Export Behavior of Japanese Firms*

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I. Introduction

Japan's external current account during the high-growth era from the mid-1950s to the late 1960s recorded deficits in periods of boom and surpluses in periods of recession, and was thus almost balanced over the period as a whole. In the early 1970s, the current account showed persistent surpluses until they were broken by deficits in the years immediately after the floating exchange rate regime was introduced and the First Oil Crisis took place. However, the late 1970s, which were characterized by the economy's adjustment to lower growth rates, saw the current account turning back to surpluses. In response to this, there were increased pressure from abroad to Japan for self-restraint on exports, more liberalization of imports, and increases in domestic demand. Another deficits that were temporarily brought about by the Second Oil Crisis were reversed again to surpluses during the early 1980s. The export ratios for firms have increased considerably, and at the same time firms' reliance on overseas market have risen as well. Under this situation, there has been growing trade frictions with foreign countries.

Among various views on how so-called "persistent surpluses" have been formed, the most prevalent is one that is based on a savings-investment balance approach (one of the macro-economic approaches). On the basis of this approach, some argue that surpluses are attributable to excess savings or high savings ratio in Japan, and some others argue that they are attributable to the difference in fiscal stances between Japan and the United States. These macro-economic approaches are important indeed in clarifying interdependence between the economies of Japan and the

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United States, in estimating the size of "structural component" (excluding the effects of business cycles) of surpluses, and in pointing out need for further substantial efforts to reduce the size of surpluses.

However, it seems obvious that macro-economic approaches per se are not sufficient to analyse real economies. Because empirical analysis of the above-mentioned savings-investment approaches are based on ex post data, the approaches do not necessarily exclude a view that increases in exports would generate savings-investment imbalances by increasing firms' profits and therefore savings. Even if one supposed that ex ante savings-investment imbalances constituted "the structural cause" of current account surpluses, one would need to make explicit micro-economic mechanisms underlying such causality. One cannot deny that we lacked efforts to analyse firms' export behavior from micro-economic point of view.

This paper, therefore, aims at empirically investigating factors influencing exports by looking at micro-economic aspects of firms' behavior. Here, a simple equilibrium framework is used, assuming that markets for firms are different between domestic and abroad. This analysis includes an estimation of price elasticity and income elasticity both for exports and for domestic demand, an estimation of scale economy of firms' activities, and a test of conjectures on the features of domestic and foreign markets (more specifically degree of market concentration). This analysis covers mainly the 1980s.

On the basis of the above empirical analysis, its implication to firms' export behavior after the G-5 agreement (September 1985) will be summarized.

The approach of this paper differs from most of past research works, which did not separate domestic and export markets. This paper applies equilibrium framework to firms' export behavior by separating domestic and export markets.

Section II examines the major features of the developments of export ratio (complied from GNP statistics) and the relations between such ratio and the business cycles of the U.S. economy. Then it analyses the relations between export demand and domestic demand by using a VAR model. The data used there are mainly from "Financial Statements of Principal Enterprises" of the Research and Statistics Department of the Bank of Japan.

Section III presents the framework for examining the background of the changes in the micro-economic export ratios. First, it is postulated that enterprises regard the export and domestic markets as separate. Then, based on the "marginal income = marginal expenditure" formula in accordance with the micro-economic theory of equilibrium, the principal factors for determining the export attitude of an enterprise (and the export ratio), apart from the effects of financial constraint, are shown in terms of (1) so-called economies of scale, (2) the differentials of price elasticities between the domestic and export markets and the differentials of market response elasticities (one firm's view or expectation of market responses to such firm's supply

change, in other words, one firm's view on the degree of market concentration), and exchange rates, and (3) the differentials of income elasticities between domestic and export markets. Based on these, Section IV measures scale elasticities and then summarize, on an industry-by-industry basis, the major characteristics of such elasticities with attentions paid to their relations to export ratios. Section V calculates the differentials between domestic and export prices by using "Wholesale Price Indices" of the Bank of Japan. Section VI estimates respective functions for domestic and export demand, from which the section points out the main features of income elasticities, price elasticities and market response elasticities on an industry-by-industry basis for domestic demands and exports respectively. Section VII summarizes the differences in financial constraints between the high-growth period and the most recent several years by combining an input-output analysis. Lastly, Section VIII investigates, on an industry-by-industry basis, factors that contributed to the rise in export ratios. Then the section examines the recent developments of exports since the fall of 1985.

The conclusions of this paper can be summarized below:

(1) The export ratio of the Japanese economy has shown an accelerated rising trend since the beginning of the 1980s. During the same period, it is observed that domestic demand has had a declining influence on exports and that exports in turn has had a stronger influence on domestic demand. It is also found that the rise in the export ratio is due not to changes in the shares of various industries in the economy, but to the rise of export ratio of each industry.

(2) Firms perceive the export market as quite different from the domestic market. Firms decide their supply schedule for domestic and export markets so as to equilibrate the marginal revenue from domestic market, the marginal revenue from export market, and marginal cost of production. Determining factors of firms' supply schedule are the determinants for export ratios as well: more specifically (i) scale economy, (ii) differentials of price elasticities between domestic and export markets, (iii) differentials of market response elasticities between both markets, (iv) exchange rates, and (v) differentials of income elasticities between both markets.

(3) Scale elasticities rose in the late 1970s (notably in machine manufacturing) and thereafter accelerated the speed of rising. This is attributable to (i) so-called economies of scale associated with larger size of production, (ii) so-called economies of scope associated with product diversification, and (iii) so-called Marshallian externality. The effect of scale economies on export ratios is evidenced by the fact that export ratios have shown a rising trend or have stayed at a relatively high level for industries such as electric machinery, automobile and steel, which have higher scale elasticities.

(4) Although the differences between domestic and export prices have not been significantly large, there have been certainly differences. By and large, export prices have been lower than domestic prices (for instance, 5 percent in 1980-84). The

differences have had a very close relation to the exchange rate movement of the Japanese yen. The differences for raw material industries are relatively small, those for machinery are somewhat wide. It is estimated that the improvement of export margins due to factors such as the appreciation of the yen has enabled firms to reduce export prices in foreign currency terms, thereby pushing up export ratios.

(5) For raw material industries, income elasticities of exports have been lower than those of domestic market. For machinery, those of exports have been higher. This forms an important background of the rising export ratios of machinery.

(6) For most of industries including automobile and other machinery, price elasticities of exports have been lower than those of domestic market. However, for electric machinery and refined machinery, those of exports are substantially higher. Such higher elasticities, together with the decline of export prices, possibly contributed to the rise in export ratios for the two industries.

Market response elasticities of exports have been lower than those of domestic market (notably for machinery), which means that firms perceive export market more competitive. This further implies that the existence of economies of scale would tend to lead to increase in exports.

Market response elasticities do not have unambiguous relations to domestic business cycles. The conjecture from this is that domestic recession, through changes of firms' perception of markets would not significantly increase exports.

(7) During the high-growth period, financial constraint seems to have worked as an incentive to increase exports through easier encashment of export bills. However, this mechanism have had a decreasing importance since the middle of the 1970s, because the economy turned into slower-growth period, which increased the availability of funds for firms.

(8) Taking account of the above, one can estimate that the backgrounds of the recent rise of the export ratio of the Japanese economy are notably (i) economies of scale mainly in machinery, and (ii) the depreciation of the Japanese yen. One can add (iii) higher income elasticities of exports and (iv) smaller size of market response elasticities of exports as factors contributing to the rise. One of the implications of the above findings for the future would be that the exchange rate, among the above factors, would work to depress the export ratio, owing to the yen's appreciation after the fall of 1985. However, this effect would quite possibly be limited, because the substantially higher scale elasticities and the higher income elasticity of exports in machinery (which has a large share in the economy) would reduce such expected effect of the yen's appreciation (namely high export prices). This suggests considerable efforts be required to restructure the export-oriented economy.

II. Characteristics of Changes in Exports

1. Changes Measured by GNP Statistics

When we examine the changes in export ratio of the Japanese economy based on GNP statistics, we find the following characteristics (Figure 1-1).

Firstly, after following a gradual upward trend from 1955 onward and showing a marked increase in 1974 immediately after the First Oil Crisis, the export ratio in real terms (at constant prices) registered a moderate drop during the period of adjustment to the so-called low growth economy until about 1979. Since 1980, however, it has again followed a marked upward trend. When we examine the ratio in nominal terms (at current prices), we find similar developments.

Secondly, the relationship between the GNP growth rate and the export ratio seems to have changed in recent years. During the period from 1955 to around 1980, the export ratio in real terms rose as the GNP growth rate slackened and it fell as the growth rate picked up. This trend was even more marked in nominal terms. Since around 1980, however, such a trend has become less marked. Both the export ratio and the GNP growth rate have begun to change in the same direction, i.e., when GNP grew, exports grew at a higher rate. The same applies to changes in nominal terms.

With these characteristics which can be intuitively obtained from the figure in mind, let us now examine in more concrete terms the relationship between the trends and cyclical fluctuations in export ratio (or the export growth rate) on one hand, and demand, both internal and external, on the other, with particular attentions paid to the changes around 1980 mentioned above. Figure 2-1 shows the changes in export growth and domestic demand growth rates.

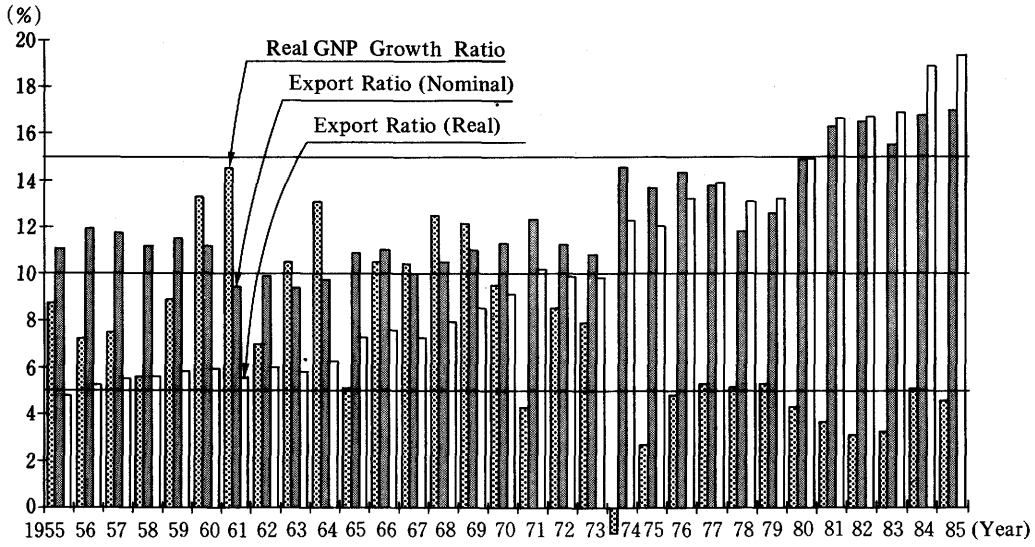
First, let us examine the trends in export ratio after seasonal and cyclical changes being eliminated. Although there are various methods for breaking down time series into trends and other component factors (cyclical, seasonal and irregular), we have used the Bayesian approach here. This method is designed to obtain clear trends by correctly ascertaining statistical characteristics of time series. This method has the following features.[1]

1) It estimates a trend as a stochastic process.
2) The model is formulated on the basis of a priori information on changes in trends.

1. We relied on Naniwa (1985) for this method. See his paper for details. In the Bayesian approach, estimation is made on ex post information set combining ex ante information set (available information before obtaining sample information) and sample information.

Figure 1 Trends for Export Ratios

(1) Real GNP Growth Ratio and Export Ratio



(Reference) Detrended Sequence with AIC

Case 1 No structural shift 211.2

	AIC		AIC
1972 I	221.4	1975 I	212.3
II	223.7	II	211.3
III	223.7	III	209.8
IV	225.6	IV	207.9
1973 I	227.5	1976 I	211.0
II	223.0	II	214.5
III	221.2	III	217.3
IV	221.7	IV	254.4
1974 I	222.5	1977 I	221.9
II	220.9	II	220.5
III	219.6	III	220.2
IV	217.2	IV	219.0

Case 2 With structural shift (1 period)

	AIC		AIC
1978 I	216.3	1981 I	211.7
II	220.0	II	213.3
III	223.5	III	216.6
IV	222.4	IV	217.3
1979 I	220.4	1982 I	214.7
II	217.0	II	213.2
III	214.2	III	213.7
IV	209.5	IV	242.4
1980 I	205.3		
II	200.1		
III	201.8		
IV	211.9		

(2) Changes in Real GNP-Based Export Ratio

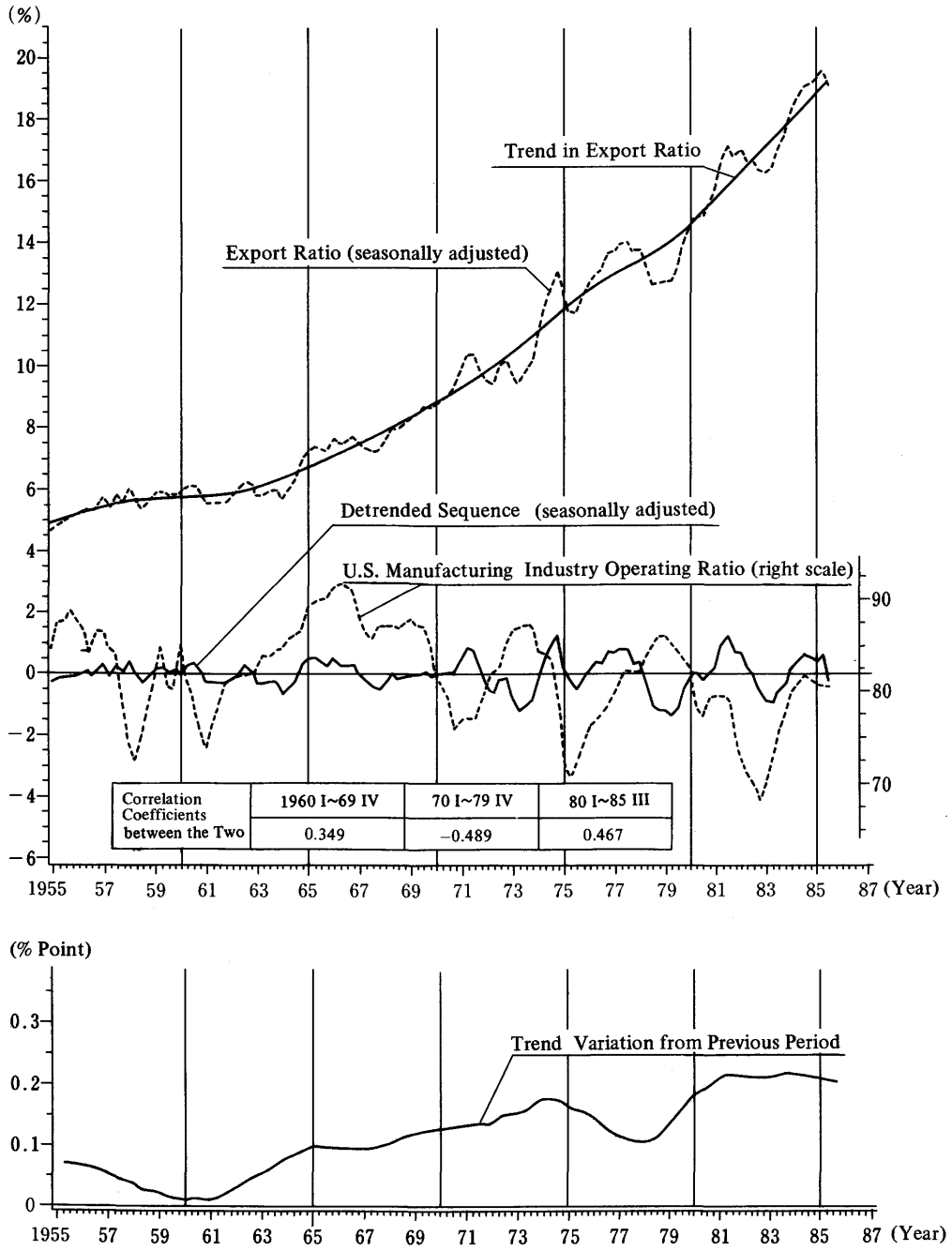
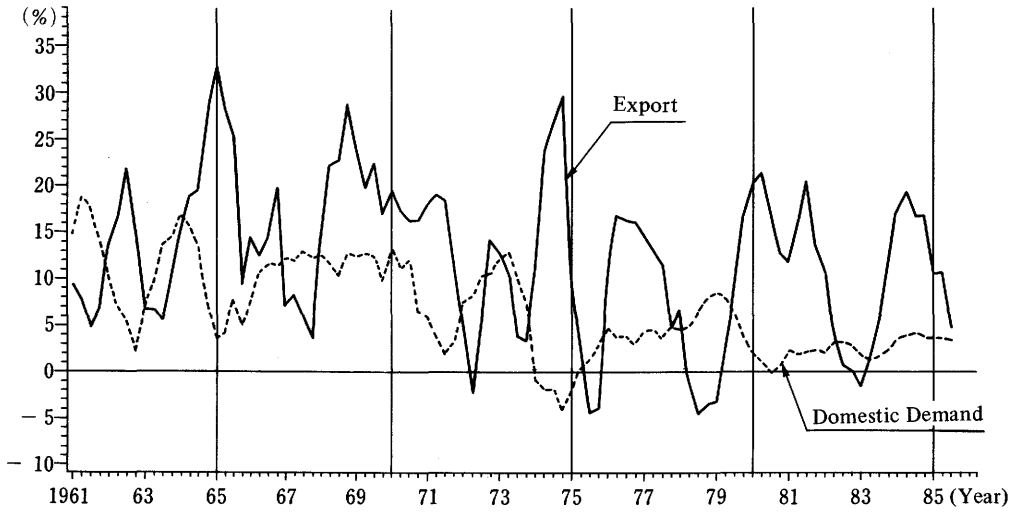


Figure 2 Relationship between Export and Domestic Demand (Real GNP Base)

(1) Export and Domestic Demand (as ratio of previous year)



(2) Variation Analysis according to VAR Model

(Component Ratio %)

Explained Variable \ Explanatory Variable		EX	DD		DD	EX
1962 I ~ 1980 IV	EX	66	34	DD	97	3
	DD	3	97	EX	35	65
1981 I ~ 1985 III	EX	77	23	DD	69	31
	DD	32	68	EX	23	77

Residual Variance Correlation Coefficient Matrix

Explained Variable \ Explanatory Variable		EX	DD
1962 I ~ 1980 IV	EX	1.000	−0.038
	DD	−0.038	1.000
1981 I ~ 1985 III	EX	1.000	0.006
	DD	0.006	1.000

Note: The length of the lag (3 periods) is selected by AIC, and the component ratios for the 20 periods are indicated.
Data are ratio of same period of previous year.
Ex: Export DD: Domestic Demand.

3) At the same time, other component factors are also estimated on a probability basis.

Figure 1-2 shows the trends in export ratio calculated by this method. While showing an upward trend during the decade from 1965, it showed a particularly marked upward shift toward 1975 as well as around 1980 and has since then continued to rise at a considerable pace.

As for the cause of the upward shift at the end of the decade from 1965, we should mention that while businesses continued to make efforts to cope with the sluggish domestic demand following the First Oil Crisis, pressure for export drive continued to prevail for a long period of time. Of course, we should not overlook the fact that stable domestic prices helped increase the price competitiveness of exports in this case.

In contrast, the rise in export ratio since around 1980 has been persistent while the pressure for export drive has been reduced by the completion of adjustments in business management to cope with low-growth economy. This can be attributed to the low yen exchange rate between 1979 and 1984, worked in favor of exports, and to other factors peculiar to various industries, which will be dealt with in detail later in this paper.

Let us now examine the question of whether the relationship (mutual dependence) between exports and the domestic demand has changed since around 1980. When we refer to the "dependence" in this paper, we have in mind the so-called "Granger Causality." Among various methods for conducting this type of examination, we use a VAR model designed to analyse the actual value of each variable as the weighted sum of the past innovations of other variables and the past and present innovations of the variable itself. Although there are cases in which exports fluctuate under the influence of overseas business conditions and cases in which the domestic demand fluctuates under a tight or easy policy, such relations will not be taken up straight forwardly. Rather, we employ a more indirect approach, that is, examining the relationship between GNP components such as export and domestic demand.[2] Figure 2-2 shows the results of the analysis.

As seen in Figure 2-2, during the period of high growth from the 1960s through the 1970s and the subsequent period of adjustment, exports (EX) were largely determined by the domestic demand (the so-called recession-driven type exports), while the domestic demand (DD) showed an extremely strong degree of autonomy.

However, since 1980, the independence of the domestic demand markedly receded and came to be determined by exports to a considerable extent. In other

2. This method of variance decomposition is described by Ito - Hayashi (1983) and Okina (1985). In this method of variance analysis, the conclusion may differ, depending on the order of variables. Therefore, the results obtained after changing the order will also be examined.

words, the influence of the domestic demand on exports decreased in relative terms and they began to fluctuate more independently.

When we look at these results, it is necessary to consider the following points;

1) The VAR model can only check the superficial relationship between exports and the domestic demand (not necessarily the true causal relationship)
2) As for the 1980s, the estimation period is short, and statistical information is not necessarily sufficient. In this sense, analysis based on this model can be described as preliminary.

Let us now consider the relationship between cyclical movements in export ratio (real GNP basis) and fluctuations in overseas business conditions. The capacity utilization rate of the manufacturing in the U.S. can be used as a variable for the business conditions in that country which is Japan's largest importer (accounting for 37% of Japan's total exports in 1984) and furthermore, as an indicator for fluctuations in overseas business conditions. Cyclical fluctuations in export ratio are represented by the adjusted export ratio (adjusted for the trends and the seasonality). The relationship between the export ratio and the capacity utilization rate of the U.S. manufacturing computed in this way is examined for the following three periods (Figure 1-2).

The first period covers the 1960s when the U.S. business continued to be on a high plane (the so-called "Hundred Golden Months"). During the period, firms in Japan repeatedly resorted to recession-driven type exports in response to tight policy which was adopted as the balance of Japan's international payments hit the ceiling.

As the domestic business recovered, however, the export ratio, which had risen as a result of export drives, began to fall. However, the range of such fluctuations in export ratio was small compared with those in subsequent periods as far as we can judge from Figure 1-2. Also, since Japan's export share in world trade was still small and the boom in the U.S. was still in progress, there were no marked signs of the so-called trade friction.[3]

The second period covers the 1970s when the export ratio and the U.S. capacity utilization rate began to show what might be called a reverse correlation. This was probably one of the factors for the growing trade frictions during this period. Such a change in the relationship between two variables was due to the fact that the U.S. business became overheated mainly because of the Vietnamese War, leading to intensified inflation, tight policy, and then business recession, while Japan's dependence on export increased during the First Oil Crisis and the subsequent period of adjustment.

The third period covers the years after 1980. In these years, cyclical fluctuations in export ratio have begun to move in the same direction as those in the U.S. business

3. As for the export behavior during the period of high growth, refer to Kanamori (1970), Watanabe - Negishi (1971), Takahashi (1975) and Sasanami (1980).

(the export ratio rises with a business boom in the U.S.). This probably means that fluctuations in the U.S. business conditions have begun to determine those in export ratio (Ueda (1985)). Despite the increased influence of U.S. demand on Japanese export, trade frictions have intensified as Japan's share in the U.S. imports has increased.

Let us now check the changing pattern of cyclical fluctuations in export ratio. We use a time-variant auto-regressive model in order to examine changes in covariance of variables adjusted for trends. This model is expressed by a stochastic difference equation. Here it is assumed that coefficients changes gradually over time. Structural shifts are checked by the AIC criterion.[4] This approach, applied to the period from 1972 to 1982, gives us a result that there most probably was a structural shift in 1980 in the pattern of cyclical fluctuations of the export ratio.

Based on a number of findings mentioned above, it can be said that Japan's export ratio has begun to show different aspects after around 1980: 1) the upward trend has increased its pace, 2) the impact of domestic demand on exports has decreased (the element of drive due to recession has decreased), and the impact of exports on the domestic demand seems to have increased, and 3) exports have become more responsive to the U.S. business conditions in the sense that exports fluctuate in the same direction as the U.S. business.

Because such a rise in export ratio in recent years and the resultant larger external imbalances reflect, export, an increasing difference between domestic savings and investments, it is not easy to ascertain a "causal relationship" between the two from ex post facto figures. Many of the past analyses attached more importance to the causality from excess savings to surpluses in current account (see, for example, Ueda (1985)). However, the above approach using the VAR model suggests the existence of causality from exports to domestic demand. In other words, the mechanism from increased exports to increased corporate earnings (savings) has strongly functioned.

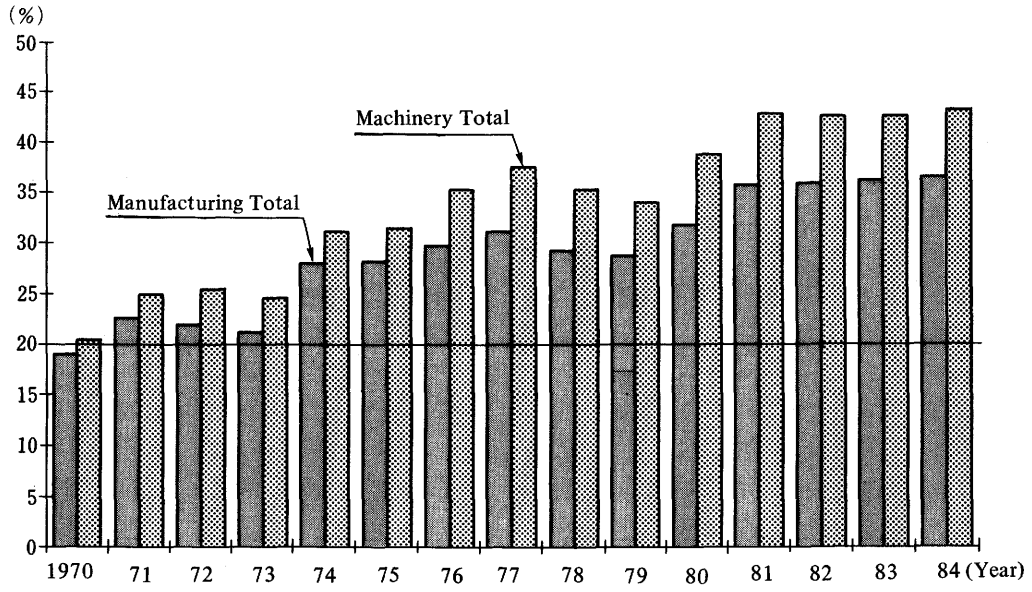
2. Characteristics of Exports by Industries

Taking account of the above mentioned developments in export ratio in macro terms, let us now examine the export behavior of firms in the main industries during the 1980s. The data used for analyses are from "Financial Statements of Principal Enterprises" compiled by the Research and Statistics Department of the Bank of Japan. The data have the following characteristics:

1) Long-term time series are available.
2) It is possible to use detailed statistics on costs such as fixed costs and vari-

4. Refer to Naniwa (1986) for the details of this analytical method.

Figure 3 Changes in Export Ratios for Each Main Industry



(Reference) Fluctuations in Export Ratios

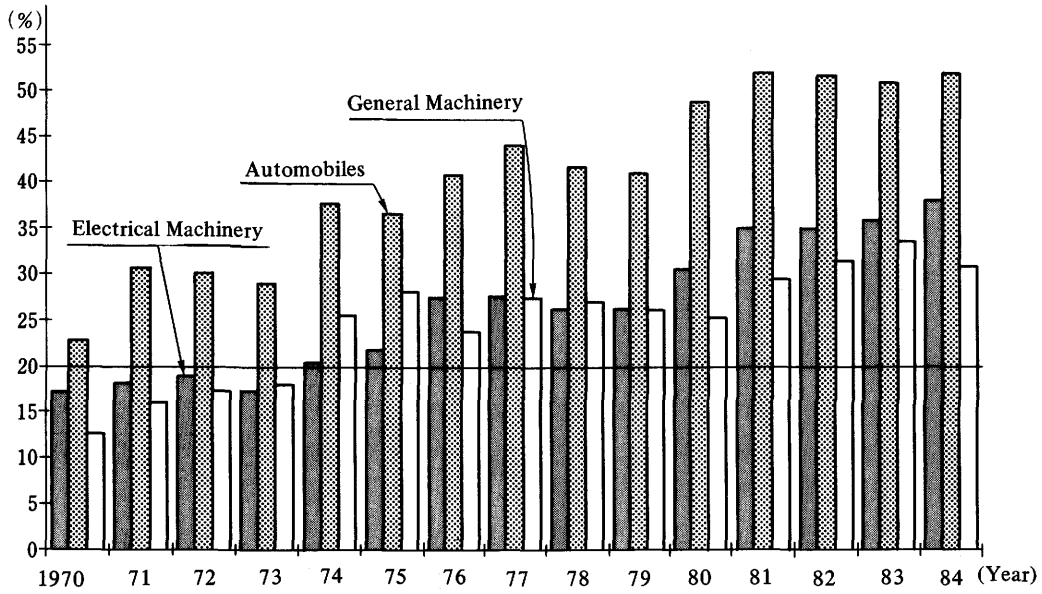
(%Point, Based on 24 Main Industries)

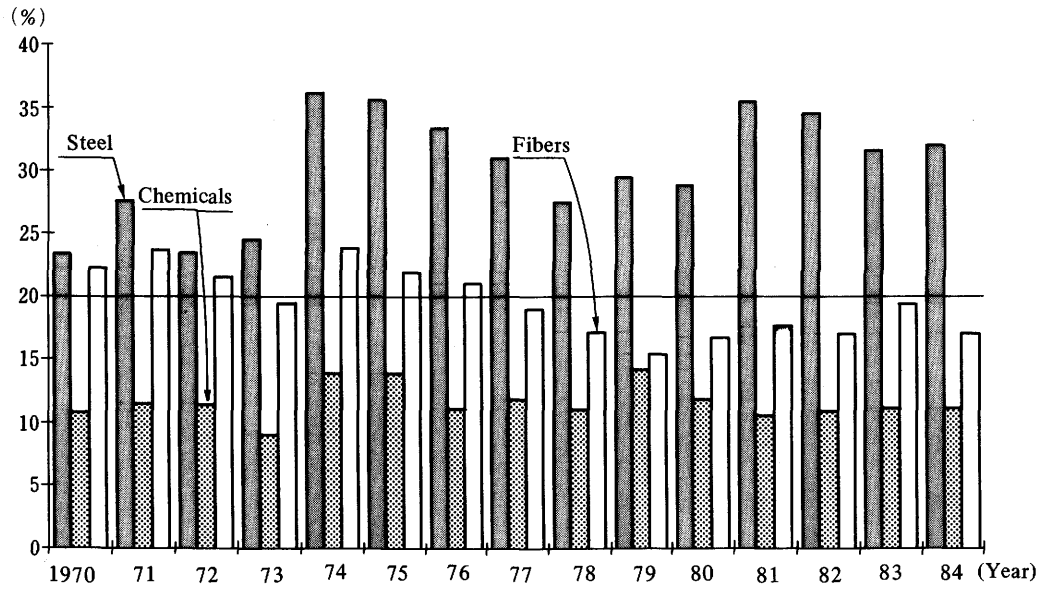
	1965→73	1973→79	1979→84
Change Range in Export Ratio	(19.5→21.3) +1.8	(21.3→28.9) +7.6	(28.9→36.5) +7.6
Effect on Change in Sales Structure	−0.3	+0.1	+0.6
Effect on Change in Export Ratio for Each Industry	+1.6	+6.2	+6.1

Note: The analysis of the factors for fluctuations in the export ratio (EVS) is calculated according to the following formula (W_i = i Sales weight for industry)

Effect of change in sales structure $= \sum_{i=1}^{24} (EVS_{i,-1} \cdot W_i) - \sum_{i=1}^{24} (EVS_{i,-1} \cdot W_{i,-1})$

Effect of change in export ratio for each industry $= \sum_{i=1}^{24} (EVS_i \cdot W_{i,-1}) - \sum_{i=1}^{24} (EVS_{i,-1} \cdot W_{i,-1})$


(%)
55
50
45
40
35
30
25
20
15
10
5
0
General Machinery
Automobiles
Electrical Machinery
1970
71
72
73
74
75
76
77
78
79
80
81
82
83
84
(Year)


(%)
40
35
30
25
20
15
10
5
0
Steel
Chemicals
Fibers
1970
71
72
73
74
75
76
77
78
79
80
81
82
83
84
(Year)

able costs (these statistics account for more than 70% of the total customs-cleared exports in 1984).[5]

When we examine these statistics (Figure 3), we find that the average export ratio for the 24 main industries in 1984 was 36% (17% on the GNP basis (nominal exports, etc./nominal GNP)). There was marked rises in 1974 and 1980 as in the case of the figure on the GNP basis.

