

INDUSTRIAL ORGANIZATION, ECON 312  
INTRODUCTION AND BASIC MICROECONOMICS

## 1 Introduction to Industrial Organization

Industrial Organization is the study of the workings of markets and industries (defined as any large-scale business activity), especially in the manner firms competes with each other. However, in its content it is very similar to microeconomics. So why do we have a separate field?

The main differential arises from Industrial Organization's (IO) focus on the following aspect of interaction between firms in any industry:

1. Price Competition
2. Product Competition
3. Effects of Advertising
4. Research and Development

Further as whereas Microeconomics typically focus on the extreme types of competition such as perfect competition, and monopoly, IO deals mainly with Oligopoly (including duopoly and monopolistic competition) which is more akin to reality.

### Questions addressed in IO

The definition of market power in IO is the ability of the firm(s) to charge a price ( $P$ ) above that of the marginal cost. That is given that a firm's profit function is the difference between revenue ( $R = P \times Q$ ) and total cost ( $Q \times C$ ) (assuming constant marginal cost of  $C$ ), the maximized profit is

$$P - C \geq 0$$

If the firm(s) indeed have market power, the above inequality would be strict.

- **Is there Market Power?**

Based on the central tenet of the Chicago School, as long as there exists free entry and exit, no firm can consistently charge prices greater than the marginal/unit cost, and thereby earn extraordinary profits. If they attempted to do so, profits would encourage entry ( **free entry and exit** is the central idea behind the perfectly competitive market structure) , thereby driving prices down towards the marginal cost. Empirically, this has been substantiated by findings that

profits are indeed low among firms in the US economy. However, that is not to say that there are no industries where firms do indeed have some form of market power, through perhaps the control of entry into the industry or as derived through **advertising**. Consider the accusations levied against Microsoft, and the existence of organizations such as the League for Programming Freedom, that fights against patenting of software and user interface copyrights. It is these issues that principally drive research in Industrial Organization.

- **How do Firms Acquire and Maintain Market Power?**

Market Power gives rise to higher profits, and a profit maximizing firm would seek to maintain that power. Market Power can be secured via **patents, copyrights** etc, i.e. through securing legal protection **property rights**. Consequently, the high investments in **Research and Development**. Since such behavior is merely rational and optimal, do organizations such as the League for Programming Freedom have a case? Isn't a program a significant invention and consequently worth protecting? Isn't the investment in time, and equipment just as significant as that invested into the development of hardware? Where do we draw the line between what is significant and what is not significant? Isn't the invention of new technology the result of both current and new knowledge as well? Are patents anti-competitive and consequently reduces our net welfare as consumers? But how do we then protect firms from flagrant copying, which if occurs reduces the incentive for firms to innovate? Is it possible for the economy to offer patents to protect a firm's work, and at the same time require them to share the technology and thereby increase society's welfare?

Of course there are other ways that firms can secure market power through:

1. Strategic choice of price and quantity, and bundling of goods,
2. Product differentiation,
3. Advertising (which sometimes merely create the illusion of differentiation), and
4. Mergers, Acquisitions and Restructuring of production/operations.

- **What are the implications of Market Power?**

When firms charge prices greater than their cost of production, it ultimately benefits themselves. However, isn't the selfish gene in all of us? The social planner then decides what is exorbitant, and what isn't by weighting society's welfare consisting of both firms and consumers. The effects the social planner has to contend with are that;

1. The first order effect of market power is the **transfer of consumer surplus to producers'**  
,
2. Inefficient allocation (**allocative inefficiency** and **productive inefficiency**) of resources through both consumer and firm choices consequent to the actions that give market power,
3. **Rent Seeking** behavior by firms to secure their market power through influencing policy makers.

