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The Production Structure of the Manufacturing Sector and Its Distribution Implications: The Case of Taiwan

by

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Abstract

The Production Structure of the Manufacturing Sector and Its Distribution Implications: The Case of Taiwan

by

Yhi-Min Ho

Using Taiwan's 1971 Census of Manufacturing data, the paper analyzes the characteristics of production, in the CES framework, of the manufacturing industries at the two-digit level and their impact on the pattern of income distribution found in Taiwan. The focus is on the variations in the efficiency of factor utilization and in factor combinations due to differences in size of manufacturing establishments. Findings reported in the paper suggest that, (1) the size variable is not consistently related to the level of efficiency estimated, and (2) variations in factor intensity between firms of different sizes are significant. The latter finding is considered particularly significant to empirical studies investigating the interaction between factor demand, consumption patterns, and income distribution.

The Production Structure of the Manufacturing Sector and Its Distribution Implications: The Case of Taiwan

1. Introduction

Industrialization through adoption of capital-intensive technology and the development of large-scale, capital-using industries inconsistent with the factor endowment of the LDC's has long been recognized to have serious socio-economic consequences for employment and income distribution in those LDC's.[1] Paradoxically, development policies and programs in most LDC's still seem to persist in that direction. A partial explanation of this biased approach to development may lie in the belief that modern, capital-intensive techniques and industries of the Western vintage are necessarily more efficient than their traditional, labor-intensive counterparts in the LDC's, and in the belief that distributional and equity issues will resolve themselves in the context of growth. Frequently it is argued that in an economy where capital is scarce development programs should emphasize the use of capital with maximum output per unit of capital.[2] Techniques that have high

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[1]See, for example, (1) Richard S. Eckaus, "The Factor Proportions Problems in Underdeveloped Areas," American Economic Review, Vol. 45, No. 4 (September, 1955), pp. 539-565; and (2) Werner Baer and M. E. A. Hervé, "Employment and Industrialization in Developing Countries," Quarterly Journal of Economics, Vol. 80, No. 1 (February, 1966), pp. 88-107.

[2]This is clearly stated in (1) United Nations, ECAFE, "Criteria for Allocating Investment Resources Among Various Fields of Development in Underdeveloped Countries," Economic Bulletin for Asia and the Far East, June, 1961; (2) United Nations, ECATE, "Problems and Techniques of Economic Planning and Programming with Special Reference to ECAFE Countries," Economic Bulletin for Asia and the Far East, November, 1955; and (3) Galenson, W. and H. Leibenstein, "Investment Criteria, Productivity and Economic Development," Quarterly Journal of Economics, Vol. 69, No. 3 (August, 1955), pp. 343-370.

labor content per unit of capital and yield a low output per unit of capital are considered inferior to those with a relatively lower labor content. The adoption of large-scale, capital-intensive techniques and industries are also often justified on the basis of their dynamism in terms of interindustry linkages and externalities they generate.[1] Surprisingly, little empirical evidence is available to substantiate these claims. By citing the differences in the productivity of individual factors without specifying the form of a production function the evidence so far is unconvincing and inadequate, if not misleading.

However, the capital-intensive development approach is objectionable on more fundamental grounds. The fact that industrial expansion in the LDC's has failed to generate a labor-absorbing process consistent with their resource base is largely attributable to this capital-intensive biased approach to development. Emphasis on externalities and interindustrial linkages invariably creates regional imbalances. As a result, the economic reality in the LDC's after decades of effort is disturbing indeed. The glaring relative income gap between the rich and the poor has remained unchanged. The absolute living standard of the poor may have actually deteriorated. The dismal conditions one finds in most LDC's have led some leading development economists to declare that "hundreds of millions of desperately poor people throughout the world have been hurt rather than helped by economic development."[2]

The harsh reality in the LDC's should be clear enough to shatter the traditional view that more equitable patterns of income distribution will more

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[1]See Albert O. Hirschman, The Strategy of Economic Development (New Haven: Yale University Press, 1958).

[2]Irma Adelman and Cynthia T. Morris, Economic Growth and Social Equity in Developing Countries, (Stanford, California: Stanford University Press, 1973), p. 192.

or less automatically emerge once the development process reaches a certain stage. It is equally conceivable that the existing biased patterns of income distribution in the LDC's may continue to endure indefinitely, unless the direction of development policies is reoriented and the priority of development programs is rearranged.[1] For the conventional and traditional models of development are biased in their distributional impact, in favor of the rich who own the capital and the elite group in the labor force who have the skills. If the consumption patterns of various income classes are invariably biased in terms of their capital content, all the links necessary to perpetuate the existing inequality are established.

A theoretical possibility of breaking up the chain that perpetuates the existing income distribution pattern, through the interaction between factor demand, income distribution and consumption patterns, has been suggested by Dudley Seers and Land-Soligo independently.[2] They hypothesize that the factor-intensity of the consumption patterns of the rich may differ from the patterns of the poor, in terms of their capital requirement. If then factor differentials exist, employment growth and distributional equity are complementary instead of competitive goals.

The question of whether the rich's consumption pattern is more capital-intensive than the poor's is definitely an empirical one. Empirical findings pertaining to the Seers-Land-Soligo hypothesis so far reported are not consistently supportive of the proposition. For example, evidence I have obtained

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[1]The shift in emphasis from growth to distribution is clearly seen in Hollis Chenery, et. al., Redistribution With Growth, (London: Oxford University Press, 1974); and Irma Adelman and Cynthia T. Morris, op. cit.

[2]Land, James W. and Ronald Soligo, "Income Distribution and Employment in Labor Redundant Economies, "Philippine Economic Journal, No. 1, 1974, pp. 57-82; Dudley Seers, Towards Full Employment: A Programme for Colombia (Geneva: International Labour Office) 1970.

from Taiwan suggests otherwise.[1] The inconsistency in the findings may have to do with a host of conceptual and statistical issues involved in this kind of empirical exercise. One major source of the disagreement in empirical evidence is the question of aggregation; of consumption items from household surveys and of production data from input-output tables. As confirmed by simulation tests, the results from my study of Taiwan are sensitive to variations in the degree of aggregation. Presumably, the empirical findings may be equally sensitive to the degree of aggregation of the production data applied. In particular, firms that produce similar consumption goods may have different factor combinations because of differences in size and location. To the extent that factor combinations do vary between firms, the factor-intensity proposition may be re-examined to reconcile the inconsistency in empirical evidence so far obtained.

