CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

A plethora of scholarship focuses on high prescription drug prices. The vast majority of this work examines the actions of the pharmaceutical companies that influence pricing. Chief among these disputed actions are marketing practices utilized by the pharmaceutical industry to sell its products, not only to the public, but also to physicians and other medical professionals with the ability to prescribe medications. This chapter will review research into the high prices of pharmaceuticals. Most of the work focuses on the manufacturers rather than the entire industry, although some does look at the wholesale sector. No research to date has examined the retail sector of the pharmaceutical industry as a possible source of high drug prices, even though some have included it as a part of the puzzle when examining the industry as a whole.

Several examinations in the last 15 years have examined how pharmaceutical prices are determined. William S. Comanor and Stuart O Schweitzer examined how pharmaceuticals are bought and sold, and described some of the links in the pharmaceutical industry chain. Included was a look at pharmaceutical price data and what influences the prices of prescription drugs, such as large buyers like health maintenance organizations (HMOs) that routinely receive large discounts from manufacturers. Comanor and Scheweitzer point out that since this information is rarely disclosed to the public, many discussions of influences on prescription prices
simply leave out these discounts and rebates, which therefore lead to reporting higher prices.

These manufacturer discounts and rebates to large buyers were the subject of an earlier study, which sought to determine if the discounts had adverse effects on buyers who do not get the same discounts. Kenneth G. Elzinga and David E. Mills found that while consumers outside of hospitals and managed care companies did not receive discounts, neither did they suffer a loss. The prices they paid were not affected by the discounts received by the large buyers.

Researchers also have found that prescription drug prices vary greatly from store to store, sometimes even within the same town. Alan T. Sorenson examined pharmacy prices from upstate New York and found that prices varied by as much as 50% from store to store, with no obvious explanation for the differences. He did find, however, that consumers are more likely to price shop for drugs that they need to take on a regular basis, causing the price variation on those to be lower than on drugs only taken occasionally.

The U.S. Government Accountability Office (GAO) also examined the rising prices for prescription drugs, but as with the Senate hearing on forces behind rising costs, it chiefly focused on retail pricing trends. These are known as "usual and customary" prices, the prices that someone without health insurance or access to another third-party payer would pay. In the report, researchers focused on 99 drugs used primarily by both Medicare enrollees and non-Medicare enrollees with health insurance.

Both the Senate and the GAO have reported on the differences in the prices of drugs in Canada compared with those in the United States. A Senate hearing in 2001 discussed proposed legislation introduced by Senators Byron L. Dorgan (D-ND), John McCain (R-AZ), and Charles Schumer (D-NY) to "allow pharmacists and licensed distributors to go to other countries and access a lower price prescription drug, the identical drug, the same pill put in the same bottle, produced in the same FDA-
inspected plant, bring it back to this country and pass the savings along to the consumers." The research presented simply examined on the difference in retail prices but did not discuss wholesale prices. Nor did it consider the possibility of imitating some of Canada's existing price controls in order to control the inflation of U.S. drug prices, choosing to focus instead on opening up competition to encourage the U.S. pharmaceutical industry to lower prices. This bill died when the session ended. Dorgan reintroduced similar legislation, S. 242, also called The Pharmaceutical Market Access and Drug Safety Act, on January 10th, 2007, which not only would have allowed pharmacists to access cheaper prescriptions in other countries but also called for the inspection of foreign drug manufacturing facilities as well as the use of anti-counterfeiting technology. This bill never made it out of legislative hearings. A similar bill, with the same title, was introduced on March 4, 2009 in both the House and the Senate, and was referred to committee, where it died when the session ended.

A GAO report on this same topic is useful because it compares prices and price containment strategies in both the United States and other countries. This report provides several possible forms of price containment, such as price ceilings and profit limits, which the United States might consider should a large disparity be found between average wholesale prices of drugs and retail prices of drugs.

In 2007, the Senate Special Committee on Aging looked at the previously mentioned issue of gifts to physicians and the effect those gifts have on the prices of prescription drugs. The committee heard testimony that suggested that these gifts were compromising doctors' medical judgment “by putting their financial interest ahead of the welfare of their patients.” This hearing was the precursor to a House bill, H.R. 5605, also known as the Physician’s Payments Sunshine Act of 2008, which sought to make disclosure of gifts worth more than $100 mandatory. This bill never made it past the committee before the Congressional session ended.

