Chapter 11

Monopoly

I think it’s wrong that only one company makes the game Monopoly.

Steven Wright
Chapter 11 Outline

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11.2 Market Power
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11.1 Monopoly Profit Maximization

- A *monopoly* is the only supplier of a good for which there is no close substitute.
- Monopolies are not price takers like competitive firms
  - Monopoly output is the market output
  - Monopoly demand curve is the market demand curve
  - Monopolists can set their own price given market demand
  - Because demand is downward sloping, monopolists set price above marginal cost to maximize profit.
- Like all firms, monopolies maximize profits by setting price or output so that marginal revenue (MR) equals marginal cost (MC).
11.1 Monopoly Profit Maximization

• Monopolies maximize profits by setting price or output so that marginal revenue (MR) equals marginal cost (MC).

• Profit function to be maximized by choosing output, \( Q \):
  • \( \pi(Q) = R(Q) - C(Q) \), where
  • \( R(Q) \) is the revenue function
  • \( C(Q) \) is the cost function

• The necessary condition for profit maximization:
  \[
  \frac{d\pi(Q^*)}{dQ} = \frac{dR(Q^*)}{dQ} - \frac{dC(Q^*)}{dQ} = 0
  \]

• The sufficient condition for profit maximization:
  \[
  \frac{d^2\pi(Q^*)}{dQ^2} = \frac{d^2R(Q^*)}{dQ^2} - \frac{d^2C(Q^*)}{dQ^2} < 0
  \]
11.1 Monopoly Profit Maximization

- A firm’s MR curve depends on its demand curve.
  - MR is also downward sloping and lies below D
- If \( p(Q) \) is the inverse demand function, which shows the price received for selling \( Q \), then the marginal revenue function is:

\[
MR(Q) = \frac{dR(Q)}{dQ} = \frac{dp(Q)Q}{dQ} = p(Q)\frac{dQ}{dQ} + \frac{dp(Q)}{dQ}Q = p(Q) + \frac{dp(Q)}{dQ}Q
\]

- Given a positive value of \( Q \), MR lies below inverse demand.
- Selling one more unit requires the monopolist to lower the price
  - Price is lowered on the marginal unit and all other units sold
11.1 Monopoly Profit Maximization

- Monopoly’s marginal revenue is less than the price it charges by an amount equal to area C
11.1 MR Curve and Price Elasticity of Demand

- We can rewrite MR function so that it is stated in terms of elasticity:

\[
MR = p + \frac{dp}{dQ} Q = p + p \frac{dp}{dQ} \frac{Q}{p} = p \left[1 + \frac{1}{(dQ/dp)(p/Q)}\right] = p \left(1 + \frac{1}{\varepsilon}\right)
\]

- This makes the relationship between MR, D, and elasticity quite clear.
  - The quantity at which MR = 0 corresponds to the unitary elastic portion of the demand curve.
  - Everywhere that MR > 0, demand is elastic.
  - Where demand hits the vertical axis, MR=P and demand is perfectly elastic.
11.1 MR Curve and Price Elasticity of Demand

- Relationship for inverse demand function of
  \[ p(Q) = 24 - Q \]
  and marginal revenue function of
  \[ MR(Q) = 24 - 2Q \]
11.1 Monopoly Example

- Inverse demand function: \( p(Q) = 24 - Q \)
  - Can be used to find the marginal revenue function:
    \[
    MR(Q) = 24 - 2Q
    \]
- Quadratic SR cost function: \( C(Q) = VC(Q) + F = Q^2 + 12 \)
  - Can be used to find the marginal cost function:
    \[
    MC(Q) = \frac{dC(Q)}{dQ} = 2Q
    \]
- Profit-maximizing output is obtained by producing \( Q^* \):
  \[
  MR(Q^*) = 24 - 2Q^* = 2Q^* = MC(Q^*)
  \]
  - Solving this expression reveals \( Q^* = 6 \)
- The inverse demand function indicates that people are willing to pay \( p = \$18 \) for 6 units of output.
11.1 Monopoly Example

- The monopolist’s profit maximizing choice of output is found where $MR=MC$ and $p$ comes from the demand curve.
11.1 Monopoly Example

