

# Industrial Concentration and Profitability in the Korean Manufacturing Sector

Kap-Young Jeong\*

## I. Introduction

Empirical research on industrial organization for developing countries has received little attention in the literature. This in part stems from the fact that data on market structure and performance is usually not available for developing countries, and if it is available, it is often of questionable accuracy. The neglect also results partly from the lack of interest from development economists and policy makers who may emphasize economic growth even at the expense of market distortions.

In fact, empirical investigation into the market structure and economic performance for a developing economy is a complex task. Not only is there little data, but development is often accompanied by rapid changes in economic structure which may alter the elements of market structure and performance. Also, for developing countries and newly industrialized countries (NICs), there is generally a bigger export/import problem in the study of structure-performance. This makes it difficult to capture the determining forces of concentration and influencing factors on profitability.

The objective of this study is to empirically test the validity of traditional structure-performance hypotheses for the Korean manufacturing sector. The primary traditional structure-conduct-performance hypothesis states that performance in an industry depends upon the conduct of sellers, and that conduct in turn depends on the structure of the relevant market. Since in practice much conduct cannot be observed, common tests look to the link between monopoly structure and monopoly performance.

The market structure forms the basis for conduct that includes actual pricing policies including conspiracy, mutual forbearance, and price leadership as well as secret price cutting and aggressively competitive pricing at "the going price" etc. Conduct, in turn, affects firms' revenue and cost as well as influencing profitability and other measures of performance. Economic performance can also be affected by other factors such as entry barriers, foreign competition, and industrial policy.

---

\*Department of economics, Yonsei University.

Moreover, institutional features and motivation of business enterprises might constitute fundamental influences on their economic performances. Indeed, numerous statistical tests for developed countries support the hypothesis that seller concentration plays an important role in determining the performance of firms. Nevertheless, a few studies have been only conducted for the developing countries.

In testing the traditional hypothesis, most studies were undertaken by using the ordinary least squares regression with single equation models. Some authors, however, have suggested that important simultaneities may be entailed in the structure-conduct-performance model and that these variables might be determined simultaneously rather than individually. More recently, there have been increasing concerns with both simultaneous and recursive systems in explaining the model. That is, the endogenous elements of market structure are determined not only by the truly exogenous variables, but also by the elements of past market conduct. Empirical research on dynamic and recursive systems has also grown along with this line of developments of the traditional paradigm.<sup>1)</sup>

In this study we will investigate the determinants of profitability, the validity of the market power hypothesis, and the limit price hypothesis for an open developing economy. In addition, the influences of trade variables such as exports and imports on profitability will be also examined. Following this section, our basic model for empirical tests is presented. The third section presents the empirical results and the conclusions are summarized in the last section.

## II. The Basic Model

Expected concentration in period  $t$  can be written as:

$$CR(t) = f[CR(t-1), B(t), GRO(t)] + u(t-1)$$

where  $CR(t)$  and  $CR(t-1)$  are concentration in period  $t$  and in  $t-1$ , respectively,  $B(t)$  is entry barriers in  $t$ , and  $GRO(t)$  is industry growth in  $t$ .  $CR(t-1)$  is the initial starting point for  $CR(t)$ , but further, higher  $CR(t-1)$  will tend to lead to higher prices and hence greater expected entry for any  $B(t-1)$  and  $GRO(t-1)$ . If barriers are stable over time, then  $CR(t)$  should tend to converge to a function of barriers and growth in period  $t$ , and actual entry in  $t-1$  along with other exogenous variables. Entry ( $ENT$ ) in  $t-1$  affects profits ( $PR$ ) in  $t-1$  as well as  $CR(t)$ . Entry in  $t-1$  will affect

---

1) For example, Masson and Shaanan (1982) empirically tested the stochastic and dynamic elements of Kamien & Schwartz (1971), Gaskins (1971), and Baron (1973).

profits in period  $t$  only indirectly through  $CR(t)$ . Thus, if  $ENT(t)$  affects  $PR(t)$  and  $ENT(t-1)$  determines  $CR(t)$ , then the entry link between  $CR$  and  $PR$  is recursive.