It is interesting to note that the 2010 healthcare legislation did not directly address prescription drug issues. The statute does, however, mandate insurance
coverage for all U.S. citizens, beginning in 2014, which will ease some of the strain of prescription drug costs on the consumer, but does not address the underlying problem.

As is evident from the scholarship this chapter has examined, the pharmaceutical industry has received a great deal of scrutiny, with much of the focus on manufacturers. What is absent in the core of the research is any systematic examination of wholesalers or retailers; this study sought to fill that gap in order to judge whether further research, particularly on retailers, is warranted. Economic theories, including those of Adam Smith and John Maynard Keynes, might offer some insight into why the remainder of the industry has remained largely untouched when it comes to the search for the source of high pharmaceutical prices. One of the challenges of having little prior research regarding wholesaling and retailing in the pharmaceutical industry is formulating an appropriate research design.

2.2 RELATED WORKS

Chaiyot Hemaratchata studied the medicine patent by analysis of expected result of The Legislation Council is through the Scope of Revised Patent Act of 1999 on 27 February, 2003 about extension of patent to medicine product as (Chaiyot Hemaratchata, 2003):

The effect of industrial and investment: The revision of patent law for protecting in medicine product caused to the change of structure and domestic medicine industry development that as : The Thais manufacturer is decreased; Co-investment between Thais and foreigner will increase; Having more investment of manufacture that is investment of increasing production and extending the marketing that caused the benefit to aboard patent owner.

The effect of economics: Chaiyot Hemaratchata divided to consider in the effect of economics caused by the medicine protecting patent such as:
The effect of medicine price: The price of new medicine that are protected by the patent, the medicine into the order will high because of the manufacturer who can use the right of patent law for limiting the number of production and determining of the price of medicine and the requestor from the patent will take the royalty included with the cost of production that caused to high.

Most of the price of medicine that are not protected into the patent is basic medicine into the account and no effect but there are a lot of medicines that are protected by the patent and basic medicine is decreased and affect to a higher price of medicine.

The price of medicine that protect into the medicine patent during first five years that it is not a change but after it is high because there are many protected medicine. Because of the Thais, no manufacturers have to pay the money for the right of royalty for making the medicine to the patent owner. The foreign company that caused Thailand to lose foreign money and the medicine has the protection that no sell in Thailand, Thailand will lose the money for purchasing this medicine.

The effect of using public budget: Because Thailand has a small income population and cannot help in the health sector; the government has to help by establishing the project that allocating the budgets for caring the health of them by determining the list of medicine that most of basic medicine, which the protection of patent is expired. But some are given the patent that affect to the budget of expense. If the price of protected medicine is increased, the government has to allocate the budget of health a lot. The effect of employment the protection of medicine patent caused to the small company that is closed and reduced the labour, so the labor has to suffer the problem of unemployment.

The effect of consumer expense: When the price of medicine is high and protecting of patent to the medicine and affect to the consumers as when the consumers have to pay or expense of purchasing is increased.
Magazzini, Pammolli and Riccaboni (2004) attempt to set up a model of generic competition and prices, considering the role that some fundamental properties of the markets (e.g., their relative size and growth) have in shaping the dynamics of market structure following patent expiration in four major developed countries (USA, UK, Germany, and France). The history of the national regulatory systems of these countries is characterized by a set of highly differentiated trajectories and patterns that have led to hugely diversified healthcare and pharmaceutical systems, in particular in terms of the extent and regimes of regulation. Evaluation of the efficiency of different forms of government intervention is both theoretically and empirically complex and is further complicated by the fact that regulation takes very different forms across countries and over time. This situation has constantly led to controversies, and sometimes to bitter confrontation. The focal issues in the debate are clearly patent protection and price regulation, two issues that are deeply intertwined. On the one hand, it is widely recognized that patents have an important role as an incentive to innovation in pharmaceuticals. On the other hand, the monopoly power conferred to patent holders should be countervailed by limiting the opportunity to raise prices in a market characterized by informational asymmetries and low-demand price elasticity. However, price regulation is vigorously opposed by the industry and by many economists. First, it is argued that the industry is extremely competitive, even in specific sub-markets. Second, it is maintained that price regulation distorts the price mechanisms, curbs the profits of companies and hence the incentives to innovation and in general creates environments where competition is too lenient. Recently, policies have moved toward the use of less invasive regulation and a higher reliance on more market-friendly measures. Prominent among these is the support for the introduction and diffusion of generics after patent expiration.

