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# Incomplete Information and Asymmetric Information

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***Abstract***: Asymmetric information refers to that uncertainty which arises as a result of co-ordination problems between two agents. This has a limited applicability in the understanding of how businessmen attempt to protect themselves against the possible fluctuation in macro-economic variables and from a possible adverse competitive atmosphere. This paper argues that incomplete information allows us to identify those variables whose unknown position might cause uncertainty, which in turn allows us to understand why, and types of, measures are undertaken by businessmen in an attempt to protect themselves from the adverse impact of unforeseen events. Results from these measures are contrary to the findings of the neo-classical model.

***JEL Classification***: D80

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## Introduction

Although both incomplete information and asymmetric information refer to causes of uncertainty, they address different kinds of uncertainty.

Incomplete information, on the one hand, deals with the situation where the event is uncertain. That is, the authors refer to the future event, which is not known, largely due to the fact that the variables' future movements, which ultimately determine the outcome of a current decision or action, are not known to the agent. As a result agents

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undertake decisions based on the information they have in their possession. However as the agents know that their decision is based on incomplete information, they take measures which include some precautionary measures should the outcome turn out to be an unfavourable one and other measures are taken to enhance the chances of a favourable outcome. Conventional economists generally avoid the problem that arises when the event is uncertain.

Asymmetric information, on the other hand, refers to market uncertainty. That is, the authors refer to the uncertainty that arises when one agent either deliberately distorts or does not disclose all the relevant information to another agent, during their interaction phase. Consequently, the agent with less information is in a disadvantageous position when dealing with the agent who has superior information. Thus asymmetric information addresses that type of uncertainty that arises during the operational phase or inter exchange phase between agents. It then leads to an interesting strategic play, allowing economists to formulate models within the framework of game theory,[2] while in the case of incomplete information there is not much room for strategic interplay.[3] However, it is also interesting to note that these strategic interplays between agents are being formulated by assuming agents are rational, and their prior probability distribution and their utility function is common knowledge [Brandenburger and Dekel (1990)]. Alternatively as Milgrom and Roberts (1987, p.184) wrote, 'the probability distribution over what the particular private information of the various players could be common knowledge.' Essentially, it amounts to redefining the game in such a way that each agent knows the probability distribution of the variable which is uncertain. Thus the game whose outcome is supposed to be uncertain has been transformed or re-arranged in such a manner where the absence of information is being replaced with complete information about the probability distribution.[4]

It is argued in this paper that the common knowledge assumption is not sufficient to transfer the problem of uncertainty into the risk factor. This is because, in order to deploy the common knowledge assumption first one should be able to rank all the alternative options that are open to our rivals in terms of their superiorty or inferiority in an *arithmomorphic*[5] manner, which is required, if the choices are to be made by following the path of pure logic. In reality, such a clear cut ranking is not possible on an a priori basis, and consequently we cannot deploy the common knowledge assumption.[6] In fact we have a fundamental problem in its formulation.[7] In any situation if we wish to predict what our rival is likely to do, we are first required to examine what the rival's position is, from which we then are able to examine alternative options that may be availble to him. It is the payoff of each of these various alternative options which allows us to form the payoff matrix, from which we try to predict the likely behaviour of our agent.

A fundamental problem is that we cannot determine or define, the agent's position entirely from his entitlement or pecuniary position; rather it is determined in conjunction with the objective function or goals, with which one intends to measure the 'position of an agent'[8], otherwise these words have no meaning. The seriousness of the above problem could be easily realized, once we wish to measure the agent's payoff function in the space-time dimension framework.[9] In this situation every point in the payoff function will be represented by our own gain and loss, that is just not one or the other. That is, a short term gain will be associated with a long term loss and vice versa, and in between these two axioms each agent will be confronted with an infinite number of points to choose from. Given the problem described, in this situation for example, even if we know our rival's financial entitlement or position, in the absence of knowledge about his objectives or goals we are not in a position to predict which point our rival is likely to choose from. In fact, it will be shown that in many cases authors of the asymmetric information placed much effort on working out what the rivals are likely to do without investigating whether the agent's initial entitlement provides them with any real opportunity to make a move. Needless to say, how the rival agent is likely to react to the first agent's strategy will always remain a matter of some uncertainty.

The above problem therefore suggests that even if we reduce the number of agents to two, uncertainty in relation to what the other will do, still remains. Given the situation described, incomplete information on the other hand recognizes that in the absence of future information it is not possible to formulate a mathematical expectation, therefore we cannot reduce the problem of uncertainty within the framework of risk analysis. This implies that entrepreneurs, whether in a conflict situation or facing an uncertain event, have to take precautionary measures. These precautionary measures are of a different type to those discussed within the framework of moral hazzard. Precaution has a cost, which is not attributed to the direct cost (e.g. interest cost, wage bill, input cost and etc), but mainly arises due to the provision of unfavourable outcomes, and is built systematically into the structure of price. This in turn forces price to exceed the average cost. That is, if the total quantity that a businessman produced is being sold then price will remain greater than the direct cost by an exact amount of the cost of producing that quantity which a businessman assumed, may not be sold. Alternatively, we can say that if all the output is sold then price will exceed the direct cost, by an exact amount that was built into the price structure as a precautionary cost. On the other hand, this means that if price equalizes the direct cost, the quantity supply will become greater than that of quantity demand. This then suggests that the present concept of equilibrium is unlikely to hold (or be achieved) in the presence of uncertainty. Needless to say this follows from the Keynes-Shackle notion of uncertainty[10], although it has not so far been formalized. The former type of uncertainty was introduced by the game theorists, popularized by

Akerlof (1970) and subsequently adopted by many economists (and applied in various fields of econmic analysis including analysis of the credit market, management, product market, agriculture and etc).

This paper is divided into two parts. In the first part we examine whether the problem of uncertainty can be reduced to risk analysis as suggested by the authors of the asymmetric information constraint. It will be argued that even in a situation of asymmetric information, we have difficulties in addressing the above problem within the framework of risk analysis. In the second part, we examine the issue of uncertainty which was introduced subsequently within the framework of incomplete information, where uncertainty is seen from a different perspective and an attempt is made to identify the source of uncertainty, so that it is possible to examine what businessmen do and why they do take these measures. An interesting conclusion which follows is that these factors cause a serious breach in achieving the so called notion of efficiency.

## Asymmetric Information

The asymmetric information constraint mainly refers to the problems that are associated with imperfect information. Imperfect information mainly refers here to the information gap that often persists between rival agents. The information gap mainly arises as one agent does not disclose all the relevant information to his rival agent, specially that information which is not necessarily advantageous to him, and often such agents deliberately distort the information. Authors of the asymmetric information literature, argues that despite this information gap, an agent who has inferior information will still be able to formulate a probabilistic pattern of the behaviour of the other agent who has superior information with the help of game theory.

