Introduction to Industrial Organization
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Lecture Note 2

Part 1: The Firm (Ch.3)

1. Do firms max profits?
   - Management separated from ownership and managers may have other objectives than shareholders.

In most modern corporations, management is separated from ownership, that is, the recipients of the firm's profits are not the agents whose decisions ultimately determine the firm's profit level.

Profits are only one aspect of firm success. In general, the managers' objectives differ from those of the shareholders.

What are the ways that the maximization is reached?

1.1 Internal discipline

One thing the shareholder can do is to appoint a manager with a contract that induces the latter to act in the former's interest. Since normally the manager knows more than the shareholders, there is a problem of **asymmetric information**. **Agency theory** deals with this class of strategic interaction, that is a, a principal who wants an agent to act in the principal's interest but who possesses less information than the agent.

For students who have interest on this topic, *moral hazard or principal-agent problem* is what more close to this topic.

1.2 Labor market discipline

Likelihood of Departure of a Board Member

Explanatory variables	Insider	Outsider
CEO less than 4.5	0.25	0
Recent Stock market Return	-0.49	0
Stock market return lagged one year	-0.28	-0.30

The above result shows that the reputation effect provides incentives to manager.

1.3 Product market discipline

- Product market competition produces selection (firms cannot survive if do not maximize profits).
- Product market competition produces information through signals.

1.4 Capital market discipline

- Less efficient firms are prone to be taken over by efficient firms.

Example from US banking industry:

Banking varies considerably throughout the US. In particular, some states are take-over friendly, whereas others are not. This fact provides a natural experiment on the effect of takeovers and the threat of takeover on firm performance. Based on a cross section of states, the following results are obtained:

Explanatory variable	Profit margin	Stock options
Takeover are allowed (1 or 0)	0.112	-4.77
Percentage of shares controlled by five largest nonmanagement shareholders	0	0
Common stock and stock options owned by most highly paid officer divided by annual cash compensation	-0.023	

The 0.112 coefficient indicates that everything else constant, profit margins are 11.2% higher in states that allow takeovers than in states that do not. This means that the threat of takeovers significantly disciplines managerial behavior. Shareholder concentration seems to have no effect on firm profitability. Performance pay has a negative effect on profitability, although the effect is low. Finally stock options are less common in states where takeovers are allowed. This means that stock options are a "substitute" for takeovers as a mechanism to induce value-maximizing behavior on the part of managers.

2. What determines the firm's boundaries?

- Two dimensions of size: horizontal and vertical
  - ✓ - how much of a product, how many products
  - ✓ - how many stages of the production process
- Horizontal boundaries: Firms tend to produce at the level average cost is minimized
  - ✓ Two complications:
    - ❖ "saucer"-shaped instead of u-shaped curves
    - ❖ multi-plant firms
- Vertical boundaries: determined by the make or buy micro decisions
  - ✓ - specific assets and the problem of post-contractual opportunism, the "hold-up problem"
  - ✓ - the classical example: GM-Fisher Body
  - ✓ - incentives problems in the complete separation/integration solutions
  - ✓ - intermediate solutions:
    - ❖ "tapered integration" (Coca-Cola and Pepsi bottling)
    - ❖ franchising (McDonald's, fashion design stores)
    - ❖ long term rels. (Japanese firms' solution)

3. Why are firms different?

- Firms differ in size and performance, even with the same size
- Several determinants:
    - ✓ impediments to imitation
        - ❖ patents.. ...and tacit knowledge
    - ✓ strategy
    - ✓ history
        - ❖ eg: the learning curve: Boeing, McDonnell and Lckheed

Part 2: Perfect Competition (Ch.6)