Jonsson (2001) argues that pricing is a crucial part of the success of any product, but is particularly important in the pharmaceutical industry. Price setting for drugs is increasingly dependent on economic factors (cost-effectiveness) and cost containment policies, and drug companies need to address such issues when
deciding on a pricing strategy for a product across the globe, throughout various stages of its patent life, and across different formulations, strengths, and pack sizes. Of the two available pricing options for different dose strengths, the offering of a single price, or flat price, has many advantages over the monotonic pricing strategy. Theoretically, the flat price is appealing from a social perspective, since in most case production costs are independent of the strength prescribed. The major role of price is not to ration the scarce availability of "substance" but to recoup fixed cost for discovery and drug development. From a cost effectiveness perspective, flat pricing also seems rational, since in many cases the physician aims for the lowest dose for a given effect. The dose is increased when the treatment fails to achieve the target. However, there are also benefits to patients. They can receive the dose that they need without incurring a penalty for higher doses. Healthcare providers can feel confident that their patients will be optimally treated; since there are no economic incentives to choose one dose over another for the prescriber. For third-party payers, the additional benefit is that they can easily predict the total expenditures based on epidemiological data about the patient population and defined indications.

Lanjouw (1998) had analyzed how the introduction of product patents for pharmaceuticals may benefit or adversely affect India. Her analysis is based on information obtained over a period of six months, from September 1996 to March 1997. The primary data was collected by taking interviews with a wide range of people in the Pharmaceutical industry. Although the paper does not arrive at a conclusive answer to whether the introduction of pharmaceutical product patents in India will bring about heartless exploitation of the poor and suffering, still it does provide some suggestions about the way events might unfold as the policy is implemented.

Sampath (2005) in her research paper analyzes her survey of 103 Indian pharmaceutical firms. The scope of her study was limited to analyzing emerging firm strategies of Indian firms as a response to a gradual transition to product patent protection. The study has categorized firms in the Indian Pharma Industry into 3 main groups based on empirical data collected and identified the main strategies and
their triggers in each one of the 3 firm groups. The survey found that Indian firms are adapting a combination of cooperative and competitive strategies, in order to adapt as well as capitalize on opportunities created by the new patent regime. The Indian domestic pharma companies have faced the international competition and although product patent has thrown up lot of opportunities, still consolidation will happen in the industry in coming years. The study also found a high correlation between export intensity and R&D investments in the Indian Pharma sector. Firms that had greater revenues from exports were able to invest a larger amount on R&D.

Some other studies have examined various aspects of the WTO product patent and its impact on the Indian Pharmaceutical industry using different methodological techniques, in order to predict the impact of product patent protection on the Indian pharmaceutical industry. These studies are by Fink (2000), Chaudhuri, Goldberg & Jia(2004), Watal (2000) Fink (2000) in his research paper has examined the impact of patent protection on the behaviour of pharmaceutical TNC’s and market structure in India. The research study simulates the effects of introducing patent protection for pharmaceutical products on market structure and static consumer welfare. The simulations reveal to what extent price increase, profits and static welfare losses depend on the values of assumed elasticities. The study reveals that if future drug discoveries are mainly new varieties of already existing therapeutic treatments, the impact is likely to be relatively small. If newly discovered drugs are medicinal breakthroughs, however, prices may be significantly above competitive levels and static welfare losses relatively large.

Chaudhuri, Goldberg and Jia (2004) use detailed product-level data sets from India to conduct a case study of Quinolones in India, to show the potential adverse welfare effects of the TRIPS Agreement on the Indian industry. They estimate that “in the absence of any price regulation or compulsory licensing, the total welfare losses to the Indian economy from the withdrawal of the four domestic product groups in the fluoroquinolone sub-segment would be on the order of US$ 713 million, or about 118% of the entire systemic anti-bacterials segment in 2000”.

41
Watal (2000) has examined the effect of the introduction of pharmaceutical patents on prices and welfare losses in India. The paper also points out that there are several measures available for reducing welfare losses available for reducing welfare losses permissible under TRIPS. The studies which have focused specifically on the change in strategies of Indian pharmaceutical companies are Madanmohan, Rishikesh (2003), Chittor, Ray (2003), Sampath (2005), Sampath (2006), Singh, Surendar (2003), Singh, Surendar (2003), Agrawal, Thakkar (1997), Saranga, Phani (2003), Dey (2006) and Nair (2007)).