The basic structure of our model is based upon the above framework. We assume that current concentration is partly a function of entry in the past periods and the past entry in turn is determined by profits in earlier periods and growth of demand along with other variables. As in the numerous studies on other countries, profitability is a function of concentration in our model. But differently from others, our concentration/profits structure is recursive through an entry process;  $ENT(t-1)$  determines  $CR(t)$ , and  $CR(t)$  and  $ENT(t)$  affect profits. Potential entrants may respond to profits by entering in  $t$  which will determine  $CR$  in  $t+1$ . We shall also assume that profit rate is a linear function of concentration, entry, and trade variables. Hence, for a typical industry, we can specify our profit equation as:

$$PR(t) = a_0 + a_1 CR(t) + a_2 B(t) + a_3 GRO(t) + a_4 ENT(t) + a_5 EXS(t) + a_6 IMS(t) + u(t)$$

The variables are defined as:

- $PR(t)$  = industry profit rate in period  $t$
- $CR(t)$  = seller concentration ratio in  $t$
- $B(t)$  = entry barriers in  $t$
- $GRO(t)$  = industry barriers in  $t$
- $GRO(t)$  = industry growth rate in  $t$
- $ENT(t)$  = entry rate in  $t$
- $EXS(t)$  = export-sales ratio in  $t$
- $IMS(t)$  = import proportion of domestic market in  $t$
- $u(t)$  = error term

For a more complete system we should extend the model to the concentration and profit equations. Also a sufficient condition for the recursive system may be examined by evaluating the covariances among error terms of each equations. The scope of this paper is, however, confined only to the profit equation.

There are two sources of simultaneity within the profit equation: the simultaneity of concentration and profit, and the simultaneity of profits and imports.<sup>2)</sup> We handle the problem of the possible concentration-profit

---

2) The simultaneity of the advertising-sales ratio and profits is a subject of continuing debate. For recent arguments, see Martin (1979) and Geroski (1982). A Wu test based upon a conventional advertising equation on our data also supports that advertising can be treated as an exogenous variable.

simultaneity by recognizing that our model is in recursive structure. We treat  $CR(t)$  as predetermined variable by  $ENT(t-1)$  and other exogenous variables when determining  $PR(t)$ . Similarly we assume that imports also respond to profits with some lag. Martin (1979) suggested the simultaneity of advertising and profits, but in our model, as in most other studies, advertising is treated as an exogenous variable.

In the remainder of this section, we examine each variable determining profitability.

### 1. Concentration

Consider an industry with  $n$  firms producing a homogeneous product. The profit function of firm  $i$  is:<sup>3)</sup>

$$\Pi_i = P \cdot q_i - C_i(q_i) \quad (1)$$

where

$$p = P(Q)$$

$$Q = q_1 + \dots + q_n$$

$$C_i(q_i) = \text{cost function of firm } i$$

Neglecting the problems of potential entry at present, the first order condition for profit maximization is:

$$(d\Pi/dq_i) = P + q_i P'(Q) (dQ/dq_i) - C'_i(q_i) = 0 \quad (2)$$

$$\text{where } (dQ/dq_i) = 1 + (\sum q_j / dq_i) \quad (3)$$

$$= 1 + \lambda_i \quad (4)$$

$\lambda_i$  represent firm  $i$ 's conjecture as to its rival's response to a change in its output in a non-cooperative Stackelberg model. Substituting (4) into (2) yields

$$P + q_i P'(Q) (1 + \lambda_i) = C'_i(q_i) \quad (5)$$

Incorporating the price elasticity of industry demand into (5), the equilibrium condition for the firm is

$$P[1 - (S_i/n)(1 + \lambda_i)] = C'_i(q_i) \quad (6)$$

$$\text{where } n = -(P/Q)(dQ/dP), \quad S_i = (q_i/Q)$$

Assume that marginal costs are equal to average costs. By multiplying (5) by  $q$  and summing over the  $n$  firms in the industry, we have:

3) The theoretical models on concentration-profit relationship are mainly developed by Saving (1970), Cowling and Waterson (1976), and Clarke and Davies (1982).

$$[\sum P \cdot q_i - \sum C'_i(q_i) \cdot q_i] / PQ = [-(\sum S_i^2)(P'(Q)Q^2) / PQ][1+u] \tag{7}$$

or  $(TR - TC) / TR = (H/n)(1 + u) \tag{8}$

where  $U = (\sum \lambda_i q_i^2) / \sum q_i^2$  or a weighted conjectural variation term,  $H$  is the Herfindahl index,  $TR$  is the total revenue, and  $TC$  is the total cost of the industry. This indicates that industry average price-cost margin or profitability is positively related to the Herfindahl index ( $H$ ), and negatively related to the elasticity of the industry demand.

