THE POSSIBILITY INDEX: AN INVESTMENT CRITERION

by

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CONTENTS

PREFACE

The topic of this paper is, as the title shows, to formulate an investment criterion. The research was focused on the Indian economy. But it is also useful for the economy of developed countries.

I. INTRODUCTION

The topic of this paper is, as the title shows, to formulate an investment criterion. Author has devised an investment criterion and named it the Possibility Index (hereafter called the PI). This is the index which shows the possibility of growth of each sector. Here, the industry is classified into each sector such as the Diesel Engine Industry, the Cement Industry, the Lead Industry, etc. The basic theory is to allocate the limited resources preferentially into the sector of which the PI is relatively high or the possibility of growth is relatively high. The research is focused on the Indian economy. But the PI is applicable to other economies also. The contents of each section are as follows.

In section II, the theoretical framework of PI is shown. Here, the exact way to calculate the PI is not specified. It is specified after examining the Indian and the Japanese economy. And, the method of analysis of each sector of the Indian and the Japanese economy is shown.

In section III, the manufacturing industry in India is analyzed according to the method prescribed above.

In section IV, the manufacturing industry in Japan is analyzed. From the comparison between these two countries, some serious problems in Indian economy were found.

In section V, the method to work out the PI is specified taking account of the results of survey of both economies and the PI is worked out with regard to each sector.

In section VI, the final conclusions are drawn.

In the appendix, all the figures and the tables are collected.

II. THEORETICAL FRAMEWORK

1 Some Theories on Investment Decision

In this section, some theories on investment decision in the development economics and the macroeconomics are briefly surveyed. Especially, they were surveyed with regard to the factors taken into account and the determinant factors of in vestment decision.

J. J. Polak and N. S. Buchanan developed the Capital-Turnover Criterion.[1] Polak concluded that resources must be allocated to the project where the rate of turnover is the highest.

Alfred E. Kahn criticized Polak and Buchanan and developed the Social Marginal Productivity (SMP) Criterion.[2] This criterion aims to maximize the national product by allocating the resources in the manner that makes the SMP of investment equal among all the projects.

Hollis B. Chenery advanced this theory by taking account of the effect of investment on the balance of payment.[3]

Walter Galenson and Harvey Leibenstein criticized the SMP criterion and developed the reinvestment criterion.[4] This criterion aims to make the investment into the project from which the largest amount of saving per unit of capital invested can be derived.

Amartya K. Sen reviewed the capital-turnover criterion, the SMP criterion, and the reinvestment criterion and put forward a fourth criterion which he called the time series criterion.[5] This criterion aims to maximize the output within a certain period of time.

Krishna K. Singh mentions, although this is not his original theory, the ratio of labor to investment criterion.[6] This criterion aims to maximize the employment per unit of additional

[1] J. J. Polak, "Balance of Payments Problems of Countries Reconstructing with the Help of Foreign Loans," *Quarterly Journal of Economics* 57 (February 1943): 208-40; and Norman S. Buchanan, *International Investment and Domestic Welfare* (New York: Henry Colt, 1945), quoted in Subrata Ghatak, *An Introduction to Development Economics,* 2nd ed. (London: Allen & Unwin, 1986), p. 85.

[2] Alfred E. Kahn, "Investment Criteria in Development Programs," *Quarterly Journal of Economics* 65 (February 1951): 38-61.

[3] Hollis B. Chenery, "The Application of Investment Criteria," *Quarterly Journal of Economics* 67 (February 1953): 76-96.

[4] Walter Galenson and Harvey Leibenstein, "Investment Criteria, Productivity, and Economic Development," *Quarterly Journal of Economics* 69 (August 1955): 343-70.

[5] Amartya K. Sen, "Some Notes on the Choice of Capital-Intensity in Development Planning," *Quarterly Journal of Economics* 71 (November 1957): 561-84.

[6] Krishna K. Singh, *Investment Project in A Planned Economy* (Delhi: Amar Prakashan, 1985), pp. 22-5.

capital. Ragnar Nurkse supports this idea.[1]

Economists like Rosenstein-Rodan, Nurkse, etc. supported the balanced growth.[2] On the other hand, economists like Albert O. Hirschman, Charles P. Kindleberger, Paul Streeten, etc. supported the unbalanced growth.[3]

The Cost-Benefit Analysis takes account of the cost-benefit ratio.

In theories on external economies and economies of scale, Tibor Scitovsky distinguished two types of external economies.[4] One is discussed in the equilibrium theory and another is discussed in the theory of industrialization in underdeveloped countries.

Chenery cited this Scitovsky's example of external economies and calculated the effect of it following this example.[5]

Larry E. Westphal showed some ways of calculating the effect of economies of scale using the method of MIP (Mixed Integer Programing).[6] Furthermore, Chenery and Westphal calculated the effect of economies of scale and timing of investment using a model with realistic assumption about the nature of horizontal and vertical interdependence.[7] On the other hand, Westphal and Jacques Cremer extended the aforementioned Chenery's analysis on the interdependence of investment decisions by analyzing the effect of interdependence on make-buy decisions under the assumption of existence of economies of scale.[8]

On the other hand, in the field of macroeconomics, John M. Keynes developed the theory of marginal efficiency of capital.[9]

In the theory of acceleration principle, the investment is dependent on the change in output or GNP. But, Chenery introduced factors such as the flexible accelerator, the lag between the

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[1] Ragnar Nurkse, *Problems of Capital Formation in Under Developed Countries* (Oxford: Basil Blackwell Publisher Ltd., 1953; reprint ed., Delhi: Oxford University Press, 1973).

[2] Paul N. Rosenstein-Rodan, "Problems of Industrialization of Eastern and South-Eastern Europe," *Economic Journal* 53 (June- September 1943): 202-11; and Nurkse.

[3] Albert O. Hirschman, "The Strategy of Economic Development," Precis of a lecture delivered at the Institute on ICA Development Programming; reprinted in A. N. Agarwala and S. P. Singh, ed., *Accelerating Investment in Developing Economies* (London: Oxford University Press, 1969), pp. 3-11; Charles P. Kindleberger, *The Terms of Trade: A European Case Study* (New York: Technology Press/Wiley, 1956), quoted in Ghatak, p. 98; and Paul Streeten, "Unbalanced Growth," *Oxford Economic Papers* 11 (June 1959): 167-90.

[4] Tibor Scitovsky, "Two Concepts of External Economies," *Journal of Political Economy* 62 (April 1954): 143-51.

[5] Hollis. B. Chenery, "The Interdependence of Investment Decisions: Essays in Honor of Bernard Francis Haley," in *The Allocation of Economic Resources*, ed. Moses Abramovitz et al (Stanford: Stanford University Press, 1959), pp. 82-120.

[6] Larry E. Westphal, "Planning with Economies of Scale," in *Economy Wide Models and Development Planning*, ed. Charles R. Blitzer, Peter B. Clark, and Lance Taylor (Oxford: Oxford University Press, 1975), pp. 257-306.

[7] Hollis B. Chenery and Larry E. Westphal, "Economies of Scale and Investment over Time," in *Structural Change and Development Policy*, A World Bank Research Publication, ed. Hollis B. Chenery (n.p.: Oxford University Press, 1979), pp. 217-67.

[8] Larry E. Westphal and Jacques Cremer, "'The Interdependence of Investment Decisions' Revisited," in *Economic Structure and Performance*, ed. Moshe Syrquin, Lance Taylor, and Larry E. Westphal (Orlando: Academic Press, Inc., 1984), pp. 543-72.

[9] John M. Keynes, *The General Theory of Employment, Interest and Money* (London: Macmillan & Co., Ltd., 1936; reprint 4th ed., Tokyo: Maruzen Co., Ltd., 1973), p. 135.

changes in demand and the new investment to meet new demand, and the optimum degree of overcapacity.[1]

D. W. Jorgenson developed a new theory called the neoclassical theory of investment.[2] In the final result namely in the investment function, the investment depends on the desired capital stock, and so it depends on the user cost of capital.

Tobin's q theory forms the main stream of recent investment theories.[3] In this theory, the adjustment cost is taken into account. He mathematically got the following results.

(1) $q > 1 \rightarrow$ Net Investment > 0

(2) $q = 1 \rightarrow$ Net Investment $= 0$

(3) $q < 1 \rightarrow$ Net Investment < 0.

2 Possibility Index

This is an investment criterion devised by author and this is the topic of this paper. The PI shows the possibility of growth of each sector, for example, sectors such as the diesel engine industry and the cement industry. The PI aims to raise the efficiency of economy as a whole by allocating the resources preferentially into the sectors where the PI is relatively high, namely where the possibility of growth is relatively high. In other words, the PI aims to find the sectors of which the production capacity should be expanded or cut most preferentially. The PI is worked out by the following formula for each sector and every year.

$$PI_{ij} = \frac{DCAP_{ij}}{CAP_{ij}} \qquad (II.\ 1),$$

i: year,

j: code number of sector,

PI: Possibility Index,

DCAP: desired production capacity,

CAP: actual production capacity.

Namely, the PI is the ratio between the desired production capacity and the actual production capacity. CAP is available from the existing statistics as will be shown later. But DCAP must be worked out. The way to work out DCAP will be specified after examining the results of survey on the Indian and the Japanese manufacturing industry. But the major variables of DCAP are as follows.

$$DCAP_{ij} = F(DO_{ij},\ DC_{ij},\ CU_{ij},\ AR_{ij}) \qquad (II.\ 2),$$

DO: relation between demand and output (demand = domestic demand + foreign demand),

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[1] Hollis B. Chenery, "Overcapacity and the Acceleration Principle," *Econometrica* 20 (January 1952): 1-28.

[2] Dale W. Jorgenson, "Capital Theory and Investment Behavior," *American Economic Review* 53 (May 1963): 247-59.

[3] James Tobin, "A General Equilibrium Approach to Monetary Theory," *Journal of Money, Credit and Banking* 1 (February 1969): 15-29.

DC: relation between demand and production capacity,

CU: capacity utilization,

AR: availability of raw materials.

The factors taken into account and the determinant factors of investment in the investment theories surveyed and the PI are shown in the TABLE 1. The differences between the PI and other investment theories will be examined in the conclusion.

3 Method of Analysis

The Indian and the Japanese manufacturing industries were surveyed with regard to the variables of DCAP in order to analyze how these variables reflect the possibility of growth. The survey was carried out, as we will see later, by drawing the data into the graphs and by comparing both of Indian and Japanese manufacturing industries. By analyzing all the data available and comparing both Indian and Japanese manufacturing industries, some serious problems of Indian manufacturing industries were found.

III. MANUFACTURING INDUSTRIES IN INDIA

The purpose of analysis is to see how the variables of DCAP, namely the variables of the PI, reflect the possibility of growth. Sixty-three sectors were selected for the survey on the output, the production capacity, and the capacity utilization.[1] From 63 sectors, 9 sectors were selected as the examples. The criteria of selection are the yearly fluctuation of capacity utilization and the average capacity utilization. The calculation was made during 27 years from 1951 to 1977. The average capacity utilization is the arithmetic average, and the fluctuation is calculated by the following formula.

$$FL_j = \frac{\sum_{i=1}^{n} | ACU_j - CU_{ij} |}{n} \quad \text{(III. 1)},$$

i: year

j: code number of sector,

n: number of years surveyed, in this case, 27 years,

FL_j: fluctuation of capacity utilization of j sector,

ACU_j: average capacity utilization of j sector during 27 years,

CU_{ij}: capacity utilization of j sector in i year.

$$CU = \frac{OUT}{CAP} \cdot 100$$

OUT: output

CAP: production capacity

According to this way, following 9 sectors were selected.

Large Fluctuation

1 Diesel Engine Industry,

2 Radio Receiver Industry,

Small Fluctuation

3 Cement Industry,

4 Soda Ash Industry,

High Capacity Utilization

[1] Government of India, Ministry of Planning, Department of Statistics, Central Statistical Organization, *Statistical Abstract* (New Delhi: Central Statistical Organization, Relevant Issues), (hereafter cited as GOI, *Abstract*).

5 Power Transformer Industry,
6 Electric Motor Industry,

Low Capacity Utilization

7 Ceramic Insulator Industry (low tension),
8 Lead Industry,

Others

9 Soap Industry.

The reason for selecting the Soap Industry is that the shape of graph was interesting to author.

The production capacity is calculated according to the number of shift of operation. If the shift number is 1, the production capacity is the output produced in 8 hours operation. If the shift number is 3, the production capacity is the output produced in 24 hours operation. The shift number of Cement Industry and Soda Ash Industry is 3 and that of other 7 sectors is 1.[1]

In this paper, the results of only the Cement Industry, the Electric Motor Industry, the Ceramic Insulator Industry, and the Lead Industry are shown due to the restriction on pages. The results are drawn into graphs. For example, the graphs of the Cement Industry are shown in the Fig. 1-5 (from Fig. 1 to Fig. 5). The sources and notes of data are shown in the section 1 of the Appendices.

In the graph A, the output (OUT), the production capacity (CAP), the capacity utilization (CU), the desired capacity (DCAP), and the desired capacity utilization (DCU) are shown. The unit of Y axis is percent (%). Therefore, CU and DCU can be read directly from the value of Y axis. But, OUT, CAP, and DCAP are adjusted to the scale of Y axis. So the value of them cannot be read from the Y axis. The unit of them is shown in the note. In case of the Cement Industry, the unit of OUT, CAP, and DCAP is "tonnes." The original data are OUT and CAP only. CU was calculated by author. DCAP and DCU, which will be mentioned in the section V, were also calculated by author.

In the graph B, the output (OUT), the production capacity (CAP), the exports and imports (EXPORTS and IMPORTS), and the estimated demand (ED) are shown in real terms. The unit of each item is common, so each line can be compared directly.

In the graph C, the output (OUT), the production capacity (CAP), the output in the unorganized sector (OUT-U), the production capacity in the unorganized sector (CAP-U), the target of output (O-TARGET), and the target of production capacity (C- TARGET) are shown. The unit is common among all items.

In the graph D, the exports (EXPORTS) and imports (IMPORTS) in money term are shown. This is also to see the situation of demand and supply. The exports and imports in real term are shown in the graph B. But the unit of them is not necessarily appropriate. For example, the unit of real term of the Electric Motor Industry is "horsepower." But there are some types of electric motors. Namely, they are different in the horsepower and structure. So, the figures in terms of money is also useful. And the data of each term are not available sufficiently, so two types of

[1] Raghunath K. Koti, *Utilization of Industrial Capacity in India, 1967-68*, Gokhale Institute Mimeograph Series No. 9 (Poona: Gokhale Institute of Politics and Economics, n.d.), pp. 91-9.

data can compliment with each other.

In the graph E, the relation between the demand and the output (DO), the relation between the demand and the production capacity (DC), the availability of raw materials within the country (DAR, Domestic Availability of Raw Materials), and the availability of raw materials including the imports (TAR, Total Availability of Raw Materials) are shown. The meaning of each item is as follows.

The relation between the demand and the output (DO) is divided into 11 classes.

5: The demand exceeds the output to the maximum extent,

4: Intermediate situation between 5 and 3,

3: The supply is very inadequate,

2: The shortage of supply is clearly reported,

1: The shortage of supply is suggested,

0: The demand and the supply are equal,

-1: The excess production is suggested,

-2: The excess production is clearly reported,

-3: The production is very excessive,

-4: Intermediate situation between -3 and -5,

-5: The production is excessive to the maximum extent.

The relation between the demand and the production capacity (DC) is also divided into 11 classes.

The domestic availability of raw materials (DAR) is divided into 6 classes.

0: The raw materials are available sufficiently,

-1: The shortage is suggested,

-2: The shortage is clearly reported,

-3: The raw materials are very inadequate,

-4: Intermediate situation between -3 and -5,

-5: The raw materials are inadequate to the maximum extent.

The availability of raw material including the imports (TAR) is also divided into 6 classes.

The above four items are determined subjectively, not determined according to the objective data. For example, if there is a report that the demand and the output is equal, DO is 0. And if there is a report that the output is very inadequate as compared with the demand, DO is 3. Here, the availability of raw material includes the availability of electric power, transport facility, etc.