Madanmohan, Rishikesh (2003) have dwelt upon the adaptive strategies in the Indian pharmaceutical industry. They have analyzed several adaptive strategies to be used by the Indian pharmaceutical companies to cope up with the WTO product patent law. They have also analyzed the factors driving the movement towards consolidation and augmentation in the sector.

Chittor, Ray (2003) researched on the internationalization paths of emerging economy firms through a strategic group analysis of internationalizing firms in the Indian pharma industry. This study analyzed proprietary data set of strategic variables from forty firms and the analysis revealed significant variation in their internationalization strategies.

Sampath (2006) in her research paper talks about her survey of 103 Indian pharmaceutical firms. The scope of her study was limited to analyzing emerging firm strategies of Indian firms as a response to a gradual transition to product patent protection. The study has categorized firms in the Indian Pharma Industry into 3 main groups based on empirical data collected and identified the main strategies and their triggers in each one of the 3 firm groups. The survey found that Indian firms are adapting a combination of cooperative and competitive strategies, in order to adapt as well as capitalize on opportunities created by the new patent regime. The Indian domestic pharma companies have faced the international competition and although product patent has thrown up lot of opportunities, still consolidation will happen in
the industry in coming years. The study also found a high correlation between export intensity and R&D investments in the Indian Pharma sector.

Firms that had greater revenues from exports were able to invest a larger amount on R&D. Singh, Surendar (2003) in their article have focused upon the strategies used by small and medium scale pharma companies to meet the challenges of the patent regime. The larger companies like Ranbaxy and Cipla etc. were preparing for the new patent regime since 1995 onwards, however the small and medium scale pharma companies did not make much of an effort and now realizing that their toplines and bottomlines are going to be impacted because of product patent they have devised few strategies: Toll Manufacturing, Bottom fishing, In-licensing, Niche plays and contract manufacturing. The article is based on interviews with top executives of small and medium Pharma companies who have implemented with success the above mentioned strategies.

Agrawal, Thakkar (1997) have examined the strategies adopted by different companies to survive the phase of patent expiration. The authors suggest that companies should not increase the prices when the patent is about to expire, rather if the marketing strategies are well planned the costs involved in product development can be recovered even after the expiry of the patent. Companies need to have a combination of product modification, promotional and pricing strategies to save a company from losing market share on a patent expired product.

Saranga, Phani (2003) have found out that there is evidence that there appears to be a direct relationship between internal efficiencies and higher growth. They have concluded that irrespective of the growth strategies adopted by the individual firms, internal efficiencies will have a higher probability of survival and growth. Thus the internal efficiencies would help firms in the Indian Pharma Industry to overcome any new challenges arising out of the change in patent process from the year 2005.
Dey (2006) has explored the strategies adopted by global pharma majors in
India in view of the product patent in India. Among the various vigorously being
pursued by MNC pharma companies are accelerating patented product launches,
Mergers & acquisitions, reducing R&D expenditure by outsourcing clinical trials,
sourcing their manufacturing requirements for API from independent manufacturers
in India. However MNC’s in India are faced with host of problems like price control,
competition from big domestic Indian Pharma companies and data Exclusivity. The
author concludes that MNC’s should go in for innovation, thereby slowly developing
newer molecules and at the same time becoming price sensitive.

Nair (2007) has stressed upon the fact that if visionary strategies are adopted
by Indian pharma companies then the future will be bright for these companies.
Strategies such as Drug Discovery, Para IV filings, focus on production of high
quantum and moderately priced generics, strengthening API/drug intermediates
production, outsourcing to MNC’s upgrading manufacturing facilities to USFDA
standards and investing in Pharma support services such as analytical services,
diagnostic services, data management services and clinical research operations will
prove worthwhile in the long run and help India to move up to the top of the global
Pharma Industry.

The present study is however an empirical research study. The data used in
this research paper was collected in a firm-level Survey of 62 Indian Pharmaceutical
companies between June 2006 & July 2007 to find out impact of Product patent on
Indian Pharmaceutical Industry and to study the change in marketing strategies of
Indian Pharmaceutical companies.