Classified by industry, marked increases in export ratio are found in machinery-related industries such as automobile, electrical machinery (household appliances, electronic parts, etc.), and precision machinery. The ratio either remained at roughly the same level or showed signs of decline in raw-material-related industries such as chemical, textile and iron and steel.

Let us briefly examine the relationship between the marked upward trend in the export ratio of the whole economy and the movements of export ratios for individual industries. The movements of the export ratio of the whole economy can be divided into the following two elements:

1) The effect of changes in industrial structure (changes in each industry's share for the total sales of exports and domestic sales).[6]
2) The effect of changes in the export ratio of each industry (changes in export attitude of each industry).

The table included in Figure 3 shows the results obtained by calculating these two types of effects for the main 24 industries in manufacturing. The years from 1965 to 1984 are divided into the following three periods, which, as mentioned above, saw markedly different movement in the export ratios of the main industries: a) the period of high growth (1965-73), b) the period of adjustment to low-growth economy after the First Oil Crisis (1974-79) and c) the period from 1980 (1980-84).

5. However, the analysis below covers 24 industries listed below, excluding those industries (food, printing, oil refining, rubber products, etc.) with a small number of establishments or an extremely low export ratio (which are clearly oriented toward domestic demand by nature); chemical fibers, cotton spinning, other textiles (clothing, etc.), paper and pulp, general chemicals, inorganic chemicals, organic chemicals, cement, other ceramics and earthenware (except glass), ordinary steel, special steel, electric wire and cable, metal products, mother machines, industrial machinery, mechanical tools and parts, general electrical machinery, heavy electrical machinery, household appliances, communication and electronic equipment, electronic parts, automobiles, shipbuilding, and precision machinery.

6. According to the traditional argument of Heckscher-Ohlin, changes in export ratio are caused by changes in industrial structure resulting from fluctuations in relative factor prices such as wages and prices of capital goods, but not by fluctuations in the export ratio of each industry (refer to Ito - Oyama (1985). For Heckscher-Ohlin's theorem: "Each country has comparative advantage in industries that intensively use factors relatively abundant in the country"). According to Heckscher-Ohlin, relative factor prices are equalized in the long run by foreign trade.

It shows that the effect of changes in industrial structure on the export ratio were negligible until around 1980 (at least for these 24 main industries). Even after 1980, the effect has continued to be extremely small. In contrast, the impact of a rise in the export ratio of each industry was extremely large, showing that a rise in the export ratio of the whole economy was almost entirely due to this effect.[7]

This means that the impact of changes in industrial structure resulting from fluctuations in relative factor prices caused by the Oil Crisis, etc., was considerably limited, as far as the export ratios of the main industries in manufacturing are concerned.[8] Therefore, when elucidating changes in export ratio, it will be necessary to analyse the structure of production costs in each industry as well as the export attitude of each industry in micro-economic terms.

Let us now formulate the export behavior of firms within the framework of profit maximization, taking account of the above results.

III. Premises for Analysis and Theoretical Framework

1. Premises for Analysis

The majority of the past research work on the export behavior of the Japanese main industries assumed that firms viewed the export market as marginal. This can be typically seen in the view of Murakami (1984); "we must conclude that firms' behavior during the period of high growth was competitive and oriented toward domestic demand."[9]

In many cases of formulating export functions (annual White Paper on Trade, etc.), they added inventory ratios or capacity utilization rates (indicators for the domestic condition of supply and demand) to the difference between export prices and the U.S. prices for competitiveness as well as the exchange rate and the demand

7. The export ratio of the whole economy on a GNP basis rose while the weight of the tertiary industry (with a low export ratio) increased. This was due to a rise in the export ratio of manufacturing and not to a rise in the weight of manufacturing (with a higher export ratio compared with the tertiary industry). However, there is a possibility that a somewhat different conclusion could be obtained if different classification of data was employed (for instance, consider the levels of products or production units). Here in this analysis, such classification is not employed because I assume that the decision-making body is a corporate body (which may be engaged in multiple production) and not a production unit. Finally, the problem of relocation of production units overseas through direct investment should have also been taken up here, but it has been left for future analysis.

8. There is another possibility that the domestic demand for industries with rising export ratios declined, resulting in the constant total sales (both exports and the domestic demand) of such industries.

(income) overseas.

From the viewpoint of micro-economic theory, however, even those phenomena which are called as export drives should be formulated in the context of firms' optimizing behavior (profit maximization). When the upward trends in export ratios in recent years are taken into account, serious questions arise about the view that the export market is marginal with regard to many products including automobiles and household appliances. Moreover, it is difficult to explain the export ratio only in the context of the so-called export drive resulting from a domestic recession in view of the fact that the export ratio has been rising in recent years after firms completed adjustment to low growth and after the domestic inventory ratio (or capacity utilization rate) bottomed out.

Accordingly, when explaining the export behavior of main firms in recent years, it is also necessary to pay attention not only to the domestic business condition but also to other factors influencing the export market, such as exchange rates, demand elasticities of the export market and of the domestic market, and the cost structure of firms.

When formulating corporate behavior through such an approach, I take the view in this paper that firms make a dicision on their exports to maximize their profits in the short term. As for the export market, we do not regard it as marginal but as a market considerably different from the domestic market in terms of demand elasticity and price level.

Differentials between the export prices and the domestic prices for the same product exist in the cases where the cost of price discrimination is small compared with the resulting profit. Such cases include the following:

1) There are no resales (or shifts of consumers between markets are limited).
2) The price elasticity differs from one market to another.
3) Oligopolistic businesses raise prices by curbing quantities in order to avoid the problem of dumping. (Imai, Uzawa, Komiya, et al (1971), p. 256)

Of course, the "separation" or "division" between export and domestic markets per se does not imply the existence of large-scale price differentials between the two markets. The requisite for price differentials is that the profit from "discrimination" exceeds its cost.

9. Export drive is a phenomenon which occurred not only in Japan during the period of high growth but also in other countries. For examples, in the case of Japan see Sasanami (1980): for an analysis of domestic demand and exports during a short-term business cycle in the United Kingdom, refer to Cooper - Hartley (1969).

Takahashi (1975) states that the increase in plant investment during the high growth period reflected the anticipated expansion of export demand, and that the policy of encouraging exports was the representation of "an effort to reduce external deficits by the positive method of increasing exports instead of the negative method of curbing the domestic demand" (p. 158). It seems, however, that such a view was a minority.

This also means that the premise of perfect market competition is not necessarily appropriate for the analysis of markets and that, instead, an imperfect market model should be adopted. Interestingly enough, the proposition of "export drive" seems to assume that firms have some form of market control.

Let us consider which is appropriate for the analysis here, a model for monopolistic competition or one for oligopoly.

Monopolistic competition indicates a market structure whereby a large number of firms sell closely substitutable commodities. There, product differentiation is based on patents, trade marks, quality, performance, design, etc., and the products of different firms are different for the consumer but at the same time, closely substitutable.

The main feature of oligopoly is that, as the number of competitors is limited, each firm acts in response to the moves of its competitors. In other words, there exists mutual dependence based on conjecture between firms.

Among the main industries in the Japanese economy, material industries like iron and steel, and chemicals can be categorized as oligopolistic. In assembly industries like electrical machinery and automobile, product differentiation has been made to a considerable degree, and the products have been closely subsitutable. In a number of other industries, a small number of firms determine their actions, taking the sales trends of their competitors as important indicators. Therefore, let us, here in the following analysis, take a tentative assumption that Japan's main firms are more or less oligopolistic.

Based on the above premise, let us design a framework for corporate profit maximization. Under imperfect competition, there are many cases where, even when a firm knows about the objective demand for the whole industry, it cannot perfectly perceive the demand for the firm itself. There are two approaches in formulating the behavior of a firm that takes account of the demand for the firm itself: 1) one based on a perceived inverse demand curve[10] and 2) the other based on a firm's conjecture on the responses of its competitors.

When the perceived inverse demand function is expressed as $P_i(Q_i)$, the following relationship exists between $P_i(Q_i)$, the quantity of demand (Q_i), that Company i faces, production cost (C_i) and profit (Π):

$$\Pi(Q_i) = P_i(Q_i) \cdot Q_i - C_i \tag{1}$$

10. In general, the preceived inverse demand curve for Company i is also dependent on the production quantity (Q_i) of other companies. Therefore, this formulation assumes that each company follows a conjecture of the Cournot-Nash type with each company taking the actions of other companies as a given condition. For this formulation, Hideo Hayakawa of the Institute for Monetary and Economic Studies, gave useful comments.

The first order condition for profit maximization with marginal returns being as MR_i is:

$$MR_i = P_i + \frac{dP_i}{dQ_i} \cdot Q_i = P_i\left(1 + \frac{1}{e_i}\right) = MC_i \tag{2}$$

Here e_i is the price elasticity of the preceived demand and MC_i marginal cost.

However, the perceived price elasticity (e_i) does not necessarily match the price elasticity value (e) of the objective demand curve, or is not observable.

It one defines $\lambda_i = e/e_i$ here, λ_i can be interpreted as a measure of market power of Company i (the larger λ_i, the larger the market power). In a case where a company reduces its prices, if all the other companies reduce their prices by the same rate, λ_i comes to equal 1.0. If the other companies do not reduce their prices further, $0 \leqq \lambda_i \leqq 1$.

Next, assuming that there are no price differentials between firms, that the price determined in the market is P, and that the total demand is Q, the Equation (2) can be rewritten as follows:

$$MR_i = P\left(1 + \frac{dP}{dQ} \cdot \frac{Q}{P} \cdot \frac{dQ}{dQ_i} \cdot \frac{Q_i}{Q}\right) = P\left(1 + \frac{\lambda_i}{e}\right) \tag{2}'$$

$$\text{Here } e = \frac{dQ}{dP} \cdot \frac{P}{Q},\ \lambda_i = \frac{dQ}{dQ_i} \cdot \frac{Q_i}{Q}$$

Here, λ_i is considered to be the market response elasticity (Tsujimura – Kuroda (1974)). This represents a firm's conjecture of changes in all the other companies' supply when the firm increases (decreases) its own supply. In the case of a perfect seller's monopoly, $\lambda = 1$, and under perfect competition $\lambda = 0$. In ordinary cases $0 < \lambda < 1$.

In other words, in advance of its production decision, each company conjectures the production (supply) attitudes of the other companies in the same industry, and such conjectures are formed on the basis of the past experiences of each company (Iwata (1974)).

In addition to the market share of the individual company, the value of i also reflects the following factors. When λ_i is large, it means that the company conjectures that if it increases its own production, the other companies will act in the same way. Conversely, a smaller value implies that the company judges the market to be competitive and believes that a reduction of prices will make a quantitative expansion possible. An analysis of firms behavior, therefore, needs to distinguish rate the parameter (e) derived from the behavior of the consumer side as a whole and the parameter (λ_i) showing the conjecture of the supply side with regard to the condition of market competition (Tsujimura (1982)). Thus, basically the same analytical results can be obtained from both approaches: the perceived inverse demand curve and the conjectured behavior.

It is evident that the firms that this study deals with are under the different conditions with regard to demand and cost for their products, and that their mutual relationships take various forms: cooperation, complicity, schism and contention. Accordingly, it is difficult to formulate the behavior of oligopolistic firms in a simple and conclusive way like that in the case of perfect competition or monopoly. This is also clear from the above stated fact that "conjecture" is an important element for determining corporate behavior aimed at profit maximization.

What follows does not intend for any strict formulation of this kind of imperfect competition or any examination of the outcome that such competition would ultimately bring about; rather the differences in corporate behavior toward export and domestic markets will be analysed. First, let us examine the conditions on demand and supply sides faced by firms in the market (production or cost function).

2. Framework for Analysis

First, let us formulate the short-term profit maximization of a firm (quantitative restrictions on finance are not considered here; they will be examined in Section VII).

Define the demand quantities faced by the firm on both export and domestic markets and their prices Q_E, Q_D, $R \cdot P_E$ and P_D (R: exchange rate; P_E: price in foreign currency), and the production cost C, then the profit (Π) for the firm can be shown by the equation below (Company i is treated as the representative company of the industry concerned, and the accompanying letter i is omitted).

$$\Pi = (R \cdot P_E \cdot Q_E + P_D \cdot Q_D) - C \tag{3}$$

The profit is maximized in a situation where marginal return from exports (MR_E), marginal return from domestic sales (MR_D), and marginal cost of production (MC) are equal. Thus, when $Q = Q_E + Q_D$, the condition for profit maximization is:

$$MR_E = R \cdot P_E\left(1 + \frac{\lambda_E}{e_E}\right) = \frac{dC}{dQ} = MC \tag{4}$$

$$MR_D = P_D\left(1 + \frac{\lambda_D}{e_D}\right) = MC \tag{5}$$

From Equations (4) and (5)

$$MR_E = MR_D = MC \tag{6}$$

Now let us look at marginal cost. It is necessary to specify the production or cost function, and we face the problem of how to treat the elasticity of substitution between the factors of production. While a function of the trans-log type would better be used for checking the elasticity of substitution, this study employs a Cobb-

Douglas type function which is easy to handle.[11]

$$\ln(Q) = \ln(Q_E + Q_D) = \alpha \cdot \ln K + \beta \cdot \ln L + \gamma \cdot \ln M + \delta \cdot \ln T + A \tag{7}$$

Here K: capital stock, L: labor force, M: intermediate input, T: technological progress rate, A: constant term.

The cost function is as shown below.

$$C = r \cdot K + w \cdot L + P_M \cdot M \tag{8}$$

Where r: capital cost per unit, w: wage rate, P_M: intermediate input price.

The first order conditions of cost minimization from the Equation (8) are:

$$\left.\begin{aligned} r &= P \cdot \alpha \cdot \frac{Q}{K} \\ w &= P \cdot \beta \cdot \frac{Q}{L} \\ P_M &= P \cdot \gamma \cdot \frac{Q}{M} \end{aligned}\right\} \tag{9}$$

P is the average price for the products.

From the Equation (9), therefore,

$$C = P(\alpha + \beta + \gamma) \cdot Q = P \cdot k \cdot Q \tag{9}'$$

Here k is the scale elasticity $(= \alpha + \beta + \gamma)$.

When the short-term cost function (C_S) is considered on the assumption that the capital cost ($r \cdot K$) and the personnel cost ($w \cdot L$) are fixed,

$$C_S = \overline{r \cdot K} + \overline{w \cdot L} + P_M \cdot M \tag{10}$$

and if the Equation (7) is substituted for (10), we obtain

$$C_S = \overline{r \cdot K} + \overline{w \cdot L} + P_M \cdot \frac{Q^{\frac{1}{\gamma}}}{(A \cdot \bar{K}^{\alpha} \cdot \bar{L}^{\beta} \cdot e^{\delta T})^{\frac{1}{\gamma}}} \tag{10}'$$

Therefore, if the Equation (9) is also used, the short-term marginal cost (MC_S) is

$$MC_S = \frac{dC_S}{dQ} = \frac{P_M \cdot M}{\gamma} \cdot \frac{1}{Q} = P \cdot Q \cdot \frac{1}{Q} = P \tag{11}$$

From (9) and (11)

$$MC_S = \frac{C}{k \cdot Q} \tag{11}'$$

An increase in productivity (technological progress) brings about the similar effect to

11. For the trans-log type function, see Horiye (1984) for an example of its application to the price function. The Cobb-Douglas function is the case in which the strongest restrictions are imposed on the trans-log type function.

that of an increase in scale elasticity because both shift the marginal cost curve downward.

From the Equations (4), (5) and (11)′, under short-term equilibrium,

$$R \cdot P_E\left(1+\frac{\lambda_E}{e_E}\right) = P_D\left(1+\frac{\lambda_D}{e_D}\right)=\frac{C}{kQ} \tag{12}$$

holds. The Equation (12) shows that the following three variables are equalized under a short-term equilibrium: 1) marginal return from exports determined by the exchange rate (R), foreign currency term export prices (P_E), the market responsive elasticity on the export market (λ_E), and the price elasticity (e_E); 2) marginal return from domestic sales determined by domestic prices (P_D), the market responsive elasticity on the domestic market (λ_D) and the price elasticity (e_D); and 3) the short-term marginal cost determined by the total costs (C), the total sales (Q) and the scale elasticity (k).

To examine the equilibrium condition on the market, it is necessary to formulate the condition on the consumer side (the demand curve) as well as the firms' side (marginal return = marginal cost) mentioned above. Income (y) and price (P, including relative prices) of the various factors determining demand (D), are taken up here, although we will look at the more precise function form in Section VI. Thus,

$$D = f(y,\ P) \tag{13}$$

Here, exports and the domestic demand are determined by the income elasticity and the price elasticity on each market, but the effects of product quality, brand and habit-forming factors are neglected.[12] This section deals with mainly the price elasticity of a commodity on domestic and external markets, while the price elasticity of competing goods, for example, U.S. products on the U.S. market will be dealt with in Section VI.

Although it is possible that market equilibrium is influenced by noneconomic factors and medium- and long-term factors, this study places focus on the factors which determine the attitudes or businesses toward exports, that is, the short-term supply schedules of firms regarding exports and domestic demand.

On the basis of the theoretical framework shown by the Equations (12) and (13), the following factors determine equilibrium sales quantities for the export market (expressed as a function of income and price), and hence, the export ratio of a firm and its attitude toward exports:

① Economies of scale (scale elasticity k)

12. It would be also necessary to consider the imports of the commodity. However, in view of the fact that Japan's trade structure is vertically specialized, the effect of competing imports is judged to be limited (particularly, the case of the main manufacturing firms). When formulating the domestic demand as well, therefore, the effects of imports (and import prices) are disregarded.

② Ratio of export prices vs. prices for domestic demand ($R \cdot P_E/P_D$), or, more precisely,

A Ratio of price elasticity of exports vs. that of domestic demand (e_E/e_D)

B Ratio of market responsive elasticity of exports vs. that of domestic demand (λ_E/λ_D)

C Exchange rate (R)

③ Ratio of income elasticity of exports vs. that of domestic demand (e_{yE}/e_{yD})

Here the supply schedules for firms are drived individually, without using the reduced form equations obtained from the Equations (12) and (13).

As regards ②-A, B, and C, the following mutual dependence holds:

$$R \cdot P_E/P_D = \frac{1+\frac{\lambda_D}{e_D}}{1+\frac{\lambda_E}{e_E}}$$

Then, based on the Equations (4) and (5), ① and ② determine the supply curve of a firm for exports and domestic demand, and ③ determines the degree of shift in the demand curve.

When considering these relationships based on Figure 4-1, it can also be said that the supply curves of a firm for exports and domestic demand are shown by the curves given below, which are obtained by shifting up the marginal cost curves (MC) (the degree of deviation of the two curves from the MC curves is dependent on λ/e).[13]

$$S_D\left(=\frac{MC}{1+\frac{\lambda_D}{e_D}}\right)$$

$$S_E\left(=\frac{MC}{1+\frac{\lambda_E}{e_E}}\right)$$

The increase in export ratio (based on tne premise of equalized marginal returns (MR) between from exports and from domestic demand) is determined by the degree of shift in both these curves and demand curves for exports and domestic demand. In view of the above relationships, let us now consider several typical cases in which export ratio rises (Figure 4-2; all expressed in yen).

(1) Case of Decrease in Domestic Demand

A decrease in domestic demand causes a left downward shift of the demand

13. Although, strictly speaking, it is not correct to call S_D and S_E supply 'curves', they can be proxies for such curves, because (i) it is possible to regard them as supply curves if λ/e (a factor on the demand side) is constant, and (ii) analysis is easier if we use a concept similar to that of equilibrium in general market competition.

curve (which causes a drop in domestic prices in the very short run). Then, equilibrium is restored through an increase in export volume (a drop in export prices), which reflects an improvement in the profitability of exports relative to that of domestic demand, and, as a result, the export ratio (EVS) rises. In this case, the marginal cost declines as indicated in the column for domestic demand. This decline in marginal cost can be shown as a rightward shift of the marginal cost curve (MC) in the column for export.

Shift in domestic demand curve $\rightarrow P_D\downarrow(R\cdot P_E/P_D\uparrow)$

$\rightarrow\overline{MR_E} > MR_D \rightarrow Q_E\uparrow(R\cdot P_E\downarrow) \rightarrow MR_E = MR_D(EVS\uparrow)$

(2) Case of Growth in Overseas Demand

With a right upward shift of the export demand curve, export prices in foreign currency terms rise, and the subsequent improvement in the profitability of exports vs. that of domestic demand increases exports (as a result, equilibrium is restored through a drop in export prices and a rise in domestic prices).

Shift in overseas demand curve $\rightarrow P_E\uparrow(R\cdot P_E/P_D\uparrow)$

$\rightarrow MR_E = MR_D(EVS\uparrow)$

(3) Case of a Drop in Yen's Value

A depreciation of the yen shifts the supply curve and the demand curve for exports (on a yen basis) upward to the same extent (hence, the export volume does not change). While this leads to an increase in exports through a result and improvement in marginal returns for exports relative to domestic demand (this, in turn becomes a pressure for lower export prices on foreign currency terms), it works as a factor for decreasing domestic supply and increasing domestic prices. These push the export ratio upward.

$R\uparrow\rightarrow MR_E > \overline{MR_D} \rightarrow Q_E\uparrow(P_E\downarrow) \rightarrow MR_E = MR_D(EVS\uparrow)$

(4) Case of a Drop in Market Response Elasticity for Exports

A drop in market response elasticity or market response price elasticity for the export market ($|\lambda_E/e_E|$) causes a rightward shift in the supply curve for exports and an improvement in marginal returns of exports. This also contributes to a rise in export ratio through the equalization of both export and domestic marginal returns (in other words, through a relative rise in domestic prices).

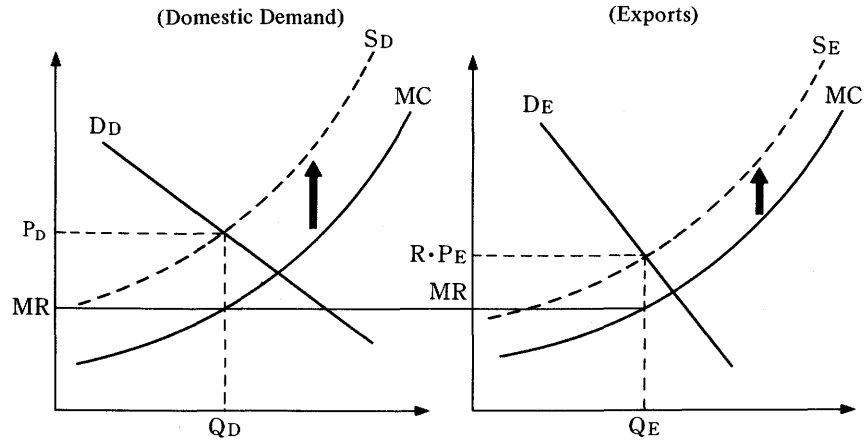
$|\lambda_E/e_E|\downarrow\rightarrow MR_E > \overline{MR_D} \rightarrow Q_E\uparrow(P_E\downarrow,\ P_D\uparrow) \rightarrow MR_E > \overline{MR_D} \rightarrow Q_E\uparrow(P_E\downarrow)$

(5) Case of an Increase in Scale Elasticity

While an increase in the scale elasticity gives a firm incentives to increase its production, this itself does not necessarily raise the export ratio. It leads to a rise in export ratio when a firm conjectures that the overseas market is more competitive

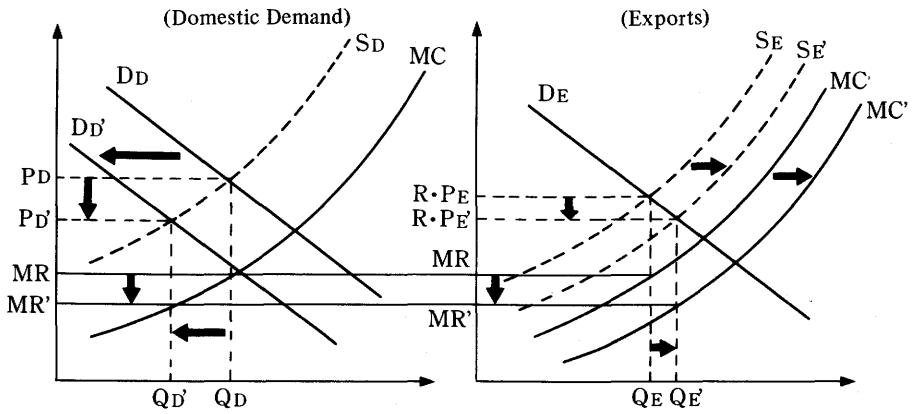
Figure 4 Fluctuation Mechanism for Export Ratios

(1) Mechanism for Determining

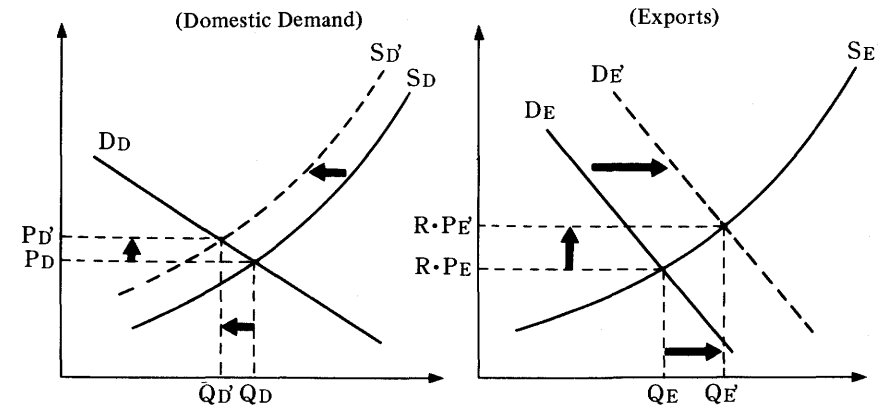


(2) Fluctuation in Export Ratio

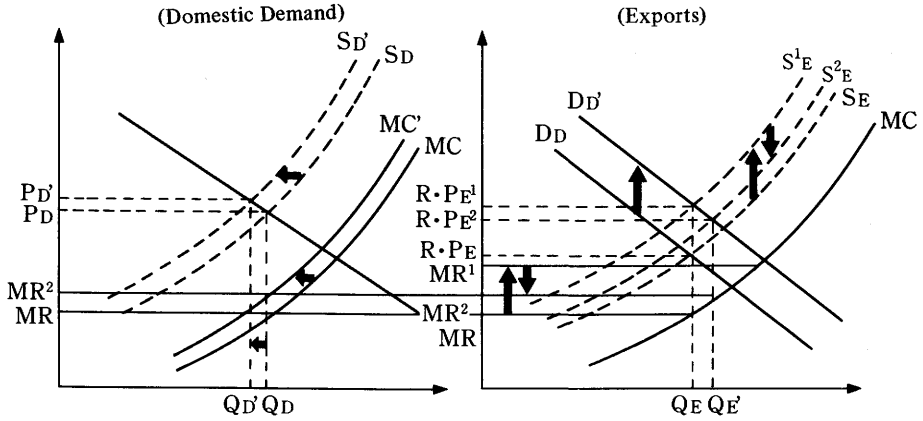
a. Case of Decline in Domestic Demand



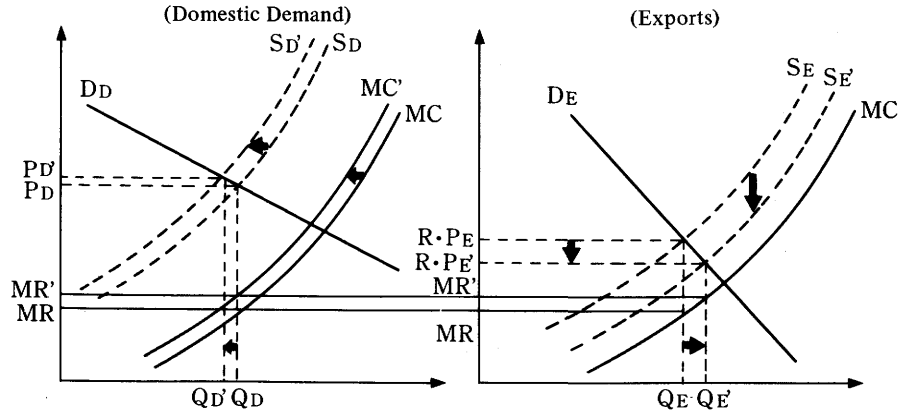
b. Case of Increase in Overseas Demand



c. Case of Fall in Yen Exchange Rate



d. Case of Reduction in Elasticing Values to Market Response for Export



注) D_E : Export Demand
Q_E : Export Quantity (initial)
$R \cdot P_E$、S_E : Export Price (initial) and Supply Quantity
D_D : Domestic Demand
Q_D : Domestic Demand (initial)
P_D、S_D : Domestic Prices (initial) and Supply Quantity
MC : Marginal Cost (initial)
Q_E' : Export Quantity (after fluctuation)
$R \cdot P_E'$、S_E' : Export Price (after fluctuation) and Supply Quantity
MC' : Marginal Cost (after fluctuation)
Q_D' : Domestic Demand (after fluctuation)
P_D'、S_E' and Supply Quantity (after fluctuation) and Quantities

than the domestic market ($|\lambda_E/e_E| < |\lambda_D/e_D|$) The same mechanism also operates in case of an increase in productivity (technological progress), which is a factor for a downward shift of the marginal cost curve.

$$k\uparrow \rightarrow MR_E > \overline{MR_D} \rightarrow Q_E\uparrow(P_E\downarrow) \rightarrow MR_E = MR_D(EVS\uparrow)$$

(6) Case of an Widening Differential between Domestic and External Income Elasticities

Even when the subjective equilibrium conditions for a firm and the growth rates of domestic demand and exports are unchanged, there will be a pressure for a rise in the export ratio, if a firm perceives that the income elasticity for demand on the overseas market is larger than domestic market.