The profitability was analyzed with regard to following 11 sectors.[1]

1 Flour Mills
2 Soaps and Glycerine
3 Cement (Hydraulic)
4 Insulators

[1] Government of India, Ministry of Planning, Department of Statistics, Central Statistical Organization, *Annual Survey of Industries: Census Sector* (Calcutta: Central Statistical Organization, Relevant Issues) (hereafter cited as GOI, ASI).

5 Typewriters and Duplicators
6 Non-Ferrous Basic Metal Industries (Including Alloys and Their Products)
7 Internal Combustion Engines
8 Electrical Lamps
9 Radio Receivers, Including Amplifying and Public Address Equipment
10 Electric Motors
11 Equipment for Generation, Transmission and Distribution of Electricity Including Transformers

Among these 11 sectors, the Cement Industry and the Electric Motor Industry are same as 2 sectors in 9 sectors above.

Here, the profitability is the figure calculated from the output, the input, the fixed capital, and the number of workers. The way of calculation of profitability is shown by abbreviation above each graph. The meaning of each abbreviated letter is as follows.

I: input,
O: output,
FC: fixed capital,
M: number of workers.

For example, (O - I) / (FC + I) means the expression

$$\frac{\text{(output - input)}}{\text{(fixed capital + input)}} \qquad \text{(III. 2)},$$

In this way, (O - I) / (FC + I), (O - I) / FC, O / FC, (O - I) / M, (O - I - FC) / M, and FC / M were calculated and drawn on the graphs. The result of (O - I) / (FC + I) is shown in the Fig. 14-15. There, 11 sectors are divided into two graphs, A and B. Other results are omitted. As written above, these 11 sectors are different from 9 sectors for which the graphs A-E were drawn. But Cement and Electric Motor are common for 9 sectors and 11 sectors. The code number of Cement is 3 and that of Electric Motor is 10.

With regard to these data, the relative values among 11 sectors were calculated. They were calculated for each year by the following formula.

$$Y_{ij} = \frac{X_{ij} - \mu_i}{\sigma_i} \qquad \text{(III. 3)},$$

$_i$: year,
$_j$: code number of sector,
Y: relative value among sectors,
X: calculated value from original data, for example, (O - I) / (FC + I),
μ: average value of X among 11 sectors,
σ: standard deviation of X among 11 sectors.

Needless to say, if Y is greater than 0 it is higher than the average, equal to 0 the average, and smaller than 0 lower than the average respectively. The results are shown only for the Cement

Industry and the Electric Motor Industry in the Fig. 16-17.

1 Cement Industry (3)[1]

As written above, the code number is 3 both among 9 sectors and 11 sectors. This sector was selected as an example of the small fluctuation of capacity utilization. The fluctuation of capacity utilization is the smallest among 63 sectors. The average capacity utilization is 86.4%. But, as mentioned earlier, the production capacity of the Cement Industry and the Soda Ash Industry was calculated on the 3 shift basis. So, the 86.4% is close to the upper limit of capacity utilization. The graph A to E are shown in the Fig. 1-5. In case of the Cement Industry and the Electric Motor Industry, as mentioned above, the data of profitability are available. The profitability was analyzed about 11 sectors including the Cement Industry and the Electric Motor Industry. The profitability, (O - I) / (FC + I), of 11 sectors selected are shown in the Fig. 14-15. The relative value was worked out by the formula (III. 3) and the results of the Cement Industry are shown in the Fig. 16.

It can be seen in the Fig. 1 or the TABLE 2 that the output has been growing steadily and the production capacity has been expanded very smoothly following the output, and so the capacity utilization has been stabilized very well. This forms a strong contrast to the Diesel Engine Industry and the Radio Receiver Industry although they were omitted. The situation of the Cement Industry looks very well. But, some serious problems were found in the survey.

The price and the distribution of cement has been under control for mostly all the period surveyed.[2] The relation that price control → low price → small profit → inadequate investment → shortage of cement was often reported.[3] And the power cut, the voltage fluctuation, the inadequate and irregular coal supply, the shortage of wagons for the transport of raw materials as well as cement, and the labor troubles were the principal causes of the low capacity utilization.[4] Sometimes the black market, where the price was three times the official price, emerged.[5]

The control of price and distribution was removed in order to stimulate the expansion of industry in January 1966. So, the price rose and, stimulated by this, the producers ventured on the expansion of undertakings one after another.[6] But, thereafter, the control was imposed again and

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1 The number in the parenthesis is the number of 9 sectors selected.

2 Kothari & Sons, *Kothari's Economic and Industrial Guide of India, 1978-79* (Madras: Kothari & Sons, n.d.), p. 4 (Cement) (hereafter cited as K&S, *Economic & Industrial Guide*).

3 For example, K&S, *Economic & Industrial Guide, 1973-1974*, p. 2-3 (Cement).

4 K&S, *Economic & Industrial Guide, 1973-74*, p. 2 (Cement); and K&S, *Economic & Industrial Guide, 1976*, p. 1 (Cement).

5 K&S, *Economic & Industrial Guide, 1976*, p. 4 (Cement).

6 Kazuo Ōsugi ed., *Indo: Keizai to Toushikankyou* (Tokyo: Institute of Developing Economies, 1968), pp. 306-7.

the price was fixed.[1]

These situation can be observed in the graphs. In the Fig. 2, the estimated demand sometimes exceeds the output. In the Fig. 5, the demand-output relation (DO) often shows the supply shortage. The domestic availability of raw materials (DAR) are often -3, meaning that the raw materials were often very inadequate.

On the other hand, the profitability is seen in the Fig. 14 where the code number of Cement is 3. The profitability did not fluctuate largely. The relative value of profitability among 11 sectors are seen in the Fig. 16. There, the fixed capital per labor (FC/M) is high but the labor productivity ((O - I) / M, (O - I - FC) / M) is low because the profitability of capital ((O - I) / (FC + I), (O - I) / FC, O / FC) is low.

Thus, the administered price and distribution are the serious problems in the Cement Industry.

2 Electric Motor Industry (6)

As written above, the code number is 6 among 9 sectors and 10 among 11 sectors. This sector was selected because of its high capacity utilization. The average capacity utilization is 106.1%, 3rd among 63 sectors and the fluctuation of capacity utilization is 7th.

In the Fig. 6-8, in the years the supply was inadequate, the capacity utilization was high and the imports was much greater than the exports.

On the other hand, in the Fig. 15 where the code number of Electric Motor is 10, the profitability is high in the period 1959-66 while they are not so far from the average in the period 1968-71. In the Fig. 17, the profitability of capital [(O - I) / (FC + I), (O - I) / FC, O / FC] is relatively high in the period 1959-1966 as compared to the period 1968-1971. In the former period, larger shortage of supply was reported as compared with latter period (Fig. 8). The fixed capital per worker (FC / M) is relatively low but the profitability of capital is high and the productivity of labor [(O - I) / M, (O - I - FC) / M] is mostly average or higher.

3 Ceramic Insulator (Low Tension) Industry (7)

This sector was selected as an example of the sectors of low capacity utilization. The average capacity utilization was 36.5%, the lowest among 63 sectors and the fluctuation of capacity utilization was 35th.

In the Fig. 9 and the TABLE 2, the highest capacity utilization was 70.4% recorded in 1955 and the lowest one was 7.7% recorded in 1972.

In the Fig. 10, from 1951 to 1955, inadequate supply of insulators and low availability of raw materials were reported. But in the later period, the capacity utilization declined. The liter-

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[1] Kothari & Sons, *Kothari's Economic Guide and Investors' Handbook of India, 1969-1970*, (Madras: Kothari & Sons, n.d.), p. 111 (hereafter cited as K&S, *Economic Guide & Investors' Handbook*).

ature concerned are not abound, so the cause is not known exactly. But it seems that the shortage of demand made the capacity utilization decline. The production capacity was not cut despite the low capacity utilization. The reason seems to be that this industry was protected as a small-scale industry.[1]

4 Lead Industry (8)

Also this sector was selected as an example of low capacity utilization. The average capacity utilization is 49.2%, 59th among 63 sectors and the fluctuation of capacity utilization is 27th.

In the Fig. 11, the production capacity had not shown a large change until around 1976. The capacity utilization had stayed at low level for mostly all the period surveyed. From 1947 to 1950, for which the data is not drawn into the graph, the capacity utilization had been between 3.2% and 10.5%.[2] Therefore, for 27 years ranging from 1947 to 1973, the capacity utilization was between 3.2% in 1947 and 64.9% in 1959.

In the Fig. 12, the estimated demand shows the much higher value than the output, and in many years the amount of import is several times or more than ten times the domestic production.

In the Fig. 13, the shortage of raw materials and the lead are often reported. The extent of shortage is, for the raw materials from 2 to 5, and for the supply of lead from 3 to 5 respectively. This means that the shortages are extremely serious for both the raw materials and the supply of lead. Thus, the capacity utilization was very low due to the inadequate supply of lead ore and the supply of lead was inadequate. And so the lead has been imported by the amount several times or more than ten times the domestic production.

We have seen that the capacity utilization was low due to the lack of demand in the Ceramic Insulator Industry and due to the shortage of raw materials in the Lead Industry respectively. As represented by these examples, in India, the major causes of low capacity utilization are two. One is the lack of demand and the other is the shortage of raw materials. Koti had conducted a survey on 517 items. According to him, in the sectors of low capacity utilization, 42% of them is due to the lack of demand, 21% to the shortage of raw materials, 4% to both causes, 17% to the lack of demand, the shortage of raw materials, the shortage of power, the labor trouble, and the lack of fund. Namely, 82% is related to the lack of demand or the shortage of raw materials.[3]

[1] Government of India, Ministry of Industry, Department of Industrial Development, Indian Investment Centre, *Guidelines for Industries, 1973-74* (New Delhi: Indian Investment Centre, 1973), p. 202 (hereafter cited as GOI, *Guidelines*).

[2] Kothari & Sons, *Investors' Encyclopaedia, 1955-56* (Madras: Kothari & Sons, n.d.), p. 16 (Mining & Chemicals) (hereafter cited as K&S, *Encyclopaedia*).

[3] Koti, summarized from p. 29 and 45.

IV. MANUFACTURING INDUSTRIES IN JAPAN

Regarding Japan also, same type of analysis was carried out as far as possible. Thirty sectors were selected for the survey of the output, the production capacity, and the capacity utilization.[1] They were selected considering the continuity of data. Regarding the profitability, the data are available for 12 sectors.[2]

In case of Japan, the output and the capacity utilization are shown by the index. And the production capacity was calculated from above two variables by author. So the output and the production capacity cannot be compared directly on the graph like the Indian manufacturing industries. And the capacity utilization of different sectors cannot be compared directly. But, as we will see it, relative trend of progress can be seen from the graphs. Also the output and the capacity utilization are available for the above 12 sectors of which the data of profitability are available.

Regarding the above 12 sectors, analyzed data on the profitability are, for example, as follows.

$$PR = \frac{\text{Current Profit}}{\text{Total Capital}},$$

PR: Profit Rate (current profit rate of total capital),

Current Profit: sales amount + non-operating income - cost of sales - selling cost - general administrative cost - non-operating expenses,

Total Capital: current assets + fixed assets + deferred assets.

Relative value of each data was calculated according to the expression (III. 3).

Like the case of India, some sectors were selected for the further survey. But the capacity utilization is shown by the index and the fluctuation of capacity utilization is not so different among sectors. So the criterion of selection is different from that of India. Here, with regard to the adjustment of production capacity, only the Electric Machine Industry, the Precision Machine Industry, the Chemical Fertilizer Industry, and the Silk Reeling Industry are examined (Fig. 18-21). Former two sectors are the examples of increasing rate of growth, and latter two sectors are the examples of decreasing output. In case of the Electric Machine Industry and the Precision

[1] Tsūshousangyou Daijin Kanbou Chousa Toukeibu, ed. *Koukougyou Shisū Souran* (Tokyo: Ōkurashou Insatsukyoku, Relevant Issues) (hereafter cited as MITI (Ministry of International Trade and Industry), *Souran*); and ----------, *Koukougyou Shisu Nenpou, 1981* (Tokyo: Ōkurashou Insatsukyoku, 1981), pp. 64-74, and pp. 164-7 (hereafter cited as MITI, *Nenpou*).

[2] Ōkurashou, *Zaisei Kin'yū Toukei Geppou*, Houjin Kigyou Toukei Nenpou Tokushū, (Tokyo: Ōkurashou Insatsukyoku, Relevant Issues) (hereafter cited as Ōkurashou, *Zaisei Geppou*); Ōkurashou Rizaikyoku Keizaika, *Houjin Kigyou Toukei Nenpou, 1960* (Tokyo: Ōkurashou Insatsukyoku, 1960), Relevant Pages (hereafter cited as Ōkurashou, *Kigyou Toukei*).

Machine Industry, the output has been increasing with progressively increasing rate of growth. The production capacity has been expanded according to the increase in the output.

On the other hand, in case of the Chemical Fertilizer Industry and the Silk Reeling Industry, the output has been decreasing and the production capacity has been cut according to the decrease in the output. In case of the Chemical Fertilizer Industry, major causes of the decrease in output were two oil shocks. Also the decrease in the demand, the overcompetition, and the loss of international competitive power had made this industry a structural slump ridden industry.[1] In the Fig. 22, the export of chemical fertilizer had been increasing until 1972 and thereafter began to decrease. It is observed that the production capacity has been cut according to the decrease in the exports (Fig. 20).

In case of the Silk Reeling Industry, the output had been gradually increasing until 1969 and thereafter turned to the decreasing trend. The silk had been the most important goods for export until 1920's. But thereafter the exports decreased drastically due to the depression and the development of synthetic fiber in the USA. Since 1966, Japan has been importing the silk.[2] We can see that the maximum point of production is very close to the point where the export of raw silk ended and the import began (Fig. 23). Thus the production of the Silk Reeling Industry has decreased due to the decrease in demand and so the production capacity has been adjusted according to the situation.

Regarding the profitability, the positive relation between the growth rate of output and the current profit rate of total capital was observed although their graphs are omitted here.

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[1] Nihon Keizai Shinbunsha, ed., *Zemināru Nihon Keizai Nyūmon* (Tokyo: Nihon Keizai Shinbunsha, 1987), p. 31.

[2] Hisao Kanamori, *Kouza Nihon Keizai - Jou: Keizai Shakai no Shikumi* (Tokyo: Chuoukeizaisha, 1982), p. 11.

V. FORMULATION OF THE INVESTMENT CRITERION

1 The Way to Calculate the Possibility Index

As mentioned in section II, the Possibility Index (PI), is the ratio between the desired capacity and the actual capacity. It is written again. It is calculated by the following formula.

$$PI = \frac{DCAP}{CAP} \cdot 100 \qquad (V.\ 1),$$

DCAP: desired capacity,

CAP: actual capacity.

CAP is available from the existing statistics, so the surveys on the Indian and the Japanese manufacturing industries have been conducted in order to find the way to calculate DCAP. Examining the data and information available, the possible and best way to calculate the PI seems to be as follows. DCAP is worked out on the basis of Optimal Capacity Utilization (OCU). The Optimal Capacity Utilization is the rate at which the profit rate is the maximum or the production is the most profitable. So, it is different from a company to a company, or from a sector to a sector. Here, OCU is set at 90.0%. But, even if it is set at 80.0%, it does not affect the results considerably as will be shown later. The method of calculation is different according to the situation of capacity utilization, demand and supply, availability of raw materials, etc. The method is specified as follows according to the situation.

A. CU $\geqq$ 90.0%

B. CU $<$ 90.0% due to the lack of demand

C. CU $<$ 90.0% due to the shortage of raw materials, but the supply is inadequate

CU: capacity utilization

In case of A, the Electric Motor Industry can be cited as an example. In that industry, there are many years in which the capacity utilization was above 90.0% and the demand was excessive as compared with the production capacity. So the production capacity must be expanded in order to lower the capacity utilization to 90.0%. So DCAP is worked out by the following formula,

$$DCAP = \frac{OUT}{0.900} \qquad (V.\ 2),$$

OUT: actual output.

