Monopoly
Chapter 24 (cont.)
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 ever justified/efficient?
- Monopoly Behavior: price discrimination
Consider a quantity tax, \( t \) per unit

- Consumers pay \( p = P(y) \), but monopoly only gets \( P(y) - t \)

- Profit maximization problem:

\[
\max_y (P(y) - t)y - C(y) = \max_y P(y)y - C(y) - ty
\]

- Optimal condition:

\[
MR(y) = MC(y) + t
\]
Example: Linear Demand

- Inverse demand: \( P(y) = 10 - y \); cost: \( C(y) = 4y \)
- Find MR: \( MR(y) = 10 - 2y \)
- Find MC: \( MC(y) = 4 \)
- Optimality condition:

\[
MR(y) = MC(y) + t \iff 10 - 2y = 4 + t,
\]

- So \( y^t = \frac{6 - t}{2} = 3 - \frac{t}{2} \)
- Find price by plugging into inverse demand:

\[
p^t = 10 - (3 - \frac{t}{2}) = 7 + \frac{t}{2}
\]

Notice: with \( t = 0 \), \( p^m = 7 \), so the tax raises the price by \( p^t - p^m = \frac{t}{2} \), i.e. less than the full amount of the tax.
Monopoly Taxation

General (not just for monopoly) question: how much of a tax is passed to the consumer?

Recall our analysis of tax incidence competitive firms: the price rises by less than the amount of the tax.

Also, recall how elasticity influences tax incidence: the more elastic supply, the more of the tax is borne by the consumer.
Monopoly Taxation

General (not just for monopoly) question: how much of a tax is passed to the consumer?

- Let’s answer this question more rigorously and more generally.
- Start with the perfectly competitive case, where 
  \( p = MC(y) + t \) is the profit maximizing condition.
- Differentiate w.r.t. \( t \):
  \[
  \frac{\partial p}{\partial t} = \frac{\partial MC}{\partial y} \frac{\partial y}{\partial t} + 1 \leq 1
  \]
  - The first term is negative, except when \( MC \) is constant, in which case supply is perfectly elastic and \( t \) is passed completely to the consumer.
Monopoly Taxation: How much is passed to the consumer?

Is this as bad as it can get for the consumer, bearing the full incidence of the tax?

- Let’s look at the monopoly case
- In our example, \( p^t - p^m = \frac{t}{2} \), so the price only goes up by half the amount of the tax
- For a more general answer, start with the profit maximizing condition, \( MR = MC \).
- Recall that we can rewrite the profit-maximization condition in terms of elasticity:

\[
P(y^t) = \left[ \frac{1}{1 + \frac{1}{\epsilon}} \right] [MC(y^t) + t]
\]

- Differentiate w.r.t. \( t \):

\[
\frac{\partial P}{\partial t} = \left[ \frac{1}{1 + \frac{1}{\epsilon}} \right] \left[ \frac{\partial MC}{\partial y} \frac{\partial y}{\partial t} + 1 \right] + [MC(y^t) + t] \frac{\partial [junk]}{\partial t}
\]
Monopoly Taxation: How much is passed to the consumer?

Ugly:

\[
\frac{\partial P}{\partial t} = \left[ \frac{1}{1 + \frac{1}{\epsilon}} \right] \left[ \frac{\partial MC}{\partial y} \frac{\partial y}{\partial t} + 1 \right] + [MC(y^t) + t]\frac{\partial [junk]}{\partial t}
\]

What does this mean?

- Let’s consider the worst case for the consumer: perfectly elastic supply, i.e. constant MC \( \frac{\partial MC}{\partial y} = 0 \).
- Simplify expression:

\[
\frac{\partial P}{\partial t} = \left[ \frac{1}{1 + \frac{1}{\epsilon}} \right] + [MC(y^t) + t]\frac{\partial [junk]}{\partial t}
\]

- First term: increasing tax increases effective MC, so price increase is proportional to markup
- Second term: but moving along demand curve can change elasticity, size of the markup.
Original question: does $p^t$ increase by the full amount of $t$?

\[
\frac{\partial P}{\partial t} = \left[ \frac{1}{1 + \frac{1}{\epsilon}} \right] + [MC(y^t) + t] \frac{\partial [junk]}{\partial t}
\]

- First term: increasing tax increases effective MC, so price increase is proportional to markup.
- Second term: but moving along demand curve can change elasticity, size of the markup.
- With linear demand, we’ve seen the second effect dominate (example)
- When is the second effect not so important?
Monopoly Taxation: How much is passed to the consumer?

Moving along the demand curve doesn’t *necessarily* change elasticity.

- Recall: constant elasticity demand curve \( D(p) = p^\epsilon \)
- With this kind of demand, elasticity doesn’t change along curve, markup multiplier is constant
- So \( \frac{\partial [\text{junk}]}{\partial t} = 0 \) and first term dominates
- This means that price increases by multiplier (> 1) times tax
Monopoly Taxation: How much is passed to the consumer?

Example: constant demand elasticity

\[ P(y^t) = \left[ \frac{1}{1 + \frac{1}{\epsilon}} \right] [MC(y^t) + t] \]

- Suppose \( D(p) = p^{-2} \) so \( \epsilon = -2 \) and \( C(y) = 4y \) so \( MC(y) = 4 \)

\[ P(y^t) = \left[ \frac{1}{1 + \frac{1}{-3}} \right] [4 + t] = 2[4 + t] = 8 + 2t \]

- \( p^m = 8 \) with no tax, so the tax raises the price by \( p^t - p^m = 2t \), i.e. the price rises by twice (markup = 2) the amount of the tax

*The monopolist exploits the tax to increase her profit margin.*

- This can be very bad for consumers.
A natural monopoly arises when the firm’s technology has economies-of-scale large enough for it to supply the whole market at a lower average total production cost than is possible with more than one firm in the market. In other words, ATC is decreasing, so a smaller producer would have higher costs.
A natural monopoly deters entry by threatening predatory pricing against an entrant. Setting $p$ closer to MC will force the entrant to exit, because it has higher costs.
Like any profit-maximizing monopolist, the natural monopolist causes a deadweight loss.
Regulating a Natural Monopoly

Why not command that a natural monopoly produce the efficient amount of output? Then DWL = 0, right?
At the efficient output level, $y^e$, $ATC(y^e) > p(y^e)$ so the firm makes an economic loss.

A natural monopoly cannot be forced to use marginal cost pricing. Doing so makes the firm exit, destroying both the market and any gains-from-trade.
Because of the inefficiency of monopoly, government has an interest in discouraging abuse of monopoly power.

For a natural monopoly, this may mean regulatory schemes that induce the efficient output level, without exiting.

Or, the government become the provider of the natural monopoly good, providing it at below the profit-maximizing cost.

Because it’s difficult to prevent people from stealing intellectual property, the government grants patents/copyrights which give monopoly power.

This gives firms the ability to capture the profits from the new technologies they produce, giving them the incentive to innovate.

The government trades off the inefficiency of monopoly for the private provision of knowledge/R&D, a public good.