According to game theory, although it is recognized that the agent does not know much about his\her rival agent, the former agent is aware that he has at his disposal a very different kind of highly pertinent information, i.e. he knows something about himself - his own financial position and his attitude towards taking chances or risk, where the former is the crucial determinant of the latter. Together, these must determine to what extent he desires, and can afford, to take a chance. The foundation of any rules for making a rational decision under uncertainty must be contingent upon at least these two elements: the player's psychological make up and his pecuniary situation or position.[11] Now the importance of our pecuniary circumstance mainly arises, because from the pecuniary position we can investigate what are the feasible alternative options available to our rival and which of these options are likely to produce a gain or loss. Game theory claims that once the gain or loss is known, then it is common knowledge what our rival is likely to do, since our psychological make-up

in this situation is assumed to be influenced or determined by the gain or loss. Thus, in order to address the above problem within the game theory framework, first we need to define our rival's position, from which, according to the available alternative options, we are supposed to be able to construct our rival's payoff matrix. It is from this payoff matrix, we should be able to rank which moves are likely to produce our rival's highest attainable gain or lowest attainable loss. Thus our rival's position plays the most crucial role in the determination of his strategy. Yet in game theory no clear cut distinction is made between choice and position. In fact the result of each choice that is presented in the payoff matrix is referred to as the position. Consequently, the feasibility of these choices in each individual context is not examined.

It will be argued there remains a serious difficulty in establishing the rival's position accurately from one's own position. Even if we assume such a position can be established mechanically, options that are availabe to our rival, given the position, often do not offer any clear cut gain or loss to formulate any meaningful payoff matrix from which we can ordinally rank strategies. The issue is further complicated by the fact that when we consider the time horizon over which a business enterprise is likely to operate, the game is no longer confined to the simple loss or win, as the game involves whether one wishes to make a short term or long term gain, where our set of values and objective function play an important role.

*Options Examined From the Mechanically Determined Position*

Let us examine the above issue with reference to Stiglitz and Weiss's (1981) use of the incentive effect. They argue that as the higher interest rate reduces the expected net return for projects which succeed, this may induce borrowers or firms to switch from a so-called low risk to a high risk project where the probability of success is low, and where the return will be high in the event of success. The above argument is based on the assumption that the individual's attitude towards risk is largely a function of his\her own pecuniary (i.e. financial) situation, implying that those who have less to lose in the event of an unsuccessful venture will be more willing to undertake risk.[12] This implies that the selection of a project may vary with the level of interest rates. On the basis of this argument they provide an explanation of why in the presence of excess demand a rational banker instead of raising interest rates introduces a non-price form of rationing. But they overlook two important factors that must come into consideration when making the decision to switch between projects following changes in the interest rate: (a) there is a cost associated with selection and switching between projects and (b) the possibility of an adverse impact from the crowding out effect. The issue of the switching cost arises due to the fact that investment expenditure is largely irreversible. That is, these are mostly sunk costs and therefore

cannot be recovered. Therefore, if a firm wishes to switch from a low return to a high return project, which often involves switching from one industry to another industry or it may involve switching from a cheaper product to an expensive product, it must take into consideration the net loss that would accrue as a result of the sunk costs from the old project. This is because a firm's capital (i.e. plant and equipment), marketing techniques and advertising techniques are all to some extent specific to that project. These, therefore, in their present form, will have little or no use for other projects or for other industries, so in their present form are sunk costs. In principle, a firm should be able to sell its plant and equipment to any other firm which is involved in that specific project within that industry. However, as the value of plant and equipment will be about the same for all firms within that industry, it is unlikely that one firm will gain much, if anything at all, from selling it.

Furthermore, in the event of changes in the interest rate, if a firm considers that its current project's net return is not sufficient in comparison with the high interest rates, then this view should be shared by other firms operating in that industry. Therefore, all firms from that industry would have the same inducement effect. That is, they all would like to switch from low return to high return projects. In these circumstances, firms either will have no buyers for their plant and equipment, or will be forced to sell well below the current market value in order to induce other firms to buy. In either case, this suggests that a switch between projects involves a substantial loss to a firm, due to the irreversible cost. It follows that once we consider the incorporation of the switching cost as well as the selection cost, the firm's net expected rate of return may not rise sufficiently to induce it to switch from low to high return projects, even when the new project offers a higher expected rate of return.

On the other hand, if we assume that switching between projects does not necessarily imply switching from one industry to another industry, the sunk costs may be small but we cannot ignore the adverse impact of the crowding out effect. That is, if all firms within the industry decide to switch from low return projects to high return projects (i.e. from low return products to a high return products), then this movement will in turn not only reduce the return of the so-called high return projects, but will also increase the risk of the projects, because of greater competition that is brought in as a result of the greater supply of firms. This is equally applicable to the case of switching between industries.

The above argument suggests that switching between projects in the event of changes in interest rates is possible provided we assume capital is malleable (since malleable capital has properties that eliminate additional costs involved in switching) and there exists an unlimited demand in the market to absorb all additional firms without adversely affecting the prices of the product. From the above it follows that if the switching between projects involves satisfying the above two conditions, then it is unlikely that existing firms who are already committed to projects will be in a position

to make any possible additional gain by switching from those with low returns to projects with higher returns. Thus the possibility of receiving a lower expected net return remains high in the event of high interest rates, irrespective of the choice of projects, i.e. whether they choose to remain in the old project or switch to a new one. More importantly, interest rates oscillate virtually from month to month, while the process of production from its initial state to the completion period, in general takes a longer period, during which the variation in the interest rate will cause the expected net return of a project to oscillate also. Consequently, it becomes impossible for the investor to calculate the expected net return of his project that succeeds with any precision in the absence of knowledge of the future oscillation of the interest rates that will be occurring, until the completion of the production process. Given the problem described above, it is unlikely that investors' decisions to invest on any project will be influenced by the level of interest rate.

Furthermore, the higher expected rate of return and the risk are not the only two criteria on the basis of which entrepreneurs select their projects. They are also influenced by their knowledge and familiarity with that project. In most cases, entrepreneurs do not have sufficient information in relation to all projects available to them, leading them to select the project they know best, and this is to some extent irrespective of the level of interest rates.[13]

The above argument highlights one fact, that is, even if we can describe our rival's position mechanically from a particular piece of extant knowledge, which is supposed to allow us to assess our rival's current situation in terms of some gain or loss, we are confronted with a problem once we delve into our rival's options within his own context. That is, when we examine various alternative options that may be available to our rival from his mechanically determined position, we often find that one option offers no clear cut gain or loss over another set of options. Thus from the payoff function of these options or strategies, we cannot rank them in the ordinal fashion so as to suggest that strategy **A** is superior to strategy **B.** This eliminates the possibility of making a decision on the basis of our payoff matrix alone. In other words, we cannot reach a decision by following the path of pure logic, since pure logic requires us to make our decision on the basis of a discretely distinct single number in relation to the infinity of all others.

