

AN EMPIRICAL STUDY ON THE EFFECTS OF TRADE PATTERNS ON ESTABLISHMENT SIZE

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I. INTRODUCTION

Export-promotion development policies have performed better than import-substitution policies in generating economic growth in developing countries (Michalopoulos and Jay (1975), Michaely (1977), Balassa (1978), Chenery (1980), Nishimizu and Robinson (1984)). Krueger (1980) has suggested that export-promotion policies permit entrepreneurs to base their plans on whatever size plant seems appropriate: size of domestic market is no longer a virtually binding constraint. However, attempts to replace imports result in the construction of plants of less-than-efficient minimum size in developing countries where domestic markets are very small. This may be one reason why import-substitution policies have been less successful than export-promotion policies.

Some evidence presented by Pryor (1972) and Scherer (1973), and Scherer et al. (1975) emphasized market size as the most crucial influence on industrial plant size across industrialized nations, which is consistent with this hypothesis. However, Pryor and Scherer generally focused on developed countries and used domestic markets as the measure of market size. Little empirical work has been done concerning the relationship between market size and industrial plant size for developing or newly industrialized countries, where the measure of market size allows for the role of trade policies. If the hypothesis that market size determines the plant size in developing countries is true, then plant sizes in export-oriented industries (whose markets are the world market) should be comparable to those in developed countries with large markets. Plant sizes in import-competing industries, on the other hand, should be small, reflecting the small domestic market.

In this paper, we will examine empirically this issue for the Republic of Korea ("Korea" henceforth) by comparing Korean plant sizes in export-oriented industries and import-competing industries with plant sizes in the United States. Korea, one of the most successful developing countries, has adopted export-oriented trade policies. The United States (U.S.), a developed country, has the largest domestic market size in the world. The United Kingdom (U.K.), with a smaller domestic market size than the United States but a larger market size than Korea's, has a

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more open economy than the U.S. in the sense that most U.K. industries are two-way trade industries. When we compare Korean and U.S. manufacturing, export-oriented firms in Korea are expected to have plant sizes comparable to (or possibly larger than) those of U.S. firms in the same industry. When we compare industries which are export-oriented in Korea but not in the U.K., the average establishment size of Korean industry is hypothesized to be larger than that of its counterpart in the U.K. When we compare industries which are export-oriented in both countries, the average establishment size of the Korean industry may be larger or smaller than, or not significantly different from, that of the counterpart U.K. industry.

Sections II and III will explore and compare the effects of market size as generated by trade patterns on the average plant size in Korea and the U.S., and the U.K.. We report the results of this bilateral comparison between Korea and the U.S., and Korea and the U.K. of establishment size through matched pairs of industries. Section IV reports the major conclusions obtained in the paper and suggests further research that could be done in this area.

II. THE EFFECTS OF TRADE PATTERNS ON ESTABLISHMENT SIZE IN A COMPARISON BETWEEN THE UNITED STATES AND KOREA

The international difference in plant sizes can be explained by differences in technology and transportation cost (these being the supply conditions) and differences in market size, market density, and the rate of market growth (these being the demand conditions). Market size is the most consistently significant determinant of plant size difference across industrialized countries in the empirical studies.

The effective market size can be augmented by trade policies. Export-promotion policies raise the demand for domestic products by increasing the market size to the world market. This increase in demand allows exporting firms or plants to obtain economies of scale. Increased exports provide an opportunity to take advantage of scale economies; thus the size of the plant becomes a much more important advantage. This gives rise to a large plant size. Most small firms, however, face many problems, such as capital scarcity, lack of managerial ability, and limited credit availability. There are usually significant information costs and the high risk associated with selling goods in the international market. Small-scale firms cannot afford the high information costs required for foreign outlets. These problems make small-scale firms produce goods primarily for the domestic market or export goods to a limited number of countries. The export-promotion policy does not in general directly affect the small-scale firms.

Under the import-substitution policy, the percentage of the firms in the small size category may increase because entry of new firms is large due to protection. Market size is limited to a small domestic market which is a binding constraint on plant sizes.

