CHOICE OF TECHNIQUES AND CHOICE OF INDUSTRIES*

By SHIGERU ISHIKAWA**

I. *Introduction*

In the contemporary theoretical discussion on the choice of techniques and scales of productive capacity in the context of economic development, there seems to be at least two shortcomings resulting in a serious reduction of their practical usefulness: (1) as regards the production functions or their families of individual industries which constitute one of the crucial constraints of any investment decision, these discussions tend to assume those of a property which is uniform regardless of the difference in industries and which does not have universal applicability; (2) in regard to investment criteria such as the Social Marginal Productivity Criterion, or the Reinvestment Criterion, for instance, the discussions again incline to postulate uniform applicability of a single criterion regardless of the differnces between sectors with dissimilar behavioristic patterns (especially important in the latter respect is the difference of the cottage and factory sectors as will be defined shortly). This paper aims at giving empirical considerations to these two respects on the basis of experiences in Asian countries, and deriving suggestions as regards a more general approach to the problem of choice of techniques and scales.

The data used in this paper are fundamentally the following two kinds: the census of manufactures data which survey all the establishments or factories at a given point of time and the engineering data which show certain technical and economic contents of a set of alternative projects conceivable under the currently available technology. The former reflects the cumulative results of investment decisions as regards techniques and scales, which were made at various points of time in the past with various motives and then existing technological and other restricting conditions. During the passage of time, the techniques that the country would be able to borrow must have changed as the result of technological progress in advanced countries; and accordingly, the differencials between the traditional and the imported technologies must have increased. Moreover, the definition of an industry in the census data is, even when classified in great detail, inevitably a composite of a number of industries in the economics sense. It might seem, therefore, that the census data are out of use as the data for studying choice of techniques and scales at any point of time and that only the

* This paper is an enlarged version of the writer's article: "Big and Small Factories in Asian Countries" (in Japanese), *Keizai Kenkyu* Vol. 13, No. 2 (April 1962). The writer is indebted to Professors Kazushi Ohkawa, Mataji Umemura, Shozaburo Fujino, Yoshiro Matsuda, for their comments on the original version of the paper and to Mr. Konosuke Odaka for a careful correction of English of the manuscript. Part of the computations were assisted by the members of the Computation Section of the Institute of Economic Research and Mr. Zenkei Higuchi, Mrs. Chieko Nakada, for whom the writer also wishes to express appreciation. Finally, thanks are due to the Research funds for Asian Studies extended by the Ministry of Education which enabled us to collect research materials extensively and enabled me to be engaged in this study.

** Professor (*Kyōju*), Institute of Economic Research.

engineering data are suitable for this purpose. However, when the available engineering data are scarce, the census data should be relied upon for clarifying technologically restricting conditions. With the help of supplementary data obtained from other sources, various motives of investors, technological and other conditions of investments and their over-time changes may be separated out to a certain extent. In so far as this can be done, let it be noted, the census data are especially useful in exploring non-technological conditions concerning the choice of techniques or scales.

In using the census-of-manufactures data for such purposes, emphasis is placed throughout in this study upon the international and intertemporal comparisons of the patterns of size structures of establishments. Therefore, some comments are in order as regards the methods which are adopted in this study for analyzing such patterns. Size structure is measured in terms of the distribution of total employment among the different size classes of establishments, which are also measured in employment terms. While this measure of size structure seems much more appropriate than that in terms of the number of establishments, it is fraught with some defects from which the measurement in terms of the values of total product is exempt.[1] But the latter, in turn, is affected by the difficulties of international and intertemporal comparison of the prices in terms of which its values are expressed.

The choice of employment is, however, mainly due to the unavailability of statistics on the latter terms. In the process of the study, it was found beneficial, as will be described later, to employ a broad grouping of various size classes: (1) those with employment less than 20 persons and (2) those with employment 20 or more. The former size class is denoted generically as the 'cottage sector' and the latter, as the 'factory sector'.

The census of manufactures data used for this study are available altogether for eight developing countries in Asia, apart from Japan, for which time series data also exist since 1909. The census data for the U.S. and West Germany are referred to only briefly. (In a few other countries in Asia, censuses of manufactures have also been taken, but the data by size classes of establishments have not been published). However, in the census data for the above eight countries excluding Taiwan, the smallest size class of varying definition and scope, to be included in the 'cottage sector', is not covered, so that this missing class was filled in boldly by using either independent census data on small scale manufactures or labor force surveys. As regards various other limitations of the census data, the minimum of the necessary descriptions will be made at relevant places.

In contrast to the census data, the engineering data are extremely scanty as far as those in use or proved to be technically usable in the Asian context are concerned. Since, however, the choice of techniques or scales in the factory sector of underdeveloped countries is in fact the choice from the existing techniques of advanced countries and from differing scales of production in each of such techniques, it may be permissible with due reservation to rely upon such data in advanced countries. Yet, the collection of such data was quite inadequate in this study.

---

[1] This refers mainly to the fact that productivity per worker varies greatly among countries, partly due to differences in capital-labor ratios and partly to the intensiveness or quality of labor. Measurement of size structure in terms of capital assets may be better, but it also is fraught with a similar defect because of the difference in capital-labor ratio or the degree of capital utilization. See the writer's article: 'A Comparison of Size Structure in Indian and Japanese Manufacturing Industries', *This Journal*, Vol. 2, No. 2, March 1962.

In the following, some of the properties of size structures of the entire manufacturing industries and their determinants are first explored mainly on the basis of the census data (Chapter 2). Next, characteristics of size structures by industries are studied for the cottage and the factory sectors, respectively, also by relying upon the census data (Chapter 3). Factors determining the size patterns are investigated from various respects. A few engineering data are used for exploring the technological factors (Chapter 4). Finally, as concluding remarks, some suggestions for the approach to the choice of techniques and scales are made (Chapter 5).

II. *The Size Structure of Entire Manufacturing Industries and Its Determinants*

As a first step of the study, a cross-country investigation of the size structures of whole manufacturing industries was attempted on the basis of Table 1, which was prepared from censuses of manufactures and other similar data of eight Asian countries.[2] Size of establishment is shown in six common classes by the number of employment of: (i) size class with employment less than 20 persons, (ii) with 20–49 persons, (iii) with 50–99 persons, (iv) with 100–499 persons, (v) with 500–999 persons and (vi) with 1000 or more persons. As mentioned above, the size (i) is called in this study the 'cottage sector'. When a broader grouping for the 'factory sector' becomes necessary, the size (ii) is denoted as the 'small' size class; the sizes (iii) and (iv) as the 'medium' size class and the sizes (v) and (vi) as the 'big' size class.

Looking at the table, it is easily found that the ratio of total employment in the cottage sector to that of the whole manufacturing industries, abbreviated as the 'cottage ratio', is very large in Pakistan, India and Ceylon; it becomes, however, smaller when one moves to other countries in Asia at seemingly higher stages of economic progress. Intertemporal changes in the same ratio of a few countries also suggest a similar tendency.

It seems from these findings that the investigation of size structure of the factory sector can be more effectively done by calculating the weight of each size class simply as the percentage ratio of the number of employment in the respective class to that of the entire factory sector. However, even from such indicators of size structure in this sector, a common size pattern is not as clear as in the cottage sector. As regards the relative weight of the size class with employment 1000 or more persons, the writer's previous study on the comparative size structures between Japan and India indicated that this weight is much larger in India than in Japan in any period for which the census of manufactures are available.[3] When the scope of comparison is extended to cover other countries, however, this Indian characteristics can be observed only in Pakistan. Replacing this size class by the 'big' size class as defined above, these observations still hold if, however, the weight of this class in Japan for 1909 is ignored. As regards the small and medium size classes, we concluded previously that the Japanese size structure is characterized, when compared to that in India, by the fact that industries tend to grow to these size classes. This same conclusion may also apply to Taiwan, Hong Kong, South Korea and the Philippines.

[2] There are a number of statistical problems involved in preparing this table, especially as regards the reliability of its estimated parts. The procedures and comments on these were omitted due to the space limitation.

[3] S. Ishikawa, 'A Comparison of Size Structure...', *op. cit.*

TABLE 1. SIZE STRUCTURE OF MANUFACTURING INDUSTRIES IN ASIAN COUNTRIES BY SIX SIZE CLASSES

	(1) Total number of workers(employees) in whole manufacturing industries ('000)	(2) Ratio of workers (employees) in size class of less than 20 employees to (1) (%)	(3) Total number of workers (employees) in size class of 20 or more employees ('000)	(4) Percentage ratios of number of workers in respective size classes to (3) (%)				
				20~ 49	50~100	100~499	500~999	1000~
A. In terms of workers								
1. India (1954)	*4,145*	64.2	*2,663*	10.2	10.7	21.0	9.7	48.4
2. Ceylon (1952)	*143*	70.4	*42*	12.8	15.0		72.2	
3. Philippines (1956)	*411*	63.6	*149*					
(1957)	*411*	58.4	*171*	21.5	13.7	31.6	33.2	
4. Korea, South (1957)			*172*	30.5	19.4	32.1	6.4	11.6
(1963)			*282*	22.0	16.4	29.9	31.7	
5. Taiwan (1961)	*328*	44.0	*184*	21.7	12.2	33.8	17.1	15.1
6. Hong Kong (1960)	*229*	8.0	*199*	15.7	13.8	43.7	11.8	15.0
7. Japan (1909)			*607*	26.5	16.1	29.8	9.2	18.4
(1919)			*1,266*	20.2	13.4	28.4	11.0	27.0
(1935)			*2,361*	20.9	13.6	27.8	13.0	24.8
(1940)	*4,270*	29.6	*3,007*	19.7	10.8	23.7	11.6	34.1
(1952)	*4,150*	25.6	*3,082*	23.2	13.4	27.2	10.5	25.7
(1958)	*5,979*	23.8	*4,558*	24.4	15.4	28.1	10.2	21.8
B. In terms of Total employees								
1. India (1950-51)	*14,490*	79.5	*2,969*					
(1954)	*15,395*	78.1	*3,378*					
(1954, CMI)			(1,699)	(4.8)	(5.0)	(11.1)	(10.4)	(68.7)
(1955)	*17,550*	76.8	*3,910*					
(1955, CMI)			*(1,710)*	(4.7)	(5.1)	(11.5)	(9.9)	(68.9)
(1956)			*3.046*	10.4	11.2	21.4	10.7	46.4
(1956, CMI)			(1,886)	(4.6)	(5.1)	(11.5)	(10.1)	(68.6)
2. Pakistan (1956)			*323*	10.9	8.2	20.0	13.2	47.7
3. Ceylon (1952)	*280*	83.2	*47*	12.9	15.1		72.0	
4. Philippines (1956)	*962*	84.3	*151*					
(1957)	*1,009*	82.9	*173*	22.1	13.7	31.3	32.9	
5. Korea, R. of (1957)			*175*	31.3	19.3	31.7	6.3	11.4
(1963)								
6. Taiwan (1961)	*436*	41.7	*254*	21.3	11.8	31.8	17.8	17.3
7. Japan (1909)			*615*	27.5	16.4	28.5	9.4	18.2
(1919)			*1,501*	20.4	13.5	28.1	11.1	26.9
(1930)	*4,785*	56.1	*1,478*	19.8	14.7	33.2	14.2	18.2
(1935)			*2,805*	20.8	13.6	28.0	12.9	24.7
(1940)	*5,647*	37.3	*3,542*	19.3	10.8	24.1	11.6	34.2
(1952)	*4,803*	34.0	*3,734*	24.1	13.6	27.1	10.3	24.9
(1958)	*6,664*	30.1	*4,660*	25.0	15.4	28.2	10.0	21.3
8. (USA) (1954)	*16,126*	7.5	*14,915*	19.4		31.4	13.7	35.4

Sources: [I 1, 2, 4, 6]; [C 1, 3]; [A 1, 2]; [P 2, 3, 4, 5]; [F 1]; [K 1, 2]; [J 1, 2]; [G 1].

