CHAPTER II

LITERATURE REVIEW

This chapter was organized into 4 sections. Price dispersion and discrimination concepts were respectively reviewed in the first two sections. The third section gave details of the tools used to measure the extent of price discrimination. Independent variables which influenced the extent of price discrimination were illustrated in the last section.

2.1 Price Dispersion

Price dispersion is the variation in prices charged by the vendor to different buyers for the same product (Borenstein & Rose, 1994).

- **Source of Price Dispersion**

Price dispersion may arise both from variation in the costs of product sold to different buyers and from discrimination. Disentangling these sources is difficult because costs of product data are inaccessible from the research standpoint. This limitation prevents us from determining the presence of price discrimination through the comparison of the markup of price over marginal cost across the different buyers of the same product. Instead, price discrimination could be identified and quantified using another approach conducted in other studies by measuring price dispersion while attempting to control dispersion due to cost difference. (Borenstein & Rose, 1994; Hayes & Ross, 1997) This study will also be operated using this approach to identify and quantify price discrimination of the selected pharmaceutical products.

2.2 Price Discrimination

Price Discrimination is usually defined as charging different prices for different units of the same commodity at the same time, when those price differences are not related to cost differences (Denzau, 1992).

Price discrimination brings more revenue to firms through the increase of the price that buying consumers pay and/or the increase in the number of customers. Successful discrimination thus needs market power of sellers, their ability to identify different consumer groups with known price elasticity, and resale of products are impracticable in this market.

The problem in studying price discrimination is to determine when two products will be considered the same in which case we can apply the definitions and to determine when two completely different goods are. A more radical but effective solution is to limit ourselves to cases where the products in question are perfect substitutes. By asking the question whether one can consume both at one transaction such as one cannot simultaneously consume both an economy seat and a first-class seat, or a book buyer will purchase either a hardcover or a paperback, but not both. This also illustrates discrete choice model, in which consumers are assumed to choose one option from a set of alternatives (Clerides, 2000).

Clerides (2000) defined price discrimination (PD) in another way. He defined 2 definitions of price discrimination that implied identifying methods in the definitions. He described by formally supposing that there are existing varieties 1 and 2 of some goods and they are priced at p_1 and p_2 respectively. Marginal costs of production are assumed to be constant in quantity produced and equal to c_1 and c_2 respectively. The following two definitions of PD with differentiated products have been proposed:

Definition 1: *Price discrimination occurs whenever price-cost differentials (PCDs) of two (or more) varieties of the same goods are not the same; that is, whenever* $p_1 - c_1 \neq p_2 - c_2$

Definition 2: *Price discrimination occurs whenever price-cost ratio (PCRs) of two (or more) varieties of the same goods are not the same; that is, whenever* $p_1 / c_1 \neq p_2 / c_2$

In identifying price discrimination, two major issues arise. First, the criteria used to identify PD suffer from a robustness problem. There is not (and there cannot be) any statistical theory that tells us the extent to which PCDs or PCRs must differ for PD to exist. Therefore, if we were to follow the criteria strictly, we would have to proclaim PD even when the differences or ratios differ by very small amounts (Clerides, 2000).

There are three different types of price discrimination recognized in microeconomics.

1. **Third degree price discrimination or multi-market discrimination**
2. **Second degree price discrimination or quantity discrimination**
3. **First degree price discrimination or perfect price discrimination**

The next 3 sub-sections describe definition, examples, and other related features of each particular type of these price discriminations.

2.2.1 Third Degree Price Discrimination

This type of price discrimination exists where the firm is able to segment its customers into two or more separate markets, each market defined by unique demand characteristics. Some of these markets might be less price sensitive (price inelastic) relative to other markets where quantity demanded is more sensitive to price changes (price elastic). The firm might find that by charging a higher price 'P_1' and selling a level of output 'Q_1' in the first market and a lower price 'P_2' selling a higher level of output 'Q_2' in the second market; profits are greater than when firm charged a single price 'P^* ' ($P_2 < P^* < P_1$) for all units sold. Specifically, the firm will attempt third degree price discrimination if: $P_1Q_1 + P_2Q_2 > P^*Q^*$ ($Q^* = Q_1 + Q_2$, total costs are the same in either case).

In order for this type of price discrimination to be effective, the firm must be able to prevent a third party from engaging in arbitrage (buying in the second market at a price slightly above P_2 and selling in the first market at a price slightly below P_1 forcing both prices towards P^*) and profiting from the price differences. The two markets must be kept separated (Ruby, 2003).

That means the firms cannot charge too large a price differential. Too large price differential would enable entry by arbitraging to be profitable. In addition, it cannot regularly price discriminate on very large purchase quantities; as such purchases would provide the inventory for a competitor to arbitrage the submarkets. (Denzau, 1992)

Prescription drug prices for senior and non-senior was used to illustrate. A cheaper price was charged to higher price elastic demanders (seniors), while higher price for price inelastic customers (non-seniors).

Another example is the case of telephone company about price elasticity of the two customer groups, residential and business. Since the phone company knows how important phone service is to a business, it believes business users' demand is less price sensitive than residential customers'. It thus charges business users a higher rate and increases its total revenues through this policy. This is because the firm weighted between the revenue gains from price increase and from quantity increase when they decrease their price.

Another example is "dumping". Dumping is selling a product for export at a price lower than the average costs of the goods. When firms sometimes produce more than their home market demand reaching the economy of scale, selling some output in the export market to the rest of world can lower costs for the firm. In this case, foreign demand is perfectly elastic which the firms have to lower its price to sell in the world market. Two prices are set, one for domestic market another for the rest world market.

