Measuring Competition Using Lower Bound Concentration Curve: the Case of the Indonesian Manufacturing Industry

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The Indonesian trade liberalization and deregulation in nineteen eighties dubbed by as may as a success story. One aspect of these policies that has not been widely studied is their implications on domestic competition. The first part of my theses is to estimate and measure domestic competition and identify how trade liberalization, competition policy, entry regulation, and rent seeking affect domestic competition, using aggregate industry data. The lower bound concentration curve based on stochastic frontier function is used for this objective. In the second part, a model or rent seeking behaviour will be developed and an empirical examination of this model will be carried out.
I. Introduction

Does trade liberalization promote domestic competition? The conventional wisdom has been that a wider exposure to international trade will increase competitive pressure on domestic oligopolies and thus have the effect of reducing their market power. However, the effectiveness of trade liberalization in disciplining domestic competition depends on a number of factors. It is determined by how the trade liberalization policy is designed, by the reaction of imports to domestic collusion, and on the response of domestic oligopoly to the policy. The Indonesian trade liberalization in the nineteen eighties is a good case to test these aspects of trade liberalization given the uniqueness of Indonesia’s trade liberalization. The emphasis of the Indonesian trade liberalization was more on promoting exports rather than promoting efficiency in resource allocation. One aspect of Indonesia’s trade liberalization of particular interest is the extent of rent seeking activities in influencing trade policies in Indonesia.

The first step in analysing the competition effect of a policy is to measure the intensity of competition. The common method used in measuring the intensity of competition is the price-cost margin or some proxy for this measure. A large gap between price and cost indicates that firms in the market have significant power to increase price above marginal costs without provoking entry. The implication is that variations in price cost margins across industry can be used as an indicator of variations in market power and thus, on the variations of the intensity of competition across industry. The variation is influenced by a number of factors, among them public policy.

An important criticism of the SCP approach is that it ignores specific industry characteristics. The type of firm interaction which prevails in each industry and the characteristic of products in that industry determine the equilibrium for that industry. For this reason critics of the traditional SCP approach maintain that the predictions of this approach lack precision.

A more recent development in industry analysis due to Sutton (1991) has allowed a new method of measuring competition. The model looks at the statistical regularities that apply across industry and at the same time is robust across different assumptions about price competition among firms. In particular it looks at the relationship between market concentration and market size under the assumption of free entry. This relationship establishes a lower bound concentration curve which is a benchmark from which competition is measured. Deviation from the lower bound indicates that the entry condition facing the industry deviates from the free entry conditions of the benchmark. Once the deviations are
identified and measured they can be used to explain variation in the degree of competition across industries resulting from entry barriers.

The lower bound curve can be estimated using the stochastic frontier method proposed by Battese and Coelli (1995). The advantage of this method is that it allows us to estimate the lower bound curve and simultaneously estimate the factors that cause concentration to deviate from the lower bound. A stochastic lower bound concentration curve is estimated using observed structural variables such as the size of exogenous sunk costs and minimum efficient scale, whereas the entry condition function is estimated using a proxy for government intervention such as the role of state enterprises, a proxy for strategic behaviour such as the extent of rent seeking activities, and the pressure from international trade.

The contribution of this paper is two-fold. It provides an explanation of the dynamics of market structure in Indonesia during the trade liberalization era, and an understanding of the competition aspect of the liberalization policy. The paper will be organized in the following manner. A brief literature review will be provided in the next section, followed by a discussion of theoretical background on the lower bound concentration curve. The empirical model of a lower a bound curve will be provided in the section that follows. The next two sections discuss the empirical model of the lower bound function and the estimation method respectively. This is followed by a discussion of the empirical specification of the lower concentration function. Discussion of data sources and the empirical result will be given in the section that follows. A concluding section follows.

II. Brief literature review

Although competition lies at the heart of efficiency in the market economy, the concept is difficult to define. For this reason, research has tended to focus on the characteristics of a competitive market and to measure the intensity of competition in a market by examining deviations from this ideal. One of the most important characteristics of a competitive market is that firms in this market earn normal profit, which is defined as the profit high enough for firms to stay in the market but not to encourage entry and exit. Deviation from normal profit indicates deviation from a competitive market.

Economists are interested in explaining what causes the market to deviate from its competitive level as it entails welfare loss to society. The methodology that is commonly used to explain the intensity of competition is the structure-conduct-performance (Collins and Preston, 1969; Strickland and Weiss, 1976; Martin, 1988; Kalirajan, 1993; Bhattacharya and Bloch, 1997; Bhattacharya, 2002) approach which was first popularized by (Bain 1956). The
approach is based on the notion that a proxy for competition such as market structure will
determine the type of interactions between firm and the result of these interactions will be
shown in the industry performance. Price competition is implicitly imbedded in the market
structure or explicitly in observed behaviour variable such as advertising expenditure.

An important determinant of competition is exposure to international trade. One of
the early studies incorporating trade as a determinant of competition was Esposito and
Esposito (1971) who maintained that foreign competitors, due to their large number, can pose
a bigger threat to the ability of domestic firms to raise price above average costs compared to
domestic competitors. Empirical studies along this line of reasoning tend to support this
hypothesis (Domowitz, Hubbard et al. 1986; Domowitz, Hubbard et al. 1986; Katics and
Petersen 1994). However, incorporating a measure of trade exposure as a determinant of
profitability disregards the competitive structure of the domestic market. If the domestic
market is competitive to begin with, introducing imports will have little effect on the
profitability of industry. Imports may push inefficient domestic firms out of the market but
will have little effect on the profitability of efficient domestic firms. Therefore the
competitive impact of imports has to be discussed in the context of non-competitive domestic
producers (Geroski and Jacquemin 1981). The empirical implication is that the effect of
imports can only be measured if imports are introduced into the model as an interaction with
market concentration. Studies along this line of argument tend to support the import-as-
market-discipline proposition although there are mixed results as to the strength of the pro-
competitive force of imports. Using data from Chile, Melo and Urata (1986) were not able to
show convincingly that increase in import reduces profitability although they did show that
the effect of market concentration falls with the increase in import. More conclusive results
were obtained by Tybout (1996) using the Chilean data and by Grether (1996) using Mexican
data, although in both cases the results are sensitive to the empirical specification of the
model. Ghellinck et al. (1988) modify the SCP approach to allow sufficient flexibility to
absorb industry-specific features and found support of the import-as-market-discipline
hypothesis.

The SCP approach has been subject to much scrutiny. Researchers working in the
tradition of the Chicago school of industrial economics maintain that high profitability in a
concentrated industry has to be interpreted as a reflection of superior efficiency of larger firms
over smaller ones, not as a reflection of market power. One of the most influential researchers
in this tradition is Demsetz (1973) who argued that if a high concentration industry enjoys
high profitability then the profitability of large firms in that industry should not be different
from the profitability of small firms. He found that that the profitability of larger firms was in
fact higher than smaller firms which he regarded as proof that larger firms were more efficient than smaller firms.

Another criticism of the SCP approach is that the cost data used in the empirical analysis do not reflect economic costs and thus provide a biased estimate of market performance. Researchers in the new industrial economics school overcome this problem by avoiding the use of cost data and instead they estimate the price to marginal cost ratio. The approach, which draws from the work of Hall (1988), is based on the notion that a firm’s profit maximizing choice of input and output is determined by output price, which in turn is determined by the market structure. Therefore, if data on a firm’s output and inputs is available it is possible to estimate the price-cost ratio that the data implicitly represent. Levinsohn (1993) used this method to estimate the price-cost ratio of the manufacturing sector in Turkey and found that the price cost ratio declined after trade liberalization. Konings et al. (2001) used it to test the impact of competition policy on performance in Belgium’s and the Netherlands’ manufacturing industries. The model was also used by Kee and Hoekman (2007) to test the effect of competition law on domestic competition using cross country data of 28 industries in 42 developed and developing countries.