2.3 ECONOMICS OF PRICING

Although this research examines the cost of pharmaceuticals as a political
issue, it would be a mistake to completely ignore the economic aspect. Demand is
perhaps the most important factor influencing retail prices. Demand, however, is
less important for prescription drugs, since health care providers influence how much and how often a drug is prescribed. In microeconomic theory, demand is primarily a function of price and is "considered a list of prices and quantities, with one quantity for each possible price." According to George Stigler in *The Theory of Price*, there is one basic rule of demand: "people will not buy less, and usually buy more, of a commodity when its price falls." This expectation is represented by the demand curve, which always has a negative slope, since the higher the price rises, the less consumers will buy of a certain item. This inverse relationship is also known as the "law of demand." Since factors other than the price of an item influence a purchasing decision, three factors must be held constant when determining demand: the prices of other commodities, the money income of the consumer, and the preferences of the consumer.

An important feature of the theory of demand is the concept of elasticity. According to Milton Friedman in *Price Theory*, elasticity of demand is the "ratio of the percentage change in quantity demanded to the percentage change in price that is responsible for this change in quantity demanded when 'other things' are given and when the change in price approaches zero." This is important because it "provides a very convenient method of indicating the behaviour of total receipts," or sales. Elasticity depends on two factors: changes in price and quantity, which "must have opposite effects in total receipts." Demand is said to be elastic when the percent change in price is smaller than the change in quantity. This has the effect of causing demand to move in the opposite manner from price; for example, when the price of a service or good goes up, demand for the service or good goes down. On the other hand, demand is said to be inelastic when the change in price is larger than the change in quantity demanded, causing sales to move in tandem with price. When demand is elastic, if the price drops, so will demand; if inelastic, demand stays relatively stable no matter what the price does (e.g., demand for milk).

As mentioned earlier, when applied to a typical retail outlet, demand works as the primary influence on prices. When it is applied to a pharmacy, however, a problem is encountered. In a normal retail setting, a consumer will enter the
establishment and purchase his or her desired goods with few restrictions. In order to purchase a prescription drug at a pharmacy, however, that same customer needs a prescription from a doctor or other licensed medical practitioner. Thus, health care providers influence, and some would say manufacture, much of the demand in pharmacies. Not only do they control the initial purchase, but they in some instances, the proprietor of a store can reserve the right to limit the amount of a particular product that a customer is able to purchase. This often happens, for instance, during a sale in which the price of an item has been drastically reduced, and the proprietor wishes to prevent one or two customers from buying all of the stock at once.

Doctors cannot control all of the demand for various reasons, the primary one being that pharmacies do not exclusively sell prescriptions drugs. Also, the patient may choose not to fill prescriptions, also regulate how much and how often a patient can purchase a drug before having to obtain a new prescription. Because of this extra dimension to demand, it is important to examine retail pharmacies' prices, since consumers do not solely influence demand and therefore price.

Economics and politics often intertwine, and nowhere is this more evident than in the works of such pivotal economists as Adam Smith and John Maynard Keynes, two men on opposite sides of the political-economic spectrum. Smith was the originator of the concept of *laissez-faire*, which many credit as the root of capitalism, while Keynes advocated interventionist policy on the part of the government when it came to the operation of markets.

Adam Smith’s idea of *laissez-faire* was first conceived with the idea of the Invisible Hand in *The Theory of Moral Sentiments*, and later expanded upon in *The Wealth of Nations*. This “invisible hand” was said to guide a person to “promote the public interest,” whether or not s/he knows that s/he is doing so. According to Smith, an individual only “intends his own gain, and he is in this, as in many other cases, led by an invisible hand to promote an end which was no part of his intention.” This invisible hand, though not explicitly mentioned, is thought to
play a role in Smith’s theory of *laissez-faire*, in which the state steps back and lets the market regulate itself. Although Smith focused primarily on international free trade, he emphasized the importance of internal free trade. Utilizing the corn trade in Great Britain as an example of the dangers of government intervention, Smith stated:

“When the government, in order to remedy the inconveniences of a dearth, orders all the dealers to sell their corn at what it supposes a reasonable price, it either hinders them from bringing it to market, which may sometimes produce a famine even in the beginning of the season; or if they bring it thither, it enables the people, and thereby encourages them to consume it so fast as must necessarily produce a famine before the end of the season. The unlimited, unrestrained freedom of the corn trade, as it is the only effectual preventative of the miseries of a famine, so it is the best palliative of the inconveniences of a dearth; for the inconveniences of a real scarcity cannot be remedied, they can only be palliated. No trade deserves more the full protection of the law, and no trade requires it so much, because no trade is so much exposed to popular odium.”