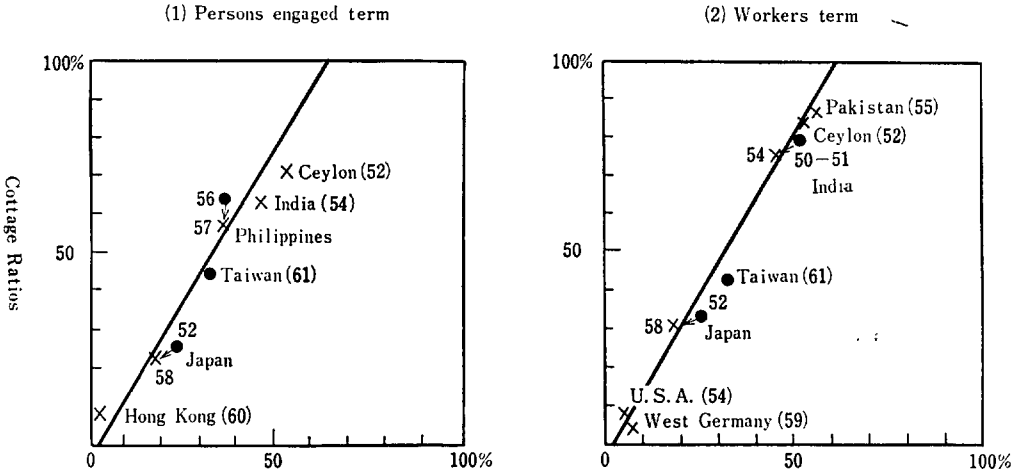
Notes: For India, CMI denotes Census of Manufacturing Industries, which covers only 28 industries out of 62 industries in the official Indian industrial classification.

Cottage Ratio and the Rate of Economic Progress

Since our ultimate aim of investigating the size pattern of establishments is to derive suggestions as regards the choice of techniques and scales, a crucial question to be raised when any observation has been made with respect to the size pattern is: What are the factors responsible for moulding such pattern? Since this chapter deals with the size pattern of manufacturing industries as a whole and this procedure is necessarily crude, we shall give some broad and rather intuitive considerations on such factors, without giving prior examinations of the general framework of the analyses.

In the case of the statistical behaviors of the 'cottage ratio', a hint for explanation was already obtained. For a more precise determination of the correlation between the 'cottage ratios' as indicated in Table 1 and the rates of economic progress of the countries concerned, a check was done by taking as an indicator of the rate of economic progress the proportion of national income originated from the primary industry. Fig 1. shows the result: a significant correlation between the two. Since a cross-country comparison is often very crude and

FIG. 1. RELATIONSHIP BETWEEN COTTAGE RATIOS AND DEGREES OF ECONOMIC PROGRESS (SELECTED ASIAN COUNTRIES)



Source: For cottage ratio Table 1; for the Primary Industry ratio, [G 2] [G 3] and [G 3-1].

Notes: National income data used for Ceylon, Taiwan are in *GDP* term; for Japan *NDP*. Regression lines fitted and their significance are expressed by

(1) $Y=-5.2906+1.2704X$, $R^2=0.7831^{**}$

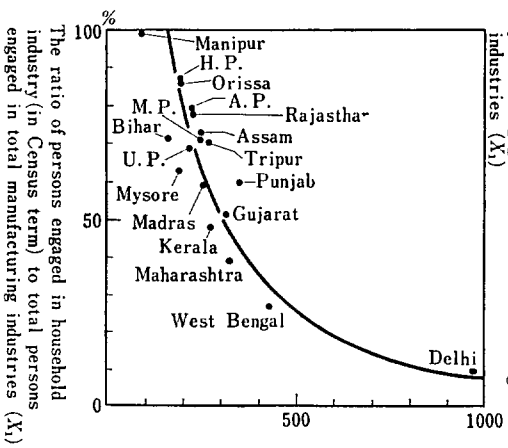
(2) $Y=-5.8794+1.6743X$, $R^2=0.9862^{**}$

especially, in this case, is based on the cottage-ratio data with a statistical weakness, a further test of the correlationship was attempted by the cross-state and cross-prefecture data in India and Japan. The results are, as shown in Fig 2, still significant.[4]

Yet, even though the 'cottage ratio' could be explained statistically by the rate of economic progress, this in itself needs an economic explanation. For this to be successfully done, an enormous volume of surveys and studies, which have so far been made in India and Japan as regards the organizational and managerial aspects of household or small-scale enterprises, should be consulted. However, a point pertinent to the question is probably that most of the enterprises in the cottage sector consist of those of households which aim not at profit-maxinization, but at obtaining (or at least supplementing) the money sufficient to meet the

FIG. 2. RELATIONSHIP BETWEEN COTTAGE RATIO AND PER CAPITA INCOME

a. India (1960-1961)



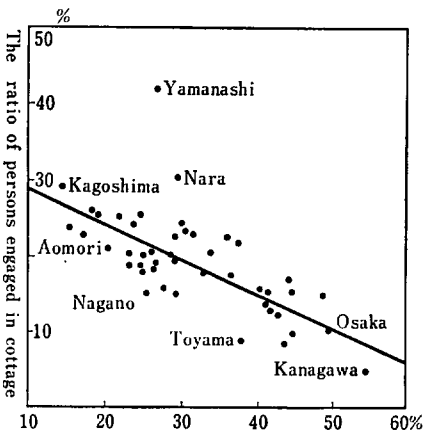
Per capita State income (X_2)

Sources: X_1—[I 11], X_2—estimated by the Indian Institute of Public Opinion as referred to in *The Eastern Economist*, March 30, 1962, p. 866.

Notes: By fitting loglinear regression equation, it was obtained that

$\log X_1 = 2.488 - 1.1287 \log X_2$, $R^2 = 0.8255^{**}$

b. Japan (1960)



The ratio of prefectural income originated from the secondary industry (X_2)

Source: X_1—[J 2], X_2—[J 6]

Notes: By fitting linear regression equation, it was obtained:

$X_1 = 33.5522 - 0.4557 X_2$, $R^2 = 0.4612^{**}$

when X_2 is represented by per capita prefectural income, the resulting equation is

$X_1 = 32.8934 - 0.1228 X_2$, $R^2 = 0.3207^{**}$

household living expenses. Consequently as the number of such household enterprises decreases with the economic progress, the 'cottage ratio' also tends to become smaller. That the nature of the household enterprise is related to sustaining family living is suggested by results of Indian national sample surveys on household enterprises as can be seen in Table 2. First, the smallness of the number of persons engaged per household and of the proportion of the hired labor should be noticed. The magnitude shown here of monthly net earnings

[4] For India, per capita state income was chosen as an indicator of the rate of economic progress. For Japan, if this indicator is used, the significance is slightly reduced, as is indicated in the notes to Fig. 1. The reason why the location of Yamanashi Prefecture is out of line is not immediately known.

from manufacturing activities per household indicates that these households in the rural areas belong to the lowest income group amounting to roughly 20 percent of all the rural households. Even in the urban areas, where the situation might seem brighter, such enterprising households earn the average income which is only slightly over what is called in India a poverty line—the monthly income of Rs. 50.[5] Moreover, though these indicators represent the national average for total industries and total districts, the variations of the numerical figure are not large.

TABLE 2. INDICATORS OF CHARACTERISTICS OF HOUSEHOLD ENTERPRISES IN INDIA

	Series I. (NSS, 1955)		Series II. (NSS, 1953–55)	
	Rural	Urban	Rural	Urban
1. Number of persons engaged per household	1.19	1.85	2.1	2.2
2. Average number of working days per household per working day	1.13	1.79	—	—
3. Of it, hired mandays	0.11	0.43	—	—
4. Monthly value of output per household: Rs	31.13	180.60	37.3	236.4
5. Monthly net earnings per household: Rs	11.43	65.74	15.2	73.5
6. Monthly hired labor charges per household: Rs	1.47	12.29	2.8	21.6

Source: [I 6], [I 5–2]

Notes: Series I refers to household enterprises smaller than registered factories (enterprises employing less than 10 persons with power, or 20 without) as surveyed by Eighth Round National Sample Survey and Series II, household enterprises smaller than those covered by Industries (Development and Regulations) Act 1951 (enterprises employing less than 50 persons with power or 100 without) as surveyed by Ninth Round NSS. Net earnings are defined as value added *less* rent, interest and levies; it includes hired labor charges and depreciation. One rupee equals US $0.21 in official exchange rate.

TABLE 3. DISTRIBUTION OF EMPLOYMENT IN MANUFACTURING INDUSTRIES BY TYPE OF ENTERPRISES (INDIA, 1955)

('000 person engaged)

	In rural areas	In urban areas	Total
1. Employing less than 10 with power, or 20 without, using mainly household labor	8,068	2,821	10,889
2. Employing less than 10 with power, or 20 without, using mainly hired labor	833	897	1,730
3. Employing 10–49 with power, or 20–99 without	197	298	495
4. Employing 50 or more with power, or 100 or more without	1,438	1,650	3,088
5. Total	10,536	5,666	16,202

Source: P. N. Dhar and H. F. Lydall, *The Role of Small Enterprises in Indian Economic Development*, Asia Publishing House, 1961, p. 3 (cited as special tabulation made for the Planning Commission from employment data collected in the Ninth Round of the National Sample Survey, May-Nov. 1955).

[5] These evaluations are based on those data on percentage distribution of the population by monthly household expenditure processed from results of NSS 13th Round. See "Inequalities of Personal Income in the Indian Union", *Eastern Economist*, March 30, 1962.

Next, Table 3 will give an idea on the numerical magnitude that such household enterprises occupy in the cottage sector: if it may be assumed that the sum of lines (1) and (2) corresponds to the cottage sector, the household enterprises accounts for 90% of the cottage-sector employment in the rural areas, and 76% in the urban areas.

As another explanation of why the cottage ratio and the rate of economic progress are correlated, it may be argued that the cottage sector is protected by a form of market imperfections, namely the localization of the product market, the extent of which, in turn, is a function of economic progress. This argument may further be strengthened by an observation that the products manufactured in the cottage sector are generally heterogeneous from those in the factory sector, *e.g.*, *gur* (native sugar), *bidi* (native cigarretes) and handwoven *sary* in India; they are protected by the taste of local people still largely ignorant of or unaccustomed to the mill-made products.[6]

In contrast to the previous explanation which placed emphasis on the difference in organizational principles, this may be deemed as focussing on the relative strength of competitive positions between the cottage and the factory sectors, and in this sense these two explanations are not mutually exclusive. However, as for the relative importance of these two explanations, the first seems to be greater at least in the experience of Japan in recent years. In Fig. 5 (p. 27), over-time changes in the cottage ratios for Japan are shown by separating them into those of the size classes with 1–9 and 10–29 persons. It shows clearly that the relative weight of the former size class decreased with the progress of the economy, while that of the latter increased. Although this seems to be consistent with the former explanation, it may be not with the latter, since the latter explanation in terms of the localization of market should be applicable not only to the household enterprises but also to the other small-scale enterprises in the cottage as well as in the factory sectors. And while the cottage sector may be more appropriatelly represented by the size class with 1–9 persons, that with 10–29 persons includes the smallest

---

[6] This market localization hypothesis yields as its corollary a hypothesis that in the economy with a relatively high rate of growth (especially due to the faster growth of agriculture), the cottage ratio is also high, compared with the economy in the same stage of economic progress but with the rate of growth lower. This is because of the fact that, given the difficulties for the factory products to intrude into the local markets as well as the length of time required for the factory sector to expand its productive capacity, the magnitude of benefit accruing from the increase in demand is the larger for the cottage sector, the higher is the rate of economic growth. However, the writer's attempt at testing this hypothesis has not so far yielded significant results. For this attempt, the rate of growth of the per-capita state or prefectural income (or gross agricultural income) was added as another explanatory variable to the regression equations, which are described in the notes to Fig. 2. Using the same notations as before, and denoting further the rates of growth in such incomes as X_3 (total income) or X_4 (gross agricultural income), the following equations are obtained:

India (X_3 is taken from the same source as X_2: the rate of growth between 1955–56 and 1960–61)

$$\log X_1 = 2.6141 - 1.2251 \log X_2 + 0.1098 \log X_3 \qquad R^2 = 0.8366$$
$$(0.3389)\ (0.1614)\qquad (0.1095)\qquad S^2 = 0.0109$$

Japan (X_3 is taken from [J 6]; the growth rate between 1955 and 1960. X_4 is taken from Ministry of Agriculture and Forestry, *Report on the Farm Economic Survey 1957* and *1960*, Tokyo, 1959 and 1962; the growth rate between 1957 and 1960)

$$X_1 = 31.6720 - 0.4489 X_2 + 0.0093 X_3 \qquad R^2 = 0.3999$$
$$(7.2893)\ (0.1248)\quad (0.0583)$$
$$X_1 = 33.1661 - 0.4550 X_2 + 0.0031 X_4 \qquad R^2 = 0.4612$$
$$(9.1042)\ (0.0770)\quad (0.0707)$$

size class of the factory sector. On the other hand, however, it may be contended that since Fig 5 shows the economic behaviors of Japan in recent years where the formation of the national economy is nearly complete, the same behaviors do not apply to such underdeveloped economies as India, and here even the relative weight of the latter size class may decrease with the delocalization of market accompanying with the economic progress. This is a problem yet to be determined.