The present paper has two objectives. First, it is an attempt to test the hypothesis that factor combinations do vary between firms of different sizes. Since the test is conducted in the framework of a production function, other production characteristics with significant distributional implications are identified as well, and particular attention is focused on the differentials in efficiency and on how they are related to other production characteristics. Secondly, in the theoretical framework described, the paper evaluates the

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[1]Yhi-Min Ho, "Income Redistribution and Its Effects on Factor Demand in Taiwan: A Simulation Approach," Southern Economic Journal, Vol. 43, No. 2, (October, 1976), pp. 1017-1030. Findings from similar studies, done by John G. Ballentine, Tuncay M. Sunman and Ronald Soligo for Colombia, Pakistan and Turkey, confirm the factor-intensity proposition; see Ballentine, John G. and Ronald Soligo, "Consumption, Earnings Patterns and Income Distribution," Program of Development Studies Discussion Paper 67, Rice University, 1975, and Sunman, Tuncay M., "Short-run Effects of Income Distribution on some Macro-Economics Variables: The Case of Turkey," Program of Development Studies Paper 46, Rice University, 1973.

possible links between the characteristics of production functions and the size, as well as functional, distribution of income, based on the Taiwan development experience.

The postwar development experience in Taiwan is interesting in many aspects. In particular, Taiwan seems to have struck a commendable balance between equity and growth. There is strong evidence suggesting that during the 1960's when Taiwan's economy underwent fundamental changes and achieved a remarkably high rate of growth the size distribution of income improved as well. According to the household income and expenditure survey data, the degree of income inequality measured by the conventional Gini coefficient was reduced from 0.36 to 0.33 between 1964 and 1970.[1] This improvement in the distribution is definitely something quite exceptional to the common pattern of events found elsewhere. In other developing countries, the degree of income inequality typically increases during the transitional stage of growth.[2]

What is the "secret" then behind the success in maintaining a reasonable balance between growth and equity? The answer to the question, I believe, may be found in the analysis of the expansion experience of the manufacturing sector in Taiwan. In Taiwan, as is equally true in other LDC's, the manufacturing sector is undoubtedly the leading sector in the drive for industrialization.

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[1]Computed from data shown in Bureau of Accounting and Statistics, Taiwan Provincial Government, Report on the Survey of Family Income and Expenditure in Taiwan, 1964 and 1970 issues; Taipei Municipal Government, Report on the Survey of Family Income and Expenditure in Taipei, No. 8 (March, 1971).

[2]See Simon Kuznets, "Economic Growth and Income Inequality," American Economic Review, Vol. XLV, No. 1 (March, 1955), pp. 1-28; and Felix Paukert, "Income Distribution at Different Levels of Development: A Survey of Evidence," International Labour Review, Vol. 108, Nos. 2-3 (August-September, 1973), pp. 97-125.

In Taiwan, GDP originating from the sector increased as much as five times between 1960 and 1970, from NT$9.5 billion to NT$52.0 billion; and the relative share of the sector in GDP rose from 17% in 1964 to 27% in 1970. Persons engaged in the manufacturing sector accounted for 37% of non-agricultural employment in 1970. Therefore, what was going on within the sector may be decisive, and definitely informative, of what was going on elsewhere in the economy. In analyzing the characteristics of the production function of the manufacturing sector in Taiwan, attempts will be made to provide some evidence and plausible interpretation of the possible connections between Taiwan's pattern of development and its distribution attributes.

2. Methodology

The model

For the particular purposes of the study, in identifying the characteristics of production and their distribution implications, I make use of the well-known CES production function. The principal justification for the adoption of the CES form is the function's general character regarding the elasticity of substitution. The alternative is either to assume the elasticity of substitution to be unitary (Cobb-Douglas type) or to be zero (Leontief type). Neither one is satisfactory. As is well-known, the ease with which one factor may be substituted for another factor, defined as elasticity of substitution, plays a major part in the neoclassical theory of functional distribution of factor income. In the final analysis, the distribution of income is determined by the interplay between factor demand and factor endowment and how readily one factor may be substituted for the other.

The CES function, with returns to scale properties unspecified, can be written as:

$$Q = \gamma[\alpha K^{-\rho} + (1-\alpha)L^{-\rho}]^{-\frac{\mu}{\rho}} \tag{1}$$

where Q, K, and L represent output, input of capital services and input of labor services respectively. The function, defined in (1) has four parameters: γ, the efficiency parameter, α, the capital intensity parameter, μ, the scale parameter, and ρ, the distribution parameter. And if σ is defined as the elasticity of substitution of labor for capital, σ is related to the distribution parameter ρ as follows:

$$\sigma = \frac{1}{1+\rho} \tag{2}$$

In order to set the stage for the discussion of our empirical estimates of the parameters of the CES form and their role in determining the growth as well as distribution pattern in Taiwan, we need to briefly describe the four parameters. First, we note that given any combination of inputs, a change in the efficiency parameter γ will change the output by the same proportion. Thus, the parameter measures the degree of efficiency of a given technology (or a given input combination). Differences in the parameters therefore indicate the differentials in the efficiency of the use of inputs. The scale parameter, μ, defines the degree of returns to scale. Increases in the scale of operations increase output by the same proportion if $\mu = 1$. By indicating the scale effect on output, the parameter has definite implications with respect to employment. Specifically, the employment content per unit of output is higher for $\mu < 1$ than for $\mu = 1$ or $\mu > 1$.

For a given factor ratio, one technology is capital-intensive, in the pure technical sense, if the marginal rate of substitution of labor for capital of the said technology is less than that of other technologies. It can be shown that the marginal rate of substitution of labor for capital in the CES world is:

$$MRS = \frac{\alpha Q}{\alpha K} \Big/ \frac{\alpha Q}{\alpha L} = \left(\frac{\alpha}{1-\alpha}\right) \left(\frac{K}{L}\right)^{-(1+\rho)}. \tag{3}$$

Under the assumption of cost minimization, the following holds in equilibrium:

$$MRS = \frac{\alpha Q}{\alpha K} \quad \frac{\alpha Q}{\alpha L} = \frac{r}{w}, \tag{4}$$

where r is the unit cost of capital services and w the unit cost of labor services. From (3) and (4), the following can be derived:

$$\frac{K}{L} = \left(\frac{\alpha}{1-\alpha}\right)^{\sigma} \cdot \left(\frac{w}{r}\right)^{\sigma}. \tag{5}$$

Equation (5) indicates that the optimal combination of capital and labor inputs as a decision variable is determined by the capital intensity character of a given technology, by the degree of ease in substituting one factor for another, and by labor costs relative to capital costs.

