Market structure

What if there’s just one producer?

- One of the conditions of the first welfare theorem is that markets be competitive.
- In a competitive market, all agents take prices as given.
- Our general equilibrium model assumed that the auctioneer called prices and agents made choices based on these prices.
- But in reality we know that prices are set by agents and influenced by their choices. How does this affect the market outcome?

There is a monopoly for a good if it is produced by a single large price-setting firm and there exist barriers to entry and exit.

- We will parse this statement as we go along.
- “Monopoly” is a loaded natural-language word too. Why?
- Textbook: Chapter 12

Motivations for price-setting

- The fact a monopolist is a price-setter rather than a price-taker immediately nullifies FTWE.
- We can view this in one of two ways.
  - First: we are simply incorporating the real-world notion that prices are set by agents and not an auctioneer.
  - Second: a monopolist faces the entire demand curve in its market, and so its supply choice and the market-clearing price are jointly determined.

Monopoly in the Edgeworth box

To see why monopoly breaks FTWE, let’s examine it in the context of the Edgeworth box representing an exchange economy.

- As usual we will begin with two consumers and an initial allocation, the endowment.
- Say that consumer A knows consumer B’s preferences and is allowed to pick the price ratio in the economy - to act as a monopolist.
- What price ratio will she choose?
Price-setting in the Edgeworth box

Figure: B's offer curve

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Price-setting in the Edgeworth box

Figure: A's preferred point on B's offer curve

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Price-setting in the Edgeworth box

Figure: A's preferred price ratio

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Price-setting in the Edgeworth box

Figure: Resulting allocation $x$ is not Pareto efficient

Monopoly in the Edgeworth box

- Consumer $A$ set her preferred price ratio: her preferred point on $B$’s offer curve.
- This is not Pareto efficient. Price-setting has nullified FTWE.
- Why? There are unexploited gains from trade, but to realize them $A$ would have to change the price ratio, which affects her gains from the trades that lead to $x$.
- This is because we assumed that $A$ sets a price ratio that will apply to all trades equally.

A perfectly discriminating monopolist

- What if $A$ could set different prices for different units?

A perfectly discriminating monopolist

Figure: B’s indifference curve through $\omega$
A perfectly discriminating monopolist

Then A can offer a series of trades, each at B’s maximal willingness to pay.
- This is Pareto efficient!
- When each unit can be sold at a different price, all mutually beneficial trades are realized, with A getting all the surplus from each.
- We’ll return to this idea next week when we consider monopoly behavior.

Partial equilibrium

- Let’s leave the exchange economy to model a single firm producing a good that is then sold to consumers.
- We’ll use partial equilibrium analysis to see why monopoly nullifies FTWE
- (So we’re holding fixed the rest of the economy.)
- The monopolist’s problem is to choose price and output.
- These are jointly determined: at a given price consumers will demand some amount of the good.

The monopolist’s problem

- The monopolist, being the only firm, faces the entire demand curve for the good.
- The monopolist’s problem is in essence to select its preferred point on this demand curve: its preferred price-quantity pair \((y, p)\).
- For now we will assume that the monopolist must set the same price for all units it sells (counterexamples?).

Assume that the monopolist’s objective is to maximize profit:

\[
\pi = \frac{R - C}{Revenue - Costs} = p(y)y - c(y)
\]

This is a function of one choice variable, quantity \(y\), because \(y\) defines the price \(p\) according to the demand curve.
Market demand

Social efficiency

What would be the socially efficient amount of production of this good?
- Consider the marginal cost (MC) to the economy of producing an extra unit of the good.
- Since the monopolist is the only producer, this is also the marginal cost to the monopolist.
- Given our cost function \( c(y) \), \( MC = c'(y) \).
- It would be socially efficient to produce extra units of this good so long as the marginal cost of that extra unit is less than what some consumer is willing to give up for that unit.
- That is, while \( MC(y) < p(y) \).
- The socially efficient price is thus \( p = MC(y) \).

Marginal cost

Social efficiency

The socially efficient output: \( p(y) = MC(y) \)
The monopolist’s problem

Let’s see if the monopolist will choose this.