*The Position Examined in the Light of Objective Function and Set of Values.*

We argue that our gain and loss is always examined in the light of our objective function and our set of values in conjunction with our position, where our experience plays an important role in shaping and reshaping our objective function. Therefore, it is incorrect to formulate our gain or loss matrix by considering our position

mechanically. It is important to note that, while a financial gain or a loss can be calculated from a set of strategies, once we know our mechanical position, but such calculations are inter-mingled with conscience. This is especially the case when our gain or loss may adversely affect another party, with whom we may or may not have a conflict of interest.[14] In such a situation, our sense of 'just' in relation to what is right or wrong and fair or unfair enters into our evaluation procedure which in turn helps us to decide whether to take advantage of such an opportunity or not.[15] As the sense of 'just' differ between two individuals, the course of action that will be taken by two individuals will also differ. This implies that our values are independent of our pecuniary position.

Furthermore, if we evaluate our gain and loss not just within the context of that strategy, but examine the strategy from its long term implication, then the gain or loss is no longer confined to the simple claim (i.e. my gain means another's loss), rather it can be divided into two parts, composed of a short term gain with a long term loss and a long term gain with a short term loss. In between these two axioms we have an infinite number of combinations of gains and losses to choose form. In such a system, as the gain is no longer associated with the other's loss only, but it is also associated with our own loss as well, and as a result, assessment of these gains and losses associated with each choice will unlikely to allow ranking and in fact they may overlap with each other. Consequently, we would not be able to make our choices by relying upon pure logic or what Georgescu-Roegen (1971) called *arithmomorphic* process. Any point in between these two axioms therefore will be selected by relying upon an individual's own intuition and his own objective function, where his set of values and experience will play an important role.[16] Furthermore, each set of points chosen by an individual will be considered by him as his own optimal choice, and accordingly each individual will formulate his own strategy in order to achieve his own objectives, and this will be considered as an optimal strategy by that individual only. The success or failure of the strategy is then evaluated by the individual with reference to his objectives in conjunction with his position i.e whether these have been achieved or not. Now if the other individuals do not have the same objective function while they may be in the same position (i.e. they have the same entitlement), each will come up with a different set of strategies and will consider this set as the optimal one. In this situation, we can say there remains no unique set of strategies that will be ranked equally by all individuals, no matter which way we define our rules of the game. This is because, there remains no optimal gain or minimal loss that complies with everyone's objectives. Thus even if we know our rival's entitlement (which allows us to determine his position), real opportunity and capability,[17] we are still not in a position to predict with any precision how our rival is likely to behave. This is because his likely behaviour will also be influenced by his personal set of values and objectives.[18] Therefore, we need to define our objective function and our set of values,

before examining whether we can make a gain or loss from our 'current position' as without doing this, these words do not have any meaning. In other words, position must be examined in the light of our own set values and objectives (i.e.perspective), without which neither the word 'position' nor the words 'gain or loss' carry much meaning.[19]

If the above analysis is correct then I simply cannot define the agent's gain or loss by putting myself in his position, and therefore it is impossible for me to predict the agent's likely set of strategies, since two persons ranking of choice will differ, as it has been revealed on many occasions that two individuals in the same pecuniary position can not only show a different preference towards taking a risk, but for the same individual preferences towards taking a risk differ between two points in time. Thus it is not possible to formulate a universal rule that allows us to predict how an agent will choose his strategy out of all the alternative strategies that are open to him. Consequently, every society in the evolutionary process, introduced various moral and ethical codes that are supposed to guide our conduct, and furthermore it also introduces rules and regulations that are geared to prevent us from undertaking strategies that are harmful to others. Institutions such as the banking sector also undertake measures, for example, they ask for collateral and investigate borrowers' credit worthiness prior to advancing loans, in order to ensure that a voluntary or involuntary default by some, harms neither the banking sector nor their other customers (Basu,1994,1995). These devices can be classified as anti-chance introduced for the very fact that in our interaction phase we cannot predict what our rival is likely to do, but we can deter him from what he is not supposed to do. Reasons for developing all these measures follow from the observational fact or experience, not from the *arithmomorphic* process. This therefore suggests that in a situation of 'market uncertainty' we do have difficulties in resolving such uncertainty by resorting to game theory.

## Incomplete Information

### *The Problem of Randomizing Businessman's Probability*

The distinction between risk and uncertainty can be clearly defined in the case of a lottery. This has been shown succinctly by Lawson, as he wrote (1985, p.915)"....if I purchase one out of a million lottery tickets, then the hypothesis that my ticket will be 'drawn' has many rivals, but given the evidence available to me (one million lottery tickets and a 'fair' draw) the hypothesis that I shall win, though improbable, is not uncertain. However, if I do not know the number of lottery tickets and I have no information about this number, then the hypothesis that I shall win is uncertain." In the

buisness world we do not have the opportunity to make such a clear cut distinction. This is because we are neither in a situation where we have a complete set of information to form an accurate probability nor a situation where we have no information to form a probability. The situation is somewhere in between: we know the past, but we do not know the future. However, there remain some common variables that have played an important role in influencing the outcome of business decisions and they are likely to play an equally important role in the future. There exist some other variables whose importance has not been recognized in the past but may play an important role in determining the future outcome. In this situation we slip back to the past to form a subjective probability on the basis of these common variables by assuming that these variables in future are more likely to behave in the same manner as they have behaved in the past. As Keynes (1937, p.114) wrote, 'Nevertheless, the necessity for action and decision compels us as practical men to do our best to overlook this awkward fact and to behave exactly as we should if we had behind us a good Benthamite calculation of a series of prospective advantages and disadvantages, each multipied by its appropriate probability, waiting to be summed.' However, businessmen know that in reality the actual probability may differ from these subjective probabilities due to changes in the exogeneous factors, and more importantly they believe that they can change the distribution of probabilities through the course of their own actions. This is where the distinction between the lottery player and a businessman comes in.