Namely, DCAP is the production capacity which yields OCU.

In case of B, the Ceramic Insulator Industry can be cited as an example. In this case, the capacity utilization was low due to the lack of demand so the production capacity should be cut according to the demand. So in this case also, DCAP is worked out by the formula (V. 2).

In case of C, the Lead Industry can be cited. In case of the Lead Industry, the demand was much larger than the production capacity but the capacity utilization was very low due to the shortage of raw materials. So it is fruitless to expand the production capacity because the company cannot increase the out put with the increased capacity due to the shortage of raw materials. And also, it is fruitless to cut the production capacity to raise the capacity utilization because there exists a sufficient demand as compared with the production capacity. Therefore, it is desirable to maintain the present production capacity and to supply sufficient raw materials immediately. Therefore, DCAP is worked out by the following formula,

$$DCAP = CAP \qquad (V. 3).$$

If we got DCAP by the above way, we can calculate the desired capacity utilization (DCU). DCU is worked out by the following formula.

$$DCU = \frac{OUT}{DCAP} \qquad (V. 4).$$

DCU is the rate at which the sector operates with actual output OUT and DCAP. So OCU is 90.0% but DCU can be below 90.0% as we will see it later.

DCAP, DCU, and the PI were worked out with regard to the Indian 9 sectors selected according to the way above.

2 Calculation of the Desired Capacity

For example, the situation of the Cement Industry are shown in the Fig. 1-5. In 1951, the capacity utilization was 89.8% and there is no report that the supply was inadequate. But, taking account of the situation around this period, it seems that the supply was inadequate (Fig. 5). So DCAP was worked out by the formula (V. 3). From 1952 to 1955, in 1960, and from 1963 to 1965, the capacity utilization was at or above 90.0%, so DCAP was worked out by the formula (V. 2). DCAP of remaining years, except for 1958, 1959, 1967, and 1968, were worked out by the formula (V. 3), because the capacity utilization was below 90.0% but the supply seemed to be inadequate. In 1958, 1959, 1967, and 1968, the capacity utilization was below 90.0% and the supply was adequate or excessive (Fig. 5). So DCAP was worked out by the formula (V. 2).

The results are shown in the Fig. 1. With regard to DCU, it is sometimes equal to and different from actual capacity utilization. This depends on the situation of market as written above. DCAP of other 9 sectors were worked out by the similar way.

3 Calculation of the Possibility Index

We have worked out DCAP, so now we can work out the PI by the formula (V. 1). The results are shown in the Fig. 24-25 and the TABLE 3. Nine sectors are divided into two graphs. The rank of PI is shown in the Fig. 26-27. There, the rank is reversed so that we can optically compare the graphs of the PI and the rank. Namely, if the PI is highest the rank is 9, and if the PI is lowest the rank is 1.

For example, in case of the Cement Industry (code number of sector is 3), the PI is near or equal to 100.0. But the rank ranges from 9th to 1st. For example, the PI is 100.0 in 1951 and 1956. But the rank is 1st in 1951 and 3rd in 1956. This is because the rank is the relative value among 9 sectors.

Thus we can see the PI and the rank of it. Observing all the 9 sectors, we can see following situation. In the first decade namely from 1951 to 1960, the PI of the Electric Motor Industry (6) shows high value, and the Ceramic Insulator Industry (7) shows low value. Their ranks are at the top or the bottom in some years respectively. From 1961 to 1970, the Diesel Engine Industry (1) and the Power Transformer Industry (5) show high value, and the Ceramic Insulator Industry (7) shows low value. The ranks of Diesel Engine Industry (1) and the Power Transformer Industry (5) are at the top in some years, and the rank of the Ceramic Insulator Industry (7) is always at the bottom. From 1971 to 1980, the Power Transformer Industry (5) and the Soap Industry (9) show high value, the Diesel Engine Industry (1) and the Electric Motor Industry (6) declined to low level, and the Ceramic Insulator Industry (7) turned to the rising trend after showing the extremely low level. The Power Transformer Industry (5) and the Soap Industry (9) are at the top rank in some years respectively. The Diesel Engine Industry (1) declined to the bottom rank, and the Electric Motor Industry (6) declined to the 2nd rank. The Ceramic Insulator Industry (7) rose up to the 3rd rank after staying at the bottom for 23 years. As for the Lead Industry (8), although the capacity utilization was very low in many years, the PI is 100.0 in most years due to the reasons mentioned above.

4 Formulation of the Possibility Index

So far, we have examined the data available and have worked out the PI from them. So, we must specify the necessary and technically possible data for the PI and the way to work out the PI with them.

The calculation of the PI is carried out according to the formula (V. 1). The basis of calculation is OCU (optimal capacity utilization). OCU is the rate at which the profit rate is the maximum. In the calculation above, OCU was set at 90.0%. But even if it was set at 80.0% or at other values, the results does not affect seriously at least with regard to the sectors near the top rank or the bottom rank. We have seen it above. So far, we have adopted 90.0% as OCU for all the sectors concerned. But we should specify OCU for each sector. For example, in the iron and steel industry, the blast furnace cannot be turned off so easily, so the operation must be continued throughout the day. Therefore, OCU must be necessarily close to 300.0% on the one shift basis. But, in many industries, OCU can be far below 300.0%. In case of cement industry, the capacity utilization was shown on three sift basis but in other industries the capacity utilization was shown on one sift basis. Also this problem must be solved. OCU must be worked out for each sector taking account of the features of each sector. The way to specify OCU cannot be specified here. Author must leave this problem for the later research.

Here, OCU was defined as the most profitable capacity utilization. But, the capacity utilization at which the profit rate is zero may be more appropriate. Let us call this the minimum required capacity utilization (MRCU). The profit is positive above MRCU, the profit is zero at MRCU , and the profit is negative below MRCU. MRCU may be more easily worked out than OCU.

From the above analysis, we can specify the statistics necessary for the calculation of DCAP and OCU or MRCU.

1 Output and Production Capacity,

2 Estimated Demand (including the information on demand and supply situation of the products in the market),

3 Availability of Raw Materials (including the electric power, transport facility, labor force, etc.),

4 Profitability,

5 Exports and Imports.

The specification of these statistics must follow the criteria below.

1. The classification of sector must be common among the statistics. For example, the classifications of sector for the profitability and for the output and production capacity are not common. This is the serious obstacle to the analysis. Secondly, the unit of output and production capacity must be coordinated. For example, in the Electric Motor Industry, the unit is horsepower. But there are so many types of electric motors. Some motors have small horsepower and some have big horsepower, and the structure of electric motor is not same. We can solve this problem by setting a standard product. For example, we can set the electric motor of one horsepower and of popular structure as a standard product. Other types of electric motors can be converted into this standard product in terms of the cost of production. Namely, if the cost of electric motor of other type is three times the standard electric motor, one unit of this motor is converted into three units of the standard motor. Thus, every type of electric motor can be converted into the standard electric motor.

2. The classification of sector must be modified. Namely, if some types of electric motors can be manufactured by the same production facility, they should be classified as in the same sector. But, if they cannot, they should be classified as in the different sectors. But, for example, even if the electric motor and the power transformers can be manufactured by the same production facility, they cannot be classified as in the same sector because the purposes are different.

So far, we have worked out the PI from the existing data. Now, we can specify the way to work out the PI with the data specified above. The capacity utilization adopted as the base of calculation is OCU or MRCU. Here, the capacity utilization is shown on one shift basis and the capacity utilization adopted as the basis is OCU set at 90.0%. The way to work out DCAP is shown according to each case bellow. Basically, the ways of calculation are composed of three cases.

A. 90.0% $\leqq$ CU $\geqq$ 300.0%, if CU is 300%, the production capacity is fully utilized.

B. $CU < 90.0\%$, due to the lack of demand.

C. $CU < 90.0\%$, but the supply is inadequate due to the shortage of raw materials or other reasons.

CU: capacity utilization

In case of A, basically, DCAP is worked out by the following formula.

$$DCAP = \frac{OUT}{0.900} \qquad (V.\ 2),$$

OUT: output.

This is because $90.0\% \leqq CU$ and so production capacity should be increased according to the output. But, the case A is further divided into four cases according to the relation between the supply of and the demand for product, and to the situation of availability of raw materials.

In case A-1, CU = 300%, the supply is inadequate, and further raw materials are available sufficiently.

In case A-2, CU = 300%, the supply is inadequate, and further raw materials are not available.

In case A-3, CU = 300%, the supply is adequate.

In case A-4, $90\% \leqq CU > 300\%$.

In case A-1, the production capacity is fully utilized but the supply is inadequate. In this case, actual demand is greater than the output. So, DCAP is worked out by the formula

$$DCAP = \frac{ED}{0.900} \qquad (V.\ 5),$$

ED: estimated demand

In case A-2, further raw materials are not available, so it is impossible to increase the output. So, DCAP should be worked out by the formula (V. 2).

In case A-3, the supply is adequate, so the output needs not be increased. So, DCAP is worked out by the formula (V. 2).

The case A-4 is divided into two cases. In case A-4-1, the supply is adequate. In this case, DCAP is worked out by the formula (V. 2) because the output needs not be increased. In case A-4-2, the supply is inadequate and the raw materials are inadequate. If the raw materials are available sufficiently, the output will increase. In this case, the output needs to be increased in order to meet the demand. But it is impossible to increase the output because the raw materials are inadequate. So, DCAP is worked out by the formula (V. 2), not by the formula (V. 5). Thus in case A as a whole, only in case A-1, DCAP is worked out by the formula (V. 5). In other cases, DCAP is worked out by the formula (V. 2).

In case B, DCAP is worked out by the formula (V. 2). Because $CU < 90.0\%$ due to the lack of demand.

In case C, this case is divided into two cases. In case C-1,

$$\frac{ED}{CAP} \geqq 0.900 \qquad (V.\ 6).$$

ED: estimated demand

This means CAP is optimal or less as compared with ED. So if the raw materials are supplied sufficiently, CU will be ≧ 90.0%. But it is fruitless to increase the production capacity because of shortage of raw materials. So DCAP is worked out by the formula

$$DCAP = CAP \qquad (V.\ 3).$$

In case C-2,

$$\frac{ED}{CAP} < 0.900 \qquad (V.\ 7).$$

This means CAP is excessive as compared with ED. So DCAP is worked out by the formula (V. 5).

As a whole, the formula (V. 2) is used in case, A-2, A-3, A-4, and B. The formula (V. 3) is used in case C-1. The formula (V. 5) is used in case A-1 and C-2.

Thus, we can work out DCAP more precisely with the modified statistical system specified above. And, the PI is worked out by the formula

$$PI = \frac{DCAP}{CAP} \cdot 100 \qquad (V.\ 1).$$

VI. CONCLUSION

As mentioned earlier, the purpose of research is to formulate a practical investment criterion, not an abstract one. In this regard, it seems that the PI is superior to other theories in the recognition of reality. For each theory surveyed, the factors taken into account and the determinant factor of investment are listed in the TABLE 1.

As a whole, the theories surveyed take account of the profitability of firms or projects concerned but do not take account of the present market situation. But, as we have seen in the analysis of the Indian manufacturing industries, the supply of products and the demand for it do not necessarily coincide, and the raw materials are not always available sufficiently. On the other hand, the PI can incorporate these factors into its system. This difference is quite crucial when we need the practical investment criterion.

However, the linkage effect, which was taken into account in the theories of the balanced growth and the unbalanced growth and in the theory on external economies and economies of scale, cannot be incorporated. This is the weak point of the PI. But, it is very difficult to measure the linkage effect covering the economy as a whole because the Input-Output Table is necessary to calculate the linkage effect over the economy as a whole. In this case, if the industry is classified into the sector like the data for capacity utilization, the number of sectors will amount to several hundreds. Furthermore, the I-O table is necessary for every year. But, at the present situation of statistical system, it is impossible to work out such an I-O table every year. Furthermore, in case of India, the data are available from the organized sector only, not available from the unorganized sector. So, it is mostly impossible to work out the linkage effect accurately. So the best way was to give up calculating the linkage effect and to work out the PI which does not take account of the linkage effect.

As the conclusion, we must evaluate the reliability of the PI as an investment criterion. The PI, like other investment criteria, cannot be the perfect criterion. But what we can expect from the PI is the more efficient investment, not the perfect investment. If, for example, 500 sectors are selected for the analysis and the PI of each sector is calculated, we cannot say that the PI is reliable with regard to two sectors of which the ranks are 250th and 251st. But, with regard to two sectors of which the ranks are 1st and 250th, the PI can be highly reliable. We can find the sectors at or near the top rank and the sectors at or near the bottom rank respectively. Namely, we can find the sectors of which the production capacity should be increased or cut most preferentially. The immediate adjustment of the production capacity according to the situation is crucial for the Indian economy to grow faster, as we have seen in the comparable analysis on the Indian and the Japanese economy.

However, prompt adjustment of production capacity according to the PI is not always appropriate. For example, the military forces, educational system, health and welfare organizations, some social infrastructures such as railway or road, etc. should not be adjusted according to the possibility of growth. But, most manufacturing industries operating in the market economy should be. Cutting the production capacity according to the PI may cause unemployment. But for this concern, we should examine the case of the Textile Industry. As we have seen in the survey of the Japanese manufacturing industries, the production in the Textile Industry has been stagnated. Especially, the production in the Silk Reeling Industry has been decreasing. Many textile companies cut the production capacity and reduced the production. But some textile companies had diversified their management and their current profit hit the highest record in their history. For example in case of Teijin, one of the biggest textile companies in Japan, its composition of sales is Tetron (synthetic fiber) 52, Nylon 9, Other Textile 3, Chemical Synthetic Products 23, Medicine 12, Technical Plan and Others 1 in September 1989. The company has achieved the highest record of current profit in its history in March 1989 (the end of fiscal year) and is going to break the record at the end of next fiscal year. Other companies such as Toray Industries and Asahi Chemical Industries are also in the similar situation.[1]

The examples of diversification can be seen in other industries also. In case of the Iron and Steel Industry, it is said that "The iron is the state." Thus, this industry is one of the most important industries in Japan. But its status in the world is declining due to the competition from abroad. So some companies are also diversifying the management into the field such as the information, communication, electronic products, real property, etc.[2] In the Shipbuilding Industry also, some companies are diversifying the management.[3]

It is said the life cycle of one industry is 30 years. One industry is born, grows, gets matured, and gets old. This period is said to be 30 years.[4] Therefore, most industry must always adjust its management according to the changes in the situation.

Finally, we should examine the future perspective of the possible contribution of the PI. Author has specified the necessary statistics for the PI. These statistics needs radical modification of the existing statistical system. But if they become available, we can work out the more reliable PI. If some countries in the world adopt the new statistic system for PI, the international comparison will be possible. The PI will be useful not only for the developing countries but also for the industrialized countries because there is no country where there is no control of the economy by the government. On of the most remarkable international specifications of statistics is the I-O table. The Institute of Developing Economies in Japan sent the experts to the ASEAN countries to instruct the local staffs. So today, the international I-O table, which works as an I-O table

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[1] Touyou Keizai, *Kaisha Shikihou*, First Series in 1990 (Tokyo: Touyou Keizai, December 1989), pp. 179-81.

[2] Touyou Keizai, pp. 350-2.

[3] Touyou Keizai, pp. 612-4.

[4] Nihon Keizai Shinbunsha, p. 29.

including multiple countries, is available.[1] In the table, Indonesia, Peninsular Malaysia, Philippines, Singapore, Thailand, Japan, Korea, and U.S.A. are linked in one I-O table. If the statistic system for PI is introduced into each country like the international I-O table, it will become a very important data to observe the situation of world economy.

[1] Institute of Developing Economies (I.D.E), *International Input-Output Table for ASEAN Countries, 1975*, I.D.E. Statistical Series, no. 39 (Tokyo: Institute of Developing Economies, 1982).

APPENDICES

1 Source and Note of the Figures

Fig. 1-13 (From the Fig. 1 to the Fig. 13)

The graphs from A to E of 4 sectors selected

In the graph A, the relation between the data and the line is as follows.