1. We have 1) demand function; 2) firm profit function and 3) five central assumptions of perfect competition.

1.1 Demand

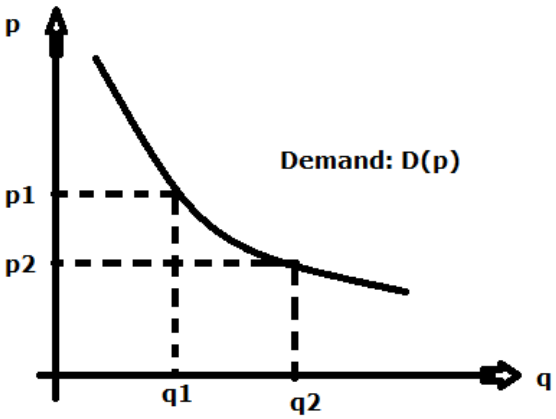

Figure 6.e1 Demand

Demand is downward sloping. If output shift from q1 to q2, price must go down in order for consumers to willing to buy everything. If firms increase price from p2 to p1, demand will decrease from q2 to q1.

1.2 Profit function for one firm,

profit=revenue-cost

$$\pi = p(Q)q - C(q)$$

$p(Q)q$: If total output is Q, which is the sum quantity of all firms, then the market total revenue is $p(Q)q$.

$C(q)$: The total cost of producing q, including wage, input cost, rent, everything.

In the profit function above, p(Q) reflects total output and the firm's q units of output is only part of Q. But in a perfect competitive market, this q is ignored by the firm. The firm does not this its output decision has effect on p(Q), market price.

In a perfect competitive market, the firm's profit maximization problem is

$$max_q = p(q)q - C(q)$$

In this maximization problem, p is treated as given. It does not depend on Q or q. The firm has no market power. It can not affect the price.

The question is: what make a market perfect competitive so that firms do not have market power? This could be the market structure is such that firms really cannot manipulate price. Here are the five assumptions about the market structure.

A market structure includes number of firms, costs and types of behavior permitted.

1.3 Five central assumptions of perfect competition:

- Many suppliers in each market (atomicity)
- Product supplied is identical (product homogeneity)
- All agents know the prices set (perfect information)
- All firms have access to the same technology (equal access)
- Firms can enter and exit the market as they wish (free entry)

2. The behavior of one firm

Taken price as given, firm chooses q to maximize profits

$$\max \quad \pi = p(Q)q - C(q)$$

If the cost is convex (some inputs are fixed or there are diminishing marginal returns), the firm's First Order Condition (FOC):

$$P=C'(q)$$

P: marginal revenue of last unit produced.
C'(q): marginal cost of last unit produced.

- If marginal revenue is higher than marginal cost, the firm can increase profit by increasing output. If marginal revenue is lower than marginal cost, the firm can increase profit by decreasing output.
- For every possible P(Q), there exists q*(P) satisfy MC*(q)=P.

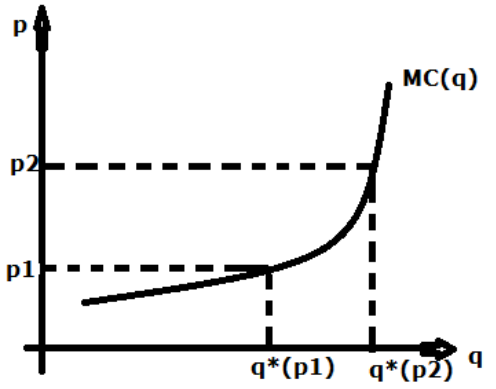

Figure 6.e2 Perfect Competitive optimal quantity

Figure 6.e2 illustrates that when price is higher, firms more willing to produce at levels that generate high costs.

3. Firm's shutdown decision

To consider firm's shutdown decision, it makes sense to break down cost into fixed cost and variable cost, or sunk cost and non-sunk cost.

$$C(q) = FC + CV(Q)$$

FC: cost does not vary with output and cannot be avoid when q=0. For example, a long-term lease.
VC: costs that vary with output. For example, labor costs, input material costs, ect.