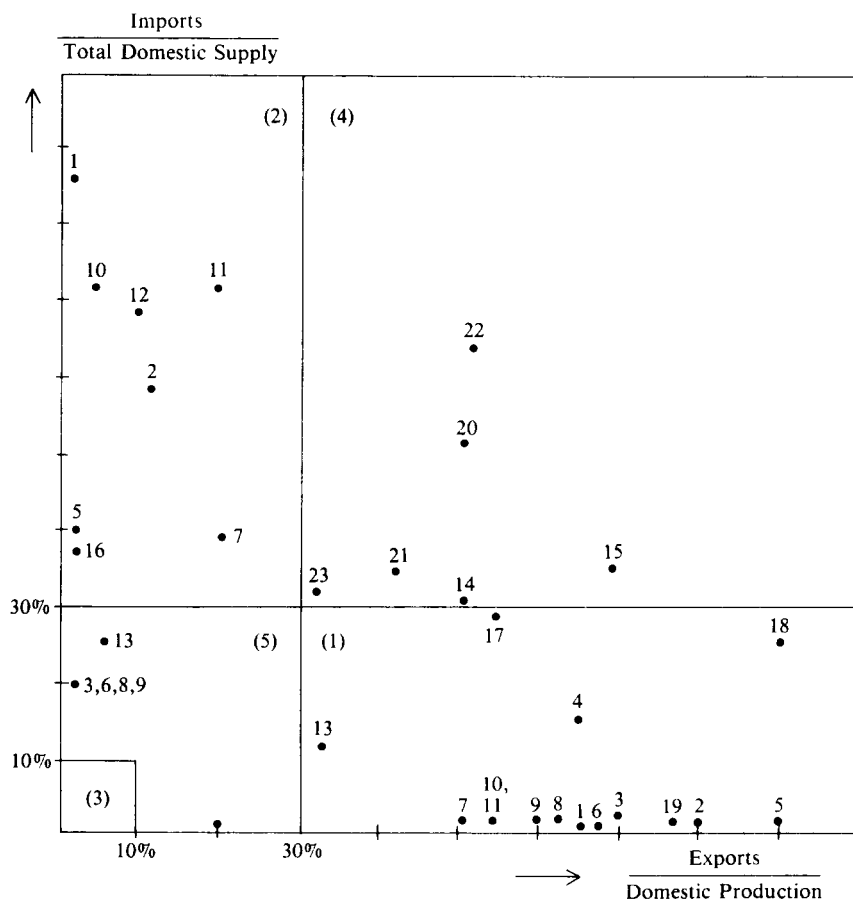
1. Hypothesis and Data

The testable hypothesis is that export-promotion policies mostly affect the large-scale plants; hence, the weight of plants in the larger size category increases. The number of plants in the smallest size category declines or at least is constant. These factors give rise to a large plant size. When, under the import-substitution policies, the percentage of plants in the small size category increases because of the large entry of new firms into this size category and the limiting of market size to small domestic markets, a relatively small plant size results. We test this hypothesis by comparing the size distribution of establishments in the U.S. and Korea. The domestic market of Korea is very small compared to that of the U.S. If we compare domestic market size, the U.S. manufacturing industries are expected to be larger than those of Korea in all industries. However, Korean export-oriented industries have extended their market internationally. As a consequence, some of Korea's export-oriented industries can be larger than their U.S. counterparts. Therefore, we would expect export-oriented firms in Korea to have plant sizes comparable to (or possibly larger than) those of U.S. firms in the same industry.

In Korea, until 1963, import-substitution policies had dominated the manufacturing industry as a whole. Since 1963, the policy has shifted away from import substitution and toward export promotion. For this reason, we would expect to observe a shift over time in the plant size comparison between U.S. and Korean firms reflecting this change in policies and market sizes.

We need definitions of export-oriented, import-competing, and home-goods industries in Korea to test the above hypothesis using disaggregated (four-digit level in terms of Standard Industrial Classification [S.I.C.] of the U.S.) industry level in 1977 and 1982. We adopt the following rules:¹ (1) export-oriented industries are defined as those with exports greater than 30 percent of domestic production and imports less than 30 percent of total domestic supply, i.e., imports plus domestic production less exports; (2) import-competing industries are defined as those with imports greater than 30 percent of total domestic supply and exports less than 30 percent of domestic production; (3) homegoods industries are those with both exports and imports less than 10 percent of domestic production and total domestic supply; (4) strong two-way trade industries which have both exports greater than 30 percent of domestic production and imports greater than 30 percent of total domestic supply are considered to be export-oriented industries (these industries usually import intermediate goods and export final goods); and (5) the rest of the industries are classified into import-competing industries for the purpose of our hypothesis testing. These industry groups are shown in Figure 1. The number of Figure 1 stands for the specific industries shown in Table 7.

¹There was no unique cutoff point to distinguish industries by trade patterns in previous studies. Nishimizu and Robinson (1984) adopted 10%, and Nam (1975) used 50% as a cutoff point. Our cutoff choice—30%—comes from the average of these two—10% and 50%.



Note: The number stands for the specific industry shown in Table 7.

[Figure 1] Scatter Diagram of Korean Industries by Trade Patterns

The data on exports, imports, and domestic production are derived from the *Input-Output Tables* issued by Bank of Korea and the *International Trade Statistics Yearbook* published by the United Nations. The data on the size distribution of establishments by employment size are obtained from *Report on Mining and Manufacturing Survey* issued by Economic Planning Board of Korea and *Census of Manufactures* published by the Bureau of the Census of the United States. Uniformly for two countries a manufacturing plant or “establishment” is defined as a physical unit (facility) of production on a single site—i.e., a single factory, mill, refinery, workshop, etc.

Some measurement errors may exist within the process of collecting and retrieving data between two countries. However, there is no reason to believe that these measurement errors exist in any one particular industry group, i.e., export-oriented,

import-competing, or home-goods industries. Therefore, unless these measurement errors are concentrated within any one industry group, they will not bias the results.

2. Statistical Issues and Empirical Findings

The matched pairs for each industry by those three industry groups are obtained by selecting an industry from the Korean manufacturing sector and matching it with a counterpart industry(ies) from the U.S. manufacturing sector at the four-digit S.I.C. level. The matched pairs of industries are disaggregated as much as possible with available data. Some industries cannot be matched because the range of the products which belongs to an industry is quite different between two countries, or the number of Korean industrial establishments is too small to be compared. 22 (23) pairs of export-oriented; 13 (15) pairs of import-competing; and 20 (18) pairs of home-goods industries were obtained from 1977 (1982) data.² The establishments which have less than five employees are excluded from our sample since no data is available from the Korean census. Two types of testing methods will be used in our hypothesis-testing: the mean-difference method, and the stochastic dominance method.

A. Mean-Difference Test

The individual difference in means for each pair of the sample can be used as the basis for estimating the difference in industry size between Korea and the U.S. A comparison of the two sample means (as denoted by the mean-difference tests) for an industry may lead to the conclusion that one country's industry tends to be of a larger size than the counterpart industry of the other country. The null hypothesis in the mean-difference test is stated such that there is no significant difference between the mean of Korean industry (m_k) and the mean of the counterpart U.S. industry (m_{us}). The alternative hypothesis is that either $m_k < m_{us}$ (in the case of export-oriented industry) or $m_k > m_{us}$ (in the case of import-competing and home-goods industries).

The Student t-distribution can be applied for the mean-difference test no mat-

²The veneer sheets and plywood industry, which was classified as an export-oriented industry in 1977, is dropped from the export-oriented industry group in 1982. The percentage of exports of the veneer sheets and plywood industry has decreased drastically since 1980 because of the export ban on logs by Indonesia and the Philippines as well as the sluggish demand for wood products by housing construction industries in the U.S. and Europe (*Business Week*, May 3, 1982). The hydraulic cement industry whose percentage of exports is less than 30 percent of total domestic production (about 21 percent) is included in the export-oriented industry group because its imports are almost zero. The metal cans and shipping container industry was classified as a home-goods industry in 1977, but it was transformed to an export-oriented industry in 1982. The line communication equipment industry was defined as a home-goods industry in 1977, but it was transformed to an import-competing industry in 1982. Synthetic rubber, which was included in import-competing industries in 1982, was dropped from the import-competing industry group in 1977 because the Korean synthetic rubber industry had only three establishments in 1977.

ter what the sample size is, since the normal curve is nearly identical to the Student t-distribution for large samples. The Student t-statistic is

$$t = \frac{\bar{X}_A - \bar{X}_B}{\sqrt{\frac{(n_A-1) S_A^2 + (n_B-1) S_B^2}{n_A + n_B - 2}} \sqrt{\frac{1}{n_A} + \frac{1}{n_B}}}$$

where \bar{X} , S , and n are sample mean, sample standard deviation, and sample size, respectively. We are going to report the results of the mean-difference method under the assumption of normality.