The SCP approach is also criticized for its assumption of a one-way relationship between market structure, conduct, and market performance. It is argued that if market concentration contributes to a firm’s profitability then there will be an incentive for firms to engage in strategic actions to reduce the number of existing firm and to prevent potential competitors from entering the market. Furthermore, if import competition has the effect of reducing profitability there is also an incentive for domestic firms, especially those in high concentration industry, to engage in rent seeking activities to influence trade policy or to request compensation. The endogeneity problem is usually perceived as an econometric problem which can be resolved using instrumental variables or a simultaneous equation approach. However, Schmalensee (1989) maintains that in a cross industry analysis essentially all variables are endogenous such that no exogenous variables can be used for instruments.

A more recent approach to industry analysis, due to Sutton (1991), provides an alternative method of estimating competition. In this model, Sutton used game-theory to explain firms’ profit maximizing behaviour when there are sunk costs associated with production. He distinguished two types of sunk costs: the exogenous sunk costs needed to set up a plant of minimum efficient scale and the endogenous sunk costs which cover the cost of advertising and R&D. He showed that when entry and exit are assumed to be free, the equilibrium number of firms, and thus market concentration, depends on the market size, the
magnitude of sunk costs, and the intensity of price competition. Given the intensity of price competition, the model predicts that there is a lower bound to concentration which decline to zero as the market size increase towards infinity. The empirical implication is that we would observe market concentration of similar industries to be lower in countries that has larger market size. The requirement that the industries being compared are similar is to ensure that the relationship between market size and market concentration being compared is estimated based on industries that have similar exogenous sunk costs and similar type of price competition imbedded in them. The model also predicts that an increase in the intensity of price competition will lead some firms to exit and others to merge so that the level of concentration tends to increase.

Sutton maintained that the negative relationship market size and market concentration may fail to hold in endogenous sunk costs industries. He argued that in industries where the bulk of the sunk costs are advertising and R&D expenditures, the lower bound concentration does not converge to zero as market size increases. In this model, it is assumed that advertising is used to influence consumer’s willingness to pay a higher price. The model shows that as the market size increases, firms will invest a larger amount of resources in advertising or R&D, thus increasing the level of sunk costs. As the sunk costs increases, the minimum efficient scale will increase and there will be less incentive for firms to enter even though market size has increased. The consequence is that the market concentration does not necessarily decrease with an increase in market size.

The model predicts that actual market concentration may not attain the lower bound concentration if entry and exit is impeded. Sutton claimed that the observed high market concentration in countries with relatively large market sizes is due to the entry condition in those countries. He identified a first mover advantage as one factor that inhibits entry in these countries. Since the presence of entry barriers will push the actual concentration level away from the lower bound, the deviation of the actual concentration level from the lower bound curve can be used as a measure of the entry condition and therefore, as a measure of the lack of competition arising from entry conditions. In this sense the lower bound concentration can be used as the benchmark from which the intensity of competition can be measured.

The lower bound concentration model has been successfully used to explain the competitive effect of market expansion and of changes in policy regimes. Lyons et al. (2001) used the model to analyse the effect of European market integration on the intensity of competition in the European Union. The model has also been used to analyse the effect of regime change in competition policy. Symeonidis (2000) used the model to explain why

1 The price competition can be Cournot, Bertrand, or collusive.
concentration ratios in U.K manufacturing industries increased following the imposition of the 1956 Restrictive Trade Practices Act which abolished cartels. Driffield (2001) used the model to test the hypothesis regarding the competitive effect of foreign direct investment in the U.K. He showed that larger foreign direct investment in the UK had pushed the concentration ratio closer to the lower bound, indicating that foreign direct investment had a positive effect on domestic price competition.

III. **Lower bound concentration as measure of competition**

Sutton (1991) models the relationship between market size, sunk cost, price competition and market concentration in the following manner. He assumes that entry and exit are totally free and that firms make decision in a multi-stage game. In the first stage firms decide whether or not to enter the market given the size of entry costs (which is treated as sunk cost), the market size, and the knowledge of the intensity of price competition in the next stage. In the second stage firms that decided to enter determine the level of output that will maximize their profit. In industries with endogenous sunk costs the game is played in three stages. In this industry firms choose the level of endogenous sunk cost in the second stage and determine profit maximizing output in the third stage. The number of firms entering in the first stage is solved by backward induction.

Consider the exogenous sunk costs industry. Let there be $N$ firms that decide to enter the first stage. In the second stage, firms that decided to enter determine their profit maximizing output and price. The equilibrium outcome in the second stage can be represented by the gross profit function $\Pi(N, S, \alpha)$, where $S$ and $\alpha$ are shift parameters indexing market size and the “intensity of competition”. The intensity of competition captures the pricing strategy of firms, which will in turn be influenced by institutional factors such as trade and competition policies and the nature of the goods being produced.\(^2\) The model assumes that the gross profit declines with the number of firms ($\Pi_N(0)$), increases with market size ($\Pi_S(0)$), and decreases with the intensity of price competition ($\Pi_{\alpha}(0)$).

The number of firm entering in the first stage (market concentration) can be solved by backward induction. Assuming symmetric firms, the number of firm can be solved from the free entry condition:

$$\Pi(N, S, \alpha) = F$$

(1)

\(^2\) For example, homogenous goods tend to have tougher price competition as they have a high elasticity of demand.
Where $F$ is the size of exogenous sunk cost. Given the size of sunk cost and the assumption about the toughness of competition, let the equilibrium number of firms entering in the first stage be $N^*$. From equation 1, a functional relationship between the market size and the equilibrium number of firms can be established. If the market concentration is defined as $1/N^*$ the relationship between market size and market concentration curve can be written as

$$C = 1/N^* = f(S | \alpha, F)$$

(2)

Sutton maintains that the relationship occurs at the lower bound since a market concentration that is lower than the lower bound ($N < N^*$) implies negative profit for every firm and therefore cannot be supported as an equilibrium. The properties of the gross profit function imply that an increase in market size, ceteris paribus, will have to be matched by an increase in the number firms (a fall in market concentration) for the equilibrium condition to hold. Therefore, in equilibrium there will be a negative relationship between market size and market concentration.

Using the equilibrium condition 1, the following properties of the lower bound concentration can be established. First, an increase in the intensity of price competition ($\alpha$) will reduce market concentration, since an increase in the intensity of price competition, ceteris paribus, will reduce profit and therefore be matched by a fall in the number of firms to keep the equilibrium condition intact. A consequence of this property is that a change in trade and competition policy regime that increases the price competition should increase the lower bound concentration.

The second property is that an increase in the magnitude of entry cost (sunk cost) $F$ will increase concentration. An increase in the sunk cost, ceteris paribus, will reduce gross profit and therefore will have to be matched by a fall in the number of firm (an increase in market concentration) to keep the equilibrium. It follows from this property that an increase in the minimum efficient scale due to a larger setup costs (sunk costs) will increase the lower bound concentration.

The above predictions do not always apply to industries with large advertising and R&D sunk costs. These two sunk costs are endogenously determined because an increase in market size will push firms to increase their advertising and R&D expenditures in order to capture a larger share of the market. Since higher sunk costs imply higher entry costs, the implication is that entry will not necessarily occur when market size increases. As long as the increase in profit due to the increase in market size is relatively larger than the increase in advertising costs, firms will enter in response to an increase in market size. The implication is
that a negative relationship between market size and market concentration will prevail. This situation will generally occur when the market size is relatively small. However, as the market becomes relatively large the endogenous sunk costs effect will eventually take over the market size effect, and the negative relationship between market concentration and market size will then cease.

The lower bound concentration can be perceived as the benchmark concentration. It is the market concentration that will prevail under free entry. The actual market concentration may deviate from the lower bound due to entry restrictions. These restrictions may be created by entry-deterring strategic behaviour such as investment in excess capacity (Spence 1977; Dixit 1980), raising rivals’ costs (Salop and Scheffman 1983; Salop and Scheffman 1987), and predatory pricing. The restriction may also be created directly by governments through legal entry restriction, or indirectly as a result of trade and industrial policy. These policies may arise due to market failure consideration, but it can also arise as result of rent seeking activities (Salop, Scheffman et al. 1984; Grossman and Helpman 1994; Hillman, Long et al. 2001). In addition, in countries where state enterprises play an important role in the economy, the entry barriers may be erected as a policy to protect these enterprises.