The monopolist chooses $y$ to maximize $\pi$:

$$\pi(y) = \frac{R(y)}{\text{Revenue}} - \frac{c(y)}{\text{Costs}}$$  \hspace{1cm} (3)  \\
$$\text{Revenue} - c(y)$$  \hspace{1cm} (4)

The first order condition is:

$$\pi'(y) = R'(y) - c'(y) = 0$$  \hspace{1cm} (5)  \\
$$\Rightarrow R'(y) = c'(y)$$  \hspace{1cm} (6)  \\
$$MR = MC$$  \hspace{1cm} (7)

The monopolist will produce up until the point where marginal revenue is equal to marginal cost. What is marginal revenue?

Marginal revenue

Consider the same problem with revenue written in full, price times quantity:

$$\max_y \pi(y) = p(y)y - c(y)$$  \hspace{1cm} (8)

The first order condition is:

$$\pi'(y) = p(y) + p'(y)y - c'(y) = 0$$  \hspace{1cm} (9)  \\
$$\Rightarrow p(y) + p'(y)y = c'(y)$$  \hspace{1cm} (10)

The left-hand side is marginal revenue. To sell one more unit when demand is downward-sloping requires decreasing the price; so the marginal effect on revenue is to add a sale ($p(y)$) but reduces the revenue on all previous units ($p'(y)y$).

Optimal choice

- Geometrically, this means that marginal revenue curve must lie below the demand curve $p(y)$.
- (Note that the demand curve is by definition also the average revenue curve.)
- The marginal unit adds less to the firm’s revenue than price it sells for.
- So the monopolist’s optimal choice is at a lower level of output than the socially efficient level.

Marginal revenue curve

Drawing the marginal revenue curve
Optimal choice

The monopolist produces less than is socially efficient. At \( y^* \) there is a potentially positive gain from the extra trade: the marginal consumer is willing to give up more than the marginal cost of production. But the monopolist will not agree to it, since the effect on the price of inframarginal units means that profits would be lower. This is precisely what we saw in our Edgeworth box analysis earlier.

The monopolist’s markup

How much higher is the price \( p^* \) than the socially efficient price \( MC(y) \)?

First consider marginal revenue again:

\[
MR = p(y) + p'(y)y \tag{11}
\]

\[
p(y) \left[ 1 + p'(y) \frac{y}{p(y)} \right] \tag{12}
\]

\[
p(y) \left[ 1 + \frac{1}{\epsilon(y)} \right] \tag{13}
\]

\[
p(y) \left[ 1 - \frac{1}{|\epsilon(y)|} \right] \tag{14}
\]

Marginal revenue depends on the elasticity of demand \( \epsilon(y) \), the rate at which demand changes as price changes.

The monopolist’s markup

This means that at \( MR = MC \):

\[
p(y) \left[ 1 - \frac{1}{|\epsilon(y)|} \right] = MC(y) \tag{15}
\]

\[
p(y) = \frac{MC}{1 - |\epsilon(y)|} \tag{16}
\]

The markup over marginal cost is thus \( \frac{1}{|\epsilon(y)|} \).

- Note that the monopolist will never produce at a point where demand is inelastic (where \( |\epsilon| < 1 \)).
- From such a point reducing output increases revenue and decreases cost.
Welfare effects of monopoly

Monopolist’s optimal choice and socially efficient choice

Gains and losses from monopolist’s choice

Deadweight loss

Consider these three areas that represent the change between the socially efficient outcome and the monopolistic outcome:

A. This amount is **gained** by the monopolist due to the higher price for the units he sells. It is also **lost** by consumers for the same reason.

B. This amount is **lost** by consumers; since those units are not produced by the monopolist, the consumers do not get the surplus on those units.

C. This amount is **lost** by the monopolist since those units are not sold at the price $MC(y)$.

The area $B + C$ is the **deadweight loss of monopoly** (note that this is ‘utilitarian’!).
The monopolist’s profit

How is the monopolist doing in all of this?
- We haven’t figured out what the monopolist’s profit is yet.
  \[ \pi = R - C \] (17)
  \[ \Rightarrow \pi = \frac{R}{y} - \frac{C}{y} \] (18)
  \[ \Rightarrow \pi = y(p - AC) \] (19)
- We need to know average cost.
- This profit could be positive or negative!