The mean-difference method has both advantages and disadvantages when compared to regression analysis. One of the advantages of the mean-difference method is that we may successfully test our hypothesis with a limited number of variables, i.e., exports, imports, and domestic production. The other advantage of this method is that it does not require the assumption which is required in regression analysis, i.e., all populations of industries have the same standard deviation. The disadvantage of the mean-difference test is that we cannot control the possible influences other than market size difference in distinguishing Korean industries by trade patterns. This may bias the results if there is no correlation between included variable—trade pattern—and omitted variable.

The size distribution of firms or plants is usually highly skewed to the right, which causes some trouble in applying the mean-difference test in its original form. The statistical distributions mentioned perhaps most frequently as explaining the size distribution of firms or plants are the *lognormal* distribution and the *Pareto* distribution. The lognormality of size distribution of firms or plants is obtained from a random walk based on Gibrat assumption, which implies that the expected percentage rate of growth in size is independent of the size already attained. Since the Pareto distribution is basically suitable only for the right tail of the distribution (namely, large firms or plants), this distribution is not our prime interest. The lognormality of establishment size distribution may be tested by the chi-square statistic.³

³The ways to estimate two parameters (mean and standard deviation) of the distribution in question and to make goodness of fit tests need some explanations about procedures, since published census data are grouped into several categories (not same interval) in terms of employment size. Let $ESTA_i$ = the number of establishments in each size class, $WORK_i$ = the number of total employees in each size class, r = the number of size classes, and $n = \sum_{i=1}^r ESTA_i$. First calculate mean (M) and standard deviation (SD) of the logarithms of establishment size by

$$M = 1/n \left[\sum_{i=1}^r \log (WORK/ESTA)_i \cdot ESTA_i \right]$$

$$SD = \left\{ 1/n \cdot \sum_{i=1}^r [\log (WORK/ESTA)_i - M]^2 \cdot ESTA_i \right\}^{1/2}$$

Once the parameters of the distribution in question have been estimated, we get expected frequencies (e_i) in each class by applying the standardized lower and upper bounds of each size class to the standard normal distribution function. Then the statistic

The summary statistics from the mean-difference test based on Student t-statistics are reported in Table 1.⁴ In the case of import-competing and home-goods industries, the average establishment sizes of the U.S. industries are significantly larger than those of Korean industries (24 of total 33 industries in 1977, 27 of total 33 industries in 1982), as we expected. Among import-competing industries, only tanneries and leather finishing industry of Korea is significantly larger than its counterpart in U.S. industry in 1977. Meanwhile, no Korean import-competing industry is significantly larger than its U.S. counterpart in 1982. As far as home-goods industries are concerned, only two Korean industries—the prepared animal feeds industry and the bottled and canned soft drink industry—are significantly larger in average establishment sizes than counterpart U.S. industries in both years. Korean pharmaceutical preparations are also significantly larger than the counterpart U.S. industry, but only in 1982.

In the case of export-oriented industries, the average establishment sizes of the Korean industries are statistically larger than those of counterpart U.S. industries with 10(9) of total 22(23) pairs of industries of which 8(6) are statistically insignificant in 1977(1982). Those Korean industries which are significantly larger than counterpart U.S. industries in average establishment sizes are: (1) canned seafoods, (2) leather garments, (3) cement (hydraulic), (4) structural metal member, (5) radio and television receiving sets, (6) sporting and athletic goods, (7) dolls and toys, in both years, (8) rubber footwear (1977 only) or canvas goods (1982 only), (9) women's handbags (1977 only) or rolled steel product (1982 only), and (10) electronic tubes and semiconductors (1977 only).

The main point we are going to emphasize in this analysis is the relationship between market size generated by trade patterns (export-oriented, import-

[Table 1] Mean-Difference Method (1977 and 1982): Size as Measured by Number of Employees

		Korea>U.S.	Korea = U.S.	Korea<U.S.	Total
Export-Oriented Industries	(1977)	10	8	4	22
	(1982)	9	6	8	23
Import-Competing Industries	(1977)	1	1	11	13
	(1982)	0	2	13	15
Home-Goods Industries	(1977)	2	5	13	20
	(1982)	3	1	14	18

Note: The number in table stands for the number of industries in each industry group.

$$G = \sum_{i=1}^k [(e_i - ESTA_i)^2 / e_i]$$

is calculated which has approximately the chi-square distribution with r-k-1 degrees of freedom where k is the number of parameters fitted.

⁴The detailed statistics from the mean-difference test by industry groups can be obtained from the author by request.

competing, or home-goods oriented) and the ratio of Korean to U.S. establishment size in the same industry, rather than the actual value of the latter ratio. There is a significant difference in the latter ratio when we compare export-oriented industry group with import-competing, or home-goods industry groups. In the case of export-oriented industries, many industries (17 of 20 industries in 1977, 15 of 21 industries in 1982) have greater than or equal to one in the latter ratio, while most import-competing and home-goods industries have less than one in this ratio.

Until now, the mean-difference test has been based on the number of employees as a measure of the size of the establishment. However, if export-oriented industries of Korea are particularly labor intensive when compared with their U.S. counterparts, size comparisons based on number of employees weakens this variable's power to test our hypothesis.

The mean-difference test is retried by using value added as a measure of the size of the establishment in 1977. The use of value added, which includes cost share of capital as well as cost share of labor in the mean-difference test, will help to bring about more reliable results when we test our hypothesis. If outcomes from the mean-difference test—which uses value added—are the same or close to those from the mean-difference test, which uses number of employees, the results already reported in Table 1 are sufficient to evaluate our hypothesis.