In developing countries entry barriers may also be influenced by the presence of multinational corporations. There are two ways that multinational corporations can influence domestic entry conditions. First, competition among developing countries for foreign direct investment may lead these countries to offer market protection as an incentive. Similarly, multinationals may require some kind of market protection in return for their investment in these countries. In this respect the presence of multinationals tends to be associated with higher entry barriers. On the other hand, the presence of multinationals can discipline the anti-competitive conduct of domestic oligopolies. In this respect, multinationals tend to reduce domestic entry barriers (Driffield 2001).

The deviation of the actual concentration from the lower bound can be used as a measure of competition which results from the entry conditions. If the deviations can be estimated, we can identify the factors that determine their variability across industries and across time. In particular, we would be interested in looking at how rent seeking activities, government protection for state enterprises, and strategic behaviour affects entry conditions and competition across industries and across time.

The model allows us to separate market concentration into elements that are determined by structural variables such as market size, the magnitude of sunk costs, and the competition policy regime, and elements that are determined by entry conditions. The former
determines the lower bound concentration and the latter determines the deviation of the actual concentration from lower bound. The sunk cost model of market concentration determination can be expressed in the following general form:

\[ CR = f(N, F, \alpha) + g(z) \]  

The first term in the right hand side of equation 3 is the lower bound function that is determined by structural variables. The second term is the entry condition which is determined by a vector of independent variable \( z \).

IV. **Empirical model for lower bound function**

Sutton (1991) used a frontier model to estimate the lower bound concentration curve. The frontier model has been widely used to analyse production and cost function (for a good review of the frontier function see Kumbhakar and Lovell, 2000). Development of the econometric method of estimating frontier functions has been presented almost entirely in the context of efficiency in production and cost. Aigner and Chu (1968) initially introduced the model as a deterministic model where the frontier curve is determined entirely by a set of predetermined independent variables. A stochastic model of the frontier function was introduced simultaneously by Aigner et al. (1977) and Meeusen and Broeck (1977). The stochastic frontier model allows the frontier curve to be determined by a random variable in addition to the predetermined independent variables.

The stochastic frontier model has the following general form:

\[ y_{it} = f(x_{it}; \beta) \cdot \exp(v_{it}) \cdot \exp(u_{it}) \]  

where \( i \) is index of observation, \( t \) is time index, and \( k \) is index of the independent variables. The variation of \( y \) across observations is influenced by two elements: the first element is the deterministic function \( f(x_{it}; \beta) \) which is determined by the magnitude of a set of predetermined variables \( x_{it} \) and the unknown parameters \( \beta = (\beta_0, \beta_1, \ldots, \beta_k) \) which can be statistically estimated. The parameters reflect the effect of the independent variables \( x_{it} \) on the dependent variable \( y \) and are common to all observations. The second element is the stochastic component which consists of \( \exp(v_{it}) \) and \( \exp(u_{it}) \) and is assumed to be specific to observation \( i \) at time \( t \). The random variable \( v_{it} \) accounts for measurement errors and other random factors, whereas \( u_{it} \)
measures the deviation of the actual dependent variable $y$ from its frontier.\(^3\) The deviation ratio can be written as the following

$$DR_{it} = \exp(u_{it}) = \frac{y_{it}}{f(x_{it}; \beta) \cdot \exp(v_{it})}$$

A log linear specification of the stochastic frontier model can be written as

$$\ln(y_i) = \beta_0 + \sum_{j=1}^k \beta_j \ln(x_{ji}) + v_i + u_i \tag{5}$$

The term $u_i$ is non-negative since the frontier function is the lowest attainable value of $y$ for observation $i$ given the values of the independent variables for that observation. Unlike $u$, the error term $v_i$ is not restricted to be non negative. Assumption regarding the distribution of $u_{it}$ and $v_{it}$ will be given in the next section.

The model described by equation 5 can be estimated using cross-section data, time series data, or panel data. Sutton (1991) conducted a cross-country study of the same (similar) group of industries to estimate the lower bound concentration function. He used similar industries because technology and the pricing behaviour in these industries were expected to be the same across countries, such that the differences in the long run concentration level across countries can be explained by differences in market size. Therefore, the concentration curve estimated using this data should be the lower bound concentration curve for these industries. Sutton asserted that the deviation of each country’s actual concentration from the estimated lower bound concentration showed the entry condition in that country. In a country that had a strict competition policy on entry deterrence activities, the market concentration level will be very close to the lower bound, and vice versa. Similarly, in a country where there was a first mover in the industry, or where there were many legal entry restrictions, the market concentration will deviate further away from the estimated lower bound concentration.

When the lower bound concentration is estimated using cross industry data the term $u_i$ measures the differences in competition intensity across industry. The differences in competition intensity result from differences in entry conditions across industry. In an industry where there are no legal barriers to entry, where government imposes a strict competition policy on strategic entry deterrence activities, and where government adopts a free trade regime, the level of concentration will be very close to the industry’s estimated lower bound concentration. On the other hand, in industries where there are many entry

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\(^3\) In production analysis $u_{it}$ measures the technical inefficiency.
restrictions, which may result from strategic behaviour or from government regulation, the level of concentration will fall far from the estimated lower bound concentration. Therefore, deviation from the lower bound concentration captures the height of entry barriers and its implication on competition. The variations of this “deviation” across industry are determined by factors such as competition policy, trade policy, and the presence of first mover in the industry. When the lower bound function is estimated using time series data for one industry, the deviation of actual concentration from the lower bound concentration at each period may indicate the government entry regulation policies toward the industry for that particular period.

With regard to Indonesian manufacturing industries, trade policies differ across industries and across time. For example, the government adopted a protectionist policy before 1987 but the degree protection varied across industries. Between 1987 and 1995 trade was liberalized but the speed and the degree of liberalization in each period during this time varied, with most of the liberalization policies occurring between 1989 and 1990. Because of these features a cross section or a time series analysis will be inadequate to estimate the lower bound concentration curve. For this reason panel data for the manufacturing industries will be used to estimate the lower bound concentration.

V. The method of estimating the stochastic frontier function and the deviation index.

Battese and Coelli (1992) proposed using maximum likelihood to estimate equation 5. They assumed the noise component \( v_{it} \) to be independently and identically distributed normal with zero mean and variance \( \sigma_v^2 \), that is, it is iid ~ \( N(0, \sigma_v^2) \). It is also assumed to be independently distributed of the second random variable \( u_{it} \). The latter is assumed to be non-negative and independently and identically distributed (iid) truncated normal distribution with mean \( \mu \) and variance of \( \sigma_u^2 \) (iid ~ \( N(\mu, \sigma_u^2) \) \(^4\)). We assume \( u_i \) to be systematically influenced by a set of exogenous variables such as government policies, rent seeking activities, and other external factors. If we assume the set of explanatory variables are the vector \( Z \), the component \( u_{it} \) can be written as

\[
 u_{it} = Z \delta + w_{it}
\]

where \( \delta \) is column vector of unknown scalars and \( w_{it} \) is the unexplained component of the deviation which has an assumed distribution. One method that has been used in the literature

\(^4\) Other assumptions regarding the distribution of \( u_i \) that have been used are exponential distribution and gamma distribution (see Reifschneider and Stevenson, 1991)
to estimate equation 7 (e.g Pitt and Lee, 1981) is a two-stage approach: in the first stage $u_{it}$ is estimated based on the stochastic frontier function, and in the second stage the estimated $u_{it}$ is regressed on the set of explanatory variables using OLS. The problem with this method is that it produces inconsistent estimates of the $\delta$s. To overcome this problem Battese and Coelli (1995) proposed estimating equation 7 and the stochastic frontier equation 5 simultaneously.

Consider the error term $u_{it}$. Since this term is assumed to be non-negative the unexplained component $w_{it}$ in equation 7 will have the following property:

$$w_{it} \geq -Z_{it} \delta$$  \hspace{1cm} (8)

To accommodate this property Battese and Coelli assume that $w_{it}$ is distributed as a truncated normal distribution with zero mean and variance $\sigma_w^2$, such that the truncation occurs at $w_{it} = -Z_{it}\delta$. This ensures that the assumption about the distribution of $w_{it}$ is consistent with the assumptions that $u_{it}$ is a non-negative truncation of $N(Z_{it}\delta, \sigma_\upsilon^2)$.