Electrification and its Impact upon the Factory Sector

Since the investigation of size classes in the factory sector does not yield distinct, common patterns at the level of whole manufacturing industries, it might seem that there is no need at this stage to explore some of the common determinants of size patterns in this sector. However, the writer attempted an investigation of the impact of the spread in the use of electricity upon the size patterns in this sector, mainly by a suggestion obtained from Professor M. Shinohara's survey on the Japanese literature as regards small industry.[7] Although the investigation has yet been inconclusive, some remarks seem to be worth-while making.

According to Shinohara's survey, there was no practice before 1910 (in other word, in the Meiji period) of using the term 'small-medium enterprises' which is now so popular in Japan; there was only the term 'small industry' or 'indigenous industry' as contrasted to 'big' or 'mechanized' industry; the word 'small-medium enterprises' made its appearance from the end of the Meiji period to the World Depression of 1930's. This is said to be partly because of the fact that during the period these small enterprises underwent a fairly widespread mechanization and many of them advanced themselves into the class of medium industry. In

TABLE 4. THE RATIO OF THE NUMBER OF ESTABLISHMENTS USING POWER TO THE TOTAL NUMBER OF ESTABLISHMENTS

Size classes of establishment by the number of employees	Japan				India 1954	Taiwan[4] 1961
	1909	1914	1919	1929		
1～ 3(4)	n.a.	n.a.	n.a.	n.a.		34.4
4(5)～ 9	14.5	29.0	46.1	74.8	3.0[5]	38.2
10～ 19[1]	30.4	49.2	65.2	86.2		89.7
20～ 49[2]	64.1	76.1	85.7	93.2	79.2	93.9
50～ 99	78.2	87.8	92.8	96.8	77.9	94.6
100～499	87.1	93.9	97.2	98.8	82.9	99.0
500～999	95.1	96.9	100.0	99.7	90.0	100.0
1000～	100.0	97.6	100.0	100.0	98.8	100.0
total	28.3[3]	46.0[3]	61.3[3]	81.5[3]	3.1	44.4

Sources: [J 2], [I 1, I5-1, I5-2, I5-3], [F 1]

Notes: 1) For Japan, the size class is 10～29, 2) For Japan, 30～49, 3) Total excluding 1～4 class. 4) Original figures are given in terms of the number of firms. 5) Indirectly calculated by the writer on the basis of information given in the above sources. Especially important among such information is the one given in [I5-3] p. 6, which states that, of the household enterprises employing less than fifty persons (when use of power; in case of not using power less than 100), roughly 1% uses power in rural areas and about 3% in urban areas.

[7] Miyohei Shinohara, *Survey of Japanese Literature on the Small Industry, with Selected Bibliography*, Tokyo 1964 (mimeographed).

TABLE 5. PER CAPITA ELECTRICITY PRODUCTION OF SELECTED ASIAN COUNTRIES

(unit: KWH)

Country	Year	Per capita production	Country	Year	Per capita production
Burma	1959	17.8	Indonesia	1959	11.9
Ceylon	1959	27.9	Japan	1959	1,068.6
M. China	1959	62.0		1937	372.9
Taiwan	1959	329.8		1929	211.5
Malaya	1959	137.0		1919	63.8
Hong Kong	1959	319.2		1914	28.0
India	1959	43.8		1909	5.5

Source: For the figures of 1959, [G 7]; for historical series of Japan, total electricity production is from Ryoshin Minami; *Provisional Estimates of Indexes of Electricity Rates (1907–1960)*, Rockefeller Project Series, IER, Hitotsubashi University, 1962 (Mimeographed) and total population from [J 8].

order to check these observations, the writer has prepared Tables 4 and 5. As it is evident from the former table, the relative weight of those establishments using power rapidly increased in the smaller size classes during 1909 to 1929. In parallel with this the spread of the use of electricity is observed in the latter table as especially rapid during this period. While the census of manufactures is not available for the period before 1909, such spread of motive power and especially of electricity may have resulted in a shift in the size pattern of the factory sector, so that the small and medium size classes became relatively more important as we have already seen in Table 1. And, to be more important, the fact that for some countries such as India and Pakistan, the small and medium sizes of the factory sector is relatively few may possibly be explained by the backwardness in their uses. Logically, these hypotheses possess an aspect of truth, since the spread of motive power and especially of relatively cheap electricity is likely to strengthen the competitive power of the small and medium size classes as against the big one.

From the columns of India and Taiwan appeared in Tables 4 and 5, it will be observed that the spread of motive power and electricity in contemporary India is in a similar stage to that in Japan around the period 1909 to 1914; and in Taiwan in a similar stage to Japan in the early 1930's. It might seem then that the relative thinness and thickness of the small and medium size classes in the two countries are related to the spread of motive power and electricity. However, the relationship between the two variables is to be studied further. And as far as it was investigated by the cross-state or cross-prefecture data of India and Japan (for 1909, 1914 and 1919), no correlation has so far been found.[8]

[8] At this stage of the writer's study, the poor result seems to be explained by the difficulty to find statistical indexes reflecting the spread of electricity and motive power appropriately. However, this may be due to the shortcomings of the hypothesis. Thus, for instance, in one of the writer's studies related to this hypothesis, he found that indexes of the spread of electricity appeared to be correlated more closely with the number of employment per thousands of population in the medium size establishments rather than with the ratio of employment in the medium size establishments in the total factory sector employment, as far as Indian and Japanese data (1909–1919) are used. And the similar correlation seems to exist even for the big size class in case of India.

III. *Size Structure by Industries*

On the basis of the finding in the last chapter that the behavior and its determinants of size structure in manufacturing industries are quite likely to differ between the cottage and the factory sectors, investigations of size structures by industrial branches will be made separately for these two sectors in this chapter and in the following one.

Cottage Sector

First, the properties of size structures in the cottage sector were investigated in terms simply of the 'cottage ratio' by industry, and of the ratio of the number of employment in each respective industry within the cottage sector to the whole employment of that sector (the latter ratio is hereafter called the 'component ratio of cottage sector' by industrial branch). While the data for making such analysis on the basis of international comparison are much more limited than in our previous discussion (e.g., Table 1), Tables 6 and Figures 3 and 4 were constructed for these two ratios.[9] From these it is observed that:

(1) The ranking of industries in terms of the 'component ratios of cottage sector' seems to be fairly similar among the Asian countries, if the grouping of industries are made as done in Table 6. This grouping followed in fact the one used in an Indian national sample survey on the household enterprise smaller than the registered factories; this survey was made

TABLE 6. COMPONENT RATIOS OF COTTAGE SECTOR BY MAJOR INDUSTRIAL GROUPS (SELECTED ASIAN COUNTRIES)

%

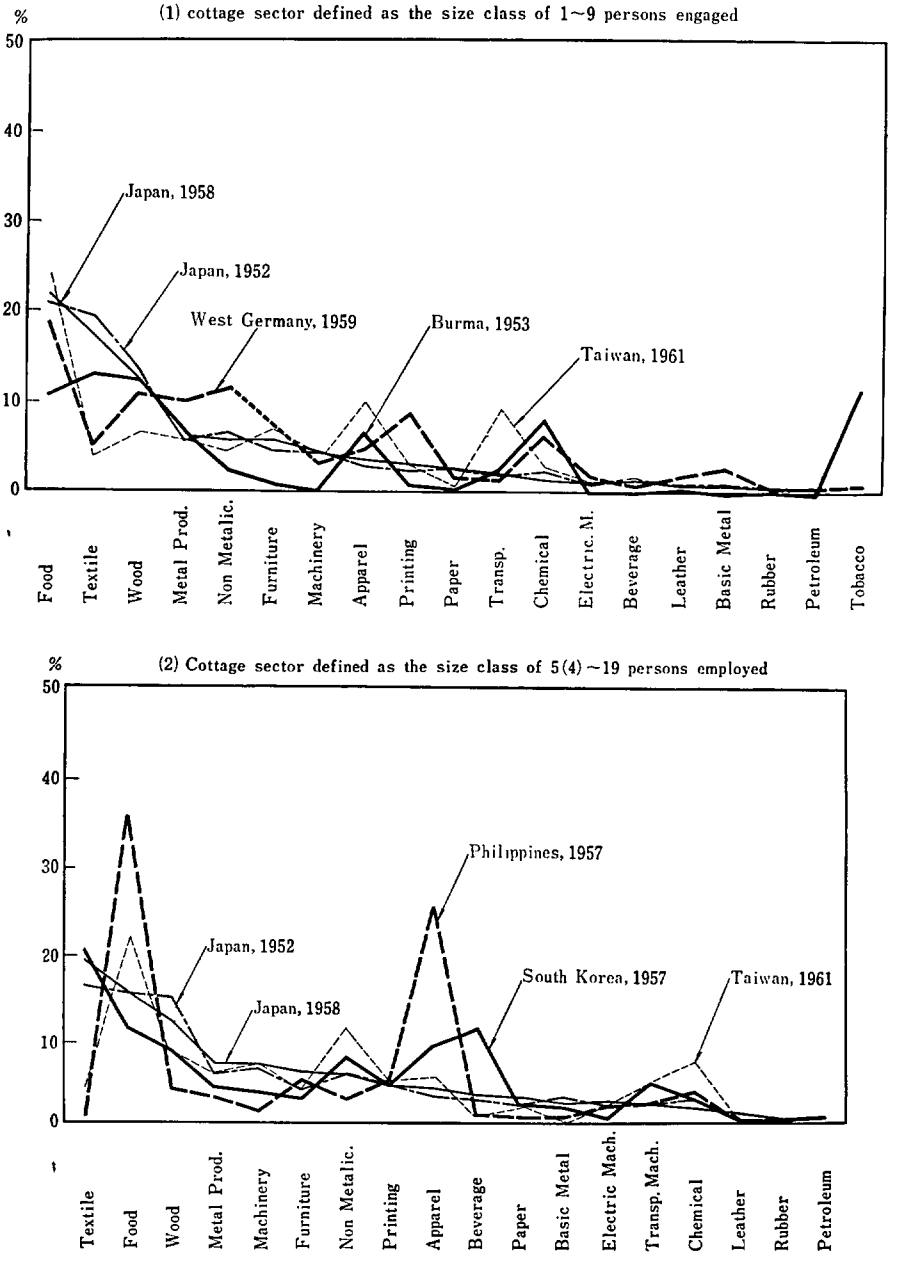
	India 1955 (1~20, household)[1]	Ceylon 1952 (5~10)	Philippines 1957 (5~20)	Burma 1952 (1~9, urban)	Korea, South 1957 (5~9)	Taiwan 1961 (1~20)	Japan 1958 (1~20)	West Germany 1959 (1~9)
1. Food, beverage & Tabacco, (20, 21, 22)[2]	37.55	35.51	37.15	22.44	23.69	42.79	32.85	19.66
2. Textile (23)	24.10	6.76	0.88	13.08	17.44	4.99	16.92	5.78
3. Tailoring, shoes & leather (24, 29)	8.98	n.a.	25.86	7.10	10.94	12.01	25.79	2.06
4. Wood, glass and ceramics (25, 26, 33)	21.94	12.15	9.23	16.17	19.51	16.44	33.42	24.44
5. Metal and its product (34, 35)	6.04	n.a.	3.64	6.62	4.87	7.93	10.34	11.47
6. Chemicals (31)	0.30	5.60	3.41	8.07	1.77	6.45	4.57	6.31
7. Other industries (27, 28, 30, 32, 36, 37, 38, 39)	9.28	39.95	19.80	26.48	21.75	17.29	21.97	30.23
8. All industries	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Notes: 1) Establishments employing less than 10 persons when using power, but less than 20 when not using power. Non household enterprises such as cooperatives, joint stock companies or public bodies were also left out. 2) ISIC 1-digit number.