Even though the value added of Korean establishments is converted into U.S. dollars through the exchange rate, an adjustment is necessary in the value added between these two countries, since the exchange rate at a certain point of time does not necessarily hold purchasing power parity between these two countries. In addition, the wage rate is lower in Korea than in the U.S., implying a lower level of value added in Korea. The average value added of each matched industry of the U.S. is multiplied by β ($= 0.82$) which is the ratio of average value added per establishment of Korean industries to that of U.S. industries. The summary results, which are adjusted by β and unadjusted, are reported in Table 2. The outcomes from import-competing and home-goods industries are almost identical between the two different size measures. Meanwhile, in export-oriented industries, only one industry—dolls and toys—has opposite results. The Korean dolls and toys industry is significantly larger than its counterpart in the U.S. in terms of number of employees as a measure of size, but becomes significantly smaller than its U.S. counterpart when value added is used as a size measure.

In order to emphasize the effects of market size on establishment size, the results of the mean-difference test using number of employees as a size measure in 1967 (which is the earliest time period to be used in this comparison) are introduced because some of the manufacturing industries had begun to gradually transform from import-substitution industries into export-oriented industries since about 1963 as mentioned earlier. The results, which are reported in Table 3, show that no Korean industry is significantly larger than its counterpart U.S. industry in 1967. When the outcomes from 1967, 1977 and 1982 are considered, we can conclude

[Table 2] Mean-Difference Method (1977): Size as Measured by Value Added
U.S. value added is adjusted by $\beta = 0.82$

	Korea>U.S.	Korea = U.S.	Korea<U.S.	Total
Export-Oriented Industries	12	4	6	22
Import-Competing Industries	1	1	11	13
Home-Goods Industries	2	5	13	20

U.S. value added is unadjusted

	Korea>U.S.	Korea = U.S.	Korea<U.S.	Total
Export-Oriented Industries	1	2	19	22
Import-Competing Industries	0	0	13	13
Home-Goods Industries	0	0	20	20

Note: The number in this table stands for the number of industries in each industry group.

[Table 3] Mean-Difference Method (1967): Size as Measured by Number of Employees

	Korea>U.S.	Korea = U.S.	Korea<U.S.	Total
Export-Oriented Industries	0	4	7	11
Import-Competing Industries	0	1	9	10
Home-Goods Industries	0	1	10	11

Note: The number in this table stands for the number of industries in each industry group.

that export-oriented (outward) trade policies significantly and positively affected the size of industrial establishments.

B. The Role of the Foreign Direct Investment

Foreign direct investment may play a role in determining industrial establishment size through the exporting of goods. If the empirical findings about relative size of Korean industry (compared with U.S. industry) by trade patterns are mainly or partly due to direct investment from abroad, our hypothesis should be modified. In general, foreign direct investment plays a modest role in Korean manufactur-

ing when compared to other newly industrialized countries.⁵

In order to find out the possible effect through export of foreign direct investment on the relative size comparison of Korean industry, we are going to examine whether the relationship between the ratio of exports to domestic production and foreign shares in value added in Korean manufacturing is positively strong.⁶ The Pearson correlation coefficient between foreign shares in value added and the percentage of exports is -0.174 (the significance probability of the correlation is 0.366), while the Pearson correlation coefficient between foreign shares in value added and the ratio of imports to total domestic supply is 0.215 (the significance probability of the correlation is 0.263). The negative and weak correlation coefficient between foreign shares in value added and the percentage of exports indicates that no close and positive relationship exists between a direct investment from abroad and an export performance in Korean manufacturing. This allows us to conclude that the relationship between market size as generated by trade patterns and the relative comparison of industry sizes is consistent with our hypothesis.

C. Stochastic Dominance Methods

We may test our hypothesis by applying the stochastic dominance method, which does not require any assumptions about shape nor the parameters for the population frequency distributions. The principles of stochastic dominance were well described in Hadar and Russell (1969). Let f and g denote the probability density functions of a (discrete or continuous) random variable taking the values x_i (the set of the x_i is denoted by X), and let $F(x_i)$ and $G(x_i)$ be the respective cumulative distributions. Two different types of dominance conditions are used in this method. First, the probability function g is said to be at least as large as (or stochastically larger than) f in the sense of first-degree stochastic dominance (FSD) if and only if

$$G(x_i) \leq F(x_i) \text{ for all } x_i \in X.$$

The value of the cumulative distribution of the g probability function never exceeds that of the f probability function in FSD. The second dominance condition is weaker than FSD, which is referred to as second-degree stochastic dominance (SSD). The probability function g is said to be at least as large as (or stochastically larger than) f in the sense of SSD if and only if

$$\sum_{i=1}^r G(x_i) \bullet \Delta x_i \leq \sum_{i=1}^r F(x_i) \bullet \Delta x_i \text{ for all } r < n,$$

⁵In Korea, industries which have a significant percentage (more than 30 percent) of foreign shares in value added are high technology industries. These industries are basic chemicals (48 percent), petroleum refineries (about 90 percent), glass and glass products (30 percent), and electrical machinery (33 percent). In other industries, foreign direct investment plays a fairly small role in Korea.

⁶Data on foreign shares in value added in Korean manufacturing is taken from Hill and Johns (1985).

where $\Delta x_i = x_{i+1} - x_i$, and x_n is the largest value taken by the random variable. It holds whenever the area under one cumulative distribution is equal to, or larger than, that under the other cumulative distribution.

Once the areas under two cumulative distributions, F and G , have been estimated, we may face the task of the hypothesis-testing. This can be accomplished by the nonparametric sign test which considers the difference in direction between two populations that involve samples of matched pairs.⁷

The summary results from the stochastic dominance method are reported in Table 4.⁸ In this paper, if the difference between two areas of a matched pair of industries is less than one percent of the average of two areas, then those areas are considered to be not different (tied).

In Table 4, of the 22 pairs of industries which are classified as export-oriented industries, 14 Korean industries are stochastically larger, 3 Korean industries are stochastically smaller, and 5 are tied, than are (to) their U.S. counterpart industries, in 1977. Meanwhile, the results from 1982 are weaker than those from 1977. More precisely, 9 Korean industries are stochastically larger, 8 Korean industries are stochastically smaller, and 6 industries are tied, than are (to) their U.S. counterparts, in 1982. In the case of import-competing industries, most Korean industries are stochastically smaller than corresponding U.S. industries in both years. Only the industry of tannery and leather finishing in Korea is stochastically larger than its counterpart U.S. industry in 1977. Of the 20 (18 in 1982) pairs of industries which are considered as home-goods industries, 3 (in 1977) or 2 (in 1982) Korean industries are stochastically larger and 17 (in 1977) or 15 (in 1982) Korean industries

[Table 4] Stochastic Dominance Methods (1977 and 1982): Size as Measured by Number of Employees

		Korea>U.S.	Korea = U.S.	Korea<U.S.	Total
Export-Oriented Industries	(1977)	14	5	3	22
	(1982)	9	6	8	23
Import-Competing Industries	(1977)	1	0	12	13
	(1982)	0	2	13	15
Home-Goods Industries	(1977)	3	0	17	20
	(1982)	2	1	15	18

Note: The number in this table stands for the number of industries in each industry group.