Bearing in mind these six typical cases where the export ratio rises, let us measure the scale elasticity for each industry as a factor on the supply side of firms and then calculate the price ratio between exports and domestic demand. Further, based on the demand function, income elasticity, price elasticity and market response elasticity will be calculated for exports and domestic demand to examine the relationship between these factors and the export ratio.

IV. Movements of Scale Elasticity by Industry

1. Method for Measuring Scale Elasticity

The scale elasticity is defined as follows. When the product (Q) is produced by factors of production $V = \{v_1, \ldots, v_N\}$, the production function is

$$Q = f(v_1, \ldots v_N) = f(V) \tag{14}$$

Under this production function, the scale elasticity (k) is defined as the elasticity of the production quantity (Q) against the scale of factors of production (μ), provided $Q = f(v_1, \ldots, v_N) = F(\mu v_1^{\circ} \ldots, \mu v_N^{\circ})$.

$$k = \frac{d\ln Q}{d\ln \mu} = \frac{\frac{dQ}{Q}}{\frac{d\mu}{\mu}} \tag{15}$$

At this time

$k > 1$: increasing returns to scale (economies of scale exist)

$k = 1$: constant returns to scale

$k < 1$: decreasing returns to scale

As for measuring the scale elasticity (k), there is a method whereby it can be estimated directly by specifying the production function shown in (14). However,

this may cause multicollinearity between the factors of production because the volume of factor inputs increase with scale. Therefore, this study uses the method devised by Yoshioka (1977, 1985),that is, measuring the scale elasticity from the data on relative prices of production and factors inputs, assuming the cost minimization of firms and the homogeneity with degree k of the production function,[14] without specifying the production function and the cost function (for example, Cobb-Douglas type, CES type, etc.).

An outline of the method is given below (for details refer to Yoshioka (1985) and Kuroda – Kaneko (1985)).

By using Frish's approximating equation, the Equation (15) becomes

$$k = \frac{\frac{dQ}{Q}}{\frac{d\mu}{\mu}} \fallingdotseq \frac{\ln Q_{i+1} - \ln Q_i}{\ln \upsilon_{i+1} - \ln \upsilon_i} = \frac{\ln Q_{i+1} - \ln Q_i}{\ln \upsilon_{i+1}^{j} - \ln \upsilon_i^{j}} \tag{16}$$

assuming that $Q_{i+1} > Q_i$ and that samples of Q_i are arranged in the order from small to large, υ is the production factor input and $\upsilon_{i+1}^{j} = \mu_{i+1} \cdot \upsilon_j^{o}$, $\upsilon_i^{j} = \mu_i \cdot \upsilon_j^{o}$. For the actual data there is no guarantee that the Equation (16) holds for all the samples; but it is assumed here that it holds for all the j.

When approximating $\ln \upsilon_{i+1}^{j} - \ln \upsilon_i^{j}$ $(= \ln (\upsilon_{i+1}^{j} / \upsilon_i^{j}))$, quantity indices for factors of production are used (Yoshioka (1985)). As for the quantity indices, the following four are considered: the Laspeyres index, the Paasche index, the Fisher index and the divisia index. First, the Laspeyres index for production factor quantity (QI_L) in the case of i = 1 when P is the vector for production factor inputs, will be

$$QI_L = \frac{P_1 V_2}{P_1 V_1} \tag{17}$$

and the Paasche index for the production factor quantity (QI_P) will be

$$QI_P = \frac{P_2 V_2}{P_2 V_1} \tag{18}$$

Accordingly,

$$k_L = \frac{\ln Q_2 - \ln Q_1}{\ln QI_L} \tag{17}'$$

14. This means $Q = \lambda^{-k} \cdot f(\lambda V)$ with λ as the positive scalar. The explanation below is based on Yoshioka (1979, 1982, 1984, 1985). As an example of the same type of method, refer to Kuroda – Kaneko (1985).

$$k_P = \frac{\ln Q_2 - \ln Q_1}{\ln QI_P} \tag{18}'$$

The upper and lower limits of the scale elasticity correspond to the cases where the aggregate Paasche index and the aggregate Laspeyres index are assumed respectively.

The Fisher Index (QI_F) and the divisia index (QI_D) are expressed as below.

$$QI_F = \sqrt{\frac{P_1V_2}{P_1V_1}\cdot\frac{P_2V_2}{P_2V_1}} = \sqrt{QI_L \cdot QI_P} \tag{19}$$

$$QI_D = \prod\left[\frac{v_1^2}{v_1^1}\right]^{\frac{1}{2}\left[\frac{p_1^1 v_1^1}{P_1V_1} + \frac{p_1^2 v_1^2}{P_2V_2}\right]} \tag{20}$$

The scale elasticity of the Fisher formula and divisia formula are shown in the following equations.

$$k_F = \frac{\ln Q_2 - \ln Q_1}{\ln QI_F} = \frac{\ln Q_2 - \ln Q_1}{\ln \sqrt{QI_L \cdot QI_P}} \tag{19}'$$

$$k_D = \frac{\ln Q_2 - \ln Q_1}{\ln QI_D} = \frac{\ln Q_2 - \ln Q_1}{\ln \prod\left[\frac{v_i^2}{v_i^1}\right]^{\frac{1}{2}\left[\frac{p_1^1 v_1^1}{P_1V_1} + \frac{p_1^2 v_1^2}{P_2V_2}\right]}} \tag{20}'$$

And between k_L, k_P, k_F and k_D, the following relations hold:

$$k_L < k_F,\ k_D < k_P \tag{21}$$

Based on the above formulations, let us now measure the scale elasticity of main manufacturing industries. Using the data on production volume, input of production factors etc., for each firm in the Bank of Japan's "Financial Statements of Principal Enterprises" (manufacturing), we measure the scale elasticity for each industry on a cross-section basis. This study covers 24 industries and the period of 20 years from 1965 to 1984. When measuring, the Equation (14) is modified to the following form:

$$Q = f(M,\ K,\ L) \tag{14}'$$

Here Q : total production (= sales + increase/decrease in inventory − commodities purchased, real)
M : total inputs of intermediate goods (real, 1980 prices)
K : end-of-period balances of fixed assets
L : number of employees

The cost function is considered to be of the same form as the Equation (8). Thus,

$$C = P_M \cdot M + r \cdot K + w \cdot L \tag{8}$$

$P_{M,r}$ and w are the prices of production factors M, K, and L respectively. More specifically,[15]

P_M : 1.0
r : (depreciation cost + interest payable)/end-of-period balances of tangible fixed assets
w : per capita labor costs (labor costs/number of employees)

Here k itself should be calculated from the Equation (8), as the envelope of the Equation (10) that is the short-term cost curve. Therefore, the amount of production and that of production factor inputs, need to be adjusted for short-term deviations of capacity utilization ratio. As has already been pointed out, in this study it is assumed that the capital stock and the number of employees are unchanged in the short-term, and that only the inputs of the intermediate goods change as the level of production changes. Taking account of the above, we used, for the analysis, the adjusted amounts of production and of intermediate goods inputs that could have been realized if the capacity utilization ratio had been maintained at the level of its past peak (original data are from the MITI's "Index for Capacity Utilization Ratio of Manufacturing Industry").

From the above adjusted amounts of production and of production factor inputs, firms within a given industry are arranged from small to large in order of the amount of production. Then, comparisons of each pair of two adjacent firms in that order give input indices for various factors production (QI_L, QI_P, QI_F, QI_D, Equations (17)–(20)) and the scale coefficients (k_L, k_P, k_F, k_D, Equations (17)'–(20)'), The Equations (17)–(20) are expressed as below.

15. As for the prices of products and those of intermediate goods, it is assumed that there are no differences between firms of a given industry during a given financial year. As for labor inputs, it is necessary to consider differences between the firms in not only the number of employees but also the number of working hours. Also, differences may arise with the degree of newness of capital stock. However, this study covers large firms only and it is thus judged that such differences within a given industry are not significant. Moreover, as was also stated in Note 7, firms are all engaged in "multiple production" more or less. This study is based on the assumption that there are no significant differences in this respect within a given industry.

$$QI_P = \frac{P^2{}_M \cdot M^2 + r^2 \cdot K^2 + w^2 \cdot L^2}{P^2{}_M \cdot M^1 + r^2 \cdot K^1 + w^2 \cdot L^1} \tag{17}''$$

$$QI_L = \frac{P^1{}_M \cdot M^2 + r^1 \cdot K^2 + w^1 \cdot L^2}{P^1{}_M \cdot M^1 + r^1 \cdot K^1 + w^1 \cdot L^1} \tag{18}''$$

$$QI_F = \sqrt{QI_P \cdot QI_L} \tag{19}''$$

$$QI_D = \left[\frac{M^2}{M^1}\right]^{\frac{1}{2}}\left[\frac{P^1{}_M \cdot M^1}{C_1} + \frac{P^2{}_M \cdot M^2}{C_2}\right] \times \left[\frac{K^2}{K^1}\right]^{\frac{1}{2}}\left[\frac{r^1 \cdot K_1}{C_1} + \frac{r^2 \cdot K_2}{C_2}\right] \times \left[\frac{L^2}{L^1}\right]^{\frac{1}{2}}\left[\frac{W^1 \cdot L^1}{C_1} + \frac{W^2 \cdot L^2}{C_2}\right] \tag{20}''$$

Here $P_M{}^1 = P_M{}^2$, $C_i = P_M{}^i \cdot M^i + r^i \cdot K^i + w^i \cdot L^i$

i = 1: firms with a small production scale

i = 2: firms with a large production scale

The scale coefficient k_j (j = L. P, F, D) obtained above naturally has sampling errors. In order to reduce such disturbances, we have employed the method of estimating the average scale elasticity value (k) for each year and for each industry by applying the equation below.[16]

$$\ln Q_{i1} = a + k \ln G_i + e_i \tag{22}$$

Here $G_1 = 1.0, \qquad Q_{i1} = \frac{Q_i}{Q_1}$

$$G_2 = QI_{21} = \frac{QI_2}{QI_1}$$

$$G_3 = QI_{21} \cdot QI_{32} = \frac{QI_2}{QI_1} \cdot \frac{QI_3}{QI_2}$$

$$G_i = QI_{21} \cdot QI_{32} \cdots QI_{ii-1} = \frac{QI_2}{QI_1} \cdot \frac{QI_3}{QI_2} \cdots \frac{QI_i}{QI_{i-1}}$$

It should be noted here that as for the calculation of the production output (Q_i), the total amount of production of the firm concerned, that is, the total sum of multiple products is used in all cases (refer to Note 14). Accordingly, even when the production is proportionate to the input cost, economies of scale can be found for

16. In preparing the SAS data for calculations, we are indebted to Hiroko Kittaka and Chizuru Tsukagoshi of the Bank of Japan's Computer Information Bureau for their cooperation.

firms, which have the larger weight of the so-called set-up cost for exploring sales markets in their total cost.

Moreover, because this analysis of the scale elasticity focuses on the relationship between production and cost, it does not deal with the effects on economies of scale of different technological levels of firms. So it is important to bear in mind such effects.

Attention should also be paid to the fact that such a scale elasticity actually contains, apart from economies of scale (in a narrow sense) on a single good basis, a merit of multiple production, (economies of scope), as well as the Marshallian externality.

2. Results and Their Interpretation

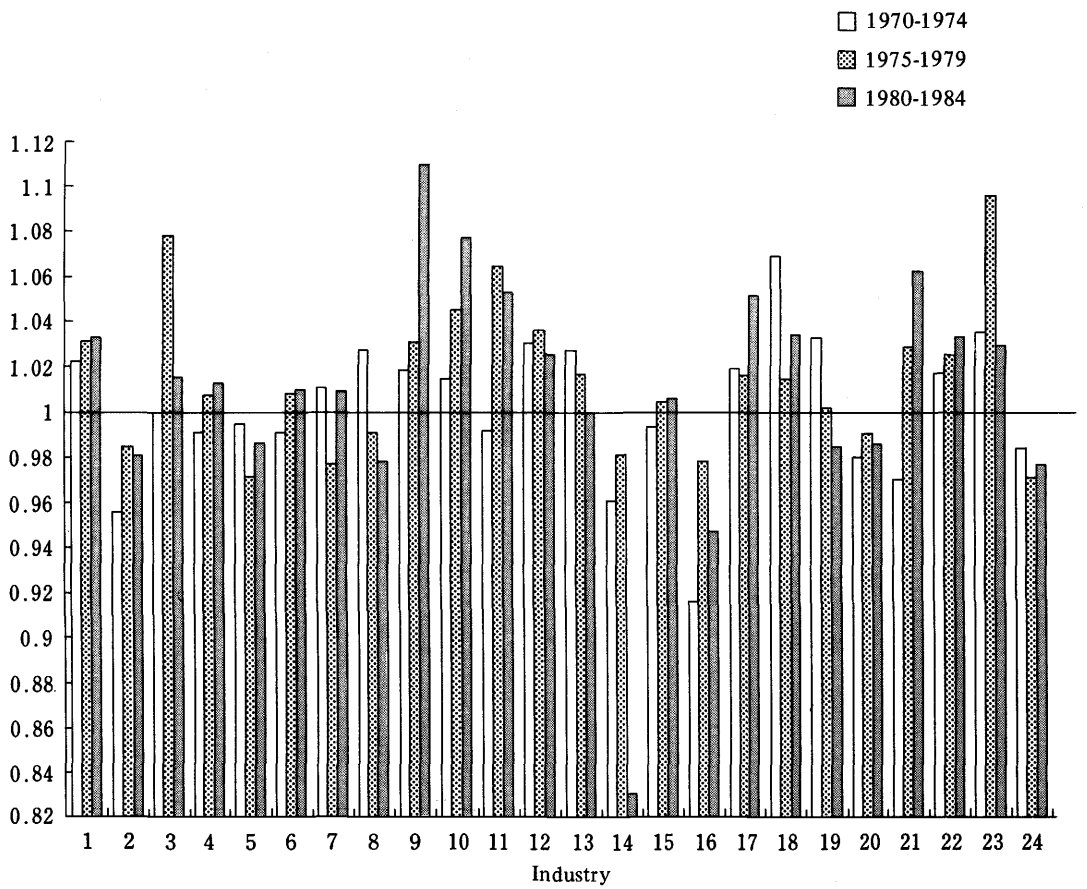
Let us look at the results shown in Reference 1 and 2 (mentioned later). In order for the assumption of homogeneity to be appropriate, it is necessary for each value for k to satisfy conditions $k_L < k_F$ and $k_D < k_P$ as shown in the Equation (21) and for the degree of deviation of each coefficient to be small. The years of 1969 and 1984 are selected as typical examples for the high-growth period and for the recent period respectively, instead of examining all twenty years. The results for both years are statistically significant. The cases where the estimated value of k_L (lower limit) exceeds that of k_P (upper limit) are found only in other textiles and cement in 1969 and in metal products and communications and electronic equipment in 1984. Moreover, their deviation ratios ($|\frac{k_P - k_L}{k_L}|$) were trivial. These results indicate the appropriateness of the method for measuring scale elasticity based on the two premises (the homogeneity of the production function and cost minimization of the firms). The scale elasticities, classified by index formulae and by year are shown in References 3–6 (mentioned later).

Let us interpret these results by focusing on the scale elasticity (k_F) by Fisher's formula which falls on in between the estimated upper and lower limits and consider the relationship between such elasticity and the export ratio. Reference 3 and Figure 5 on the scale elasticity gives the following findings.

First, the industries with greater scale elasticity are chemical fibers, other textiles (clothing, etc.), iron and steel, general electrical machinery, heavy electrical machinery, electronic parts, automobiles, shipbuilding, other ceramics and earthenware, and electric wires and cables, whereas cotton spinning, mother machines, mechanical tools and parts, and furniture have smaller scale elasticity.

Second, k is close to 1.0 on the whole. This implies that, as far as the main manufacturing industries are concerned, the linear homogeneity (constant returns to scale) holds approximately. Also, when we compare these results with those of Yoshioka (1985) based on factories, we find that our results for k_F are smaller for

Figure 5 Scale Elasticity Values



1. Synthetic Fibers
2. Cotton Spinning
3. Other Textiles (Clothing, etc.)
4. Paper and Pulp
5. Synthetic Chemicals
6. Inorganic Chemicals
7. Organic Chemicals
8. Cement
9. Other Ceramics and Earthenware
10. Normal Steel
11. Specialty Steel
12. Electric Wires and Cables
13. Metal Products
14. Construction Machinery
15. Industrial Machinery
16. Machine Tools and Parts
17. General Electrical Machinery
18. Heavy Electrical Machinery
19. Household Electrical Appliances
20. Communications and Electronic Machinery
21. Electronic Parts
22. Automobiles
23. Shipbuilding
24. Precision Instruments

electrical machinery and metal products. For these industries in 1978, Yoshioka's results were respectively 1.06 (1.02 in our study) and 1.07 1.02 here). Compared with that at the factory level, the economies of scale at the level of firms which include several factories are relatively small.

However, even if k_F is close to 1.0, the extent of economies of scale is considerable when inter-firm differences in the amounts of factor inputs or output scale is large.[17] For example, as for the main firms under this analysis, the difference in production scale between the largest and smallest businesses reached 67.5 times for chemical fibers and 55.3 times for industrial machinery in 1984. Accordingly, the actual impact on the production and cost structures of the economies of scale seems considerably large.

Third, when we look at Figure 6, we find that the scale elasticity for the main manufacturing industries rose in 1975, led by the machinery industry and that it has been on the further increase in the 1980s (1.018 for 1970-75 (machinery industry 1.0134) — 1.0191 for 1975-80 (1.0135) — 1.0244 for 1980-85 (1.0179)).

We should bear in mind here that when calculating the scale elasticity value k, a firm's total output covering all types of products is used as the output. Therefore, there is a possibility that the observed scale elasticity k consists of not only (1) the so–called scale merit simply due to the scale of production, but also of (2) merits due to the diversification of products (economies of scope), (3) the Marshallian external effect, and (4) technological progress.[18]

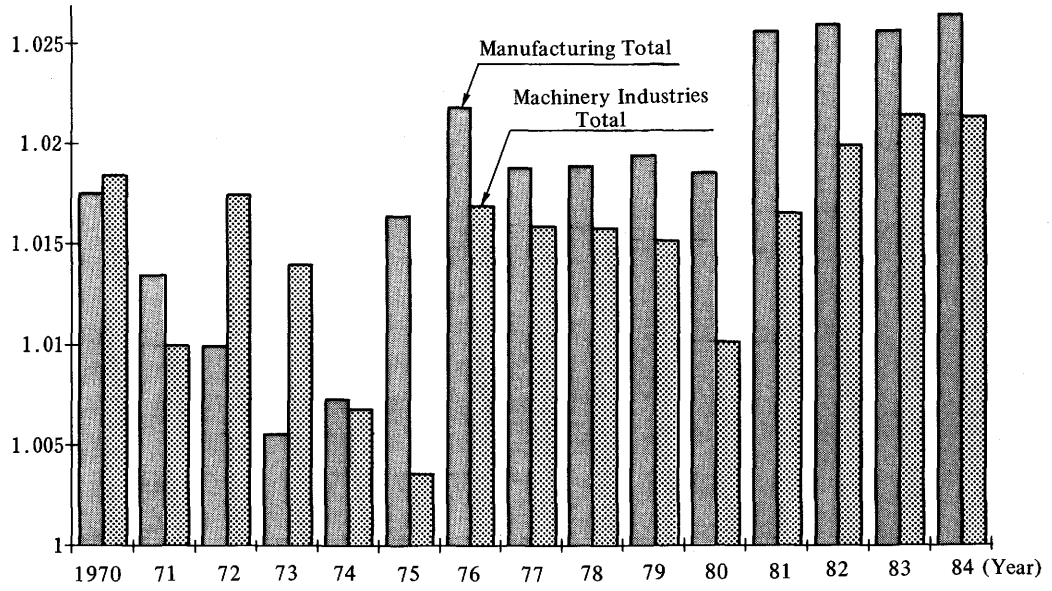
This is inferred from the finding that the industries with a large or rising k include general electrical machinery automobiles, other textiles (clothing, etc.), chemical fibers, etc., for which the effects of simple scale merit appear to be relatively small.

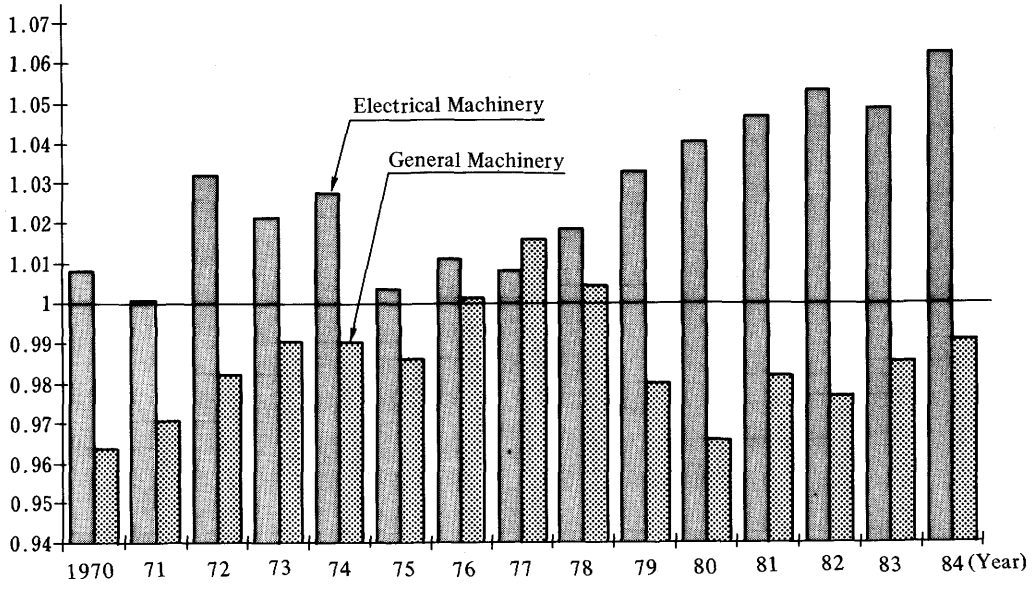
In the case of general electrical machinery, for instance, economies of scale cannot be found for the firms, solely producing household appliances. Large scale firms in general electrical machinery are benefitting from wide-ranging know-how in various subsectors including heavy electrical machinery and electronic parts.This seems also true for chemical fibers. Large-scale firms in chemical fibers have a larger weight in sales of synthetic materials, pharmaceuticals and building materials. They utilize knowledge they originally acquired in the field of chemical fibers to produce other goods.

17. The values of k of 1.02 and 1.05 mean that, if there is a difference of 100 times in production scale, a large-scale firm has a 10% and 26% respectively higher productivity than a smaller firm. Such differences are considerably large (Refer to Reference 3 for difference in production scale between the largest and smallest businesses in 1984).

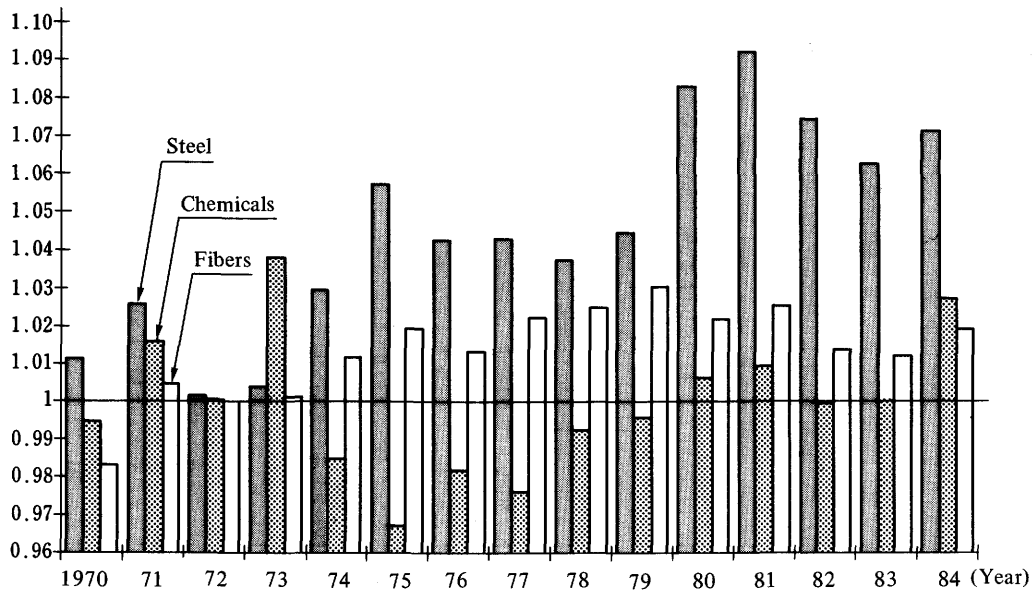
18. Economies of scope mean that if two commodities (y_1, y_2) are produced, the cost $f(y_1, y_2)$ is cheaper than when they are produced separately $(g(y_1, 0) + h(0, y_2))$, $(f(y_1, y_2) < g(y_1, 0) + h(0, y_2))$. For details refer to Baumol (1984) and Kasuya (1986).

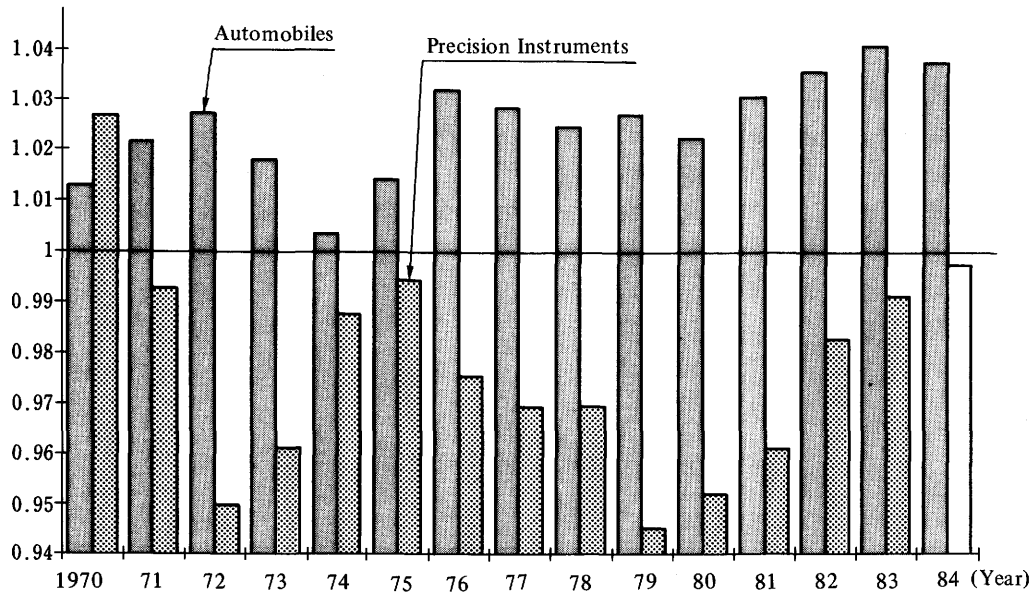
Figure 6 Scale Elasticity Values for Main Industries





Note: Weighting Total for Exports for Each Year


1.10
1.09
1.08
1.07
1.06
1.05
1.04
1.03
1.02
1.01
1
0.99
0.98
0.97
0.96
Steel
Chemicals
Fibers
1970 71 72 73 74 75 76 77 78 79 80 81 82 83 84 (Year)


1.04
1.03
1.02
1.01
1
0.99
0.98
0.97
0.96
0.95
0.94
Automobiles
Precision Instruments
1970 71 72 73 74 75 76 77 78 79 80 81 82 83 84 (Year)

As for the Marshallian external effect, the rise in scale elasticity of machinery industry since the beginning of the 1980s can be attributed to the effects of the dissemination of high technology, which is represented in prevalent use of mechatronics and robot technology. There is a possibility that the development of such technologies has worked as an advantage to large-scale firms.