• Should a profit-maximizing monopoly produce at $Q^*$ or shut down?
• As with competitive firms, a monopoly should shut down in the monopolist’s price is less than its AVC.
• In our example, AVC at $Q^*$ of 6 is $6.
• Because $p = $18 is clearly above $6, the monopoly in this example should produce in the SR.
11.1 Effects of a Shift of Demand Curve

• Shifts in demand need not affect monopolist’s level of $Q^*$
11.2 Market Power

- **Market power** is the ability of a firm to charge a price above marginal cost and earn a positive profit.
  - Monopoly has market power; competitive firms do not.
- Market power is related to the price elasticity of demand
  - Recall that
    \[ MR = p \left(1 + \frac{1}{\varepsilon}\right) = MC \]
  - Rewrite as
    \[ \frac{p}{MC} = \frac{1}{1 + (1/\varepsilon)} \]
  - Thus, the ratio of price to MC depends only on the elasticity of demand at the profit maximizing quantity.
- The more elastic the demand curve, the less a monopoly can raise its price without losing sales (and vice versa).
11.2 Market Power

• The **Lerner Index** (or price markup) is another way to examine the way in which elasticity affects a monopoly’s price relative to its MC.

\[
\frac{p - MC}{p} = -\frac{1}{\varepsilon}
\]

• The Lerner Index ranges from 0 to 1 for a profit-maximizing firm.
  • Competitive firms have a Lerner Index of 0.
  • The Lerner Index gets closer to 1 as a firm has more market power (and faces less elastic demand).
11.2 Sources of Market Power

- Elasticity of the market demand curve depends on consumers’ tastes and options.
- Demand becomes more elastic (which implies less market power for the firm):
  - as better substitutes for the firm’s product are introduced
  - as more firms enter the market selling a similar product
  - as firms that provide the same service locate closer to the firm
- As a profit-maximizing monopoly faces more elastic demand, it has to lower its price.
- Examples: Xerox, USPS, McDonald’s
11.3 Welfare Effects of Monopoly

• Recall from Chapter 9 that competition maximizes welfare, which is the sum of consumer surplus and producer surplus, because price equals marginal cost.

• By contrast, a monopoly
  • sets price above marginal cost (and above the competitive price)
  • causes consumers to buy less than the competitive level of output
  • generates deadweight loss
11.3 Welfare Effects of Monopoly

- The competitive equilibrium, $e_c$, has no DWL, while the monopoly equilibrium, $e_m$, has $DWL = C+E$. 

<table>
<thead>
<tr>
<th></th>
<th>Competition</th>
<th>Monopoly</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consumer Surplus, $CS$</td>
<td>$A + B + C$</td>
<td>$A$</td>
<td>$-B - C = \Delta CS$</td>
</tr>
<tr>
<td>Producer Surplus, $PS$</td>
<td>$D + E$</td>
<td>$B + D$</td>
<td>$B - E = \Delta PS$</td>
</tr>
<tr>
<td>Welfare, $W = CS + PS$</td>
<td>$A + B + C + D + E$</td>
<td>$A + B + D$</td>
<td>$-C - E = \Delta W = DWL$</td>
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11.4 Taxes and Monopoly

• Taxes (ad valorem and specific) affect monopoly differently than a competitive industry:

1. Tax incidence on consumers (the change in the consumers’ price divided by the change in the tax) can exceed 100% in a monopoly market but not a competitive market.

2. If tax rates $\alpha$ and $\tau$ are set so that the after-tax output is the same with either type of tax, the government raises the same amount of tax revenue in a competitive market using either type of tax, but raises more revenue using an ad valorem tax than a specific tax under monopoly.
11.4 Taxes and Monopoly

• Comparative Statics (of specific tax, \( \tau \))
  • Before-tax cost function is \( C(Q) \)
  • After-tax cost function is \( C(Q) - \tau Q \)
  • Necessary condition for maximizing after-tax profit:

\[
\frac{dR(Q)}{dQ} - \frac{dC(Q)}{dQ} - \tau = 0
\]

• Derivative (with respect to \( \tau \)) of the sufficient condition for maximizing after-tax profit:

\[
\frac{dQ}{d\tau} = \frac{1}{\frac{d^2R}{dQ^2} - \frac{d^2C}{dQ^2}}
\]

