service
- Patent: drugs, technology; intellectual property
- Sole ownership of a resource: toll road
- Cartel: OPEC
- Large economies of scale: local utilities
Monopoly is heavily regulated

- Antitrust Law: abuse of monopoly power is a felony
- Dept. of Justice (DOJ) has antitrust division
- Federal Trade Commission (FTC) has regulatory oversight
Government & Monopoly

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But govt. creates monopolies (USPS) and issues patents/copyrights that grant monopoly power.
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If if monopoly is so bad, why does the government enable it in some cases?
What quantity maximizes profits?

Setup the problem:

- For any firm, profit is given by
  \[ \Pi(y) = R(y) - C(y), \]
  where \( R(y) \) is revenue and \( C(y) \) is cost.

- Profit maximization problem:
  \[ \max_y R(y) - C(y) \]
What quantity maximizes profits?

Graphical analysis:

R(y) = p(y)y
What quantity maximizes profits?

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\[ R(y) = p(y)y_c(y) \]
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\[ c(y) \]

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What quantity maximizes profits?

Graphical analysis:

At the profit-maximizing output level, the slopes of the revenue and cost curves are equal: $MR(y^*) = MC(y^*)$. 

\[
R(y) = p(y)y - c(y) \\
\Pi(y) = R(y) - c(y) \\
MR(y) = p(y) \\
MC(y) = c'(y) 
\]
What quantity maximizes profits?

Algebraic analysis:

- Optimality condition:
  \[
  \frac{d\Pi(y)}{dy} = 0 \implies R'(y) - C'(y) = 0 \implies R'(y) = C'(y)
  \]

- At the profit maximizing quantity, \( y^* \):
  \[
  MR(y) = MC(y)
  \]
What quantity maximizes profits?

Algebraic analysis:

• **If the market is competitive**, the firm takes $p$ as given/fixed (demand curve is flat)
• In that case, $R(y) = py$, where $p$ is constant, so $MR(y) = p$.
• Profit-maximizing condition: $p = MC$
What quantity maximizes profits?

Algebraic analysis:

- Monopoly is not a price taker, though
- Demand slopes down
- Recall \( MR(y) = P(y) + P'(y)y \) is below \( P(y) \)
What quantity maximizes profits?

Algebraic analysis:

- Choose quantity \( y^* \) s.t. \( MR = MC \)
- Set price according to \( P(y^*) \)
- Profit-maximizing condition: \( p = MC \)
- Price is marked-up over marginal cost \( p > MC \)
Monopoly: Example

- Inverse Demand: \( P(y) = 10 - y \), so marginal revenue is...
Monopoly: Example

• Inverse Demand: \( P(y) = 10 - y \), so marginal revenue is...

• Clicker Vote:

A) \( MR = -1 \)
B) \( MR = 10 - \frac{y}{2} \)
C) \( MR = 10 - y \)
D) \( MR = 10 - 2y \)
Monopoly: Example

- Inverse Demand: $P(y) = 10 - y$, so marginal revenue is...

- Clicker Vote:
  
  A) $MR = -1$
  B) $MR = 10 - \frac{y}{2}$
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Monopoly: Example

- **Inverse Demand:** \( P(y) = 10 - y \), so marginal revenue is \( MR(y) = 10 - 2y \).
- **Cost function:** \( C(y) = 2y + y^2 \), so \( MC(y) = 2 + 2y \)

- **Optimality condition:**
  \[
  MR = MC \iff 10 - 2y = 2 + 2y
  \]

- So \( y^m = \frac{8}{4} = 2 \)
- ... and \( p^m = P(y^m) = 10 - 2 = 8 \)
Monopoly: Example

\[ p^m = 8 \]

\[ y^m = 2 \]

MC = MR

Demand

Price

\[ MC = MR \]
Monopoly: Now you try it!

Clicker Vote: Find the monopoly price and quantity when inverse demand is given by $p = 30 - 2q$ and the cost function is $c(q) = q^2 + 31$.

A) $(p, q) = (10, 5)$$
B) $(p, q) = (20, 5)$$
C) $(p, q) = (15, 7.5)$$
D) $(p, q) = (0, 7.5)$
Clicker Vote: Find the monopoly price and quantity when inverse demand is given by $p = 30 - 2q$ and the cost function is $c(q) = q^2 + 31$.

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Monopoly Price and Elasticity of Demand

How does the monopoly price relate to the elasticity of demand?

\[ MR = p(y) + y \frac{dp(y)}{dy} = p(y)[1 + \frac{y}{p(y)} \frac{dp(y)}{dy}] \]

Recall that

\[ \epsilon = \frac{p(y)}{y} \frac{dy}{dp(y)}. \]

So

\[ MR = p(y)[1 + \frac{1}{\epsilon}]. \]
Monopoly Price and Elasticity of Demand

How does the monopoly price relate to the elasticity of demand?

- $MR = p(y)[1 + \frac{1}{\epsilon}]$ and $MR = MC$, so $MC = p(y)[1 + \frac{1}{\epsilon}]$. 