——————— OUT (output, adjusted to the scale of CU)
＋＋＋＋＋＋ DCAP (desired production capacity, adjusted to the scale of CU)
◇◇◇◇◇◇ DCU (desired capacity utilization)
---------------- CAP (production capacity, adjusted to the scale of CU)
×××××× CU (capacity utilization)

In the graph B, the relation between the data and the line is as follows.

——————— OUT (output)
＋＋＋＋＋＋ IMPORTS (imports)
◇◇◇◇◇◇ ED (estimated demand)
----------------- CAP (production capacity)
▽▽▽▽▽▽ EXPORTS (exports)

In the graph C, the relation between the data and the line is as follows.

——————— OUT (output)
＋＋＋＋＋＋ OUT-U (output in the unorganized sector)
◇◇◇◇◇◇ O-TARGET (output target)
----------------- CAP (production capacity)
×××××× CAP-U (production capacity in the unorganized sector)
▽▽▽▽▽▽ C-TARGET (capacity target)

In the graph D, the relation between the data and the line is as follows.

＋＋＋＋＋＋ IMPORTS (imports)
▽▽▽▽▽▽ EXPORTS (exports)

In the graph E, the relation between the data and the line is as follows.

□□□□□□ DC (demand-capacity ratio, relation between the demand and the production

capacity)
◇◇◇◇◇◇ DO (demand-output ratio, relation between the demand and the output)
△△△△△△ DAR (domestic availability of raw materials, availability of raw materials in the domestic market)
×××××× TAR (total availability of raw materials, total availability of raw materials including the imports)

The unit and source of data of the Fig. 1-13 are as follows.

Fig. 1 3 CEMENT A
SOURCE
OUT and CAP: GOI, *Abstract*, Relevant Issues. Other data were calculated by author.
NOTE: Unit of OUT and CAP is tonnes.

Fig. 2 3 CEMENT B
SOURCE
OUT and CAP: Same as the Fig. 1. EXPORTS: Government of India, Directorate of Public Relations and Publications, Directorate General of Technical Development, *Handbook of Industrial Data* (New Delhi: Directorate General of Technical Development, 1975), Relevant Issues (hereafter cited as GOI, *Handbook*); K&S, *Economic Guide and Investors' Handbook, 1961*, p. 67; and Kothari Enterprises, *Kothari's Industrial Directory of India, 1986* (Madras: Kothari Enterprises, n.d.), p. 7 (Cement) (hereafter cited as Kothari, *Directory*). IMPORTS: GOI, *Handbook, 1966*, p. 141; K&S, *Economic Guide and Investors' Handbook, 1961*, p. 67; and Kothari, *Directory, 1986*, p. 3 and 7 (Cement). ED: GOI, *Guidelines, 1978/79*, p. 142; GOI, *Handbook*, Relevant Issues; Government of India, Planning Commission, *Sixth Five Year Plan, 1980/85* (New Delhi: Planning Commission, n.d.), p. 48 (hereafter cited as GOI, *Sixth Plan*); K&S, *Economic & Industrial Guide, 1973/74*, p. 3 and 5 (Cement); K&S, *Economic Guide and Investors' Handbook*, Relevant Issues; K&S, *Encyclopaedia*, Relevant Issues; and Kothari, *Directory, 1986*, p. 2 (Cement).

Fig. 3 3 CEMENT C
SOURCE
OUT and CAP: Same as the Fig. 1. O-TARGET: Confederation of Engineering Industry, *Handbook of Statistics, 1986*, 19th ed. (Delhi: Confederation of Engineering Industry, December 1986), p. 116 (hereafter cited as CEI, *Handbook*); GOI, *Guidelines, 1986/87*, p. 113; GOI, *Handbook, 1973*, p. 255; K&S, *Economic Guide and Investors' Handbook, 1969/70*, p. 110; and Kothari, *Directory, 1986*, p. 3 (Cement). C-TARGET: CEI, *Handbook, 1986*, p. 116; GOI, *Guidelines, 1986/87*, p. 113; *K&S, Economic & Industrial Guide, 1973/74*, p. 1 (Cement); K&S, *Economic Guide and Investors' Handbook, 1969/70*, p. 110; K&S, *Encyclopaedia, 1954*, p. 2 (Cement); and Kothari, *Directory, 1986*, p. 3.

Fig. 4 3 CEMENT D

SOURCE

EXPORTS: GOI, *Handbook*, Relevant Issues. IMPORTS: GOI, *Handbook, 1966*, p. 141; and GOI, *Sixth Plan*, p. 75.

Fig. 5 3 CEMENT E

SOURCE

DO: GOI, *Guidelines, 1973/74*, p. 203; GOI, *Handbook, 1966*, p. 141; K&S, *Economic & Industrial Guide*, Relevant Issues; K&S, *Economic Guide and Investors' Handbook*, Relevant Issues; K&S, *Encyclopaedia*, Relevant Issues; and Kothari, *Directory, 1986*, p. 8. DAR: GOI, *Guidelines, 1986*, p. 113; K&S, *Economic & Industrial Guide*, Relevant Issues; K&S, *Economic Guide and Investors' Handbook*, Relevant Issues; K&S, *Encyclopaedia*, Relevant Issues; and Kothari, *Directory, 1986*, p. 6.

Fig. 6 6 ELECTRIC MOTORS A

SOURCE

OUT and CAP: Same as the Fig. 1. Other data were calculated by author.

NOTE: Unit of OUT and CAP is horsepower.

Fig. 7 6 ELECTRIC MOTORS D

SOURCE

EXPORTS: GOI, *Guidelines*, Relevant Issues; GOI, *Handbook, 1975*, p. 87; K&S, *Economic & Industrial Guide, 1978/79*, p. 28 (Engineering); K&S, *Economic Guide and Investors' Handbook, 1961*, p. 117; and K&S, *Encyclopaedia, 1956/57*, p. 542. IMPORTS: GOI, *Guidelines, 1979/80*, p. 14; GOI, *Handbook, 1975*, p. 87; K&S, *Economic Guide and Investors' Handbook*, Relevant Issues; and K&S, *Encyclopaedia, 1956/57*, p. 541.

Fig. 8 6 ELECTRIC MOTORS E

SOURCE

DO: GOI, *Guidelines*, Relevant Issues; GOI, *Handbook, 1966*, p. 41; *K&S, Economic Guide and Investors' Handbook*, Relevant Issues; and K&S, *Encyclopaedia*, Relevant Issues. DAR: GOI, *Guidelines*, Relevant Issues; GOI, *Handbook*, Relevant Issues; K&S, *Economic Guide and Investors' Handbook, 1961*, p. 116; and K&S, *Encyclopaedia, 1960*, pp. 170-1.

Fig. 9 7 CERAMIC INSULATORS A

SOURCE

OUT and CAP: Same as the Fig. 1. Other data were calculated by author.

NOTE: Unit of OUT and CAP is numbers from 1951 to 1956 and thereafter tonnes.

Fig. 10 7 CERAMIC INSULATORS E

SOURCE

DO: Government of India, Ministry of Commerce and Industry, Development Commissioner (Small Scale Industries), *Teiatsu You Zetsuen Touki, (Toubu Chihou)* [The title in English is not known], Hon'yaku Shiryou no. 27, Indo Chūshoukougyou Shirīzu, no. 27, trans. Ōsaka Ajia Chūshoukigyou Kaihatsu Sentā (n. p. : Ōsaka Ajia Chūshoukigyou Kaihatsu Sentā, 1965), Relevant Pages (hereafter cited as GOI, *Zetsuen Touki*); and K&S, *Encyclopaedia*, Relevant Issues.
DAR: GOI, *Zetsuen Touki*, Relevant Pages; and K&S, *Encyclopaedia*, Relevant Issues.

Fig. 11 8 LEAD A

SOURCE

OUT and CAP: Same as the Fig. 1. Other data were calculated by author.

NOTE: Unit of OUT and CAP is tonnes.

Fig. 12 8 LEAD B

SOURCE

OUT and CAP: Same as the Fig. 1. EXPORTS: GOI, *Handbook, 1975*, p. 59. IMPORTS: GOI, *Guidelines*, Relevant Issues; GOI, *Handbook*, Relevant Issues; K&S, *Economic & Industrial Guide, 1978/79*, p. 28 (Minerals & Metals); K&S, *Economic Guide and Investors' Handbook, 1961*, p. 245 (Mining & Chemicals). ED: GOI, *Guidelines*, Relevant Issues; GOI, *Handbook, 1973*, p. 149; GOI, *Sixth Plan*, p. 49; and K&S, *Economic Guide and Investors' Handbook*, Relevant Issues.

Fig. 13 8 LEAD E

SOURCE

DC: GOI, *Handbook, 1973*, p. 149. DO: GOI, *Guidelines*, Relevant Issues; GOI, *Handbook, 1966*, p. 59; K&S, *Economic & Industrial Guide*, Relevant Issues; K&S, *Economic Guide and Investors' Handbook*, Relevant Issues; and K&S, *Encyclopaedia*, Relevant Issues. DAR: GOI, *Guidelines*, Relevant Issues; K&S, *Economic Guide and Investors' Handbook*, Relevant Issues; K&S, *Encyclopaedia*, Relevant Issues; and Koti, pp. 74-5.

Fig. 14-15 Profitability of 11 sectors selected

SOURCE: GOI, ASI, Relevant Issues.

Fig. 16-17 Relative value of profitability of the cement and the electric motors among 11 sectors

SOURCE: same as the Fig. 14-15.

Fig. 18-21 The out put, the production capacity, and the capacity utilization of 4 sectors in Japan

SOURCE: MITI, *Nenpou, 1987*, pp. 70-8; and ----------, *Souran*, Relevant Issues.

NOTE: The data are shown by the index with the base year 1980.

Fig. 22-23 The exports and the imports of the Chemical Fertilizer and the Silk Reel-ing

SOURCE: Nihon Kanzei Kyoukai, ed., *Gaikoku Boueki Gaikyou* (Tokyo: Nihon Kanzei Kyoukai, Relevant Issues).

Fig. 24-25 The PI of 9 sectors in India

NOTE: The numbers beneath the graph are the code number of 9 sectors.

Fig. 26-27 The rank of PI of 9 sectors in India

NOTE: The numbers beneath the graph are the code number of 9 sectors.