Thus it seems that the rise in scale elasticity in recent years owes more to the progress in multiple production and the Marshallian external effect than to the so-called pure scale merit. This can also be attributed to the fact that firms have been attaching more importance to investments for cost-saving than to those for expansion in scale and endeavoring to economize input costs.

Fourth, among those industries with greater scale elasticity, the export ratio for electrical machinery (general electrical machinery, heavy electrical machinery and electronic parts), automobiles, iron and steel has either stayed at a high level or risen. In the case of precision machinery, for which the scale elasticity value has been rising in recent year, the export ratio has exceeded 60%. Thus it can be inferred that the level of the scale elasticity and its direction of change in these industries has had a dominant influence on the level of the export ratio of the whole economy.

Needless to say, an increase in k or a high level of k alone does not necessarily represent more active attitude toward exports or cause an increase in the export ratio. On the whole, however, economies of scale has been a major factor for an increase in the export ratio in recent years (as evidenced typically in automobiles and general machinery, whose efforts to explore overseas markets bore fruit in the 1970s).

V. Trends in Ratio of Export vs. Domestic Prices

1. Computation of the Price Ratio

As has already been seen, even for the same item, there is a possibility of a growing difference between export and domestic prices of the product (on the yen basis). Let us calculate the difference in absolute level between export and domestic prices for each industry and check in tangible terms the premises for the existence of price differentiation seen in III. At the same time, let us consider the effects on exports of changes in the ratio between export and domestic prices resulting from fluctuations in exchange rate.

First, from the Bank of Japan's "Wholesale Price Indices," time series (1980 = 100) of export and domestic price indices are prepared for 142 items. Then, the index of the ratio between export and domestic prices (export price index/domestic price index) is calculated. Here it should be noted that there have been cases in which in brands used for computing the index of a given goods are changed (especial-

ly for durable consumer goods and capital goods), and that export and domestic models have different specifications. It is, therefore, impossible to prepare the index for the ratio between export and domestic prices in the strict sense. However, it can be said that changes in the Wholesale Price Index indicates approximate trends (among the 24 industries listed above, the price index for shipbuilding is not available, so it is excluded from the following analysis).[19]

Next it is necessary to compute the absolute levels of the ratio of export vs. domestic price using the indices above calculated. However, when calculating the absolute levels, we face the following problems: 1) in actual transactions, even if the brands and transaction conditions are the same, prices more often than not differ depending on the client, the volume and terms of sales, etc., 2) especially in the case of the machinery industry, the prices of its products often change due to brand modifications and changes in their quality, and 3) it is not appropriate in terms of generality to select and use specific brands among all the brands included in an index.

In view of the above, I use the average unit price of each item (sales amount/sales volume) in 1980 (the base year) as export and domestic price levels. Data used are from "Nihon Boeki Geppo," of the Ministry of Finance and "Kogyo Tokeihyo" and "Kikai Tokei Nenpo" of the Ministry of International Trade and Industry.

Although we endeavored to make the items match with the items in the Wholesale Price Index as much as possible, perfect matching was not practically possible. Also, since average unit prices include the effects of changes in product quality and of whether or not intermediary dealers exist, they may vary considerably, depending on the time of calculation.[20] Computation of differentials between export and domestic prices in a strict manner will be the task for the future. In particular, in view of the problem concerning brand modifications, the data on the machinery industry should be interpreted with some allowance.

Finally time series of price level differentials were computed through multiplying absolute price level at the base period by the export and domestic price ratio index (time series). They were then weighted and aggregated according to the relative importance of export for each industry to compute time series of the export and domestic price ratio for each industry.[21] While the calculations were made for the years from 1965 to 1985, it should be noted that from 1965 to 1970 there are only a

19. The domestic Wholesale Price Index deals with the prices of domestic products for the domestic market, usually, at the first wholesale stage. The export price index deals with the prices of export goods at the FOB basis.

20. The Wholesale Price Index itself is the average of prices of several brands and businesses and, as a result, does not show movements in time series of specific brands.

21. For these calculations we are indebted to Yuko Uchino, Former Visiting Student at the Bank of Japan's Institute for Monetary and Economic Studies.

limited number of items available that are common to the period which followed (especially in the machinery industry), so there are some problems about statistical reliability with the period from 1965 to 1970 (the analysis below chiefly concerns the years from 1970 on).

2. Movements of the Export and Domestic Price Ratio

Keeping the above points in mind, let us now look at the computed export and domestic price ratio (Table 1, Figures 7 and 8).

First, when based on the average for the main manufactured products, the differential between export and domestic price levels falls within ±10% over the whole period, and around ±5% since 1980, which is not so large. On the whole, however, it is true that there exist some differentials between the two prices. That is, export prices are somewhat lower. Of course it is necessary to interpret the figures obtained with some allowance in view of the conditions peculiar to the base period and the pace at which firms adjust themselves to changes in market environment, including the exchange rate. However, judging from the fact that the export vs. domestic price ratio changes with some amplitude, it can be concluded that firms regard the two markets as separate and act accordingly (Table 1, Figure 8).

Second, the changes of the export vs. domestic price ratio are considerably different from those of export price index/domestic Wholesale Price Index, and the range of changes is relatively small (Figure 7). This difference between the two seems to be due to differences in terms of weight given to each item and also to the fact that the domestic Wholesale Price Index covers many items which do not correspond to those in the export price index.[22]

Third, judging from the facts of a rise of this ratio in 1974 (export prices relatively higher than domestic prices), a fall in 1978 and a rise in 1982, we find that the export vs. domestic price ratio changes maintaining the close relationship to the rises and falls of the yen exchange rate.[23] When the yen depreciates, the export vs. domestic price ratio rises. This improves the relative profitability of exports, thereby in turn

22. In the case of the 1980-based indices, the number of items for the export price index (covering mainly industrial products) was 212 as against 757 industrial products in the domestic Wholesale Price Index.

23. As for the export prices covered by the wholesale Price Index, the Bank of Japan collects the foreign currency prices for brands whose export contracts are made in foreign currency terms. Such prices are converted into yen prices by the spot exchange rates for customers of foreign exchange banks. As of December 1982 the composition by contract currency was as follows:
Yen-based: 28%* U. S. dollar-based: 65% other currency-based: 7%
* According to export "Yushutsu Ninsho" statistics, the ratio has recently increased to about 40%.

Table 1 Changes in Export Prices and Domestic Prices for Corresponding Items

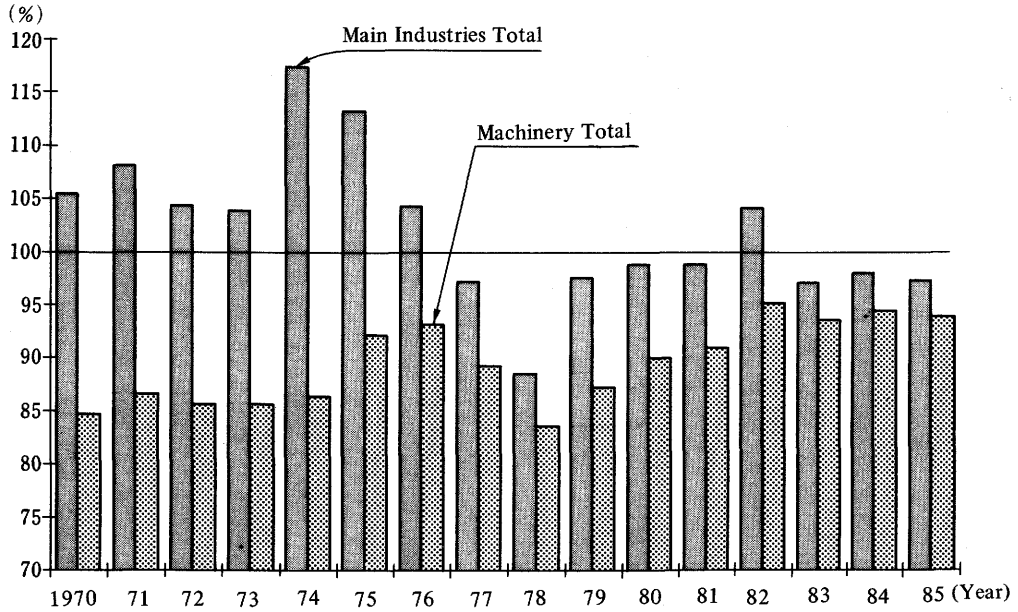
$$\left(\frac{\text{Export Prices}}{\text{Domestic Prices corresponding to Export Items}}\right)$$

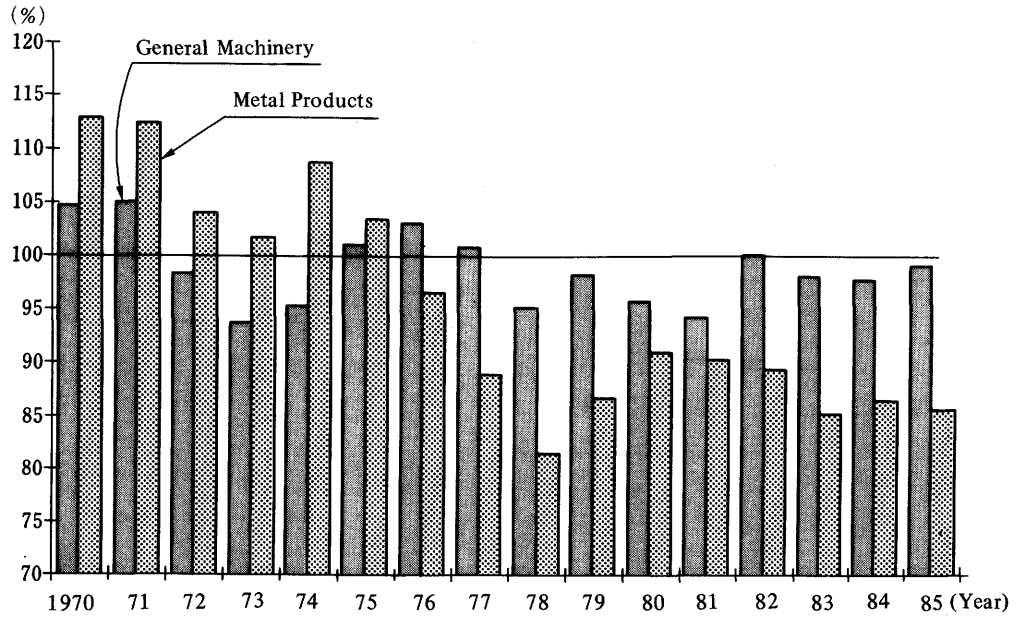
(1980=100)

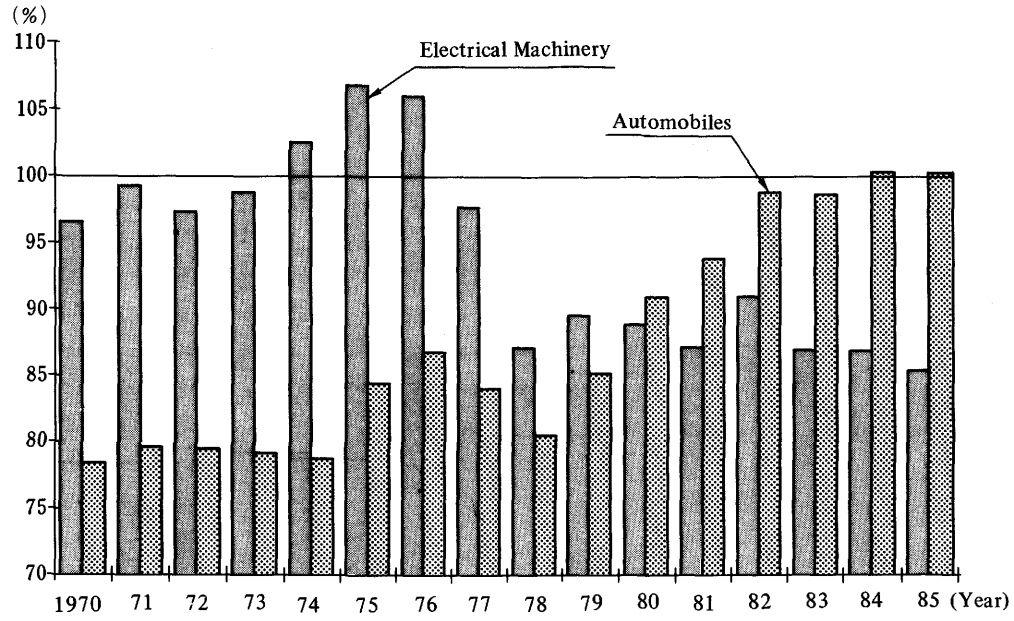
	Total	Metal Products	General Machinery	Construction Machinery	Industrial Machinery	Machinery Parts	Electrical Machinery	Heavy Electrical Machinery	Household Electrical Appliances	Electronic Parts	Automobiles	Precision Instruments
1970	98.5	124.0	109.1	107.2	106.5	125.4	108.7	148.0	97.2	110.9	86.1	91.1
1971	100.5	123.5	109.7	107.8	109.0	114.7	111.7	142.2	105.2	108.0	87.5	90.5
1972	98.3	114.3	102.6	108.2	101.1	106.9	109.5	133.7	104.9	105.3	87.4	90.5
1973	98.1	111.7	97.9	99.5	96.9	101.9	111.1	135.3	104.4	111.4	87.1	91.0
1974	105.1	119.5	99.7	102.3	100.2	95.0	115.3	148.2	102.5	124.1	86.4	94.0
1975	106.0	113.6	105.5	104.0	105.2	107.7	120.2	137.4	109.9	132.9	92.7	101.2
1976	102.1	106.0	107.7	108.2	107.9	106.5	119.2	143.6	108.6	128.2	95.3	102.9
1977	97.1	97.6	105.4	106.1	106.0	101.7	109.9	120.6	104.9	114.6	92.3	104.1
1978	90.2	89.6	99.5	98.0	100.0	97.3	98.0	104.6	96.2	97.9	88.5	104.8
1979	97.1	95.2	102.6	108.9	102.2	100.5	100.8	102.1	101.7	98.0	93.6	102.5
1980	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1981	101.2	99.2	98.7	95.6	99.8	94.3	98.1	94.1	101.4	92.9	103.2	101.0
1982	106.0	98.2	104.5	108.6	104.5	102.0	102.5	96.8	105.8	98.4	108.7	86.7
1983	102.1	93.6	102.3	111.5	102.2	96.7	97.8	93.6	100.1	95.2	108.4	90.1
1984	103.2	95.0	102.2	106.9	102.8	95.4	97.9	92.3	101.1	94.2	110.1	88.1
1985	101.9	93.6	102.9	105.5	103.7	96.5	96.2	89.5	97.7	96.8	110.2	87.3
Absolute Level	95.1%	91.1	95.8	114.3	91.8	105.9	88.9	89.4	84.4	106.2	91.0	82.4

	Steel	Normal Steel	Specialty Steel	Electric Wires and Cables	Chemicals	Inorganic Chemicals	Organic Chemicals	Ceramics and Earthenware	Textile	Chemical Fibers	Natural Fibers	Clothing etc.
1970	102.9	101.2	139.0	134.4	124.8	101.9	129.3	140.2	110.5	109.4	111.8	132.7
1971	108.0	106.7	133.4	145.3	101.9	94.6	103.3	131.3	117.7	120.1	108.1	143.7
1972	101.9	100.8	123.2	127.5	115.2	83.8	121.4	124.4	107.3	107.7	101.5	153.8
1973	99.7	98.7	120.6	110.4	127.0	94.7	133.3	122.9	104.4	115.1	71.3	122.0
1974	126.5	126.5	126.2	90.8	150.9	137.7	153.5	130.9	118.4	125.8	96.2	120.1
1975	113.4	113.3	115.8	76.5	133.7	174.0	125.9	133.4	107.0	110.6	94.6	125.7
1976	99.1	98.6	108.5	81.1	92.3	120.1	86.9	120.4	103.4	108.6	86.4	118.7
1977	86.5	86.0	97.2	98.5	100.9	94.8	102.0	111.7	102.3	106.2	90.1	106.8
1978	80.5	80.5	80.7	88.5	85.7	84.5	86.0	98.0	91.3	94.0	82.2	101.5
1979	93.6	93.4	97.1	95.2	111.0	98.0	113.5	104.4	99.5	104.2	85.1	104.8
1980	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1981	101.6	101.9	95.7	110.1	93.4	93.3	95.9	100.3	100.9	101.7	98.8	97.2
1982	105.8	105.8	104.5	124.2	99.8	93.0	104.8	111.3	107.0	110.2	98.2	101.7
1983	92.8	92.7	94.8	121.2	97.0	85.6	103.6	104.0	108.6	111.1	102.0	98.6
1984	94.5	94.4	97.7	125.8	97.2	89.4	102.5	102.7	109.7	113.7	98.9	98.9
1985	91.6	91.5	92.9	127.1	98.0	97.9	100.6	103.2	109.5	114.7	95.2	100.0
Absolute Level	113.9%	114.5	103.4	70.8	93.2	93.1	93.2	121.4	104.5	101.8	113.6	92.1

Figure 7 Changes in Export and Domestic Relative Price Levels (Export Prices/Export Products as against Domestic Prices)






(%)
110
105
100
95
90
85
80
75
70
Electrical Machinery
Automobiles
1970 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 (Year)

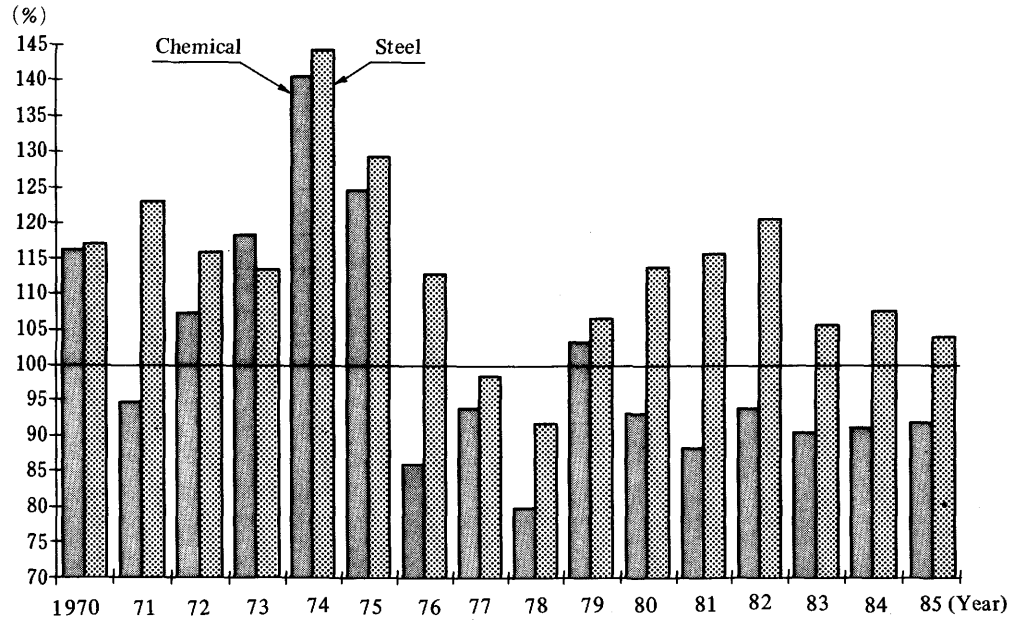
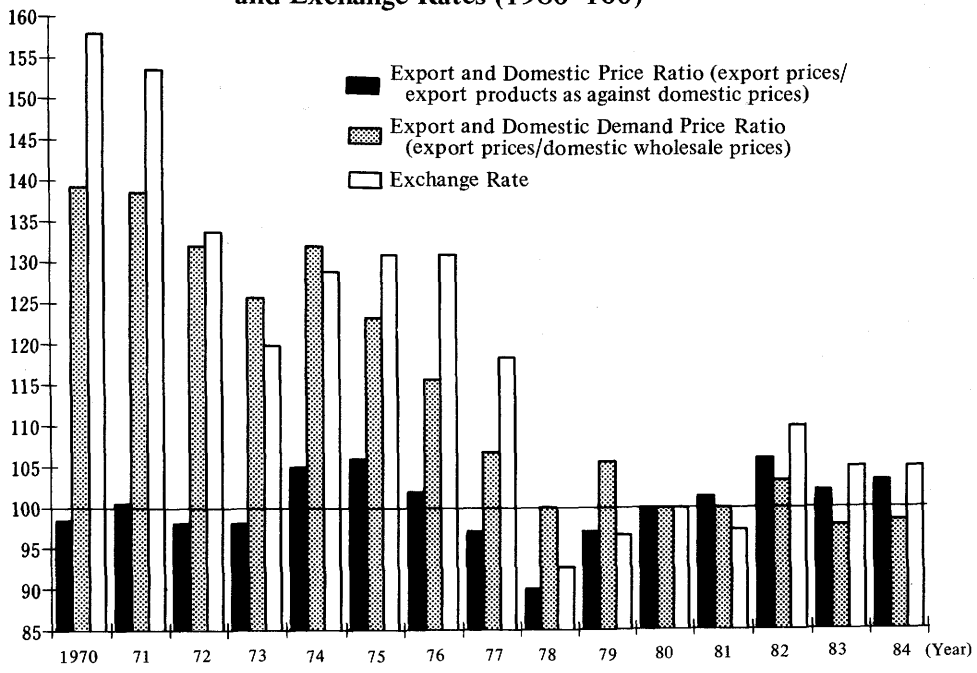

(%)
145
140
135
130
125
120
115
110
105
100
95
90
85
80
75
70
Chemical
Steel
1970 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 (Year)

Figure 8 Changes in Export and Domestic Demand Price Ratios and Exchange Rates (1980=100)



Fluctuations in Export and Domestic Demand Price Ratio (Ratio of previous year)

Year	Export and Domestic Demand Price Ratio	Yen-Based Export Price	Exchange Rate	Dollar-Based Price	Export Products to Domestic Price
1970	4.11	1.77	−0.00	1.77	−3.17
1971	1.95	−1.84	−2.85	1.04	−4.31
1972	−2.11	−2.52	−12.85	11.84	−0.52
1973	−0.26	4.39	−10.38	16.49	4.55
1974	7.18	25.06	7.50	16.34	18.42
1975	0.80	1.01	1.61	−0.59	−0.98
1976	−3.70	−0.67	−0.08	−0.60	2.22
1977	−4.88	−4.65	−9.46	5.30	0.21
1978	−7.07	−7.21	−21.63	18.39	−0.10
1979	7.65	7.22	4.13	2.97	−0.04
1980	2.98	6.35	3.47	2.79	3.16
1981	1.21	0.89	−2.74	3.74	−0.32
1982	4.72	4.38	12.94	−7.58	−0.34
1983	−3.65	−4.94	−4.64	−0.32	−1.34
1984	1.05	1.00	0.00	1.00	−0.08

Note: The export and domestic demand price ratio is based on export prices/export products as against domestic prices.

generating the scope for firms' lowering export prices in foreign currency terms. As a result, the volume of exports increases. Therefore, the export and domestic marginal returns, which diverge in the short run equalize out again in the long run (refer to III.2.). It also appears that in recent years sluggish domestic prices, together with the depreciation of the yen, contributed to a fall in export prices in foreign currency terms, resulting in increased exports (particularly in 1982).

Fourth, when we examine the level of each industry in recent years (Table 1, Figure 8), we find that the difference between export and domestic prices has been small for such material industries as iron and steel, chemicals and fibers. Even in the machinery industry, the price difference has disappeared for automobiles as a result of a substantial increase in export prices (self-restraint of automobile industry may also have had an effect).

On the other hand, export prices are generally lower for electrical machinery (heavy electrical machinery, household appliances), general machinery (industrial machinery, machine parts) and precision machinery. For these industries improved export profitability, resulting from the depreciation of the yen, seems to have increased the scope for firms' lowering export prices in foreign currency terms and subsequently led to an increase in exports (a rise in export ratio).

As for electric wire and cable and precision machinery, because the differences between export and domestic prices are too large, it is necessary to further study the method for calculating the price for the base period (see VI).

In this kind of analysis we should take into account the effects of the increase in yen-based export contracts. Needless to say, it is difficult to explain the export ratio by the export vs. domestic price ratio alone. The export vs. domestic price ratio, however, provides an effective indicator for examining the possibility that changes in the yen exchange rate lead to changes in export ratio through changes in export profitability and export prices in foreign currency terms.

VI. Trends in Elasticity of Export and Domestic Demand

1. Demand Function

Using this export vs. domestic price ratio, let us now estimate demand functions for exports and for the domestic demand. Then let us consider the relationship between the calculated income elasticity, the price elasticity, the market response elasticity, and exports (note that there exists a relationship shown in the Equation (12) between the price elasticity, the market responses elasticity, and the export vs. domestic price ratio calculated in the preceding section).

Factors for determining the demand function are income, the prices of the commodity concerned, and the prices of competing commodities, the qualitative charac-

teristics of each commodity, and the effect of habit-forming. Since the objective of this study is to examine the export-determining mechanism when firms seek to maximize profits by equalizing marginal returns from domestic and export markets and marginal costs, only income and price are used for formulation. In other words, it is based on the equation below, which is derived from (13):[24]

$$D = f(y_1, P_1/P_2, \bar{\alpha}) \tag{13}'$$

D : demand volume; y_1 = real income;
P_1 : price of the commodity concerned;
P_2 : price of competing commodity;
$\bar{\alpha}$: factors other than income and price (assumed to be fixed).

The effect of restricted supply resulting from various restrictions on exports (automobiles, iron and steel, etc.) will be considered later on.

As for the statistics used for measurement, "Financial Statement of Principal Enterprises" and "the Wholesale Price Index" are used to compute the export volume (D_E) and the domestic demand volume (D_D). For other variables, considering the relative importance of exports to the U.S. and restrictions on data, etc., the real GNP of the U.S. (y_u) and the real GNP of Japan (y_j) are used to compute real income and the U.S. producer price index (P_u, converted into yen) and the Japanese domestic Wholesale Price Index (P_{DC}) for the prices of competing commodities.[25] The actual equations used for estimation are:

$$D_E = f(y_u, P_E/P_u) \tag{23}$$

$$D_D = g(y_J, P_D/P_{DC}) \tag{24}$$

24. In estimating the parameter for the demand function there is the problem of the so-called identification. In this section, however, full-scale formulation taking this problem into account is left for the future. What are done here in this respect are restricted to; 1) checking the plausibility of the parameter and 2) comparison with the results of other papers. For details see Kuroda (1984) and Christ (1985).

25. The amount of exports and that of domestic shipments of each item in "the Customs Clearance Statistics" and "Kogyo Tokeihyo Tables" could also be used, and in a certain sense could give more accurate elasticity. However, in view of the fact that this study is, as has been stated earlier, intended to cover firms engaged in multiple production, it would not be appropriate to use such elasticity. It might be added here that when figures from a shipment index for mining and manufacturing are used, there is only a slight improvement in fitting as compared with those based on individual firms (data from "Financial Statement of Principal Enterprises"). For the computation of the U. S. producer price index for each industry we are indebted to Shigeru Uebayashi of the Research and Statistics Department of the Bank of Japan (now at Economic Planning Agency).

Here

$$\frac{\partial D_E}{\partial y_u}>0,\ \frac{\partial D_E}{\partial P_E}<0,\ \frac{\partial D_E}{\partial P_u}>0$$

$$\frac{\partial D_D}{\partial y_J}>0,\ \frac{\partial D_D}{\partial P_D}<0,\ \frac{\partial D_D}{\partial P_{DC}}>0$$

They are carried out in various forms including logarithmic and semi-logarithmic modes. The results with right signs for parameters and with higher explanatory power are selected. This covers 1970-84 because, as stated earlier, the data for the export vs. domestic price ratio for the period from 1965 to 1969 were considered to have poor reliability.

The results are given in Reference 7. It shows that, apart from material industries such as iron and steel and chemicals, they fit well on the whole. Prominently better results are for the machinery industry with a large weight. As for paper and pulp, cement and special steel, however, the results obtained do not satisfy the conditions for signs. So the analysis below excludes these and is limited to 20 industries.

Based on these results, the income elasticity, the price elasticity and the market response elasticity are calculated for each industry. While it should be noted that the elasticity for the industry concerned as a whole does not necessarily conform to that of each individual firm, the elasticity for the industry concerned is regarded here as that of a representative firm of that industry. Let us look at the various elasticities (Tables 2–4).

2. Trends of Various Elasticities

First, the income elasticity is small for such material industries as iron and steel, chemicals, fibers, etc. For the industries, the elasticity of exports (rate of change in exports/rate of change in income overseas) is smaller than the elasticity of the domestic demand. In contrast, for the machinery industry with a high export ratio, the income elasticity is generally large for both exports and the domestic demand with the former being larger (general machinery, electrical machinery, automobiles and precision machinery). Among such industires, the income elasticity is extremely large for electronic parts. This seems to be due to the rapid expansion in demand reflecting the development of mechatronics using semiconductors.