In the case of a lottery, the chance of success is even, ie if I buy one ticket and the total number of tickets issued is 10,000, then my chances of winning is 1 out of 10,000. This is true for all participants. So in the case of a lottery, the probability or chances are randomized. An individual cannot alter his ticket's chances during the course of the game. He can improve his chances by purchasing more than one ticket but each ticket's chance remains exactly equal. In the business world, an individual businessman believes that he can alter his chances through his effort and skill during the course of the business. Suppose there are 100 businessmen who decide to open a business, each knows that their survival possibility is 70 percent with a failure possibility of 30 percent. But no one knows who falls within that 70 percent possibly and who falls within the 30 percent possibly. Thus, all of them make an effort to remain in the 70 percent survival rate. That is, the very fact they know their possibility, itself causes them to change that possibility, which is similar to Heisenberg's principle of uncertainty.[20] These efforts in conjunction with changes in the exogeneous factors, in turn, at least at the disaggregate level, alter the individual's probability of outcome. That is, while someone has improved his survival possibility, another's has slipped back, if we assume the average probability remains unchanged at the end of the period. At the sametime, it is equally possible that every individual could improve (or reduce) their probability through their effort, and as a result at the

end we will observe that the actual probability differs from the subjective probability.[21] This suggests, that a businessman's probability is not totally randomized and this is where the uncertainty comes in.[22] That is, even if a businessman knows his chances at the begining, during the course of the business he knows that these chances can be, and possibly will be, changed. This means from the initial position we cannot predict the outcome. Thus, even if it is possible to provide the subjective probability on average, it is not possible to determine the individual's actual probability. Therefore, for each individual, uncertainty remains in relation to his own outcome.

*Dividing the Uncertainty; Macro and Micro*

Business decisions are in general made in the presence of uncertainty. Uncertainty mainly arises due to two broad factors, namely fluctuation in the aggregate demand and the competitive atmosphere under which a firm operates.[23] We denote these two factors as macro and micro economic factors respectively. Macro economic factors are external to the firm and to the industry, and this is because these factors fall outside the jurisdiction of any industry. Firms within the industry neither have any control over these factors nor have they any future information in relation to these factors' movements and position. The basic problem is that we cannot tell anything from the current position of these factors about the future direction of their movements and vice versa. Consequently we call them external factors, whose future movements and position ultimately determine the outcome of the firm's project. These factors include the price of their own product, and of a substitute, the price of other products and services, consumers' incomes, taste and preferences, technological change, tax policy etc. We lump these factors into two components, that is those factors that affect the consumer's financial ability and those factors that affect the consumer's perception about any particular commodity.

Micro economic factors are referred to as internal, that is internal to the industry. Namely, firms within the industry compete with each other in order to achieve a greater share of the market. Therefore, given the demand, the increase in the share by one firm means some other firms will loose their respective market share. As every firm within the industry attempts to increase its own share, but no one knows which one of them will be able to achieve this, there is uncertainty for every firm. Therefore, competitive behaviour among firms within the industry constitutes another form of uncertainty. Firms do not compete with other firms per se to become larger than their rivals, but there are some well known reasons behind such actions, other than to just maximize their own profitability. Every firm knows that if there is a fluctuation in the aggregate demand, firms who have achieved greater economies of scale, which imply

lower per unit cost, will have a greater possibility of survival. This factor itself introduces competition among firms to obtain a greater share of the market. However to achieve this, a firm needs to undertake a change in the method of production and to increase its own size of operation, which are necessary to achieve a lower per unit cost of production. Given the market price, achieving a lower per unit cost, means firms within the industry will have greater margins between the price and the average cost. Therefore, at any point of time if a greater fluctuation in sales occur, it still allows a firm to receive revenue that may allow it to cover its cost of production. Firms are forced to take these measures especially because in the absence of precise knowledge in relation to the value of the elasticity, firms cannot change the price in anticipation that the market will be cleared. In other words, no one knows, including firms, what the market clearing price (i.e. demand price) is. An interesting point to note here, is that the uncertainty that follows from the possible fluctuations in the macro economic variables, itself forces firms within the industry to compete with each other for a greater share of the market, thereby causing the emergence of another form of uncertainty.

*The Position of Individual Product's Demand; Indeterminism*

Every businessman know that the quantity that he is currently producing to meet tomorrow's demand, may in fact fall short or exceed tomorrow's demand. If the current production level falls short of tomorrow's demand, then he realizes that his anticipation was wrong, and he fails to gain or maintain his share in the growing market. But no financial loss has occurred, only a potential gain has not been realized. Contrarily, if the current output level exceeds tomorrow's demand, then he will be left with a certain amount of unsold output. This means, he has to bear a certain amount of financial loss. Thus a businessman is confronted with two conflicting problems in his decision making; on the one hand, if his output falls short of current demand, then his own share of the market will be reduced, especially when the market is growing; on the other hand, if his supply of output exceeds the current level of demand, then he will be making a loss. Under this circumstances, the businessman's first priority will be to ensure that under the worst scenario he should be able to recover his cost of production. Given both possibilities, the businessman will attempt to ensure a sufficient level of production, so that he does not fail to realize the gain when there is an opportunity to do so, while at the same time he has to make provision should demand fall short of supply. This means the decision to produce a certain quantity may not follow from the mean value of his own product demand, rather it will be chosen from somewhere between the best scenario and the mean value. In addition to

that, he has to undertake measures that will protect him from a financial loss should demand fall short of supply.

Conventional theory claims that in this situation, businessmen use price to address the problem. However, it has been observed that businessmen do not react quickly enough to the demand price to clear the market. This is because they do not know the precise value of the elasticity. In fact, it will be argued below that even if the elasticity value is known from the past, one cannot predict with any accuracy whether a point reduction or so in price will clear the market.

Price affects demand via two factors: firstly, it affects our purchasing ability, other things being equal, and secondly it also affects our relative preference system. The importance of the second factor has not been recognized in the economic literature, and in fact it has been taken as constant.[24] We argue that, the preference system is not constant, in fact it changes as the price of any commodity we purchase, changes. Given our income, the combination of goods that fills our consumption basket itself represents our prefernce system. That is for other than essentials, for the goods we prefer most we generally allocate more funds than for the goods we prefer least. Now given our preference system, for example, if the price of our most favoured goods increases, we normally, instead of reducing the consumption of our most favoured goods, cut back consumption of our least favoured goods. This means we allocate more funds for the purchase of the same quantity of our most favoured goods and allocate less funds for the least favoured goods. In other words, while the order of our preference system may remain the same, the relative position has changed in favour of the most favoured goods[25], as a result of an increase in the price of our most favoured goods, ie relatively we prefer most favoured goods more at a higher price ( or when our purchasing ability declines) than at a lower price ( or when our purchasing ability improves). In contrast with the above, when the price of our least favoured goods increases, we cut back our consumption of our least favoured goods, ie the relative preference for the least favoured has declined. In other words, the relative preference for the most favoured goods has improved. Furthermore, when the price falls for our least favoured goods, our consumption of least favoured goods does not normally change; rather we take the opportunity to spend more on the most favoured goods. This reveals an interesting phenomenon, in that when the price falls for the least favoured goods our relative preference for those goods falls too. This suggests that when the price of any commodity rises or falls, then our purchasing ability falls or rises respectively. In other words, from the movement in the price of any commodity businessmen can determine the direction of change in consumers' purchasing ability. But from the movement of price of any commodity that consumers purchase, businessmen cannot determine the direction of change in consumers' relative preference system. This is because consumers' preference system is independent of price, yet paradoxically it is the purchasing ability in conjunction with their relative