John Maynard Keynes, however, believed that letting the market work on its own would promote success and maintain a balance for only so long. During times of economic hardship, the system of free trade actually would work against balance, and thus the government’s intervention would be needed to correct the market. To Keynes, the problem that upset the balance of the economy, and produced unemployment in particular, was savings, and he noted that as income increases, so too does a person’s saving habits. Savings were only useful if they were to be invested by businesses, not stored in bank accounts; thus in his view the only useful method to turn around a recession was to spend money. He thought that if the government increased spending, it would increase consumers’ demand for goods and services, such as occurred during the Great Depression of the 1930s, with one major difference.

Keynes advocated any spending, including wasteful spending, to stimulate a depressed economy: “Pyramid-building, earthquakes, even wars may serve to increase wealth,” though it “would, indeed, be more sensible to build houses and the like; but if there are political and practical difficulties in the way of this, the
above would be better than nothing.” The U.S. federal government’s primary policy regarding pharmaceuticals and pharmacies in general has been one based on *laissez-faire*: Congress has allowed the industry, particularly the retail sector, to regulate itself, with a few notable exceptions. Perhaps the most well known is the addition of Medicare Part-D in 2006, which offered government-sponsored drug coverage to citizens over the age of 65.

### 2.4 TOWARDS AN ANALYTICAL FRAMEWORK

As is evident from the discussion so far, there is a vast body of literature in both the developed countries and in India that empirically explore the Schumpeterian hypothesis. However, there is no consensus with regard to the results of the analysis. The diverging results could probably be explained by measurement problems associated with the concept of Pricing and market concentration on the one hand and empirical procedures used in the estimation. However, the studies, in both the developed and developing countries, consider only R&D expenditure, R&D employment or patents as a proxy for pricing.

The input measures of pricing (R&D employment and R&D expenditure) are also widely used in studies in the developed country context. Scientists and research support staff are at the core of the research organization and are directly involved in the conduct of research. In this case, time units spent on research must be identified, which is always difficult. Kuznets (1962) calls for a study of specialized human capabilities to measure the inventive capacity of personnel. Exact time units, mental effort and human ability measures are beyond the scope of economics (Rajeswari 1992). Thus, the measure of the research efforts of personnel fails to be a complete measure of its own. Research expenditure is the most important quantifiable measure of research effort that is used in empirical studies. It is a logical and direct measure, but can still be incomplete. Thus, the diverse and incomplete measurement of pricing could be one of the reasons for the observed variation of results in empirical studies.
The measurement of concentration is yet another problem faced by researchers. It is not possible for a single concentration measure to capture all components of market structure. The most commonly used index in the empirical studies in the developed and Indian context is the K-firm concentration index, defined as the cumulative share of the Kth firm. Its popularity is mainly due to easy availability of data and ease of computation. The choice of K is, of course, arbitrary. Conventionally in developed economies, K takes the value between 3 to 8. The problem with the measure is that it does not disclose any information on firms ranked after K. A more comprehensive measure of market concentration is the Hirschman-Herfindahl index. It is defined as the sum of the squared shares of ‘n’ firms; its advantage is that it takes into account the shares of all the firms in the market. At the same time, the squaring up of the values means that smaller firms contribute less than proportionately to the value of the index. This is a valid approach, as the entry of a number of small firms with minuscule market shares would hardly affect the market power of the top firms. But a prerequisite for this index is that information on the market shares of all firms be available, a fact which restricts its use.

A problem common to these two measures is that they are static in nature and do not capture movements in concentration levels, as top firms keep on changing their ranks over the years. This is an obvious defect as the intensity of competition depends largely on the ability of the top firms to maintain their position (Vijayabhaskar 1991). Still, most of the empirical studies have taken a four-firm concentration ratio or the Herfindahl index, as they are easy to compute and serve the purpose with little defects, which usually can be ignored. However, these incomplete measures of concentration could probably have resulted in the diverse results seen in the empirical studies attempting to verify the market concentration/innovative activity relationship.