Once the parameters of the frontier function have been estimated the next step is to calculate the value of $u_{it}$ from the equation. The deviation of the observed values of the variable $y_{it}$ from their frontier value can be expressed as the ratio of these two values

$$DR_{it} = \frac{\hat{y}_{it}}{y_{it}} = \frac{\exp(x_{it}\beta + v_{it})}{\exp(x_{it}\beta + v_{it} + u_{it})} = \exp(-u_{it})$$  \hspace{1cm} (11)

If the industry has achieved the lower bound concentration then $DR_{it}=1$. On the other hand $DR_{it}<1$ implies that there are entry barriers that inhibit the concentration ratio from moving toward its lower bound level. The larger the entry barriers the larger will the value of $DR$ be.

VI. Empirical specification for the lower bound concentration model

The first challenge in any empirical work on market structure and competition is to find the empirical counterpart of the theoretical concepts. Theories seldom give sufficient guidelines on how concepts should be measured empirically. In the case of market structure the simplest definition is the number of firms in the market. In empirical work, this concept is usually translated into the size distribution of firms, measured as seller concentration. The four measures of size distribution that are widely used in empirical work are: the k-th firm concentration ratio, the Hirschman-Herfindahl index, the entropy index, and the Gini coefficient index. Each measurement has its own advantages and disadvantages such that the decision to choose one measurement over the other is basically determined by its relevance to
the objective of the research. For this research we will use the Hirschman-Herfindahl index to take into account the role of smaller firms in the concentration measure. Furthermore, it is shown that the results are consistent when a four-firm concentration ratio is used in place of the Hirschman-Herfindahl index. Both concentration indexes are measured using production data.

One problem of using either the Herfindahl index as measure of concentration or the k-th firm concentration ratio is that their values are constrained from above and below. The Herfindahl index is constrained by zero from below and by ten thousand from above, whereas the k-th firm concentration ratio has to fall between zero and one. As long as the main purpose of the study is to estimate the regression parameters this problem is not a big issue. It becomes an issue when the result is used to estimate the concentration level. In this case there is no guarantee that the estimated concentration will fall between the upper and lower limits. To overcome this problem the following log transformation of concentration is used

\[
LHHI_{it} = \ln \left( \frac{HHI_{it}}{10000 - HHI_{it}} \right)
\]

This transformation will ensure that the concentration measure will always fall between the upper and lower limit.

The second issue is whether the concentration measures need to be adjusted for foreign trade. This issue is particularly relevant for Indonesia since it is an open economy and the period of study involves a period when exports and imports increased sharply due to trade liberalization. The trade adjusted concentration is obtained using the following formula:

\[
HHI_{adj} = \frac{HHI_{it}(O_{it} - X_{it})}{(O_{it} - X_{it} + M_{it})}
\]

Where \(O\) is the total production of industry \(i\) at time \(t\), \(X\) is the exports of industry \(i\) at time \(t\), and \(M\) is imports of industry \(i\) at time \(t\).

As explained in the previous section, the structural variables that are of interest to this model are the size of market, the size of set-up costs (sunk costs), and the toughness of price competition. In addition we will also include the minimum efficient scale to take into account the effect of economies of scale. Previous empirical studies have shown that these four variables are generally statistically related to market concentration, whether the latter is measured by the four-firm concentration ratio or by the Hirschman-Herfindah index (Curry and George 1983).
In this study market size will be measured by industry output deflated by the producer’s price index. However, since the estimation will utilize panel data there is an issue whether the relationship between concentration and market size is contemporaneous. We assume that entry does not materialize immediately following a demand shock since it takes time for new firms to be established. This is particularly true in Indonesia, where new investment in some sectors of the economy has to be approved by the government. We found that output with a one year lag has the highest correlation with current market concentration. For this reason market size enters the model with a one year lag.

The second structural variable is the setup cost. It is the cost associated with acquiring a plant of minimum efficient scale and it is assumed to be exogenously determined. Theory predicts a positive relationship between lower bound concentration and the setup costs. To obtain a proxy for setup costs we use the industry’s aggregate market value of fixed capital. The value of the industry’s total fixed capital is divided by the number of firms, assuming that each firm is operating at the minimum efficient scale, to arrive at the costs of setting up a single firm. In this paper the minimum efficient scale will be measured in terms of labour employed. The number of firms with minimum efficient scale can be obtained by dividing the total number of workers employed in the industry by the minimum efficient scale. For this purpose, the minimum efficient scale has to be estimated first.

There are three approaches that are generally used in the literature to derive the minimum efficient scale (Waterson 1984): the technological or engineering costs study, the survivor technique, and the first moment distribution of firm size. The engineering cost approach would require a survey that is beyond the scope of this research so only the latter two will be considered. Conceptually the survivor technique is superior to the first moment distribution approach. The survivor technique identifies the level of output that most firms gravitate to over a period of time. This output is the minimum efficient scale since firms can only survive if they operate with this scale in the long run. The problem with the survivor technique is that it assumes that there is no technology change affecting minimum efficient scale. This assumption may not be tenable in developing countries undergoing trade liberalization. Trade liberalization and foreign direct investment generally exposes these countries to newer and better technology (Tybout 2000), which in turn may change the minimum efficient scale. Due to these issues the first moment distribution method is employed to measure minimum efficient scale. Labour is used as the measure of scale and minimum efficient scale is the number of workers used by firm of median scale. The number of firm with the minimum efficient scale is obtained by dividing the total number of workers employed in the industry to the number of workers employed by the median firm.
The minimum efficient scale is also included as one of the independent variables in the model. It is included to control for variations in the economies of large scale across industries and across time. However, as economies of scale may arise from high setup costs there is a possibility that the minimum efficient scale variable is correlated with setup costs. In fact, when minimum efficient scale is measured by the number of workers employed we found a strong statistical correlation between this variable and the setup cost variable such that it creates a multicollinearity problem in the regression. To overcome this problem we used a more practical approach to measure minimum efficient scale. It was measured by the relative efficiency of the large firms, defined as the ratio of output (in real terms) per unit of labour of the largest four firms relative to the output per unit of labour of the median firm. The method, which is used by Davies et al. 1988, Davies and Geroski (1997) and by Bhattacharyya and Bloch (2000), is based on the idea that if economies of scale exist the efficiency of large firms will be higher than small firm. The larger the minimum efficient scale, the higher the relative efficiency of the large firm.

Intensity of competition should capture two aspects of competition. The first aspect is the type of firm interaction that exists in the industry, that is, whether firms choose price or quantity as the strategic variable, and their conjectural variation. This aspect of competition can be measured by the degree of product homogeneity on the assumption that producers of homogenous goods face tougher price competition because of the high degree of substitutability of their products, whereas differentiated goods tend to have softer price competition. Following Bhattacharyya and Bloch (2000) the degree of homogeneity is measured by the proportion of output that is sold as intermediate input. This is based on the idea that intermediate goods tend to be more homogenous, whereas consumer goods tend to be differentiated. Since tougher competition implies lower profit, there will be fewer firms in the market and therefore higher concentration. For this reason we would expect a positive relationship between this variable and the lower bound concentration.

The second aspect of competition is the general competition environment associated with government policy toward competition. The two elements of this aspect that are of interest are the effect of competition law and the effect of the trade and industrial policy regime on domestic competition. The first element is not relevant to this paper since competition law was not introduced in Indonesia until 2001. The second element is included because the imports-as-market-discipline hypothesis predicts that trade liberalization will have a disciplining impact on anti-competitive behaviour.

The effect of trade and trade policy on competition will be measured in the following manner. Trade policy regime is measured is by introducing a time dummy variable that
separates the period before and after the trade and industrial policy change. The dummy variable will measure whether there is a shift in the general competitive environment following a trade regime change. If the import-as-market-discipline hypothesis holds, that is if price competition increases following trade liberalization, we expect an upward shift in the lower bound concentration. The effect of trade, particularly imports, at the industrial level is measured by the level of the effective rate of protection. Technically, the effective rate of protection measures the percentage of an industry’s value added under trade restrictions relative to the value added obtained under free trade, and it is calculated based on the input-output table. Calculations of effective rate of protection for Indonesia for 1987, 1989, and 1995 are available from Fane and Phillips (1991), Wymenga (1991), and Fane and Condon (1996). The advantage of these three calculations is that they factor in non-trade barriers in their calculation, which give them a more comprehensive measure of effective rate protection. The other advantage is that they are calculated using the same methodology which allows them to be compared to each other.