Following Clarke and Davies' (1982) approach, the degree of collusion can be also incorporated into the model. Suppose each firm believes every other firm will react to its output change as follows:

$$(dq_j) / q_j = \alpha (dq_i / q_i) \text{ for all } j \neq i \text{ and for all } i \tag{9}$$

The parameter  $\alpha$  represents the degree of implicit collusion and is assumed to be fixed in each industry. If the value of  $\alpha$  equals to 0, each firm expects that all other firms will react to output change proportionately so as to keep the same market share. A low value of  $\alpha$  implies that rivals will not react by as much proportionately, while perfect collusion is approached as  $\alpha$  goes to 1. Under this assumption, the equilibrium condition (6) and (8) can be rewritten as:

$$P [ 1 + (1/n)(S_i - \alpha S_i + \alpha) ] = C'_i(q_i) \tag{10}$$

$$(TR - TC) / TR = (\alpha/n) + (1 - \alpha) H/n \tag{11}$$

This condition indicates that the industry gross profit-revenue ratio depends on the degree of collusion ( $\alpha$ ), the demand elasticity ( $n$ ), and the concentration index. As an extreme case, if all firms behave under the Cournot model, then this results in a non-cooperative Nash equilibrium as:

$$(TR - TC) / TR = H/n \tag{12}$$

Assuming that the demand elasticity is fixed in the short run, the concentration index ( $H$ ) is the determinant of the ratio of price-cost margin to the revenue. For a general case ( $0 < \alpha < 1$ ) and assuming that higher concentration leads to high degree of collusion ( $\partial \alpha / \partial H > 0$ ), it is clear that industry profitability is positively related to  $\alpha$  as well as concentration.

This model can be extended to incorporate import penetration of domestic market by foreign producers. If domestic and import products are homogeneous, the profit function of domestic firm  $i$  becomes:

$$\Pi_i = P(Q_d + M) q_i - C_i(q_i) \tag{13}$$

where  $P = P(Q) = P(Q_d + M)$

$Q_d =$  domestic sales by domestic producers

$M =$  imports

Following the same procedure as above, the profit-maximizing condition for firm  $i$  is

$$P [ 1 + (1/n)(q_i/Q_d)(Q_d/(Q_d + M)) ] = C'_i(q_i) \quad (14)$$

Aggregating over  $n$  firms both sides, we have

$$(TR - TC)/TR = (H_d/n)(1 + u + m)$$

where  $H_d =$  the Herfindahl index of domestic concentration

$$m = M / (Q_d + M)$$

This implies that import share has a negative influence on the profitability of industry.

Therefore, under the assumption of no threat from potential entry, profit-maximizing behavior leads to the conclusion that profitability is positively related to concentration and to the degree of industry collusion, while the demand elasticity is negatively related to profitability. Furthermore, the degree of "agreement" or collusion is also expected to be positively related to seller concentration.

## 2. Entry Barriers

The threat of potential entry has been recognized as an important constraint on the incumbent firms' pricing behavior. In order to maximize its present value, a monopolistic firm should take into account the possibility that its behaviour and the consequent supernormal profits may attract new entrants into the market. This indicates that profit must be maximized subject to likely entry responses. It has been generally recognized that the higher barriers to entry, the greater the established firms' ability to raise price above long-run average cost without inducing new firms into the industry.

Bain's (1956) static limit price model suggests that monopolists with high entry barriers will charge an entry forestalling price rather than a short-run profit-maximizing price which would encourage entry. Monopolists facing lower barriers, however, will not limit price, because their opportunity cost of short-run profits foregone to forestall entry is great. Recent dynamic/stochastic models (Baron (1973), Kamien & Schwartz (1971),

Gaskins (1971)) predict instead that firms will often select an intermediate "optimal limit price," setting price between the entry forestalling price and the short-run profit maximizing price. The relationship between entry barriers and the optimal profits is predicted in different fashions. The Gaskins' model predicts a continuous decrease of optimal profits as entry barriers increase, while other models indicate that optimal profits may be a declining function of barriers in some ranges, but will be rising for higher barriers. Nevertheless, the theory of limit pricing does not provide a unanimous conclusion on the relationship between entry barriers and optimal profits. The pattern of relationship between entry barriers and profits have been a subject of continuing debates.

Following the classical Bain's (1956) treatise, three types of entry barriers are incorporated in the model: minimum efficient scale (MES), absolute capital cost (CAR), and product differentiation measured by the advertising sales ratios (ASR).

