Lecture 2: Market Structure Part I (Perfect Competition and Monopoly)

EC 105. Industrial Organization

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Market structure #1: Perfect Competition

- Consider market for a single good.
- The perfectly competitive firm is a **price taker**: it cannot influence the price that is paid for its product.
- This arises due to consumers' indifference between the products of competing firms
  - $\Longrightarrow$ so they will buy from store with lowest price.
- Consumers' indifference arises from:
  - Product homogeneity
  - Consumers have perfect information
  - No transactions cost
  - Many firms

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PC firm's profit maximization problem

- $\max_q \pi(p) = pq - C(q)$
- First-order condition: $p = C'(q) = MC(q)$
- Second-order condition: $C''(q) > 0$, satisfied if $MC(q)$ is an increasing function
- If $p \uparrow$, production rises along $MC(q)$ curve: $MC(q)$ is the "supply curve" of the firm.

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PC firm's supply curve

- Where does the supply curve bottom out?
- With U-shaped AC curve, at low levels of production, $AC >> MC$.
  - Firms shouldn't agree to produce at those levels
- A firm produces only when its profits from producing exceed the costs it would avoid by not producing
- **In short-run:** avoidable costs do not include sunk costs. Shut down when revenues fall short of *avoidable costs*
  - Non-avoidable costs typically include components of fixed cost (rental, capital machinery, etc.)
  - In short-run, non-avoidable costs contribute zero opportunity cost, as they cannot be recovered. "Bygones are bygones"
  - But in real life, people appear more reluctant to leave an enterprise if they have sunk more resources into it: "sunk cost fallacy"
  - Eat too much at AYCE buffet to "get your money's worth"?

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PC firm's shutdown decisions

- **In short-run:** shut down once $pq <$ Avoidable costs.
  1. All fixed costs are sunk. Avoidable costs $= VC(q)$: shut down once $p < AVC(q)$ $(< AC(q))$.
  2. Proportion α of fixed costs not sunk. Avoidable costs $= VC(q) + \alpha F$: shut down once $p < AVC(q) + \frac{\alpha F}{q}$
- **In long-run:** avoidable costs include sunk cost. Shut down when $pq < C(q) \Longrightarrow p < AC(q)$
  - In LR, components of fixed cost can be avoided (rental), scrapped (machinery), etc. Opportunity cost no longer zero.
- Short-run supply curve? Long-run supply curve? Graph.

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The perfectly-competitive industry: Short run

In the **short run**:

- Industry demand curve: downward sloping. Graph.
- Price determined by intersection of industry demand and supply curves. Graph.
- In short-run equilibrium: positive profits for each firm as long as $p > AC(q)$.
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The perfectly competitive industry: Long-run

- In the long run, number of firms can vary
- **Assume "free entry and exit":** firms enter and exit unconstrained
- Any short-run profits (quasi-rents) soaked up by new firms in long-run
  - $\Longrightarrow$ Price is driven down to the minimum of the AC curve
- Long-run industry supply curve: horizontal at minimum of the average cost curve
  - All firms are at MES
- In some markets, LR supply curve may be (softly) upward-sloping if min AC is rising in market demand Q
  - (due, for example, to resource scarcity)
  - Fossil fuels, fracking

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PC as normative benchmark

The features of PC outcome serve as a *normative efficiency benchmark* against which alternative market structures are judged:

$$\mathbf{p = MC(q) = \min_q AC(q)}$$

- **Economic efficiency:** resources used in most productive manner
- **Firm Efficiency:** Production at $p = MC(q)$: firm produces an additional unit only if it can cover the production costs. This maximizes *producer surplus*.
- **Consumption efficiency:** Consumers who value good more than its marginal cost obtain the product. This maximizes *Consumer surplus*.
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- Desirable outcome reached despite (or due to?) self-interested optimizing behavior of each individual.
- These ideas can be generalized very broadly
  - Arrow, Debreu, McKenzie, ++

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General equilibrium

- Consider the general case with multiple goods, and heterogeneous firms and agents.
- All agents are price takers.

- Given prices, consumers choose how much of each good to buy in order to maximize their welfare, given that their expenditures must not exceed their income. This gives rise to demand functions.
- Given prices, producers choose production plans to maximize profits given their technological possibilities, giving rise to supply functions.