Sources: same as those in Table 1.

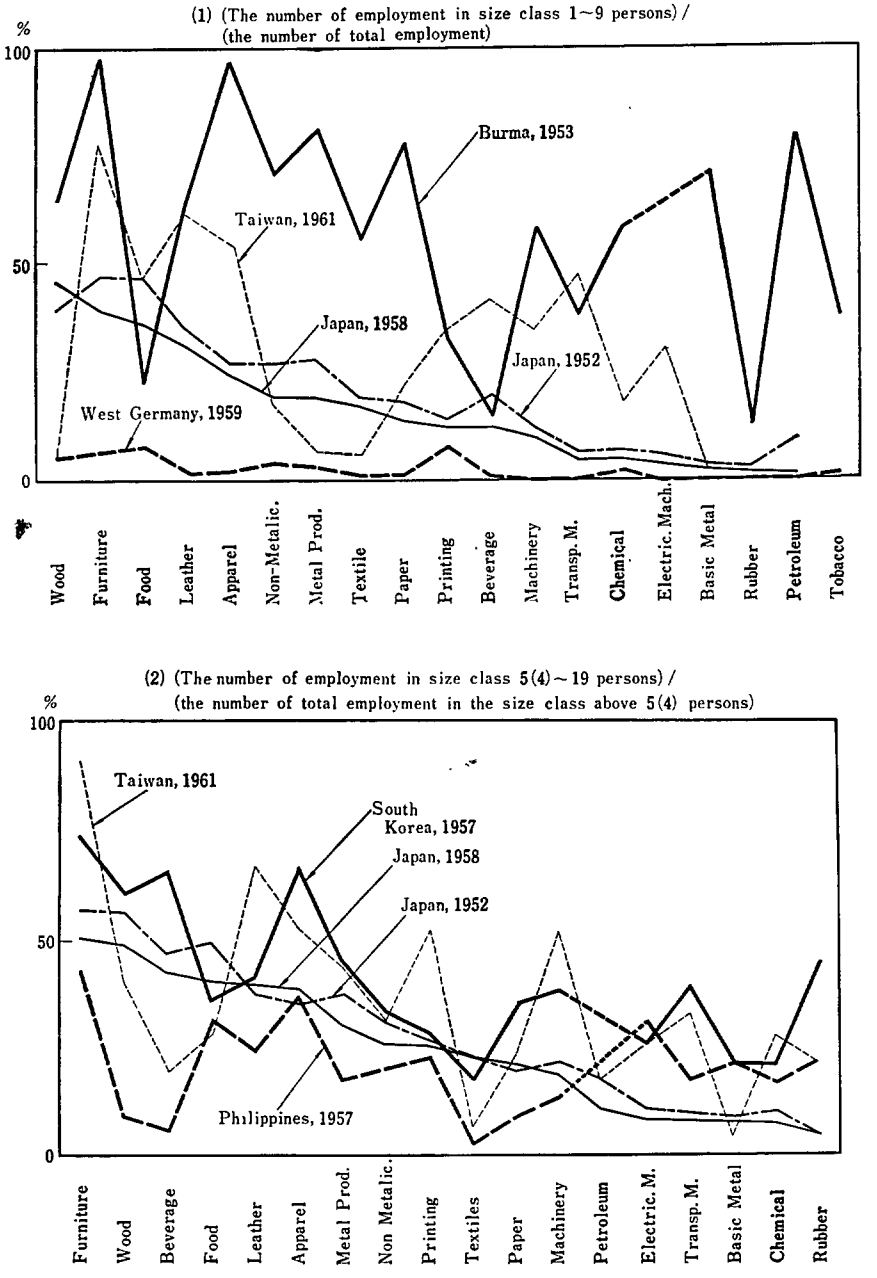
[9] Attention should be paid to the fact that, for many countries, the data for whole range of the cottage sector are not available; as a result the comparability problems remain. As regards the figures of Burma, it should be noted that the coverage of areas is limited to those where the government effectively controlled in the period of civil warfare.

FIG. 3. COMPONENT RATIOS OF COTTAGE SECTOR BY ISIC 2-DIGIT INDUSTRIES



Sources: the same as in Table 1.

FIG. 4. COTTAGE RATIOS OF ISIC 2-DIGIT INDUSTRIES



Sources: the same as in Table 1.

for the purpose of identifying major industrial branches into which these enterprises tend to concentrate. There remains some ambiguity, however, in the statistical correspondence of this grouping to the 2-digit grouping in the UN's *International Standard Industrial Classification* (ISIC). The table, however, seems to suggest that in most Asian countries including Japan, major industries in the cottage sector are all common; namely, first, the food and related industries, secondly, the clothing and related industries and, thirdly, the housing material and related industries. The weights of industries of other categories, mostly producers' or capital goods categories, are relatively small. When the grouping of industries is made in greater detail, such similarity among countries of the "component ratios of cottage sector" is reduced. But a broad similarity appears to be observed even in Fig. 3, where the grouping industries are made by the 2-digit industrial classification in ISIC and where the order of industries is arranged according to the ranking of the ratio in Japan 1958.

(2) As regards the ranking of the 'cottage ratios' among industries, the irregularity among countries prevails. In Fig. 4 showing the cottage ratios of ISIC 2-Digit industries, however, some broad patterns may be observed: first, the cottage ratios are generally higher in the food, clothing, housing material and related industries and lower in the producers' and capital goods industries, and second, the differentials between the cottage ratios among these industrial groups are in general larger in the less developed countries than in more developed countries. Exceptions to these rules appear to be largely explained by specific importance in imports or exports of the commodities concerned in such irregular cases.

For the purpose of checking the relevance of these findings from cross-country analyses in terms of over-time tendencies, time-series data for Japan were investigated and in generally good results were obtained. Here only one of the results is presented in Fig. 5, showing the over-time changes of cottage ratios by industry for the period for which census data are available for the size classes indicated. From this it will become clear that in the industries of consumer goods category, the ratios are higher in earlier years but their rate of decline rapid while in the industries of producers' and capital goods categories, the reverse is the case. This observation holds with much more strength, if the focuss is placed on the size class with employment of 1-9 persons.

Factory sector

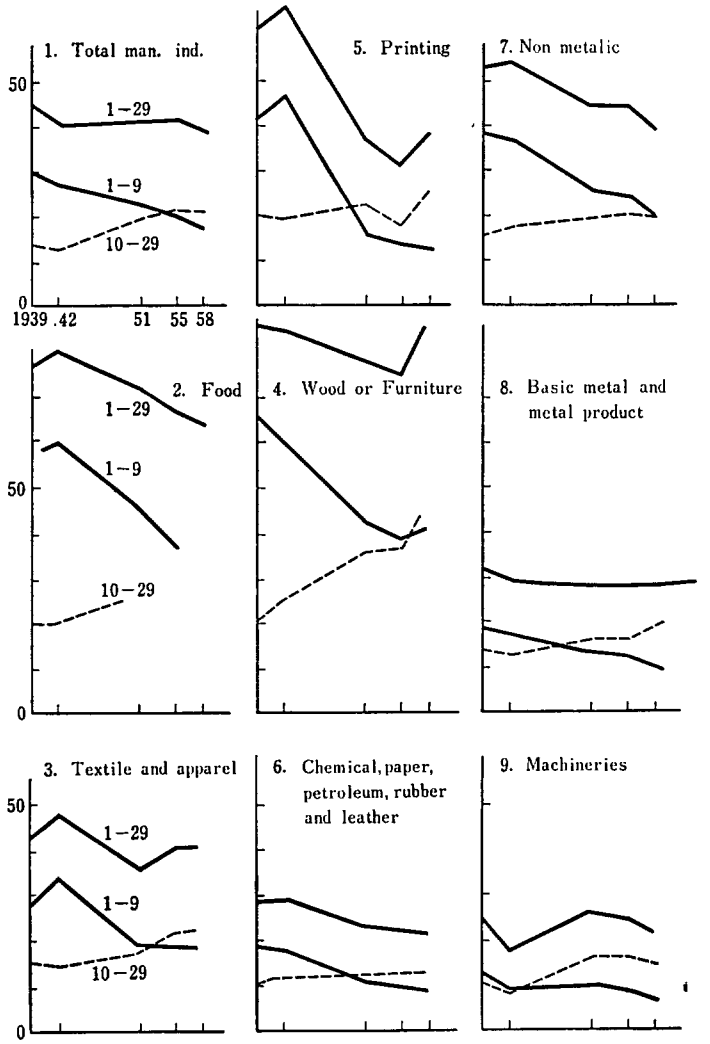
Investigations of size structures by industries in this sector are made in terms of, *firstly*, whether, in each country with available census of manufactures data, a modal size with a significant industrial concentration is observable, and, *secondly*, the extent to which the modal size, when observable, coincides or differs among the countries concerned. Before describing the results, however, an elaboration of the working rules adopted is in order.

(1) For observing the modal size, a special method which is suggested by Professor Steindle was used:[10] in order to overcome a difficulty arising from the arbitrariness of size grouping in the census data, the number of persons engaged in any size class is discounted by the ratio of (the logarithmic value 0.30103)÷(the logarithmic value of that size range), and the size class with the largest number of persons, thus calculated, is considered as the modal size.[11]

[10] Joseph Steindle, *Small and Big Business* Oxford Univ. Press 1947.

[11] When dealing with the largest size class in the census data, Steindle simply ignored it. In this study, however, we assumed that the establishments in this class are distributed within a hypothetical range calculated by doubling the average per establishment size in employment term.

FIG. 5. OVER TIME CHANGES IN COTTAGE RATIOS
(Japan, 1939–1958)



Source: [J 2]
Notes: Cottage sector refers in this table to the establishments with employment up to 29 persons.

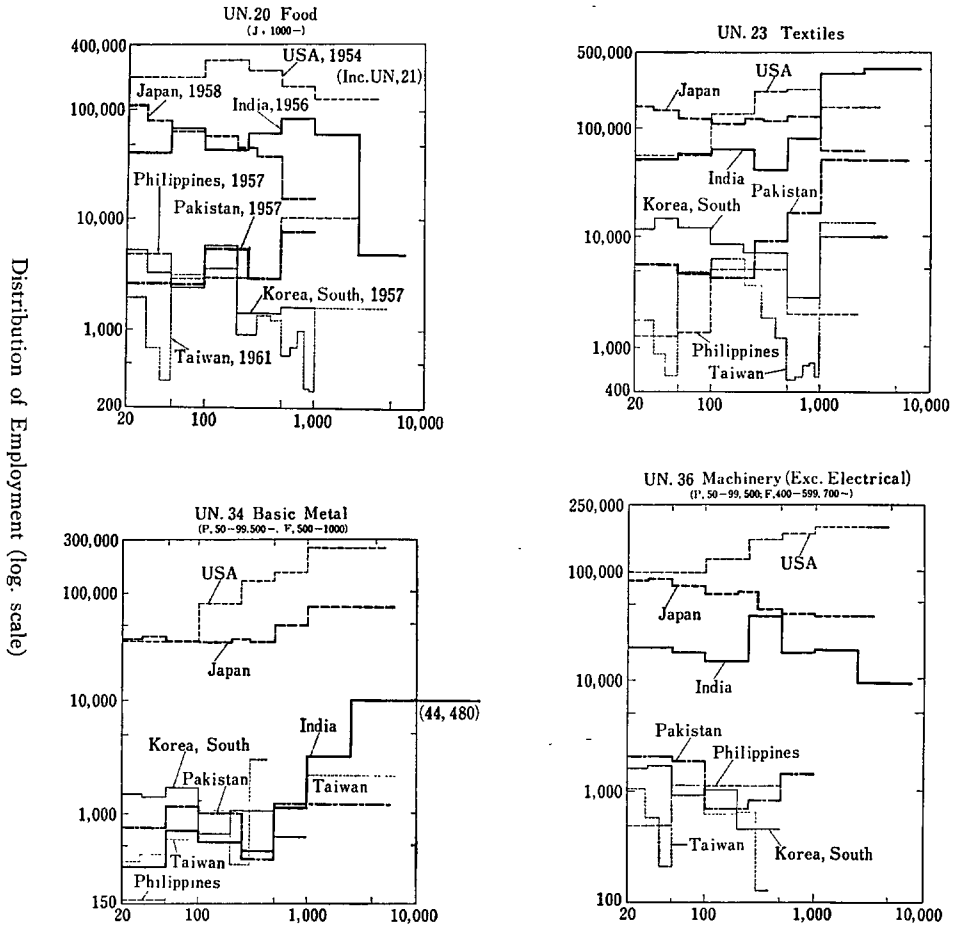
(2) For assessing the degree of concentration of persons engaged into the modal size, an interquatile range was used; when an interquartile range is less than 0.60206 logarithmically, and the bi-modal size, even if it does exist, is not substantial, the concentration is considered high.