Since the effective rate of protection is available only for these three years whereas the analysis uses the period from 1987 to 1995, the effective rate of protection for the remaining years have to be estimated. For this purpose two possible methods of estimation are considered. The first method assumes that the effective rate of protections for 1988 are the same as that of 1987, the effective rate of protections from 1989 to 1994 are the same as 1989, and for 1995 and 1996 they are the same as the effective rate of protection in 1995. The second method assumes that the effective rate of protection are different in each year and the effective rate of protection for periods other than the three years where the figures are available are obtained by extrapolation. The effective rate of protection for 1988 is obtained by extrapolation using 1987 and 1989 figures, whereas the effective rate of protection figures between 1989 and 1995 are obtained by extrapolation using the effective rate of protection in 1989 and 1995. For 1996 we assume that the effective rate of protection is equal to that of 1995. It is decided to choose the second method on the assumption that trade liberalization in Indonesia occur gradually and therefore, the effective rate of protection also declines gradually.

The import-as-market-discipline hypothesis predicts that there is positive relationship between the effective rate of protection and the lower bound concentration since a higher protection will shield domestic collusive behaviour from import competition. However, we allow the possibility that imports join the domestic collusion rather than challenge it, or act as price followers with respect to domestic oligopolist (Urata 1984; Globerman 1990; Feinberg 1996). Under this circumstance we will expect an insignificant or even a negative relationship between ERP and lower bound concentration.
Although there are strong theories to support the relationship between the lower bound concentration and the six independent variables mentioned above, there is very little guide on the functional form of this relationship. A linear relationship between concentration and the independent variables is assumed in Geroski et al. (1987), Geroski (1991), Bhattacharya and Bloch (2000), and Bhattacharya (2002); whereas a log linear relationship is used by Sutton (1991), Symmeonidis (2000), and Lyons et al (2001) for the lower bound relationship. The latter three use a log linear relationship since the logistic transformation of the concentration ratio is used as measure of concentration instead of the actual value. For this paper we follow Sutton’s specification of log linear relationship.

Given the above determinants of lower bound market structure we can write the lower bound concentration function as

\[ LCR_{it} = \beta_0 + \beta_1 DTRDRGM + \beta_2 LMKSZ_{it} + \beta_3 LMES + \beta_4 LSETUP_{it} + \beta_5 ERP_{it} + \beta_6 PDR_{it} + \nu_{it} + \mu_{it} \]  

where:  
\( i = \) industry index;  
\( t = \) index of time

\( LCR = \) logistic transformation of concentration ratio

\( DTRDRGM = \) dummy trade regime (1=after 1989)

\( LMKSZ = \) natural log of market size

\( LMES = \) natural log minimum efficient scale

\( LSETUP = \) natural log setup costs

\( ERP = \) effective rate of protection

\( LPDR = \) natural log of proportion of output sold as intermediate input

The expected signs of the coefficients are given in Table 1 below.

<table>
<thead>
<tr>
<th>Variable</th>
<th>DTRDRGM</th>
<th>LMKSZ</th>
<th>LMES</th>
<th>LSETUP</th>
<th>ERP</th>
<th>PDR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected sign</td>
<td>+/-</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>+/-</td>
<td>+</td>
</tr>
</tbody>
</table>

The second part of the model is the entry condition element of market concentration. This is measured by the deviation of actual concentration from the lower bound concentration. The actual concentration ratio of the \( i \)-th industry at the \( t \)-th period can deviate from the lower bound depending on the degree of entry barriers that existed in each industry at a different time. Entry barriers due to strategic behaviour, a first mover advantage, a monopoly licence, and government privileges can lead market concentration to deviate from the lower bound. The deviation is measured by the random factor \( \nu_{it} \), which is assumed to be systematically determined by a set of explanatory variables.
The most significant impediment to competition in developing countries is government-created entry barriers (Singleton 1997). In Indonesia these barriers can be found for example in the wheat flour industry where only two firms were allowed to operate. The other government-created barrier is the requirement that all large investments have to be approved by the government through the Investment Coordination Board. Furthermore, due to the extensive government role in the economy and an authoritarian political system, entry can be deterred by influencing government policy. If rent seeking is an effective method for restricting entry it will have the effect of pushing the actual concentration level away from the lower bound. However, measuring rent seeking is always the issue in empirical work on this subject.

In this paper, charity donation expenditures are used as a proxy for rent seeking activities. Donations and political contributions are identified by Grossman and Helpman (1994) as the means by which rent seekers influence policy. In the case of Indonesia there is a possible link between these expenses and the funds raised by charity foundations belonging to the political elite and policy makers. Charity foundations are popular institutions among politicians and the ruling elites to generate donations and funds because they have very few legal restrictions on public accountability, at least during the period of study. Donations will be a good measure of rent seeking activities in industries where there is a large opportunity for rent seeking. This will be in industries where government intervention is significant or in industries that are subject to crony influence. For example, in Indonesia the wood and paper products industry, the cement industry, and the machinery industry have all been identified as sector that are sensitive to rent seeking activities (Basri and Hill 1996). Donation expenditures by large and medium scale manufacturing firms are recorded in the Industrial Statistics database published by the Indonesian Central Bureau of Statistics.

However, rent seeking is one of many purposes behind donations. The other objectives of donations include philanthropic objectives, social responsibility, and public relations. If donations are used for purposes other than rent seeking, then their variation across firms or across industries should be random and not systematically related to profits or production. In particular, we will not see a systematic relationship between industry’s total donation expenditure and the level of entry barriers in that industry. On the other hand, if donations are used as a rent seeking tool, we will see a positive relationship between the two variables. Donation expenditures in each industry are measured in real terms (deflated by the consumer’s price index) per unit of labour employed in the industry.

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5 The reason for this regulation is to avoid excess capacity.
The second determinant of the entry condition is foreign investment. Foreign investment has played a very important role in Indonesia’s manufacturing sector since the late sixties when the New Order government adopted a very friendly atmosphere for foreign investment. Although the degree of openness has fluctuated during the thirty years of the New Order regime, the government’s stance towards foreign investment has always been more favourable compared to imports. Foreign investors are better equipped to break down domestic entry barriers compared to new domestic producers, as they usually come with better technology and efficiency, and greater resources. As a consequence, they have a better chance of overcoming domestic entry barriers. On the other hand foreign firms may see the privileges that they get from government incentives as a way to generate monopoly rents from the local market. Therefore, their presence will not induce more domestic competition but merely replace the domestic oligopoly. The role of foreign firms is measured by their share in total industry output. An industry’s foreign firms output is obtained by multiplying the share of foreign ownership in each firm to the firm’s output and aggregating them for all firms. The ratio of this output to the total industry output is the share of foreign firms’ output.

Entry restrictions may be imposed by governments to protect state enterprises. State-owned enterprises play a very important part in the Indonesian economy, not only because their existence is sanctioned by the constitution, but also because they are used by government as an “agent” of economic development, playing such role as employment generator, and as a means for technology transfer. Because of their importance, many state enterprises are protected by government not only from foreign competition but also from potential domestic competition. Given this condition it would be reasonable to include the role of state enterprises in a particular industry as one of the variables determining the ease of entry. We measure the role of state enterprises by their share in total industry output. This is obtained in the same manner as the share of foreign firm in total industry output.