The observed differentials in factor intensity therefore are attributable to variations in relative factor costs, the requirements of the existing technology and the lags in adjustments responding to changes in technology and factor costs.[1]

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[1]That is, $\left(\frac{K}{L}\right)_t^* = \left(\frac{K}{L}\right)_t^{1-\lambda}$ only if $\lambda = 0$, where $\left(\frac{K}{L}\right)_t^*$ is defined as the desired level of K/L in the tth period, as compared with the $(K/L)_t$ achieved. In the above frame, λ may be defined as the lag coefficient of adjustment. If

The role of the capital intensity parameter in the CES function in determining the factor ratio is made clear from the above. That is, given σ, the elasticity of substitution of labor for capital, and given w/r, the relative factor cost ratio, the higher is α, the higher is K/L. If the unit of measurement of labor costs are common to all firms and to all industries, the intensity of capital in competitive equilibrium may be measured by the marginal rate of substitution of labor for capital, for a given K/L.

The role of the elasticity of substitution in the CES world in dividing the final output between capital and labor may be made explicit by the following:

$$\frac{\alpha Q}{\alpha K} \Big/ \frac{\alpha Q}{\alpha L} \cdot \left(\frac{K}{L}\right) = k/1, \tag{6}$$

where k stands for the capital's share in the final output, and 1 the labor's share. Equation (6) can be rewritten, using (2) and (3) as

$$k/1 = \left(\frac{\alpha}{1-\alpha}\right)\left(\frac{K}{L}\right)^{1-\frac{1}{\sigma}}. \tag{7}$$

From (7) it is clear that the capital share increases if capital grows relative to labor and if σ is greater than 1; the capital share decreases if capital grows relative to labor and if σ is less than 1.

The estimating equations

The logarithmic transformation of the CES function shown in (1) is log non-linear; and therefore the conventional least-square method cannot be directly applied to obtain the estimates of the parameters.

$\lambda = 0$, from equations (4) and (5) it can be shown that $(K/L)_t = \left(\frac{w}{r}\right)^{\frac{\sigma}{1-\lambda}} \cdot \left(\frac{\partial}{1-\partial}\right)^{1-\lambda}$

Following Brown,[1] the method I adopted is to specify a side equation of the form defined in equation (5). As shown by Moroney, this equation is free from serious identification and specification errors.[2] Logarithmic transformation of the side equation takes the form as below:

$$\text{Log } \left(\frac{K}{L}\right) = \sigma \log \frac{\alpha}{1-\alpha} + \sigma \log \left(\frac{w}{r}\right). \tag{8}$$

All variables in (8) retain the same definition. Using data on K, L, w, and r, estimates of α, the capital intensity parameter, and σ, the distribution parameter can be obtained.

Since the estimate of α is dependent on the unit of measurement of the variables in (8), all variables in (8) are converted to index numbers, with the

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[1]Murray Brown, On The Theory and Measurement of Technological Change (Cambridge: Cambridge University Press, 1968) pp. 128-133. This particular method is one of several alternatives of estimating the parameters of the CES production function. In the original paper by Arrow, Chenery, Minhas and Solow, the CES function was derived from the log linear relation between value-added per employee and the average wage rate, and from which the elasticity of substitution may be obtained. The log linear function specified assumes constant returns to scale and competitive product and factor markets; see K. J. Arrow, H. B. Chenery, B. S. Minhas, and R. M. Solow, "Capital-Labor Substitution and Economic Efficiency," The Review of Economics and Statistics, Vol. XLIII, No. 3, (August, 1961) pp. 225-250. The same function, permitting any degree of homogeneity, was separately and independently derived by Murray Brown and John S. de Cani; see M. Brown and J. S. de Cani, "Technological Change and the Distribution of Income," International Economic Review, Vol IV, (September, 1963) pp. 289-309. R. G. Bodkin and Lawrence R. Klein proposed a direct nonlinear estimation procedure in order to obtain the parameters; the proposed procedure has the deficiency that output and factor prices were assumed to be exogenous; see R. G. Bodkin and L. R. Klein, "Nonlinear Estimation of Aggregate Production Functions," The Review of Economics and Statistics, Vol. XLIX, No. 1, (February, 1967) pp. 28-44.

[2]The step-wise procedure adopted here is unconstrained by the assumptions of constant returns to scale and competitive markets as shown by J. R. Moroney. The method is clearly preferable if empirical data on capital input required for the procedure are available; see John R. Moroney, "Identification and Specification Analysis of Alternative Equations for Estimating the Elasticity of Substitution," Southern Economic Journal, Vol. XXXVI, No. 3, (January, 1970) pp. 287-299.

first observation of each sample group as the base.

For notational simplicity, we create a new variable V, defined as:

$$V = [\hat{\alpha}K^{-\hat{\rho}} + (1-\hat{\alpha})L^{-\hat{\rho}}] - \frac{1}{\hat{\rho}}$$

where $\hat{\alpha}$ and $\hat{\rho}$ are estimates of the parameters from (8). Inserting (9) into (1), we have:

$$Q = \gamma \cdot V^{\mu}$$

The logarithmic transformation of (11), shown below in (12), provies the equation for estimating γ, the efficiency parameter and μ, the scale parameter.

$$\text{Log } Q = \text{Log } \gamma + \mu \cdot \text{Log } V \qquad (11)$$

The data

The empirical basis of the present study is the fourth Industrial and Commercial Census of Taiwan taken in 1971.[1] The survey provides comprehensive observations at the establishment level. For this paper, however, the regressions were run on the two-digit industry groupings. For the purpose of analyzing the differences in efficiency and other production parameters among firms of various sizes, firms in each of the two-digit industry groups are divided into three classes. Establishments with a total of 50 employees or more are classified as large firms; between 10-49, medium firms; and under 10, small firms.

The 1971 Manufacturing Census of Taiwan registered 44,054 establishments in the sector. Table 1 shows the distribution of the establishments registered by the census in the nine two-digit industries.

Our regression analysis takes the whole manufacturing sector as the sample

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[1]The 1971 census data on Taiwan's manufacturing sector on magnetic tapes are made available to the author.