(3) International comparison of size pattern is made by classifying various size classes into the three major classes: small (20–49), medium (50–499) and large (500–). Specifically,

when the modal size with a fairy high concentration is found in the same major class in both India and Japan, this industry is designated as having a "prevailing size".[12]

For the purpose of illustrating the first step of this investigation, Fig. 6 is drawn. It compares size structures of five Asian countries as well as the U.S. as regards four 2-digit

FIG. 6. COMPARISONS OF SIZE STRUCTURES OF FACTORY SECTOR BY SELECTED INDUSTRIES (SIX ASIAN COUNTRIES AND THE U.S.)



Sources: [I 2] [A 2] [P 3] [K 2] [F 1] [J 2] [G 6]

Notes: Size classes shown in the brackets under the title of each diagram indicate either the lacking intermediate classes (Taiwan) or that the figures for those classes are hidden in the census publication (Philippines).

[12] The name "prevailing size" was borrowed from Professor P. Sargant Florence in his *The Logic of British and American Industry* (Revised edition), London, 1961, pp. 22–3, though the definition and the method of measurement are not exactly identical with his.

manufacturing industries of ISIC. Size classes and distribution of persons engaged are indicated by the rule (1) above. By carefully looking at the diagram, the comparative size patterns of these industries will be broadly understood. However, more precise descriptions of those are made in Table 7, together with those of other fourteen 2-digit manufacturing industries. From this we observe that:

(1) For seven industries listed in lines I, II and III, identical modal sizes exist between India and Japan, even though "prevailing sizes" are difficult to observe. If the rule for comparison is relaxed a little bit, printing, apparel, machinery, and petroleum may also be included in the industries of this category. Of the remaining six industries in IV, the Indian size patterns are generally deviated toward bigger sizes.

(2) As compared with India and Japan, the size patterns in Pakistan, the Philippines, Taiwan and South Korea with respect to the industries in I, II and III are generally lopsided toward the smaller sizes. For the industries in IV, however, the size patterns in these countries are, like those of India, deviated rather toward bigger sizes than those of Japan. An exception is South Korea, which shows in general similar patterns to Japan.[13]

(3) Contrary to these four countries, the modal sizes in the U.S. of the industries in I, II and III are observed to be much bigger than those of India and Japan. This appears to apply even to the size patterns in the industries in IV; but in this group low concentrations or dispersions of employment are in general observed in a similar way as in the other countries in Asia.

Since, however, each respective 2-digit industry are considered as a composite of many industries manufacturing broadly similar but actually heterogeneous products, it is quite possible that the size pattern of an industry, defined in a more rigid sense, becomes obscure. Lest we should be misled by such shortcomings, further investigations were done as regards 30 3-digit industries, the selection of which was, however, conditioned by the availability of data in the Indian censuses. Although these industries are still composites of heterogeneous industries, exemplified by the cases of the sugar industry as a composite of traditional *gur*-making and modern sugar-refining and of the ship-building industry as a composite of wooden-boat building, steel-ship building industry as well as repairing of boats and ships, these are perhaps the industry data in the most disaggregative level in so far as censuses of manufactures are to be relied upon. Unfortunately, data for 3-digit industries are available only for Taiwan, South Korea as well as for India. Due to the spatial limitation, tabular descriptions of the investigation are omitted, except for Table 8 which attempts a comparison of Japanese and Indian size patterns. However, together with certain other sets of comparisons, one may observe that:

(1) As compared with the previous comparisons, relatively more cases of identical size patterns can be found; among these, ten industries listed in A a I, A a II and A a III have "prevailing sizes".

(2) If the three broad grouping of the size classes, which we have arbitrarily chosen for determining whether there exists an identical size class, is revised to allow for a more detailed grouping, Indian patterns are generally lopsided to larger size classes, as is the case in 2-digit industries. Together with industries of varying sizes, only four industries are observed where the Indian patterns are leaned toward smaller size classes; namely, wheat flour, hosiery,

[13] The check of the 1963 Census of Manufactures may yield a different result, as is suggested by a comparison of overall size structures of total manufacturing industries in 1957 and 1963 as shown in Table 1. The writer has not yet done it.

TABLE 7. SIZE PATTERNS OF 19 INDUSTRIES OF 2-DIGIT IN UN'S ISIC. (SIX ASIAN COUNTRIES AND THE U.S.)

Size pattern as observed in India and Japan		Size pattern of industries as shown in (2) in A, P, K, F		Similarity of the US pattern to (1)
Size pattern (1)	Industries (2)	Similar to (1) (3)	Different from (1) (4)	(5)
I Mod. in big	Basic metal (J: low con., I: bi-mod in Med.)	A (low con.), F (low con.)	P K (mod. in med.)	Similar (high con.)
	Elect. Mach. (J: low con.)		A, F (mod. in med. low con.) P, K (mod. in small)	Similar (high con.)
	Rubber (J I: bi-mod in medium)	K	A, P, F (mod. in medium)	Similar (high con.)
	Tramp. Mach. (I: bi-mod. in medium)	F (low con. bi-mod. in small med.)	A, P (mod. in medium) K (mod. in small)	Similar (high con.)
II Mod. in medium	Nonmetalic Mineral (J I: low con.)	K F (low con.)	A, P (mod. in big, but low con.)	Similar (low con.)
III Mod. in small	Wood	P (low con.) K	A, F (low con.)	Dissim. (mod. in med.)
	Furniture (lack of big)	P, K, A (low con.)	K (lack of size, 100)	Dissim. (mod. in med.)
	Leather (lack of big)		A, K, F (lack of big)	Dissim. (mod. in med.)
IV Differing mod.	Textile (I: mod. in big, J: disp.)	A (mod. in big) P (mod. in med.) F (mod. in big, bi-mod. in med.) K (mod. in small, bi-mod. in big)		Mod. in big, low con.
	Paper (same as above)	A (mod. in big) P & F (mod. in med.) K (mod. in small)		Mod. in med., low con.
	Metal product (I: disp., J: mod. in med.)	A, F, K (mod. in med.) P (mod. in med., lack of size, 100~)		Mod. in big, low con.
	Food (I: disp., J: mod in small)	A, P, F & K (disp.)		Mod. in med., low con.
	Beverage (I: mod. in med., J: mod. in small, bi-mod. in med.)	A & F (mod. in med.) P (mod. in big, low con.) K (mod. in small)		Disp.
	Apparel (I: mod. in small, bi-mod. in big, J: mod. in small)	A (mod. in big, bi-mod. in small) P & K (mod. in small) F (mod. in med.)		Disp.
	Chemical (I: mod. in med., J: mod. in big)	A & F (mod. in big, bi-mod. in med.) K (mod. in small)		Mod. in big
	Petroleum (I: mod. in big, disp.)	K (mod. in small) F (disp., lack of big)		Mod. in big
	Printing (I: mod. i in med., J: mod. in small)	A & P (disp.) F & K (mod. in med.)		Disp.
	Mach (I: mod. in med. low con., J: mod. in small, low con.)	A & F (disp.) K (mod. in small)		Mod. in big, low con.
V Other	Tobacco (I: mod. in in med., J: no data published)	A & P (mod. in big) F & K (no data published)		Mod. in big, low con.

Notes: Abbreviations for countries are A: Pakistan, P: the Philippines, F: Taiwan, K: South Korea, I: India and J: Japan; con.: concentration, mod.: modal size and disp.: dispersed.
Source: Same as in Table 1.

glass and tanning.

(3) As compared with the common patterns in Table 8, the South Korean pattern leans in general to smaller size classes as it did in the case of 2-digit industries; in Taiwan, however, the pattern seems to be lopsided to larger size classes than in Japan, though her census data lack several of the 30 industries concerned.

TABLE 8. SIZE PATTERNS OF 30 INDUSTRIES OF 3-DIGIT IN UN'S ISIC (JAPAN FOR 1958, INDIA FOR 1956)

Size Pattern	Industries		
	Consumer goods	Producer goods	Mixed-type goods
A. Common pattern for the two countries			
a. Industries with all size classes			
I. Concentration into big size class		Cement Cotton spinning	Woolen textile Jute textile
II. Same, but with bi-mod. in small	Sugar Soap	Iron and Steel Petrol. Refin. Shipbuilding	
III. Same, but with bi-mod. in med.			Glass
IV. Dispersed	Ceramics	Textile machines	Sewing machines Plywood and Tea-chest
b. Industries with big size class			
I. Mod. in medium class, but with bi-mod. in small class	Fruit and veget. processing*		
II. Concentration into small class	Rice milling Hosiery		
III. Mod. in small, but fairly dispersed	Cotton weaving Clothing or tailoring Tanning**		
IV. Dispersed	Textile dyeing		
B. Varying modal classes			
a. Industries with all classes	Electric lamps Bicycle		Automobile
b. Industries with big size class lacking	Tea Wheat flour Veget. oil		

Notes: * For Japan fairly dispersed.
** In Japan, the size class 500–999 exists.

(4) Upon examinations of long-term changes in the size patterns in Japan since 1909, it was found that the industries in which modal classes became larger are quite common; e.g., sugar, vegetable oil, wheat flour, soap, petroleum refinery, cemment and automobile. In some industries, on the other hand, the modal classes became smaller; among these, tea was an industry which transformed during these periods from an export industry to an industry mainly catered for the domestic market; and cotton spinning is marked by the rapid automatization after the Second World War. Industries with unchanged size patterns were iron and steel, shipbuilding and glasses.

IV. *Determinants of Size Structure by Industries*

When we considered in Chapter 2 the determinants of size patterns of the manufacturing industries as a whole, we postphoned a general consideration as regards such determinants and relied mainly upon our intuition. Before going into the investigation of this chapter, however, such consideration has to be attempted. In doing this, attention is focussed upon the size pattern of a single industry in the economics sense.

Now, let us describe the determinants of it in the form of a general summary:

A. Technological factors from the economics point of view: factors of this category should be approached especially from the following respects:
   (1) Degree of divisibility of the capital equipment in use—this is related to the problem of continuity of the production function in respect to the capital equipment.
   (2) Proportionality or disproportionality of the volumes of capital equipment, raw materials and labor to the volume of output—this is related to the problems of economies or diseconomies of large scale production.
   (3) Substitutability between labor and the capital equipment in use.
   (4) When different techniques exist for an industry, their varying properties should be assessed in terms of the above three factors.