Since direct estimates of MES are not available for the Korean manufacturing industries, the average plant size at the midpoint of an industry's output, referred to as the Florence median or Weiss' measure, is used in this study. In the previous studies on other countries the proxy was measured as percent of "the size of the industry," usually estimated by the value of total shipment (VS). In an open economy, however, exports and imports make the size of the domestic market an imprecise concept. The measured MES based upon the unadjusted industry size for the trade variables could have no significant influence as an entry barrier. In this study the size of industry is adjusted for exports and imports to reflect "the actual size of domestic market" defined as:  $VS - X + M$ .

Entry will not, however, always occur on a large scale basis. An entrant often begins with a small plant that is clearly undersized compared to MES plants. This implies that the entrant often produces at higher average cost levels than those of the established firms. The difference in average costs is naturally dependent upon the shape of the long-run cost curve. The flatter the cost curve, the smaller is the disadvantage associated with small-scale entry, and vice versa. For example, if an average cost is steeply sloped below MES, substantial cost disadvantage can be associated with small-scale production. On the other hand, little disadvantage to a small-scale plant is present when the average cost is relatively flat. Hence, by failing to reflect the shape of average cost curve in the lower range of the output distribution, the MES proxy might ignore the degree of difficulty involved in successfully operating suboptimal plant sizes. Particularly in view of the Korean economy, where the persistence of a large number of small firms has been one of the significant characteristics of the industrial sector, it is

essential that the MES measure reflects the extent of the cost disadvantage associated with a small-scale plant. Taking these shortcomings of MES proxy into account, a measure of the cost disadvantage ratio (CDR) suggested by Caves et. al. (1975) is used. Under the assumption that all plants in each industry produce the same products with similar production functions, and that the capital-labor ratio does not vary too much with scale, the value added per worker can be viewed as an indicator of productivity or an inverse measure of costs. Hence, CDR is defined as the ratio of value added per employee in small plants relative to the value added per employee in large plants. A high value of CDR implies that the cost disadvantage of small plants is low, while a low value indicates substantial disadvantage for the small plants. If the value of CDR is 1, there would be no cost disadvantage associated with small-scale plants. Since interest here is in barriers to entry caused by economies of scale, the value of CDR is constrained to take no value higher than unity in our study. After estimating CDR and MES, we actually use a specific measure of scale-related entry barrier, TCM, defined as MES times (1-CDR). TCM is assumed to reflect the interactive effects of MES and CDR and assigned to take value of MES adjusted for the cost disadvantage effects (CDR).

Besides scale-related entry barriers, product differentiation has also been recognized to create an entry barriers in many studies. Product differentiation may be genuinely inherent in the product itself, or it may be created in the consumer's mind by promotional measures such as advertising, even when the actual differences are trivial. This is more likely to happen in consumer goods rather than in producer goods. Advertising can deter entry in two ways. Since advertising is subject to economies of scale, it represents a capital cost and has long lasting effects. Advertising can also create brand royalty that constitutes an entry barrier. Therefore, a positive relationship is expected between advertising and profitability. In previous studies, the advertising-sales ratio has been measured by the ratio of advertising expenditures to all industry shipment including exports. For the U.S. and U.K. this approach may be appropriate. But where exports are large, and the focus is on competition in the domestic market, we suggest instead the following measure:

$$ASR = A / (VS - X)$$

where A is advertising expenditure, VS is the value of shipment including export, and X is exports. Our measure reflects the advertising intensity of domestic firms based on their domestic sales.

The standard method for measuring the capital variable is by estimating the capital requirements for a plant of minimum efficient scale. Since MES

has already been estimated, the initial capital cost for an entrant (CAR) of a plant of MES may be estimated by multiplying MES by total industry assets.

We also incorporate the actual entry rate in period  $t$ ,  $ENT(t)$ , in the profit equation. As discussed in the previous section,  $ENT(t)$  is partly determined by the profit rate and concentration in the past period. It also captures the effects of other entry barriers not reflected in MES or CAR. Since an entry raises a competitive pressure to the incumbent firms, a negative effect is expected on profit rates.

### 3. Growth of Demand

The effect of demand growth on profit rates can be explained by many factors such as firms' pricing behavior, reactions of potential entrants, and the capacity adjustment in the industry. Theoretical predictions do not provide a unanimous conclusion with regard to the effect of growth on profit rates.