⁷Morley and Smith (1977) paired establishments of two different nationalities in the same industry in Brazil to deal more effectively with the problem of small sample size and the problem of noise in the data created by aggregation. They used the sign test to determine whether the median value added per worker and electrical energy per worker differed significantly between nationalities in the direction predicted by their hypothesis.

⁸The estimated areas of matched pairs of industries using number of employees as a size measure can be obtained from the author by request.

are stochastically smaller than their U.S. counterparts.

When we apply the sign test to results from the stochastic dominance method, the tied outcomes are eliminated from the analysis. This leaves us with 17 pairs with a sign difference for the export-oriented industry group in both 1977 and 1982, respectively. We find that $b(0.0245, 17, 1/2) = 12$ and $b(0.5, 17, 1/2) = 8$ from the binomial distribution table.⁹ Since the number of positive sign (B) which is 14 in 1977 exceeds $b(=12)$, Korean export-oriented industries are larger than their U.S. counterparts at the 5 percent level of significance. Meanwhile, $B(=9)$ is greater than $b(=8)$ in 1982, implying that Korean export-oriented industries are larger than their U.S. counterparts at the 5 percent level of significance in 1982. Both the import-competing and home-goods industries of the U.S. are larger than their Korean counterparts at the 5 percent level of significance.

The number of the positive sign or the actual value of the significant level is not the main purpose of this analysis. The results that show that export-oriented industries are significantly different than import-competing or home-goods industries in comparisons of U.S. and Korean establishment sizes are important. In addition, two points can be made from the empirical findings. First, the mean-difference method and the stochastic dominance method are complements rather than substitutes. The results from these two methods are relatively similar and support our hypothesis well. Second, when we compare empirical outcomes from the stochastic dominance method about export-oriented industries between 1977 and 1982, the results from 1977 are stronger than those from 1982. More precisely, 14 Korean export-oriented industries are stochastically larger than counterpart U.S. industries in 1977, but 9 Korean export-oriented industries are stochastically larger than their U.S. counterparts in 1982, while the results of import-competing or home-goods industries are pretty similar in both years. These empirical findings are well consistent with the actual economic situation of Korea in 1982. The Korean economy had cooled down in 1982 because of a slackening in export demand and delayed foreign investment due to political instability since 1980 as well as the Western recession (*Business week*, Nov. 1, 1982). The real GDP growth of Korea slowed down, averaging 5.5 percent in 1982 (against 6.5 percent in the previous year). Economic expansion was mainly domestically induced in 1982, as export demand remained sluggish through the year. The overall slowdown was apparent in all sectors but construction, especially in manufacturing. Manufacturing production was up only 5 percent in 1982 (13.5 percent in 1981) with the output of key export industries such as clothing and electronic appliances virtually stagnating. Exports increased by about 3 percent in value, while volume growth increased by 7 percent (against 18 percent in 1981). As *International Trade 1982/83* by General Agreement on Tariffs and Trade showed, export revenue from textiles, clothing,

⁹ $b(\alpha, n, 1/2)$ is the upper α percentile point of the binomial distribution with sample size n and probability $1/2$.

and footwear, which together account for 27 percent of total exports, stagnated in 1982 and exports of electronic appliances (such as TV and radio sets) dropped steeply in both volume and value. These actual situations are consistent with our results.

III. THE EFFECTS OF TRADE PATTERNS ON ESTABLISHMENT SIZE IN A COMPARISON BETWEEN THE U.K. AND KOREA

This section will examine the effect of market size as generated by different trade patterns on average establishment size through a comparison of U.K. industry with counterpart Korean Industry. Why is this comparison necessary? The United kingdom (U.K.), which is one of Europe's developed countries, has a smaller domestic market size than the U.S. However, the U.K. has a larger market size than Korea. The U.K. domestic market size in terms of GNP is about ten times larger than the Korean domestic market size, while the U.K. domestic market size in terms of population is one and half times larger than that of Korea. The other reason for the comparison of Korea and the U.K. is the role of two-way trade. The U.K. has a more open economy than the U.S. in the sense that the U.K. engages in heavier international trade than the U.S. does. Most U.K. industries are two-way trade industries. For these reasons, it is worth comparing Korean industry with U.K. industry in order to examine the relationship between market size (generated by different trade patterns) and relative establishment size between these two countries.

1. Hypotheses to be Tested

When we consider only domestic market size between two countries, the size of most of the Korean manufacturing industries is expected to be smaller than that of the counterpart U.K. industries. However, since both countries engage in heavy international trade, we can set four hypotheses to be tested.

First, when we compare industries which are defined as export-oriented in Korea but not in the U.K. (either import-competing or home-goods in the U.K.), the average establishment size (in this section the average size of an industry is computed based on log-normal distribution) of Korean industry is hypothesized to be larger than that of the counterpart U.K. industry.

Second, in the case of industries which are defined as import-competing or home-goods in Korea but export-oriented in the U.K., the average establishment size of Korean industry is hypothesized to be smaller than that of its U.K. counterpart.

Third, in the case of industries classified as import-competing or home-goods industries in both Korea and the U.K., the average establishment size of Korean industry is expected to be smaller than, or not significantly different from, that of corresponding industry in the U.K., because the domestic market size of the U.K. is larger than that of Korea.