   The smallest possible size of an establishment in an industry will be determined by the minimum volume of capital equipment conditioned by factor (1). Elements of economies of scale by factor (2) will affect the location of modal and, some times, even prevailing sizes. Factor (3) is considered to assume importance in cases where the capital equipments in a process of production consist of a set of principal and subsidiary equipments and the latter equipments may be substituted for by labor.[14] In such cases, and especially when the proportion of the subsidiary to the total equipments is large, it becomes possible that the modal size and the degree of concentration vary depending upon the relative prices of labor and capital goods.

B. Economic factors
   (1) Factors related to the input markets—the pertinent point is: (1) what are the relative prices of various inputs, which are supposedly determined by the factor proportions, provided that conditions of the perfect market prevail; (2) to what extent they are modified by market imperfections of various kinds and how factor mobilities are affected by the same imperfections.
   (2) Factors related to the product market—the size of national market and its possible localization due to market imperfection are important in this respect.
   (3) Factors related to international trade—comparative advantage or disadvantage, or the competitive position of a domestic product affects also the size structure, through its influence upon the size of demand. In this regard, the competitive position refers not only to the present one, but, perhaps to be more important in the case of deliberate economic planning, to the prospective one.

[14] We assume here that the principal equipments in the process cannot be substituted for by labor. The substitution of subsidiary equipments by labor is widely observed in the big factories in present-day underdeveloped countries. The writer once studied this problem in the Chinese context. S. Ishikawa, Choice of Techniques in Mainland China, *The Developing Economies*, Preliminary Issue No. 2, Sept.–Dec., 1962, pp. 23–56.

C. Institutional factors: the problem is whether the initiator of an investment project is a household whose aim is merely sustaining its family living, or the enterprise with object of profit-maximization, or, finally, public enterprise whose objective is governed by the national economic interests.

D. Other factors such as the endowment of natural resource and the size of the nation.

In the investigation in Chapter 2 of determinants of the size patterns of entire manufacturing industries, we have focussed our attention exclusively on a few of the above factors. Thus, in the case for the cottage sector, the institutional factors and the factor of imperfect product market were stressed; the relative spread of motive power and electricity in use, which was noted in reference to the factory sector, is related to the technological factor (3) as well as to the economic factor (1). In the studies on determinants of size structure by industry, the working and its relative merit of each respective factor were attempted, although in the following the results of the studies will be described necessarily on a selective basis.

Cottage Sector

The problems to be clarified as regards this sector are: (1) why the ranking of industries in terms of 'component ratios of cottage sector' is fairly similar among the countries so that the ratios are higher in the consumer goods industries and lower in the producers' and especially capital goods industries; (2) why the 'cottage ratios' among the industries appear, though less distinctly, to be roughly in the same order, while the more underdeveloped the country under question is, the larger are the differentials in the 'cottage ratios'; and (3) why these observations apply in the over-time series as well?

Upon examinations in the light of the above factors determining size structure, the pertinent points seem to be followings:

(1) Most fundamental factor is, as described in respect to the size structure of industries as a whole, that the enterprises in this sector are mostly households with the aim of sustaining family living; the proposition developed previously as regards the correlation between the cottage ratio and the rate of economic progress seems to hold in the by-industry studies as well.

(2) As one of the important results emerging, the cottage sector cannot choose techniques requiring a minimum volume of fixed and working capital which is beyond their capacity to finance by themselves or to borrow with their credit-worthiness. It follows that the enterprises in this sector tend to concentrate in the industries whose minimum requirement of capital is relatively small, and that the industries with relatively big amount of minimum capital requirement are avoided, even though the profitability or the earning power of invested capital is expected to be higher in the latter and lower in the former.

(3) The institutional factor requires, on the other hand, that the industries chosen in this sector must guarantee the enterprises a certain level of minimum earnings for sustaining household living. As one of the factors determining the earning per enterprise or per unit capital equipment, one may conceive of relative earning power of the capital employed in the cottage sector to that in the factory sector. This factor works not in the usual way where competition takes place among the modern enterprises, but in such a way that the efficiency of the modern enterprises determines the prevailing market price of the product, and, through it, the earning power of the cottage sector. Therefore, the 'component ratios of the cottage sector' tend to be larger for those industries where the superiority of earning power of capital in the factory sector to that in the cottage sector is less marked.

There are other factors as well: factor market conditions discriminating the cottage sector (such as higher rates of loan interest; higher prices of raw materials) and product market conditions which in cases of localization of market favors in general the cottage sector. However, there seems to be no reason to consider that the former works in differential ways among the industries in the cottage sector, though, in cases of the latter, consumer's taste favoring the traditional products may work only in the consumer goods.

(4) In regard to the relative positions of the industries in this sector concerning the minimum requirement of capital per household enterprise and the earning power of the capital employed, there seems to have been a consistent tendency over time that the consumer goods industries were favored in the cottage sector as against the producers' and capital goods industries. This is because of the following reasons. In the cottage sector, there has so far been no appreciable change in techniques; those in use are almost all out-moded, however advanced once they may have been at one time in modern history. In the factory sector, though the technological progress was in general very rapid, it was more so in the producers' and especially in the capital goods industries and less so in the consumers' goods industries, excepting perhaps those of consumer durables in recent years.

In Table 9 are shown selected indices of the techniques which are in use in the cottage sector in India. These data, which belong to engineering data of a kind, are excerpts from Dr. K. Prasad's laborious work (referred to in the same table). While we do not intend by these to present full substantiation of the above inference, these are expected to give some idea about it; especially important are the magnitudes of minimum capital requirements and annual earning per unit of production (enterprise) as classified by techniques and industries; moreover, the relationships between the magnitudes and the 'cottage ratios' of respective industries are, though numerically crude, of some importance also. Thus, for instance, as for the handspinning industry whose earnings per unit of production are very small, the cottage ratio is also very small, though capital requirements are among the smallest; as for handmade paper, the cottage ratio is the smallest because of the double reasons, *i.e.*, large capital requirement and negative earnings.[15]

Factory Sector

In this section explanations should be given to the statistical observations in the last chapter as regards the factory sector; namely that in many industries which are classified as heavy industries, modal size classes are consistently found in the big size class both in India and Japan; in other industries, size patterns are characterized either by varying modal sizes or by heavy dispersion; but in the cases of varying modal sizes, Indian modal sizes generally lean to the larger side; as for the other Asian countries with the exception of South Korea, the size patterns of the heavy industries are in general lopsided to the medium size classes, and those of the other industries are to larger size classes than those in Japan.

Summarizing the examinations, it may be said that:

(1) The enterprises in this sector are mostly private corporations aiming at profit-maximiza-

[15] In his Chapter on 'Techniques of the Cotton-Weaving Industry in India', Professor A. K. Sen discussed the problem of choice among different techniques of cotton-weaving in terms of the criterion of growth potential of national economy (Sen, *Choice of Techniques*, Basil Blackwell, Oxford, 1960, pp. 102–114). While the writer agrees with Sen's contention, he also feels it important at this stage of discussions on the choice of techniques to note observed facts as described in the text. The reason is to be indicated in the last chapter of this paper.

TABLE 9. SELECTED INDICES BY TECHNIQUES AFFECTING THE CHOICE OF TECHNIQUES IN COTTAGE INDUSTRIES (DATA BY P. N. DHAR)

	Number of persons employed per unit of production	Number of working days per person employed	Required amount of capital per unit of production (Rs)		Annual earning of unit of production (Rs)	Self employment (SE) or wage employment (WN)	Cottage ratio (%)
			Fixed capital	Working capital			
A. Handpounding of rice							80
1. The Pestle-and-mortor method	2	150	10	525	131.4	SE	
2. The ordinary Dhenki method	2.5	150	40	750	183	SE	
3. The Improved Assam Dhenki method	2	150	40	2700	355.7	SE	
4. The Chakki-Dhenki method	5	150	355	4800	432	WE	
B. Vegetable Oil							80
1. The Ordinary Ghani method	1.5	300	500	3000	302	SE	
2. The Improved Ghanki method	1.5	300	650	6000	764	SE	
C. Sugar							70
1. The Cottage Gur industry	4	100	513	1500	120	WE	
2. The Cottage Khandsari industry	4	100	2125	5000	9902	WE	
D. Hand spinning of cotten yarn (20's)							30
1. The ordinary Charka method	1	300	10	40	35.8	SE	
2. The Ambar Charka method	1	300	100	200	312.9	SE	
E. Handweaving of cotton cloth							85
1. The Throw-Shuttle handloom method	1.25	300	5	300	381.5	SE	
2. The Flyshuttle handloom method	1.25	300	40	450	576	SE	
3. The Banaras semi-automatic handloom method	1.5	300	200	1500	1920	SE	
4. The Madanpura semi-automatic pedal handloom method	1.5	300	250	2250	2880	SE	
5. Non-automatic power-loom	1.16	300	4000	4000	2250	WE	
F. Hand tanning							90
1. As shown by Aligarh Survey	2	295	675	100	240	SE	
2. A village tanning center	7	300	20,500	10,200	1,050	WE	
3. A center proposed by the Khadi Bord	20	300	29,000	31,300	45,540	WE	
G. Leather footwear	2.5	300	1,035	595	2,370	SE	95
H. Handmade paper							10
1. Operated by bullock-power	4	160	3,500	300	−660	SE	
2. Operated by a 3 HP motor engine	4	160	4,100	300	−628	SE	
I. Handmade match	7.5	300	2,000	1500	1,500	WE	65
J. Handmade soap							75
1. case 1	2	300	320	1,500	581	SE	
2. case 2	4	300	8,000	9,500	1,068.8	WE	

Source: Kodamath Prasad, *Technological Choice under Developmental Planning: A Case Study in the Small Scale Industries of India*, Popular Prakashan, Bombay, 1963, pp. 88–147, 45.

Remarks: In all the cases listed above, the annual earning of the production unit is derived without counting the renumeration to the owner and his family into the cost; in the case of wage employment, the owner is assumed not to work as worker For computation of the cost, those funds for obtaining fixed and working capital are borrowed by paying an interest of 16% per annum, which is higher than that prevailing for factory sector; the price of product is assumed to be equal to that of the similar factory product, except the cases of D 1, D 2, I and J 2; the prices of raw materials are assumed generally higher than those prevailing in the factory sector.

tion, with the rest consisting of state enterprises whose objective may be considered as maximizing long-run national economic interests;

(2) With respect to market conditions, there are a number of difficulties to assume perfect competition, especially because the conditions of factor supplies vary from state to private enterprises, and from a private enterprise of one size to another with a different size. Competitive assumption holds, however, to a much greater degree than in the case of cottage sector.

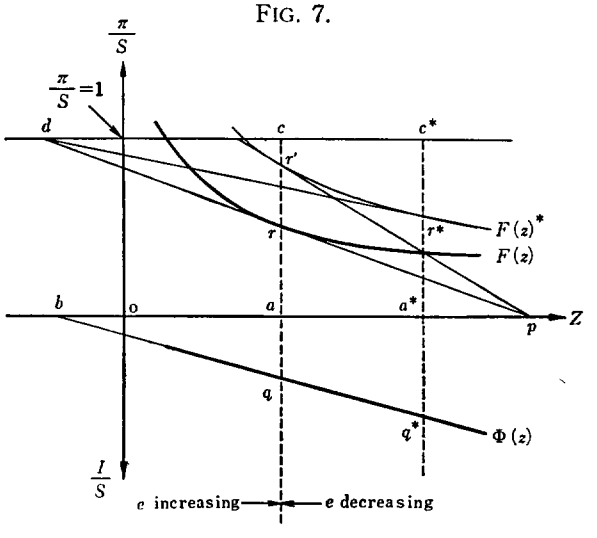
(3) Especially important factors affecting size patterns of this sector seem to be, *first*, technological conditions governing the industry, *second*, product and factor prices, *third*, the size of the national economy and, *fourth*, long-run international competitive power of the industry.