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- $MR = p(y)[1 + \frac{1}{\epsilon}]$ and $MR = MC$, so $MC = p(y)[1 + \frac{1}{\epsilon}]$.
- Rewrite as

$$p(y) = \frac{MC}{1 + \frac{1}{\epsilon}}$$
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  \[ p(y) = \frac{MC}{1 + \frac{1}{\epsilon}} \]
- Note that $MR, p > 0$ implies $\epsilon < -1$
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- This means that a monopolist chooses an output level at which demand is elastic.
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- Rewrite as $p(y) = \frac{MC}{1 + \frac{1}{\epsilon}}$
- Note that $MR, p > 0$ implies $\epsilon < -1$
- This means that a monopolist chooses an output level at which demand is elastic.
- Intuition: if on inelastic part, cutting output (raising price) increases revenue (and maybe lowers costs)
Monopoly Price and Elasticity of Demand

How does the monopoly price relate to the elasticity of demand?

\[ p(y) = \frac{MC}{1 + \frac{1}{\epsilon}} \]

- Because elasticity is negative (demand slopes down), price is always above \( MC \)
Monopoly Price and Elasticity of Demand

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- Markup pricing: price is marginal cost plus a “markup”. What happens to the markup as demand becomes less elastic?
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- Monopolist increases price
- Example: if \( \epsilon = -3 \), \( p(y) = \frac{3MC}{2} \); if \( \epsilon = -2 \), \( p(y) = 2MC \)
Perfect Competition vs. Monopoly

Price and Quantity: given a cost function, how does the behavior of a monopolist compare to that of a competitive firm?

\[ p^m > p^c \quad \text{and} \quad y^m < y^c \]
Inefficiency of Monopoly

• What are the welfare effects of monopoly? Who gains and who loses?

• Since $p^m > p^c$, seller gains, consumers lose

• But since $y^m < y^c$, we know that there are unrealized gains from trade. So the losses outweigh the gains: there is some welfare loss.

• The deadweight loss (DWL) is the societal loss in welfare. It measure the inefficiency of monopoly relative to the competitive outcome.
Calculating the DWL of Monopoly

In competitive equilibrium
Consumer surplus = A + B + C
Calculating the Deadweight Loss of Monopoly

In competitive equilibrium
Producer surplus = D + E
Calculating the DWL of Monopoly

In competitive equilibrium
Total surplus = A + B + C + D + E

Demand
MR
Price
MC

In competitive equilibrium
Total surplus = A + B + C + D + E

Price

Demand
MC

In competitive equilibrium
Total surplus = A + B + C + D + E
Calculating the DWL of Monopoly

In Monopoly case

Producer surplus = B + D

Demand

MC

price

y

p^m

p^c

y^m

y^c

A

B

C

D

E

MR

y

y^m

y^c

B

Calculating the DWL of Monopoly

In Monopoly case
Consumer surplus = A

\[ p_m \]
\[ p_c \]
\[ y_m \]
\[ y_c \]
Calculating the DWL of Monopoly

In Monopoly case
Total surplus = A + B + D

DWL = (A + B + C + D + E) – (A + B + D) = C + E

MC
Demand

price

y

A
B
C
D
E

p^m
p^c
MC(y^m)

y^m
y^c

MC

y

Calculating the DWL of Monopoly

Calculating Deadweight Loss of Monopoly

y
Demand
MR
price
ym
pm
MC
pc
yc
B
Inefficiency of Monopoly

The need for regulation

- Competitive market provides greater surplus than monopoly
- Can changing from a monopolistic market to a competitive one make everyone (consumers and monopolist) better off (Pareto improving)?
- In other words, is there room for a Pareto improving deal in which a monopolist agrees to act like a competitive firm?
- No, because this will make the firm worse off
- Thus, the DWL of monopoly rationalizes antitrust laws
Example (continued)

- Inverse demand: \( P(y) = 10 - y \)
- Marginal cost: \( MC(y) = 2 + 2y \)
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- Recall: \( p^m = 8 \) and \( y^m = 2 \)
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- What is the competitive equilibrium?
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- Inverse demand: \( P(y) = 10 - y \)
- Marginal cost: \( MC(y) = 2 + 2y \)
- Recall: \( p^m = 8 \) and \( y^m = 2 \)
- What is the competitive equilibrium?
- Use \( p = MC \)

\[
P(y^c) = 10 - y^c = 2 + 2y = MC(y^c)
\]
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\[
P(y^c) = 10 - y^c = 2 + 2y = MC(y^c)
\]

- So \( y^c = \frac{8}{3} \) and \( p^c = \frac{22}{3} \)
Example (continued)

- So what is the DWL of monopoly?
Example (continued)

- So what is the DWL of monopoly?
- We can calculate DWL using

\[
DWL = \frac{1}{2} [P(y^m) - MC(y^m)][y^c - y^m]
\]
Example (continued)

- So what is the DWL of monopoly?
- We can calculate DWL using

\[ DWL = \frac{1}{2}[P(y^m) - MC(y^m)](y^c - y^m) \]

- Aside: in general, this is an approximation. Because of linear demand, MC, here it is exact.
Example (continued)

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- We can calculate DWL using

\[
DWL = \frac{1}{2} [P(y^m) - MC(y^m)] [y^c - y^m]
\]

- Aside: in general, this is an approximation. Because of linear demand, MC, here it is exact.
- So DWL is

\[
DWL = \frac{1}{2} [8 - 6] [\frac{8}{3} - 2] = \frac{2}{3}
\]