This situation may apply within the domestic market. In case of drug market, between public hospitals and private setting (drugstores, private hospitals), dumping is done in public hospital and higher price is set for drugstores and private hospitals. The demand of public hospital is almost perfectly elastic (price taker).

Different kinds of tickets, say "business" or "leisure" tickets can be charged at different rates, depending on the consumer demand characteristics. It may be that travelers are segmented, so that some people always want one kind of ticket while others always want the other. When these tickets have different prices we would call this practice *Interpersonal discrimination*, since different customers face different prices. Alternatively, it could be that a given traveler demands a mix of business and leisure tickets, depending on the nature of the planned journeys, and differential charging here is an example of *Intrapersonal discrimination* (Armstrong & Vickers, 2001).

- *Welfare Analysis*

With third degree price discrimination, there are three potential sources of social inefficiency. First, aggregate outputs over all market segments may be too low if prices exceed marginal cost. However, it has to be tested that price discrimination leads to increase or decrease in aggregate output relative to uniform pricing. Second, for a given level of aggregate consumption, price discrimination will typically generate inter consumer misallocations relative to uniform pricing. And third, there may be inter-firm inefficiencies as a given consumer may be served by an inefficient firm, perhaps purchasing from a more distant or higher-cost firm to obtain a price discount (Stole, 2003).

2.2.2 Second Degree Price Discrimination (Quantity Discrimination)

Firms behave different prices charging for different units of goods. This type of price discrimination involves the establishment of a pricing structure for a particular goods based on the number of units sold. Quantity discounts and block pricing are two common examples. In this case, the seller charges a higher per-unit price for fewer units sold and a lower per-unit price for larger quantities purchased. The seller is attempting to extract some of the consumer's surplus value as profits with residual surplus remaining with the consumer over and above the actual price paid.

In the figure below, we find an example of a firm charging three different prices for the same product. The price P_0 is charged per unit if the buyer chooses to buy Q_0 units of the goods. A lower price P_1 is charged for a greater quantity Q_1 and the price P_2 is charged for the quantity Q^*_2 (the level of output that P_2 = MC -- the marginal costs of production) (Ruby, 2003)

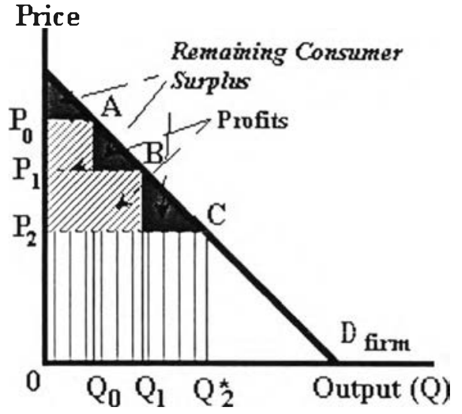

Figure 2.1 Second Degree Price Discrimination (Ruby, 2003)

Common examples of second degree price discrimination include quantity discounts for energy use, electrical or telephone service (Denzau, 1992); the variations in price for different sizes of boxed cereal, packaged paper products; and sodas (Ruby, 2003). A firm may combine second degree and third degree price discrimination (Denzau, 1992).

In case of detecting quantity discrimination, Lott and Robert (1991) have warned the researchers that there are often cost explanations for price differentials that are just as compelling. In the case of package size discounts, possible cost factors include: (1) economies of scale in production (i.e. larger products are less costly to produce per unit) (2) transactions, inventory, or restocking costs for either the retailer or manufacturer which are lower per-unit for larger sized goods. The point is to let the data say whether or not cost factors can explain non-linearity in observed prices (John R. Lott & Roberts, 1991).

Cohen (2004) found that there are unobservable attributes that could lead one to infer price discrimination when in fact, prices arc cost-based or demands are independent across sizes

1. *Cost Unobservable*. The cost of offering a particular size is different among 2 markets. The differences of price are caused by cost differences rather than price discrimination. If costs are weakly monotonic in package size, however, this will not be a problem

2. *Demand Unobservable*. Demand may be independent across package sizes. One size is more expensive than another would then be due to differences in the elasticity of demand in each size market, and not because firms are inducing consumers to purchase one or the other of the sizes to extract additional surplus (price discrimination) (Cohen, 2004).

2.2.3 First Degree Price Discrimination (Perfect Price Discrimination)

This type of product pricing is based on the sellers' ability to determine exactly how much each and every customer is willing to pay for goods. Different consumers have different preferences and levels of purchasing power and thus the amount they would be willing to pay for goods often exceeds a single competitive price. This difference between what a consumer is willing to pay and the price actually paid is known as consumer surplus. Thus a firm engaging in first degree price discrimination is attempting to extract the entire consumer surplus from its customers as profits (Ruby, 2003).

Suppose the firm knows the reservation price (willingness to pay) of every consumer. Firms can then charge different prices for each different customers at his/her reservation price (willingness to pay). Situation like this, the firms can extract the entire consumer surplus. Behaving this, firms' marginal revenue is the demand curve. The profit is increased from charging some consumers higher prices than the single price and also from more customers buying at lower prices as shown in the following figure.

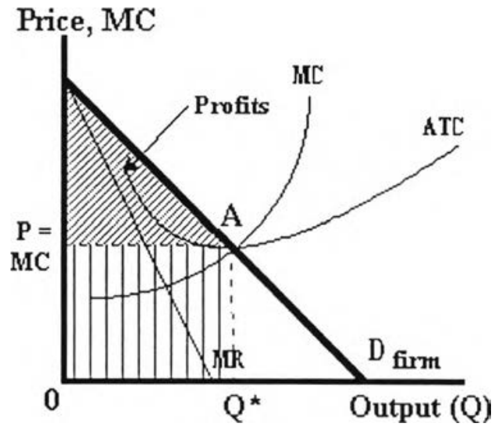

Figure 2.2 First Degree Price Discrimination (Ruby, 2003)

From the figure, the firm will sell a quantity of output 'Q*' up to the point where the price of the last unit sold just covers the marginal costs of production. The difference between the price charged on each unit and the average costs of producing 'Q*' units of output will be the firm's profits.