2 Figures

Fig. 1

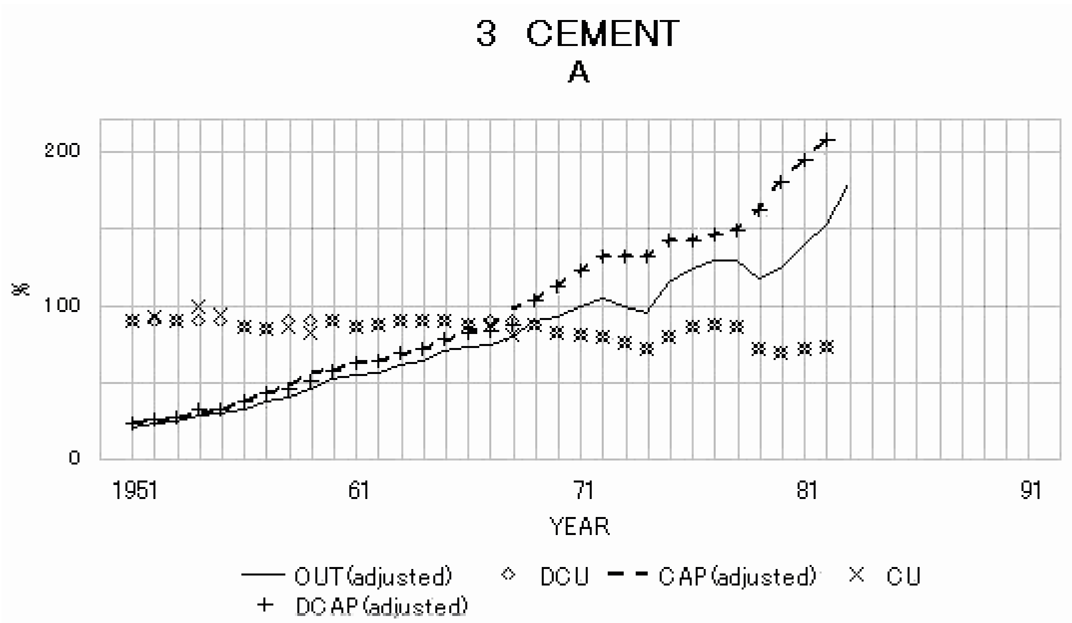


Fig. 2

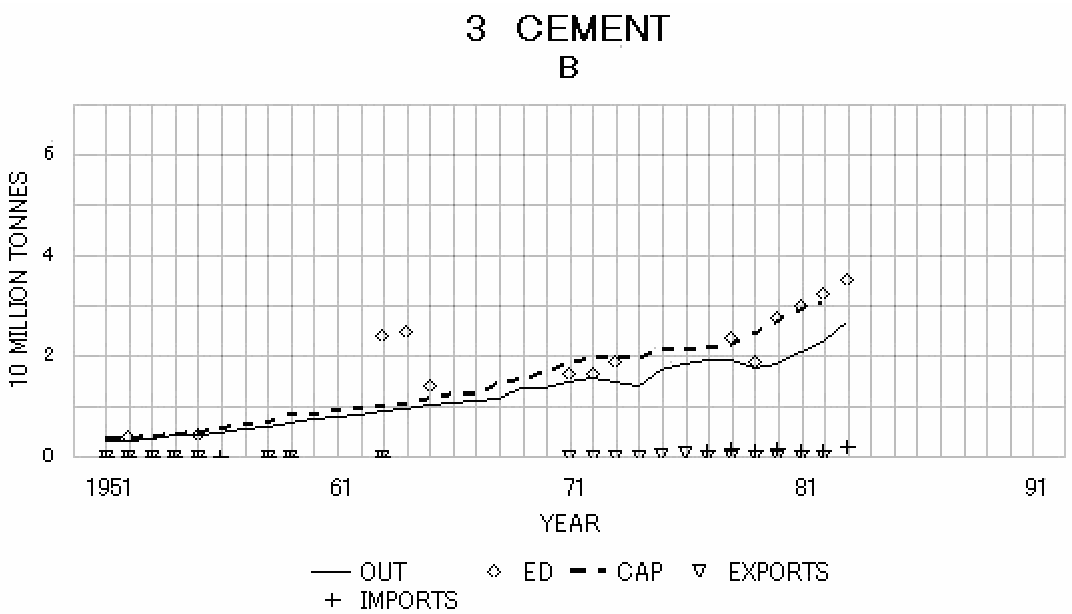


Fig. 3

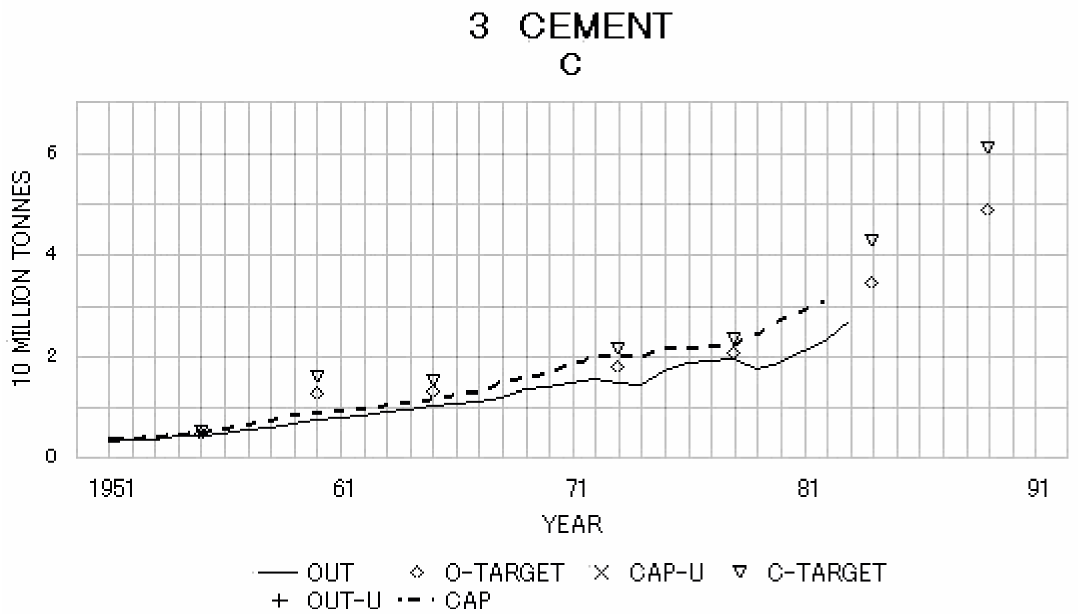

3 CEMENT
C
10 MILLION TONNES
0
2
4
6
1951
61
71
81
91
YEAR
OUT
O-TARGET
CAP-U
C-TARGET
OUT-U
CAP

Fig. 4

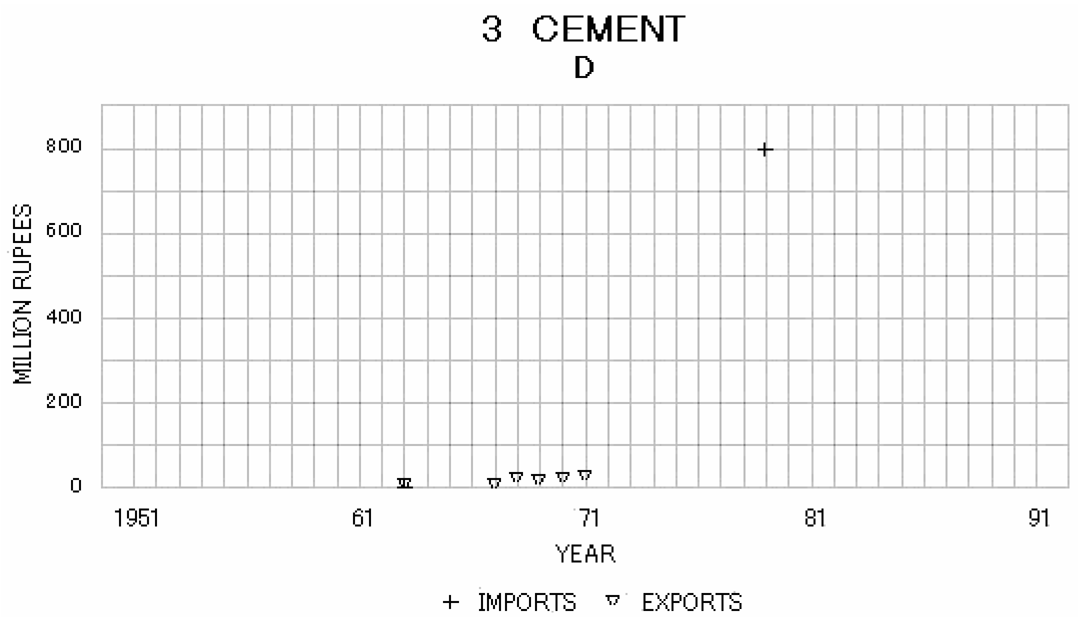

3 CEMENT
D
MILLION RUPEES
0
200
400
600
800
1951
61
71
81
91
YEAR
IMPORTS
EXPORTS

Fig. 5

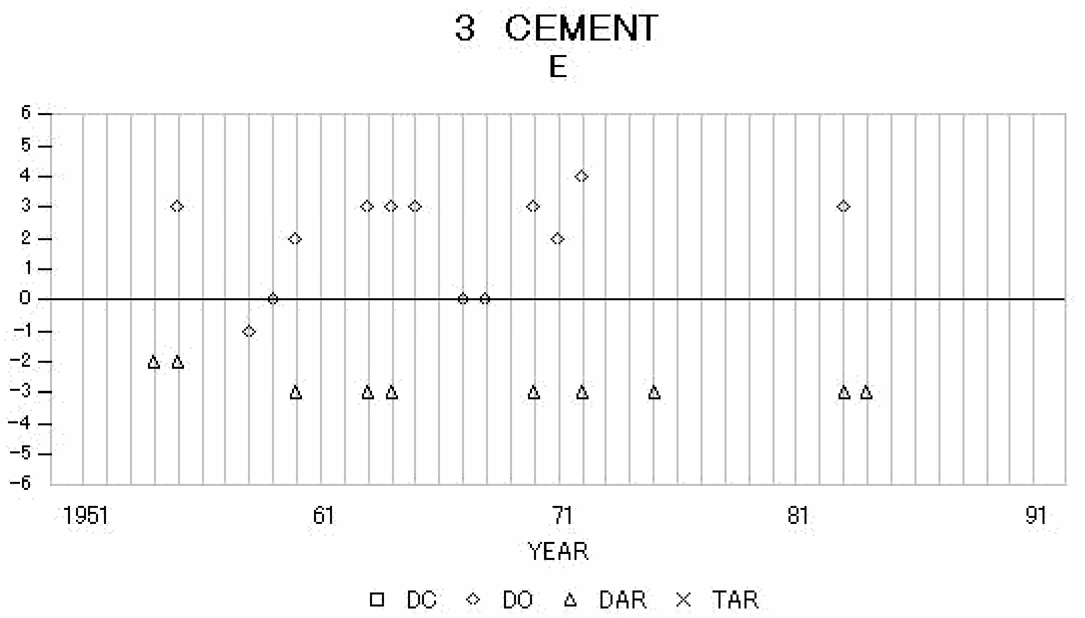

3 CEMENT
E
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
1951
61
71
81
91
YEAR
DC
DO
DAR
TAR

Fig. 6

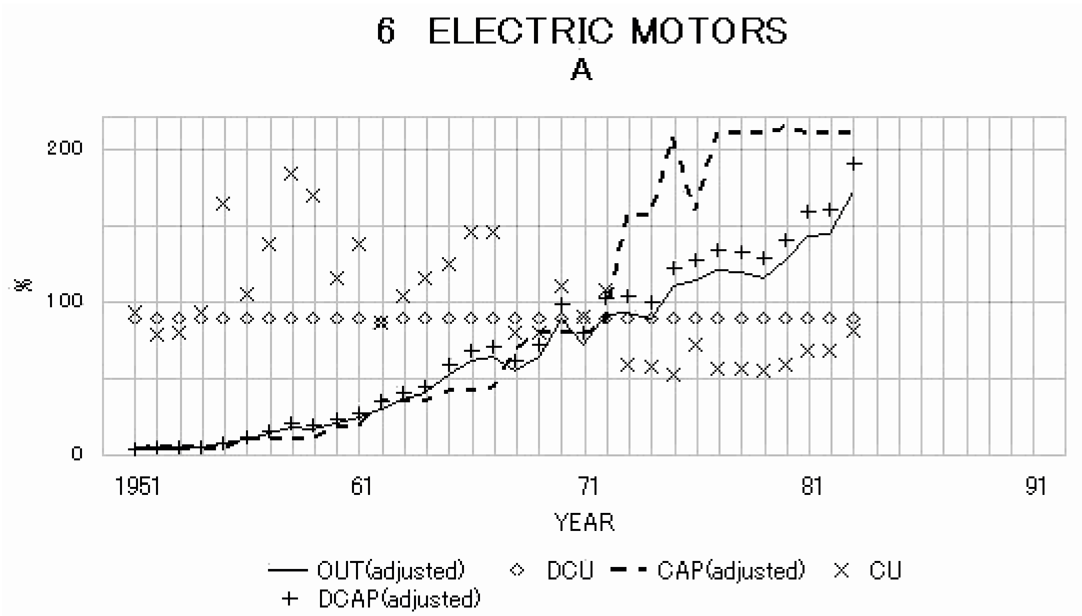

6 ELECTRIC MOTORS
A
%
200
100
0
1951
61
71
81
91
YEAR
OUT(adjusted)
DCU
CAP(adjusted)
CU
DCAP(adjusted)

Fig. 7

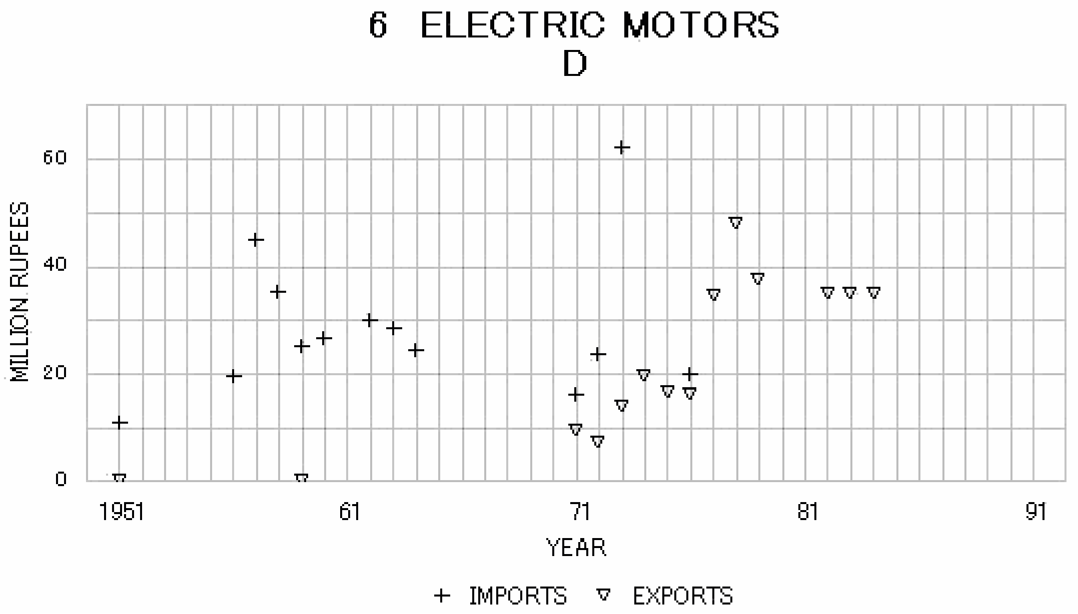

6 ELECTRIC MOTORS
D
MILLION RUPEES
0
20
40
60
1951
61
71
81
91
YEAR
+ IMPORTS
EXPORTS

Fig. 8

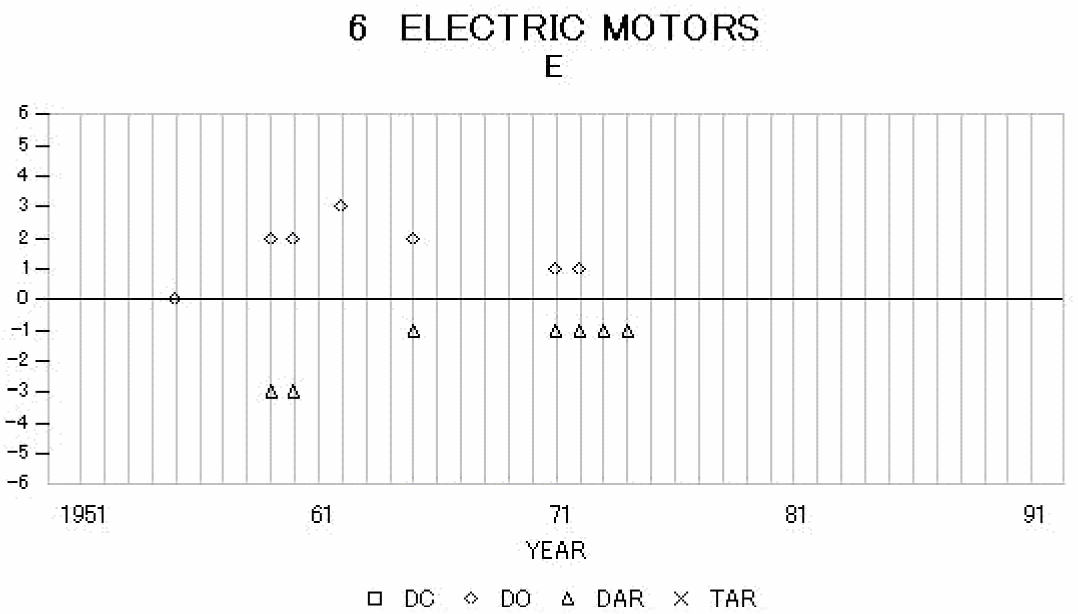

6 ELECTRIC MOTORS
E
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
1951
61
71
81
91
YEAR
DC
DO
DAR
TAR

Fig. 9

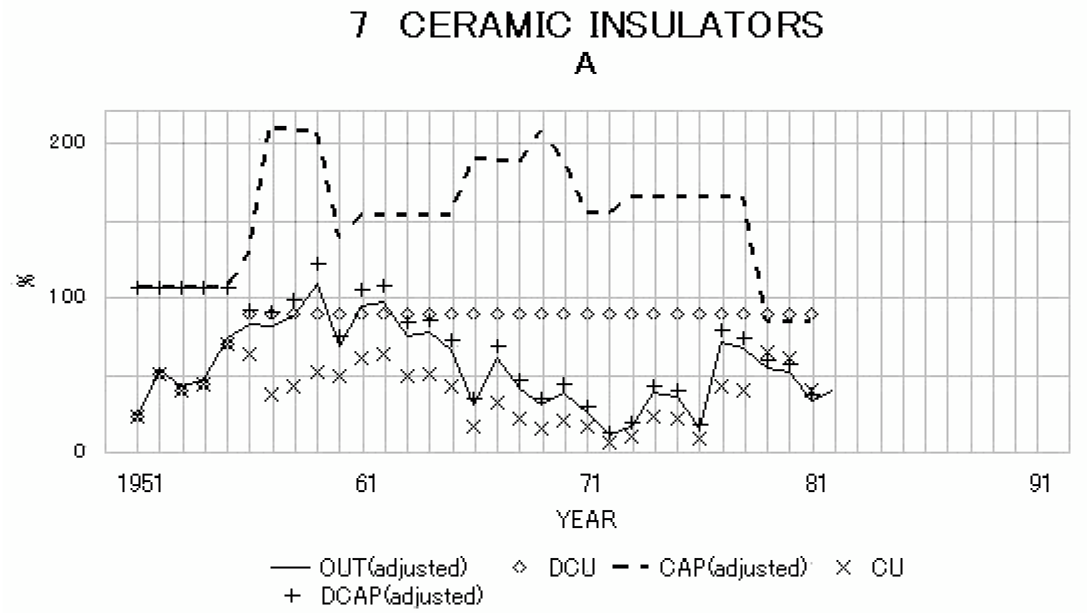

7 CERAMIC INSULATORS
A
200
%
100
0
1951
61
71
81
91
YEAR
OUT(adjusted)
DCU
CAP(adjusted)
CU
DCAP(adjusted)

Fig. 10

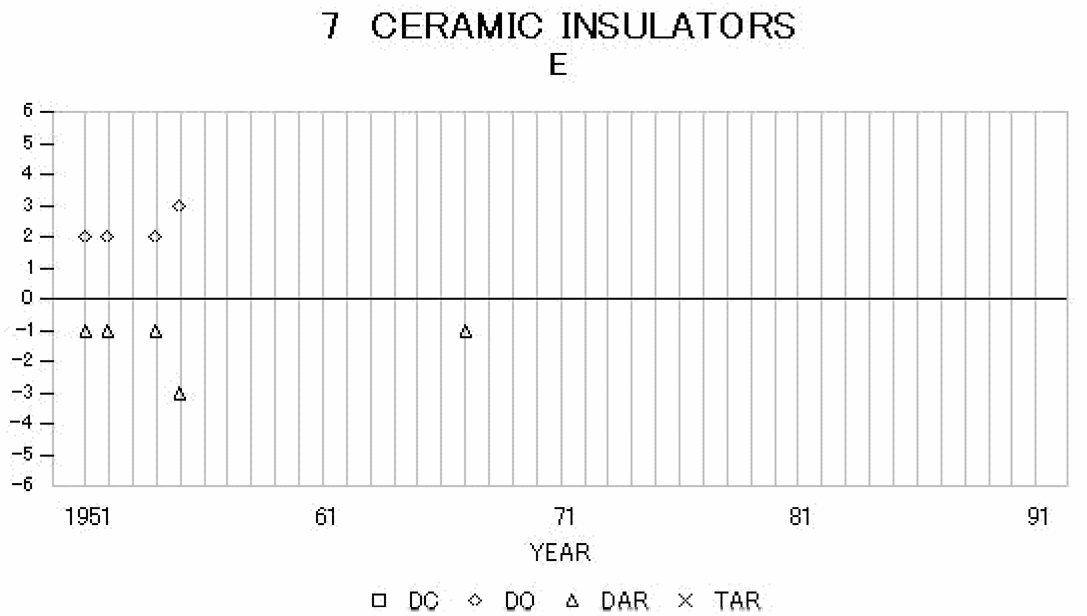

7 CERAMIC INSULATORS
E
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
1951
61
71
81
91
YEAR
DC
DO
DAR
TAR

Fig. 11

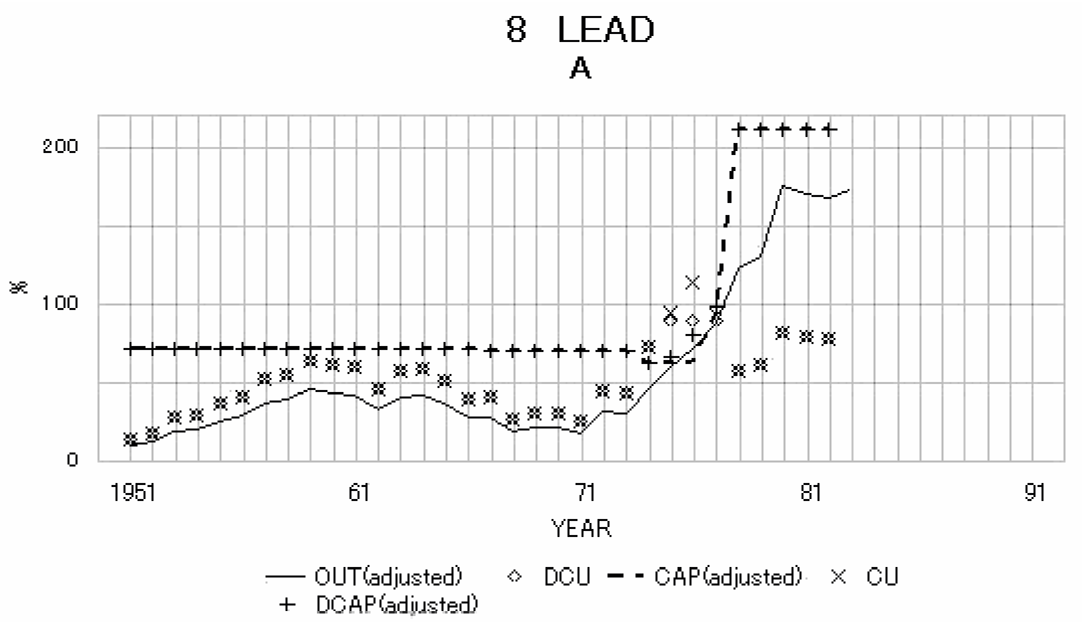

8 LEAD
A
%
200
100
0
1951
61
71
81
91
YEAR
OUT(adjusted)
DCU
CAP(adjusted)
CU
DCAP(adjusted)

Fig. 12

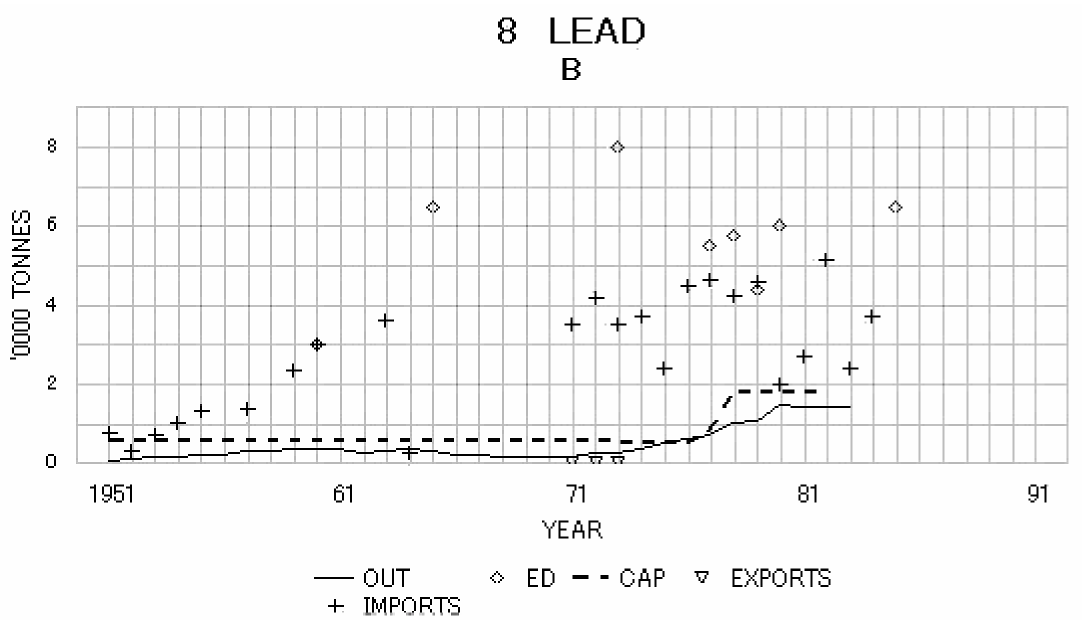

8 LEAD
B
'0000 TONNES
8
6
4
2
0
1951
61
71
81
91
YEAR
OUT
ED
CAP
EXPORTS
IMPORTS

Fig. 13

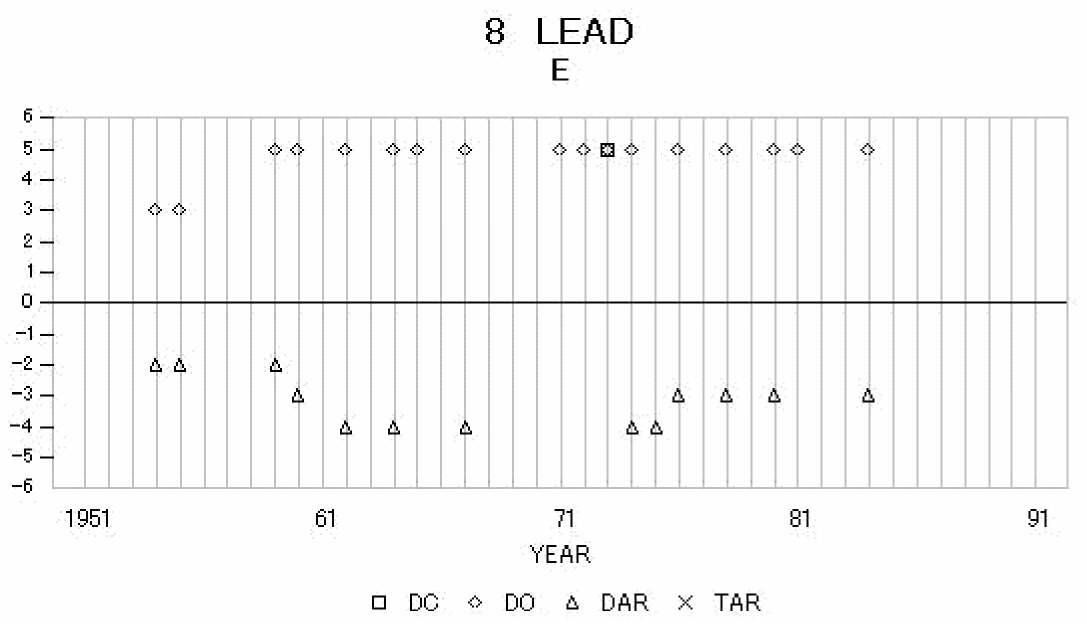

8 LEAD
E
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
1951
61
71
81
91
YEAR
DC
DO
DAR
TAR

Fig. 14

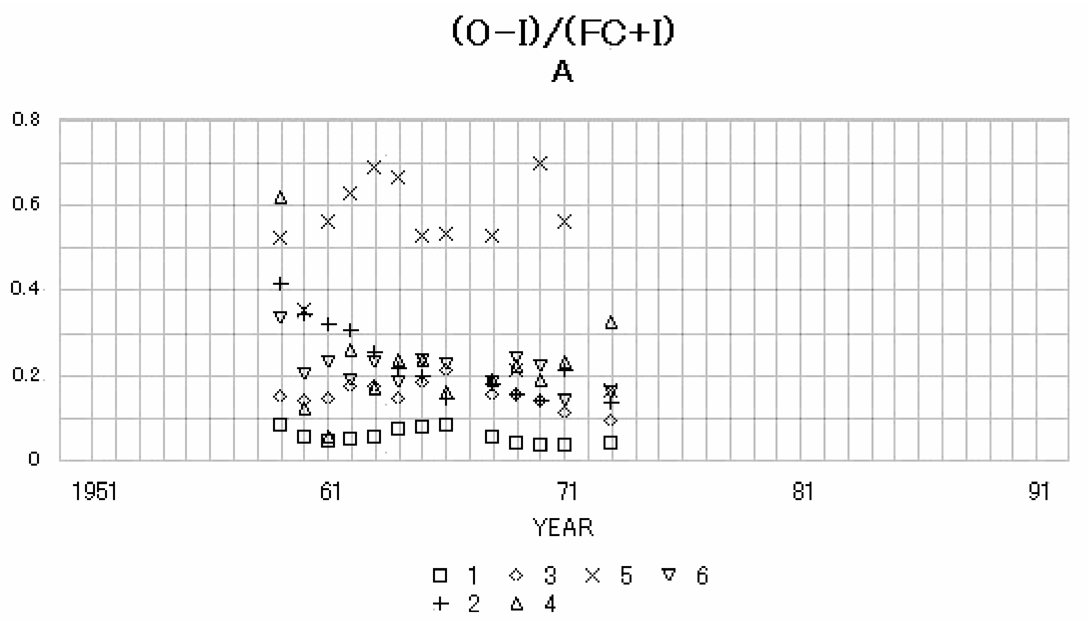

(O-I)/(FC+I)
A
0.8
0.6
0.4
0.2
0
1951
61
71
81
91
YEAR
1
3
5
6
2
4

Fig. 15

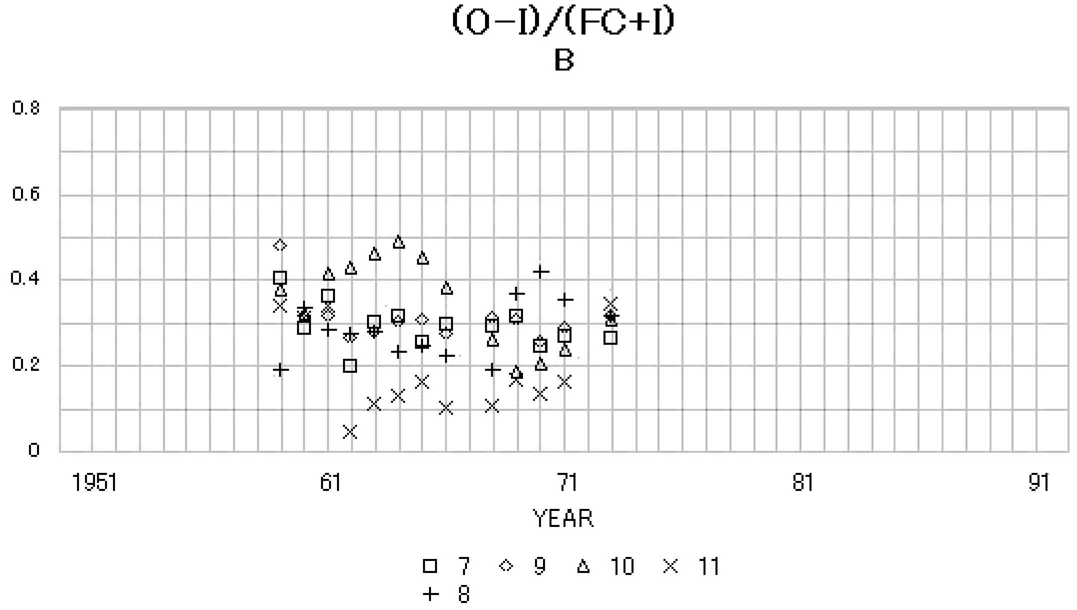

(O−I)/(FC+I)
B
0.8
0.6
0.4
0.2
0
1951
61
71
81
91
YEAR
7
9
10
11
8

Fig. 16

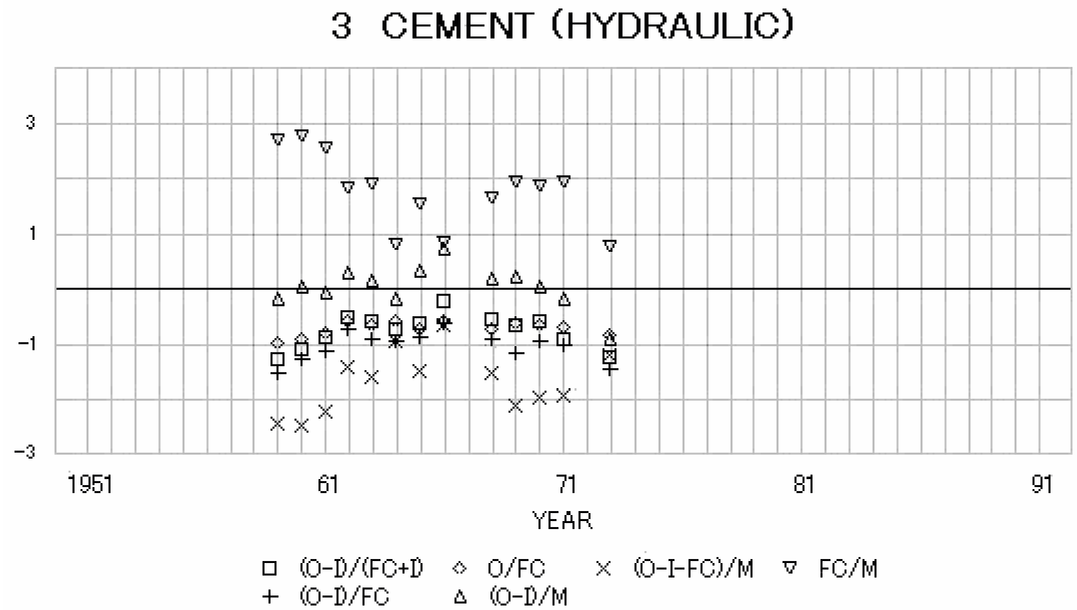

3 CEMENT (HYDRAULIC)
3
1
−1
−3
1951
61
71
81
91
YEAR
(O−I)/(FC+I)
O/FC
(O−I−FC)/M
FC/M
(O−I)/FC
(O−I)/M

Fig. 17

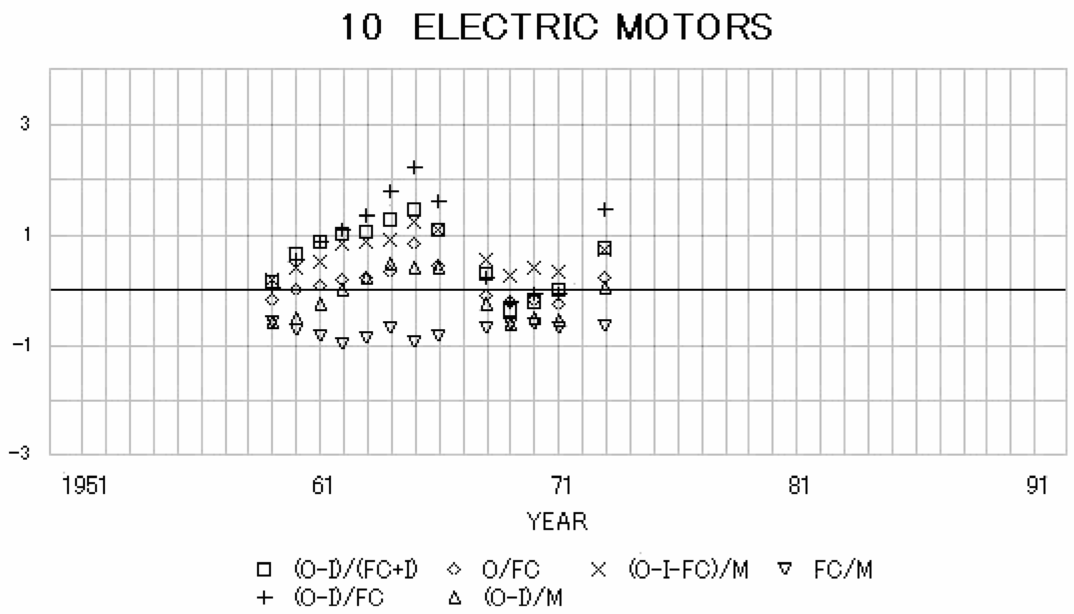

10 ELECTRIC MOTORS
3
1
-1
-3
1951
61
71
81
91
YEAR
(O-D)/(FC+D)
O/FC
(O-I-FC)/M
FC/M
(O-D)/FC
(O-D)/M

Fig. 18

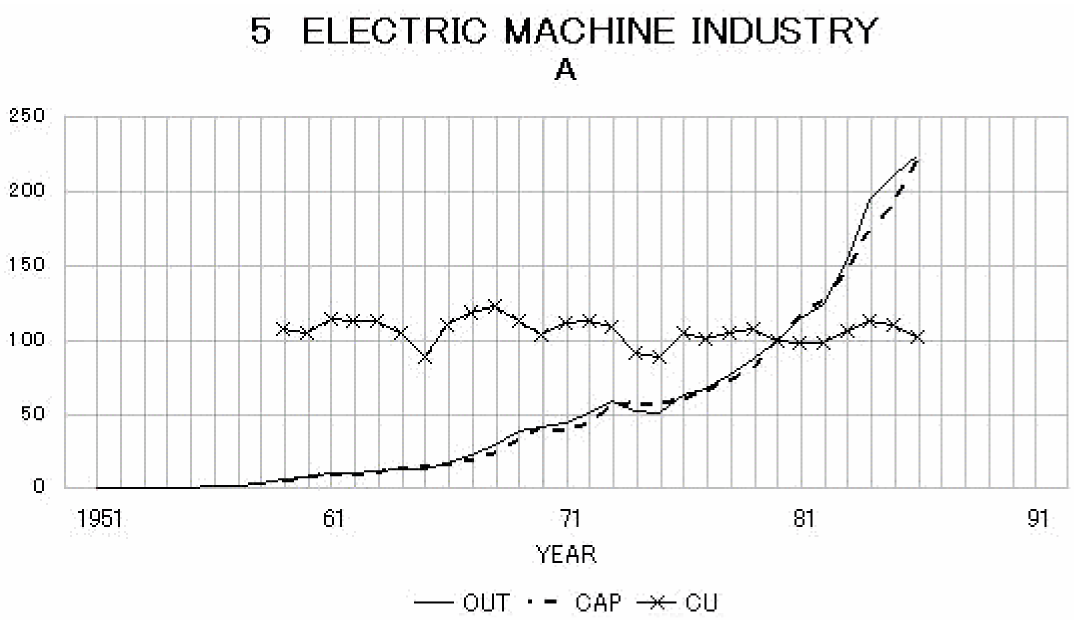

5 ELECTRIC MACHINE INDUSTRY