Adding average cost

MC must pass AC at AC’s lowest point

The monopolist’s profit

Negative profit for the monopolist
Barriers to entry and exit

Why does the monopolist stick around to make negative profit?

- The reason is that way back at the start we defined monopoly as a market with a single large producer and barriers to entry and exit.
- In a competitive market, the incentive for entry by small individual firms when profits are positive and exit when profits are negative pushes profits to zero.
- Here this is not possible.
- Barriers to entry or exit could exist for any number of reasons, some naturally occurring and some constructed by regulators or the monopolist itself.

Removing barriers to entry is a natural place to try to restore socially efficient production. But is this always possible?

Minimum efficient scale

One possible reason for a natural barrier to entry relates the volume of demand to the minimum efficient scale (MES) in the industry.

- MES is the level of output that minimizes average cost.
- If this is ‘low’ relative to the size of demand, there is room for many ‘small’ firms to enter at a price close to $p = \min AC$; it is possible to have many firms each ‘small’ relative to the market.
- But if MES is ‘high’, there might be room for only one firm to make positive profits, so no entrant challenges them.

High MES captures the same idea as natural monopoly.
Regulating a monopoly

- To remove barriers to entry might be difficult if they are driven by high MES.
- Is there anything else we could do?
- A regulatory solution would see the government or some other public entity constrain or dictate the choice of the monopolist.
- Perhaps a regulator could simply dictate that the firm must price at marginal cost to enforce the socially efficient outcome?

Natural monopoly

High MES looks a lot like what was driving negative profits in our earlier example: AC was ‘high’ relative to MC.
- One situation in which this could be true is if fixed costs are very large relative to marginal costs.
- This is called a natural monopoly.
- For example, there are large fixed costs to producing one unit of software - it must be developed - but small marginal costs.
- The socially efficient price (at marginal cost) may in such a case leave the monopolist with negative profits.

To force \( p = MC \) might drive the firm to negative profit.
- If so, there must also be either a barrier to exit - so that the firm cannot leave the industry and its owners are forced to endure losses - or the firm will exit.
- The next resort might be to try \( p = AC \). This is still below the socially efficient level of trade, but the firm makes zero profit rather than negative.

A natural monopolist making negative profit at \( p = MC \)
Price at average cost

\[ p = AC \] yields zero profit to the monopolist

Regulating a monopoly

How are these regulatory demands set?
- To enforce one of these prices requires first that we know what it is.
- The regulator must therefore determine what the cost structure of the industry is.
- How can the regulator get this information?
- If the regulator must rely on knowledge from the firm itself, we may worry about misleading reports or corruption.
- To create a regulator to collect all this information is obviously not costless. We must also weigh the deadweight loss of monopoly against the cost of regulating the industry.

Government provision

A final alternative could be for the public to take control of production of this good.
- Then the price could be set at marginal cost - social efficiency - and a public subsidy could cover the negative profit.
- For example, the high fixed cost of broad public transport may render it a natural monopoly, and it is often provided by the government.
- But it’s also hard to measure the costs of a government provider. How can we verify that the public provider is operating at minimum cost?

Monopoly

- Here we analyzed the market for a good produced by a single large firm and with barriers to entry and exit.
- The monopolist will optimally choose an output lower than the socially efficient level. The monopolist can make positive or negative profits, but overall there is a deadweight loss of surplus relative to the socially efficient output.
- Removing barriers to entry and exit could restore the ability of entry and exit to push the market to the socially efficient output, but a barrier to entry might be naturally occurring.
- Regulatory solutions that constrain the monopolist could restore efficiency, but we’d need to know costs, and it’s possible that the socially efficient output is lossmaking.
- Government provision could plausibly suffer similarly from cost-measurement and cost-containment problems.
Next we’ll think about market power in two further ways.

- First, why a constant price?
  - If the firm has the power to set prices, can they do better by setting prices more creatively than a single, uniform price for all units?
  - The answer is in general yes, and we’ll explore how.
- Second, what about cases between monopoly and competition?
  - If there are ‘a few’ firms, surely they still influence price to some extent?
  - We’ll see a couple of examples of how we can think about this issue.