The model explaining variation in the degree of competition resulting from the entry condition is specified in the following form

\[ u_{it} = \delta_1 DNT_{it} + \delta_2 FOR_{it} + \delta_3 GOV_{it} + w_{it} \]  \hspace{1cm} (15)

where:  \( i = \) industry index ,  \( t = \) index of time  
\( DNT = \) donation expenses  
\( FOR = \) output share of foreign firms  
\( GOV = \) output share of state enterprises

The error term  \( w_{it} \) has the properties explained in previous section. The expected signs of the coefficients are given in Table 3.
Table 3 Expected sign of entry condition regression

<table>
<thead>
<tr>
<th>Variables</th>
<th>FOR</th>
<th>DNT</th>
<th>GOV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expected signs</td>
<td>+/-</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

The lower bound model applies to exogenous sunk cost industries only, but does not necessarily apply to the endogenous sunk costs industries. Therefore, the regression has to be run separately between the exogenous sunk costs industries and the high advertising and R&D intensity industries.

VII. Data and the empirical results

The data used in this study are mainly taken from the industrial statistics for large and medium size manufacturing industries published by the Indonesian Central Bureau of Statistics (BPS). The period covered by study is between 1986 and 1996. The regression analysis uses industry level data which are based on the four digit Indonesian Standard Industrial Classification (ISIC) code. Before 1990 the Indonesian manufacturing data published by the BPS are classified into the four digit ISCI code, and for 1990 and beyond the data is classified into five digit code. For consistency in estimation, the industry data for the period 1990 and beyond are reclassified into the relevant four digit code. Supporting trade data are obtained from BPS trade statistics and the BPS Input-Output Table. The data for effective rates of protection are taken from Fane and Phillips (1991), Wymenga (1991), and Fane and Condon (1996).

The software used to run the regression is the FRONTIER 4.1 package. It is one of the few software packages that allows estimation of frontier functions. The advantage of FRONTIER 4.1 is that it allows a more flexible assumption regarding the distribution of the $u_\alpha$ component of the error term. In particular it allows us to estimate equation 14 and equation 15 simultaneously. The program follows a three-step procedure to get the maximum likelihood estimates of stochastic function’s parameters. In the first step the OLS estimates of the function is obtained. In the second stage a two-phase grid search is conducted with the starting value set to the OLS estimates. In the last stage, the values selected in the grid search are used as the starting values in an iterative procedure.

The regression is run on two groups of industries, the low advertising (exogenous sunk costs) industries, and the high advertising (endogenous sunk costs) industries. The classification is based on each industry’s ratio of advertising expenditure to total output. Unfortunately the data on advertising expenditures are only available from 1992 to 1996.

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6 FRONTIER 4.1 is provided by Tim Coelli from the Efficiency and Productivity Analysis, the University of Queensland.
annual average advertising expenditure to sales ratio for all industry during this period was 0.77%. The lowest annual average advertising ratio, which stands at 0.0001%, is for the re-milled rubber industries, and the highest advertising expenditure ratio was for the drug and medicine manufacturing industry with an annual average of 11.31%. Following Sutton (1991 and Symeonidis (2000) we define an exogenous sunk cost industry as one which spends less than 1% of its output on advertising. According to Symeonidis the 1% cut-off point was chosen as it is commonly used to classify industries according to advertising or R&D intensity. Out of the 116 industries there are 98 industries that have an expenditure ratio of less than 1% and 18 industries that have advertising expenditure ratio more than 1%. The breakdown of these industries for each group by two digit ISIC is given in Table 4.

### Table 4. Breakdown of industry by advertising intensity

<table>
<thead>
<tr>
<th>ISIC</th>
<th>Descriptions</th>
<th>Low advertising</th>
<th>High advertising</th>
</tr>
</thead>
<tbody>
<tr>
<td>31</td>
<td>Manufacture of food, beverages and tobacco</td>
<td>24</td>
<td>10</td>
</tr>
<tr>
<td>32</td>
<td>Textile, clothes, and leather industry</td>
<td>16</td>
<td>-</td>
</tr>
<tr>
<td>33</td>
<td>Wood and wood products</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>34</td>
<td>Paper, paper products, printing, and publishing</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>35</td>
<td>Chemicals, petroleum, coal, rubber, plastic products</td>
<td>10</td>
<td>6</td>
</tr>
<tr>
<td>36</td>
<td>Non metallic mineral products</td>
<td>10</td>
<td>-</td>
</tr>
<tr>
<td>37</td>
<td>Basic metal industries</td>
<td>1</td>
<td>-</td>
</tr>
<tr>
<td>38</td>
<td>Fabricated metal, machinery, and equipment</td>
<td>17</td>
<td>2</td>
</tr>
<tr>
<td>39</td>
<td>Other manufacturing</td>
<td>5</td>
<td>-</td>
</tr>
<tr>
<td>Total industries</td>
<td>98</td>
<td>18</td>
<td></td>
</tr>
</tbody>
</table>

The summary of the mean and standard deviation of the five independent variables by industry’s advertising ratio for at the beginning of observation, the end of the observation, and the period in between, is given in Table 5 below. As shown in the table, the average level of concentration declines over the period of study and market size has increased. The decline in the effective rate of protection is the result of trade liberalization that occurred after 1986. The exogenous sunk cost industry (low advertising) has higher setup costs relative to the endogenous sunk costs industry (high advertising). The average minimum efficient scale measure increases from 1987 to 1990 but falls from 1990 to 1996. However, the changes in the minimum efficient scale are not statistically significant. The average setup costs have increased over the 10 years period being observed, but the increase is not statistically significant.

The data also shows that foreign firms tend to have a larger share in the high advertising industries, whereas government-owned firms tend to be in the low advertising

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7 Based on difference of mean test.
industries. This is consistent with the fact that most state enterprises are in the intermediate input industries rather than in consumer products’ industries.

Table 5. The descriptive statistics for four variables by advertising intensity, 1987, 1990, and 1996.

<table>
<thead>
<tr>
<th>Year</th>
<th>Advertising</th>
<th>CR4ADJ</th>
<th>MSIZE</th>
<th>MES</th>
<th>SETUP</th>
<th>ERP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>(22.13)</td>
<td>(3.765.001)</td>
<td>(13.33)</td>
<td>(11.180.000)</td>
<td>(199.09)</td>
</tr>
<tr>
<td>1987</td>
<td>Low</td>
<td>44.5</td>
<td>2.170.861</td>
<td>4.33</td>
<td>3.667.508</td>
<td>144.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(20.93)</td>
<td>(5.687.404)</td>
<td>(3.75)</td>
<td>(1.928.699)</td>
<td>265.8</td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>64.6</td>
<td>2.553.684</td>
<td>3.89</td>
<td>1.271.867</td>
<td>265.8</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(23.05)</td>
<td>(4.093.598)</td>
<td>(3.75)</td>
<td>(248.10)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>47.6</td>
<td>2.230.265</td>
<td>4.60</td>
<td>3.295.770</td>
<td>163.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(22.14)</td>
<td>(4.093.598)</td>
<td>(12.33)</td>
<td>(211.26)</td>
<td></td>
</tr>
<tr>
<td>1990</td>
<td>Low</td>
<td>39.74</td>
<td>3.583.172</td>
<td>5.47</td>
<td>8.592.677</td>
<td>161.21</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(21.14)</td>
<td>(5.528.048)</td>
<td>(15.10)</td>
<td>(199.09)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>63.21</td>
<td>4.293.751</td>
<td>4.33</td>
<td>1.718.168</td>
<td>285.27</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(20.40)</td>
<td>(8.585.111)</td>
<td>(5.00)</td>
<td>(248.10)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>45.45</td>
<td>3.693.434</td>
<td>5.29</td>
<td>7.525.943</td>
<td>180.80</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(22.67)</td>
<td>(6.061.211)</td>
<td>(14.01)</td>
<td>(211.26)</td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td>Low</td>
<td>38.98</td>
<td>9.062.377</td>
<td>5.19</td>
<td>9.302.766</td>
<td>49.16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(20.54)</td>
<td>(13.500.000)</td>
<td>(9.28)</td>
<td>(121.30)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High</td>
<td>62.34</td>
<td>7.687.570</td>
<td>10.82</td>
<td>2.683.190</td>
<td>111.17</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(21.96)</td>
<td>(13.100.000)</td>
<td>(15.04)</td>
<td>(150.99)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>42.61</td>
<td>8.849.045</td>
<td>6.06</td>
<td>8.275.590</td>
<td>58.78</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(22.34)</td>
<td>(1.340.000)</td>
<td>(10.50)</td>
<td>(127.63)</td>
<td></td>
</tr>
</tbody>
</table>

Note: figures in parenthesis are the standard deviations
1) ERP for 1989, 2) ERP for 1995

The regression analysis is conducted separately for exogenous sunk cost and endogenous sunk costs. For the exogenous sunk cost industries the regression is run for six industry groups and for all the total industries. The six industry groups are: food and beverage (ISIC 31), textile (ISIC 32), wood and paper product (ISIC 33 & 34), chemical products (ISIC 35), non-metallic mineral products (ISIC 36), and fabricated metal products (ISIC 37 & 38). For the endogenous sunk cost (high advertising) industries the regression is run for the total industry due to the limited number of observations, and because we assume that these industries are bound by their similarity in advertising expenditure rather than by industry characteristics.