The particularly large income elasticity of exports in the machinery industry seems to be due to the ability to change the production structure (and products) in response to changes in the demand structure abroad by exploiting the merits of diversification mentioned earlier and also due to the fact that technological progress has made these changes possible.

In other words, such developments have contributed to a rise in export ratio.

Table 2 Changes in Elasticity Values for Exports and Domestic Demand (1)

	Normal Steel		Electric Wires and Cables		Metal Products		Construction Machinery		Industrial Machinery		Machine Tools and Parts		General Electrical Machinery	
	Prices Elasticity Value		Prices Elasticity Value		Prices Elasticity Value		Prices Elasticity Value		Prices Elasticity Value		Prices Elasticity Value		Prices Elasticity Value	
	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand
1970	−0.7233	−0.5675	−4.1272	−0.7429	−0.3699	−2.6797	−3.1153	−5.728	−1.8167	−1.4086	−1.3078	−0.2959	−1.0769	−1.7246
1971	−0.5181	−0.5957	−8.1323	−1.0363	−0.3091	−2.3311	−2.4189	−6.030	−1.4864	−1.4425	−0.6013	−0.2169	−1.0769	−1.7246
1972	−0.5438	−0.5328	−6.6820	−0.9400	−0.2490	−1.9688	−2.9875	−6.094	−1.2434	−1.4748	−0.4775	−0.2396	−1.0769	−1.7246
1973	−0.5654	−0.5172	−9.2966	−0.8210	−0.2371	−4.7608	−2.2677	−4.914	−1.0004	−1.2629	−0.3093	−0.1427	−1.0769	−1.7246
1974	−0.6880	−0.6747	−4.1564	−1.0345	−0.2728	−5.3618	−2.0307	−6.288	−0.6888	−1.2625	−0.2023	−0.1417	−1.0769	−1.7246
1975	−0.6443	−0.7693	−1.6484	−1.0828	−0.1924	−5.4095	−2.2658	−9.496	−0.6785	−1.3249	−0.2023	−0.1786	−1.0769	−1.7246
1976	−0.5224	−0.8386	−1.6090	−0.8357	−0.2035	−4.2594	−1.7541	−10.039	−0.9688	−1.4379	−0.2332	−0.1738	−1.0769	−1.7246
1977	−0.4977	−0.9119	−1.1718	−0.6764	−0.1975	−3.8835	−1.0682	−9.285	−0.7487	−1.5054	−0.2500	−0.1575	−1.0769	−1.7246
1978	−0.5284	−0.9176	−1.0873	−0.5420	−0.2103	−3.4409	−0.6794	−5.845	−0.6212	−1.4120	−0.2995	−0.1435	−1.0769	−1.7246
1979	−0.6296	−0.8336	−0.9192	−0.5410	−0.1269	−3.0263	−0.6549	−4.254	−0.5513	−1.1879	−0.2346	−0.1186	−1.0769	−1.7246
1980	−0.7425	−0.8823	−0.8234	−0.5356	−0.1503	−2.8535	−0.5090	−3.547	−0.5333	−1.0850	−0.2072	−0.1038	−1.0769	−1.7246
1981	−0.7705	−0.9579	−0.5998	−0.4567	−0.1458	−3.1125	−0.4629	−3.1355	−0.3898	−1.0999	−0.1878	−0.1028	−1.0769	−1.7246
1982	−0.8146	−0.9930	−0.7437	−0.4825	−0.1405	−2.7802	−0.6811	−3.1948	−0.3394	−1.0647	−0.2112	−0.0937	−1.0769	−1.7246
1983	−0.6931	−1.0545	−0.7582	−0.4542	−0.1301	−3.0283	−0.6782	−3.0905	−0.2992	−1.1032	−0.1886	−0.0943	−1.0769	−1.7246
1984	−0.6714	−0.9526	−0.7585	−0.3822	−0.1363	−3.2416	−0.3946	−2.9003	−0.3603	−1.0618	−0.1407	−0.0854	−1.0769	−1.7246

	Income Elasticity Value		Income Elasticity Value		Income Elasticity Value		Income Elasticity Value		Income Elasticity Value		Income Elasticity Value		Income Elasticity Value	
	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand
1970	0.1720	1.4972	13.6900	1.6381	3.65368	1.0995	16.4016	0.6540	6.9699	0.4313	12.6881	3.5649	4.8047	1.3885
1971	0.4010	1.5158	26.9749	2.2850	3.05365	0.9565	12.7355	0.6885	5.7026	0.4416	5.8335	2.6126	4.8047	1.3885
1972	0.4530	1.4630	22.1643	2.0726	2.45999	0.8078	15.7292	0.6957	4.7705	0.4515	4.6322	2.8869	4.8047	1.3885
1973	0.5028	1.4527	30.8370	1.8104	2.34257	1.9535	11.9391	0.5611	3.8381	0.3867	3.0008	1.7192	4.8047	1.3885
1974	0.3353	1.5859	13.7869	2.2810	2.69467	2.2001	10.6912	0.7180	2.6427	0.3865	1.9624	1.7067	4.8047	1.3885
1975	0.3884	1.6620	5.4677	2.3875	1.90124	2.2196	11.9293	1.0842	2.6031	0.4056	1.9630	2.1522	4.8047	1.3885
1976	0.4713	1.7315	5.3372	1.8427	2.01041	1.7477	9.2354	1.1462	3.7168	0.4402	2.2628	2.0943	4.8047	1.3885
1977	0.4588	1.8001	3.8869	1.4915	1.95127	1.5935	5.6238	1.0601	2.8725	0.4609	2.4251	1.8973	4.8047	1.3885
1978	0.5102	1.8119	3.6067	1.1950	2.07724	1.4119	3.5769	0.6674	2.3834	0.4323	2.9052	1.7289	4.8047	1.3885
1979	0.4136	1.7341	3.0491	1.1928	1.25343	1.2417	3.4478	0.4857	2.1151	0.3637	2.2757	1.4291	4.8047	1.3885
1980	0.3728	1.7705	2.7311	1.1809	1.48509	1.1708	2.6799	0.4049	2.0462	0.3322	2.0105	1.2511	4.8047	1.3885
1981	0.3881	1.8353	1.9896	1.0071	1.44038	1.2771	2.4374	0.3580	1.4958	0.3367	1.8224	1.2393	4.8047	1.3885
1982	0.3392	1.8669	2.4671	1.0639	1.38832	1.1407	3.5861	0.3647	1.3023	0.3260	2.0489	1.1290	4.8047	1.3885
1983	0.3973	1.9235	2.5150	1.0015	1.28521	1.2426	3.5706	0.3528	1.1479	0.3378	1.8304	1.1358	4.8047	1.3885
1984	0.4207	1.8344	2.5161	0.8428	1.34706	1.3301	2.0776	0.3311	1.3827	0.3251	1.3654	1.0286	4.8047	1.3885

Table 3 Changes in Elasticity Values for Exports and Domestic Demand (2)

	Heavy Electrical Machinery		Household Electrical Appliances		Communications & Electronic Machinery		Electronic Parts		Automobiles		Precision Instruments	
	Prices Elasticity Value		Prices Elasticity Value		Prices Elasticity Value		Prices Elasticity Value		Prices Elasticity Value		Prices Elasticity Value	
	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand
1970	−0.5734	−2.434	−2.0727	−1.2674	−0.8224	−1.6622	−0.6061	−0.4580	−2.2494	−0.6599	−12.919	−3.0516
1971	−0.5734	−2.434	−2.0727	−1.0702	−0.8224	−1.6622	−0.6061	−0.4580	−1.4620	−0.6378	−10.228	−2.9333
1972	−0.5734	−2.434	−2.0727	−0.9386	−0.8224	−1.6622	−0.6061	−0.4580	−1.3219	−0.5656	−9.473	−2.7150
1973	−0.5734	−2.434	−2.0727	−0.6886	−0.8224	−1.6622	−0.6061	−0.4580	−1.1869	−0.4658	−8.231	−2.0336
1974	−0.5734	−2.434	−2.0727	−0.8359	−0.8224	−1.6622	−0.6061	−0.4580	−0.8695	−0.5061	−8.147	−2.0385
1975	−0.5734	−2.434	−2.0727	−0.7644	−0.8224	−1.6622	−0.6061	−0.4580	−0.8615	−0.4649	−10.244	−2.3269
1976	−0.5734	−2.434	−2.0727	−0.6540	−0.8224	−1.6622	−0.6061	−0.4580	−0.6884	−0.4220	−7.636	−2.1105
1977	−0.5734	−2.434	−2.0727	−0.5327	−0.8224	−1.6622	−0.6061	−0.4580	−0.5365	−0.3931	−5.645	−1.9599
1978	−0.5734	−2.434	−2.0727	−0.4408	−0.8224	−1.6622	−0.6061	−0.4580	−0.4901	−0.3380	−4.965	−1.5971
1979	−0.5734	−2.434	−2.0727	−0.3629	−0.8224	−1.6622	−0.6061	−0.4580	−0.4602	−0.2968	−3.594	−1.1799
1980	−0.5734	−2.434	−2.0727	−0.3287	−0.8224	−1.6622	−0.6061	−0.4580	−0.3559	−0.2910	−2.633	−1.0366
1981	−0.5734	−2.434	−2.0727	−0.2903	−0.8224	−1.6622	−0.6061	−0.4580	−0.3124	−0.2838	−2.1269	−0.9029
1982	−0.5734	−2.434	−2.0727	−0.2588	−0.8224	−1.6622	−0.6061	−0.4580	−0.3172	−0.2745	−1.6735	−0.8947
1983	−0.5734	−2.434	−2.0727	−0.2196	−0.8224	−1.6622	−0.6061	−0.4580	−0.2970	−0.2516	−1.4590	−0.8455
1984	−0.5734	−2.434	−2.0727	−0.1877	−0.8224	−1.6622	−0.6061	−0.4580	−0.2733	−0.2393	−1.1411	−0.6551

	Income Elasticity Value		Income Elasticity Value		Income Elasticity Value		Income Elasticity Value		Income Elasticity Value		Income Elasticity Value	
	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand
1970	4.6170	1.9842	7.8112	1.1353	5.8901	2.6625	10.1283	4.4435	15.4474	3.1875	12.7166	3.3389
1971	4.6170	1.9842	7.8112	1.0380	5.8901	2.6625	10.1283	4.4435	10.0397	3.0808	10.3156	3.2631
1972	4.6170	1.9842	7.8112	1.0063	5.8901	2.6625	10.1283	4.4435	9.0779	2.7320	9.7334	3.0909
1973	4.6170	1.9842	7.8112	0.8667	5.8901	2.6625	10.1283	4.4435	8.1506	2.2502	8.6383	2.4995
1974	4.6170	1.9842	7.8112	0.7127	5.8901	2.6625	10.1283	4.4435	5.9713	2.4446	8.5396	2.4139
1975	4.6170	1.9842	7.8112	0.6308	5.8901	2.6625	10.1283	4.4435	5.9160	2.2456	10.4897	2.6319
1976	4.6170	1.9842	7.8112	0.6071	5.8901	2.6625	10.1283	4.4435	4.7277	2.0384	8.0683	2.4428
1977	4.6170	1.9842	7.8112	0.6268	5.8901	2.6625	10.1283	4.4435	3.6841	1.8987	6.2559	2.3138
1978	4.6170	1.9842	7.8112	0.6692	5.8901	2.6625	10.1283	4.4435	3.3655	1.6329	5.6809	2.0648
1979	4.6170	1.9842	7.8112	0.6736	5.8901	2.6625	10.1283	4.4435	3.1600	1.4336	4.3522	1.7572
1980	4.6170	1.9842	7.8112	0.5984	5.8901	2.6625	10.1283	4.4435	2.4443	1.4055	3.4127	1.6085
1981	4.6170	1.9842	7.8112	0.6159	5.8901	2.6625	10.1283	4.4435	2.1457	1.3708	2.9360	1.5094
1982	4.6170	1.9842	7.8112	0.6339	5.8901	2.6625	10.1283	4.4435	2.1786	1.3259	2.4790	1.5061
1983	4.6170	1.9842	7.8112	0.6675	5.8901	2.6625	10.1283	4.4435	2.0399	1.2154	2.2910	1.4675
1984	4.6170	1.9842	7.8112	0.7055	5.8901	2.6625	10.1283	4.4435	1.8772	1.1558	2.0046	1.3619

Table 4 Changes in Elasticity Values for Exports and Domestic Demand (3)

	Synthetic Fibers		Cotton Spinning		Clothing, etc.		Synthetic Chemicals		Inorganic Chemicals		Organic Chemicals		Other Ceramics and Earthenware	
	Prices Elasticity Value		Prices Elasticity Value		Prices Elasticity Value		Prices Elasticity Value		Prices Elasticity Value		Prices Elasticity Value		Prices Elasticity Value	
	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand
1970	−0.2220	−0.2268	−0.7893	−0.9909	−0.652	−0.3164	−0.1263	−1.3221	−0.2861	−1.4759	−0.2874	−0.9636	−0.0711	−2.3610
1971	−0.1716	−0.2066	−0.7248	−0.8955	−0.652	−0.3164	−0.0657	−1.1797	−0.2381	−1.9275	−0.2160	−0.9332	−0.0655	−2.2490
1972	−0.1341	−0.1613	−0.8654	−0.9267	−0.652	−0.3164	−0.0658	−1.0145	−0.1850	−1.9642	−0.2292	−0.8172	−0.0701	−2.2108
1973	−0.1342	−0.1250	−0.9958	−1.0681	−0.652	−0.3164	−0.1090	−1.1010	−0.2368	−1.5162	−0.3088	−0.7094	−0.0796	−1.7729
1974	−0.1203	−0.1776	−0.7767	−0.6714	−0.652	−0.3164	−0.1684	−1.9544	−0.4087	−1.5101	−0.2907	−0.9386	−0.0671	−1.6731
1975	−0.1025	−0.1507	−0.9723	−0.8516	−0.652	−0.3164	−0.1353	−2.0702	−0.9588	−2.2881	−0.2506	−0.9744	−0.0533	−2.0678
1976	−0.1218	−0.1529	−1.5412	−1.3166	−0.652	−0.3164	−0.1081	−2.3697	−0.5456	−2.4695	−0.1923	−0.9679	−0.0531	−2.1582
1977	−0.1188	−0.1500	−1.7187	−1.1713	−0.652	−0.3164	−0.1229	−2.6511	−0.3707	−2.9155	−0.2424	−1.0794	−0.0517	−2.2648
1978	−0.1278	−0.1352	−1.5997	−1.2928	−0.652	−0.3164	−0.0774	−2.5718	−0.2894	−2.8171	−0.2076	−0.8319	−0.0622	−2.5216
1979	−0.1361	−0.1105	−2.1374	−1.3187	−0.652	−0.3164	−0.1203	−2.6016	−0.3242	−2.4558	−0.1634	−0.8579	−0.0453	−2.0744
1980	−0.1257	−0.1172	−2.0515	−1.1603	−0.652	−0.3164	−0.1218	−3.3627	−0.5077	−3.4174	−0.2641	−0.9059	−0.0408	−2.0869
1981	−0.1209	−0.1185	−1.6828	−1.2050	−0.652	−0.3164	−0.1404	−3.3991	−0.5549	−3.8794	−0.2636	−0.8998	−0.0437	−2.2488
1982	−0.1414	−0.1077	−1.4577	−1.1627	−0.652	−0.3164	−0.1714	−3.4036	−0.5902	−3.8292	−0.2720	−0.8938	−0.0510	−2.2105
1983	−0.1558	−0.1419	−1.7213	−1.4375	−0.652	−0.3164	−0.1424	−3.0886	−0.4475	−3.4590	−0.2502	−0.8527	−0.0471	−2.1258
1984	−0.1161	−0.0792	−0.9346	−0.8222	−0.652	−0.3164	−0.1319	−2.8976	−0.4110	−3.1400	−0.2180	−0.7345	−0.0466	−1.9669

	Income Elasticity Value		Income Elasticity Value		Income Elasticity Value		Income Elasticity Value		Income Elasticity Value		Income Elasticity Value		Income Elasticity Value	
	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand
1970	0.6302	1.9128	0.0345	0.8178	0.1457	0.3092	0.8124	0.8764	1.1266	0.2615	0.2553	0.5751	0.4567	0.3865
1971	0.4874	1.7426	0.0316	0.7390	0.1457	0.3092	0.8636	0.8617	1.0956	0.0234	0.1919	0.5570	0.4209	0.3681
1972	0.3807	1.3606	0.0378	0.7647	0.1457	0.3092	0.9046	0.8372	1.0798	0.0530	0.2036	0.4877	0.4503	0.3619
1973	0.3811	1.0544	0.0435	0.8815	0.1457	0.3092	0.9273	0.8742	1.1313	0.0064	0.2743	0.4234	0.5113	0.2902
1974	0.3417	1.4980	0.0339	0.5541	0.1457	0.3092	0.9301	1.1545	1.2566	0.0407	0.2582	0.5602	0.4310	0.2739
1975	0.2911	1.2713	0.0425	0.7028	0.1457	0.3092	0.8476	1.1889	1.6142	0.0191	0.2226	0.5815	0.3428	0.3385
1976	0.3457	1.2896	0.0673	1.0866	0.1457	0.3092	0.7768	1.2342	1.2654	0.0670	0.1708	0.5776	0.3411	0.3533
1977	0.3374	1.2657	0.0751	0.9667	0.1457	0.3092	0.7993	1.1878	1.1633	0.1107	0.2153	0.6442	0.3323	0.3707
1978	0.3629	1.1407	0.0699	1.0670	0.1457	0.3092	0.8762	1.0476	1.1381	0.0794	0.1844	0.4965	0.3996	0.4128
1979	0.3864	0.9323	0.0934	1.0883	0.1457	0.3092	0.8617	1.2493	1.1663	0.0753	0.1451	0.5120	0.2915	0.3396
1980	0.3569	0.9888	0.0897	0.9576	0.1457	0.3092	0.8259	1.5526	1.2734	0.0859	0.2346	0.5406	0.2624	0.3416
1981	0.3433	0.9998	0.0735	0.9944	0.1457	0.3092	0.7503	1.4776	1.2771	0.1896	0.2341	0.5370	0.2808	0.3681
1982	0.4014	0.9091	0.0637	0.9596	0.1457	0.3092	0.6909	1.4121	1.2682	0.0417	0.2416	0.5334	0.3279	0.3618
1983	0.4425	1.1974	0.0752	1.1864	0.1457	0.3092	0.7457	1.2820	1.1975	0.0004	0.2222	0.5089	0.3029	0.3480
1984	0.3296	0.6686	0.0408	0.6785	0.1457	0.3092	0.7644	1.2646	1.1828	0.0169	0.1936	0.4383	0.2996	0.3220

For instance, the income elasticity of exports for 1984, weighted by the export value, was 2.646 (3.273 in 1979), was considerably higher than 1.253 (1.374) of the domestic demand. Meanwhile the level of income elasticity for the machinery industry has since 1975 by and large remained at the same level.

Next, the price elasticity (based on the absolute values), being generally below 1.0, is small compared with the income elasticity. The price elasticity for exports is smaller than for the domestic demand. When compared with the price elasticity ($\frac{\partial l_n X_E}{\partial l_n P_U}$, $\frac{\partial l_n X_D}{\partial l_n P_{DC}}$ based on absolute values) of competing goods on export and domestic markets, the elasticity of competing goods is generally large on the export market. It is especially true for the machinery industry (general electric machinery, communications and electronic equipment, automobiles and industrial machinery). For instance, the increase in Japan's exports resulting from a 1% rise in the prices of U. S. products is larger than a reduction resulting from a 1% rise in Japanese prices.

On the domestic market, however, the elasticity of the goods concerned is large compared with that of competing goods, notably for machinery industry. Also, in terms of time series, there are many industries whose elasticity has been falling in recent years, especially for exports, notably for automobiles, industrial machinery, machine tools, etc. The price elasticity for 1984, weighted by the export value, was 0.677 for exports (0.840 in 1979) and 0.686 (0.736) for the domestic demand.

The fact that the price elasticity of exports is smaller than that of the domestic demand indicates that, while the effect of increased earnings due to a rise in prices is limited on the domestic market, that of increased earnings due to a change (or rise) in prices is relatively large on the export market. This trend seems to have become stronger in recent years.

The industries of household appliances and precision machinery, however, differ from other industries in the respect that the price elasticity of exports is considerably above that of the domestic demand and that the level itself is high. This high price elasticity of exports of these industries seems to have contributed to the increase of the export ratio because the price level of these industries has maintained a downward trend reflecting competition.

Let us compare the price elasticity measured in this study with the results in other studies. There are no similar examples of emprical results separately for exports and for the domestic demand by industry. No other study covers recent years, thus a strict comparison is difficult, but the representative results which have so far been obtained are as follows. First, in the case exports, Citrin (1985, measurement period 1970–79) obtained –0.7 ~ –0.5 (in this study –0.5 ~ –0.8) for iron and steel, –2.96 for color TV (–2.07 for household appliances) and –2.70 (–2.25) for small passenger cars. As for the domestic demand, Maki (1983), covering the period from 1958 to 1971 and basing on "the Household Income and Expenditure Survey", gives –0.53 (–0.66) for automobiles, –1.7 ~ –2.6 (–1.3 ~ –1.7) for household appliances

and –2.8 (–3.1) for precision machinery for 1970. The period covered by this study differs from ours and there are differences as regards data so that strict comparisions are not possible. However, as far as the above results are concerned there is no great discrepancy with the results of this study.

Finally, let us calculate the market response elasticity (λ), which can be deemed to show the condition of competition on the market. As has already been pointed out, the market response elasticity indicates the firm's conjectured change of supply volume of all other firms in response to a change in the firm's supply volume.

A rise in λ means that the firm's conjecture on the market conditions gets closer to conjecture of the other firms (narrowing of the perception gap between firms); in other words, the difference between the shape of the demand curve of the market as a whole and that of the demand curve faced by the firm concerned is reduced. This means that the degree of oligopoly becomes stronger in the sense that the firm acts paying attention to the behavior of other firms. Conversely, the smaller the value of λ is, the greater is the extent to which the firm regards the market condition as competitive. In other words, the firm thinks that, by reducing prices to some extent, it can get a large increase of demand.

While λ should be calculated directly by observing the behavior of firms on the market, this is actually difficult because of limitations in data. Alternatively, from the Equation (12), the followings are assumed here:

$$\lambda_E = -\frac{e_E}{R \cdot P_E}(R \cdot P_E - MC) = -e_E\left\{1 - \frac{C}{k(E + R \cdot P_E / P_D \cdot D)}\right\} \tag{25}$$

$$\lambda_D = -\frac{e_D}{P_D}(P_D - MC) = -e_D\left\{1 - \frac{R \cdot P_E / P_D \cdot D}{k(E + R \cdot P_E / P_D \cdot D)}\right\} \tag{26}$$

Under an equilibrium, λ is determined by the price elasticity, scale elasticity, export vs. domestic price ratio, total costs, and the amounts of exports and domestic demand, and a method was adopted whereby λ was obtained by employing these various variables. It should be noted that the effects of the exchange rate are included in changes of λ. The values for λ for each industry are shown in Table 5; their characteristics are as follows.

First, with a few exceptions, all the market response elasticity of both exports and domestic demand (λ_E, λ_D) are between 0.0 and 1.0. This indicates that the framework for analysis premising market equilibrium and the method employed for making calculations are roughly appropriate. However, for the industries of electric wires and cables, precision machinery and automobiles, the market response elasticity of exports becomes minus in some periods. Based on the Equations (25) and (26),

Table 5 Changes in Market Response Elasticity Values for Exports and Domestic Demand

(x100)

	Construction Machinery		Industrial Machinery		Machine Tools and Parts		General Electrical Machinery		Heavy Electrical Machinery		Household Electrical Appliances		Communications and Electronic Machinery	
	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand
1970	107.5	132.4	25.5	22.4	49.7	5.2	19.5	40.4	22.5	48.2	28.3	44.6	26.6	41.6
1971	76.7	111.4	20.6	19.9	18.4	3.4	21.3	37.7	20.8	46.4	32.4	34.8	23.1	37.2
1972	79.6	66.2	11.7	23.5	11.6	3.4	22.5	41.5	18.5	46.7	32.9	31.0	22.8	39.8
1973	50.9	67.7	7.8	22.7	6.6	2.1	23.1	40.6	19.4	48.7	29.9	21.6	25.4	38.2
1974	46.0	70.4	6.9	21.7	2.6	1.7	22.6	35.8	22.4	46.9	22.6	23.4	28.7	32.0
1975	38.5	14.2	10.0	23.5	4.0	1.5	27.4	36.1	17.6	36.3	30.6	21.6	32.8	33.5
1976	40.7	59.0	17.0	26.5	3.7	0.9	28.5	39.4	18.7	33.1	30.7	19.1	32.3	36.8
1977	26.3	93.5	11.6	26.9	6.2	3.0	23.9	41.8	12.7	39.5	24.7	14.7	26.2	36.4
1978	14.6	82.4	7.2	26.7	2.1	0.6	15.0	43.5	7.8	46.7	17.2	12.8	17.1	37.4
1979	22.2	78.9	7.9	23.3	3.7	1.2	20.2	46.9	7.7	51.3	25.1	11.2	19.4	41.8
1980	15.5	85.1	6.4	20.9	3.6	1.3	19.6	47.1	6.3	50.0	21.3	9.5	20.3	41.1
1981	11.8	68.4	4.8	21.8	2.5	1.3	19.2	49.1	3.4	51.0	22.5	8.3	15.9	41.7
1982	20.8	51.4	5.7	21.5	3.8	1.0	22.6	48.4	5.0	51.2	25.7	7.1	20.4	43.2
1983	21.3	45.6	4.7	23.1	2.8	1.2	18.3	48.2	2.1	47.2	18.4	5.9	19.5	45.5
1984	12.2	53.4	5.5	21.3	2.1	1.2	21.0	51.9	2.8	52.7	19.0	5.0	20.7	49.2
	−0.026	−0.565	0.004	0.068	0.130	0.292	0.288	−0.674	0.489	−0.667	−0.019	0.130	0.857	−0.678
	(0.411)	(0.515)	(0.169)	(−0.690)	(0.534)	(0.456)	(−0.321)	(0.218)	(0.073)	(0.421)	(0.050)	(0.212)	(−0.308)	(0.423)

	Electronic Parts		Automobiles		Precision Instruments		Metal Products		Electric Wires and Cables		Normal Steel		Other Ceramics & Earthenware	
	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand
1970	23.5	12.7	−14.3	10.9	−125.9	53.8	9.4	42.3	29.1	8.5	20.8	9.9	4.3	57.0
1971	22.1	12.4	−7.5	10.4	−127.1	47.6	9.2	49.2	105.3	10.7	15.7	8.9	3.8	51.3
1972	24.9	15.6	−3.8	10.2	−110.7	45.4	6.1	42.9	28.7	12.7	16.0	9.9	4.0	49.2
1973	28.4	17.0	−8.2	7.1	−85.7	35.1	5.8	110.8	−107.6	10.4	17.6	11.5	4.5	43.1
1974	27.0	12.3	−11.7	5.4	−62.5	33.8	7.2	107.1	−172.9	9.2	31.2	14.0	3.7	42.2
1975	29.4	12.6	−3.1	5.8	0.1	38.7	4.3	106.4	−119.4	7.1	22.9	12.6	2.8	44.2
1976	31.7	16.0	1.2	6.2	13.6	35.3	3.2	80.6	−94.0	7.4	14.3	15.2	2.6	44.6
1977	26.9	14.8	−0.5	5.9	20.0	33.9	1.9	77.3	−32.1	7.5	7.0	14.2	2.3	48.7
1978	21.3	14.9	−2.6	5.1	29.6	30.1	1.3	81.0	−39.3	7.9	7.2	18.8	2.4	60.8
1979	21.9	15.3	0.7	4.8	22.6	24.6	1.4	70.0	−28.9	6.1	18.1	19.9	2.0	53.7
1980	22.5	15.2	2.7	4.6	8.2	20.9	2.0	61.1	−21.0	5.9	25.2	21.6	1.8	52.9
1981	20.0	15.5	3.3	4.6	4.8	16.8	1.7	63.8	−6.3	6.3	27.5	24.0	2.0	55.3
1982	22.5	15.7	5.0	4.6	−23.5	16.5	1.6	58.7	2.0	6.9	28.4	20.9	2.6	55.2
1983	20.7	15.3	4.5	4.1	−14.2	15.6	0.9	63.0	−0.8	5.9	15.5	18.6	2.3	54.3
1984	20.9	15.8	4.4	3.8	−12.9	12.5	1.3	70.7	2.1	5.1	18.0	19.9	2.3	53.2
	0.330	−0.884	0.622	−0.674	0.285	−0.597	−0.485	−0.243	0.487	−0.136	−0.182	0.302	−0.581	−0.089
	(−0.257)	(0.376)	(0.760)	(−0.641)	(−0.054)	(0.091)	(0.072)	(−0.330)	(−0.044)	(0.716)	(0.109)	(−0.770)	(0.414)	(0.064)

	Synthetic Chemicals		Inorganic Chemicals		Organic Chemicals		Synthetic Fibers		Natural Fibers		Clothing, etc.	
	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand
1970	3.1	17.9	2.9	21.7	8.1	12.9	5.4	3.6	20.6	6.0	20.2	4.9
1971	0.5	16.0	0.3	25.2	1.4	9.6	5.1	2.9	17.0	5.3	23.6	4.9
1972	1.1	14.1	−1.7	28.7	5.0	9.6	3.0	2.4	16.3	5.9	25.7	4.5
1973	3.4	21.8	2.5	32.2	10.7	13.5	4.7	3.0	−7.4	13.7	19.1	6.5
1974	7.1	37.5	14.5	26.2	12.1	15.9	3.6	1.9	12.7	5.7	13.9	4.1
1975	3.9	22.9	42.9	24.2	6.0	10.5	1.7	0.9	0.1	−6.2	12.1	1.8
1976	−0.4	23.2	12.7	35.5	−1.7	11.2	2.2	1.5	−4.9	−1.7	11.4	3.1
1977	0.6	29.5	1.3	43.1	1.8	13.0	1.8	1.2	8.9	3.4	5.8	3.3
1978	−0.6	35.6	−1.7	46.3	−1.1	12.9	1.5	2.1	−8.6	2.0	5.3	4.4
1979	2.4	45.7	2.8	40.9	3.6	15.0	3.1	2.0	13.3	12.2	8.4	5.0
1980	0.9	47.7	4.5	52.0	2.2	13.4	2.1	1.8	40.1	9.9	6.4	5.4
1981	0.4	41.9	5.7	59.0	0.9	12.5	2.3	1.9	26.6	6.6	4.5	5.3
1982	1.8	37.5	13.4	62.9	3.8	14.3	3.5	1.7	23.3	7.2	6.3	4.8
1983	1.6	43.1	7.9	62.0	3.9	15.8	4.1	2.4	30.5	6.6	4.8	5.0
1984	2.0	52.7	8.7	63.7	3.5	14.7	3.4	1.5	18.2	7.8	5.0	5.0
	−0.146	0.149	0.146	0.279	−0.375	−0.175	−0.712	−0.751	0.022	−0.471	−0.489	−0.431
	(0.329)	(−0.446)	(−0.171)	(−0.713)	(0.252)	(0.131)	(0.765)	(0.872)	(0.018)	(0.435)	(0.784)	(0.504)

1. The market response elasticity value is calculated as in the following formula. $\lambda_E = (e_E / P_E) \cdot (MC - P_E)$ $\lambda_D = (e_D / P_D) \cdot (MC - P_D)$ λ_E : Response elasticity values for exports λ_D : Response elasticity values for domestic demand e_E : Price elasticity values for exports e_D : Price elasticity values for domestic demand P_E : Export prices P_D : Domestic prices MC : Marginal costs
2. The measurement period for the correlation coefficients with the inventory ratios (working ratios) is 1975 - 1980.

this means that export prices are at a level below marginal costs. When we note that particularly for electric wires and cables and precision machinery export prices are around 70-80% of domestic prices, it seems necessary to re-examine the method for calculating the absolute level of the export vs. domestic price ratio for the base period.