Common examples of first degree price discrimination include car sales at most dealerships where the customer rarely expects to pay full sticker price, scalpers of concert and sporting-event tickets, and road-side sellers of fruit and produce.

2.3 Price Discrimination Identification and Quantification

2.3.1 Theoretically Identifying Price Discrimination

- **Price to Cost Ratio**

Price discrimination is identified existing when the price-cost ratio changes over different buyers, the price scheduled (quantity discount), and markets. Or

- **Price-Cost Differences**

Price discrimination is identified existing when the price-cost differences change over different buyers, the price scheduled (quantity discount), and markets. (Clerides, 2000)

However, the marginal cost of manufacturers is unable to be observed. To identify price discrimination has to be done in the setting that the differences due to cost differences are restricted. In a nutshell, measuring price dispersion while controlling cost induced price dispersion, is to quantify the price discrimination (Borenstein & Rose, 1994; Hayes & Ross, 1997).

There are many methods used to quantify price dispersion found in reviewed literatures. Those are price range, coefficient of variation, the relative quintile range of fares, variance, standard deviation, the ratio of highest and lowest prices and inequality measurement (Borenstein & Rose, 1994; Busse & Rysman, 2004). Variance and standard deviation are rarely used as these measures are scale sensitive and closely related to the mean statistics. In addition, these statistical measures determine the variation by one variate. Alternatively, the measurement of inequality has a rich history in the economic literature with the bulk of it pertaining to the evaluation of income inequality. This measure takes two variates into account to determine variations (inequality) at the same time.

Similarly, the dispersion of prices is and example of price inequality which may be quantified into an index just as income inequality may (Hayes & Ross, 1997). The following sub-sections review inequality measures which covered overview, computation method, interpretation, and application in measurement price dispersion.

2.3.2 Inequality Measurements

2.3.2.1 Axiomatic Approach

There are five keys axioms which usually require inequality measures to meet (Litchfield, 1999).

The Pigou-Dalton Transfer Principle. This axiom requires the inequality measure to rise (or at least not fall) in response to a mean-preserving spread: an income transfer from a poorer person to a richer person should register as a rise in inequality and an income transfer from a richer to a poorer person should register as a fall (or at least not as an increase) Consider the vector y' which is a transformation of the vector y obtained by a transfer δ from y_j to y_i, where $y_j < y_i$, $y_j + \delta < y_i + \delta$, then transfer principle is satisfied if $I(y') \geq I(y)$. Most of inequality indices in the literature, including the Generalized Entropy class, the Atkinson class, and Gini coefficient, satisfy this principle, with the main exception of the logarithmic variance and the variance of logarithms.

Income Scale Independence. This requires the inequality measure to be invariant to uniform proportional changes: if each individual's income changes by the same proportion (as happens say when changing currency unit) then inequality should not change. Hence, for any scalar $\lambda>0$, $I(y)=I(\lambda y)$. Again most standard measures pass this test except the variance since $var(\lambda y)= \lambda^2 var(y)$.

Principle of Population. The population principle requires inequality measures to be invariant to replication: merging two identical distributions should not alter inequality. For any scalar $\lambda>0$, $I(y)=I(y[\lambda])$, where $y[\lambda]$ is a concatenation of the vector y, λ times.

Anonymity. This axiom, sometimes also referred to as 'Symmetry', requires inequality measures be independent of any characteristic of individuals other than their income (or the welfare indicator whose distribution is being measured). Hence for any permutation y' of y, $I(y)=I(y')$.

Decomposability. This requires overall inequality to be related consistently to constituent parts of the distribution, such as population sup-groups. For example, if inequality is seen to rise amongst each sub-group of the population then expected overall inequality would also be increased. Some measures, such as the Generalised Entropy class of measures, are easily decomposed into intuitively appealingly components of within-group inequality and between-group inequality: $I_{total}= I_{within} + I_{between}$. Other measures, such as the Atkinson set of inequality measures, can be decomposed but two components of within- and between-group inequality do not sum to total inequality. The Gini coefficient is only decomposable if the partitions are non-overlapping, that is the sub-groups of the population do not overlap in the vector of income.

The following part reviewed some inequality indices which were frequently brought up in price dispersion literatures. The review covered index calculation, properties, and their evidences in price dispersion.

- **Gini Coefficient**

Gini coefficient or index was firstly established in the world in English language since 1921 by Corrado Gini. It was proposed as a summary statistics of dispersion of a distribution. During a long history over 80 years, the Gini index gradually became one of the principal inequality measures in the discipline of economics. This measure is understood by many economists and has been applied in numerous empirical studies and policy research (Xu, 2004). The Gini index can be used to measure the dispersion of a distribution of income, or consumption, or wealth, or a distribution of any other kinds. Although the kind of distributions where the Gini index is used most is the distribution of income, its applications are not be limited to income distributions.

Gini index is not too different from other dispersion measures such as variance and standard deviation. But when coming to a decision as to which inequality measure should be adopted in a study, economists found that it was rather difficult to select one statistics over others without any justification in terms of social welfare implication. It is now known that many well-known inequality measures indeed have direct or implicit relations with social welfare functions and that the measured inequality can be interpreted as social welfare loss due to inequality.