TABLE 1: Distribution of Manufacturing Establishments by Industry and by Size

	Industry Code and Description	Establishment Size			
		Large	Medium	Sm	Total
31	Food, beverage and tobacco manufacturing industries	295	990	11,836	13,121
32	Manufacture of textiles, wearing apparel and leather products	996	1,388	1,442	3,826
33	Manufacture of wood, bamboo, vine, willow and products	220	843	2,792	3,855
34	Paper and paper products manufacturing and printing industries	164	815	1,512	2,491
35	Manufacture of chemicals, crude oil, coal, rubber and plastic products	663	1,628	2,836	5,127
36	Manufacture of non-metallic mineral products	255	1,103	1,281	2,639
37	Basic metal industries	95	215	183	493
38	Manufacture of metal products and machinery equipment	907	2,910	6,777	10,594
39	Manufacture of miscellaneous industrial products	216	407	1,285	1,908
	Total	3,811	10,299	29,944	44,054

Source: The 1971 Industrial and Commercial Census of Taiwan.

base with two exceptions. First, as shown in Table 1, Industry 31 and Industry 38 account for nearly half of the 44,000 establishments in the manufacturing sector. Moreoever, in terms of the establishment distribution within these two-digit industries there is another high degree of concentration. In 3117, rice husking and polishing, there were nearly 7,000 establishments; and in 3820, machinery equipment manufacturing and repairing, there were 4,000 establishments. To reduce the matrix size in the computation (otherwise it reaches the monstrous dimension of 13,000 x 8) I decide to take the first 1,960 observations on tapes in each of the two 4-digit industries as samples and drop the remaining establishments. Secondly, as in all other census surveys, false reporting is inevitable. For example, establishments reported employees but showed no entry of wages paid; presumably, this involved only proprietor-owned establishments. To eliminate these unusable observations of a similar nature, establishments are thrown out from the regression analysis if (1) no wages were paid by the firm or no income was withdrawn by the proprietor, or (2) value-added of the establishment is negative.

The variables

As previously stated, all variables used in the regression analysis are observations at the establishment level. Output of an establishment is defined as the firm's value-added during the census year. Capital input is measured by the size of total capital assets in operations at the end of the census year; it included the following: land, buildings, transportation equipment, machinery, cash assets and inventory. Labor input is represented by the number of persons engaged at the end of the census year. The labor input adopted here therefore makes no adjustments to account for the differences in the composition, by sex

and by skills, of labor employed within an establishment. Unit cost of capital is represented by the gross rate of return to capital, which is defined as the ratio of gross value-added minus total wage bill to total value of capital assets in operations.[1] Unit of cost of capital therefore measures the rental cost of capital per year. Unit cost of labor is simply the average wage rate of the establishment, that is, the total wage bill of the establishment divided by the total number of employees at the end of the census year.

3. A Description of the Growth Pattern of Taiwan's Manufacturing Sector

Before discussing the empirical findings on the parameters of the production function of the manufacturing industries, it will be useful at this point to digress a little for a description of the general character of the growth pattern of the manufacturing sector in Taiwan during the crucial transitional stage in the 60's. The fundamental changes in the sector in terms of output composition and factor combinations can be summarized as shown in Table 2.

As suggested earlier, the manufacturing sector of Taiwan was undoubtedly the leading growth sector in Taiwan when the whole Taiwanese economy underwent fundamental changes in dimension as well as in character. Growth rates within the sector, however, varied from industry to industry. In terms of value-added, Industry 35, the chemical industries including crude oil, rubber and plastic, led the growth within the sector, followed by Industry 39, the miscellaneous, 38, manufacture of metal products and machinery equipment, 33 manufacture of wood, bamboo and other related products, and 32, the textiles and apparel

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[1]The rental cost of capital defined in the theoretical sense measuring the opportunity cost of capital cannot be accurately represented empirically. The definition adopted here follows the convention used by Arrow, Chenery, Minhas and Solow; see Arrow, et al. op. cit.

TABLE 2: Input and Output Changes in Taiwan's Manufacturing Sector. 1961, 1966, 1971

Industry	Census Year	Establishment	Capital Assets (In millions)	Employees (Persons)	Value-added (In millions)
31	1971	13,184	34,944	145,576	5,327
	1966	12,749	20,570	137,767	5,203
	1961	15,208	-	104,902	7,273
32	1971	3,818	50,363	310,097	8,321
	1966	1,890	17,167	117,394	2,866
	1961	8,004	-	94,661	2,467
33	1971	3,858	11,527	82,069	3,144
	1966	1,801	4,521	36,512	1,296
	1961	6,402	-	38,053	970
34	1971	2,488	8,716	51,820	2,124
	1966	1,319	3,016	30,412	977
	1961	1,798	-	26,638	827
35	1971	5,118	61,276	192,119	13,610
	1966	2,634	22,521	81,854	6,093
	1961	2,596	-	43,344	2,699
36	1971	2,652	12,051	63,238	2,380
	1966	2,080	5,993	46,196	1,988
	1961	2,268	-	39,312	1,656
37	1971	494	10,864	30,135	713
	1966	175	4,216	17,342	728
	1961	86	-	10,899	846
38	1971	10,568	43,986	273,567	11,000
	1966	5,520	8,909	109,575	3,192
	1961	12,597	-	77,776	2,275
39	1971	1,912	4,410	52,936	1,414
	1966	567	559	12,608	177
	1961	2,608	-	10,082	288
TOTAL	1971	44,092	238,137	1,201,557	48,033
	1966	28,735	87,472	589,660	22,520
	1961	51,567	-	445,667	19,301

Source: Compiled from data taken from Industrial and Commercial Census of Taiwan General Report, for 1966 and 1971.

industry. Industry 39 led the growth in the expansion of employment, followed by Industries 35, 38, 32, and 37. The rapidly growing industries include such conventionally defined labor-intensive activities in the textiles, garments, plywood, plastic products, and electronic products. These labor-intensive industries' role in bringing about the "economic miracle" that Taiwan had achieved in the 60's was, therefore, quite obvious.

Aside from its rapidity, the manufacturing sector's growth in Taiwan during the 60's has at least three other noteworthy features. First of all, the growth in capital input was faster than that of labor input. For instance, total capital assets of the sector increased as much as five times between 1966 and 1971, from NT$87 billion to NT$238 billion; whereas the employment of labor just doubled in the same period. Nevertheless, according to the census report data, shown in Table 3, the share of labor income in value-added increased quite significantly between the 1961 census and 1971 census. Even allowing for a big margin of error for the 1961 census data, that may have caused the sharp changes in the relative shares between 1961 and 1971, it is reasonably evident that the functional distribution of income has changed in favor of labor income during the period when Taiwan's manufacturing sector was rapidly growing.[1] Conceivably the shift is sizeable enough to have bearings on the improvement in the size distribution of income that Taiwan has achieved in the same period.