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Welfare Theorems

- Weak assumptions about preferences and technological possibilities yield general results on competitive equilibrium.
  - 1^{st} Welfare Theorem: A competitive equilibrium is Pareto Optimal. A benevolent social planner can't improve on the competitive allocation.
    - PO: can't improve one individual's welfare w/o hurting another's. Key notion of efficiency.
  - 2^{nd} Welfare Theorem: Any Pareto-optimal allocation can be descentralized by a choice of the right prices and an appropriate redistribution of income among consumers.
    - Requires convexity assumptions that rule out increasing returns to scale.
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Market structure 2: Monopoly

Nice outcome in perfectly competitive world depends crucially on free-entry assumption.

But large fixed costs of entry exist in many markets, leading to few firms in a market.

Now focus on extreme case of industry with only one firm: **monopoly**

- Industry has one firm, who faces downward-sloping industry demand curve
- Unlike PC firms, the monopolist has **market power:** ability of a firm to profitably raise prices.
- PC firm is a price-taker: it has no market power.

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- Unlike PC firms, the monopolist has **market power:** ability of a firm to profitably raise prices.
- PC firm is a price-taker: it has no market power.

Monopoly and profit maximization

Two equivalent formulations, both yield insights: First, monopolist chooses quantity to maximize profits

- $\max_q p(q)q - C(q) = \text{Revenue}(q) - C(q)$
- Graph. Quantity can be increased only if price is lower.
  - Tradeoff between increased *marginal* demand
  - versus revenue lost on *inframarginal* consumers who would have bought even under the higher price
- FOC: $R'(q)) = p(q) + p'(q)q = C'(q) \leftrightarrow MR(q) = MC(q)$. Graph.

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Alternatively, monopolist chooses price to maximize profits

- $\max_p pq(p) - C(q(p))$, where $q(p)$ is demand curve.
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- At optimal price p^*, **Inverse Elasticity Property** holds:

$$(p^* - MC(q(p^*))) = -\frac{q(p^*)}{q'(p^*)} \quad \text{or} \quad \frac{p^* - mc(q(p^*))}{p^*} = -\frac{1}{\epsilon(p^*)}$$

  where $\epsilon(p^*)$ is $q'(p^*)\frac{p^*}{q(p^*)}$.
- Across monopolistic markets, should observe negative relationship between price and demand elasticity
- If $\epsilon \to +\infty$: $p = MC(q)$

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Inverse elasticity property is key pricing principle

- Firm's market power is *inversely related* to the elasticity of demand
  - with *inelastic* demand, firm sets prices higher
  - with *elastic* demand, firm sets prices lower
- Interpretation:
  - elasticity: primarily related to availability of close substitutes
  - when few substitutes available, a firm can set high prices without losing customers
  - when many substitutes available, a firm which sets prices too high will lose many customers
- Examples:
  - Ride-sharing (Uber's surge pricing): weekends vs. weekdays
  - Prices of iPhone 6 once iPhone 8 released.
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A puzzle, or cautionary tale

$$\frac{p^* - mc(q(p^*))}{p^*} = -\frac{1}{\epsilon(p^*)}$$

- Reasonable interpretation: "low elasticities are good for monopolist"
- What if $-1 < \epsilon(p^*) < 0$? Implies $p^* < 0$, which is nonsensical!!
- Unpack marginal revenue expression:

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  which is *negative* for prices where $-1 < \epsilon(p) < 0$. $(p'(q) = \frac{1}{q'(p)})$.
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Dead-Weight Loss

- Markup provides a quantification of price distortion, and is useful for policy purposes (later). This is not, however, an appropriate measure of distortion from a normative viewpoint. Instead, the appropriate measure is the loss of social welfare (*efficiency*).

- To measure the later we compare the total surplus (consumer and producer surplus, or profit) at the monopoly price with that at the competitive (marginal cost) price.