Gini index can be expressed in many ways. It can be expressed as a ratio of two regions defined by 45 degree line and a Lorenz curve in a unit box, or a function of Gini's mean difference, or a covariance between incomes an their ranks, or a matrix form of a special kind.

Gini index has been adopted for long time ago. It is commonly used and applicable to measure the extent of inequality in many types of distribution. In addition, Gini index can be computed by many ways either referenced or not referenced with central tendency. However, employing Gini index comes together with cumbersome processes of calculation (Lerman & Yitzhaki, 1984).

<u>*Computation Method*</u>

The computational methods for the Gini index include the geometric approach, Gini's mean difference approach (or relative mean difference approach), covariance approach, and matrix form approach.

- *Geometric Approach*

The attractiveness of the Gini index to many economists is that it has an intuitive geometric interpretation. That is, the Gini index can be defined geometrically as the ratio of two geometrical areas in unit box as shown in figure 2.3.

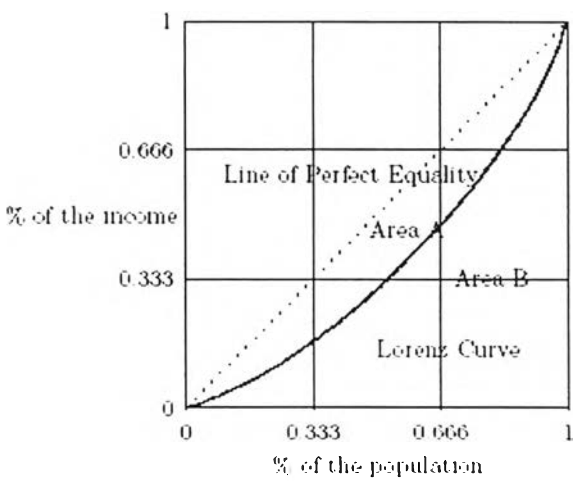

Figure 2.3 Geometrical Approach of Gini Computation

The area between the line of perfect equality (45 degree line in the unit box) and the Lorenz curve, which is called area A, while area under the

45 degree line, areas A+B. Because an area A+B represents the half of the unit box, that is, A+B = ½, the Gini index, G, can be written as:

$$G = \frac{A}{A+B} = 2A = 1 - 2B \qquad \text{.......... (1)}$$

Discrete Income Distribution

In case of discrete income distribution, the Lorenz cure is plotted by a set of (F_i, L_i). F_i is cumulative proportion of population and L_i is cumulative proportion of income. Then the area below the Lorenz curve will be defined as following formula.

$$B = \frac{1}{2}\sum_{i=1}^{n-1}(F_{i+1} - F_i)(L_{i+1} + L_i) \qquad \text{..........(2)}$$

Substituting equation (2) into equation (1) yields the Gini index G.

$$G = 1 - \sum_{i=0}^{n-1}(F_{i+1} - F_i)(L_{i+1} + L_i) \qquad \text{..........(3)}$$

From equation (3) the formula can be derived to other forms such as

$$G = 1 - \sum_{i=0}^{n-1}(F_{i+1} - F_i)(L_{i+1} + L_i)$$

$$G = 1 + \sum_{i=0}^{n-1}(F_i L_{i+1} - F_{i+1} L_i) - \sum_{i=0}^{n-1}(F_{i+1} L_{i+1} - F_i L_i)$$

Since this term $\sum_{i=0}^{n-1}(F_{i+1} L_{i+1} - F_i L_i) = 1$

Then we get $G = \sum_{i=1}^{n-1}(F_i L_{i+1} - F_{i+1} L_i)$ ....(4)

Continuous Income Distribution

Gini coefficient is defined from Lorenz curve

$$B = \int_0^1 L(p)dp \qquad \text{...(5)}$$

Substituting equation (5) into equation (1) yields the Gini index for the continuous income distribution as

$$G = 1 - 2\int_0^1 L(p)dp \qquad \text{...(6)}$$

In this study, Gini coefficient was used as a main tool to quantify the extent of price discrimination. Geometric approach for discrete distribution of Gini is employed. The working formula (3) was used in this study.

G range from 0 to 1, the value that closes to 1 means higher degree of inequality. Gini coefficient is a well known and well accepted index. It was used to quantify inequality in various setting and also in price inequality (Borenstein & Rose, 1994; Hayes & Ross, 1997).

Another two following tools has been used together with Gini coefficient to quantify the extent of price dispersion of airline tickets. The authors suggested that Gini coefficient tends to give more weight to the middle portion of a distribution and, therefore, is rather insensitive to the tails of the distribution (Hayes & Ross, 1997).

- **Atkinson Inequality Measure**

The Atkinson measure is an axiomatically based index range from 0 to 1 (Atkinson, 1970 cited in Litchfield, 1999). This measure is less common than Gini coefficient. The functional form of this index is

$$I = 1 - \left[\frac{1}{n} \sum_i \left[\frac{P_i}{\mu} \right]^{\frac{1}{1-\varepsilon}} \right]^{\frac{1}{1-\varepsilon}} \qquad \text{..................................(7)}$$

where n = the number of observations

P_i = the price of observation i

μ = the mean of prices

ε = a choice parameter

Unlike Gini, the parameter ε is an inequality aversion parameter $0<\varepsilon<\infty$: the higher the value of ε the more society is concerned about inequality (Litchfield, 1999). This allows the measurer to alter the portion of the distribution that is emphasized. For example, a large ε would emphasize inequality in the lower end of distribution whereas a small ε would create an index that is more sensitive to inequality in the upper end of the distribution. The Atkinson class of measures range from 0 to 1 with 0 representing no inequality (Litchfield, 1999).