A
250
200
150
100
50
0
1951
61
71
81
91
YEAR
OUT
CAP
CU

Fig. 19

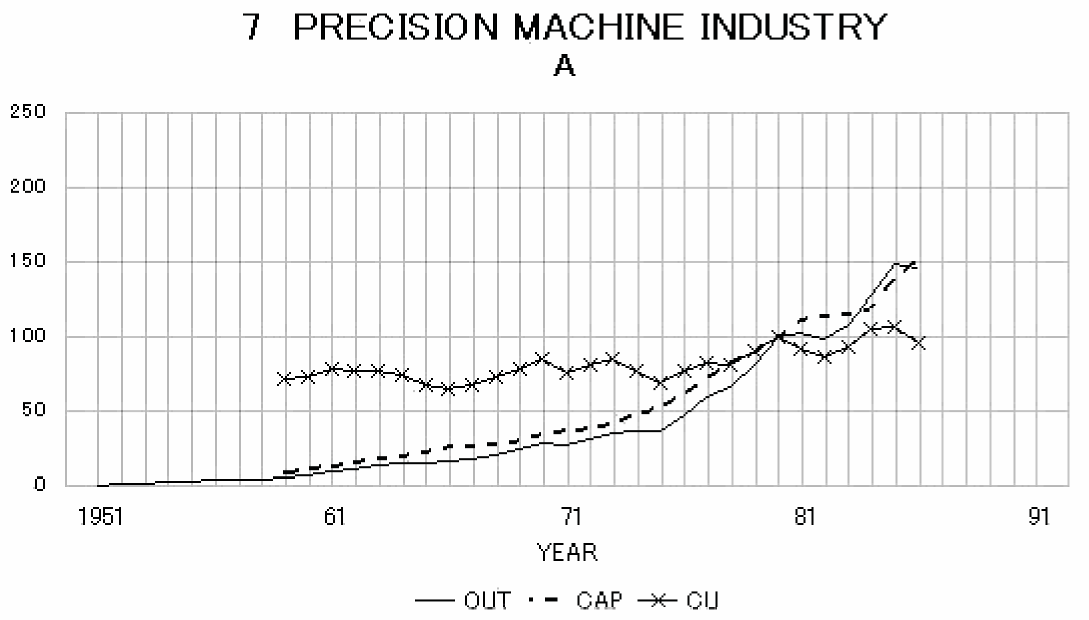

7 PRECISION MACHINE INDUSTRY
A
250
200
150
100
50
0
1951
61
71
81
91
YEAR
OUT
CAP
CU

Fig. 20

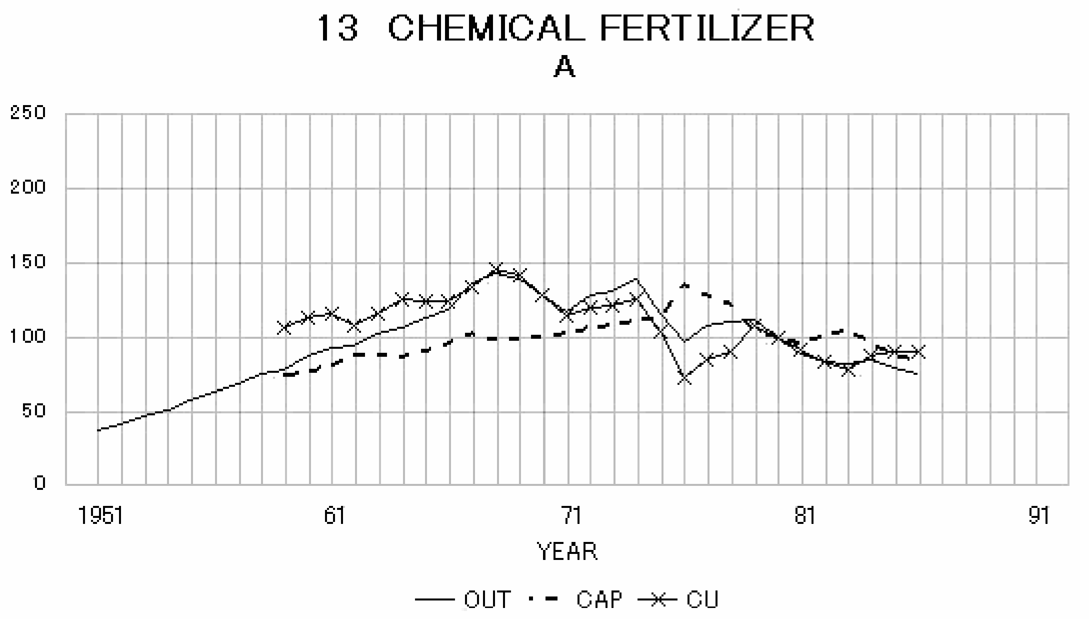

13 CHEMICAL FERTILIZER
A
250
200
150
100
50
0
1951
61
71
81
91
YEAR
OUT
CAP
CU

Fig. 21

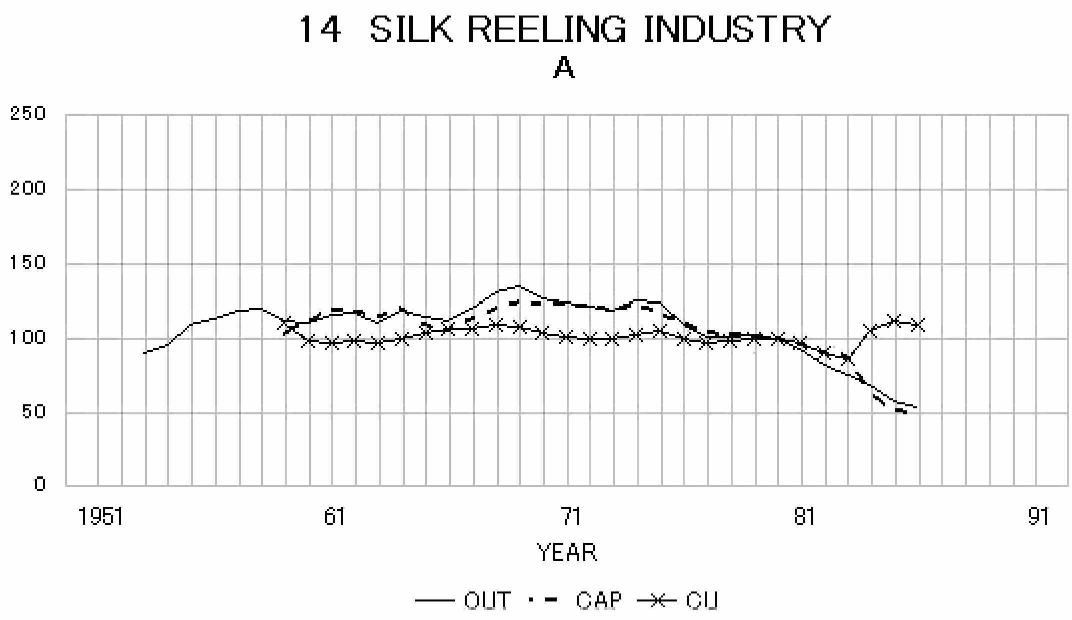

14 SILK REELING INDUSTRY
A
250
200
150
100
50
0
1951
61
71
81
91
YEAR
OUT
CAP
CU

Fig. 22

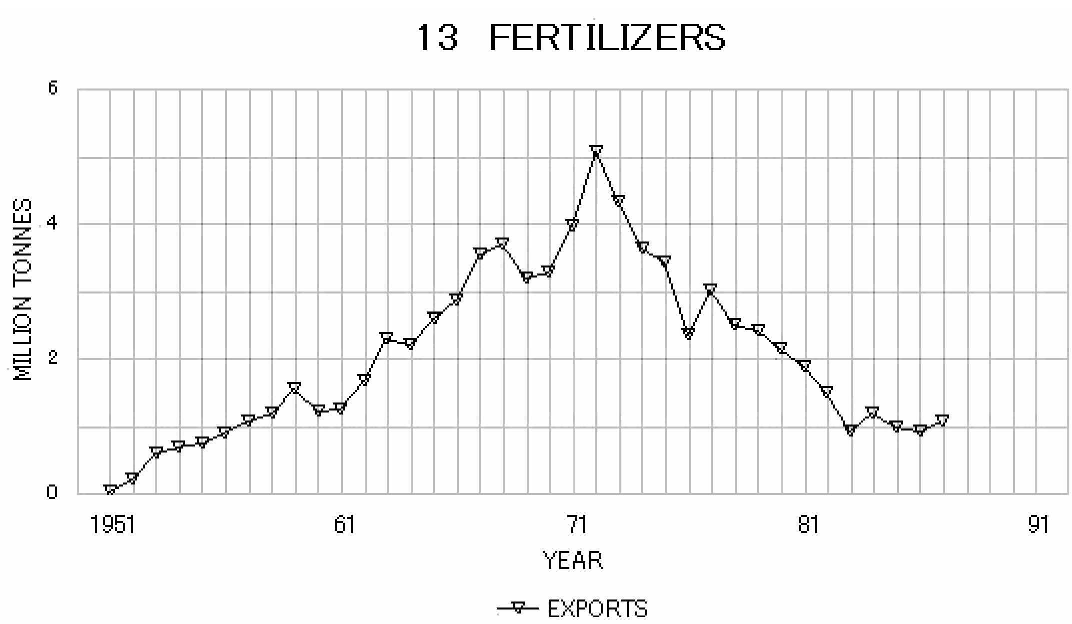

13 FERTILIZERS
MILLION TONNES
6
4
2
0
1951
61
71
81
91
YEAR
EXPORTS

Fig. 23

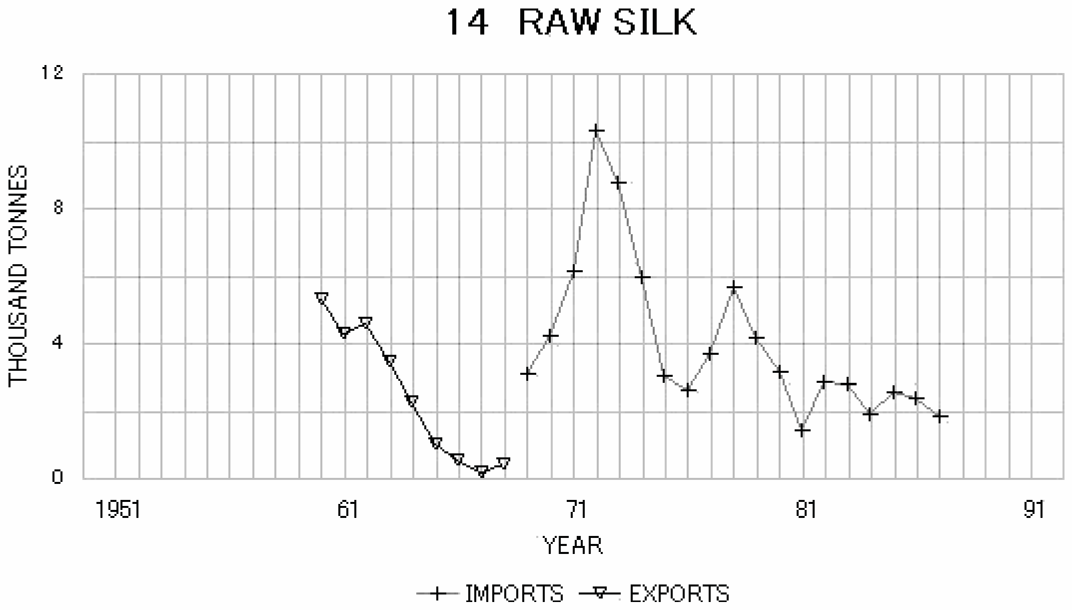

14 RAW SILK
THOUSAND TONNES
12
8
4
0
1951
61
71
81
91
YEAR
IMPORTS
EXPORTS

Fig. 24

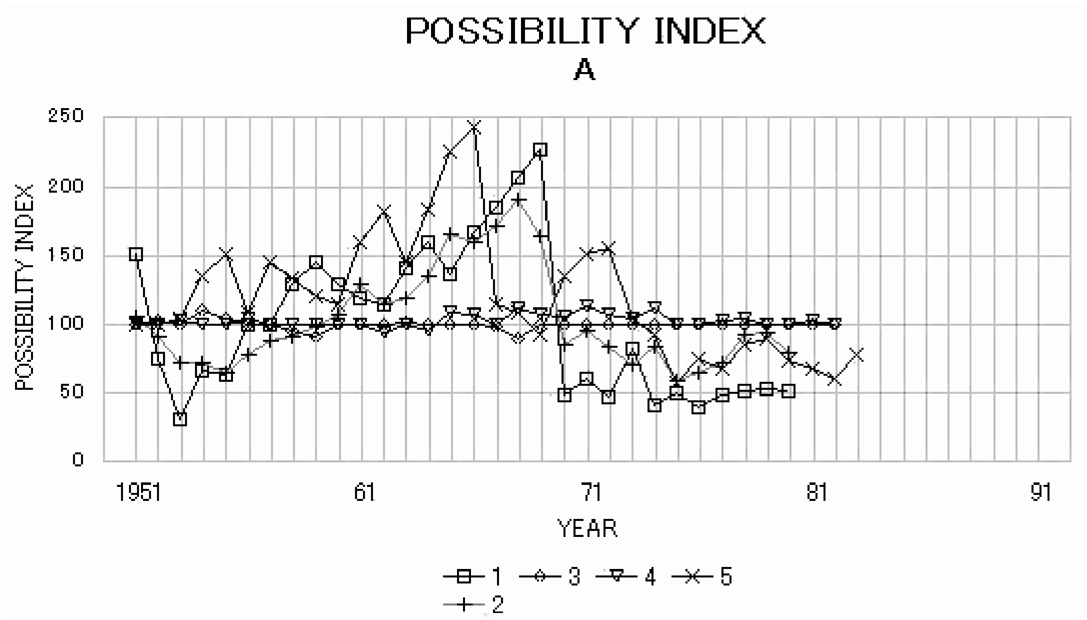

POSSIBILITY INDEX
A
POSSIBILITY INDEX
250
200
150
100
50
0
1951
61
71
81
91
YEAR
1
3
4
5
2

Fig. 25

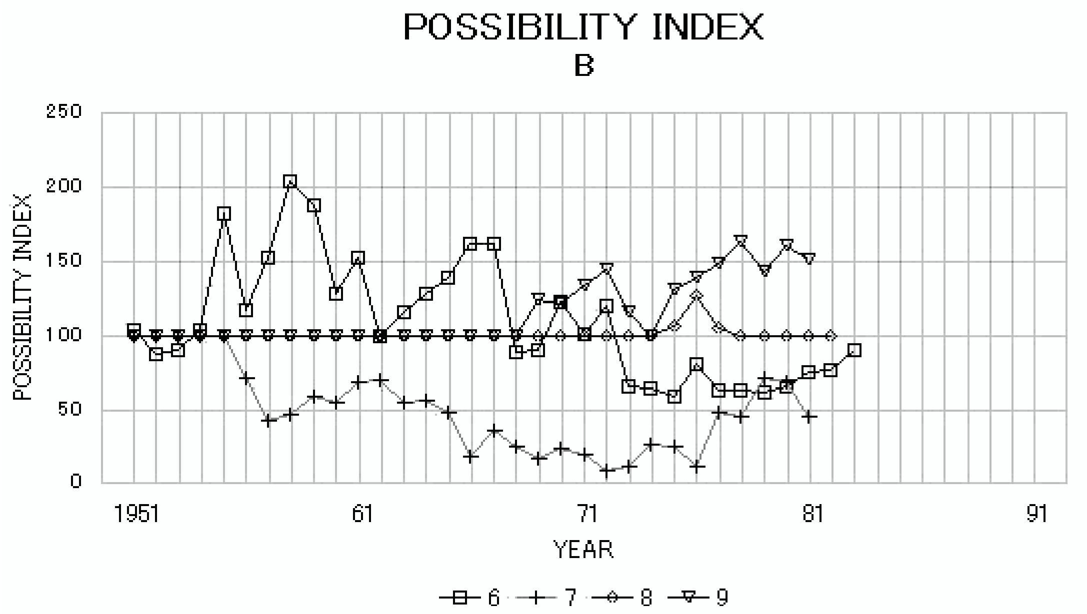

POSSIBILITY INDEX
B
POSSIBILITY INDEX
250
200
150
100
50
0
1951
61
71
81
91
YEAR
6
7
8
9

Fig. 26

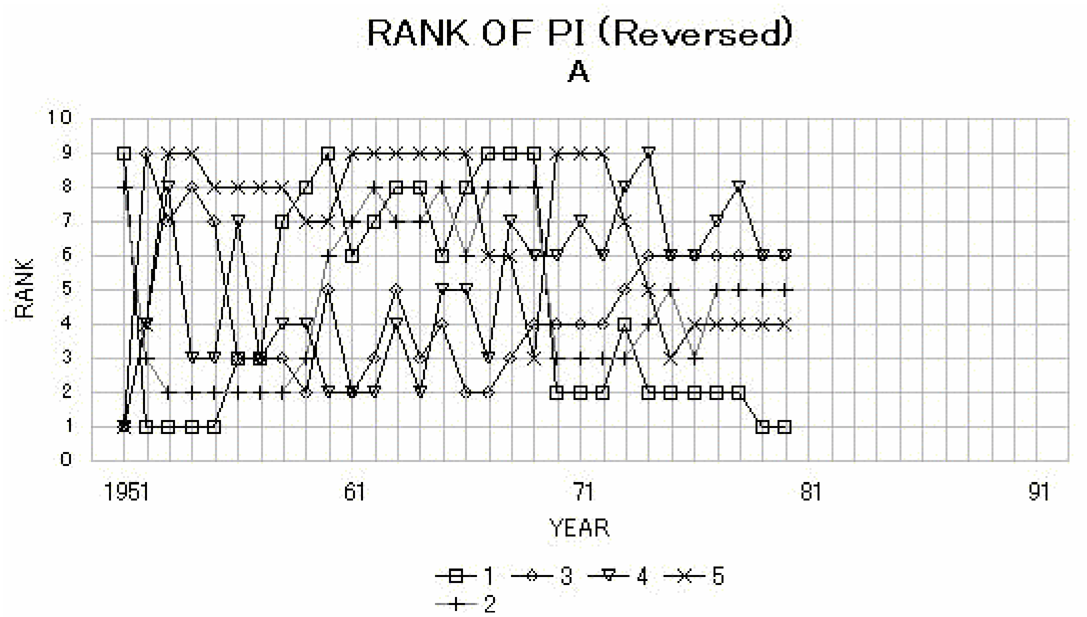
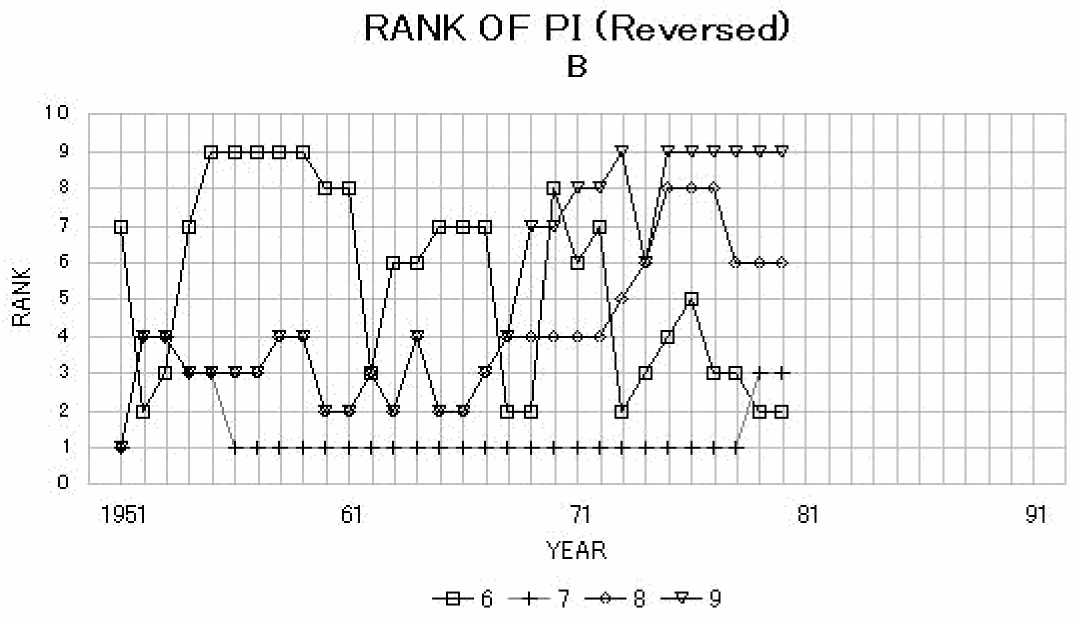

RANK OF PI (Reversed)
A
RANK
10
9
8
7
6
5
4
3
2
1
0
1951
61
71
81
91
YEAR
1
3
4
5
2

Fig. 27


RANK OF PI (Reversed)
B
RANK
10
9
8
7
6
5
4
3
2
1
0
1951
61
71
81
91
YEAR
6
7
8
9

3 TABLES

TABLE 1

INVESTMENT THEORIES, FACTORS TAKEN INTO ACCOUNT, AND DETERMINANT FACTORS OF INVESTMENT

Name of Theory	Factors Taken into Account	Determinant Factor of Investment
Capital-Turnover Criterion	rate of capital-turnover (output-capital ratio)	rate of capital- turnover
Social Marginal Productivity (SMP) Criterion	SMP (average annual increment in national income from the marginal unit of investment), increment in capital (investment), output, external economies, balance of payment, labor cost, overhead cost, cost of materials	SMP
Reinvestment Criterion	saving from investment, productivity of labor, population	amount of saving per unit of additional capital
Time Series Criterion	period of recovery (gestation period of project), rate of capital-turnover, SMP, Reinvestment Criterion	period of recovery
Ratio of Labor to Investment Criterion	employment, investment	employment per unit of additional capital
Balanced Growth and Unbalanced Growth	balance between sectors or linkage effect	selection between the investment into leading sectors and the

TABLE 1 (Continued)