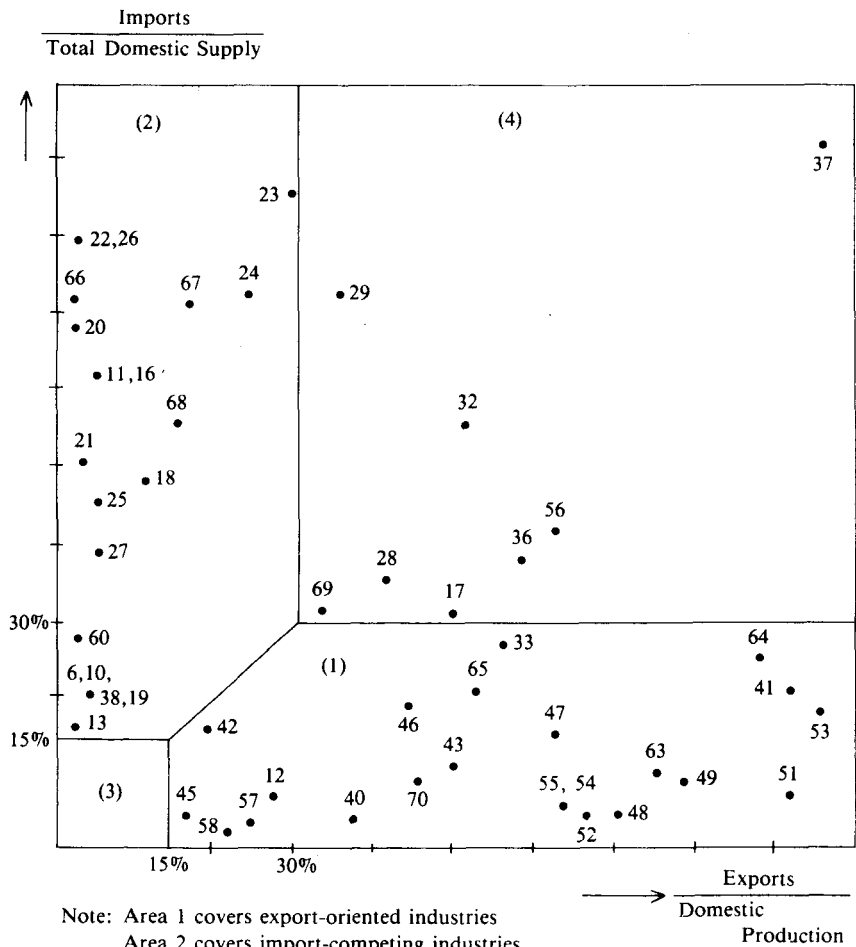
Fourth, when we compare industries which are classified as export-oriented in both countries, the average establishment size of the Korean industry can be larger or smaller than, or not significantly different from, that of its U.K. counterpart.

We need definitions of export-oriented, import-competing, and home-goods industries which are common in both Korea and the U.K. to test the above hypotheses. We adopt the following rules: (1) export-oriented industries are defined as those for which exports are greater than 15 percent of domestic production and the ratio of imports to total domestic supply (sum of domestic production and imports to total domestic supply (sum of domestic production and imports less exports) is less than the ratio of exports to domestic production; (2) import-competing industries are defined as those for which imports are greater than 15 percent of total domestic supply and the ratio of exports to domestic production is less than the ratio of imports to total domestic supply; (3) home-goods industries are those with both exports and imports less than 15 percent of domestic production and total domestic supply, respectively; and finally (4) strong two-way trade industries which have both exports greater than 30 percent of domestic production and imports greater than 30 percent of the total domestic supply are considered to be export-oriented industries. These industries usually import intermediate goods and export final goods. These industry groups are shown in Figure 2 and 3 (the number of this Figure indicate the specific industry shown in Table 8).

2. Data

The data on the size distribution of establishments came from *the Report on Mining and Manufacturing Survey* (1977), published by the Economic of Planning Board of Korea, and *Analyses of United Kingdom Manufacturing (local) units by employment size* (1977), (denoted as *Analyses of U.K.*) and *Report on the Census of Production* (1977), published by the Business Statistics Office of the U.K. as Business Monitor series.

Two points should be mentioned about the data. First, there is a difference in the statistical unit between *Analyses of U.K.* and *Report on the Census of Production* in the U.K. The statistical unit is defined in U.K. Standard Industrial Classification as the smallest unit which can provide the information normally required for an economic census. Sometimes activities which are conducted as a single business are carried on at a number of addresses. If in such cases the activities are closely related, they are regarded as the activities of a single establishment in *Report on the Census of Production*. However, in *Analyses of U.K.*, each of these activities is regarded as a separate unit. Therefore the manufacturing unit used in *Analyses of U.K.* is a physical unit of production facilities at a single site or address, which is consistent with the statistical units of Korea and the U.S. In this comparison we primarily use data on establishment size distribution from *Analyses of U.K.* Data on several industries which are not defined explicitly in *Analyses of U.K.* are taken from *Report on the Census of Production*. For example, the

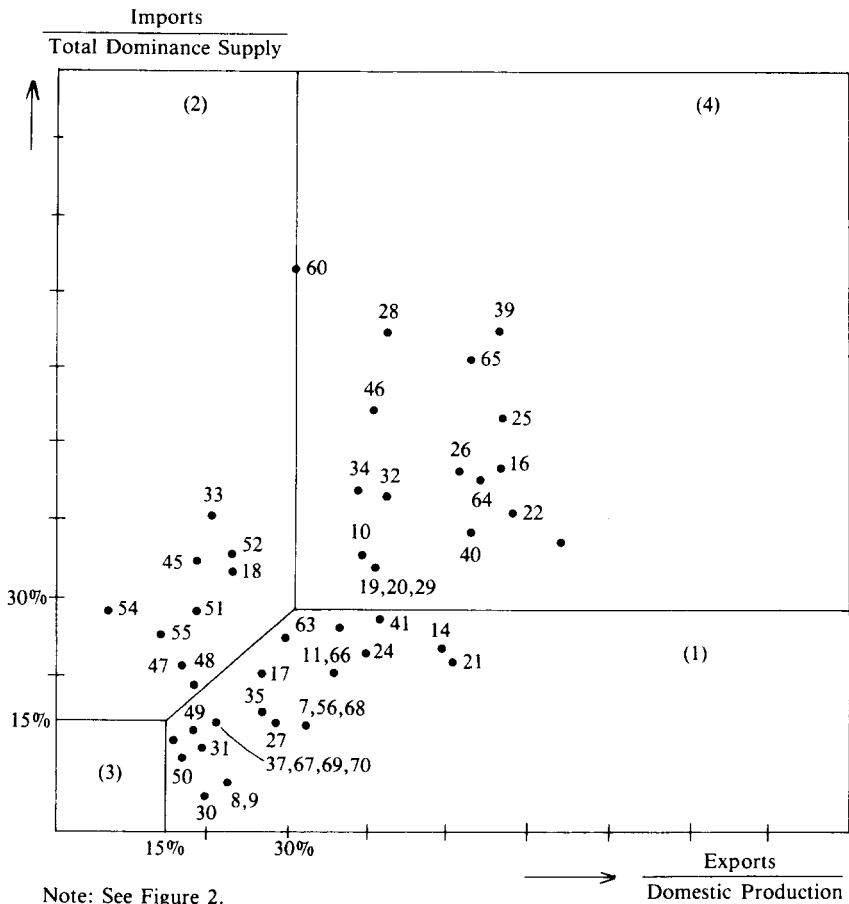


Note: Area 1 covers export-oriented industries
Area 2 covers import-competing industries
Area 3 covers home-goods industries
Area 4 covers strong two-way trade industries
The number stands for the specific industry shown in Table 8.