When is it more profitable to produce q=0 than q=q*(p)?
If q=0, $\pi = p * 0 - C(0) = -FC$
If q=q*(p), $\pi = p * q(p) - C(q) = p * q - FC - VC$

$$\pi(0) > \pi(q)$$
$$\longrightarrow -FC > p * q - FC - VC$$
$$\longrightarrow p * q - VC > 0$$
$$\longrightarrow p < AVC$$

Firm will shut down when price is less the average variable cost. Intuition, fixed costs are not avoidable, therefore don't affect firm's decision.

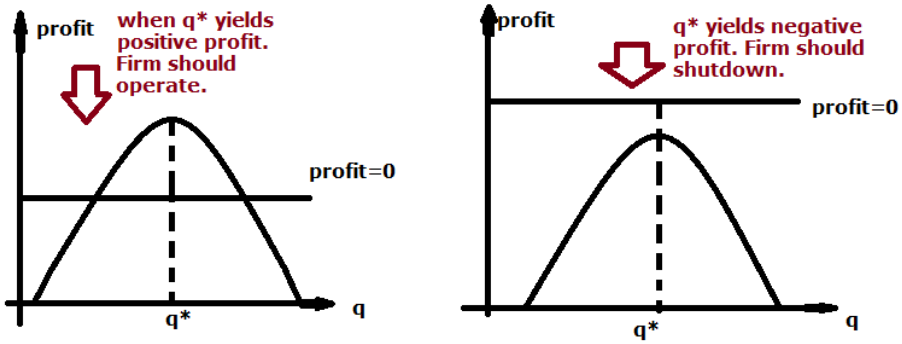

Figure 6.e3 Positive and negative profit at optimum quantity q*

Combining these results, we can derive supply curve for one firm. This supply curve is the profit maximizing output level at all possible prices. Figure 6.e3 illustrates this.

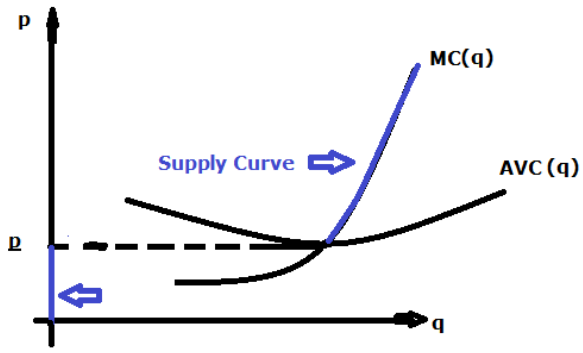

Figure 6.e4 Supply Curve in Perfect competitive

Figure 6.e4 illustrates this. If price less than p, then price is less than AVC, and the firm produce at q=0. If price is larger than p, then price is larger than AVC, and the firm produce q such that MC(q)=p.

4. Perfect competitive equilibrium in short-run

In the short-run, the number of firms is fixed at N. To get the market supply curve, just sum up across all firms:

$$Q^S(p) = \sum_{j=1}^{N} q_j^s(p)$$

To find the perfect competitive equilibrium, just search for the price level such that $Q^S(p) = Q^D(p)$.

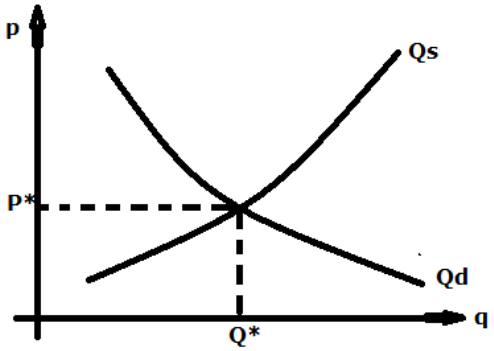

Figure 6.e5 Perfect Competitive Equilibrium

At p*, consumer demand Q* units of output. Each firm produces $q^s(p)$, which maximizes profits (so no firm has incentive to change behavior), and total output produced is equal to demand.

Example: how to solve a perfect competitive equilibrium.