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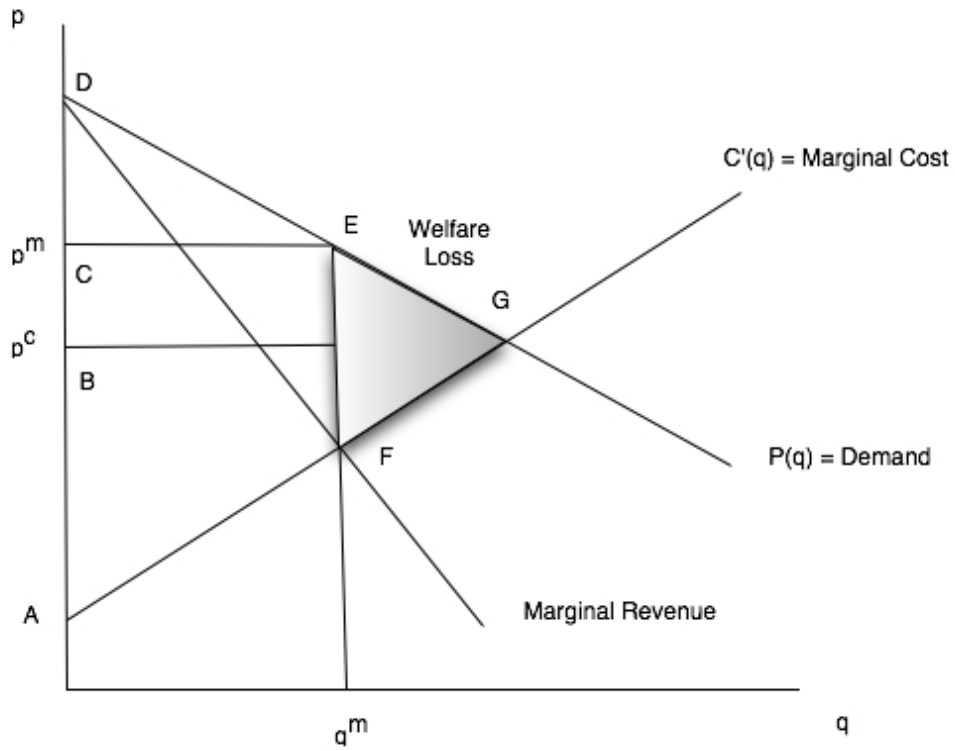

Deadweight loss

- Welfare loss results primarily from distortion in *allocation* (quantity). Not from price distortion.
- Tension btw:
  - consumer interests (markups, high prices)
  - societal interests (which includes producers)

- Recall: strong price distortions correspond to low demand elasticities
- So in precisely these situations, price changes do not affect quantity very much: small allocative impact
  - Apple may sell similar number of iPhones at $700 or at $1000
- Rather, they elicit a big transfer from consumers to firm:
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How monopolies arise

- Crucial aspect of monopoly: price-setting ability (relatively inelastic demand curve)
- Product differentiation: Apple vs. Samsung vs. RIM
- Government-granted monopolies (patents): reward for firm's innovation efforts
- Superior production technology (Demsetz critique). Monopoly "deserves" its dominant position
- Natural monopoly: industry characterized by increasing returns to scale. MES is $+\infty$, efficient to have just 1 firm.
  - Energy utilities (water, electricity, gas) typically natural monopoly.
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How monopolies disappear

- A firm with market power makes *profits*, which encourages other firms
  - – even inefficient ones (those with costs higher than monopolist)–
  - to enter: "monopoly umbrella"
- Additional entry reduces market power of firms: if price at one firm is too high, consumers will buy at other firms.
  - Demand for each firm becomes more and more elastic
- As more firms enter market, price is driven down to costs. Firms make zero profit.
- *Industry life cycle*: firms must keep innovating to survive.
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Measuring Market Power

Recall definition of market power: ability to profitably charge a price above perfectly competitive levels. How do we measure MP?

- Market share. Small firms can't have any market power. Not true: makers of "niche products" (ie. Tesla) may have a lot of mkt power!
- Availability of substitutes to monopolist's product: but perhaps (possibly cost-inefficient) substitutes only available when monopolist charges $p > MC$.
  - "monopoly umbrella", cellophane fallacy
- More recently: direct measure of market power is given by estimates of *demand elasticities*, which are reciprocal to profit-maximizing price-cost margin.
  - Estimate demand elasticities from market data: importance of econometrics, statistics, machine learning

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Summary

1. Perfect competition
   - Individual firm takes prices as given in making output decisions
   - Shutdown decisions: long run vs. short run
   - Industry equilibrium: in long-run $p = MC(q) = min_q AC(q)$
     - market efficiency, invisible hand
2. Monopoly
   - Firm has power to set both quantity and price
   - Tradeoff between higher demand but lower per-unit prices
   - $MR(q^*) = MC(q*)$; inverse-elasticity pricing property