Yet is market power really bad. Whereas the **Chicago School** of thought believes that market power does not exist. The **Austrian School** of thought insists that it is with market power that we see progress. However, another question comes to mind pertaining to measuring progress. Consider the following, having used both Scientific Word (which is the sole L<sup>A</sup>T<sub>E</sub>X producer to the academic and research market), and the various freeware versions of L<sup>A</sup>T<sub>E</sub>XI have come to realize that the latter which enjoys perfect competition with zero profits to be reaped is by far the easiest to use and far more flexible software. Of course there are cases of the reverse, can you think of any?

- What is the relevance of Public Policy in the face of Market Power?

Policy tools available to the social planner includes:

1. **Regulation:** Firms that possess Monopoly powers are under direct supervision of the state to protect consumers from flagrant price gouging or some such practice. An example being the policies guiding the pricing practice of Nova Power, where all pricing decisions until this year were subject to provincial approval.
2. **Antitrust (Competition Policy):** These policies' main purpose is to prevent firms from taking actions that increase their market power to the detriment of society. An example of which are firm mergers which is commonly believed to be anti-competitive and leads to a fall in consumer welfare due to increase market power, and greater ability to raise prices above the unit cost. Anti-competitive strategies also include predatory pricing meant to reduce the competition's market share or even to drive them out of the market. Strategic pricing threats could be used also to deter entry by new entrants. These strategies may be undertaken by a single large incumbent or a group of them. **It should be noted that the proponents of the Chicago School of thought believes that it is government intervention that encourages market power by protecting the firms.**
3. **Industrial Policy:** These policies are meant to protect the industries, where it may be deemed of strategic importance. These tend not to be due to within market actions, but are meant to keep the industries internationally relevant either domestically or internationally. However, economist typically believes these policies are not justifiable since the best decision makers or process as to which industries or firms should survive or go the way of the dinosaurs is the market, and not a government. This judgement is principally levied despite success stories in Japan. However, as noted before, it could be that a stronghold in the said industry might be of strategic importance. However, such a consideration would then have to consider governments engaging in strategic protectionistic policies. Who should win then?

In our following discussions, we will contend with the first two points only.

In Industrial Organization, we typically study an industry within a particular frame of thought in the following sequence;

*MarketStructure*  $\rightarrow$  *Conduct*  $\rightarrow$  *Performance*

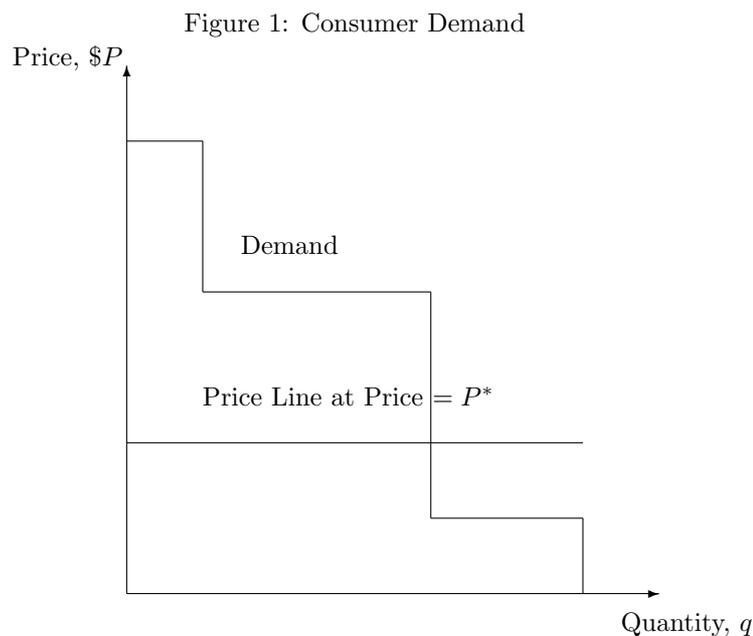
However, that is not to say that the causality flows in the prescribed direction. It is just as well that conduct of some firms might give rise to a particular market structure and consequently the observed performance.