- $Q^D(p) = 110 - p$
- Each firm has a cost function $c(q) = 16 + q^2$
- The number of firms is fixed at 20.

Solution: 1) need to find the supply curve for one individual firm. One firm choose q to

$$\max \; p * q - 16 - q^2$$

Note that we assume that p does not depend on q.

FOC: MC=MR ➔p=2q ➔q=p/2 Thus, if firm finds it is profitable to produce q=p/2, the firm will operate. Will the firm operate at this price? We need to find p in figure 6.e4.

P is such that AC(q)=MC(q). ➔ (16+q^2)/q=2q ➔ 16/q=q➔q=4 ➔ p=8. Thus, one individual's supply function is

$$q^S(p) = \begin{cases} 0 \; if \; p<8 \\ \frac{p}{2} \; if \; p \geq 8 \end{cases}$$

Now we need to derive the aggregate market supply curve:

$$Q^S(p) = 20q^S(p)$$
$$= \begin{cases} 0 \ if \ p<8 \\ 10p \ \ if \ p\geq 8 \end{cases}$$

Finally to solve for the perfect competitive equilibrium, find p* such that supply equal to demand:

$$Q^S(p) = Q^D(p)$$
$$\longrightarrow 10p = 110 - p$$
$$\longrightarrow p = 10$$

Thus, the equilibrium is p=10, output=100, and each firm produce 5 units.

5. Efficiency properties of perfect competitive equilibrium

- We only look at perfect competitive equilibrium because of its desirable welfare properties. The characteristic necessary for competitive equilibrium are so strong that we rarely see it in the world.
- Below discuss common measure welfare and why it is maximized under perfect competition.
- Suppose consumers purchase Q' units of output at price p'. How much do consumers benefit from this purchase?

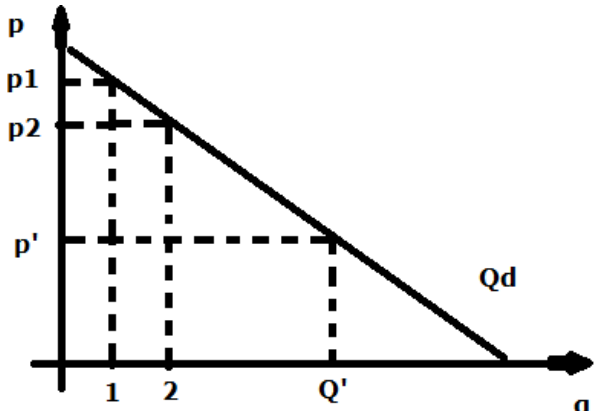

Figure 6.e6 Efficiency in competitive equilibrium

If price=p1, there is one person out there willing to purchase a unit of output. Since he is willing to pay p1, and only has to pay p', he benefits by p1-p' dollars. Similarly, the consumer who purchases the second unit of output benefits by p2-p' dollars.
To get consumer surplus keep adding up the marginal benefits until we get Q'.

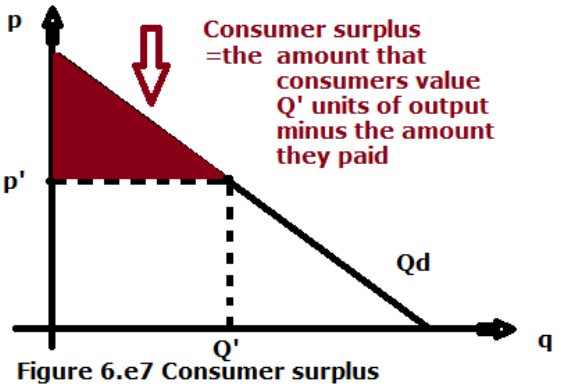

Figure 6.e7 Consumer surplus

On the producer side, suppose firms sell Q' units of output for a price P'.

Producer surplus=sum of firms' profits.