preference system that determine the demand for individual goods. It is for this reason, that even from a known elasticity value which does reflect consumers' preference order, businessmen cannot predict the position of demand for a commodity with any accuracy when price changes for that commodity. Such a result arises because changes in price will alter consumers' relative preference system, but in which direction it will change businessmen cannot determine from the current position, since the changes in the direction of the preference system do not necessarily follow the direction of the price change of that commodity. As a result, uncertainty in relation to determining the position of demand does appear when price changes. Consequently, in most cases businessmen neither attempt to adjust price nor give much relevance to the elasticity value, but rather they concentrate on quantity adjustment. This reveals why we observe sticky price.[26] Price in most cases changes when there is a change in the factor cost which is commonly referred to as changes in the cost of production. As Hall and Hitch (1951, p.112) wrote, 'Many, perhaps most [ of the entrepreneurs questioned] apparently make no effort, even implicitly, to estimate elasticities of demand....and of those who do, the majority considered the information of little or no relevance to the pricing process save perhaps in very exceptional conditions.' This fact then suggests why businessmen instead of relying on elasticity value will undertake measures that protect them from a financial loss should demand fall short of supply. The only way to avoid financial loss is for businessmen to provide for a doubtful sale. This suggests that in the presence of uncertainty it is not possible to achieve simultaneous equilibrium, with price equalizing average or marginal cost and supply of output equalizing demand for output.

Let us examine this proposition in a bit more in detail.

Suppose a businessman produces Y amount of commodity called X ( Y denotes his average share of the market). However, he knows that the sale of amount Y depends upon a very large number of variables, information about which he does not have in his possession.[27] Thus he is fully aware that the actual quantity of demand in the near future may turn out to be fractionally below that of Y. This he has gathered from his observations of the recent past. Although he is perfectly aware that this fraction or his anticipated demand could turn out to be incorrect in future, however, in the absence of any better indicator, he has no option other than to rely on the knowledge that he has gained from the present and the recent past. Suppose Z is that fraction which will not be sold in the event of the worst scenario. Now consider the cost of production of this fraction ie Z will constitute the amount of financial loss should Z (i.e. the worst scenario) occur. If the businessman's prime objective is to cover the cost of production under any ( ie observed worst ) scenario, then he will include the cost of Z in the price of X. That is, the average cost of X plus the average cost of Z together will determine the price of X.[28] Alternatively, we can say, a businessman will include the

cost of providing for doubtful sales in the determination of the price of production. Therefore, if he sells the quantity amounting to Y, his profit will be exactly equal to the total cost of Z. On the other hand, if Z occurs, his price will be equal to his average cost, i.e. total revenue will be equal to total cost. In other words, when Z occurs, zero profit condition is met, but he has an excess supply amounting to Z. Given the situation described, it should be clear that in the market which operates in the presence of uncertainty, the possibility of achieveing simultaneous equilibrium, where supply equalizes demand and P equalizes MC or AC is a difficult proposition to prove.

*Precautionary Measures*

The above argument follows from the fact that in the absence of precise knowledge in relation to the future position of demand, businessmen have to provide for doubtful sales. Furthermore, this provision for doubtful sales systematically enters into the price structure of every commodity. This is the first measure that every businessman, no matter which industry he operates in, has to take as insurance against the possible fluctuation in the macro economic variables or aggregate demand. However, a businessman cannot afford to maintain extensive provisions for doubtful sales due to the two following reasons; (a) as the provision for doubtful sales itself feeds into the price structure, a higher provision may itself raise the price to such a level where the demand for his own product may fall; (b) furthermore, a higher price due to higher provisions for doubtful sales, may itself provides an opportunity for his competitors to enter in his market. The above argument reveals an interesting phenomenon, which is that most businessmen in this situation would prefer a less competitive atmosphere to that of the competitive one. This is because the greater competition not only limits the protective measures that they think are necessary in the presence of uncertainty, but this limit itself makes them more vulnerable in the event of fluctuation in the aggregate variables. From the above it follows that all businessmen know that they have no control over the fluctuation of the macro economic variables, but they can take certain measures to prevent their competitors from threatening their market. Thus firstly, they would take various measures that attempt to protect their own market; and secondly, they would take measures that are geared towards the elimination of their competitors in the future. These two measures if successful can reduce one form of uncertainty that follows from the competitive atmosphere. This in turn allows them to take a further measure against the possible fluctuation in the aggregate demand ie they will undertake the principle of diversification.

*Positive Measures*

In the business world, two behaviours have been observed so frequently, that we can generalize these behaviours as common characteristics of every businessman. Firstly, they fiercely attempt to protect their own market share, and secondly, which in a sense follows from the first, they all attempt to increase their own share in the market. Both of these behaviours can be revealed from the observation of the tactics employed by each of them. Firstly, every businessman attempts to differentiate his own product from his competitors. Secondly, he tries to achieve the lowest cost of production given the price. The first action attempts to create some form of barrier to entry in the two following ways: (a) once a group of consumers has developed its taste and preference for a particular brand of a product, it is a difficult proposition to make that group of consumers switch to another brand when the real difference is minimal: (b) attempts to enter in such a market by making a real difference between the two products involves a substantial cost, with little or no guarantee as to whether the rival firm will be able to capture a sufficient share that will enable it to offset the additional cost that is involved in making such inroads. However, in the event of failure, the rival firm has to bear the loss.[29] Therefore, the above argument implies that the product differentiation is a measure that attempts to protect the firm's own market from its competitor, thereby attempting to minimize the uncertainty that arises as a result of internal competition. It also allows firms to some extent to govern their own price. The second strategy involves a measure that attempts to minimize the cost per unit of output given the price.