## 2 Basic Microeconomics

Insofar as IO is a sub-field within microeconomics, you are expected to have a prior knowledge of the basic concepts. We will nonetheless lay out the basic points we will be using.

- **Demand**

Goods we typically consume are in discrete amounts, such that if we were to depict the price individuals are willing to pay for a particular quantity of goods, it would look like a step function such as the following:

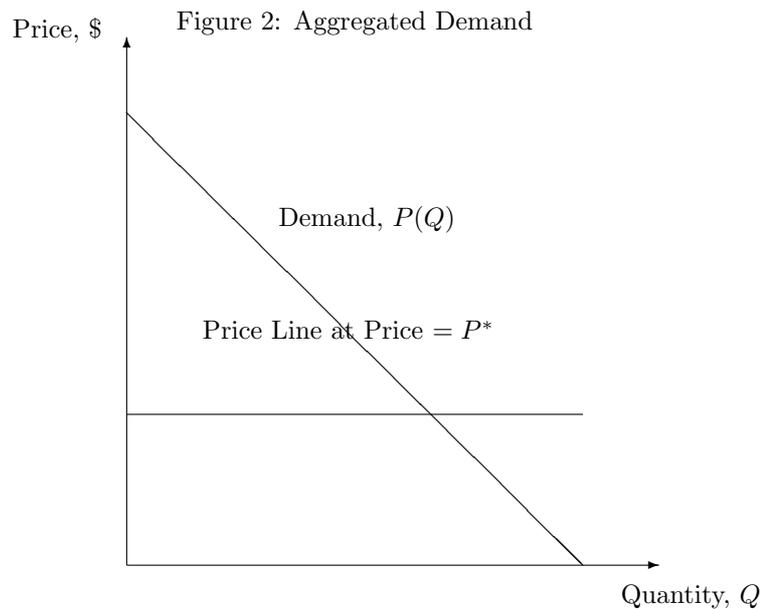


Of course since your first course in economics, for simplicity, we typically assume that products or goods are infinitely divisible on the aggregate, allowing us then to portray the demand as a downward sloping curve.

The significance of the consumer's demand curve is that it reflects the consumer's **willingness to pay** for a good. The significance of this idea is that it allows us to conceptualize the idea

of consumer's welfare as the differential between what they are willing to pay, and what they actually pay for the goods they consume, precisely it is the concept of **consumer surplus**.

When we aggregate each individual's demand curve as in the above figure, we might get the following continuous downward sloping curve. It is important to note that the usual demand curve we depict is the relationship of prices dependent (or is a function of) on the quantity consumed, that is the relationship  $P(Q)$  :



The above is the typically referred to demand curve, but to be pedantic, it is the **inverse demand**. If instead, we reverse the relationship thereby depicting quantity as a function of price,  $Q(P) \equiv D(P)$ , we have the true demand function.

You should also avail yourself with the most common measures of **demand elasticity** measures:

- **Price Elasticity:**  $\epsilon = \frac{\Delta Q}{\Delta P} \times \frac{P}{Q}$
- **Cross Price Elasticity:**  $\epsilon_{1,2} = \frac{\Delta Q_1}{\Delta P_2} \times \frac{P_2}{Q_1}$

The value of these measures are that they allow us to measure the degree of responsiveness demand is to changes in prices, i.e. in terms of percentages as opposed to changes in units consumed, the magnitude of importance being dependent on the original value.