Name of Theory	Factors Taken into Account	Determinant Factor of Invesment
		investment into group of projects
Cost-Benefit Analysis	cost-benefit ratio of investment	cost-benefit ratio of investment
Theories on External Economies and Economies of Scale	external economies, economies of scale, import price, production cost	make-buy decision depending on import price and production cost
Marginal Efficiency of Capital	interest rate, return from investment, marginal efficiency of capital	interest rate
Acceleration Principle	capital-output ratio (accelerator), capital stock, output, national income, time lag of investment, capacity utilization	change in output
Neoclassical Theory	output, capital stock, labor, interest rate, revenue before tax, price of capital goods, price of output, rate of investment, wage rate, user cost of capital , taxes, replacement of capital stock, delivery lag of investment, desired capital stock,	user cost of capital

TABLE 1 (*Continued*)

Name of Theory	Factors Taken into Account	Determinant Factor of Invesment
	net worth	
Tobin's q Theory	market value of firm, replacement cost of capital, adjustment cost, capital stock, labor, output, price of output, wage rate, capital cost	q (ratio between market value of firm and replacement cost of capital)
Possibility Index (PI)	output, production capacity, capacity utilization, profitability, availability of raw materials, imports and exports, ratio between the demand and supply in the market, estimated demand	PI (ratio between the desired capacity and the actual capacity)

SOURCE: Summarized from section II.

TABLE 2

CAPACITY UTILIZATION OF SELECTED 4 SECTORS IN INDIA

Year	Sector 3 (%)	Sector 6 (%)	Sector 7 (%)	Sector 8 (%)
1951	89.8	93.5	23.6	14.3
52	93.2	79.0	50.7	18.9
53	90.2	81.0	40.5	28.2
54	98.9	94.0	44.1	29.8
55	94.6	164.7	70.4	37.2
56	86.4	105.6	64.6	41.6
57	85.7	137.9	38.8	52.9
58	86.0	183.5	42.7	55.6
59	82.0	169.4	42.6	64.9
60	90.0	115.6	49.4	62.0
61	87.0	137.7	61.5	60.1
62	88.3	86.8	63.5	46.7
63	91.0	104.6	49.6	58.0
64	90.0	115.7	50.6	59.4
65	90.5	125.7	43.0	52.4
66	88.5	146.4	17.0	40.7
67	88.5	146.4	32.8	41.2
68	80.9	80.5	22.6	27.5
69	87.6	80.8	15.6	31.1
70	82.3	111.1	20.9	31.0
71	80.7	90.7	17.6	25.7
72	79.8	107.7	7.7	45.7
73	75.9	59.6	10.7	43.9
74	72.1	57.7	23.8	73.8
75	80.3	53.1	22.6	95.5
76	87.0	72.5	9.9	114.5
77	88.1	57.4	43.8	94.5
78	87.0	57.1	40.8	58.0
79	72.2	55.1	64.8	62.1