Inter-industry specificities or technological opportunities can play a major role in determining the relationship between innovation and firm size, and innovation and market concentration. Very few studies in India recognize inter-
industry differences in the Indian context. Understanding the importance of inter-
industry differences in the sample, Kumar (1987) introduces industry dummies to
control for technological opportunity. The problem is that in addition to
technological opportunities, industry dummies also represent other characteristics
of the industry. Kumar and Saqib (1996) in analysing the probability and intensity of
firms that do R&D, also use industry dummies to counter inter-industry differences.
According to these authors, inter-industry differences in the opportunities for
product or process innovation play an important role for pricing.

The opportunities for adaptation vary across industries, depending on many
factors, including the maturity of technology, the gap between local and global
standards, the degree of monopolistic hold over technology, the nature of
intellectual property protection and the need for such adaptation arising from
different local conditions. Kumar and Saqib use a total of nine industry dummies to
capture inter-industry specificities for a sample of 291 manufacturing firms and find
that technological opportunity is very high in the chemicals and pharmaceuticals
industry. The best way to capture the inter-industry differences in the sample is to
test the hypothesis in different industries separately. Siddharthan (1988) attempts
this in four industries, apart from pooling the whole sample and testing the
hypothesis, indicating that inter-industry specificities are an important determinant
of research effort and should be included to obtain a reliable relationship between
market structure and innovative activity.

After a detailed critical survey of studies in India, Kathuria (1989: M120)
concludes: This strand of the technology literature of India, following in the mould of
its developed countries counterpart, suffers from the same limitations as the latter
but to an even greater degree, partly because of data limitations. In addition, most
of the earlier studies have used industry rather than firm-level data, which tends to
wash out the effect of firm-level variables such as size, technical capacity, age and so
on.
Goldar (1997) looks at the methodologies adopted in studies on innovative activity in the Indian context. He believes that most of the studies are cross-section analyses with problems of hetero-scedasticity. He suggests that the ordinary least squares method used in some of these studies is not a suitable method when variables such as export orientation are related to innovative activity because of the simultaneity problem between these variables. Goldar (1997: 95) observes that: It should be noted that in many firms the R&D ratio in the sample is negligible or zero. If such firms are included in the sample to estimate the regression equation, estimation problems will be caused by the fact that the dependent variable has a lower bound. If such firms are excluded, the results get affected due to the sample selection bias. An appropriate solution for tackling this problem is to use a tobit model, as has been done by Kumar and Saqib (1996).

As seen above, the studies in the Indian context tested the Schumpeterian hypothesis in the context of liberalization, using mostly a cross-section of firms or industries. The economic liberalization in India was characterized by rapid policy changes over the years. Thus, the cross-section studies undertaken in this context may not be sufficient to capture the actual market structure/innovative activity relationship. A longer period of analysis could have given better insights on the relationship between market structure and innovative activity.

The market structure/innovative activity relationship should be examined so that, apart from size and market concentration, technological opportunity and appropriability conditions are also considered. The study also should cover a longer period of analysis to account for dynamic policy changes resulting from liberalization.

2.5 **Empirical estimation**

The previous section highlighted the conceptual and methodological problems associated with the literature on market concentration, firm size and
pricing activity. The need to redefine the concept of pricing to capture the actual process taking place in such developing countries as India has to be underlined.

There is need to attach due importance to the technological opportunities of industries as well as the appropriability conditions. A longer period of analysis, based on firm-level data may be more appropriate, especially when the period of analysis is marked by flux in the policy environment. In addition to conceptual refinement and changes, there is scope for improvement in the method of estimation as well.

2.6 ISSUES, METHODS AND HYPOTHESES

As stated earlier, the pricing behaviour of Indian firms in the present study is measured in terms of their total expenditure on the import of technology and in-house R&D. A large number of firms do not invest in innovation, and the first issue that arises is determining the probability of the firm engaging in innovative activities and the factors that influence its innovation decision. Following Kumar and Saqib (1996), this issue is approached using a probit model.

Drawing from existing literature, it is hypothesized that a number of firm-specific, industry-specific and product-specific factors shape the decision to invest in innovation and the intensity of innovative activity. Next is a brief account of the theoretical base for incorporating these variables and their expected relationship.