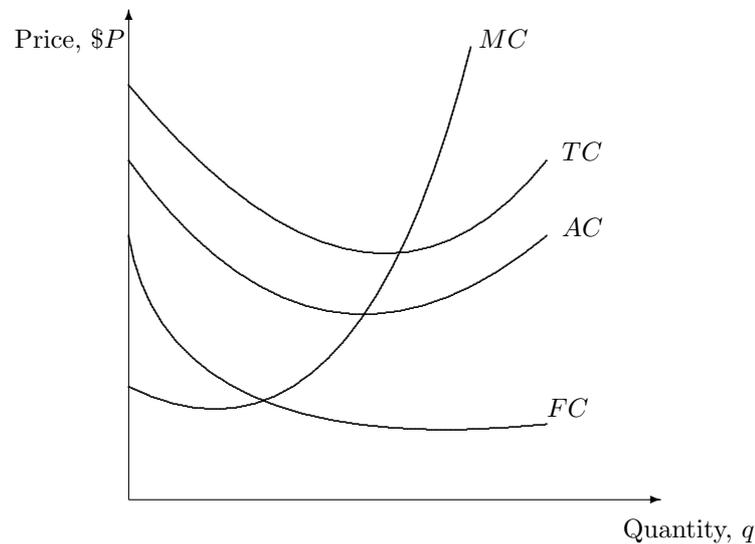
- **Costs**

The importance of the **cost function** of a firm is its ability to reflect the degree of efficiency in which a firm transforms its inputs into outputs. In making decisions on a production process we are concerned with the cost and benefit of each process, hence the emphasis on cost functions. The basic costs concepts are as follows:

1. **Fixed Cost (FC)**
2. **Variable Cost (VC)**
3. **Total Cost (TC):**  $FC + VC$
4. **Average Cost (AC):**  $\frac{TC}{Q}$
5. **Marginal Cost (MC):**  $\frac{\Delta TC}{\Delta Q}$

The following diagrams are the usual ones pertaining to the various cost concepts and their relationship with each other:

Figure 3: *MC & AC Curves*



What is the usefulness of these concepts? You should know this answer by now. Essentially, when a manager decides whether to expand production or not, he needs to know the viability of those choices. Would the firm remain profitable if it does, if the current production level is profitable? If the firm is currently not profitable, would a reduction or expansion of output levels help? Managers could decide based on comparing the incremental cost of changes in production level in relation to the price. Which means a comparison between price and marginal cost,  $MC$ , which in turn is derived from total cost,  $TC$ . Why do we then want to know more about  $AC$ ? Essentially, when a firm calculates its profits, it is not concerned with the marginal cost for the additional unit, but cost for each unit, which in turn is derived from  $\frac{TC}{q} = AC$ .

Further, from the diagram, you should note that if instead the manager mistakenly bases her decision on the concept of  $AC$  instead of  $MC$ , a situation might arise where although price is greater than  $AC$ , it is actually lower than  $MC$ . That is the incremental cost of producing an additional unit of output actually leads to a fall in profitability. Consequently, the following statement is derived:

**Marginal Cost** is the appropriate cost concept to decide how much to produce, whereas **average cost** is the appropriate cost concept to decide whether to produce at all

Recall also that if prices are lower than prices, the profits of the firm is negative, and the firm is unable to even recoup their fixed costs. Therefore a **Firm's Supply** is the portion of  $MC$  that is greater than  $P = AC$

There are other aspects to cost that are concerned with and would be heavily used in our subsequent analysis as well:

– **Opportunity Cost & Sunk Cost**

**Opportunity Cost** of a choice is the *forgone benefits from not making the optimal choice*. It is also sometimes referred to as the **imputed** cost of a choice.

**Sunk Cost** is an important cost concept in IO, and essentially refers to an investment in an asset or assets with no alternative use, i.e. no opportunity cost. Its importance lay in the idea that if the asset has no alternative use, the cost of the asset should not be taken into consideration in decision making. It should be noted that whether an investment is a sunk cost is dependent on the time frame under consideration. Generally, what we want to do is to distinguish between short run average cost (that excludes sunk cost) and long run average cost (which includes recurrent cost, i.e it includes certain sunk cost in that the short run ignores such as rent). The correct concept to use is dependent on the nature of the decision.