Higher growth of demand means higher profits in many models. This is especially true of unanticipated growth, or growth when there are adjustments costs. An exception may occur, however, in entry deterrence models. For any profit level, expected demand growth could make entry more attractive. If growth is high, then it may be more difficult to keep out entry, because the optimal limit profit level may (but need not) fall with growth. This hypothesis permits the possibility of a negative effect of growth on profits.

In a developing economy, rapid growth might bring other effects such as microeconomic disequilibrium. For example, as a result of explosive industrial growth, a developing economy often faces the situation that it is profitable for all industries at the margin to expand production. Under this condition, the profit rates of industry might primarily depend on how fast firms can adjust their production capacity. For industries that face long adjustment processes in expanding capacity, short-run profits might be substantial even if the industries are potentially competitive enough to eliminate windfalls in the long run. On the other hand, industries adjusting more quickly may accrue far lower windfalls from the rapid growth of demand, even if concentration is high.

Therefore, existing models indicate that profit rates could move in either direction: Profits could increase or decrease during the growth periods. There is no clear indication which of these two effects will be dominant, although many empirical studies support a positive relationship.

#### 4. Trade Variables

If foreign firms face no entry barriers, then import penetration may be linked to the pricing behavior of domestic firms. As market power increases, the firms tend to act more like a dominant firm, and as a result, both domestic profit rates and imports will rise. On the other hand, for any degree of market power, a outward shift of import supply curve or willingness to import more at any price would lead to a decline in profits and rise in imports.

To fully analyze the effects of imports, one needs to consider imports as endogenously determined by a demand for imports (as a function of domestic prices) and a supply of imports (as a function of foreign production costs, exchange rates, tariffs, etc.) Without a complete model of the supply side of imports to Korea, one cannot a priori predict whether imports and profits will be positively or negatively correlated.

If domestic firms are protected from import competition by some forms of trade barriers, *ceteris paribus*, they will be better able to exploit any domestic market power. In practice, potential foreign entrants usually face specific entry barriers such as tariffs, transportation costs, and quota restriction. As discussed earlier, however, the effects of those entry barriers on profit rates for the limit pricing firms move in either direction. Caves (1980) argues that theoretically the elasticity of import supply at domestic equilibrium prices is a better indicator of import competition than a simple measure of import share. However, two import supply curves, even with the same elasticity, can result in far different effects.<sup>4)</sup>

We use the proportion of imports to domestic sales (IMS) in the model defined as:

$$IMS = M / (VS - X + M)$$

where *M* is imports, *VS* is total value of shipments of domestic firms, and *X* represents exports of domestic firms. The effect of exports on profitability is also a subject of continuing debate. Khalizadeh-Shrazi (1974) and Pugel (1978) found a positive relationship between exports and the price-cost margins for U.K. and U.S. manufacturing industries, respectively. Pugel argued that U.S. firms have strong comparative advantages based upon high-technology, which can confer worldwide oligopolistic advantages. Pugel (1980) and Jacquemin, Ghellink, and Huveneers (1980) found insignificant or weak support for a positive relationship.

A firm's profit rate in an open economy can be thought of as a weighted average of profit rates from domestic and foreign markets. This can be

4) For the illustration of this case, see Jeong (1985).

written as:

$$PR = [ (VS - X) / VS ] \cdot R_d + (X / VS) \cdot R_w$$

where  $R_d$  is the profit rate from domestic market, and  $R_w$  is the profit rate made on export sales. If the exporting industries dump abroad in the sense of selling at a lower price (but profit maximizing) net of transport costs, then the profit rate from exports is lower than that rate from domestic sales. This type of dumping might increase total economic profits but may depress the weighted average of profit rates.

Maximizing a profit rate does not always maximize profits, rather expanding until the profit rate on asset falls to the opportunity cost of capital maximizes profits. Generally profits are maximized at a greater output than the output maximizes a profit rate. If world demand for Korean products is relatively elastic due to inter-country competition, *ceteris paribus*, one expects that exports will be negatively related to profit rates but positively to total profits, unless for *infra marginal* units Korea has a large cost advantage over other producers. Therefore, the export share may be negatively related to the observed profit rates.

In this context, the Demsetz superior firm argument suggests a possible positive effects of exports on profitability. Suppose the firm is superior relative to the international supply of product, then the firm will expand exports to the elastic world market, and it may achieve high profit rates in doing so. Furthermore, if an industry sells different products abroad, the effects may be of either sign. For example, if a firm sells a cheap standardized product at home and sells a differentiated braded product abroad, then it might yield a positiv relationship.