Another feature that I believe also has important implications with respect to income distribution is the skill composition of the labor force in the manufacturing sector. The 1971 Census of Manufacturing classifies persons engaged

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[1]Aside from the problem related to the quality of data for the 1961 census figures, it is relevant to note that at least for Industry 31 the sharp changes may have to do with government monopolies. Since Taiwan Provincial Bureau of Tobacco and Wine, the large concern in Industry 31, is a government monopoly, indirect business taxes may thus be hidden under the heading of the Bureau's revenues. As a result, the magnitude of value-added at factor cost may have been overstated and the labor's share understated.

TABLE 3: Share of Labor Income in Value-Added: 1961, 1966, and 1971

Industry Code	Per Cent of Labor Share 1961	1966	1971
31	0.09	0.33	0.64
32	0.21	0.42	0.70
33	0.22	0.38	0.50
34	0.26	0.38	0.58
35	0.15	0.22	0.34
36	0.18	0.28	0.56
37	0.17	0.44	-
38	0.25	0.41	0.53
39	0.16	0.62	0.61

TABLE 4: The Proportional of the Skilled Labor in Total Manufacturing Employment

Industry Code	Per Cent of Skilled Labor in Total Employment 1966	1971
31	50	45
32	39	38
33	42	40
34	56	48
35	46	51
36	41	38
37	58	60
38	49	51
39	35	39
Industry	45	45

TABLE 5: Employment Share of Medium and Small Size Firms, 1971

Industry Code	Percentage Share
31	32
32	11
33	32
34	40
35	23
36	44
37	18
38	31
39	24
All	25

in the sector into five occupational categories: managerial, technician, skilled, unskilled, and other unclassified laborers. Suppose we reclassify the first three census categories of labor as skilled and the last two census categories as unskilled. The skill composition of the labor force employed in Taiwan's manufacturing sector appears to be surprisingly stable between 1966 and 1971 from the sector's point of view. This is clearly shown by Table 4.

Finally, the rapid growth of Taiwan's manufacturing sector during the 60's is featured by the active participation of the smaller sized firms throughout the sector. The relative share of labor employment in medium and small size firms is shown in Table 5.

4. Regression Results

The estimates of the production function parameters from Equations (8) and (11) are shown in Tables 6A and 6B. Table 6A presents the estimates of α, the capital intensity parameter, and σ, the elasticity of substitution. Table 6B contains estimates of γ, the efficiency parameter, and μ, the scale parameter.

Since it is assumed that all production parameters are dissimilar among firms of different size, separate regressions were run for each of the nine two-digit industries as well as for each of the three size groups within each two-digit industry. All together, there are 36 regressions for the side equation, and 36 regressions for the CES form defined by Equation (11).

The results derived from the two regression equations are satisfactory. All 72 regression equations are statistically significant at the 99 per cent level except one. All but 4 of the α estimates, the capital intensity parameter, are significant at the 95 per cent level, or higher; and all σ estimates, the elasticity of substitution parameter, are significant at the 99 per cent level with 2 exceptions. Of the 36 γ estimates, the efficiency parameter, all but

TABLE 6A: Estimates of Elasticity of Substitution and Capital Intensity*

ICC	Regressions	Estimates $\sigma \cdot \log \frac{\alpha^*}{1-\alpha^*}$	Estimates σ	Estimates α^*	R^2	F Value	No. of Observations
31	All Firms	-1.0601	0.2808	0.6712	0.1429	918.1	5501
		(0.0163)	(0.0093)				
	Large	-0.0266†	0.4962	0.9615	0.2559	53.6	154
		(0.1395)	(0.0678)				
	Medium	0.74663	0.41124	0.9815	0.1838	130.3	575
		(0.0682)	(0.0360)				
	Small	0.7619	0.2621	0.9990	0.1425	797.4	4793
		(0.0119)	(0.0093)				
32	All Firms	-0.1996	0.3972	0.9178	0.1150	250.9	1924
		(0.0329)	(0.0251)				
	Large	-0.8597	0.3539	0.8230	0.1400	66.1	401
		(0.0756)	(0.0435)				
	Medium	-0.0673†	0.4102	0.9722	0.1120	90.2	708
		(0.0630)	(0.0432)				
	Small	1.0921	0.3881	0.9989	0.0989	98.2	887
		(0.0494)	(0.0392)				
33	All Firms	-1.5909	0.2701	0.0623	0.1295	383.0	2568
		(0.0182)	(0.0138)				
	Large	-1.48500	0.3173	0.1465	0.0829	12.4	127
		(0.1136)	(0.0901)				
	Medium	-2.1788	0.3164	0.0473	0.1441	102.2	602
		(0.0500)	(0.0313)				
	Small	0.1936	0.2446	0.9931	0.1266	269.9	1856
		(0.0183)	(0.0149)				
34	All Firms	-0.8220	0.2895	0.9348	0.1220	227.6	1632
		(0.0431)	(0.0192)				
	Large	-0.13148†	0.2567	0.9768	0.0655	8.4	106
		(0.1029)	(0.0888)				
	Medium	-0.9948	0.2393	0.8345	0.0661	40.3	556
		(0.0873)	(0.0377)				
	Small	0.8885	0.3048	0.9982	0.1723	207.5	993
		(0.0310)	(0.0212)				
35	All Firms	-3.2645	0.3587	0.0029	0.1410	545.1	3315
		(0.0261)	(0.0154)				
	Large	-0.7228	0.4642	0.8958	0.1958	98.9	403
		(0.0926)	(0.0467)				
	Medium	-3.2795	0.3550	0.0026	0.1474	195.1	1124
		(0.0438)	(0.0254)				
	Small	-0.0540††	0.3342	0.9483	0.1264	272.6	1878
		(0.0275)	(0.0202)				