To summarize, economic decisions should be based on the concepts of **economic cost** as opposed to accounting cost because it includes opportunity cost that has no parallel in accounting, and stipulates that it should ignore sunk cost that has no alternative use in the first place. The importance of these concepts in IO is that they have strategic importance. Suppose an incumbent firm wishing to deter entry by other competitors may engage in substantial investment (sunk cost) say in production capacity, revealing their commitment to drive any additional competition out of the market.

– **Economies of Scale & Economies of Scope**

The cost function of firms within a particular industry allows us to understand why certain industries have high concentration (few firms), while other are fragmented.

- \* **Economies of scale**  $\Rightarrow$   $AC$  falls as output increases.
- \* **Constant returns to scale**  $\Rightarrow$   $AC$  remains constant as output increases.
- \* **Diseconomies of scale**  $\Rightarrow$   $AC$  rises as output rises.

Empirically, most firms and industries exhibit economies of scale at low levels of production, i.e. economies of scale for low output. However, the ideas pertaining to the degree of concentration of an industry is to do with the concept of **minimum efficient scale (MES)**, which is *the lowest output level where the AC is at the min*. It is frequently expressed in terms of the total size of a particular industry,  $\frac{MES}{Q}$  where  $Q = \sum q_i$  is the total output of an industry. It is clear that if  $MES$  is large relative to the size of the market, we should then expect a relatively more concentrated industry.

In what follows in the course, we will also be asking questions pertaining to whether should production should be consolidated into a single entity or otherwise. This deals with the idea of **economies of scope**. Let there be two firms in an industry, 1 and 2, with quantities produced at  $q_1$  &  $q_2$  respectively. Let the cost of production of each firm

be  $c(q_1) \equiv c(q_1, 0)$  &  $c(q_2) \equiv c(0, q_2)$  respectively. Then we say that there are economies of scope to be reaped, i.e. production is more efficient as a single entity than otherwise when

$$c(q_1, q_2) < c(q_1, 0) + c(0, q_2)$$

This can be thought of as a justification for merger among firms, or proof of whether a firm is a natural monopoly.

- **Profit Maximization**

The profit function of a firm is just the difference between total revenue and total cost of a firm. That is

$$\begin{aligned}\Pi &= r(q) - c(q) \\ &= (P(q) \times q) - (AC(q) \times q)\end{aligned}\tag{1}$$

For a well behaved (increasing and concave profit function), the idea of profit maximization implies finding the maximizing level of output that gives the greatest profit. You can find this level of output by differentiating the profit function with respect to  $q$  (Although it may be true that firms choose prices rather than level of output. Given the relationship between price and quantity given by the demand function, finding one is equivalent to finding the other). The solution then would be;

$$\begin{aligned}\frac{\partial \Pi}{\partial q} &= \frac{\partial r(q)}{\partial q} - \frac{\partial c(q)}{\partial q} = 0 \\ \Rightarrow \frac{\partial \Pi}{\partial q} &= MR(q) - MC(q) = 0 \\ &\Rightarrow MR(q) = MC(q) \\ &\Rightarrow \frac{\partial P(q)}{\partial q} q + P(q) = MC(q) \\ \Rightarrow P(q) \left[ \left( \frac{\partial P(q)}{\partial q} \times \frac{q}{P(q)} \right) + 1 \right] &= MC(q) \\ &\Rightarrow P(q) \left[ 1 - \frac{1}{\epsilon} \right] = MC(q)\end{aligned}\tag{2}$$