Originally it was thought that the increasing return to scale only exists in a few industries which led to the development of regulation of private monopoly and the development of the public sector. However, Sraffa (1926) has shown that it is perfectly possible for an individual firm to undertake a change in the method of production in order to achieve an increasing return to scale, which in turn will reduce the per unit cost of output given the price. This in effect allows a firm to achieve a greater difference between price and cost, which increases the firm's ability to absorb the impact of a bigger fall in the aggregate demand than that of their competitors. By improvement in the method of production, we not only mean the rearrangement of inputs in such a manner that minimizes the per unit cost, but we also mean an improvement in the co-ordination that is required to make the process of production to function smoothly. Thus we are speaking of the process that led these firms to move into the use of more capital intensive methods of production, where technology of production permitted these firms to achieve a much greater scale of production than is possible under labour intensive methods, and in addition to this, we are referring to the case of an efficient managerial team who has the relevant knowledge, skills and teamwork ability to carry out such a task. These measures in turn reduce the cost as the

volume of output increases.[30] The above measures strengthen the company's position to combat uncertain incidences in the two following ways; (a) a greater margin between price and average cost increases the possibility for a firm to survive in the event of a declining aggregate demand; (b) as the firm acquires a greater share of the market, the uncertainty that arises as a result of internal competition is reduced.[31]

However, since the great depression large firms have realized that an oligopolistic position in one product market may not be sufficient to combat such uncertainty. This fact has been observed in the case of the American manufacturing sector. Since the 1920's, while the concentration of American firms in the manufacturing sector remained relatively stable, the slowing down of the economy during the 1920's and 1930's, caused a sharp change in the attitude of the large firms. Firms adopted a strategy of diversification rather than vertical integration. This choice may be for two reasons: (a) when the market is saturated, firms needs to diversify for further growth; (b) when the aggregate demand falls, firms which adopted the principle of diversification have a better chance of survival than firms who operate in the single product line. It is difficult to establish which of the above reasons played the dominant role for making the move for diversification. However, Chandler (1969, p.275) argues that economic depression might have forced firms to undertake the policy of diversification, as he wrote that, ' Where depression pushed firms into diversification, the war encourged the adoption of this strategy by opening new opportunities for the production of new products.'[32]

From the above evidence it follows that the oligopolistic position on the single product line may be an adequate measure to protect them from internal competition, but it may not be a sufficient measure against a large fluctuation in the aggregate demand. This is because when the aggregate demand falls, different industries' and products' demand falls disproportionately, while it is not possible to predict with any precise accuracy the demand for which ones will be affected most. This is because, when aggregate demand falls due to a fall in our purchasing ability, it also causes a disturbance in our relative preference system. As a result, although it is possible to say that in this situation our preference order in general will favour cheaper goods, but from this information it is not possible to predict the precise position of the demand for each individual product. The above argument suggests that it is perfectly possible, when the aggregate demand falls, that some products' effective demand may either remain the same or deviate marginally from the previous position in either direction, while some products' effective demand can in fact increase.[33]

In these circumstances, if all investment resources are diversified among superior (ie expensive) and inferior (ie inexpensive) products as well as among many dissimilar products using similar technology, it is perfectly possible to reduce the uncertainty. This is because, as the state of the economy changes, returns from some products will fall, while returns from other products will rise. Thus if all the

investment resources are diversified in this manner, they can to some extent complement each other, which in turn will reduce the uncertainty. This explains why during the 1920's and 1930's some big firms in the United States adopted the principle of diversification and used similar technology to produce dissimilar products as an additional measure against the uncertainty that emerges as a result of fluctuations in the macro economic variables.

From the analysis and evidence reviewed above it follows that in the presence of uncertainty, firms undertake a series of measures that ultimately allow them to be in a position which at best can be described as less competitive than that described by the Walrasian model.

It appears that the conventional theory has overlooked an important insight that lies behind the reason for competition, which is that every businessman, like all other human beings, likes to have stability and security.[34] Thus the maximizing profit goal, which is a highly unstable state, vigorously pursued by business people, may be largely to achieve a position where other competitors cannot threaten them. From the above it follows that even if we assume that the market starts with perfect competition, it will always move towards oligopolistic competition.

## Conclusion

Neo-classical economists address the issue of uncertainty within the framework of asymmetric information, which means information gap. There is no doubt that the information gap constitutes uncertainty, but not all forms of information gap constitute uncertainty. The gap usually implies discontinuity in information but discontinuity alone does not constitute uncertainty. For certain gaps it is perfectly possible to formulate a probabilistic pattern from the existing information, while in other cases it is not possible. For example, with a conflict of interest or in situations involving competition, if we can rank the rival's attainable gains from a set of strategies, in a given position, it is then possible to formulate an optimal choice of strategy that the rival is likely to deploy. Thus even if the rival does not reveal his true intention or information it is still possible to formulate his probabilistic pattern of behaviour, provided we know his position and if we can rank ordinally all his possible gains. This is possible with the use of game theory. However, as shown, in the real world the gains are not easy to define from one piece of information, ie from the pecuniary position. One needs to examine whether from the pecuniary position there exists any real opportunity to make a gain, and whether a person is capable of utilizing such an opportunity. This problem is further complicated by the fact that our concept of gain is intertwined with our objective function and our set of values. As these latter two factors to some extent are independent of the pecuniary position, therefore, it is

not possible to formulate any probabilistic pattern of behaviour from the pecuniary position alone. Therefore, even if we know the position, in the presence of an information gap it is not possible to transfer the problem of uncertainty within the framework of risk analysis. The problem of uncertainty mainly arises due to the fact that we lack information about the variables that affect our macro economy or aggregate demand, as we do not have information in relation to how these variables are likely to affect the outcome of our current decision even if we have information from the past. Secondly, from the individual businessman's point of view, as every individual undertakes a series of precautionary and positive measures against the possible fluctuation in the aggregate demand, no one can predict how these measures are likely to affect each other in advance. Thus even if we formulate subjective probability on the basis of past information, the value and distribution of this probabiility are likely to deviate during the life of the business, even if we assume no change has taken place in our macro economic variables. Consequently the outcome that has been predicted from the subjective probability is likely to deviate. In other words, we cannot randomize businessmen's outcome. Thus uncertainty not only arises because we cannot predict the future movements of the macro economic variables, but also we cannot predict their likely impact on the demand for the product at the disaggregate level. This problem is further complicated by the fact that as businessmen take a series of measure during the course of their business life in an attempt to protect themselves against these uncertain incidences, this does not permit us to randomize the businessmen's probabillity.

The interesting conclusion that appears from this analysis is that the results that we normally derive by assuming a perfectly competitive market, are unlikely to hold once we assume firms operate in the presence of uncertainty.

## NOTES

[1] I would like to thank M. Hughes for her helpful suggestions and comments.

[2] As Milgrom and Roberts (1987, p.184) wrote, 'The existence of this private information can obviously lead to interesting strategic play: bluffing, signaling, reputation building etc. It is also the reason why poker is of enduring popularity.'