- **Generalised Entropy (GE) Class of Measures**

The Generalised Entropy class is another group of inequality measures found in literature of price dispersion quantification. It's based on information theory. GE measures have the general formula as follows:

$$GE(\alpha) = \frac{1}{\alpha^2 - \alpha} \left[\frac{1}{n} \sum_{i=1}^{n} \left(\frac{y_i}{\bar{y}} \right)^{\alpha} - 1 \right] \qquad \text{......................................(8)}$$

Where n is the number of individuals in the sample, y_i is income of individual i, i $\in(1,2,\ldots,n)$, $\bar{y} = 1/n \sum y_i$, the arithmetic mean income. The parameter α represents the weight given to distances between incomes at different parts of the income distribution and can take any real value. At the lower value of α, GE is more sensitive to changes that affect the upper tail. The commonest α used are 0, 1, and 2. The GEs with parameters 0 and 1 become two of Theil's measures of inequality, the mean log deviation and the Theil index respectively (Litchfield, 1999).

$$GE(0) = \frac{1}{n}\sum_{i=1}^{n} \log \frac{\bar{y}}{y_i} \qquad \ldots\ldots(9)$$

$$GE(1) = \frac{1}{n}\sum_{i=1}^{n} \frac{y_i}{\bar{y}} \log \frac{\bar{y}}{y_i} \qquad \ldots\ldots(10)$$

The functional form named Theil index of GE class measure was used in the price dispersion study (Hayes & Ross, 1997) is

$$I = \frac{1}{n}\sum_i \frac{p_i}{\mu} \ln \frac{p_i}{\mu} \qquad \ldots\ldots(11)$$

Where n = the number of observations

P_i = the price of observation i

μ = the mean of prices

The value of GE ranges from 0 to ∞, with zero representing an equal distribution (all incomes identical) and higher values represent higher levels of inequality (Litchfield, 1999). The Theil index is more sensitive to variation in prices at the lower end of the distribution (Hayes & Ross, 1997). However, Jenkins and Jantti (2005) suggest Entropy class index is sensitive to the extreme values of distribution.

Hayes and Ross (1998) utilized all of these three measures together for quantifying price dispersion of airline's ticket fares. They chose an ε of 0.5 for Atkinson index which is relative low and will be sensitive to variations in "higher" prices, whereas Gini and Entropy cover the middle, and the lower end of distribution. They mentioned that the formulation of any index imposed a specific interpretation of the underlying distribution and captured it uniquely. As such, any statistical result or ordinal conclusions obtain from using a particular index may be unique to that index. Using together three indices which possess different properties and captures differing aspects of the price distribution will reduce the possibility of index specific results.

Using multiple indices emphasizing different portion of distribution seems to be advantage in Hayes and Ross point of view. By this way, the importance of various measures of market structure on different parts of distribution can be examined. For example, if a coefficient is significant in the entropy regression and not the others, that independent variable would be more important in determining inequality in the lower end of the distribution.

Although it is accepted that index ranking is often consistent with each other, there are some literatures referenced in Hayes and Ross article found the differences. Kwoka (1985) cited in(Hayes & Ross, 1998) demonstrated that various concentration measures, which were highly correlated, exhibited differences in their explanatory power when used in regression analysis. In addition, in their own article, they found the cases notably different while most results were consistent across indices.

However, in this study, the last two inequality measurements, stochastic dominance approach and capability approach, are examined in addition to Gini coefficient and reviewed in the next two sub-sections. Multiple indices will be an alternative to quantify the extent of drug price discrimination.

2.3.2.2 Stochastic Dominance Approach

Litfield in 1999 discussed three types of stochastic dominance. Those are first order, second order, and Lorenz dominances. First and second order stochastic dominances are fundamentally of use in comparisons of social welfare. And the last, Lorenz dominance is used as an alternative to axiomatic approach for ranking inequality of distributions.

- **First Order Stochastic Dominance**

Consider two income distributions y_1 and y_2 with cumulative distribution functions (CDFs), $F(y_1)$ and $F(y_2)$. If $F(y_1)$ lies nowhere above and at least somewhere below $F(y_2)$ then distribution y_1 displays first order stochastic dominance over distribution y_2: $F(y_1) \leq F(y_2)$ for all y. Hence in distribution y_1 there are no more individuals with income less than a given income level than in distribution y_2, for all level of income. Expressing in alternative way using the inverse function $y = F^{-1}(p)$ where (p) is the share of the population with income less than a given income level: first order dominance is attained if $F^{-1}(p) \geq F_2^{-1}(p)$ for all p. The inverse function $F^{-1}(p)$ is known as a Pen's Parade, 1974 (Litchfield, 1999) which simply plots incomes against cumulative population, usually using ranked income quintiles. First order stochastic dominance of distribution y_1 over y_2 implies that any social welfare function that is increasing in income, will record higher levels of welfare in distribution y_1 than in distribution y_2.