Therefore, we say that

**Profit Maximization:**  $\Rightarrow$  *marginal revenue is equal to marginal cost.*

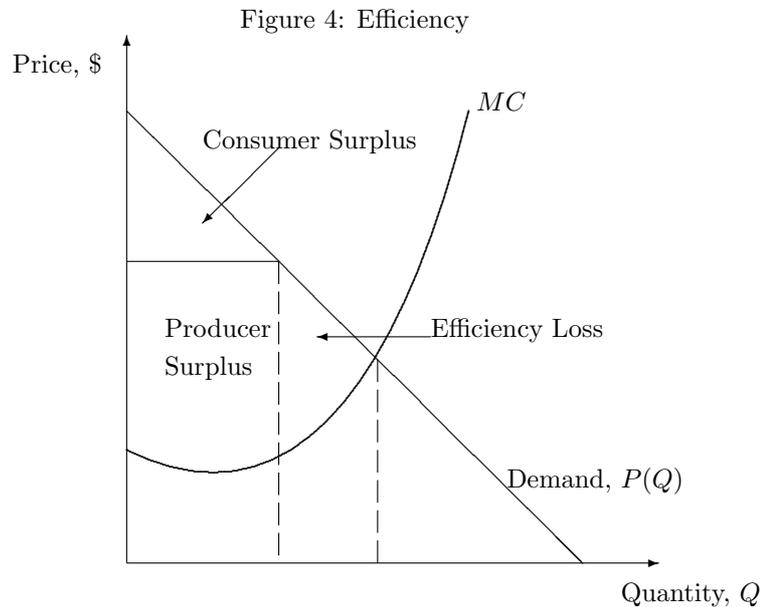
Where  $\epsilon$  (note that I am treating  $|\epsilon| \equiv \epsilon$ ) the elasticity of demand. So since  $\epsilon$  is greater than zero, the marginal revenue is always less than price. However, this is true when firms are in oligopolistic competition (an idea we will be dealing with for much of the course). Note that the last observation is because as the firms increase output, the sale of the additional output if achieved by selling each and every unit before that at a lower price.

**What is the condition if the firms are perfectly competitive? What happens if a competitive firm raises or reduces its price? Does the competitive firm need to change its prices to sell the additional unit of good?**

$$MR = MC$$

- **Efficiency**

No economic discussion would be complete without discussion of welfare. The following diagram depicts the various measures of welfare allocation, and efficiency considerations should the equilibrium price not be that where demand and supply equates.



It should be noted that total (societal) surplus is the sum of producers' and consumers' surplus, and essentially measures the incremental value to trade between the consumers and producers. The value to society from this trade is maximized when price and quantity consumed coincides with the point where demand and supply meet. If that is not true, there would be efficiency loss due to misallocation of resources.

To be precise, microeconomics and IO uses three ideas of efficiency in understanding which is the optimal allocation of resources.

- **Allocative Efficiency** refers to the idea that resources should always be allocated to their most efficient use. This is achieved when total surplus is maximized as noted above.
- **Productive Efficiency** refers to the proximity of actual production to the lowest cost attainable. It requires that the choice of inputs and production techniques be as close to the minimum as possible.
- **Dynamic Efficiency** refers to the improvement over time of the production process, and products.

The first two concepts of efficiency deals with static ideas, while the latter, as its name implies, is dynamic. The latter is also difficult to measure, since we always lack counter-factual occurrences.

But in general, there is a trade off between the two types of consideration. Whereas the perfectly competitive market structure is conducive to static efficiency, it is not dynamically efficient, as too much resources are expended in competition, and there is little profits a firm could retain to change production process or product.

**What kind of market structure do you think would be the most conducive to dynamic efficiency in the software market? Has the dispute in the software industry anything to do with market structure?**

**\*\*\* Do the following exercises to avail yourself of all the skills necessary to carry on with the course, and to ascertain that you have retained everything you learned from earlier Microeconomic courses: 2.6 to 2.10**

### 3 The Firm

As was mentioned, economics in generally treats the decision making process as a black box, with the firm maximizing profit by choosing the level of output from a set of inputs. Is this assumption really realistic?

We will rationalize this in this section. At the same time, we will set the tone for the rest of the course by examining briefly,

1. The determinants of the size of a firm, both horizontally, and vertically.
2. The determinants of why firms in the same industry might differ from each other.