Second, except for λ_D of some industries (machine tools, heavy electrical machinery, communications and electronic equipment, metal products, inorganic chemicals), the market response elasticity of both exports and domestic demand have been relatively small in recent years. Also, the value for exports (λ_E) is generally smaller than that for domestic demand (λ_D). This means that the export market is more competitive than the domestic market and firms think it possible to increase exports by reducing prices. This suggests that, at least for the main firms, economies of scale do not necessarily lead to the reinforcement of their market powers or of the oligopolistic character of the market, but to an increase of the volume of exports. It should be noted, however, that λ_E is larger than λ_D for household appliances, electronic parts, etc.

Third, in terms of time series, both λ_E and λ_D are not fixed but variable. This indicates that the firm's conjecture on the market conditions changes over time. What cause these changes of λ is the so-called macro-economic conditions common to all firms such as business cycles and exchange rate changes of yen rather than the situation of the individual firm.

In order to examine the relationship between the movements of λ and domestic business cycles, "the Inventory-Sales Ratio Index" and "the Index of Capacity Utilization" of the Ministry of International Trade and Industry will be used as proxy variables for domestic business cycles, and the correlation coefficients for these and λ_E and λ_D will be examined.

As regards λ_D, it generally falls during periods of domestic business recession as shown by a rise in inventory-sales ratio or capacity utilization ratio: this indicates that firms become less confident of their market powers and try to increase their sales without considering the activities of other firms in the same industry. This pattern can be seen clearly for machine tools, electrical machinery (heavy electrical machinery, general electrical machinery, communications and electronic equipment, electronic parts), automobiles, precision machinery, fibers and other industries. Conversely, the indusries which become confident about their market powers during recession are restricted to those in which it is relatively easy to adopt the cooperation of production reduction, such as iron and steel (ordinary steel) and inorganic chemicals.

On the other hand, the relationship between λ_E and domestic business conditions varies, depending on the industry. Thus, it is not necessarily clear-cut. When based on the Equation (25), the changes in the export vs. domestic price ratio ($R \cdot$

R_E/P_D) are influenced not only by domestic business (affecting P_D) but also by overseas business conditions (affecting P_E) and exchange rate (R). During the business recessions in recent years, in particular, they have been affected by a fall in the value of yen. For instance, during the recession from 1980 to 1982, the pressure for reducing λ_E due to the decline in domestic demand and the relative drop in domestic prices, seems to have been offset by the improved export profitability resulting from the depreciation of the yen.

Judging from such movements of the market response elasticity of exports, we can not cleary identity the so-called export drive, that is the process that, in domestic recession, the conjecture of firms (λ_E) toward the export market becomes more competitive, leading to an increase in exports, (for instance the correlation between λ_E or λ_E/λ_D and the export ratio is not necessarily high).

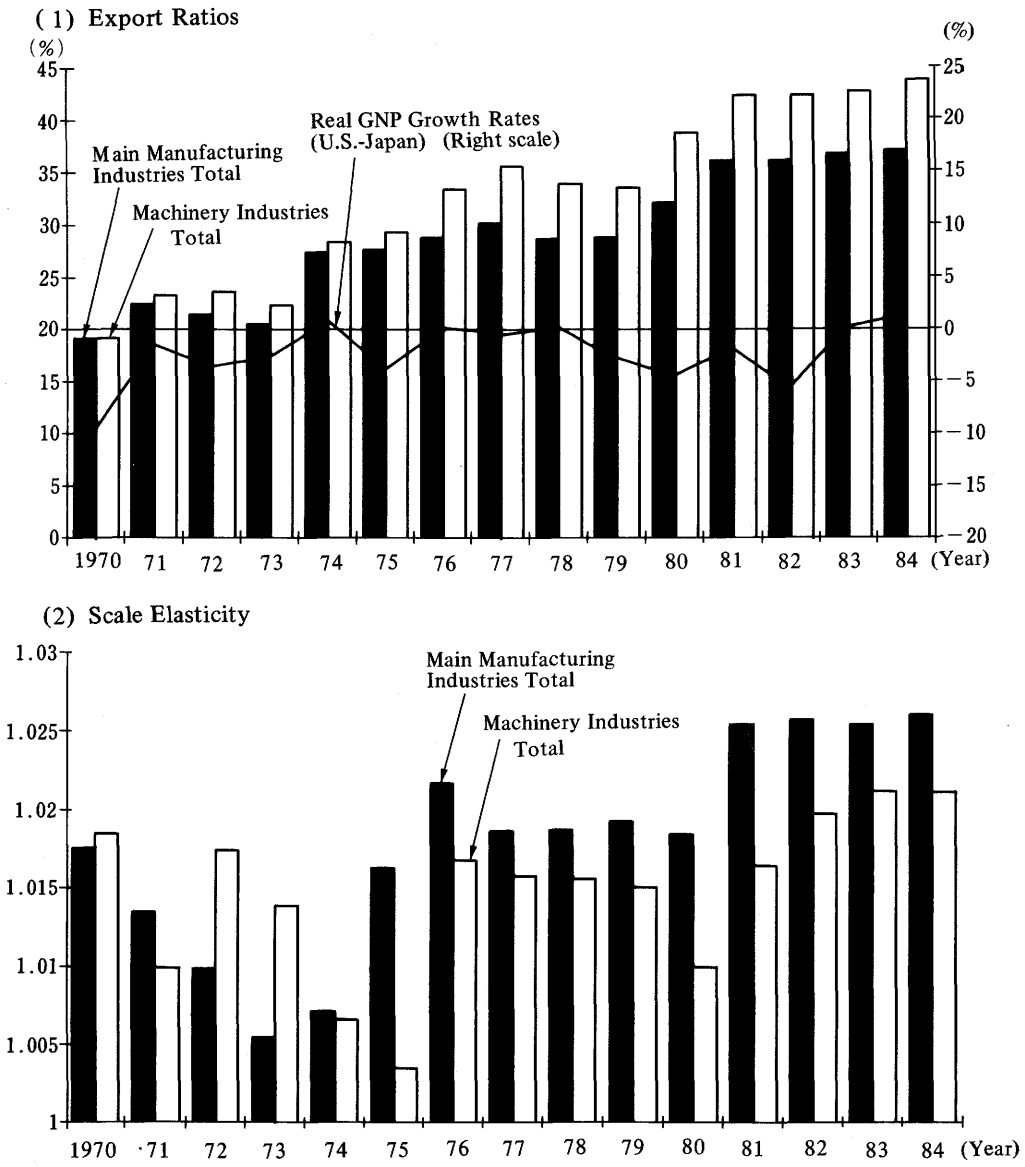
Here let us calculate the market response price elasticity by combining the market response elasticity (λ) and the price elasticity (e) (λ /e, this being the reciprocal of perceived price elasticity of the firm in the Equation (2)), and then examine its relationship with the attitude toward exports (Table 6). In the machinery industry with its large weight, while the elasticity of exports (absolute value) is smaller than that of domestic demand for electrical machinery (general electrical machinery, heavy electrical machinery, household appliances) and industrial machinery, such tendency was not clear for automobiles and machine tools. For the machinery industry as a whole, although the relationship between the market response price elasticity of exports and that of domestic demand have contributed to pushing up the export ratio, this effect has not been so large. Moreover this effect seen to have weakened in recent years (see Figure 9-4). On the other hand, the value of exports is higher for such material industries as iron and steel, and synthetic fibers. Overall, it can be concluded that in recent years the effects of the market response price elasticity on pushing up the export ratio has been limited.

VII. Fund-raising and Export Behavior of Firms

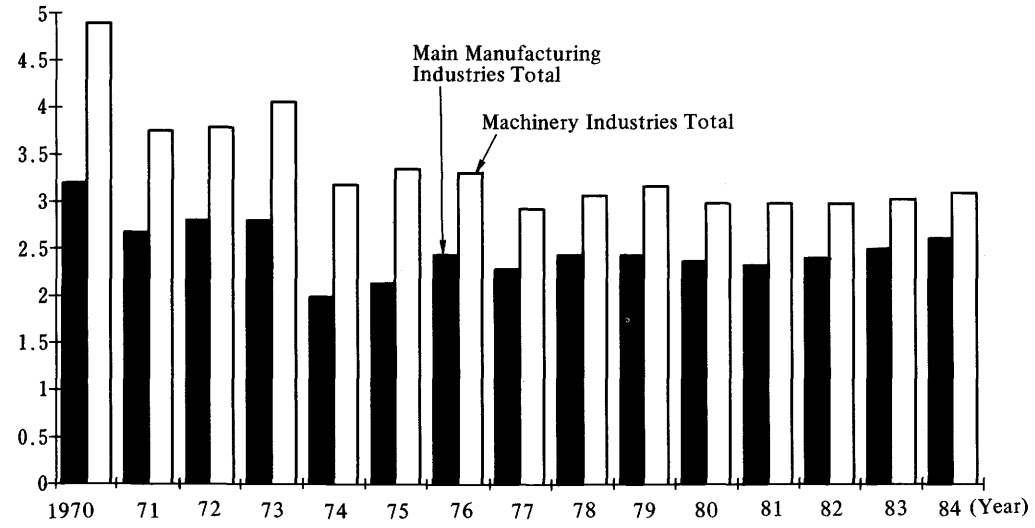
In the analysis above, financial factors have not been directly considered. It has been assumed that the domestic financial situation influences domestic business conditions through interest rates, thus affecting exports. However, it is also true that, during the period of high growth rate, exports showed a substantial increase in order to cope with the lower availability of funds during tight monetary policy. Thus, let us examine the effects of changes in the weight of exports on the fund management of firms.

If the amount of a firm's own funds at the beginning of a term is given, the main factor determining its demand for short-term funds is the amount of production or the amount of transactions of the term, which is thought to affect its fund manage-

Figure 9 Primary Factors for Fluctuations in Export Ratios



(3) Export and Domestic Demand Income Elasticity Value Ratios
(Export/Domestic Demand)



(4) Price Elasticity Values to Market Response (Export/Domestic Demand)

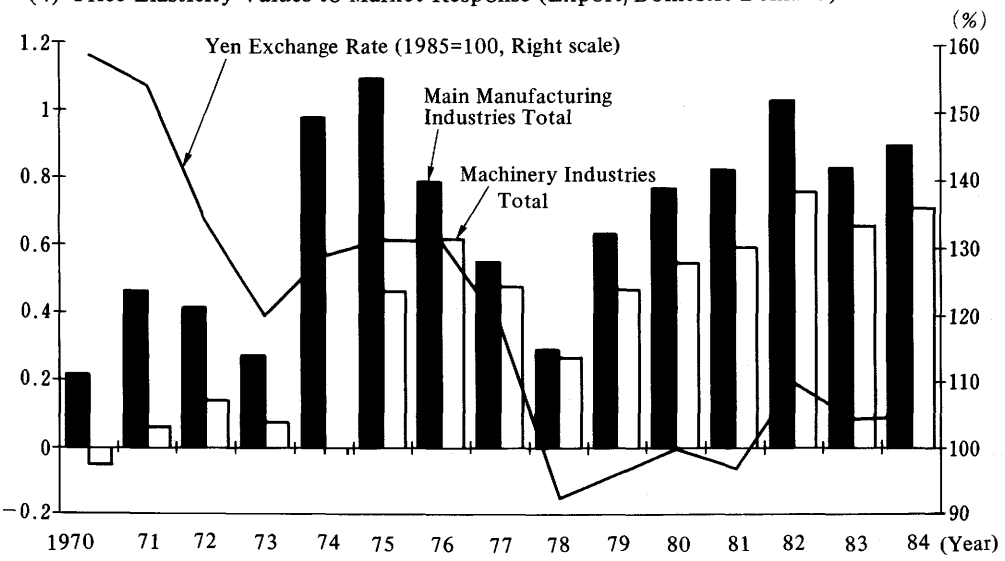


Table 6 Price Elasticity Values to Market Response for Exports and Domestic Demand

(x100)

	Construction Machinery		Industrial Machinery		Machine Tools and Parts		General Electrical Machinery		Heavy Electrical Machinery		Household Electrical Appliances		Communications and Electronic Machinery	
	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand
1970	−34.5	−23.1	−14.0	−15.9	−38.0	−17.5	−18.1	−23.4	−39.2	−19.8	−13.6	−35.1	−32.4	−25.0
1971	−31.7	−18.4	−13.8	−13.7	−30.6	−15.6	−19.7	−21.8	−36.2	−19.0	−15.6	−32.5	−28.2	−22.4
1972	−26.6	−10.8	−9.4	−15.9	−24.2	−14.1	−20.8	−24.0	−32.2	−19.1	−15.9	−33.0	−27.8	−24.0
1973	−22.4	−13.7	−7.7	−17.9	−21.3	−14.7	−21.4	−23.5	−33.8	−20.0	−14.4	−31.3	−30.8	−23.0
1974	−22.6	−11.1	−10.0	−17.1	−12.8	−11.9	−20.9	−20.7	−39.0	−19.2	−10.9	−27.9	−35.0	−19.3
1975	−16.9	−1.4	−14.7	−17.7	−19.7	−8.3	−25.4	−20.9	−30.6	−14.9	−14.8	−28.2	−40.0	−20.2
1976	−23.2	−5.8	−17.5	−18.4	−15.8	−5.1	−26.4	−22.8	−32.6	−13.5	−14.8	−29.2	−39.2	−22.1
1977	−24.6	−10.0	−15.4	−17.8	−24.8	−19.0	−22.1	−24.2	−22.1	−16.2	−11.9	−27.5	−31.8	−21.8
1978	−21.4	−14.0	−11.5	−18.9	−7.0	−4.1	−13.9	−25.2	−13.6	−19.1	−8.2	−29.0	−20.9	−22.5
1979	−33.8	−20.6	−14.3	−19.6	−15.7	−10.1	−18.7	−27.1	−13.4	−21.0	−12.6	−30.8	−23.5	−25.1
1980	−30.4	−23.9	−12.0	−19.2	−17.3	−12.5	−18.2	−27.3	−10.9	−20.5	−10.3	−28.9	−24.8	−24.7
1981	−25.4	−21.8	−12.3	−19.8	−13.3	−12.6	−17.8	−28.4	−5.9	−20.9	−10.8	−28.5	−19.4	−25.1
1982	−30.5	−16.0	−16.7	−20.1	−17.9	−10.6	−20.9	−28.0	−8.7	−21.0	−12.3	−27.4	−24.8	−26.0
1983	−31.4	−14.7	−15.7	−20.9	−14.8	−12.7	−16.9	−27.9	−3.6	−19.3	−8.8	−26.8	−23.7	−27.3
1984	−30.9	−18.4	−15.2	−20.0	−14.9	−14.0	−19.5	−30.0	−4.8	−21.6	−9.2	−26.6	−25.2	−29.5

	Electronic Parts		Automobiles		Precision Instruments		Metal Products		Electric Wires and Cables		Normal Steel		Other Ceramics & Earthenware	
	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand
1970	−38.7	−27.9	6.3	−16.5	9.7	−17.6	−25.4	−15.7	−7.0	−11.4	−28.7	−17.4	−60.4	−24.1
1971	−36.6	−27.2	5.1	−16.3	12.4	−16.2	−29.7	−21.1	−12.9	−10.3	−30.3	−14.9	−58.0	−22.8
1972	−41.0	−34.0	2.8	−18.0	11.6	−16.7	−24.9	−21.7	−4.2	−13.5	−29.4	−18.5	−57.0	−22.2
1973	−47.0	−37.3	6.9	−15.2	10.4	−17.3	−24.4	−23.2	11.5	−12.6	−31.1	−22.2	−56.5	−24.3
1974	−44.7	−27.0	13.4	−10.6	7.6	−16.6	−26.3	−19.9	41.5	−8.8	−45.3	−20.7	−55.1	−25.2
1975	−48.6	−27.5	3.5	−12.4	−0.0	−16.6	−22.3	−19.6	72.4	−6.5	−35.5	−16.3	−52.5	−21.3
1976	−52.3	−35.1	−1.7	−14.6	−1.7	−16.7	−16.2	−18.9	58.4	−8.8	−27.3	−18.1	−48.9	−20.6
1977	−44.3	−32.3	0.9	−15.0	−3.5	−17.3	−9.6	−19.9	27.3	−11.0	−14.0	−15.5	−44.4	−21.5
1978	−35.3	−32.7	5.3	−15.0	−5.9	−18.9	−6.1	−23.5	36.1	−14.5	−13.6	−20.4	−38.5	−24.1
1979	−36.1	−33.6	−1.5	−16.1	−6.2	−20.9	−11.0	−23.1	31.4	−11.2	−28.7	−23.8	−44.1	−25.8
1980	−37.2	−33.4	−7.5	−15.8	−3.1	−20.2	−13.9	−21.4	25.5	−11.0	−33.9	−24.4	−44.1	−25.3
1981	−33.1	−34.0	−10.5	−16.2	−2.2	−18.7	−11.6	−20.5	10.5	−13.7	−35.6	−25.0	−45.7	−24.5
1982	−37.2	−34.4	−15.7	−16.7	14.0	−18.5	−12.1	−21.1	−2.6	−14.3	−34.8	−21.0	−50.9	−24.9
1983	−34.3	−33.6	−15.1	−16.2	9.7	−18.5	−6.9	−20.8	1.0	−12.9	−22.3	−17.6	−48.8	−25.9
1984	−34.6	−34.7	−16.1	−15.8	11.3	−19.2	−9.5	−21.8	−2.7	−13.3	−26.8	−20.8	−49.3	−27.0

	Synthetic Chemicals		Inorganic Chemicals		Organic Chemicals		Synthetic Fibers		Natural Fibers		Clothing, etc.	
	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand	Export	Domestic Demand
1970	−24.5	−13.5	−10.1	−14.7	−28.1	−13.3	−24.3	−15.8	−26.0	−6.0	−30.9	−15.4
1971	−7.6	−13.5	−1.2	−13.0	−6.4	−10.2	−29.7	−14.0	−23.4	−5.9	−36.1	−15.4
1972	−16.7	−13.8	9.1	−14.6	−21.8	−11.7	−22.3	−14.8	−18.8	−6.3	−39.4	−14.2
1973	−31.1	−19.8	−10.5	−21.2	−34.6	−19.0	−35.0	−24.0	7.4	−12.8	−29.2	−20.5
1974	−42.1	−19.1	−35.4	−17.3	−41.6	−16.9	−29.9	−10.6	−16.3	−8.4	−21.3	−12.9
1975	−28.8	−11.0	−44.7	−10.5	−23.9	−10.7	−16.5	−5.9	−0.1	7.2	−18.5	−5.6
1976	3.7	−9.7	−23.2	−14.3	8.8	−11.5	−18.0	−9.8	3.1	1.2	−17.4	−9.7
1977	−4.8	−11.1	−3.5	−14.7	−7.4	−12.0	−15.1	−8.0	−5.1	−2.9	−8.8	−10.4
1978	7.7	−13.8	5.8	−16.4	5.2	−15.5	−11.7	−15.5	5.3	−1.5	−8.1	−13.9
1979	−19.9	−17.5	−8.6	−16.6	−22.0	−17.4	−22.7	−18.1	−6.2	−9.2	−12.8	−15.8
1980	−7.3	−14.1	−8.8	−15.2	−8.3	−14.7	−16.7	−15.3	−19.5	−8.5	−9.8	−17.0
1981	−2.8	−12.3	−10.2	−15.2	−3.4	−13.8	−19.0	−16.0	−15.8	−5.4	−6.9	−16.7
1982	−10.5	−11.0	−22.7	−16.4	−13.9	−15.9	−24.7	−15.7	−15.9	−6.1	−9.6	−15.1
1983	−11.2	−13.9	−17.6	−17.9	−15.5	−18.5	−26.3	−16.9	−17.7	−4.5	−7.3	−15.8
1984	−15.1	−18.1	−21.1	−20.2	−16.0	−20.0	−29.2	−18.9	−19.4	−9.4	−7.6	−15.8

Notes: 1. The price elasticity value to market response is calculated as in the following formula: $ERE = \lambda_E / e_E$ λ_E : Elasticity values to market response for exports e_E : Price elasticity values for exports
$ERD = \lambda_D / e_D$ λ_D : Elasticity values to market response for domestic demand e_D : Price elasticity values for domestic demand

2. The measurement period for the correlation coefficients with the inventory ratios (working ratios) is 1970 - 1984.

ment through changes in inter-firm credit in response to the speed at which bill payments and collections are carried out. One of the important factors affecting the speed of bill collection is the production-inducive dependence on each sector of the final demand (on which sector of the final demand the production of the industry concerned depends).

When we consider each demand item, the ratio of advance payments is high for government expenditure and the period for bill collection is relatively short. As for exports, firms can raise funds relatively easily by selling export bills to the foreign exchanges banks.[26] Therefore, for the industries with a high degree of dependence on this kind of demand, the weight of inter-firm credit (bills receivable and accounts receivable) as seen by its ratio to sales is relatively small and the demand for yen funds on banks is also small. In the case of plant investment in the private sector and housing investment, on the other hand, because the bill collection period is comparatively long, for firms with a large weight on transations relating to these investments, the weight of inter-firm credit or the degree of dependence on the procurement of external yen funds is large.[27]

In order to see the extent of the effects of each final demand on inter-firm credit, let us attempt to measure the inter-firm credit function (total bills receivable and accounts receivable).[28]

First, the inter-firm credit for each industry is formulated as follows.

$$\begin{aligned} FBT &= f\,(CO, EX, GV, IN, FAT_{-1}) \\ FBT &= g\,(CO, EX, GV, IN, CDT) \\ FBT &= h\,(CO, EX, GV, IN, L) \\ FAC &= k\,(CO, EX, GV, IN, CDT) \end{aligned} \tag{27}$$

26. While of course interest costs may be a problem here, for example when window guidance is in operation during periods of tight monetaty policy, the main factor for firms is thought to be quantitative availability.

27. When looking at the degree of production dependence for each industry and each demand sector from this observation (see Table 7-1), the degree of production-inducive dependence is high for private consumption in the case of food, fibers, chemicals and tertiary industries, for gross private capital formation in the case of metals, general machinery and electrical machinery, for exports in the case of automobiles, precision machinery and iron and steel.

28. This excludes the discount balances for bills receivable. We used the inter-business credit balances rather than short-term borrowings as the proxy variable showing yen-based fund management because it was not possible to obtain figures for yen-based short-term borrowings and also because the strength the domestic demand for short-term yen funds seemed to have been directly reflected in the expansion and contraction of inter-firm credit extended. This analysis was carried out here assuming no changes in inter-firm "practices" including the periods for bills receivable and accounts receivable.

FBT : Balances of inter-firm credit/sales
FAC : Balances of inter-firm credit/balances of fixed assets
FAT : Balances of fixed assets/sales
CDT : Balances of firm's liquidity/sales
CO : Degree of production-inducive dependence for consumption expenditure
EX : Degree of production-inducive dependence for exports
GV : Degree of production-inducive dependence for government expenditure
IN : Degree of production-inducive dependence for gross private capital formation
L : Amount of increase in the balances of firm's liquidity

Here CO + EX + GV + IN = 1.0.

It is assumed that the amount of inter-firm credit changes in close relation to the ratio of firm's liquidity or of the balances of fixed assets to sales as well as to the degree of production-inducive dependence for each final demand (a reduction in firm's liquidity or an increase in fixed assets operating as a factor for pressing yen fund management, thus contracting inter-firm credit).

Based on this formulation, and using the "Annual Report on Corporate Business Statistics" and the "Inter-industry Relations Tables," measurement was carried out by taking 13 of the main manufacturing industries for high-growth years (1965, 1970, 1975) and 16 of them for low-growth years (1978, 1980, 1982) and pooling the data for each of these three-year periods.[29] Table 7–2 shows the results of measurement. With the restriction CO + EX + GV + IN = 1.0 imposed in every case, all the parameters for CO, EV and GV in Table 7–2 are shown as differences from the parameter for IN. When we examine the parameters for each degree of production-inducive dependence, we find in every case the tendency that the effect of increasing inter-firm credit is generally smallest for government expenditure and strengthens in the order of exports, private consumption and private investment. However, when this phenomenon is examined in more detail, while this tendency was quite clear during the period of high growth rate, it has weakened relatively during the period of low growth rate from 1975.

Based on these analytical results, the tendency toward a relative reduction of inter-firm credit against sales in recent years (Table 7-3) may partially reflect the rise in export ratio. This reduces the demand for short-term funds on domestic financial institutions. However, with the progress toward financial liberalization, the differ-

29. As for the computer program, TSCSREG of SAS was used.

ences in the impact on financial activities caused by differences in demand items will be eliminated. The fact that the differentials between the coefficients have reduced according to the measurement results for the decade from 1975 can be interpreted to reflect such a situation. Also, since private demands for funds have leveled off from 1975 on, an export drive to increase the availability of funds as seen during the period of high growth rate seems to have substantially decreased. These considerations conclude that of the factors for determining the export behavior of firms, the factor of quantitative restrictions on funds have had a little weight, at least since 1975.

VIII. Factors for Determining the Export Ratio and Their Future Developments

Based on the above empirical results, let us now summarize the trends of the factors for the increase in export ratio in recent years for each main industry. As has been seen already, when based on the Equations (12) and (13), the factors for determining the firm's attitude of toward exports or their export ratio can be given as:

1) economies of scale (k),
2) the export vs. domestic price ratio ($R \cdot P_E/P_D$) or the market response price elasticity for exports and domestic demand ($\frac{\lambda_E \cdot e_D}{\lambda_D \cdot e_E}$)[30] and the exchange rate (R),
3) the differences in income elasticity between exports and domestic demand (e_{yE}/e_{yD}).

Let us examine the years from 1980, paying particular attentions to the machinery industry having a large relative importance.

First, concerning the machinery industry, the following factors should be noted; (1) The scale elasticity is relatively large for electrical machinery and automobiles, (2) The income elasticity of exports is large in all the machinery industries, indicating that they have been able to change their products in response to changes in the demand structure overseas, (3) The market response price elasticity ($\frac{\lambda_E \cdot e_D}{\lambda_D \cdot e_E}$) is smaller for exports, notably in the case of electrical machinery. All these factors have contributed to the rising export ratio of the whole economy (Figure 9). It should be added, however, that there is no substantial change in Factor (2), and the importance of Factor (3) have declined somewhat in the years from 1980.

Second, for iron and steel (ordinary steel), while the scale elasticity is large, the income elasticity of exports is considerably small. Also, with the market response price elasticity of exports being large compared with that of domestic demand, the export ratio has remained at the same level in recent years, though still at a high

30. In the following, based on the empirical results in VI, the market responsive elasticity value and the price elasticity value are linked.