[Figure 2] Scatter Diagram of Korean Industries by Trade Patterns

toys and sporting goods industries are not separated in the former but are distinguished in the latter.

Secondly, a large number of U.K. industries are at most disaggregated at the three-digit level (by the U.K. Standard Industrial Classification), which are broader classifications as compared to those used in classifying Korean industries. In order to match industries between the U.K. and Korea, Korean manufacturing industries are aggregated to be comparable with U.K. manufacturing industries. Establishments which have less than 10 employees are excluded in data on both countries.



[Figure 3] Scatter Diagram of the United Kingdom Industries by Trade Patterns

Data on imports and exports are taken from *Compilatory Report on Input-Output Tables*, published by the Bank of Korea, and *Overseas Trade Analyzed in Terms of Industries*, Business Monitor M10 (HMSO, 1977 and 1978), where U.K. overseas trade is expressed in terms of industries defined by the U.K. Standard Industrial Classification. This differs from the normal presentation based on the Overseas Trade Statistical Classification, with totals compiled according to the groups and items of the Standard Industrial Trade Classification.

3. Empirical Findings

A total of 70 pairs of industries were obtained from the data. These industries were divided into (1) 30 export-oriented, 20 import-competing, and 20 home-goods industries in Korea; (2) 47 export-oriented, 9 import-competing, and 14 home-goods industries in the U.K., as shown in Table 5. The summary statistics from the mean-

[Table 5] Cross Tabulation of Industries by Trade Patterns

U.K.	Korea	Export-Oriented	Import-Competing	Home-Goods	Total
Export-Oriented		17, 28, 29, 32, 36, 37, 40, 41, 42, 43, 46, 48, 49, 53, 56, 63, 64, 65, 69, 70	6, 10, 11, 16, 19, 20, 21, 22, 23, 24, 25, 26, 27, 38, 66, 67, 68	7, 8, 9, 14, 30, 31, 34, 35, 39, 50	47
Import Competing		33, 45, 47, 51, 52, 54, 55	18, 60		9
Home Goods		12, 57, 58	13	1, 2, 3, 4, 5, 15, 44, 59, 61, 62	14
Total		30	20	20	70

Note: The number in each block stands for the specific industry shown in Table 8.

difference test—based on Student t-statistics—are reported in Table 6.¹⁰

When we compare industries which are export-oriented in Korea but home-goods or import-competing in U.K., 6 Korean industries (of a total of 10 industries) are statistically larger than their counterpart U.K. industries, and 2 industries are not significantly different, while only 2 Korean industries are smaller than the same U.K. industries in average establishment sizes. In the comparison of industries which are classified as import-competing or home-goods in Korea but export-oriented in the U.K., 18 U.K. industries (of a total of 27 industries) are statistically larger than their Korean counterparts, while only one Korean industry is larger than the identical U.K. industry in average establishment sizes. In the case of industries which are classified as import-competing or home-goods in both Korea and U.K., 9 (out of 13) U.K. industries are statistically larger than the Korean counterparts, while 3 industries are not significantly different in either country in average establishment sizes.

Finally, if we compare industries which are export-oriented in both countries, we find: 5 (out of a total of 20) Korean industries are significantly larger than, 7 industries are smaller than, and 8 industries are not significantly different from the corresponding U.K. industries in average establishment sizes. Hence, as hypothesized, the direction of size comparison is unclear in this case.

¹⁰The detailed data on paired industries can be obtained from the author by request.

[Table 6] Industrial Comparisons by Trade Patterns*In the case of Industries which are Export-Oriented in Korea but not in U.K.*

	Korea>U.K.	Korea = U.K.	Korea<U.K.
Industry	12, 33, 51, 52, 54, 57	47, 55	45, 58
Number of Industries	6	2	2

In the case of Industries which are import-Competing or Home-Goods in Korea but Export-Oriented in U.K.

	Korea>U.K.	Korea = U.K.	Korea<U.K.
Industry	67	8, 9, 14, 24, 25, 31, 35, 39	6, 7, 10, 11, 16, 19, 20, 21, 22, 23, 26, 27, 30, 34, 38, 50, 66, 68
Number of Industries	1	8	18

In the case of Import-Competing or Home-Goods Industries in both Countries

	Korea>U.K.	Korea = U.K.	Korea<U.K.
Industry	5	4, 59, 62	1, 2, 3, 13, 15, 18, 44, 60, 61
Number of Industries	1	3	9

Industries which are Export-Oriented in both U.K. and Korea

	Korea>U.K.	Korea = U.K.	Korea<U.K.
Industry	32, 41, 49, 53, 64	17, 28, 29, 36, 40, 63, 65, 69	37, 42, 43, 46, 48, 56, 70
Number of Industries	5	8	7

[Table 7] Industries Compared between Korea and United States*Export-Oriented Industries*

1. Canned Seafoods
2. Canvas and Related Products
3. Knit Outerwear
4. Rope, Cordage, Cable and Twine
5. Leather Garments
6. Men's & Boy's Shirts, Workclothes and Allied Garments
7. Women's Handbag
8. Leather Footwear
9. Plywood and Veneer Sheets
10. Rubber Footwear

11. Tires and Inner Tubes
12. Cement
13. Rolled and Steel Products
14. Steel Tubes and Pipes
15. Structural Metal Members
16. Metal Cans and Shipping Containers
17. Radio and TV Receiving Sets
18. Sporting and Athletic Goods
19. Dolls and Toys
20. Electronic Tubes and Semiconductors
21. Watches and Clocks
22. Radio communication Equipment
23. Hand Tools