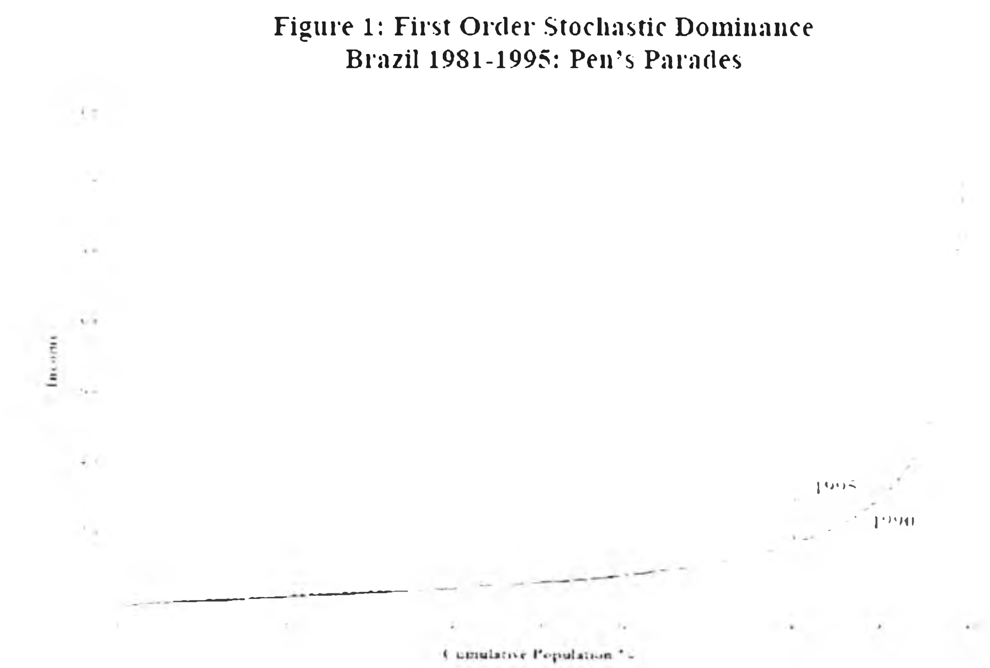

Figure 2.4 Fist Order Stochastic Dominance (Litchfield, 1999)

- **Second Order Stochastic Dominance**

Consider the deficit function (the integral of CDF) of distribution y_1, and y_2: $G(y_{i,k}) = \int_0^{y_k} F(y_i)dy$, i=1,2. If the deficit function of distribution y_1 lies nowhere above and somewhere below that of distribution y_2, then distribution y_1 displays second order stochastic dominance over distribution y_2, that is

$G(y_{1,k}) \leq G(y_{2,k})$. The dual of deficit curve is the Gineralised Lorenz curve (Shorrocks, 1983 cited in (Litchfield, 1999) defined as $GL(p)=\int_0^{y_k} ydF(y)$, which plots cumulative income shares scaled by the mean of the distribution against cumulative population, where the height of the curve at p is given by the mean of the distribution below p. Discussion in Litchfield (1999) also stated that it should now be apparent that second order stochastic dominance was therefore implied by first order stochastic dominance, although the reverse was not true.

Figure 2: Second Order Stochastic Dominance
Brazil 1981-1995: Generalised Lorenz Curves

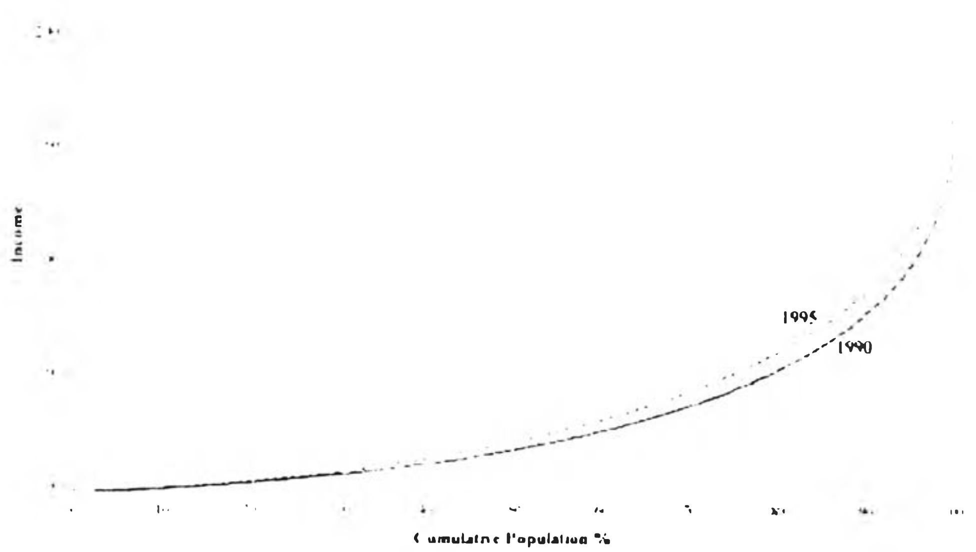

Figure 2.5 Second Order Stochastic Dominance (Litchfield, 1999)

- **Lorenz Dominance**

The third stochastic approach discussed in Litchfield, 1999 was mean-normalized second order stochastic dominance (also known as Lorenz dominance). Lorenz curve is the plot of cumulative income shares against cumulative population shares. Lorenz curve of distribution y_1 lies nowhere below and at least somewhere above the Lorenz curve of distribution y_2 then y_1 Lorenz dominates y_2. Atkinson in 1970 (cited in (Litchfield, 1999) stated that any inequality measure which satisfied anonymity and the Pigou-Dalton transfer principle would rank the two distributions in the same way as the Lorenz curves.