• As the specific tax rises, the monopoly reduces its output.
• Downward sloping means the monopoly raises its price.
11.4 Taxes and Monopoly

• Tax Incidence on Consumers
  • Consumer price may rise by an amount greater than the tax.
  • Assume constant marginal cost, \( m \), and inverse demand function with constant elasticity, \( \varepsilon \), \( p = Q^{1/\varepsilon} \)
    • Maximize profit by equating after-tax marginal cost and marginal revenue:
      \[
      m + \tau = \left(1 + \frac{1}{\varepsilon}\right)Q^{1/\varepsilon}
      \]
    • Substituting for \( Q \) in inverse demand yields the price set by monopoly:
      \[
      p = \frac{m + \tau}{1 + 1/\varepsilon}
      \]

• Differential with respect to \( \tau \) is greater than one because monopoly operates on elastic portion of demand curve.
11.4 Taxes and Monopoly

- Governments typically use an ad valorem tax rather than a specific tax because the tax revenue is greater.
11.5 Cost Advantages that Create Monopolies

• Sources of cost advantages:
  1. Control of an essential facility, a scarce resource that a rival firm needs to use to survive
     • Example: owning the only quarry in a region generates a cost advantage in the production of gravel
  2. Use of superior technology or a better way of organizing production
     • Example: Henry Ford’s assembly lines and standardization
  3. Protection from imitation through patents or informational secrets
     • Secrets are more common in new and improved processes; patents more common with new products
11.5 Cost Advantages that Create Monopolies

• A market has a **natural monopoly** if one firm can produce the total output of the market at lower cost than several firms could.

\[ C(Q) < C(q_1) + C(q_2) + \ldots + C(q_n) \]

• where \( Q = q_1 + q_2 + \ldots + q_n \) for \( n > 1 \) firms

• Examples: public utilities such as water, gas, electric, and mail delivery

• Natural monopolies may have high fixed costs, but low and fairly constant marginal costs.
11.5 Cost Advantages that Create Monopolies

• A natural monopoly has economies of scale at all levels of output, so average costs fall as output increases.
11.6 Government Actions that Create Monopolies

• Governments typically create monopolies in 1 of 3 ways:
  1. By making it difficult for new firms to obtain a license to operate
     • Example: U.S. cities require new hospitals to secure a certificate of need to demonstrate the need for a new facility
  2. By granting a firm the rights to be a monopoly
     • Example: public utilities operated by private company
  3. By auctioning the rights to be a monopoly
     • Example: selling government monopolies to private firms (privatization)
11.7 Government Actions that Reduce Market Power

- Governments limit monopolies’ market power in various ways:

  1. **Optimal Price Regulation**: government regulates the monopoly by imposing a price ceiling that is equal to the competitive price, which eliminates DWL.

  2. **Nonoptimal Price Regulation**: government-imposed price ceiling is not set at the competitive level, which reduces but does not eliminate DWL.

  3. **Increasing Competition**: allowing/encouraging market entry by new domestic firms and ending import bans that kept out international firms.
11.7 Government Actions that Reduce Market Power

- With optimal price regulation, the government imposes a price ceiling that is equal to the competitive price.
11.8 Monopoly Decisions Over Time and Behavioral Economics

• In some markets, today’s decisions affect demand or cost in the future.

• Some monopoly decisions may maximize LR profit but not SR profit.
  • Example: low introductory pricing to build up customers

• Why would consumers’ demand in the future depend on a monopoly’s actions in the present?
11.8 Monopoly Decisions Over Time and Behavioral Economics

- A good has a **network externality** if one person’s demand depends on the consumption of a good by others.
  - With a **positive** network externality, value to the consumer grows as the number of units sold increases (e.g. telephones, ATMs)
  - With a **negative** network externality, value to the consumer grows as fewer people possess the good (e.g. numbered paintings)
- A **bandwagon effect** is a popularity-based explanation for a positive network externality (e.g. iPod, UGG boots).
- A **snob effect** is an explanation for a negative network externality (e.g. original painting by an unknown artist).
Figure 11.3
Maximizing Profit