TABLE 6A--continued

ICC	Regressions	Estimates $\sigma \cdot \log \frac{\alpha^*}{1-\alpha^*}$	σ	α^*	F^2	F Value	No. of Observations
36	All Firms	-0.4771 (0.0428)	0.3502 (0.0187)	0.6163	0.1270	294.0	2015
	Large	-0.9978 (0.1069)	0.4816 (0.0792)	0.6233	0.1838	37.0	161
	Medium	0,8608 (0.0334)	0.2810 (0.0282)	0.9994	0.1050	99.7	842
	Small	-0.3681 (0.0578)	0.3171 (0.0249)	0.6929	0.1342	162.2	1041
37	All Firms	-2.5340 (0.0768)	0.2079 (0.0556)	0.0001	0.0437	14.0	285
	Large	0.5734 (0.1699)	0.1034† (0.1058)	0.9999	-0.0009	1.0	51
	Medium	-0.1342† (0.0992)	0.2555 (0.0738)	0.9618	0.0728	12.0	141
	Small	-2.6964 (0.1373)	0.2114†† (0.0999)	0.0000	0.0321	4.5	106
38	All Firms	-0.1795 (0.0118)	0.2721 (0.0101)	0.9668	0.1075	723.6	5999
	Large	1.0244 (0.1170)	0.3345 (0.0386)	0.9891	0.1334	74.9	481
	Medium	-0.1173 (0.0244)	0.2611 (0.0202)	0.9656	0.0923	167.7	1641
	Small	-0.1601 (0.0139)	0.2587 (0.0126)	0.9698	0.1022	424.0	3715
39	All Firms	1.2645 (0.0348)	0.3840 (0.0215)	0.9986	0.2081	318.4	1209
	Large	0.2408 (0.0848)	0.2448 (0.0543)	0.9856	0.1496	20.3	111
	Medium	1.0567 (0.0659)	0.3933 (0.0412)	0.9973	0.2393	91.3	288
	Small	0.8268 (0.0644)	0.3702 (0.0279)	0.9895	0.1737	176.5	836

*Numbers in parenthesis are standard errors. Unless otherwise indicated, all estimates are significant at the 99 per cent level.

†Not significant.

††Significant between 95-99 per cent.

Source: The 1971 Industrial and Commercial Census of Taiwan.

TABLE 6B: Estimates of Efficiency Parameter and the Degree of Homogeneity*

ICC	Regressions	Estimates log γ	Estimates μ	R^2	F Value	No. of Observations
31	All Firms	0.0617†	0.8044	0.6370	9654.3	5501
		(0.0381)	(0.0082)			
	Large	0.7955	0.8527	0.7015	360.3	154
		(0.0678)	(0.0449)			
	Medium	-0.4385	0.8488	0.5680	755.6	575
		(0.0578)	(0.0389)			
	Small	0.4906	0.6104	0.3858	3011.4	4793
		(0.0111)	(0.0111)			
32	All Firms	-0.1539	0.9780	0.7681	6369.8	1924
		(0.0449)	(0.0122)			
	Large	-0.5240	0.6925	0.6177	647.4	401
		(0.1408)	(0.0272)			
	Medium	1.3451	0.9139	0.6553	1344.9	708
		(0.0362)	(0.0249)			
	Small	-0.2925	0.8533	0.6700	1800.2	887
		(0.0264)	(0.0201)			
33	All Firms	-0.3376	0.9725	0.7264	6814.9	2568
		(0.0451)	(0.0118)			
	Large	0.1122†	0.8741	0.6540	241.7	127
		(0.0906)	(0.0562)			
	Medium	-0.1366††	0.7226	0.4200	436.1	602
		(0.0566)	(0.0346)			
	Small	0.5815	0.6469	0.4648	1612.3	1856
		(0.0145)	(0.0161)			
34	All Firms	1.0600	0.8812	0.7442	4744.7	1632
		(0.0390)	(0.0128)			
	Large	0.3216	0.8482	0.7613	335.9	106
		(0.0686)	(0.0463)			
	Medium	1.0508	0.7596	0.6184	900.5	556
		(0.0600)	(0.0253)			
	Small	-0.5426	0.6494	0.3803	609.8	993
		(0.0314)	(0.0263)			
35	All Firms	-1.8643	1.0628	0.7295	8938.1	3315
		(0.0256)	(0.0123)			
	Large	0.5871	0.7762	0.7608	1279.7	403
		(0.0551)	(0.0217)			
	Medium	-1.9707	0.9463	0.4235	826.1	1124
		(0.0471)	(0.0329)			
	Small	-0.6989	0.8161	0.4551	1568.8	1878
		(0.0220)	(0.0261)			

TABLE 6B--continued

ICC	Regressions	Estimates log γ	Estimates μ	R^2	F Value	No. of Observations
36	All Firms	-1.4780	0.9987	0.6689	4069.7	2015
		(0.0212)	(0.0157)			
	Large	1.4615	0.8659	0.6426	288.6	161
		(0.0678)	(0.0510)			
	Medium	1.1742	0.6285	0.4310	637.9	842
		(0.0409)	(0.0249)			
	Small	-1.5160	0.8846	0.4108	726.1	1041
		(0.0237)	(0.0328)			
37	All Firms	-1.6440	1.0016	0.7254	751.1	285
		(0.0703)	(0.0365)			
	Large	0.1524†	0.9221	0.6946	114.7	51
		(0.1415)	(0.0861)			
	Medium	0.1941††	0.7745	0.5235	154.8	141
		(0.0754)	(0.0622)			
	Small	-1.7836	0.8242	0.2697	39.8	106
		(0.1181)	(0.1307)			
38	All Firms	0.4576	0.9021	0.7214	15535.8	5999
		(0.0100)	(0.0072)			
	Large	-0.1491	0.8869	0.6989	1115.1	481
		(0.0464)	(0.0266)			
	Medium	1.0443	0.7238	0.4340	1258.5	1641
		(0.0192)	(0.0204)			
	Small	0.2938	0.6791	0.3984	2460.9	3715
		(0.0111)	(0.0137)			
39	All Firms	-0.1880	0.8817	0.6429	2175.8	1209
		(0.0259)	(0.0189)			
	Large	0.0870†	0.8226	0.5213	120.8	111
		(0.0824)	(0.0748)			
	Medium	0.3982	0.6167	0.4274	215.2	288
		(0.0602)	(0.0420)			
	Small	-1.1435	0.7355	0.4100	581.2	836
		(0.0324)	(0.0305)			

*Numbers in parenthesis are standard errors. Unless otherwise indicated, all estimates are significant at the 99 per cent level.

†Not significant.

††Significant between 95-99 per cent.

Source: The 1971 Industrial and Commercial Census of Taiwan.

4 are at least significant at the 95 per cent level; and all 36 estimates of the scale parameter are significant at the 99 per cent level.

All individual estimates of the production parameters are well behaved in the sense that they all have the appropriate sign and fall into the appropriate range. I shall discuss them separately.

The capital intensity parameter

As stated earlier, in order to obtain estimates of the particular parameter independent of the units of measurement of variables defined in Equation (8), all variables in the regression equation were converted into index numbers, with the first observation in each industry group as the base. Therefore, the capital intensity estimates can be compared only within an industry group. However, estimates of σ from the same regression equation are pure numbers and therefore are free from the above restrictions.