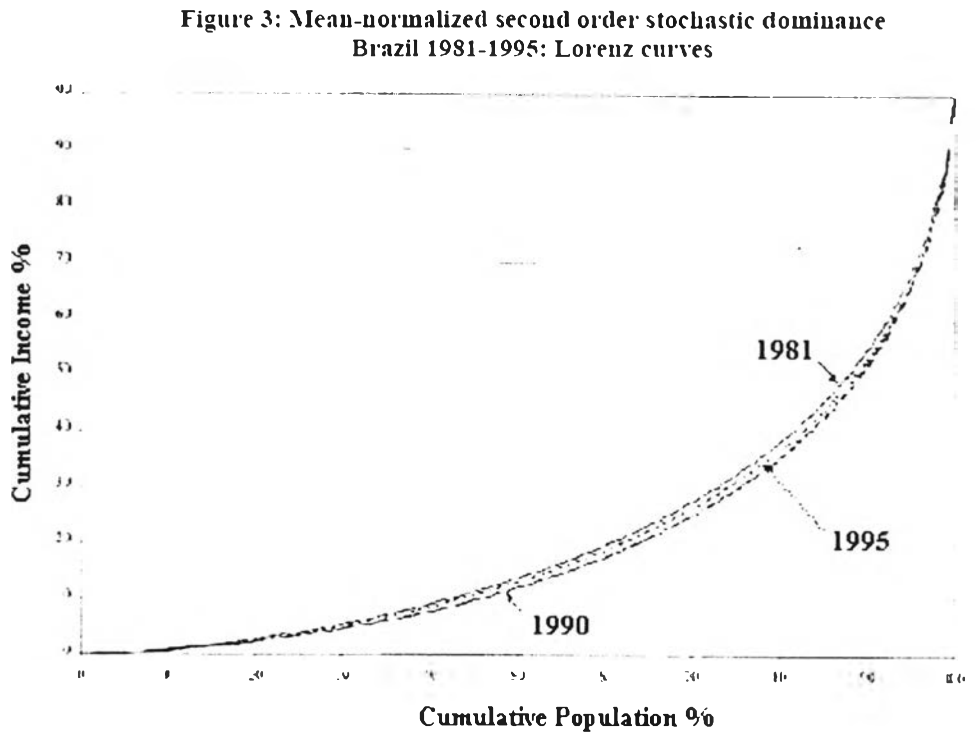

Figure 2.6 Lorenz Dominance (Litchfield, 1999)

However, it was asked among the scientists in this area that they would base the criteria of equality on income or utility alone. A very poor individual does not expect that her quality of life will improve dramatically so that she may concentrate on moderate gains only. Therefore her utility may increase a lot for a small increase in income. On other hand, a rich individual who expects a high income may not be very excited by her wealth. This distortion in utility metric brought about the new approach of economic inequality by Martha Nussbaum and Amartya Sen in 1993; the use of *capability* instead of utility in the measurement of inequality(Sen, 1993).

2.3.2.3 Capability Approach

Capability approach is a theory that has evolved in response to the shortcoming of welfarism and the narrowness of income as a target of economic and development policy. Capabilities are dependent of the preferences of the individual. The final good of human existence may not be personal welfare; indeed it is up to each citizen to determine what final good is, the goal of her/his life. The capability approach makes the individual responsible for her own preferences and also her own welfare. The responsibility of the government and the aims of public policy is to secure for each individual citizen the capability to achieve her own goals, which may or may not be her own happiness or welfare (Bojer, 2004; Sen, 1993, 1997).

2.3.3 Price Curvature

The second degree of price discrimination has different way of identification. Second degree price discrimination is relevant to nonlinear pricing e.g. volume discounting. It looks fair that one who buys more pay less per unit than one who buys less if the same price schedule is applied to all buyers. In this type of price discrimination, the shape of price schedule is measured as a degree of price curvature that reflects the magnitude of unit price differences among different quantity bought. The difference of price schedule among buyers or markets is a sign of price discrimination. Measuring degree of price curvature can be done as describe below.

The shape of the price schedule (price curvature) can be expressed as

$$P_{ij} = A_i s_j^{\beta_i} \quad \text{...(12)}$$

In practice, it is derived to be the working formula:

$$\ln(P_{ij}) = \alpha_i + \beta_i \ln(s_j) + \in_{ij} \quad \text{.....................................(13)}$$

Where P_{ij} = price of package size j of product i

S_j = size of the package j

α_i = captures the price level

β_i = captures the degree of curvature at each product

$\in_{ij}$ = mean independent of $\ln(s_j)$

This function allows a variety of pricing (Busse & Rysman, 2004);

- linear pricing (β_i=1),
- quantity discounting (β_i>1), and
- quantity premium (β_i<1).

Busse and Rysman (2004) have examined the effect of competition to the degree of price curvature. If the competition increases all prices by the proportion, then β_i will not vary with competition. Price would remain unchanged relative to one another along the schedule and thus, there is no change in the pattern of price discrimination.

If the effect of competition is to lower price for large package size by a greater proportion than price for small package size, then β_i decrease with competition. We identify this as a change in price discrimination toward greater quantity discounting. This relationship was conveyed in that study as shown in (14) (Busse & Rysman, 2004).

$$\beta_i = \gamma_0 + \gamma_1 \text{competition}_i + \nu_i \quad \ldots\ldots\ldots\ldots\ldots\ldots (14)$$

2.4 The Determinants of Inequality

Another set of information nourishing the findings was causation analysis explaining the magnitude of inequality. There were at least two ways to identify inequality determinants.

2.4.1 Decomposition Techniques

Decomposability is desirable for both arithmetic and analytic reasons. Decomposition analysis facilitates assessment of the contribution to overall inequality of inequality within and between different subgroups of population, for example, within and between workers in agricultural and industrial sectors, or urban and rural sectors (Litchfield, 1999). Analogously, in this study context, decomposition analysis was employed to assess the contribution to overall inequality of inequality within and between levels of care, within and between brands in generic level of aggregation. Inequality between levels of care from decomposition analysis would be the extent of third degree price discrimination. Moreover, momentum of each type of price discrimination to overall extent would be indicated by percent contribution of inequality within and between.