[3] For example, Philps (1988, p.4) wrote that; 'But the former [i.e. incomplete information] focuses on its implications for the decision making of an individual consumer or firm. It may go further and derive consequences for the market as a whole, but always under the assumption that uncertainty is the same for all market participants. It is natural therefore for theories of insurance decisions or investment decisions to postulate competitive markets in which there is no strategic interplay between agents. On the contrary, when the focus is on informational asymmetries, then strategic interplay becomes essential and the application naturally concerns markets characterized by monopolistic competition or oligopoly.'

[4] See also Harshanyi (1967-68,1973).

[5] Logic can handle a very restrictive class of concepts, to which Georgescu- Roegen (1971, p.14) refers as *arithmomorphic* for the reason that, 'every one of them is as discretely distinct as a single number in relation to the infinity of all others.'

[6] Even with such assumption we cannot eliminate the possibility of multiple equilibria. As Hahn (1990a, p.3) wrote, '....game theory too has had the difficulty of finding far too many equilibria....It is already clear not only that, until some progress is made here, the project of constructing a theory of the economy with strategically acting agents cannot proceed with any confidence, but also that some very 'deep' issues are involved. Thus, Brandenburger and Dekel's account of 'common knowledge' and his proposal for an 'equilibrium of beliefs'....not only confirm that there may be too many equilibria but also highlight the unsatisfactory nature of a basic hypothesis that game theory, and economic theory generally, share.' See also Phlips (1988), Hahn (1990b), Heal (1977), Kim (1985) and Brandenburger and Dekel (1990).

[7] One way to look at the problem is from the point of view of Hawking (1994, p.121), who wrote, 'The human brain contains about or a hundred million billion billion particles. This is far too many for us ever to be able to solve the equations and predict how the brain would behave, given its initial state and the nerve data coming into it. In fact, of course, we cannot even measure what the initial state was, because to do so we would have to take the brain apart. Even if we were prepared to do that, there would just be too many particles to record. Also, the brain is probably very sensitive to the initial state - a small change in the initial state can make a very large difference to subsequent behaviour. So although we know the fundamental equations that govern the brain, we are quite unable to use them to predict human behaviour.'

[8] It is interesting to note that game theorists argue that it makes no difference to the analysis how the position is defined. This is because they refer to the choices that are presented in their payoff matrix, as positions. Alternatively, the likely or future positions can be achieved from the strategies and counter strategies but no comparison is possible as to whether these likely positions are an improvement from the initial state or not. [see Boulding (1962,pp.41-42)]. But the problem is that one cannot formulate an agent's payoff matrix or likely position without knowing his initial position. In the case of the 'Prisoner's dilemma', the construction of a matrix in relation to the payoff is not a difficult proposition, although we really do not know whether prisoners face any such dilemma. However, as a prisoner's position and goals are both known, therefore it is not difficult to predict how he is likely to behave. But in many situations it is extremely difficult to define the person's or agent's concerns, initial state or position.

[9] Note that most of the analysis of the game theory is carried out independent of time. As Sen (1975, p.58) pointed out in a different context that, '...the people in question may not think of the possibility of employment in terms of a given probability of getting a job *independent of time*, but in terms of a period of *waiting* after which they can expect to get employed.....On this interpretation, the way to bring the excess labour supply situation into the individual's rational calculations is through a discounting of future higher incomes and not through a probability weight independent of time.'

[10] It is important to note that the analysis of uncertainty here follows from Heisenberg's 'uncertainty principle'. Although the use of this principle remain quite novel in the economic literature, there are economists like Boulding (1962), Chakravarty (1989) and Georgescu-Roegen (1971) who have recognized the importance of this principle in the context of economic analysis. For example as Boulding (1962, p.291) wrote, '....predictions about society or social organizations are constantly being upset by the fact that the dynamic course of society is in part dependent on human decisions, and the

decision-making process of the human organism is so complex that it can be predicted only within fairly wide limits. The stochastic element in models of the social system may also derive from a true Heisenberg principle that the attempt to extract information about the system in itself changes the system.' However, this principle should be applied with one note of cautions, as Hawking (1994, pp.120-21) wrote, 'The human brain, however, is also subject to the uncertainty principle. Thus, there is an element of the randomness associated with quantum mechanics in human behaviour. But the energies involved in the brain are low, so quantum-mechanical uncertainty is only a small effect. The real reason why we cannot predict human behaviour is that it is just too difficult.' For further analysis of the particular quote see footnote 5.

[11] See Boumal (1966) for further details.

[12] See also Jensen and Meckling (1976), who also make a similar assumption for an analysis of the behaviour of a board of directors.

[13] One of the prime examples of this kind of behaviour can be observed in the case of Australian farmers. By the mid-1980s it was more or less clear for various reasons that farming as an occupation has a bleak future in Australia. However, the majority of farmers did not sell their property nor invest in the money market nor in the government bonds that would have earned a higher income than the income they were deriving from their current occupation. In fact, despite severe draught in the last few years, while many are living below the poverty line, they are still trying to hold on to land, because farming is what they know best. Furthermore, most practical men know that there is no royal road to knowledge, as acquiring new skills or knowledge often takes a long time, where the return from such skills may not compensate the loss of income that has accrued during this transitional stage. Similar examples can be found in many other trades. From the above it follows that limitations on the selection of a project also remain, due to unfamiliarity with other available projects.

[14] We are referring to cases where interaction in general is confined to that between sellers and buyers or lenders and borrowers or share holders and directors.

[15] It is important to note that game theory has ignored this important variable i.e. our own set of values, and therefore it is no wonder that Simon who participated in game theory while he was in RAND, in an interview with Leonard (1994, p.501) said 'That was a vicious game. By the end of an evening you felt really mean about the whole human species'.

[16] As Einstein once wrote (1954, p.226) that there is no logical path through which we can reach those universal elementary laws; 'only intuition, resting on sympathetic understanding of experienc, can reach them.' Planck (1950), Bohr (Pais, 1991) and Heisenberg (1958) to name a few all held a similar view. This may be for two reasons: (a) on the one hand, valid logical argument says nothing about whether the proposition is true or false. For example,

All fish are mammals
All mammals have wings
Therefore all fish have wings.