(4) These four factors will explain the above-mentioned size patterns in the following way:

a. In those industries in which modal size classes and especially 'prevailing size classes' are found in the big size class, as is commonly the case in India and Japan, technological factors such as the economies of scale or the indivisibility of capital equipment tend to play a dominant role over the prices factor. In most of the other countries in Asia, smaller sizes of national economies work as a factor prohibiting these industries from acquiring the economies of large scale production.

b. In those industries whose modal sizes vary between India and Japan, either the substitutability of the factors of production prevails or indivisibility of capital equipment and element of the economies of scale become less important, with a result that the relative prices of factors and the product price tend to assume an equivalently larger importance in determining size patterns.[16] Since, however, the emerging countries endeavor to promote new industries with sufficient international competitive power and, at any rate, the optimum size of an industry is in general becoming larger over time, the modal size classes in these countries tend to be larger in many industries than those in Japan, which is a relatively older industrialized country by now.

FIG. 7.



[16] In those industries with relatively equal distribution of employment among size classes, this argument applies with stronger force.

Since, however, our explanations has placed so much reliance upon the existence or non-existence of the economies of large scale production, a further elaboration of the point and some empirical checking may be desirable. Let us begin with a model of Professor Steindle describing the relationship between the profitability and the scale of production.[17] This model, which seems much more useful for considering the economies of scale than that which assumes a production function of a specific nature, may be summarized diagramatically in Fig. 7.

In this figure, the east axe measuring the annual productive capacity of an establishment (z), the north the ratio of total costs (π) to the amount of sale (s) and the south the ratio of capital (I) to the amount of sales. By assuming

(i) $\frac{\pi}{s}=F(z)$ where $F'<0$, and

(ii) $\frac{I}{s}=\Phi(z)$ where $\Phi'>0$,[18]

the optimum size of an establishment, which is defined as the size yielding the largest value of profit-capital ratio $e\left(=\frac{s-\pi}{I}\right)$, may be determined. In the diagram, this size is identified as the magnitude of oa at which cd equals ab; for any size smaller than this magnitude, $cd<ab$ and e becomes larger as the size increases; For any size smaller than this, the reverse is the case.[19] When the price of the product decreases with the costs of inputs unchanged, the $F(z)$ curve shifts to $F(z)^*$, and as a result the optimum size moves to oa^*.

In order, however, to go one step further to make this model useful for our examination, *first*, in relation to *eq.*(i), the total cost must be broken down and each cost item analysed in relation to the capacity of production, and, *second*, a limiting condition in *eq.*(ii), *i.e.*, $\Phi'>0$, must be relaxed. These may be done in the following way: the total cost is defined as

(iii) $\pi=P_rR+wL+K\left(\frac{1}{n}+i\right)$

where notation p_r is the price of composite raw material; R, the volume of those; w, the wage rate; L, the quantity of labor; i, the annual rate of interest; K, the value of fixed capital and n, the number of years of its commission.[20] We assume that

(iv) $R=\bar{R}S^{\eta_r}$

(v) $L=\bar{L}S^{\eta_L}$

(vi) $K=\bar{K}S^{\eta_K}$.

Where $\bar{R}$, $\bar{L}$, $\bar{K}$, are the volumes or values of R, L, K respectively at the minimum size

[17] Steindle, *op. cit.*, pp. 25-36.

[18] In the diagram, this function is drawn in a linear form for simplicity.

[19] This is proved in this way. The condition that e is increasing, maximized or decreasing in respect to z is

$$\frac{de}{dz}\gtreqless\frac{\Phi(z)\cdot F'(z)-[1-F(z)]\cdot\Phi'(z)}{\Phi(z)^2}\gtreqless 0$$

$$\therefore\quad \frac{\Phi'(z)}{\Phi(z)}\gtreqless-\frac{F'(z)}{1-F(z)}.$$

Since, however, $\Phi'(z)/\Phi(z)$ is, in the notation of the figure, equal to $\frac{aq}{ab}\Big/aq=\frac{1}{ab}$ and $-\frac{F'(z)}{1-F(z)}=\frac{ar}{ap}\Big/cr=\frac{cr}{cd}\Big/cr=\frac{1}{cd}$, the above condition ca be expressed as $ab\gtreqless cd$.

[20] We assumed that the working capital is financed internally and its interest is not imputed for simplicity. We ignored also for the simplicity's sake the other cost items.

establishment and η denotes the elasticity of the magnitude of respective cost item (denoted by suffix) to the total sales. For simplicity, it is assumed that S equals Z. Then the conditions in which profit-capital ratio, defined by $(pS-\pi)/K$ (where p denotes price of product), is increasing, maximum or decreasing with the increase in size, are calculated by differentiating the profit-capital ratio with respect to sales as

(vii) $P-\eta_r p_r \bar{R} S^{\eta_r-1}-\eta_L w \bar{L} S^{\eta_L-1}-\eta_k[P-(P_r \bar{R} S^{\eta_r-1}+w \bar{L} S^{\eta_L-1})] \gtreqless 0.$

From this condition, it will be seen that

(1) When $\eta_r=\eta_L=\eta_K=1$, the left side of the condition become zero and the profit ratio unchanged. But this is a case in Fig. 7 where both cost function and capital-output ratio are parallel to the horizontal axe, meaning that there is no economies of scale.

(2) When $\eta_K<1$, the left side is invariably larger than zero, in so far as η_r and η_L do not exceed unity, which is a quite conceivable case. This is in fact the case where in Fig. 7 the $\Phi(z)$ curve has a negative slope, and regardless of the magnitudes of all other constants, a larger size class becomes more profitable.

(3) In the case where $\eta_K>1$, the value of the left-hand side depends upon the values of p, p_r, w, $\bar{R}$ and $\bar{L}$, if the values of η_r and η_L do not exceed unity as may be supposed in usual cases. It might seem, therefore, that the relative prices of product and factors as well as the relative factor prices come in as important factors determining the location of the optimum size. A popular example of this is the contention that in a country where labor is relatively abundant and the wage rate low, the optimum size tends to be small. However, we have to differentiate in this general case the special one where only the value of η_r is substantially smaller than unity. Here, the optimum size tends to be larger despite the relative cheapness of labor.

Considerations of these analyses from the point of view of empirical findings may suggest that it is useful to classify the economies of scale into the following patterns:

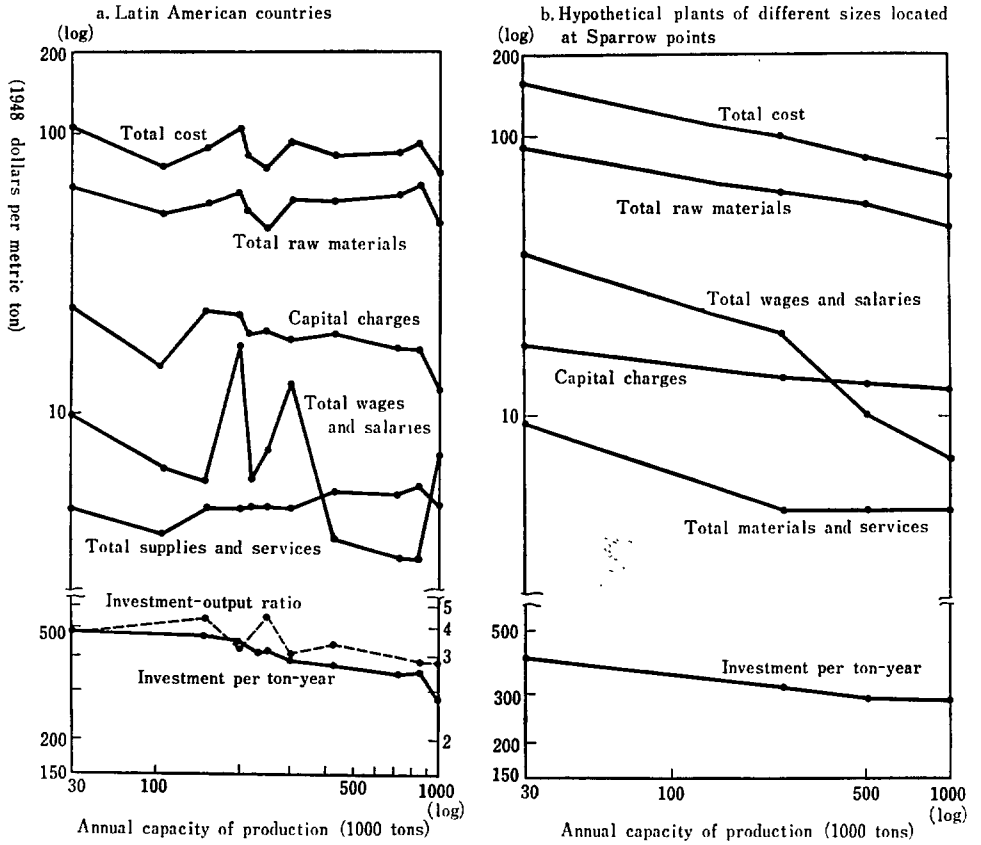
a. fixed-capital-saving-biased: η_K is substantially less than unity.
b. raw-materials-saving-biased: η_L is substantially less than unity, and
c. labor-saving-biased: η_L is substantially less than unity;

and to further classify branches of industries according to these patterns. While the studies are not yet in the stage to be able to designate the names of industries according to all of these patterns of the economies of scale, it is already clear that there are a number of industries whose patterns of the economies of scale are fixed-capital-saving-biased, though mixed with some of other patterns. As a criticism on a report of the Indian Petro-Chemical Committee as regards long-range planning, one writer complained that the unit-capacity of petro-chemical projects as conceived of by the committee is too small as compared to the representative ones in the U.S., thus resulting in much higher costs; he used for this comparison what is said to be a generally accepted formula in the organic chemical industry: $I_B=I_A\left[\frac{R_B}{R_A}\right]^{0.7}$, where I and R designate respectively the investment costs and the production capacity of a project and suffixes A and B the names of projects under comparison.[21] This formula is nothing but a special version of the *eq.*(vi); that this is likely to be the case for many branches of chemical industry is indicated in the studies of capital coefficients at Harvard Economic Research Project.[22] The case for many branches of mineral and metal industries, where $\eta_K<1$ is

[21] C. J. Dadachanji, 'Achieving Plem Targets for Organic Chemicals', *Supplement to 'Capital'*, July 4th, 1963.

[22] Ann P. Carter, 'Capital Coefficient as Economic Parameter: The Problem of Instability', in NBER (ed.), *Problems of Capital Formation*, Princeton University Press, 1957, pp. 287–310.

FIG. 8. FINISHED STEEL PRODUCTION COSTS BY COMPONENTS AND INVESTMENT PER TON-YEAR IN RELATION TO THE SIZE OF PLANTS



Source: UN, *A Study of the Iron and Steel industries in Latin America*, Vol. 1, pp. 115–6, 120–121, 123.

Notes: Investment-output ratio is computed by taking the price of finished steel as given in Table 47 (p. 121), column 3 (dollars per ton based on estimated costs).

suggested also in a study of the same kind, though not entirely conclusive.[28] Particularly for the finished steel production, there is a United Nations' ECLA's study, some pertinent passages of which are shown diagramatically in Fig. 8. In this figure, total cost and its component as well as the investment cost per ton are related to the annual production capacity, *first*, according to actual data for seven Latin American countries and Sparrow Points in the U.S. (a), and, *second*, according to the hypothetical data evaluated at the prices at Sparrow Points (b). It becomes clear from this that η_K, η_T and η_L are all less than unity, although price differentials seems to distort the pictures especially with respect to η_T.

[23] Fredric T. Moore, Capital Coefficient in Mineral and Metal Industries, *Ibid.*, pp. 311–345.

V. *Concluding Remarks*

From the empirical studies as outlined above, at least the following suggestions seem to be derived as regards the contemporary thoughts on the problems of the choice of techniques and scales of production in the context of economic development:

1. It seems preferable or even unavoidable in the analysis of the problems to treat the cottage and the factory sectors separately; the working of the mechanism of capital accumulation and growth varies and the criteria for the choice problems should accordingly be different between these two sectors. This argument applies even more strongly in the case where the economic development is taken place under the planning method.