- **Do Firms Really Maximize Profits?**

Most modern corporations operates such that there is separation between the ownership, and management. If the ownership is the management such as in a sole proprietorship or partnership operation or in some none listed companies, then it is very likely that our assumption of profit maximization should not deviate far from the truth. What about corporations? Ownership who collects the profits, and dividends would necessarily want their profits to be as high as possible, be it considered in a static (current) or dynamic sense would parallel our assumption of profit maximization. However, is management necessarily goaded by profit maximization? In general, profits is but one aspect of management. Does then mean that firms do not maximize profits? We will now argue that even though there may be divergence in incentives between ownership and management, that profit maximization may still not be a far fetched abstraction of reality.

- Internal Discipline

Of course ownership would recognize this, and consequently could exercise control by offering contracts the induce that behavior, i.e. to maximize the dividends to the shareholder/owners. However, most corporations has a substantial number of shareholders,

which means that for each shareholder, the marginal benefit from his effort in exercising greater control over the management is far too costly compared to the gains he could earn. This suggests that firms which has few shareholder or firms with an active board of directors would and could exercise greater control over their management, and yet anecdotal evidence suggests otherwise as well. Why would that be so?

It turns out that typically (anecdotally) the board of directors too have objectives other than profit maximization. In fact, their objectives may be more aligned with that of the management! How is that possible?

Even if shareholders/owners are willing to control management, they may not be able to. This is a result of asymmetry in information between the owners(principal) and agent(managers). The managers who actually run a firm typically knows what is best for the firm, while the owners do not. Consequently, the principal would not be able to effectively dictate the contract. **Agency Theory** deals with this, and it turns out that the optimal solution to this problem is for management(if they are risk neutral) to pay an initial fee, but retain all profits from her actions. This would imply that both shareholders and management become one, consequently negating the principal-agent problem.

However, there are some problems with this solution,

1. Most managers are subject to financial constraint. Consider this, if there is no such constraint, why would not they choose to instead be the shareholders. Consider another example, if you could write music like Bob Dylan or Tom Waits, wouldn't you sell your music as a songwriter, and collect royalties for every time someone rehashes your song, rather than touring like a dog. Maybe a bad example!
2. Like most individuals, managers are risk averse. Given the first problem, this may not be surprising. Considering that most outcomes from a choice are hardly known with certainty, would managers embark on risky projects that might maximize a firm's profits, or safer project, but with lower payoffs?

Therefore ownership has to balance the benefits from insuring the management against a negative outcome (through fixed salary), and the benefits from having managers having the right incentives to maximize profits. Even these ideas are a simplification of reality, since the environment in which managers operate within are far more complex. Consequently, most contract offered are simple ones where managers are offered fixed salaries to insure against risks, but have profit contingent compensation so as to attempt to bring the incentives of managers in line with ownership. However, this solution only partially solves the principal agent problem.

– Labour Market Discipline

In truth, is there real concern by the ownership that the management would actually try not to perform? Considering most individuals hardly stay on in the same firm forever,

managers themselves have vested interest to build on their own resume, i.e. their reputation. Consequently, there may not be any cause for concern even if the ownership cannot punish management for a poor performance.

– Product Market Discipline

When the firm operates within a highly competitive market, the management may have no other choice then to maximize their profits failing which their firm exits the industry and they would be out of work. Further, when competition is strong, outcomes of other firms are highly visible, which provides a signal to owners about how well their managers are doing in relation to their competition, and reduces information asymmetry.

– Capital Market Discipline

This arguement here is that if management does not perform well, it would be reflected in the capital markets. Firms that are performing under expectations are viable subjects of acquisition, where the acquirer could replace the management and make profits by behaving optimally, thereby making capital gains. This constant threat would ensure the management behaves close to the ojective of profit maximization.