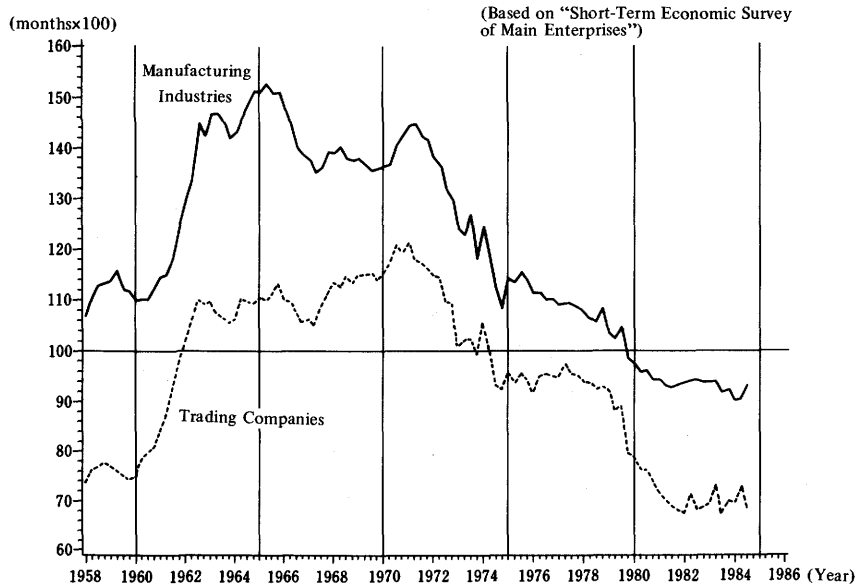
Table 7 Fluctuations in Inter-Enterprise Credit and Exports

(1) Sales Bonds and Degree of Production Induced Dependence

	Sales Bonds (ratio to sales)	Short-Term Borrowing (ratio to sales)	Degree of Production Induced Dependence (x 100)			
			Private Consumption	Private Investment	Exports	Government Expenditure
Agricultural	9.7%	23.1%	85.13	7.63	4.21	3.03
Forestry and Fishery	16.9	16.4	14.55	34.81	11.87	38.77
Mining	15.0	15.5	6.12	58.79	0.59	34.50
Food	11.1	12.6	95.08	1.47	2.45	1.00
Textiles	15.5	23.9	73.85	7.21	15.42	3.52
Timber, Paper and Pulp	21.6	25.2	4.69	26.56	12.96	55.79
Chemicals	20.9	21.0	56.44	11.77	24.93	6.86
Oil	17.5	26.9	50.52	15.79	19.57	14.12
Ceramics and Earthenware	19.1	22.8	18.25	39.69	12.43	29.63
Steel	15.5	25.4	13.51	30.42	41.81	14.26
Non-ferrous	15.8	26.5	17.40	32.39	35.03	15.18
Metals	15.2	17.1	23.28	44.86	15.93	15.93
General Machinery	26.1	21.9	9.05	50.29	30.95	9.71
Electrical Machinery	19.1	11.5	18.33	35.19	33.38	13.10
Automobiles	15.4	8.1	27.73	23.74	40.06	8.47
Other Transport Machinery	46.4	29.8	15.39	26.33	46.16	12.12
Precision Instruments	17.0	14.8	28.26	22.21	41.13	8.40
Other Manufacturing	17.0	17.5	49.48	21.39	19.62	9.51
Transportation and Communications	10.6	15.0	59.59	12.66	17.41	10.34
Electricity and Gas	5.4	13.3	55.07	14.11	13.02	17.80
Commerce	15.1	12.1	64.71	18.52	9.49	7.28
Real Estate	8.7	52.6	90.74	4.04	2.67	2.55
Services	15.6	17.0	73.62	5.30	3.54	17.54

Notes: 1. The external capital adjustment ratios are according to the Corporate Enterprise Statistical Yearbook (1980), and the degrees of production-induced dependence are according to the Industrial Related Tables (1980).
2. Short-term borrowings include discount balances for bills receivable.

(2) Changes in Balance of Inter-Enterprise Credit Extended (as Ratio of Sales)



(3) Fluctuation Factors for Inter-Enterprise Credit

a. 1965-1970-1975 (13 industries)

	CO	EX	GV	FAT-1	CDT	L	CONSTANT	R^2
FBT	−0.2244 (3.1)	−0.2918 (2.4)	−0.4303 (2.0)	0.0999 (1.3)			35.9356 (5.4)	0.316
FBT	−0.1850 (2.8)	−0.2488 (2.2)	−0.3286 (1.6)		0.6275 (1.9)		27.2558 (3.4)	0.422
FBT	−0.1697 (2.4)	−0.2072 (1.7)	−0.2654 (1.2)			0.7735 (1.1)	32.1948 (4.2)	0.320
FAC	−0.7519 (3.1)	−1.4725 (3.8)	−1.4287 (2.3)		0.3724 (0.3)		129.1240 (4.4)	0.437

b. 1978-1980-1982 (16 industries)

	CO	EX	GV	FAT-1	CDT	L	CONSTANT	R^2
FBT	−0.1160 (2.5)	−0.1109 (1.5)	−0.2159 (1.9)	0.1257 (2.7)			23.9181 (5.2)	0.069
FBT	−0.0491 (1.3)	−0.0286 (0.5)	−0.1078 (1.2)		0.7230 (6.6)		12.2039 (3.0)	0.362
FBT	−0.1070 (2.2)	−0.1058 (1.3)	−0.1728 (1.4)			0.1220 (0.5)	26.2104 (5.4)	0.060
FAC	−1.0162 (3.2)	−1.3846 (2.7)	−1.6897 (2.1)		2.7612 (2.8)		199.0370 (5.5)	0.278

Notes: 1. FBT: Balance of inter-enterprise credit extended/sales
FAC: Balance of inter-enterprise credit extended/fixed asset balance
FAT: Fixed asset balance/sales
CDT: Ready money liquidity balance/sales
CD : Degree of production-induced dependence to consumption expenditure
EX : Degree of production-induced dependence to exports
GV : Degree of production-induced expendure to government expenditure
L : Increase in ready money liquidity balance/sales

2. The SAS Program (TSCSREG) has been used.

3. The calculations here cover, for 1978-1980-1982, the 15 manufacturing industries in (1) industry; for 1965-1970-1975, timber, paper and pulp, oil and precision instruments are excluded.

level.

Third, for chemicals, the market response price elasticity of exports is small. However, with the income elasticity being generally small (though somewhat large for organic chemicals) and the scale elasticity being also small (especially synthetic chemicals), the export ratio has shown no marked changes.

Fourth, for fibers, mainly because the income elasticity of exports is small, the export ratio has remained at the same level on the whole. For synthetic fibers and others, although the scale elasticity is relatively large, the pressure for the increase of the export ratio seems to be weak because of the large market response price elasticity (synthetic fibers) and of the small income elasticity (other fibers).

Thus the important background for the rise in export ratio among the main firms

in recent years is that the large scale elasticity, notably for the machinery industry, and the depreciated yen have contributed to the expansion in exports for all industries by relatively improving the marginal export profitability (or enlarging the scope for the reduction of prices in foreigin currency terms) (Figure 9). In addition, the higher income elasticity of exports and the lower market response price elasticity seem to have contributed to the rise in export ratio.

Finally, based on these results, let us consider the future developments in exports. The rise in the yen exchange rate since the fall of 1985 has provided the pressure for lowering the export vs. domestic price ratio on the yen terms, which constitutes one of the factors for changes in export ratio (this ratio already declined for 1985). Given the framework described above, this serves as the factor for raising export prices on foreign currency terms through the deterioration in marginal export profitability, which is inevitably to lead to lowering the export ratio.

However, in view of the fact that the scale elasticity and the income elasticity of exports continue to be considerably large and the market response price elasticity is still relatively small in the machinery industry with a large weight in the economy, there is a possibility that the effect of the appreciation of the yen on lowering the export ratio will remain relatively limited. Moreover, when viewed from a fairly long perspective, it is highly probable that prices will continue to be stable in Japan compared with other countries (there is the possibility of a rightward shift in the export demand curve), and the trend toward an increase in the relative weight of commodities with large income elasticity is expected to continue, especially in the machinery industry. Therefore, in order to achieve structural reform of the economy which is the most important task for the Japanese economy at present, measures based on the production and cost structures of firms are necessary. Of course, in view of the substantial appreciation of the yen since the fall of 1985, it is difficult to say whether or not the past trends of the various elasticity will continue in the future. Needless to say, it will thus be necessary to pay close attention to the future developments in export ratio.

Reference 1 Measurement Results for Economies of Scale–for 1969

(t value in parentheses)

	Laspeyres Index			Fisher Index			Divisia Index			Paasche Index		
	Laspeyres Index	Constant	$\bar{R}^2$	Laspeyres Index	Constant	$\bar{R}^2$	Laspeyres Index	Constant	$\bar{R}^2$	Laspeyres Index	Constant	$\bar{R}^2$
(Number of Enterprises)												
Synthetic Fibers (9)	(42.3) 1.0110	(199.7) 13.1721	0.9955	(41.2) 1.0280	(194.1) 13.1650	0.9953	(41.9) 1.0221	(197.6) 13.1653	0.9955	(39.5) 1.0455	(185.6) 13.1581	0.9949
Cotton Spinning (15)	(41.6) 0.9359	(182.9) 12.6543	0.9920	(40.4) 0.9427	(175.7) 12.6264	0.9915	(41.2) 0.9463	(179.6) 12.6316	0.9918	(38.7) 0.9494	(166.5) 12.5987	0.9907
Other Textiles (Clothing, etc.) (11)	(16.3) 0.8602	(190.9) 12.9265	0.9636	(16.3) 0.8526	(190.0) 12.9205	0.9635	(16.2) 0.8588	(189.5) 12.9220	0.9633	(16.1) 0.8446	(187.4) 12.9151	0.9629
Paper and Pulp (17)	(62.8) 0.9842	(686.7) 14.2890	0.9960	(61.1) 0.9945	(667.4) 14.2869	0.9957	(60.6) 0.9946	(654.9) 14.2733	0.9957	(59.0) 1.0049	(643.0) 14.2848	0.9954
Synthetic Chemicals (5)	(5.3) 1.3058	(416.8) 16.5168	0.8698	(5.3) 1.3198	(417.6) 16.5165	0.8706	(5.3) 1.3198	(417.5) 16.5165	0.8705	(5.3) 1.3339	(418.3) 16.5163	0.8712
Inorganic Chemicals (14)	(30.1) 0.9662	(271.8) 13.4112	0.9858	(28.8) 0.9851	(264.3) 13.4331	0.9845	(29.0) 0.9804	(266.7) 13.4359	0.9848	(27.4) 1.0045	(255.0) 13.4563	0.9829
Organic Chemicals (21)	(20.8) 0.9073	(347.3) 14.6143	0.9559	(19.8) 0.9510	(336.8) 14.6326	0.9514	(19.9) 0.9465	(337.9) 14.6326	0.9516	(18.5) 0.9971	(322.1) 14.6540	0.9446
Cement (8)	(20.3) 0.9770	(196.5) 14.0198	0.9833	(20.0) 0.9458	(192.3) 14.0110	0.9827	(20.1) 0.9450	(193.4) 14.0096	0.9830	(19.3) 0.9160	(185.3) 14.0035	0.9816
Other Ceramics and Earthenware (11)	(20.5) 0.8465	(234.0) 13.6631	0.9766	(17.6) 0.9842	(201.0) 13.6595	0.9687	(18.1) 1.0028	(205.3) 13.6531	0.9703	(13.1) 1.1613	(151.2) 13.6675	0.9450
Normal Steel (17)	(144.0) 0.9994	(837.1) 14.2510	0.9992	(134.1) 1.0109	(779.0) 14.2493	0.9991	(135.4) 1.0115	(786.8) 14.2488	0.9991	(122.6) 1.0227	(711.9) 14.2477	0.9989
Specialty Steel (8)	(47.9) 0.9787	(617.3) 14.3607	0.9970	(41.7) 1.0152	(543.1) 14.3746	0.9960	(41.4) 1.0153	(538.5) 14.3725	0.9959	(34.3) 1.0538	(452.2) 14.3901	0.9941
Electric Wires and Cables (6)	(40.5) 1.0294	(1059.6) 15.9120	0.9970	(41.5) 1.0369	(1086.4) 15.9129	0.9971	(41.5) 1.0368	(1086.3) 15.9129	0.9971	(42.5) 1.0444	(1114.0) 15.9138	0.9978
Metal Products (11)	(26.5) 0.9131	(350.3) 13.8353	0.9860	(25.2) 0.9753	(332.7) 13.8358	0.9845	(25.5) 0.9663	(337.6) 13.8379	0.9848	(22.5) 1.0445	(298.4) 13.8381	0.9806
Construction Machinery (7)	(11.2) 0.8249	(226.6) 14.0510	0.9536	(10.8) 0.8513	(221.5) 14.0603	0.9505	(10.7) 0.8510	(220.8) 14.0613	0.9500	(10.4) 0.8792	(216.2) 14.0703	0.9468
Industrial Machinery (19)	(50.4) 0.9393	(372.6) 13.6824	0.9930	(55.4) 0.9721	(410.9) 13.6893	0.9942	(56.7) 0.9697	(421.9) 13.6953	0.9944	(56.4) 1.0063	(419.8) 13.6982	0.9944
Machine Tools and Parts (6)	(31.3) 0.9253	(165.0) 12.8872	0.9949	(34.8) 0.9411	(184.3) 12.8955	0.9959	(34.4) 0.9403	(182.0) 12.8942	0.9958	(39.1) 0.9574	(207.8) 12.9043	0.9967
General Electrical Machinery (4)	(35.9) 1.0287	(443.0) 16.4013	0.9977	(38.8) 1.0360	(477.3) 16.5999	0.9980	(38.6) 1.0356	(474.8) 16.4000	0.9980	(42.1) 1.0433	(517.9) 16.3986	0.9983
Heavy Electrical Machinery (6)	(14.8) 1.0670	(303.9) 14.3992	0.9777	(14.5) 1.0718	(297.7) 14.4038	0.9765	(14.5) 1.0715	(297.7) 14.4038	0.9765	(14.1) 1.0766	(291.4) 14.4084	0.9752
Household Electrical Appliances (12)	(24.2) 1.0230	(159.0) 13.6419	0.9815	(24.4) 1.0437	(161.3) 13.6537	0.9818	(24.4) 1.0420	(160.9) 13.6492	0.9818	(24.5) 1.0651	(163.1) 13.6661	0.9820
Communications and Electronic Machinery (7)	(14.0) 0.9413	(148.3) 14.3848	0.9702	(13.9) 0.9500	(147.4) 14.3834	0.9698	(13.9) 0.9578	(147.1) 14.3876	0.9696	(13.8) 0.9588	(146.2) 14.3820	0.9694
Electronic Parts (4)	(6.9) 0.8684	(106.9) 13.4941	0.9400	(6.0) 0.9612	(92.6) 13.4893	0.9216	(5.9) 0.9746	(91.3) 13.4878	0.9196	(4.8) 1.0629	(74.9) 13.4927	0.8817
Automobiles (11)	(30.1) 1.0019	(309.3) 15.6334	0.9890	(30.0) 1.0048	(310.2) 15.6387	0.9890	(30.0) 1.0032	(309.3) 15.6356	0.9890	(29.9) 1.0077	(309.8) 15.6441	0.9889
Shipbuilding (8)	(46.8) 1.0315	(366.8) 15.2927	0.9968	(47.0) 1.0366	(368.5) 15.2900	0.9968	(47.1) 1.0369	(368.9) 15.2899	0.9969	(47.3) 1.0416	(369.7) 15.2874	0.9969
Precision Instruments (9)	(24.0) 1.0096	(253.1) 13.6380	0.9863	(23.6) 1.0216	(247.3) 13.6273	0.9859	(23.7) 1.0217	(247.9) 13.6289	0.9859	(23.0) 1.0335	(238.9) 13.6167	0.9851

Reference 2 Measurement Results for Economies of Scale– for 1984

(t value in parentheses)

	Laspeyres Index			Fisher Index			Divisia Index			Paasche Index		
	Laspeyres Index	Constant	$\bar{R}^2$	Laspeyres Index	Constant	$\bar{R}^2$	Laspeyres Index	Constant	$\bar{R}^2$	Laspeyres Index	Constant	$\bar{R}^2$
(Number of Enterprises) Synthetic Fibers (8)	(102.1) 1.0243	(465.9) 13.7657	0.9993	(105.5) 1.0336	(479.6) 13.7573	0.9994	(105.7) 1.0327	(480.6) 13.7568	0.9994	(104.2) 1.0431	(472.5) 13.7489	0.9994
Cotton Spinning (13)	(62.1) 0.9841	(344.5) 13.4901	0.9969	(64.4) 0.9884	(357.4) 13.4934	0.9971	(65.0) 0.9900	(361.0) 13.4942	0.9972	(66.1) 0.9928	(367.3) 13.4968	0.9973
Other Textiles (Clothing, etc.) (11)	(23.7) 1.0316	(186.1) 12.4849	0.9824	(21.3) 1.0866	(169.8) 12.5041	0.9784	(21.0) 1.0995	(167.0) 12.5016	0.9778	(18.4) 1.1451	(149.5) 12.5289	0.9714
Paper and Pulp (9)	(33.9) 1.0866	(316.8) 14.3901	0.9931	(33.1) 1.0929	(311.3) 14.3995	0.9927	(33.3) 1.0914	(312.4) 14.3971	0.9928	(32.1) 1.0990	(303.6) 14.4091	0.9923
Synthetic Chemicals (4)	(7.0) 0.9926	(250.1) 17.1256	0.9408	(6.8) 1.0038	(244.6) 17.1251	0.9383	(6.8) 1.0031	(245.1) 17.1251	0.9385	(6.7) 1.0151	(239.1) 17.1246	0.9297
Inorganic Chemicals (12)	(23.3) 1.0080	(233.7) 13.8029	0.9801	(22.0) 1.0395	(223.6) 13.8220	0.9777	(22.0) 1.0398	(224.4) 13.8241	0.9778	(20.2) 1.0715	(208.8) 13.8439	0.9737
Organic Chemicals (19)	(26.7) 0.9989	(269.9) 14.4069	0.9754	(26.0) 1.0234	(261.5) 14.4024	0.9740	(26.2) 1.0294	(264.0) 14.4034	0.9744	(25.2) 1.0491	(252.7) 14.3980	0.9723
Cement (6)	(50.6) 0.9595	(391.8) 13.9846	0.9981	(49.6) 0.9696	(382.6) 13.9799	0.9980	(49.3) 0.9677	(380.5) 13.9788	0.9979	(47.7) 0.9799	(366.9) 13.9751	0.9978
Other Ceramics and Earthenware (11)	(28.3) 0.9815	(142.7) 12.6342	0.9876	(25.2) 1.1094	(125.0) 12.5901	0.9845	(24.9) 1.1140	(123.5) 12.5926	0.9841	(17.4) 1.2609	(85.2) 12.5604	0.9679
Normal Steel (12)	(102.4) 1.0570	(534.8) 14.5047	0.9990	(110.3) 1.0715	(577.8) 14.5125	0.9991	(112.7) 1.0661	(590.4) 14.5130	0.9991	(107.3) 1.0863	(563.9) 14.5209	0.9990
Specialty Steel (6)	(42.4) 1.0488	(687.7) 15.2806	0.9972	(43.1) 1.0598	(701.0) 15.2829	0.9973	(44.2) 1.0572	(719.7) 15.2841	0.9975	(42.7) 1.0710	(695.1) 15.2852	0.9973
Electric Wires and Cables (6)	(47.6) 1.0175	(1000.6) 16.3767	0.9978	(48.7) 1.0231	(1026.6) 16.3778	0.9979	(48.6) 1.0229	(1022.9) 16.3779	0.9979	(49.9) 1.0287	(1051.9) 16.3790	0.9980
Metal Products (13)	(50.7) 1.0345	(607.0) 14.5639	0.9953	(46.2) 1.0408	(565.6) 14.5958	0.9944	(45.0) 1.0196	(552.5) 14.5985	0.9941	(38.1) 1.0455	(477.6) 14.6293	0.9918
Construction Machinery (8)	(7.0) 0.7875	(73.1) 14.1267	0.8713	(6.1) 0.8559	(63.8) 14.1116	0.8385	(6.0) 0.8640	(62.9) 14.1161	0.8336	(5.0) 0.9157	(53.4) 14.1212	0.7773
Industrial Machinery (18)	(59.7) 0.9714	(391.2) 14.0823	0.9953	(53.7) 1.0187	(351.0) 14.0764	0.9941	(54.5) 1.0113	(356.7) 14.0824	0.9943	(46.8) 1.0701	(304.8) 14.0709	0.9923
Machine Tools and Parts (6)	(14.8) 0.9076	(105.4) 14.2009	0.9776	(14.3) 0.9329	(101.7) 14.1990	0.9760	(14.0) 0.9296	(99.3) 14.1966	0.9749	(13.7) 0.9596	(97.7) 14.1972	0.9741
General Electrical Machinery (4)	(28.6) 1.051	(318.4) 17.5233	0.9963	(28.3) 1.0637	(315.0) 17.5218	0.9963	(28.2) 1.0640	(314.2) 17.5217	0.9963	(27.4) 1.0766	(304.8) 17.5204	0.9960
Heavy Electrical Machinery (6)	(20.0) 1.042	(288.5) 14.5912	0.9876	(20.2) 1.0522	(291.9) 14.5916	0.9879	(20.2) 1.0531	(291.0) 14.5927	0.9878	(20.4) 1.0625	(294.0) 14.5922	0.9881
Household Electrical Appliances (12)	(35.3) 0.9195	(294.4) 15.6714	0.9913	(33.9) 0.9773	(283.0) 15.6749	0.9905	(33.8) 0.9805	(281.7) 15.6750	0.9904	(31.4) 1.0421	(262.5) 15.6800	0.9889
Communications and Electronic Machinery (7)	(25.7) 0.9893	(205.2) 15.6763	0.9910	(25.7) 0.9888	(206.2) 15.6851	0.9910	(25.6) 0.9856	(205.3) 15.6862	0.9909	(25.5) 0.9882	(205.2) 15.6940	0.9908
Electronic Parts (6)	(13.1) 1.0323	(211.9) 16.1244	0.9714	(12.6) 1.0548	(203.5) 16.1206	0.9693	(12.8) 1.0549	(206.9) 16.1223	0.9702	(12.0) 1.0773	(192.9) 16.1172	0.9661
Automobiles (12)	(54.6) 1.0277	(641.5) 17.1432	0.9963	(53.3) 1.0368	(628.3) 17.1500	0.9961	(53.3) 1.0374	(628.7) 17.1505	0.9961	(51.8) 1.0461	(613.4) 17.1570	0.9959
Shipbuilding (5)	(20.1) 0.9864	(156.4) 16.2312	0.9902	(20.0) 0.9882	(155.7) 16.2314	0.9901	(20.0) 0.9882	(155.6) 16.2314	0.9901	(19.9) 0.9899	(155.0) 16.2316	0.9900
Precision Instruments (10)	(24.1) 0.9813	(231.7) 15.0747	0.9848	(24.1) 0.9964	(231.2) 15.0708	0.9848	(24.1) 0.9973	(231.9) 15.0715	0.9847	(23.9) 1.0117	(228.8) 15.0671	0.9845

Reference 3 Elasticity Values (Fisher Index) etc.

	Synthetic Fibers	Cotton Spinning	Other Textiles (Clothing, etc.)	Paper and Pulp	Synthetic Chemicals	Inorganic Chemicals	Organic Chemicals	Cement	Other Ceramics and Earthenware	Normal Steel	Specialty Steel	Electric Wires and Cables	Metal Products	Construction Machinery	Industrial Machinery	Machine Tools and Parts	General Electrical Machinery	Heavy Electrical Machinery	Household Electrical Appliance	Communications and Electronic Machinery	Electronic Parts	Automobiles	Ship building	Precision Instruments
1965	1.0225	0.9401	0.7971	1.0221	1.1195	1.0500	0.8474	1.0016	0.8546	1.0418	1.0523	0.9794	1.0148	0.9746	0.9764	0.9604	1.0314	0.8526	1.0341	0.8444	–	1.0345	0.9831	1.0230
1966	1.0342	0.9434	0.8579	1.0025	1.0744	1.0405	0.8679	1.0298	1.0887	1.0285	1.0414	1.0181	1.0042	0.9376	0.9768	0.9256	1.0240	1.1714	1.0399	0.8552	–	1.0169	0.9962	1.0174
1967	1.0298	0.9455	0.8870	0.9891	1.0025	1.0274	0.8721	0.9820	1.0709	1.0180	1.0068	1.0288	1.0412	0.9586	0.9811	0.9149	1.0279	1.1941	1.0512	0.8667	–	0.9963	0.9930	1.0138
1968	1.0317	0.9610	0.9083	0.9937	1.0204	1.0030	0.9104	0.9698	0.9660	1.0275	1.0509	1.0337	1.0800	0.9881	0.9873	0.9516	1.0607	1.1414	1.0385	0.8957	–	1.0034	1.0048	1.0300
1969	1.0280	0.9427	0.8526	0.9945	1.3198	0.9851	0.9510	0.9458	0.9842	1.0109	1.0152	1.0368	0.9753	0.8513	0.9721	0.9411	1.0360	1.0718	1.0437	0.9500	0.9612	1.0048	1.0366	1.0216
1970	1.0083	0.9462	0.9518	0.9897	1.3572	0.9681	1.0003	1.0367	1.0404	1.0113	0.9832	1.0285	1.0147	0.8785	0.9794	0.9339	1.0086	1.0611	1.0574	0.9624	1.0250	1.0129	1.0653	1.0269
1971	1.0106	0.9924	1.0276	0.9800	1.0254	0.9830	1.0226	1.0344	1.0485	1.0260	0.9839	1.0301	1.0538	0.9020	0.9960	0.8740	1.0010	1.0483	1.0131	0.9844	0.9237	1.0218	1.0559	0.9926
1972	1.0309	0.9470	0.9334	0.9985	0.9693	1.0011	1.0005	1.0537	1.0491	1.0016	0.9797	1.0351	1.0634	0.9464	1.0008	0.9027	1.0325	1.1190	1.0208	0.9995	0.9417	1.0273	1.0311	0.9498
1973	1.0298	0.9301	1.0279	0.9938	0.7990	1.0430	1.0369	1.0252	1.0291	1.0040	0.9974	1.0339	1.0339	1.0176	1.0012	0.9162	1.0220	1.0433	1.0396	0.9878	0.9363	1.0178	1.0073	0.9610
1974	1.0291	0.9621	1.0605	0.9923	0.8204	0.9578	0.9907	0.9838	0.9249	1.0296	1.0136	1.0234	0.9675	1.0573	0.9902	0.9501	1.0283	1.0724	1.0318	0.9651	1.0208	1.0032	1.0135	0.9873
1975	1.0236	0.9884	1.2078	1.0114	0.8824	0.9505	0.9706	0.9909	0.9437	1.0575	1.0761	1.0635	1.0096	1.0728	0.9879	0.9225	1.0041	0.9754	1.0023	0.9756	0.9864	1.0139	1.0625	0.9940
1976	1.0213	0.9760	1.0808	0.9942	1.0513	0.9633	0.9857	0.9762	1.0201	1.0423	1.0615	1.0384	1.0354	1.0304	1.0031	0.9751	1.0118	1.0401	1.0127	0.9862	0.8540	1.0317	1.0697	0.9752
1977	1.0271	0.9826	1.1840	1.0089	0.9551	1.0156	0.9656	1.0070	0.9758	1.0430	1.0670	1.0321	1.0195	1.0204	1.0118	1.0433	1.0090	1.0151	0.9944	0.9861	1.0753	1.0282	1.1098	0.9692
1978	1.0430	0.9774	0.9842	1.0372	0.9704	1.0473	0.9768	1.0092	1.1072	1.0375	1.0507	1.0370	1.0216	0.9959	1.0139	0.9614	1.0194	1.0132	0.9995	1.0063	1.0924	1.0242	1.1692	0.9693
1979	1.0419	0.9997	0.9328	0.9846	0.9966	1.0636	0.9838	0.9699	1.1060	1.0449	1.0654	1.0076	0.9968	0.7829	1.0032	0.9876	1.0338	1.0259	0.9962	0.9977	1.1330	1.0266	1.0653	0.9449
1980	1.0315	0.9885	0.9907	0.9674	0.9423	1.0734	0.9879	1.0091	1.0865	1.0828	1.0434	1.0399	0.9920	0.7829	0.9877	0.9731	1.0413	1.0255	0.9921	0.9824	1.0492	1.0219	1.0315	0.9518
1981	1.0387	0.9849	1.0072	0.9656	0.9452	0.9624	1.0239	0.9925	1.0831	1.0921	1.0406	1.0125	0.9611	0.8429	1.0061	0.9475	1.0476	1.0699	0.9914	0.9826	1.0510	1.0302	1.0225	0.9605
1982	1.0320	0.9743	0.9783	0.9905	1.0253	0.9676	1.0105	0.9577	1.1228	1.0744	1.0530	1.0078	0.9851	0.8156	1.0047	0.9371	1.0542	1.0062	0.9883	0.9744	1.0803	1.0352	1.0284	0.9822
1983	1.0287	0.9681	1.0128	1.0462	1.0141	1.0056	0.9990	0.9603	1.1435	1.0627	1.0680	1.0425	1.0196	0.8562	1.0103	0.9422	1.0499	1.0145	0.9704	1.0005	1.0749	1.0402	1.0747	0.9905
1984	1.0336	0.9884	1.0866	1.0929	1.0038	1.0395	1.0234	0.9696	1.1094	1.0715	1.0598	1.0231	1.0408	0.8559	1.0187	0.9329	1.0637	1.0522	0.9773	0.9888	1.0548	1.0368	0.9882	0.9964
Sales Multiplier (Maximum/ Minimum)	67.5	41.7	10.9	13.8	2.0	12.9	12.5	10.9	49.7	73.3	6.4	3.7	13.9	9.8	55.3	13.8	8.1	4.5	30.3	23.5	4.3	19.0	25.2	18.9
Export Share for 1984	1.99	1.03	0.05	0.28	1.15	0.34	1.04	0.14	0.36	8.60	0.38	0.96	0.24	0.52	3.68	0.79	10.02	0.32	15.24	5.03	2.22	36.85	5.43	3.35

Reference 4 Scale Elasticity Values (Divisia Index)