2. As regards the cottage sector, it seems important for the planners to recognize that the allocation of the centralized investment[24] is needed here as an addition to the existing and the potential resources which are to be used as productive facilities in the household enterprises. The centralized investment may take various forms: either in the form of extention of low-interest loan, supply of low-priced equipments and raw materials, or in the form of subsidies when the products are marketed.[25] The potential resources are those which household enterprises are willing to mobilize by themselves (by extra efforts) only when centralized investment is allocated and it is felt that the extra efforts become rewarding. The allocation of the centralized investment may be crucial even for the continual use of the existing facilities, if their maintenance and repairs are taken into consideration. Therefore, from the national economic point of view, the amount of centralized investment funds allocated to the cottage sector must be evaluated at least in terms of the sum of the allocated funds and the investment funds which can be mobilized within the household enterprises by their inducement effect. And this inducement effect should be relied upon when the amount of centralized investment funds is, if exclusively allocated to the factory sector, insuffcient for keeping economic development at an adequate pace,[26] even though the capacity of re-investment or expanded reproduction is limited in the case of the investment in the cottage sector as compared with that in the factory sector.[27]

It seems to be in the connection with this factor that a much larger employment-creating

[24] The centralized investment is here defined as the current investment originated in the factory sector. While it is safely assumed that the private enterprises exist in this sector, especially in its smaller size classes, their investment is considered as effectively controlled by the development authorities. If it is assumed instead that these private enterprises are completely outside of the government control, the inducement mechanism of the centralized investment will also work in this sector as in the case of the cottage sector; but the employment effect will not be as much as in the latter case.

[25] As examples of these various forms, Indian policies as regards the cottage sector are of interest. Cf. Planning Commission, *Report on the Village and Small Scale Industries* (*Second Five Year Plan*) Committee, Oct. 1955.

[26] As another merit of utilizing the cottage sector, the problem of entrepreneurship may be mentioned. Like the centralized investment, supply of entrepreneurship is a limiting factor in economic development, and the expansion of the factory sector is subject to this limitation. Therefore, the developmental authorities may have to rely upon the existing and potential supply of entrepreneurship in the cottage sector, though the quality here might be much inferior to that in the factory sector.

[27] This paragraph should not be interpreted to mean that the writer favors an expansion of the cottage sector to the detriment of the expansion of the factory sector. An emphasis of economic development should always be placed upon the expansion of the factory sector to the maximum extent permissible.

effect of investment in the cottage sector, which is so publicized in the contemporary thinking of the choice problems, is to be taken into consideration. Common to almost all developing countries is the fact that a greater part of the existing industrial labor force is in fact employed in this sector, and even as regards annual increment of industrial labor force this sector must absorb its major portion. If a limited amount of the centralized investment funds is allocated exclusively to the factory sector, unemployment or underemployment problems will become formidable since the number of employment opportunities created by the funds is nothing comparable to a tremendous magnitude of the existing and potential labor force. In contrast, the allocation of the centralized fund to this sector will create employment opportunities much larger than those the same amount of centralized investment can create in the factory sector even when allocated to a size class with the lowest capital-labor ratio.[28]

3. All of the suggestions stated above regarding the cottage sector, be it noted, cannot be separeted from the problem of the choice of industries; the branches of industries to which a part of centralized investment funds can effectively be allocated in the above sense seem to be those which household enterprises prefer as a means of maintaining or supplementing household living—the branches of industries which are rather of the consumer goods type.[29]

4. Let us now turn to the factory sector. Since the centralized investment is considered to induce no extra investment here, it is only necessary for the consideration of the problems of choice of techniques and scales of production to compare varying effects that these different choices may exert directly upon the economy. Although the principles of such comparison or, in other words, the investment criteria are subject to a controversy, they may probably be much simpler than in the case for the cottage sector; the writer is inclined to consider that the central or almost single criterion in this sector is a dynamic growth potential created by such centralized investment.

However, much more complicated are the varieties in the pattern of production functions that are found in this sector for different branches of industries. By the empirical studies as outlined above, it has been made clear that, while the conventional theoretical discussions on the choice of techniques usually assume a certain type of production function or the family thereof which has the property that the output-labor and the capital-output ratios will increase as the scale of production, and, with it, the capital-labor ratio expand. A Cobb-Douglas-type production function is a case in point. Yet such a type of production function is simply a special one of various patterns of production functions that exist in fact among branches of industries. In the branches of the heavy industries, the production functions whose capital-output ratio decreases as the scale of production expands are much more common. Therefore, the application of a uniform criterion will naturally result in different conclusions depending upon industries with different production functions: in the industries whose production function is of a Cobb-Douglas type, the Re-Investment Criterion yields a certain optimum size somewhere between the biggest and the smallest sizes, while in many heavy industries, only the biggest possible size is most efficient regardless of whether the Re-Investment, the Social Marginal Productivity or the ordinary maximum-output criterion is applied.

[28] Throughout the above discussions, the writer included the cooperative organization of household enterprises in the cottage sector.

[29] One of the causes why the Chinese policies during 1958 to 1960 to promote the small enterprises on nationwide scale failed seems to be the fact that the branches of industries covered by these policies were mainly those of heavy industries. See the writer's paper; 'Choice of Techniques in Mainland China', *op. cit.*

5. Once the difference in the patterns of production functions among the different branches of industries is taken into consideration, it will become evident that text-book type discussions on the problems of choice of techniques or scales of production in complete isolation from the choice of industries is unrealistic; the actual choice of the former is always influenced or, sometimes even governed by the choice of the latter and, speaking more realistically, both choices are interdependent. In addition to these interdependent decisions, the smallness of the national economy and the availability of national investment resources also assume important roles as additional constraints.

APPENDIX. REFERENCE OF STATISTICAL MATERIALS

Pakistan: [A 1] ILO (Expanded Programme of Technical Assistance), *Report to the Government of Pakistan on a Manpower Survey*, Geneva, 1956.
[A 2] Central Statistical Office, *Census of Manufacturing Industries, 1957*, Government of Pakistan, Karachi, 1960.
[A 3] Central Statistical Office, *Pakistan Statistical Yearbook 1955*, Government of Pakistan, Karachi, 1956.
[A 4] Central Statistical Office, *Statistical Bulletin*, Nov. 1961, Government of Pakistan, Karachi, 1962.

Burma: [B 1] Union of Burma, *First Stage Census 1953, Vol. II, Industry, Cottage Industry and Home Consumed Production Industry*, Langoon, 1958.

Ceylon: [C 1] Department of Census and Statistics, *Census of Industries 1952*, Government of Ceylon, Colombo, 1954.
[C 2] ditto, *Census of Agriculture 1952, Part I-Tea Plantations, Part II-Rubber Plantations, Part III-Coconut Plantations*, Government of Ceylon, Colombo, 1956.
[C 3] ditto, *Ceylon Yearbook, 1959*, Colombo, 1960.
[C 4] ditto, *Ceylon Yearbook, 1952-53*, Colombo, 1953.
[C 5] ditto, *Standard Classification of All Economic Activities for Ceylon*, Colombo, 1953.

Taiwan: [F 1] *General Report 1961, Industry and Commerce Census of Taiwan, the Republic of China* (Vol. III), the Executive Group of I.C.C.T., Taipei, Dec. 1962.

Hong Kong: [H 1] Commission of Labor, *Hong Kong Annual Departmental Report by the Commissioner of Labor for the Financial Year, 1959-60*, Government Press, Hong Kong, 1962.

India: [I 1] The Cabinet Secretariat, *The National Sample Survey Number 28: Report on the Sample Survey of Manufacturing Industries: 1954 (1)*, Government of India, Delhi, 1960.
[I 2] ditto, *Occupational Pattern in Manufacturing Industries, India, 1956*, Government of India, Delhi, 1959.
[I 3] Central Statistical Organization, *Fifth to Twelfth Census of Indian Manufactures, 1950 to 1957*, Government of India, Delhi, 1954 to 1960.
[I 4] The Department of Economic Affairs, Ministry of Finance, *Final Report of the National Income Committee*, Government of India, Delhi, 1954.
[I 5] The Cabinet Secretariat, *The National Sample Survey Number 19: Report on Small Scale Manufactures (Household Enterprises Smaller than Registered Factories)*, Delhi, 1959.

[I 5-1] ditto, *The National Sample Survey Number 42: Report on Small Scale Manufacture (Household Enterprises Smaller than Registered Factories)*, Delhi, 1961.
[I 5-2] ditto, *The National Sample Survey Number 43: Tables with Notes on Small Scale Manufacture (Household Enterprises Smaller than Registered Factories)*, Delhi, 1961.
[I 6] ditto, *The National Sample Survey Number 21: Household Small Scale Manufacturing Establishments (Smaller than those covered by Industries Act 1951)*, Government of India, Delhi, 1959.
[I 7] Ministry of Labor and Employment, *Indian Labor Statistics, 1960*, Government of India, Delhi, 1960.
[I 8] Government of India, *Census of India 1951, Vol. 1, Part I-B Appendices to the Census Report 1951*, Delhi, 1955.
[I 9] Central Statistical Organization, *Statistical Abstract of India 1952-53 to 1957-58*.
[I 10] *Statistics of Factories, 1952 and 1953*, Government of India, Delhi, 1957.
[I 11] Government of India, *Census* of India, *(1961 Census) Paper No. 1 of 1962, Final Population Totals*, Delhi, 1962.

Japan: [J 1] Research and Statistics Division, Minister's Secretariat, Ministry of International Trade and Industry, *Kogyo Tokei 50 Nenshi (History of the Census of Manufactures for 1909-1958): Vol. 1 of Material Section*, Tokyo, March 1961.
[J 2] *Kogyo (Kojo) Tokeihyo, (Census of Manufactures)*, annual issues from 1909 up to the present.
[J 3] Ministry of International Trade and Industry, *Chushokigyo Sogo Kihon Chosa Hokokusho (Report on Comprehensive and Basic Survey of Small and Medium Enterprises)*, Tokyo. 1959.
[J 4] Institute of Economic Research, Economic Planning Agency, *Shihon-kozo to Kigyokankakusa (Capital Structure and the Differentials among the Firms)*, Tokyo, 1960.
[J 5] K. Ohkawa et. al., *The Growth Rate of the Japanese Economy since 1878*, Kinokuniya, Tokyo, 1957.
[J 6] Division of National Income Statistics, *Kenmin Shotoku Tokei (Statistics on Prefectural Income)*, Shiseido, Tokyo, 1963.
[J 7] Census Bureau, *Nihon Teikoku Dai 40 Tokei Nenkan (The 40th Statistical Yearbook of Imperial Japan)*, Tokyo, Dec. 1921.

Korea: [K 1] The Korean Reconstruction Bank, *Final Report, Census of Mining and Manufacturing 1957*, Seoul, 1958.
[K 2] Economic Planning Board, Korean Reconstruction Bank, *Report on Mining and Manufacturing Census*, Seoul, 1964.

Philippines: [P 1] Department of Labor, *Directory of Key Establishment in the Philippines in Selected Non-agricultural Industries Employing Five or More Workers During 1955*, Manila, 1956.
[P 2] NEC-BCS, *1956 Annual Survey Manufactures*, Vol. 1—Series, 2, 1958.
[P 3] ditto, *Annual Survey of Manufactures: 1957*, Vol. II, 1960.
[P 4] *The Philippine Statistical Survey of Household Bulletin, Series No. 3 (Labor Force, October 1956)*, June 1958.
[P 5] *op. cit., Series No. 5 (Labor Force, May and December 1958)*, Jan. 1960.
[P 6] CBP, *Statistical Bulletin*, Vol. XIII, No.1, March 1961.
[P 7] CBP, *Second Annual Report 1960*, 1961.

Others: [G 1] ILO, *Yearbook of Labor Statistics 1960*, Geneva, 1961.
[G 2] UN, *Economic Survey of Asia and the Far East 1960*, Bangkok, 1961.
[G 3] *Yearbook of National Accounts Statistics 1960*, New York, 1961.
[G 4] UN, *Indexes to the International Standard Industrial Classification of All Economic Activities*, New York, 1959.
[G 5] *Statistisches Jahrbuch für die Bundesrepublic Deutschland 1961, Statistischen Bundesamtes*, Wiesbaden 1961.
[G 6] *Statistical Abstract of the United States, 1957*, USDC, 1957.
[G 7] UN, *Statistical Yearbook*, 1960.