80	69.1	59.3	61.9	82.9
81	72.0	68.2	40.7	80.3
82	73.6	69.0		79.2

TABLE 2 (*Continued*)

Year	Sector 3 (%)	Sector 6 (%)	Sector 7 (%)	Sector 8 (%)
1983		81.8		

NOTE: The number of sector is the number of 9 sectors selected.

TABLE 3

THE PI OF SELECTED 9 SECTORS IN INDIA

Year	Sector 1	Sector 2	Sector 3	Sector 4	Sector 5
1951	151.8	105.5	100.0	100.0	100.0
52	74.6	91.1	103.5	100.0	100.0
53	31.4	71.8	100.3	103.3	104.3
54	66.2	72.1	109.9	100.0	135.2
55	63.9	65.3	105.1	100.0	151.6
56	100.0	78.6	100.0	104.0	109.3
57	100.0	88.1	100.0	100.0	145.0
58	129.2	91.5	95.5	100.0	134.1
59	145.2	98.8	91.1	100.0	120.9
60	129.0	106.8	100.1	100.0	114.5
61	119.7	129.9	100.0	100.0	160.4
62	114.8	114.8	100.0	94.8	182.5
63	141.3	119.0	101.1	100.2	146.1
64	160.3	134.6	100.0	95.1	184.1
65	137.2	165.6	100.5	108.5	226.0
66	166.9	160.8	100.0	107.1	244.0
67	184.8	172.4	98.3	100.0	115.2
68	206.5	190.4	89.9	111.9	108.5
69	227.5	164.3	100.0	107.8	93.4
70	48.8	85.3	100.0	105.6	134.9
71	60.3	95.4	100.0	113.0	151.4
72	47.3	83.9	100.0	108.0	155.6
73	83.1	71.6	100.0	104.5	104.4
74	41.5	83.6	100.0	111.6	92.5
75	50.3	59.5	100.0	100.0	58.3
76	40.7	65.3	100.0	100.0	75.6
77	48.9	72.9	100.0	102.9	67.3
78	52.5	92.4	100.0	104.5	85.3
79	53.6	94.7	100.0	100.0	89.8
80	51.4	79.5	100.0	100.0	73.9
81			100.0	103.3	67.5
82			100.0	100.0	60.5
83					77.7

TABLE 3 (Continued)

Year	Sector 6	Sector 7	Sector 8	Sector 9	
1951	103.8	100.0	100.0	100.0	
52	87.8	100.0	100.0	100.0	
53	90.0	100.0	100.0	100.0	
54	104.4	100.0	100.0	100.0	
55	183.0	100.0	100.0	100.0	
56	117.3	71.8	100.0	100.0	
57	153.3	43.1	100.0	100.0	
58	203.9	47.5	100.0	100.0	
59	188.2	58.5	100.0	100.0	
60	128.5	54.8	100.0	100.0	
61	153.0	68.3	100.0	100.0	
62	100.0	70.6	100.0	100.0	
63	116.2	55.1	100.0	100.0	
64	128.5	56.2	100.0	100.0	
65	139.6	47.8	100.0	100.0	
66	162.7	18.9	100.0	100.0	
67	162.7	36.5	100.0	100.0	
68	89.4	25.1	100.0	100.0	
69	89.8	17.3	100.0	124.1	
70	123.4	23.2	100.0	121.4	
71	100.8	19.5	100.0	134.0	
72	119.7	8.6	100.0	144.7	
73	66.2	11.9	100.0	116.4	
74	64.1	26.4	100.0	100.0	
75	59.0	25.1	106.1	131.5	
76	80.6	11.0	127.2	138.7	
77	63.8	48.7	105.0	148.8	
78	63.5	45.4	100.0	163.6	
79	61.3	72.0	100.0	143.8	
80	65.9	68.8	100.0	161.0	
81	75.8	45.2	100.0	151.4	
82	76.7		100.0		
83	90.9				

NOTE: The number of sector is the code number of 9 sectors selected.

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