In the context described above, the regression results suggest that the capital intensity of the prevailing technology vary little between large and small sized firms in Industries 31, 34, 35, 38, and 39. Our empirical estimates clearly suggest that the character of the prevailing technology is capital intensive for large-sized firms in Industry 37. Surprisingly, our results also indicate that small-sized firms in Industries 32, 33, and 35 are characterized by technology of high capital intensity. One plausible interpretation of these latter results may be the way the capital services were measured in this study. Our capital input is a complex measure of capital assets in land, fixed equipment, buildings and other assets, such as cash and inventory. Conceivably, the composition as well as the overall size of the composite input may vary between large and small size firms. For small size firms the input land may take on a disproportionate share in total capital requirements. This particular issue

will be examined separately in a different paper. At this point it is necessary to say that the capital intensity character of the technology alone will not determine the actual combination of factors. As shown in Equation (5), the ratio of capital to labor is a function of the capital intensity factor as well as of the relative factor costs and factor substitutability.

For comparison purposes, the intensity of capital, measured by the ratio of the marginal rate of substitution of labor for capital, which is assumed to be equal to w/r, to capital per employee, is presented in Table 7. The logic of the measurement is illustrated in Figure 1, where both axes are in the logarithmic scale. In Figure 1, Technology A may be said to be more capital intensive than Technology B.

Figure 1

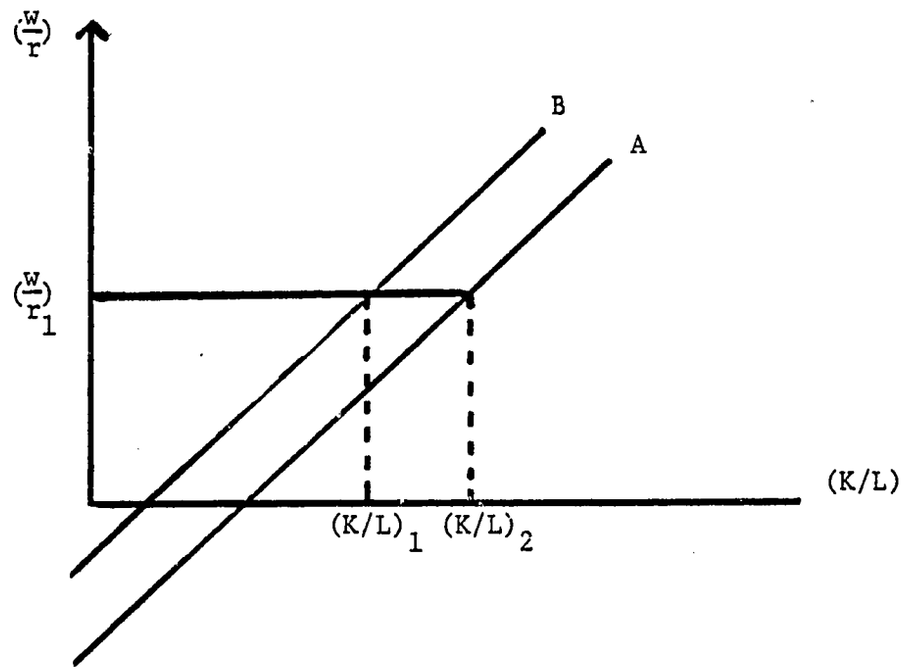

Table 7 suggests that large firms are more capital intensive than small firms for all two-digit industries except Industry 32.

TABLE 7: Marginal Rate of Substitution and Capital Intensity

Industry		Mean wage rate (1) (NT$1,000)	Mean rate of return to capital (2)	Marginal rate of substitution	K/L (NT$1,000 per employee)	MRS/ (K/L)
31	All firms	20.497	0.217	94.5	373.9	0.252
	Large firms	22.711	0.281	80.8	459.8	0.176
	Medium firms	16.390	0.245	66.9	320.9	0.208
	Small firms	15.569	0.211	73.8	118.3	0.624
32	All firms	18.255	0.235	77.7	250.5	0.310
	Large firms	18.441	0.290	63.6	214.7	0.296
	Medium firms	16.940	0.236	71.8	530.6	0.135
	Small firms	16.179	0.213	76.0	531.1	0.143
33	All firms	20.020	0.197	101.6	196.9	0.516
	Large firms	21.334	0.245	87.1	230.1	0.378
	Medium firms	17.049	0.237	71.9	134.9	0.533
	Small firms	17.991	0.180	100.0	114.7	0.871
34	All firms	23.064	0.170	135.7	230.5	0.589
	Large firms	26.550	0.181	146.7	310.9	0.472
	Medium firms	18.955	0.197	96.2	122.7	0.784
	Small firms	15.890	0.153	103.9	90.7	1.144
35	All firms	22.950	0.202	113.6	500.7	0.227
	Large firms	24.241	0.253	95.8	539.8	0.177
	Medium firms	18.815	0.224	84.0	414.5	0.203
	Small firms	15.839	0.179	88.5	249.1	0.355
36	All firms	21.197	0.174	121.8	312.8	0.389
	Large firms	25.744	0.183	140.7	467.9	0.301
	Medium firms	15.642	0.171	91.5	112.7	0.812
	Small firms	15.033	0.173	86.9	143.5	0.606
37	All firms	25.598	0.236	108.5	439.5	0.247
	Large firms	27.162	0.403	67.4	466.8	0.144
	Medium firms	18.651	0.171	109.1	289.4	0.377
	Small firms	18.858	0.242	77.9	496.3	0.157
38	All firms	21.164	0.197	107.4	209.7	0.512
	Large firms	22.579	0.270	83.6	245.0	0.341
	Medium firms	18.379	0.226	81.3	143.3	0.565
	Small firms	17.200	0.172	100.0	104.1	0.961
39	All firms	16.026	0.250	64.1	94.0	0.682
	Large firms	15.943	1.046	15.2	82.0	0.185
	Medium firms	16.623	0.263	63.2	103.7	0.609
	Small firms	15.766	0.148	106.6	174.8	0.610

The elasticity of substitution

The empirical results here are rather surprising. All 36 estimates of the elasticity of substitution parameter are significantly different from unity; and all but one are significantly different from zero as well. Our estimates of this parameter with important consequences for factor returns all fall into the range between 0.2 and 0.49. This cross-section finding is consistent with the rapid growth of capital and the decline in the relative share of capital noted before. The correspondence of the cross-section and time-series findings thus add cogency to the empirical results reported here. It is also interesting that the elasticity of substitution estimates based on the cross-section analysis at the two-digit industry level reported here are very close to those found for the U.S. manufactures at the comparable level of aggregation. The weighted mean estimate for 20 two-digit industries in the U.S. manufacturing sector is 0.328 as reported by J. R. Moroney, compared with the mean estimate of 0.312 for Taiwan.[1]