These examples illustrate that, even without government intervention, the empirical relationship between export shares and profit rates could be positive or negative depending on the elsticity, the level of world demand at any given price-cost margin, and the traits of industry. Profit rates may also be related to the government subsidization and protection for the exporting industries in a developing economy. Our export share is measured as:  $EXS = X/VS$ .

### III. Empirical Results

The data set employed in this study consists of 62 Korean manufacturing industries of which 32 are consumer and 30 are producer goods. The selection of these industries was primarily determined by the principle that the KSIC industry classifications must closely reflect the microeconomic

concept of market. Consequently, we exclude too broadly, too narrowly, or vaguely defined industries. Our sample of industries includes 48 four-digit and 14 five-digit SIC industries. Although five-digit SIC industries are more narrowly defined than four-digit industries, most data are available for only four-digit samples. Therefore, where data was available and four-digit industries included products which were not close substitutes, we use five-digit data. The mean concentration of the five-digit industries in the sample was 52%, and the overall sample mean was 58%. This, and industry definitions suggest that no bias towards higher measures of concentration due to fineness of industry definition is likely from this approach.

Since the basic hypotheses inherent in the structure-performance paradigm relate to long-run differentials rather than to short-run fluctuations in profits, we extend the period of analysis to five years, from 1976 to 1980 for all 62 sample industries. The period covers approximately a short business cycle: the first three years (1976-78) cover an expansion period; a recession began from 1979 and continued to 1980.

We employ the rates of return on assets (RA) as a measure of profit rates (PR) in this study.<sup>5)</sup> RA is estimated as net income after taxes plus interests divided by assets for each year over the five-year period and the data were provided by the Financial Analysis of the Korea Development Bank. We use three-firm concentration ratio measured by the value of shipments in 1977. Although we examine the period of 1976-80, the CR data is only available for 1977. The MES and CAR variables, however, were derived for each year from the manufacturing census data, and then averaged for the period. The advertising-sales ratio (ASR), the growth rates of domestic sales (GRO), the export-sales ratio (EXS), and the import proportion of domestic markets(IMS) are also derived for each year and averaged over the period. The entry variable(ENT) is measured as the rate of net change in the number of firms for the period of 1977-80.

In this section we estimated a variety of equations. Notably we found that heteroscedascity was significant, and that weighted least squares (WLS) methods were indicated. In order to correct for heteroscedascity we employed several techniques of WLS and found that deflation by the square root of the value of shipments can eliminate heteroscedascity. The

---

5) In order to examine the sensitivity of the model to the adoption of an alternative definition of profits, two other measures of profits, price-cost margin (PCM) and rates of return on equity (RE), were employed with the same model. But the adoption of PCM or RE as dependent variables do not substantially alter the results obtained with RA, although RE equations have generally somewhat lower explanatory power than those for RA and PCM.

notable changes entailed from weighting are that the scale related variable(TCM) shifts from negative and insignificant to positive significant, and that EXS becomes negative and significant. Further, we found that the aggregation of expansion and contraction periods may have masked some important differences between those periods. We also found that the pooling of producer and consumer goods industries cannot be rejected by a Chow test at the 5% level.

In Table 1 we present the results of regression analysis. Equation I and II are the results of OLS and WLS, respectively, for the five-year period. Equation III is the WLS result of the expansion period, while Equation IV is for the contraction period. On an overall basis, all results provide a good fit. The concentration ratios (CR), ASR and GRO appear to be the most significant explanatory factors. All coefficients of these variables are significant at 1% level with predicted signs. ENT is also significant with the expected negative sign in all equations except for the contraction period. Trade variables such as EXS and IMS are also significant with negative signs.

Contrary to our predictions, the capital requirement variable (CAR) appears to be highly significant with negative signs in all equations. In order to explain the unpredicted results on CAR, we first examined the possibility of multicollinearity among CAR, CR, and TCM. But a Belsely-Kuh-Welsch test demonstrated that there is no evidence of a multicollinearity problem among those variables.<sup>6)</sup> We also found that CAR remained negative and significant even after excluding CR and TCM variables from our equations. In an examination of our data, however, we found that several heavy and chemical industries, which usually require large amount of capital cost, had realized relatively low rates of return on assets than the average rate of all sample industries. In our data set there are five heavy and chemical industries, which have CAR larger than 60 billion won, while the mean for the entire sample is 14 billion won. In order to examine the sensitivity of our results to these five industries, we ran a regression after deletion of these industries from our sample. Nevertheless, CAR remains negative, but now insignificant in all equations.<sup>7)</sup>

Hence, the negative influences of CAR on profit rates in our empirical

---

6) The highest "condition index" of the test for all equations was 12.354. The significance level of the index generally starts from around 200.