The stochastic frontier model defined by equation 14 and 15 contains six $\beta$-parameters, three $\delta$-parameters, and three additional parameters associated with the distribution of the error terms $v_i$ and $u_i$. The three parameters are: $\sigma_u^2$ which is the variance of $u_i$, $\sigma_v^2$ which is the variance of $v_i$, and $\gamma$ which is the ratio of $\sigma_v^2$ to the sum of the two variances. The twelve parameters are estimated using maximum likelihood function. The results of the regression are given in Table 6 below.

We begin our analysis by looking at the appropriateness of using the stochastic frontier function to estimate the lower bound concentration curve for the sunk costs industry.
The likelihood ratio test for one-sided error (\(H_0: \gamma=0\)) is rejected for all industry groups. This result indicates that the traditional average response function (i.e. obtained by least squares method) is not an adequate representation of the data. In other word the result shows that the frontier approach is the correct specification of the relationship between market concentration and the independent variables. It is a lower bound relationship.

The model predicts that the market size (LMKSIZE) has a negative effect on lower bound concentration. This hypothesis is supported by the results. The signs of the coefficients for the market size variable are negative and statistically significant for all industries except non-metallic mineral products (ISIC 36) and chemical products (ISIC 35). The effect of market size on lower bound concentration for the latter two industries is positive but it is not statistically significant. This result has the feature of the endogenous sunk cost industry where an increase in market size does not effect market concentration. However, since both industries are low advertising cost industries, advertising expenditures cannot explain this finding. One possible explanation is that because the setup cost in these industries is large, a firm will need to get approval from the government, through the Investment Coordinating Board, to enter or expand. There may be costs associated with “convincing” the Board to approve the investment, and these costs increase with market size. As a result when market expands, entry costs increase making it less attractive for potential entrants to enter.

The setup cost (LSETUP) and minimum efficient scale (LMES) are predicted to have positive impact on the lower bound market concentration. The regression result supports this assertion. The coefficients for setup cost are all positive and statistically significant. The relationship between the minimum efficient scale variable and the lower bound concentration is positive and statistically significant in every case except for non-metal mineral products (ISIC 36).

The effect of the trade and industrial policy regime, represented by the dummy variable DTRDRGM, on market concentration is not obvious. The import-as-market-discipline hypothesis predicted that trade liberalization will cause an increase in the intensity of domestic price competition. If the hypothesis holds, it will be reflected by an increase in the lower bound concentration because tougher competition will reduce profit and will force firms to either exit or merge. On the other hand, because the Indonesian trade liberalization emphasized the promotion of exports rather than promoting domestic competition, it is possible that the policy could have little effect on the domestic competitive environment.

The signs of the coefficient for the trade liberalization dummy variable are all positive except for the the non-metallic mineral products industry (ISIC 36). For industries
with positive coefficients the impact of trade regime on lower bound concentration is consistent with the import-as-market-hypothesis hypothesis and the argument that trade liberalization industry in Indonesian has implicitly functioned as a competition policy for the domestic economy (Bird 1999; Hill 1999). However, it is statistically significant only in the food industry (ISIC 31) and textile industry (ISIC32), indicating that although trade liberalization has increased domestic price competition, its effect was not statistically significant in most industries. Again, this finding can be explained by the specific feature of the Indonesian trade liberalization which emphasized the promotion of exports. Protection for import substitution industries was maintained as long as this protection did not impede exports. Therefore, the impact of liberalization on these industries has been limited, as shown by the insignificant coefficient of the trade regime variable.

The sign of the trade regime coefficient (DTRDRGM) is negative but not statistically significant for the non-metallic mineral industry (ISIC 36). The negative sign, although insignificant, deserve some elaboration since it contradicts the theory. It indicates that after trade was liberalized price competition tended to soften in this industry thus inducing entry and lowering the lower bound concentration. The likely reason for obtaining this inconsistency is because the non-metallic industry consists of products that would be characterized as nontraded goods like cement products. For these industries, import competition is likely to have little impact on the pricing behaviour of domestic oligopoly. Furthermore, the government had taken a very lenient attitude towards collusive pricing in these industries and trade liberalization did not change the government’s stance on this matter. A good example for this claim is the cement industry where price was effectively set by an informal cartel organized by the industry trade association. The collusive pricing was practised with the support of government, and the support continues despite the change in trade regime (Maarif, 2001). The high profit associated with collusive pricing and high demand for cement provided a strong incentive for entry which in turn explained the drop in the level of concentration.

The effect of trade policy on lower bound market concentration is also determined by the degree of import protection, which is measured by the effective rate of protection (ERP). The import-as-market-discipline hypothesis predicts that the market power of oligopolies will fall as they are exposed to greater import competition, which will force some firms to exit and others to merge. As a consequence we will see the lower bound concentration increase as the effective rate of protection falls. The result shows that the effective rate of protection has a negative effect on lower bound concentration for all industries except the textile industry (ISIC32) and chemical products industry (ISIC35) where it is positive but insignificant. This result seems to confirm the hypothesis, however all of the coefficients are statistically
<table>
<thead>
<tr>
<th>VARIABLES</th>
<th>Low advertising industries</th>
<th>High Advertising</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ISIC 31 (Food)</td>
<td>ISIC 32 (Textile)</td>
</tr>
<tr>
<td>CONSTANT</td>
<td>-3.3963 (-4.7716)**</td>
<td>1.6864 (3.0526)**</td>
</tr>
<tr>
<td>DTRDRGM</td>
<td>0.2535 (1.8673)*</td>
<td>0.2352 (2.0163)*</td>
</tr>
<tr>
<td>MKSIZE</td>
<td>-0.1761 (-3.7550)**</td>
<td>-0.3500 (-11.1669)**</td>
</tr>
<tr>
<td>SETUP</td>
<td>0.2557 (4.8884)**</td>
<td>0.8202 (3.8726)**</td>
</tr>
<tr>
<td>MES</td>
<td>0.3784 (6.5848)**</td>
<td>0.1552 (2.5878)**</td>
</tr>
<tr>
<td>ERP</td>
<td>-0.0003 (-0.5557)</td>
<td>0.0005 (0.9914)</td>
</tr>
<tr>
<td>PDR</td>
<td>0.5188 (5.5045)**</td>
<td>-0.0964 (-1.9970)</td>
</tr>
<tr>
<td>GOV</td>
<td>0.0087 (0.6378)</td>
<td>-1.7930 (-1.0735)</td>
</tr>
<tr>
<td>FOR</td>
<td>-0.0138 (-0.8341)</td>
<td>-0.1536 (-1.7404)**</td>
</tr>
<tr>
<td>DNT</td>
<td>0.0062 (0.2878)</td>
<td>0.0401 (1.1915)</td>
</tr>
<tr>
<td>$\sigma^2 = \sigma_u^2 + \sigma_e^2$</td>
<td>2.6101 (5.8680)**</td>
<td>0.6582 (3.8683)**</td>
</tr>
<tr>
<td>$\gamma = \sigma_u^2 / (\sigma_u^2 + \sigma_e^2)$</td>
<td>0.9124</td>
<td>0.5808</td>
</tr>
<tr>
<td>LR</td>
<td>-307.00</td>
<td>-133.2119</td>
</tr>
<tr>
<td>One-sided test ($\chi^2$)</td>
<td>12.88**</td>
<td>10.51*</td>
</tr>
</tbody>
</table>

Number in parentheses are t-statistics
** ) significant at 1%, * ) significant at 5%, + ) significant at 6%
insignificant except for wood and paper products industry (ISIC 33&34). This indicates that exposure to import competition has had little impact on domestic price competition. Although the finding does not find support for the import-as-market-discipline hypothesis, it is consistent with previous finding by Melo and Urata (1986) using Chilean manufacturing data which find that import has insignificant effect on price-cost margin.