The point of decomposition analysis is to separate total inequality in the distribution into a component of inequality between the chosen groups (I_b) and the remaining within-group inequality (I_w); $I_{tot} = I_b + I_w$. This could be done either static decomposition, decomposing extent of inequality in any one year, or dynamic decomposition, a decomposition of the change in inequality over a period of time.

The static decomposition when total inequality, I, is decomposed by population subgroups to be expressed by within group inequality, I_w and between group, I_b. Within-group inequality I_w is defined as:

$$I_w = \sum_{j=1}^{k} w_j I_j$$

$$w_j = v_j^{\alpha} f_j^{1-\alpha} \quad \text{...(15)}$$

Where f_i is the population share and v_j the income share of each partition j, j=1,2,..k. In practical terms, inequality index of each sub-group is calculated and then summed by using weights of either population share, income share, or the combination, depending on the particular measure used (Litchfield, 1999).

Between group inequality, I_b is measured by assigning the mean income of each partition j, $\overline{y_j}$ to each member of the partition. GE_b is calculated by general formula as (Litchfield, 1999):

$$I_b = \frac{1}{\alpha^2 - \alpha}\left[\sum_{i=1}^{k} f_i \left(\frac{\overline{y_j}}{\overline{y}}\right)^{\alpha} - 1\right] \quad \text{...(16)}$$

In practice, the working formula was derived to fit the context:

$$T_b = \ln\left[\frac{\sum_{j=1}^{k} Q_j}{\sum_{j=1}^{k} WAP_j}\right] + \left[\frac{\sum_{j=1}^{k}\left[WAP_j \times \ln(WAP_j / Q_j)\right]}{\sum_{j=1}^{k} WAP_j}\right] \quad \text{.........................(17)}$$

Where T_b = Theil index indicating inequality between markets

WAP_j = Weight average price of market j

Q_j = Quantities purchased by market j

$$G_b = \left|1 - \sum_{j=1}^{k} (\sigma WAP_{j-1} + \sigma WAP_j)(\sigma Q_{j+1} - \sigma Q_j)\right| \quad \text{............................(18)}$$

Where G_b = Gini coefficient indicating inequality between markets

6WAP = Cumulative proportion of weight average price in a studied market

6Q = Cumulative proportion of quantities purchased in a studied market

2.4.2 Regression Technique

Regression technique is also applied when researchers want to model the effect of aggregate factors rather than specific attributes of a variable. One method is to regress the level of inequality in each year on a set of explanatory variables (Litchfield, 1999).

$$I(y)_t = \alpha + \beta_1 x_1 + \beta_2 x_2 + u_t \quad \text{..(19)}$$

A set of potential variables affecting the extent of price discrimination are reviewed and identified. To examine this set of variables the regression technique is then employed.

Potential Factors Affecting Price Discrimination

Many literatures examined a number of variables related to market structure influencing the extent of price discrimination. All of them are included to be examined in this study together with other independent variables specific to the context of drug market.

The direction of the influence of each particular variable on price discrimination is depended on type of price discrimination performed by the firms. Borenstein and Rose (1997) defined two different types of discriminating price behavior determining the direction of relationship.

The first is **competitive-type discrimination.** Segmenting consumers on the basis of their cross elasticity of demand among brands will typically produce greater price dispersion if the market is more competitive.

Another is **monopoly-type discrimination.** Segmenting consumers on the basis of their industry elasticity of demand will typically generate price dispersion if the market is closer to monopoly.

The independent variables are described in the following subsections embracing their effect in terms of direction and measurement.

2.4.2.1 Competition

Measurement: The competition in this study is defined as the number of competitors in a particular market.

Direction of effect: Borenstein and Rose (1994) in the context of airline industry found that competitive route exhibited more price dispersion under competitive type of price discrimination whereas opposite affect is expected under monopoly type of price discrimination.

Other variables encompassing product attributes which are specific to drug market context including patent covered year status, SMP status, and hospital's entry quota are expected to reflect some magnitude of competition in the market.

2.4.2.2 Market Concentration

Measurement: Market concentration is continuously measured by employing Herfindahl index which is equal to the proportion of market value over the number of competitors in that particular market.

Direction of effect: Dispersion is expected to be positive related to concentration under monopoly-type discrimination and negative under competitive-type discrimination (Borenstein & Rose, 1994).

2.4.2.3 Market Share

Measurement: Market share is equal to the proportion of market value of a particular product over the total market value.

Direction of effect: Dispersion is expected to be increased with market share under monopoly-type discrimination and decreased with market share under competitive-type discrimination.

2.4.2.4 Market Power

Measurement: Market power is defined as ability to charge higher price than other rivals for the equivalent product in a particular market. Market power can be quantified by the proportion of particular product price over the lowest price of substitutable product.

Direction of effect: Dispersion is expected to be increased with market power under monopoly-type discrimination and decreased with market power under competitive-type discrimination.

2.4.2.5 Other Variables Specified to Drug Industry Context

- **Essential Drug List Status**

The drugs in generic name listed in essential drug list are preferred to use by public hospitals than those non-listed substitutable drugs.

- **Pharmaceutical Supplier Type**

Measurement: The type of pharmaceutical supplier is categorically measured into three groups: international R&D based firms, foreign generic firms, and domestic generic firms.

All of independent variables and their influencing directions are summarized in the following table 2.1.

Table 2.1 Expected affect direction of independent variables on price dispersion

Independent variables	**Expected direction of effect on price dispersion**	
	Monopoly-type	**Competitive-type**
Number of competitors	-	+
Market concentration	+	-
Market share	+	-
Market Power	+	-
Essential drug list status	Unexpected	Unexpected
Supplier Type	Unexpected	Unexpected