7) Note that it might reflect "functional dependence." If there is measurement error of assets, the fact that assets is in the denominator of RA and the numerator of CAR could lead to a spurious negative correlation. Similar negative values in PCM and RE estimation suggest that the functional dependence cannot alone explain the negative value on CAR.

[Table 1] Regression Analysis of Rates of Return on Assets

|                            | I                     | II                    | III                   | IV                  |
|----------------------------|-----------------------|-----------------------|-----------------------|---------------------|
| CR                         | 0.058***<br>(3.966)   | 0.044***<br>(3.497)   | 0.034***<br>(2.248)   | 0.049***<br>(2.429) |
| TCM                        | -0.019<br>(-0.517)    | 0.070*<br>(1.490)     | 0.093**<br>(1.722)    | -0.051<br>(-0.679)  |
| CAR                        | -0.034***<br>(-2.736) | -0.036***<br>(-3.941) | -0.031***<br>(-3.319) | -0.008*<br>(-1.218) |
| ASR                        | 0.758***<br>(3.655)   | 0.654***<br>(3.487)   | 0.532***<br>(2.415)   | 0.834***<br>(3.286) |
| GRO                        | 0.047***<br>(2.785)   | 0.055***<br>(3.361)   | 0.039***<br>(3.244)   | 0.061***<br>(3.470) |
| ENT                        | -0.011**<br>(-1.865)  | -0.014***<br>(-2.536) | -0.009*<br>(-1.418)   | -0.009<br>(-1.113)  |
| EXS                        | -0.008<br>(-0.606)    | -0.021**<br>(-1.953)  | -0.022*<br>(-1.530)   | -0.006<br>(-0.378)  |
| IMS                        | -0.029**<br>(-2.304)  | -0.034**<br>(-2.527)  | -0.022**<br>(-1.674)  | -0.013<br>(-0.906)  |
| Constant                   | 4.800****<br>(5.602)  | 5.418***<br>(6.221)   | 5.954***<br>(7.355)   | 4.167***<br>(3.481) |
| Adjusted<br>R <sup>2</sup> | 0.600                 | 0.677                 | 0.563                 | 0.453               |

Notes: Levels of statistical significance (one-tailed test) are \*\*\* = 1%, \*\* = 5%, and \* = 10%. The t-ratios are given in parentheses.

results might be associated with special traits of a developing economy. Since the development of heavy industries in Korea was initiated only after the early 1970's, those industries might not yet operate at efficient scale of production. Further, accounting depreciation may be accelerated relative to economic depreciation. Since CAR appears to have an unpredicted negative sign in all equation, we also examined the possible counter effects of CAR on other explanatory variables. But we found that the deletion of CAR from all equations has no substantial effects on other variables except MES being more significant with positive signs in some equations.

Equation III shows that concentration ratios are highly significant with positive signs during the expansion period. Previous studies for industrialized countries suggested that effects of concentration on profitability might be weakened by a growth variable in a rapid economic expansion. In our empirical results for this developing economy, however, market structure variable has strong positive effects even in an economic expansion, although t-ratios for the expansion period are slightly

less than for the entire period (or for the contraction period, as we see in Equation IV.)

It is also notable that for an expansion period MES variable has positive and significant signs at the 5% level, while for a recession it has unpredicted and insignificant sign. The capital cost variable (CAR) still appear to have negative signs but much more significant for the expansion period than for the recession, suggesting that costs of adjustments and/or accelerated depreciation may be accounting for the CAR effects.

As shown in Equation IV, the explanatory power of the regression for the contraction period is weaker than those results for the expansion period. However, concentration ratios, growth variable, and advertising-sales ratio still appear to be highly significant. It is also notable that all trade variables appear to be insignificant with negative sign along with MES variable.

Of primary note, all our empirical results indicate that industrial concentration (CR) is one of the most significant variables along with growth variable in explaining profitability, while the entry barriers show somewhat mixed effects on profit rates. The trade variables are negatively related to the profitability in all equations.