The second part of the concentration function is the deviation of actual concentration from the lower bound. It measures the intensity of competition brought about by the entry condition in manufacturing industries. We use donation expenditures, foreign ownership, and government ownership as independent variables that explain the observed variation in entry conditions across industries.

Donation expenditures have a very significant impact on the entry condition of the wood and paper products (ISIC 33 & 34), and of the chemical products industry (ISIC 35). The wood and paper products industry in Indonesia is a very lucrative industry as Indonesia, at least during the period of study, had some market power in the world market for hardwood products. Entry into this industry depends heavily on obtaining government permits (concessions) to exploit forest wood. The license carries a very high economic rent and therefore became the reason for rent seeking activities. The trade association in this industry, APKINDO, was very influential. Not only did APKINDO have the power to determine price and allocate market shares through its joint marketing body, it can also advise the government to revoke producer’s license if it violates the price and marketing arrangement set up by the joint marketing body. More importantly APKINDO’s decisions are supported by the government. The result indicates that donation expenditure is an effective tool for this industry to influence government entry policies in this industry to ensure the economic rents.

Foreign investment is expected to increase domestic competition. The results for the textile industry (ISIC 32) and for the fabricated metal products industry (ISIC 37-38) support his hypothesis. In both industries the coefficient of the “foreign-firm share” variable (FOR) is negative and statistically significant which indicate that a larger presence of foreign firms tend to bring down entry barriers and thus bring the concentration level closer to the lower bound. However, for reasons explained earlier, the presence of foreign firms can also reduce competition if the foreign firms replace the domestic oligopoly rather than discipline their anti-competitive behaviour. This seems to be the case for the chemical products industry (ISIC 35) and for the wood and paper products industry (ISIC 34) where the coefficients are positive and significant. In these industries imports join the pricing strategy of the domestic oligopoly.
State enterprise plays a very important role in Indonesian manufacturing industry. Although there are about 500 state enterprises (fully owned or joint venture) in manufacturing industry, they play a different role in different industries. These enterprises were established for a number of reasons such as to correct market failure, as a source of government revenue (particularly those belonging to regional government), and to support the government’s economic development agendas. Some of the state enterprises are foreign firms that were nationalized in the 1950s. Depending on the objective of their creation, state enterprises have different level of importance to the government. Those that are established to support economic development agendas are generally more important to the government than those that are established for revenue sources. The importance of state enterprises is measured by the contribution of these enterprises to the total production in the industry where they are operating. The majority of state enterprises (approximately 29%) are in the food products industry (ISIC 31), however the contribution of these enterprises to the total production of this industry is only six percent. There are 90 state enterprises in the chemical product industry (ISIC 35) with an average contribution of 15 percent total industry production. The number of state enterprises in the fabricated metal products industry (ISIC 38) is 45 with an average contribution of 15 percent to total industry production. On the other hand there are only 2 state enterprises in the metal products industry (ISIC 37) but they contribute about fifty percent of the industry’s total production. Based on these figures we maintain that the role of state enterprises in the latter three industries (ISIC, 35, 37 and 38) is more important to the government than their role in the former. Therefore, we would expect entry protection to be higher in these three industries.

The result shows that the coefficient for the “state enterprises share” variable (GOV) is positive and statistically significant in the chemical product industry (ISIC 35) and in the basic and fabricated metal product industries (ISIC 37 & 38). However, the coefficient of this independent variable is not significant in the other industries.

A separate regression is run for the high advertising industries since the theory predicts a different outcome for the relationship between market size and market concentration in this industry. The result of the one-sided test (H₀ : γ=0) is rejected which means that the stochastic frontier method is more appropriate than the least squares method in estimating the relationship between the six independent variables and the concentration level. The theory predicts that in the high advertising (endogenous sunk cost) industry, lower bound market concentration may not fall with higher market size. There may still be a negative relationship between the two variables when the market is still relatively small but the relationship may not prevail as the market size becomes relatively large. The results for the 18
high advertising manufacturing industries show that the market size has a negative impact on lower bound concentration. This indicates that the market size for the advertising intensive industries is relatively too small for the firms to use advertising as the main tools of competition. As can be seen from Table 5 the difference in market size between low advertising and high advertising industries are statistically different, and from 1990 to 1996 the market size of the high advertising industries grew less than the low advertising industries.

The trade liberalization policy significantly increased domestic price competition for the high advertising industry. This is indicated by the positive and statistically significant value of the trade regime dummy variable coefficient. The tougher price competition brought about by trade liberalization forced domestic firms in this industry to either exit or merge and thus, shifting the lower bound concentration curve upward. However, the coefficient for the effective rate of protection is positive and significant which shows that lower protection tends to soften the intensity of price competition, thus reducing the incentive for firms to enter. This result contradicts the import-as-market discipline hypothesis. One possible explanation for this contradiction is that the increase in price competition brought about by higher imports is countered by an increase in advertising expenditure. Since advertising expenditure is a sunk costs, the increase in advertising implies a smaller number of firms can be supported by the market.

With regards to the factors that explain the deviation of the concentration level from the lower bound curve, the result shows that the coefficient of foreign firm’s share and donations are both positive and significant. Since the deviation measure the degree of entry barriers, the results indicates that entry barriers tend to be high when there is an extensive presence of foreign firms. The result also shows that rent seeking, as measured by the size of donation expenditures, is an effective means for creating high entry barriers. On the other hand because state own enterprise plays an insignificant role in the high advertising industry, it is insignificant in creating barriers to entry.

VIII. Conclusion

At the beginning of this paper we asked the question whether trade liberalization can increase domestic competition. It was argued that due to the specific nature of Indonesian trade liberalization, that is its emphasis on export promotion, the conventional hypothesis about the effect of trade liberalization on domestic competition may not apply. It was also argued that due to the extensive government role in the economy and to the nature of the political system, rent seeking and the presence of state enterprises could have a strong impact on domestic competition through their influence on the entry condition. We used the lower
bound function to test these hypotheses. The lower bound function, which has been used in previous studies with similar objective, was estimated using the stochastic frontier approach.

Although the model used in this paper is unconventional, it has successfully supported the hypotheses proposed in this paper. The results of the regression are consistent with the prediction of the lower bound theory proposed by Sutton. In cases where the results are inconsistent with the theory, we have provided a logical explanation for the inconsistency. With regard to testing the effect of trade liberalization on domestic competition, we have found support for the proposition that the Indonesian trade liberalization has not contribute significantly to domestic competition. With regards to the disciplining effect of import we could not find convincing support for the conventional hypothesis that exposure to imports competition increases domestic competition. We found that although a reduction in trade restrictions do generally increase domestic competition, they are not statistically significant. However, these findings are consistent with the empirical findings of some previous research on the same issue.

The results also support the assertion that rent seeking and the presence of state enterprises tend to increase entry barriers. We have found that in industries identified to be sensitive to rent seeking behaviour the proxy for rent seeking expenditure contributes to higher entry barriers, and thus soften domestic competition. The results also show that entry barriers tend to be higher in industries where state enterprises play a significant role. Lastly, we have also found that the presence of foreign firms do not always contribute to the enhancement of domestic competition.

The findings in this paper have a number of policy implications for Indonesia. First, the role of competition policy can not be entirely replaced by trade liberalization since the idea that international trade induces competition hinges on how trade liberalization policy is designed. Second, the popular notion in Indonesia that state enterprises are effective sources of government revenue and therefore should not be privatized has little merit. In a rent seeking society like Indonesia, state enterprise is more likely to be exploited by rent seekers, and therefore tend to be very inefficient. Furthermore, state enterprises are inclined to impede competition. Third, given Indonesia’s history of nepotism, cronyism, and weak governance problem, less government interference in the economy is always better.
REFERENCES