Graphically,

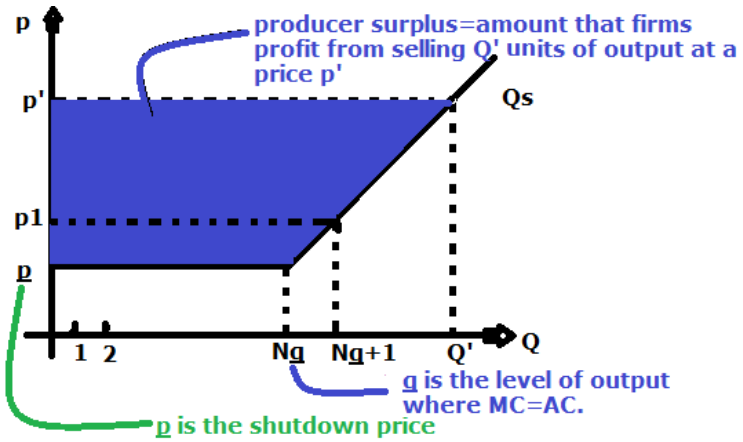

Figure 6.e8 Producer surplus

If the price is p, firms will produce Nq units of output and earn zero profits. Since firms receive p' dollars, they benefit by p'-p dollar for each unit. For the Nq+1 th unit, a firm incurs slightly higher cost (since MC is now larger than AC). The benefit from this extra unit to firms is is p'-p1.

To set producer surplus, keep adding up marginal profits until Q'. Figure 6.e8 illustrates producer surplus.

Total welfare=consumer surplus + producer surplus

In a perfectly competitive equilibrium,

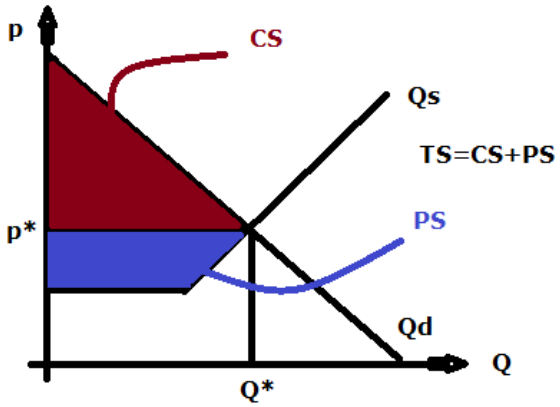

Figure 6.e9 Welfare in Competitive equilibrium

Why are perfectly competitive equilibria efficient? What is the meaning of efficiency?

An allocation, or level of output, is efficient if there is no other level of output that generates a higher level of total surplus. Below is proof that perfectly competitive allocation is efficient.

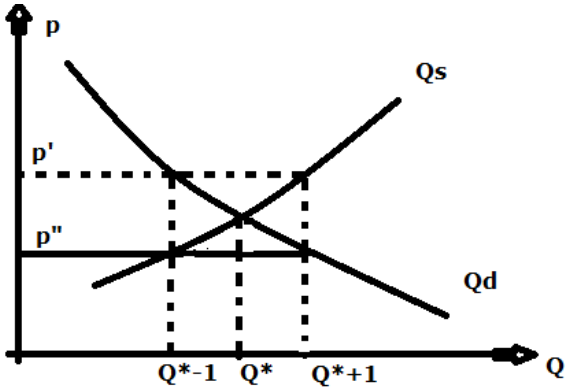

Figure 6.e10 Allocative efficiency in competitive equilibrium

Suppose we decrease output from Q* to Q*-1. Now, the last unit of output is valued by consumer at p' dollars. But it cost firms only P" dollars to build. Since p'>p", that means there are consumer do value the good more than it costs firms to produce. But this trade is not occurring. The opposite is true at Q*+1. Production costs exceed consumers' valuation. Too many transactions are occurring.

Intuition: In perfectly competitive markets, prices operate to cause firms and consumers valuation to coincide. Firms keep producing until MC increase to p. Consumers keep purchasing until their valuations fall to p. So the last unit of output is valued by an amount exactly equal to its cost to producers.