**Therefor although there is separation in between ownership and management, there is still reason to believe that profit maximization is a reasonable approximation to reality. The principle reasons being**

1. **Management incentives contracts**
2. **Labour Market Discipline**
3. **Product Market Discipline**
4. **Capital Market Discipline**

• **What Determines the Firm's Boundaries?**

If there is a particular setup that is optimal, why is there so much variance in firm size? What determines the degree of horizontal extension (different types of products) of a firm? What determines the degree of vertical integration different stages of production)?

**The Horizontal Boundaries of the Firm**

The horizontal size of a firm is largely dependent on cost considerations, so that they tend to choose the size that is at the minimum point of the ATC curve. Note that we are not talking about the optimal choice for quantity, but the size the firm should be. But if that is the case (if we think of there being a unique minimum), why is there variation between firms. This is principally because empirically, it has been found the the minimum point of the ATC is

not unique because it has a "flat bottom". This indeterminacy is also complicated when we distinguish between firms and plants.

### The Vertical Boundaries of the Firm

One of the key questions firms asks themselves is whether to buy or produce their own inputs. Although superficially, it is merely a comparison in cost differential, the concern goes beyond costs.

Consider the incentive for quality between an external supplier of an input versus a subsidiary. The former's continued relationship with the downstream firm is dependent on the quality of its products, and consequently has vested interest to maintain quality (it is also dependent on timely supply, and flexibility, etc). However, the latter knows that regardless of quality, the orders will continue to flow. That is there is an incentives problem.

If that's the case, should all firms always refrain from vertical integration. Because under vertical separation, the supplier, and purchasing firm are separate entities, the relationship is contractually based. If the relationship requires the upstream firm to make **specific investments** in its own production process, it opens the upstream firm to the **holdup problem** where the downstream firm knows that given the former's specific investment, it has no choice but to trade with her, and may attempt to **renegotiate** the contract to her own benefit (**post-contractual opportunism**)!

Solutions to these problems include,

1. Tapered Integration involves the use of both in house and upstream suppliers.
2. Franchising involves the specific investment by a parent firm consequently reaping the benefits of vertical integration, while the franchisees keep much of their profits thereby retaining much of the benefits of vertical separation (since the parent company does not own the franchisee's operation).

**Horizontal Boundaries of the firm is dependent on cost considerations, while Vertical Boundaries is dependent on the balance between investment and performance incentives.**

- **Why are Firms Different?**

#### Some Empirical Findings

1. Firms in the same industry and of similar size may perform differently.
2. Only 20% of the variation in firm profit rates can be explained by firm size, the type of industry, etc.

3. The differences in firm performance is persistent. There is **sustained competitive advantage** for some firms.

Without including consideration of industries and firms whose technology, or process are under legal protection through patents, industries where these do not exist should exhibit relative similarity, but this is hardly ever true. What are some reasons the could explain the empirical findings above.

What could explain possibly explain the other 80% of the variation in profits between firms? One explanation pertain to legal protection of invention that lend its inventor (the firm the patent is vested with) the competitive edge. But how about industries where the technology is known? This is known as **impediments to imitation**.

In some industries, although superficially technology might be common knowledge, by virtue of the production process and technology having a large number of variables, might also make imitation difficult if not impossible. This is known as **causal ambiguity**. That is although you can be taught how to make a folk guitar, but you might never know nor can that knowledge be accurately transmitted so that you make a real guitar.

Further, firms are focused not solely on their own processes, but are keenly aware of their competition, and are engage with each other in competition. This interaction requires them to adopt **strategic behavior**. Consequently, the differential between firms is the result of superior versus inferior strategies adopted in time. It is on this that industrial organization mainly focuses its attention. But this does not mean that it is the most important determinant.

A final possible argument for firm differential is due to historical occurrences that has given an incumbent firm its status in the industry vis-a-vis its competition. This conclusion in history might be a result of strategic behavior, or simply fortuitous occurrence.

**There is significant variation between firm performance among firms. Some principal reasons include impediments to imitation, causal ambiguity, firm strategy, and historical events.**

**Answer questions 3.5, 3.6, 3.9, and 3.10 of your text.**