	Synthetic Fibers	Cotton Spinning	Other Textiles (Clothing, etc.)	Paper and Pulp	Synthetic Chemicals	Inorganic Chemicals	Organic Chemicals	Cement	Other Ceramics and Earthenware	Normal Steel	Specialty Steel	Electric Wires and Cables	Metal Products	Construction Machinery	Industrial Machinery	Machine Tools and Parts	General Electrical Machinery	Heavy Electrical Machinery	Household Electrical Appliance	Communications and Electronic Machinery	Electronic Parts	Automobiles	Ship building	Precision Instruments
1965	1.0257	0.9413	0.7925	1.0202	1.1197	1.0519	0.8753	0.9774	0.8310	1.0384	1.0469	0.9789	1.0166	0.9715	0.9764	0.9628	1.0321	0.8537	1.0352	0.8493	–	1.0367	0.9828	1.0235
1966	1.0357	0.9445	0.8599	1.0034	1.0742	1.0350	0.8822	1.0054	1.1081	1.0256	1.0384	1.0186	1.0044	0.9380	0.9805	0.9262	1.0242	1.1713	1.0407	0.8566	–	1.0155	0.9959	1.0160
1967	1.0267	0.9454	0.8887	0.9881	1.0029	1.0327	0.8795	0.9693	1.0989	1.0145	1.0044	1.0267	1.0401	0.9625	0.9795	0.9179	1.0277	1.1943	1.0515	0.8678	–	0.9966	0.9927	1.0148
1968	1.0264	0.9665	0.9115	0.9962	1.0220	1.0082	0.9022	0.9536	0.9808	1.0255	1.0506	1.0340	1.0820	0.9891	0.9827	0.9590	1.0604	1.1414	1.0386	0.8994	–	1.0041	1.0057	1.0287
1969	1.0221	0.9463	0.8588	0.9946	1.3198	0.9804	0.9465	0.9450	1.0028	1.0115	1.0153	1.0367	0.9663	0.8510	0.9697	0.9403	1.0356	1.0715	1.0420	0.9578	0.9746	1.0032	1.0369	1.0217
1970	1.0047	0.9490	0.9554	0.9886	1.3522	0.9645	0.9995	1.0318	1.0610	1.0111	0.9845	1.0284	1.0112	0.8782	0.9844	0.9408	1.0083	1.0617	1.0576	0.9760	1.0386	1.0126	1.0656	1.0280
1971	1.0035	0.9938	1.0310	0.9775	1.0243	0.9827	1.0288	1.0313	1.0398	1.0297	0.9868	1.0305	1.0459	0.9023	0.9898	0.8364	1.0008	1.0485	1.0138	0.9928	0.9327	1.0224	1.0561	0.9953
1972	1.0229	0.9512	0.9287	0.9955	0.9717	1.0023	0.9828	1.0492	1.0536	1.0010	0.9945	1.0340	1.0570	0.9455	1.0046	0.9028	1.0324	1.1188	1.0207	1.0062	0.9419	1.0294	1.0298	0.9493
1973	1.0220	0.9308	1.0213	0.9903	0.8014	1.0295	1.0483	1.0255	1.0379	1.0062	0.9925	1.0348	1.0268	1.0176	1.0174	0.9143	1.0216	1.0436	1.0394	0.9998	0.9292	1.0183	1.0067	0.9643
1974	1.0244	0.9632	1.0700	0.9910	0.8253	0.9607	0.9751	0.9831	0.9277	1.0311	1.0128	1.0228	0.9565	1.0573	1.0096	0.9456	1.0281	1.0725	1.0343	0.9746	1.0214	1.0031	1.0131	0.9873
1975	1.0197	0.9883	1.2133	1.0100	0.8843	0.9496	0.9710	0.9913	0.9476	1.0578	1.0754	1.0624	1.0059	1.0774	1.9893	0.9104	1.0039	0.9755	1.0024	0.9834	0.9855	1.0140	1.0625	0.9971
1976	1.0181	0.9762	1.0721	0.9931	1.0525	0.9623	1.0016	0.9761	1.0298	1.0437	1.0606	1.0353	1.0355	1.0372	0.9998	0.9902	1.0118	1.0402	1.0142	0.9894	0.8509	1.0330	1.0692	0.9773
1977	1.0230	0.9824	1.1856	1.0092	0.9581	1.0142	0.9636	1.0064	0.9788	1.0444	1.0682	1.0298	1.0073	1.0266	1.0157	1.0604	1.0089	1.0153	0.9966	0.9911	1.0753	1.0289	1.1096	0.9703
1978	1.0360	0.9781	0.9725	1.0353	0.9721	1.0447	0.9816	1.0089	1.1076	1.0348	1.0509	1.0354	1.0226	0.9988	1.0062	0.9769	1.0196	1.0203	0.9987	1.0107	1.0914	1.0247	1.1694	0.9731
1979	1.0351	0.9994	0.9270	0.9827	0.9977	1.0565	0.9820	0.9694	1.1099	1.0437	1.0645	1.0065	1.0053	0.7868	1.0059	0.9971	1.0341	1.0259	0.9953	1.0020	1.1305	1.0267	1.0638	0.9468
1980	1.0270	0.9851	0.9362	0.9674	0.9434	1.0673	0.9965	1.0078	1.0914	1.0807	1.0463	1.0412	1.0021	0.7943	0.9960	0.9932	1.0418	1.0264	0.9916	0.9779	1.0554	1.0221	1.0298	0.9475
1981	1.0365	0.9840	0.9930	0.9651	0.9463	0.9547	1.0449	0.9915	1.0836	1.0937	1.0430	1.0124	0.9891	0.8401	1.0062	0.9624	1.0490	1.0709	0.9926	0.9764	1.0629	1.0324	1.0225	0.9556
1982	1.0304	0.9729	0.9533	0.9912	1.0258	0.9606	1.0314	0.9570	1.1178	1.0741	1.0511	1.0063	1.0045	0.8162	1.0044	0.9379	1.0553	1.0083	0.9889	0.9715	1.0877	1.0356	1.0297	0.9830
1983	1.0271	0.9671	1.0177	1.0456	1.0143	0.9971	0.9994	0.9691	1.1575	1.0610	1.0657	1.0418	1.0211	0.8561	1.0029	0.9408	1.0506	1.0160	0.9709	1.006	1.0738	1.0409	1.0728	0.9918
1984	1.0327	0.9900	1.0995	1.0914	1.0031	1.0398	1.0294	0.9677	1.1140	1.0661	1.0572	1.0229	1.0196	0.8640	1.0113	0.9296	1.0640	1.0531	0.9805	0.9856	1.0549	1.0374	0.9882	0.9973

Reference 5 Scale Elasticity Values (Laspeyres Index)

	Synthetic Fibers	Cotton Spinning	Other Textiles (Clothing, etc.)	Paper and Pulp	Synthetic Chemicals	Inorganic Chemicals	Organic Chemicals	Cement	Other Ceramics and Earthenware	Normal Steel	Specialty Steel	Electric Wires and Cables	Metal Products	Construction Machinery	Industrial Machinery	Machine Tools and Parts	General Electrical Machinery	Heavy Electrical Machinery	Household Electrical Appliance	Communications and Electronic Machinery	Electronic Parts	Automobiles	Ship building	Precision Instruments
1965	1.0069	0.9341	0.8203	1.0160	1.1001	1.0508	0.8433	0.9952	0.6217	1.0128	1.0229	0.9741	0.9885	0.9352	0.9587	0.9460	1.0286	0.8368	1.0284	0.8637	–	1.0448	0.9737	1.0362
1966	1.0066	0.9427	0.8336	0.9712	1.0496	1.0533	0.8134	1.0195	0.8993	0.9999	1.0135	1.0086	0.9792	0.8732	0.9615	0.8999	1.0196	1.1698	1.0334	0.8794	–	1.0253	0.9820	1.0167
1967	1.0173	0.9447	0.8611	0.9509	0.9808	1.0184	0.7325	0.9886	0.9117	1.0006	0.9875	1.0354	1.0244	0.8920	0.9731	0.9039	1.0214	1.1872	1.0385	0.8884	–	1.0004	0.9796	0.9959
1968	1.0225	0.9643	0.9217	0.9580	0.9995	0.9584	0.7629	0.9749	0.7974	1.0075	1.0201	1.0222	1.0730	0.9481	0.9523	0.9207	1.0550	1.1383	1.0272	0.8995	–	0.9959	0.9934	0.9978
1969	1.0110	0.9359	0.8602	0.9842	1.3058	0.9662	0.9073	0.9770	0.8465	0.9994	0.9787	1.0294	0.9131	0.8249	0.9393	0.9253	1.0287	1.0670	1.0230	0.9413	0.8684	1.0019	1.0315	1.0096
1970	0.9922	0.9407	0.9556	0.9637	1.2511	0.9528	0.9326	1.0019	0.9473	0.9940	0.9631	1.0058	0.9668	0.8493	0.9470	0.9248	1.0003	1.0586	1.0436	0.9561	0.9382	1.0054	1.0577	0.9989
1971	0.9975	0.9861	1.0082	0.9487	1.0099	0.9808	0.9201	0.9981	0.8633	1.0098	0.9293	1.0143	1.0033	0.8654	0.9254	0.8655	0.9935	1.0374	0.9990	0.9798	0.8399	1.0105	1.0555	0.9750
1972	1.0245	0.9317	0.9687	0.9892	0.9676	0.9806	0.9223	1.0058	0.9418	0.9942	0.8668	1.0231	1.0013	0.9353	0.9728	0.9007	1.0231	1.1149	1.0084	0.9924	0.8136	1.0176	1.0165	0.9168
1973	1.0212	0.9255	1.1098	0.9778	0.9857	0.9942	1.0246	1.0246	0.8780	1.0002	0.9441	1.0180	0.9556	0.9980	0.9983	0.8924	1.0139	1.0370	1.0229	0.9863	0.8559	1.0075	0.9840	0.9198
1974	1.0258	0.9515	1.1294	0.9759	0.8140	0.9032	0.9577	0.9860	0.8732	1.0200	0.9707	1.0026	0.8980	1.0300	0.9803	0.9161	1.0244	1.0733	1.0174	0.9636	0.9877	0.9924	0.9879	0.9568
1975	1.0118	0.9827	1.2433	1.0016	0.8772	0.9143	0.9315	0.9837	0.8570	1.0428	1.0172	1.0593	1.0033	1.0788	0.9819	0.8802	1.0013	0.9648	1.0062	0.9822	0.9355	0.9991	1.0553	0.9699
1976	1.0189	0.9635	1.0361	0.9785	1.0442	0.9236	0.9381	0.9688	0.9634	1.0223	1.0197	1.0345	1.0077	1.0089	0.9619	0.9426	1.0077	1.0321	1.0197	0.9891	0.8058	1.0163	1.0630	0.9349
1977	1.0158	0.9795	1.2038	1.0001	0.9541	0.9980	0.9102	1.0018	0.9113	1.0336	1.0564	1.0309	1.0075	1.0030	0.9865	1.0363	1.0019	1.0031	0.9873	0.9872	1.0005	1.0179	1.1047	0.9486
1978	1.0286	0.9744	0.8847	1.0360	0.9702	1.0302	0.9216	1.0009	0.9999	1.0339	1.0529	1.0375	0.9516	0.9876	0.9709	0.9589	1.0114	0.9862	0.9835	1.0136	1.0277	1.0108	1.1408	0.9551
1979	1.0341	0.9989	0.7868	0.9762	0.9859	1.0440	0.9313	0.9651	0.9714	1.0367	1.0628	1.0054	0.9661	0.7639	0.9799	0.9604	1.0246	1.0137	0.9687	1.0061	1.0482	1.0159	1.0475	0.9237
1980	1.0257	0.9841	0.8857	0.9610	0.9387	1.0482	0.9369	1.0060	0.9758	1.0766	1.0260	1.0407	0.9742	0.7612	0.9795	0.9952	1.0289	1.0151	0.9621	0.9871	1.0226	1.0089	1.0126	0.9313
1981	1.0327	0.9817	0.9622	0.9593	0.9424	0.9513	0.9606	0.9880	1.0149	1.0687	1.0324	1.0118	0.8668	0.8183	0.9651	0.9268	1.0319	1.0633	0.9663	0.9878	0.9814	1.0197	1.0203	0.9310
1982	1.0241	0.9731	0.9285	0.9900	1.0156	0.9358	1.0070	0.9539	1.0266	1.0643	1.0451	1.0054	0.9362	0.7901	0.9625	0.9214	1.0355	0.9789	0.9506	0.9767	1.0379	1.0310	1.0234	0.9453
1983	1.0200	0.9586	1.0188	1.0427	1.0088	0.9643	0.9948	0.9558	1.0076	1.0536	1.0676	1.0367	0.9860	0.8003	0.9735	0.9159	1.0339	0.9841	0.9249	1.0030	1.0547	1.0327	1.0287	0.9715
1984	1.0243	0.9841	1.0316	1.0867	0.9926	1.0080	0.9989	0.9595	0.9815	1.0570	1.0488	1.0175	1.0345	0.7875	0.9714	0.9076	1.0510	1.0420	0.9195	0.9893	1.0323	1.0277	0.9864	0.9813

Reference 6 Scale Elasticity Values (Paasche Index)

	Synthetic Fibers	Cotton Spinning	Other Textiles (Clothing, etc.)	Paper and Pulp	Synthetic Chemicals	Inorganic Chemicals	Organic Chemicals	Cement	Other Ceramics and Earthenware	Normal Steel	Specialty Steel	Electric Wires and Cables	Metal Products	Construction Machinery	Industrial Machinery	Machine Tools and Parts	General Electrical Machinery	Heavy Electrical Machinery	Household Electrical Appliance	Communications and Electronic Machinery	Electronic Parts	Automobiles	Ship building	Precision Instruments
1965	1.0384	0.9460	0.7743	1.0281	1.1392	1.0486	0.8475	1.0078	1.0886	1.0723	1.0832	0.9847	1.0424	1.0165	0.9947	0.9751	1.0341	0.8688	1.0397	0.8258	–	1.0303	0.9927	1.0097
1966	1.0630	0.9439	0.8828	1.0358	1.1001	1.0271	0.9246	1.0394	1.2943	1.0586	1.0707	1.0277	1.0304	1.0067	0.9919	0.9524	1.0284	1.1729	1.0465	0.8320	–	1.0086	1.0106	1.0175
1967	1.0425	0.9462	0.9117	1.0287	1.0251	1.0364	1.0549	0.9753	1.2802	1.0357	1.0268	1.0223	1.0584	1.0340	0.9886	0.9261	1.0344	1.2011	1.0640	0.8458	–	0.9922	1.0066	1.0318
1968	1.0411	0.9573	0.8931	1.0310	1.0421	1.0507	1.0691	0.9646	1.1993	1.0483	1.0833	1.0455	1.0869	1.0312	1.0241	0.9841	1.0665	1.1445	1.0499	0.8919	–	1.0110	1.0164	1.0643
1969	1.0455	0.9494	0.8446	1.0049	1.3339	1.0045	0.9971	0.9160	1.1613	1.0227	1.0538	1.0444	1.0445	0.8792	1.0003	0.9574	1.0433	1.0766	1.0651	0.9588	1.0629	1.0077	1.0416	1.0335
1970	1.0248	0.9516	0.9479	1.0167	1.4796	0.9837	1.0765	1.0721	1.1498	1.0292	1.0039	1.0518	1.0658	0.9093	1.0126	0.9431	1.0171	1.0635	1.0714	0.9687	1.1231	1.0202	1.0730	1.0560
1971	1.0240	0.9987	1.0451	1.0139	1.0413	0.9844	1.1395	1.0721	1.2595	1.0427	1.0444	1.0465	1.1067	0.9410	1.0748	0.8827	1.0086	1.0592	1.0276	0.9890	1.0218	1.0332	1.0564	1.0102
1972	1.0374	0.9623	0.8991	1.0077	0.9706	1.0223	1.0881	1.1039	1.1777	1.0090	1.1225	1.0474	1.1275	0.9577	1.0302	0.9047	1.0421	1.1230	1.0331	1.0067	1.1140	1.0370	1.0460	0.9845
1973	0.0386	0.9346	0.9500	1.0103	0.8104	1.1061	1.0823	1.0258	1.2319	1.0077	1.0565	1.0500	1.1126	1.0370	1.0035	0.9400	1.0302	1.0496	1.0567	0.9892	1.0087	1.0282	1.0316	1.0044
1974	1.0325	0.9729	0.9947	1.0093	0.8270	1.0149	1.0225	0.9817	0.9819	1.0394	1.0601	1.0448	1.0447	1.0844	0.9999	0.9846	1.0323	1.0715	1.0463	0.9665	1.0531	1.0141	1.0405	1.0184
1975	1.0354	0.9942	1.1717	1.0212	0.8876	0.9868	1.0110	0.9981	1.0424	1.0725	1.1416	1.0677	1.0156	1.0667	0.9933	0.9655	1.0069	0.9858	0.9982	0.9689	1.0404	1.0291	1.0697	1.0184
1976	1.0237	0.9889	1.1235	1.0103	1.0586	1.0054	1.0366	0.9836	1.0828	1.0630	1.1060	1.0422	1.0633	1.0515	1.0472	1.0086	1.0160	1.0482	1.0055	0.9831	0.9046	1.0475	1.0765	1.0181
1977	1.0385	0.9857	1.1630	1.0177	0.9561	1.0334	1.0247	1.0122	1.0473	1.0526	1.0778	1.0330	1.0257	1.0370	1.0376	1.0499	1.0162	1.0270	1.0015	0.9848	1.1573	1.0386	1.1150	0.9902
1978	1.0578	0.9804	1.1006	1.0384	0.9705	1.0642	1.0354	1.0176	1.2293	1.0410	1.0485	1.0364	1.0943	1.0038	1.0597	0.9636	1.0275	1.0411	1.0159	0.9989	1.1616	1.0379	1.1989	0.9836
1979	1.497	1.0004	1.1204	0.9930	1.0076	1.0838	1.0416	0.9747	1.2597	1.0531	1.0680	1.0097	1.0272	0.7965	1.0270	1.0140	1.0432	1.0383	1.0250	0.9893	1.2248	1.0374	1.0836	0.9662
1980	1.0374	0.9930	1.1040	0.9739	0.9459	1.0986	1.0415	1.0126	1.2124	1.0890	1.0610	1.0391	1.0083	0.8018	0.9956	0.9908	1.0537	1.0362	1.0236	0.9776	1.0756	1.0351	1.0509	0.9726
1981	1.0448	0.9880	1.0481	0.9720	0.9481	0.9736	1.0925	0.9971	1.1530	1.1160	1.0488	1.0133	1.0739	0.8679	1.0504	0.9683	1.0636	1.0765	1.0173	0.9774	1.1243	1.0408	1.0246	0.9909
1982	1.0399	0.9755	1.0296	0.9909	1.0351	1.0012	1.0136	0.9616	1.2277	1.0847	1.0609	1.0102	1.0349	0.8408	1.0508	0.9532	1.0732	1.0347	1.0288	0.9720	1.1227	1.0396	1.0334	1.0208
1983	1.0375	0.9776	0.9976	1.0497	1.0194	1.0495	1.0029	0.9648	1.3061	1.0719	1.0684	1.0483	1.0549	0.9103	1.0496	0.9700	1.0662	1.0465	1.0200	0.9980	1.0953	1.0478	1.1241	1.0099
1984	1.0431	0.9928	1.1451	1.0990	1.0151	1.0715	1.0491	0.9799	1.2609	1.0863	1.0710	1.0287	1.0455	0.9157	1.0701	0.9596	1.0766	1.0625	1.0421	0.9882	1.0773	1.0461	0.9899	1.0117

Reference 7 Measurement of Demand Functions for Export and Domestic Demand for Each Industry

(t value in parenthesis)

Explained Variables x_E , x_D	Exports						Domestic Demand					
	$\ln y_U$	$\ln p_E$	$\ln p_U$	$\ln(p_E/p_U)$	const.	$\bar{R}^2$	$\ln y_J$	$\ln p_D$	$\ln p_{DC}$	$\ln(p_D/p_{DC})$	const.	$\bar{R}^2$
Electric Wires and Cables	56.7(7.3)	−17.1(1.9)	24.4(2.8)		−426.2(7.0)	0.87	107.7(1.9)	−48.8(2.0)	12.7(0.3)		−901.8(0.5)	0.86
Metal Products	8.5(3.7)	−0.9(0.5)	2.1(1.5)		−62.3(5.0)	0.83	26.0(1.4)	−63.5(1.8)	34.1(0.8)		−127.2(0.8)	0.39
Construction Machinery	25.3(8.6)			−4.8(1.8)	−155.3(5.8)	0.86	28.8(7.2)			−108.6(5.4)	213.9(2.0)	0.86
Industrial Machinery	118.7(2.5)	−30.9(1.0)	65.2(2.9)		−956.3(3.9)	0.84	49.9(1.3)	−163.1(2.2)	141.5(1.9)		−291.1(0.9)	0.70
Machinery Tools and Parts	27.3(3.4)			−2.8(0.5)	−172.5(2.3)	0.63	49.2(5.4)			−4.0(0.2)	−473.2(2.4)	0.90
General Electrical Machinery	4.8(23.5)	−1.1(6.0)	1.2(13.1)			0.99	1.4(2.2)	−1.7(1.5)	0.5(0.7)		3.3(0.4)	0.97
Heavy Electrical Machinery*	4.6(17.7)			−0.6(3.0)	−15.7(6.1)	0.97	2.0(13.0)			−2.4(4.8)	7.0(5.0)	0.93
Communications and Electronic Machinery	5.9(11.4)	−0.8(3.1)	1.5(0.2)		−35.3(8.9)	0.99	2.7(3.2)	−1.7(1.8)	0.4(0.6)		−10.9(0.7)	0.97
Electronic Parts	10.1(15.3)			−0.6(2.0)	61.1(10.6)	0.97	4.4(13.9)			−0.5(0.7)	−35.4(22.7)	0.98
Automobiles	1,527.8(8.8)	−222.4(1.3)	521.5(5.6)		−11,952.8(15.1)	0.98	851.2(6.6)	−176.2(0.7)	6.0(0.0)		−7,784.7(4.8)	0.98
Synthetic Fibers	14.9(0.6)			−5.2(0.3)	−43.4(0.2)	0.10	108.2(3.8)			−12.8(0.1)	995.2(0.9)	0.63
Natural Fibers*	0.9(0.1)	−22.1(1.0)	0.9(0.1)		105.7(1.3)	0.32	81.2(2.1)	−98.4(1.5)	12.2(0.2)		−382.7(1.8)	0.14
Clothing, etc.	0.1(0.2)			−0.7(1.6)	9.2(1.2)	0.49	0.3(1.0)			−0.3(1.5)	7.2(1.7)	0.74
Organic Chemicals	5.2(0.5)			−5.9(1.1)	14.5(0.2)	0.10	76.1(3.3)			−127.5(3.2)	−95.5(0.5)	0.43
Other Ceramics and Earthenware	2.2(0.7)	−0.3(0.2)	0.2(1.3)		−20.1(1.0)	0.67	11.3(1.0)	−69.3(3.3)	109.5(3.3)		−272.2(2.1)	0.37
Explained Variables x_E/y_U , x_D/y_J		p_E/y_U	p_U/y_U		const.	$\bar{R}^2$		p_D/y_J	p_{DC}/y_J		const.	$\bar{R}^2$
Households Electrical Appliances*	7.8(0.5)			−2.1(3.8)	−35.3(2.6)	0.96		−914.6(9.5)	2,032.0(2.6)		358.3(2.6)	0.85
Precision Instruments		−1,407.2(5.5)	117.7(0.4)		11,650.9(4.2)	0.67		−433.7(12.4)	179.1(2.2)		139.7(7.1)	0.93
Steel		−0.5(1.0)	0.8(2.4)		4.7(2.3)	0.25		−2.4(2.8)	2.6(2.7)		0.1(1.5)	0.31
Synthetic Chemicals		−40.3(0.4)	98.0(1.0)		1,410.5(3.0)	0.10		−6,909.9(3.8)	5,774.4(2.4)		604.2(3.1)	0.60
Inorganic Chemicals		−30.9(2.7)	14.3(1.2)		539.2(13.3)	0.41		−1,181.3(8.0)	1,497.3(6.8)		6.2(0.3)	0.81

Note: 1. The variables are as follows (basic point of time 1980, prices WPI-based).

x_E : Exports (real), y_U : U.S. GNP (real), p_E : Export Price,

x_D : Domestic Demand (real), y_J : Japanese GNP (real), p_D : Domestic Price (export price and configuration for same item)

p_U : Price for Substitutional goods (yen-based)

p_{DC} : Price for Domestic Substitutinal goods

For competitive prices the American WPI has in the main been used. The domestic competitive prices are the domestic prices for non-tradable goods of the industry in question (or the WPI domestic industrial product prices).

2. The measurement period is 1970 – 1984. (For industries marked * it is 1965 – 1984. The explained variables for general electrical machinery, heavy electrical machinery, communications and electronic machinery, electronic parts, household electrical appliances (exports) and clothing, etc. are logarithms. Steel is based on the indices for manufacturing and mining shipments).

REFERENCES

Takatoshi, Itoh and Fumio, Hayashi, "Rational Expectation Formations and Macroeconomic Models," (in Japanese), in Kaizuka, Hamada and Yabushita edited, *Macroeconomics and Economic Policy*, University of Tokyo, 1983.

Motoshige, Itoh and Michihiro, Oyama, *International Trade*, (in Japanese), Iwanami Shoten, 1985.

Imai, Usawa, Komiya, Negishi and Murakami, *Price Theory*, (in Japanese), Iwanami Shoten, 1971.

Shoichi, Iwata, *Metrical Approach to Oligopolistic Prices*, (in Japanese), Toyo Keizai Shinposha, 1974.

Kazuo, Ueda, "Business Revenue and Expenditure and Exchange Rates – An Approach Through Savings and Investment Balance," (in Japanese), paper presented to the Symposium on Balance of Payments and Exchange Rates, *Kinyu Kenkyu*, Vol. 5 No. 1, Bank of Japan, 1986.

Kunio, Okina, "Reexamination of Empirical Studies Using Granger Causality," (in Japanese), *Kinyu Kenkyu*, Vol. 4 No. 4, Bank of Japan, 1985.

Munehisa, Kasuya, "Economies of Scope: Theory and Application to Banking," (in Japanese), *Kinyu Kenkyu*,Vol. 5 No. 3, Bank of Japan, 1986.

Masahiro, Kuroda, *Positive Economics Primer*, (in Japanese), Nihon Hyoronsha, 1984.

——— and Takashi, Kaneko, "Economies of Scale and Lending Behavior in Banking Industry," (in Japanese), *Kinyu Kenkyu*,Vol. 4 No. 3, Bank of Japan, 1985.

Ryutaro, Komiya, Masahiro, Okuno and Kotaro, Suzuki, *Japan's Industrial Policy*, (in Japanese), Tokyo University Publishers, 1985.

Yoko, Sazanami, *International Division of Labor and the Japanese Economy*, (in Japanese), Toyo Keizai Shinposha, 1980.

Kamekichi, Takahashi, *Basic Causes for Onslaught of Post-War Japanese Economy*, (in Japanese), Nihon Keizai Shinbunsha, 1975.

Kotaro, Tsujimura, *Econometrics*, (in Japanese), Iwanami Zensho, 1982.

——— and Masahiro, Kuroda, *General Equilibrium Analysis of Japanese Economy*, (in Japanese), Chikuma Shobo, 1974.

Sadao, Naniwa, "Estimation of Trends with Economic Time Series," (in Japanese), *Kinyu Kenkyu*, Vol. 4 No. 4, Bank of Japan, 1985.

———, "Nonstationary Covariance Structure of Detrended Economic Time Series: A Time Varying Model Approach," (in Japanese), *Kinyu Kenkyu*, Vol. 5 No. 4, Bank of Japan, 1986, *Bank of Japan Monetary and Economic Studies*, Vol. 5 No. 1, 1987.

Bank of Japan Research and Statistics Institute, "Concerning Functions of Exports to the United States according to the Kalman Filter Model," (in Japanese), *Chosa Geppo*, June 1985.

————, "Concerning Disequilibrium with Outside World," (in Japanese), *Chosa Geppo*, July 1985.

Takashi, Negishi and Fukutaro, Watabe edited, *Japan's Trade*, (in Japanese), Iwanami Shoten, 1971.

Yasusuke, Murakami, *New Age of the Middle Class Masses*, (in Japanese), Chuo Koronsha, 1984.

Kanji, Yoshioka, "Estimation of Scale Elasticity based on Japan's Industrial Statistics," (in Japanese), *Keizai Tokei Kenkyu*, Vol. 15, 1977.

————, "Methods for Measuring Economies of Scale in Production," (in Japanese), *Mita Shogaku Kenkyu*, Vol. 27 No. 1, Keio University, April 1984.

————, "Economies of Scale in Japan's Manufacturing Industries," (in Japanese) *Keio Economic Observatory Review*, Keio University, 1985.

Baumol, William J., Panzar, John C. and Willig, Robert D., *Contestable Markets and the Theory of Industry Structure*, Harcourt Brace Jovanovich Inc. 1982.

Christ, Carl F., "Early Progress in Estimating Quantiative Economic Relationships in America," *The American Economic Review*, December 1985.

Citrin, Daniel, "Exchange Rate Changes and Exports of Selected Japanese Industries," *IMF Staff Papers*, Vol. 32, No.3, September 1985.

Cooper, R. A. and Hartley, K., *Export Performance and the Pressure of Demand*, George Allen and Unwin, 1970.

Helpman, Elhanan, "Increasing Returns, Imperfect Markets, and Trade Theory," *Handbook of International Economics,* Vol. 1, edited by Jones, Ronald W. and Kenen, Peter B., North Holland, 1984.

Houthakker, Hendrik S. and Magee, Stepher P., "Income and Price Elasticities in World Trade," *The Review of Economics and Statistics*, May 1969.

Krugman, Paul R., "Increasing Returns and the Theory of International Trade," *NBER Working Paper* No. 1752, October 1985.

Yoshioka, Kanji, "A Measurement of Return to Scale in Production: A Cross-Section Analysis of the Japanese Two-Digit Manufacturing Industries from 1964 to 1978," *Keio Discussion Paper*, 1982.