The above argument is valid because if its premises were true its conclusion would have to be true also, even though in fact they are all false. (see Copi 1966). This may have caused Einstein to write (1954, p.271) 'propositions arrived by purely logical means are completely empty as regards reality.' (b) On the other hand, the structure of logic is so rigid that itself often limits its own use for analytical purposes. In esence as Wittgenstein wrote (1953, p.), '...Logic, presents an order, in fact the a priori order of the world: that is, the order of possibilities, which must be common to both world and thought. But this order, it

seems, must be utterly simple. It is prior to all experience, must run through all experience; no empirical cloudiness or uncertainty can be allowed to affect it-It must rather be of the purest crystal.' In reality, as shown above, most of our decisions have to be taken from the mist of this cloudiness. Consequently, as Georgescu-Roegen (1971,p.80) points out that at least three Nobel laureates namely Bridgeman, Schrodinger and Heisenberg all have cautioned us that, '...it is the arithmomorphic concept (indirectly, Logic and mathematics), not our knowledge of natural phenomena, that is deficient. Wittgenstein's (1953, p.) described it as, '...the bewitchment of our understanding by means of our language.' We also know Bohr spent much of his later life on the ambiguity of language (see Pais, 1991).

[17] See Sen (1982) for his explanation of the concept of entitlement and capability.

[18] As Einstein once said to the famous Indian poet Tagore, '...the red flower I see before me on your table may not be same to you and me.' (Pais 1994, p.107).

[19] Similarly Boulding (1962, p.57) also pointed out that, 'In the general situation of decision making under uncertainty, we not only face uncertainty as to the strategies of the opponent, whether that opponent be another person or organization or merely nature, but we face great uncertainty as to the payoff themselves. Any decision, of course, involves some image of alternative payoffs; how our image of the payoffs is affected by our previous experience is a crucial factor on which the theory of games throws but little light. The payoff matrix is a useful analytical device and, frequently, can be used to clarify a conflict situation; the notion of minimax as an equilibrium of mutual choice is important, especially as this does not involve any assumptions about behaviour beyond a certain shortsightedness in maximization. The real world, however, is much more complicated (or may be even in some respects simpler) than the Hobbesian universe of the game theorist. For a true understanding of conflict, we also have to examine love, affection, empathy, and community of feeling. These are concepts alien to the theory of games.' Of course, in reality the payoff matrix will be based as much on guess work as will be my conclusion regarding what my rival is likely to do.

[20] That is from the position we cannot calculate the momenta and vice versa. (See Heisenberg 1930).

[21] In game theory we do not have such a problem since the game is formulated independent of space and time.

[22] It is important to note that my notion of uncertainty should not be confused with Makowski's (1990) definition of uncertainty where he thinks uncertainty= risk+the possibility of learning and this is formulated within the Baysian framework. Furthermore he thinks of uncertainty in terms of bad times. Uncertainty has neither bad nor good times as it applies in either condition. Uncertainty cannot be divided between risk and a learning risk factor which itself changes during the passage of time.

[23] Both are particularly important for our present economic system. For example, during the depression, investment from the individual capitalist point of view would be folly. Yet if all capitalists invest, more would survive. Similarly, given individualized property, the ability to turn to the community for assistance is lost (as compared to tribal society). Hence uncertinty—in a sense, an historic constant—now becomes a problem for the individual capitalist.

[24] If we assume perfect foresight or assume the information in relation to the direction of all consumers' private preferences is common knowledge then of course we would not have any such problem. However this would be an extreme assumption to make in order to save the theory.

[25] In fact, where the preferential differences are marginal, changes in price can alter our order of preferences.

[26] The above argument suggests that it is not that we only observe sticky price in the case of oligopolistic competition as originally argued by Sweezy (1939) and subsequently by Sylos-Labini (1962), but that in fact their argument applies to all forms of competition.

[27] For a more detailed discussion in relation to why we cannot formulate a mathematical expectation see Basu (1994a and 1994b).

[28] A businessman will always ensure that the value of Z remains fairly low so that price does not rise sufficiently to adversely affect his own demand.

[29] See Labini (1985) and Kalecki (1939) for further analysis of the above problem.

[30] Note that according to traditional theory, the marginal cost is U-shaped in the long period. That is, marginal cost falls up to a certain point due to economies of scale, and thereafter it increases due to the growing difficulties of organization and administration for a steadily growing firm. In other words, the firm faces diseconomies of scale. Against this claim Sylos-Labini ( 1962, p.29 ) wrote that," There can be no doubt that, at least up to a point, technically conditioned economies of scale do operate; on the otherhand, it is far less certain that organisational and administrative difficulties necessarily cause the curve to rise again. One can think of many organizational devices which have in fact been applied to remedy these difficulties or, at any rate, to prevent them from growing more than proportionately with the size of the firm.'

[31] For example, in 1882, John D. Rockefeller's Standard Oil Company, which was a loose federation of forty companies formed the Standard Oil trust, through inter change of stock and other finnancial devices. The trust was not formed in order to control the industry's output, since the loose federation at that time controlled 90 percent of the industry (Kerosene) output. But the trust provided the legal instrument to rationalize the industry and to exploit the economies of scale. The company closed a few refineries, reshaped some and built new ones. Furthermore, the company re-organized the co-ordination of the flow of materials, not only through refineries, but also from the oil fields to the refineries and from the refineries to consumers. As a result of these improvements, the cost of production fell from 1.5 cents to 0.54 cents per gallon, while profit rose from 0.53 to 1.003 per gallon between 1882 and 1885. This gave them a competitive advantage against their competitors whose costs remained relatively high. The company increased its output from between 1,500 and 2000 barrels to between 5000 and 6,500 barrels which was necessary to maintain ths cost advantage. See Chandler (1984) for further details and he has provided many such examples. In 1921, Ford reorganized his factory floor, and succeeded in reducing the number of workers employed for every car built from 16 to 9. Against these observations Robinson once wrote (1931, p.3), '... the leisure is given not to those who wish to enjoy it, but to those who would prefer to be occupied.'

[32] Diversification was initially concentrated in those industries which use the most sophisticated scientific techniques, particularly those developed by modern chemistry and physics. Furthermore, the development of dissimilar products was based on similar technology and production process. This, in turn, as Chandler (1969, p.274) wrote, gave them, '... a greater opportunity to develop new products and processes than had other firms, but in addition, their size and technological and managerial know-how continue to protect them from new competitors in their basic fields.' For example, producers of

aluminum and copper started to produce items like kitchen-ware and household fittings. Food companies used their existing distribution organizations to matket an increasing variety of products etc.

[33] An example may suffice to illustrate our case: in 1973 when the oil crisis led to a rise in the price of oil, in the United States effective demand for larger vehicles declined, while effective demand for smaller Japanese vehicles increased

[34] For example, Stigler (1971) noted that lawyers, physicians, pharmacists, nurses, all belong to large occupations, where incomes are high, and the longer the members are in the occupation, the greater their financial gain, and the greater their urge to control the industry by introducing licensing arrangements. In the absence of such an arrangement, competitive forces would have driven down their higher earning capacity.

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