2.6.1 FIRM SIZE

Firm size is expected to have a positive influence on the decision and depth of in-house R&D and technology purchases. Larger firms are better able to reap internal profits and devote funds to risky Endeavour’s than smaller firms and consequently are more involved in-house R&D and the import of technology. Technology-exporting firms because of the higher royalty and lump sum payments made by these, impossibility for many smaller firms, prefer larger companies. Large
firms also benefit from the economies of marketing, production, as well as greater certainty in information. Lall (1983) is the first to note the positive influence of size on in-house R&D in India. However, later studies (Subrahmanian1971a; Katrak 1985, 1989, 1990) in the pre-liberalization regime do not report a positive relation between firm size and R&D. However, it is assumed that under liberalization, large firms are able to take advantage of the above-mentioned benefits and thus a positive relationship between firm size and pricing is assumed in the current study.

Some studies on India show a non-linear relationship between firm size and in-house R&D. Siddharthan (1988) discovers that firm size first decreases with in-house R&D, and then increases, showing a U-shaped relation. Kumar and Saqib (1996) observe an inverted U-shaped relationship where the firm size increases to a certain extent, declining thereafter. Therefore, a quadratic term for firm size is also used in the model to test for any non linearity’s between firm size and innovative activity.

2.6.2 Market Concentration

The relationship between market concentration and pricing has also been tested in both the developed and developing country context. The consensus of the developed country studies is that market concentration has only a weak positive relationship with pricing. Furthermore, Kumar (1987) observes a negative relationship in India between market concentration and R&D intensity. Market concentration in the current study is thus hypothesized to have a positive relationship with the pricing decision and its intensity.

The top eight firms in each year for pharmaceutical industry are assigned the value one and the value zero for others. This is a better measure for capturing market concentration than conventional measures like the four-firm concentration ratio or the Herfindahl index mentioned earlier.
2.6.3 Appropriability

Other things being equal, a firm having a greater part of the production chain in-house would have in-depth knowledge generated by innovative activity. This argument is put forward by Arrow (1962) where he argues that appropriability, more than sales, is best achieved by the internal application of knowledge. Therefore, a firm with a higher value added to sales will have a better chance of investing in innovative activity. The value added to sales differs from firm to firm, and this is accounted for in the current study, as it is firm specific.

2.6.4 Experience

It is assumed that firms with long-term experience will have more intense innovative activity. Older firms benefit because of accumulated learning and better ways of adapting to new products. Consequently firms with experience are expected to have a positive association with the decision to engage in innovation and its intensity. In the current study, the age of the firms is taken as a proxy for experience, and older-aged firms are expected to have a positive influence on innovative activity, both with regard to the R&D decision and its degree of intensity.

2.6.5 The Data and the Construction of Variables

The data for the study have been collected for a three-year period (2009-11) from Capitaline Database of India. The study is industry-specific and the firms are pooled for the analysis. The sample consists of 181 firms for observation.
2.7 **EMPIRICAL MODEL**

2.7.1 **LINEAR REGRESSION**

The interest of this test lies in the relationship between variables profit (dependent) and Sales and Price (independent). This linear regression gives an answer to different hypothesis used in the research. The next paragraph gives the equation for the linear regression models. The non-standardized coefficients are used to calculate the value of the utility of the dependent variable. The results are in a ceteris paribus condition.

The regression analysis is done in SPSS. The main effect of this regression analysis is to find what relations exist between the variables, more precisely, whether one variable 'causes' the other. In this study the regression analysis explains what effect price and sales has on the profit of a specific pharmaceutical firm. The general equation model of the linear regression model is:

\[ y_i = \beta_0 + \beta_1 X_{1i} + \varepsilon_i \]

For this study the following equations are used:

A) \[ y = \beta_0 + \beta_1 \text{Firm Size} + \beta_2 \text{market concentration} + \beta_2 \text{experience} + \varepsilon \]

(2.5.1.1)

B) \[ y = \beta_0 + \beta_1 \text{sale} + \beta_2 \text{price} + \beta_3 \text{market share} + \varepsilon \]

(2.5.1.2)

OR

A) \[ \text{Price} = \beta_0 + \beta_1 \text{Firm Size} + \beta_2 \text{market concentration} + \beta_2 \text{experience} + \varepsilon \]

(2.5.1.3)

B) \[ \text{Profit} = \beta_0 + \beta_1 \text{sale} + \beta_2 \text{price} + \beta_3 \text{market share} + \varepsilon \]

(2.5.1.4)