#### IV. Conclusions

The empirical results on profitability strongly indicate that concentration ratios are virtually always strong predictors of profit rates. Nevertheless, the measures of entry barriers have somewhat inconclusive results. The advertising-sales ratio is always positive and highly significant. But the coefficient of capital requirements is negative and significant in most equations. The MES variables appear to be strongly significant with positive sign only for the expansion period.

Based upon these results, we conclude that the traditional market power hypothesis draws strong support in this open developing economy, although a definitive answer cannot be given without providing complete simultaneous systems which are beyond the scope of this paper. The limit pricing hypothesis, however, has far weaker support. This result with respect to the limit pricing theory should not be surprising. Given the high growth rates in Korea, it may well be that prices would have to be virtually down to MC or AC to discourage entry.<sup>8)</sup> In this case the

---

8) Note that if an entrant believes that existing industry structure is incapable of receiving large profits, then it would not expect it to raise profits post entry. If it views low profits even would massive growth as a signal to this effect, then it would deter entry.

opportunity cost of pursuing a limit pricing strategy may not justify its benefits (e.g., Bain's "ineffectively impeded entry" case.) The effects of barriers may simply reflect equilibrium entry rates rather than a conscious choice to limit price. The counter results of the capital cost might be also related to the traits of the Korean economy especially in the process of initial development of heavy and chemical industries requiring huge capital requirements.

Additional areas of inquiry were the effects of trade variables on profitability. As discussed earlier, the precise nature of the relationship between trade variables and profit rates cannot be theoretically predicted without a full model incorporating all variables of the demand and supply of exports and imports. Our empirical findings suggest that export and import rates are negatively associated with the profitability of the domestic industry. The result on export rates is not counter to theory. The exporting industries might sell a large volume of products at lower prices (net of transport) on the relatively elastic world markets. This would result in a decline of the profit rates of the exporting industries, even if it led to higher total profits. Finally, as theoretically suggested, the import proportion also appears to be negatively related to the profitability of domestic industries.

## References

1. Bain, J. S. *Barriers to New Competition*, Cambridge, Mass: Harvard University Press 1956 .
2. Baron, D. P. "Limit Pricing, Potential Entry, and Barriers to Entry," *American Economic Review*, 63, September 1973, pp. 666-74.
3. Caves, R. E., J. Khalilzadeh-Shirazi and M. E. Porter "Scale Economies in Statistical Analyses of Market Power," *Review of Economics and Statistics*, 57, May 1975, pp. 133-40.
4. Caves, R. E. "International Trade and Industrial Organization: Introduction," *Journal of Industrial Economics*, 39, December 1980, pp. 113-17.
5. Clarke, R. and S. Davies "Market Structure and Price-Cost Margins," *Economica* 49, August 1982 , pp. 277-87.
6. Colwing, K. and M. Waterson "Price-Cost Margins and Market Structure," *Economica*, 43, August 1976, pp. 255-66.
7. Gaskins, D. "Dynamic Limit Pricing: Optimal Pricing Under Threat of Entry," *Journal of Economic Theory*, 3, 1971, pp. 306-22.
8. Geroski, P. A. "Simultaneous Equations Models of the Structure-performance Paradigm," *European Economic Review*, 19, October 1982, pp. 145-48.
9. Jacquemin, A., E. De Ghellinck and C. Huvencers "Concentration and Profitability in a Small Open Economy," *Journal of Industrial Economics*, December 1980 , pp. 131-44.
10. Jeong, K. Y. *Market Structure and Economic Performance in an Open Developing Economy*. Unpublished Ph. D. Dissertation, Cornell University, 1985.

11. Kamien, M. and N. Schwartz "Limit Pricing and Uncertain Entry," *Econometrica*, 39, May 1971, pp. 441-54.
12. Khalizadeh-Shirazi, J. "Market Structure and Price-Cost Margins in U. K. Manufacturing Industry," *Review of Economics and Statistics*, 56, February 1974 , pp. 67-76.
13. Martin, S. "Advertising, Concentration, and Profitability: Simultaneity Problem," *Bell Journal of Economics*, 10, 1979, pp. 639-47.
14. Masson, R. T. and J. Shaanan "Stochastic-Dynamic Limit Pricing: An Empirical Test," *Review of Economics and Statistics*, 64, 1982, pp. 413-22.
15. Pugel, T. A. *International Market Linkages and US Manufacturing Industry*, Cambridge: Cambridge University Press, 1978.
16. Pugel, T. A. "Foreign Trade and US Market Performance" *Journal of Industrial Economics*, From (2-2), (2-3) and (2-4), we get