Import-Competing Industries

1. Pulp Mills
2. Organic Chemicals
3. Inorganic Chemicals
4. Synthetic Rubber
5. Tanneries and Leather Finishing
6. Blast Furnace and Steel Mills
7. Rolling and Drawing of Non-Ferrous Metals
8. Boilershop Products
9. Agricultural Machinery
10. Metal Cutting Machinery
11. Mechanical Power Transmission Equipment
12. Electric Generators, Motors etc.
13. Transformers
14. Line Telecommunication Equipment
15. Motor Vehicle Parts and Accessories

Home-Goods Industries

1. Flour and other Grain Mills
2. Dry Bakery Products
3. Bread and Cakes
4. Processing Edible Oils
5. Processing Coffee and Teas
6. Prepared Animal Feeds
7. Bottled and Canned Soft Drink
8. Wood Furniture
9. Wood Container
10. Printing Papers
11. Paperboard Containers and Boxes
12. Publishing Books
13. Pharmaceutical Preparations
14. Toilet Preparations
15. Synthetic Organic Fibers
16. Iron and Steel Foundries
17. Refrigerators and Freezers

18. Motorcycles, Bicycles and Parts
19. Metal Cans and Shipping Containers
20. Line Communication Equipment

[Table 8] Industries Compared between Korea and the United Kingdom

1. Grain Mill Products
2. Bread and Flour Confectionery
3. Dry Bakery Products (Biscuits)
4. Animal and Poultry Foods
5. Soft Drinks and Carbonated Water
6. Basic Industrial Chemicals
7. Pharmaceutical Chemicals and Preparations
8. Toilet Preparations
9. Paints, Varnishes and Lacquers
10. Synthetic Resins, Plastics Materials, Synthetic Rubber
11. Synthetic Organic Dyestuffs, Pigments
12. Fertilizers
13. Formulated Adhesives, Gelatine, etc.
14. Formulated Pesticides
15. Printing Ink
16. Photographic Chemical Materials
17. Steel Tubes and Pipes
18. Non-Ferrous Metal Basic Industries
19. Agricultural Machinery and Equipment
20. Metal-Working (cutting, forming, etc.) Machinery
21. Industrial Engines and Turbines
22. Textile Machinery and Accessories
23. Construction and Earth-Moving Equipment
24. Mechanical Handling Equipment, incl. Work Trucks
25. Office Machinery, incl. Typewriters
26. Printing, Bookbinding, Paper Goods Machinery
27. Food and Beverage Machinery
28. Watches and Clocks
29. Surgical and Medical Instruments
30. Insulated Wires Cables
31. Line Telecommunication equipment
32. Electronic Tubes, Components
33. Radio and TV Receiving Sets and Sound Prod. Equip.
34. Electrical Appliances Primarily for Domestic Use
35. Primary and Secondary Batteries
36. Electric Lamps, Electric Light Fittings
37. Shipbuilding and Marine Engineering
38. Motor Vehicle Manufacturing
39. Motorcycles and Bicycles
40. Hand Tools used in Agriculture
41. Cutlery, Spoons, Forks and Plated Tableware
42. Bolts, Nuts, Screws, Rivets, etc.
43. Wire and Wire Manufactures

44. Metal Cans and Shipping Containers
45. Spinning and Doubling on the Cotton and Flax Systems
46. Weaving of Cotton, Linen, and Man-Made Fibers
47. Cordage, Rope, and Twine
48. Knitted Goods
49. Made-up Canvas Goods
50. Asbestos Products
51. Leather Products
52. Men's and Boy's Shirts, Work Clothes, Underwear
53. Hats Caps, and Millinery
54. Gloves
55. Footwear (Leather, Rubber, Plastic)
56. Pottery, China, and Earth-Ware
57. Cement
58. Furniture and Upholstery
59. Wooden Containers and Baskets
60. Paper and Board
61. Paper Containers and Boxes
62. Printing, Publishing of Newspapers and Periodicals
63. Dolls and Toys
64. Sporting and Athletic Goods
65. Musical Instruments
66. Pumps, Valves, and Compressors
67. Mechanical Power Transmission Equip. incl. Bearings
68. Electrical Machinery (Motors, Generator, Transformers)
69. Hand Tools (other than agricultural uses)
70. Rubber Products except Rubber Footwear

IV. SUMMARY AND CONCLUSIONS

The main objective of this paper was to examine the relationship between market sizes generated by trade patterns and the relative establishment sizes of Korean manufacturing industries as compared with those of counterpart industries in the United States and the United Kingdom.

In order to analyze whether a significant difference exists in the ratio of Korean to U.S. establishment sizes within the same industry by trade patterns, we adopted, both the mean-difference test and the stochastic dominance method. The results from those two methods have showed that more than two-thirds of Korean export-oriented industries have been significantly larger than or significantly not different from counterpart U.S. industries. Meanwhile most Korean import-competing and home-goods industries have had significantly not different from counterpart U.S. industries. Meanwhile most Korean import-competing and home-goods industries have had significantly smaller size of establishments than counterpart U.S. industries. The results from using adjusted value added have been fairly similar to those using the number of employees as a size measure. Furthermore, we also observed that foreign direct investment into Korea did not play a role in these

results.

When establishment sizes of Korean industries were compared with those of U.K. industries, we found that: (1) in the case of industries which were export-oriented in Korea but not in the U.K., average establishment sizes of most Korean industries were significantly larger than or significantly not different from those of counterpart U.K. industries with only two exceptions out of ten industries; (2) in the case of industries which were export-oriented in the U.K. but not in Korea, only one (out of 27 industries) Korean industries was significantly larger than the counterpart U.K. industry in terms of average establishment size; (3) in the case of import-competing and home-goods industries in both countries, only one (out of 13) Korean industries was larger than its U.K. counterpart in terms of average establishment size; (4) in the case of industries which were export-oriented in both countries, it was difficult to determine the direction of a size comparison between Korea and the U.K. as hypothesized.

The findings of this study are consistent with the view that one of the benefits of export promotion may be more efficient scale of operation. This suggests that export promotion may yield productivity gains to the economy above those obtained by import substitution. These results should be interpreted with caution, however, since direct evidence of productivity gains due to large scale in export industries has not been provided. This remains an area for future research.

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