It can be shown that the side equation that is used to generate the particular parameter implicitly assumes instantaneous adjustment without lags. It is a strong assumption. However, the assumption is not as unreasonable as it would seem. It is simply due to the fact that our regressions were run on the basis of cross-section observations. The capital stock and the combination of factors would bear and reflect the influence of changes as well as the differentials in relative factor costs at different vantage points. Therefore, the estimates would adequately indicate the technical substitutability of factors. Because of the particular definition we adopt in quantifying labor input, it is

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[1]My estimates may be compared with those reported by Moroney in still another aspect. That is, the elasticity of substitution estimated based on the log linear form used by Arrow, et al. are consistently higher than those obtained using a side equation. The findings here add weight to his argument that the log linear form relating value-added per worker to the average rate has serious identification and specification problems.

possible that the estimated parameter measures the substitutability between capital and labor as well as among various components within each input.

In any case, the general rigidity in factor substitution that I have uncovered here may very well explain why the labor's share in total value-added had increased in Taiwan's manufacturing sector between 1961 and 1971. As shown in Equation (7), the share of the slower growing factor increases in final output if the elasticity of substitution of labor for capital is less than unity. Furthermore, if labor, both skilled and unskilled, and capital have to be utilized in a package fashion, a hypothesis suggested by Werner Baer and Michael Hervé,[1] expansion of the manufacturing sector would benefit not only the skilled elite, but also the unskilled. The distributional implications of such a hypothesis is clear. Our findings that pertain to the rigidity of factor substitution partially confirms the empirical relevency of the hypothesis.

It is also significant to note that the degree of rigidity in factor substitution varies from group to group within industries, although there is no clear pattern emerging from our empirical evidence. Specifically, our results do not suggest that large firms in general are less rigid than small firms. Elasticity of substitution estimates are higher for large-sized firms in Industries 31, 33, 35, 36, and 38; less for large-sized firms in the remaining industries. It is interesting to add that in Industries 31, 35, and 36, large-sized firms are also found to be labor-intensive.

The efficiency parameter

Following what has been suggested in Section 2, the differentials in total efficiency is measured by the differences in the intercept terms of the regression equation defined in Equation (3).

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[1] Baer and Hervé. op. cit.

At the outset, it may be said that our regression results support the contention that small scale operations are not necessarily a technical deficiency in every industry. The efficiency level is higher for large-sized firms in Industries 31, 35, and 36. But for other two-digit industries, medium-sized and small-sized firms appear to be more efficient than large-sized firms. For example, the medium-size group is found to be most efficient in textiles, apparel, paper and products, metal manufacture and other basic metal industries; the small-sized firms are found to be most efficient in the manufacture of wood, bamboo and other related products. Large firms are least efficient in Industries 32, 33, and 38. And in all five industries where medium-sized firms are found to be efficient we find the highest rate of growth between 1961 and 1971.

The scale parameter

Our estimates of the scale parameter at the industry level vary from 1.06 for Industry 35 to 0.80 for Industry 31. The most significant aspect of our estimates appears to be that increasing returns to scale were unimportant. Broadly speaking, our empirical findings suggest constancy in returns to scale for Industries 32, 33, 35, 36, and 37 at the industry level. Within each of these industries, decreasing returns to scale were less severe for large-sized firms in almost all two-digit industries except Industries 32, 35, and 36.[1] As suggested earlier, the expansion of small-scaled firms in those industries would therefore generate a greater employment effect than a similar expansion by large firms. These industries with the described attributes expanded rapidly during

[1] I am aware of the difficulties involved in the interpretation of this coefficient in the particular CES form adopted here. The μ coefficient in Equation (1) is known to be affected by two different forces; a neutral technological advancement that changes returns to scale and changes in returns to scale due to variations in the scale of operations. In the context of the present study, a separation of the two is not essential. In fact, either interpretation is acceptable without invalidating our main argument.

the transitional stage of growth in Taiwan.

5. Summary and Concluding Remarks

Evidence from our regression analysis confirms that technology, defined in terms of factor intensity, varies due to differentials in size between firms for industries grouped at the 2-digit level in Taiwan's manufacturing sector. Capital intensity required of the prevailing technology is higher for small size firms in Industries 32, 33, and 35.[1] Conversely, large size firms in Industry 37 are more capital intensive. For other 2-digit industry groups, 31, 34, 36, 38, and 39, the factor intensity of the prevailing technologies does not differ significantly between large and small size firms.

As shown in Equation (5), the observed factor combination contains two distinct components, given elasticity of substitution. While the pure technology component, $(\frac{\alpha}{1-\alpha})^{\sigma}$, is separable from the interaction between factor demand, consumption patterns, and income distribution, the relative factor price component, $(\frac{w}{r})^{\sigma}$, is an integrated part of the interaction. Hence, our analysis may affect the empirical results of the Seers-Land-Soligo type of exercise in two ways; one relating to the disaggregation issue, and another to the influence of the existing interaction mechanism of income distribution on relative factor prices. The findings reported here combined with my previous report on the redistributional impact on factor demand in Taiwan underline the importance of the interaction between the existing pattern of income distribution and factor demand.[2]

The role of the manufacturing sector during the transitional period in transforming the character of the Taiwanese economy is evidently enormous in terms

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[1] Using direct observations, as shown in Table 7, only in Industry 32 may small firms be said to be more capital intensive than large firms.

[2] Y. M. Ho, op. cit.

of employment creation, output growth, and export expansion. While the sector expanded rapidly as a whole in the period from 1961 to 1971, growth rates differ within the sector. For the two-digit industry groups, Industries 32, 33, 35, 37, 38, and 39 grew much faster than other two-digit industries in the manufacturing sector, measured either in terms of output growth or employment expansion.

Our analysis of the production structure of the manufacturing sector of Taiwan in the well-known CES production function framework uncovers several distinctive features in the development of this growth-leading sector in Taiwan. The most significant is the active participation of firms of all sizes; this is particularly true in the fast growing industries within the sector. For the fast-growing industries, our empirical findings suggest that they have the distinctive feature of being labor-intensive. Equally interesting is our finding that small-sized and medium-sized firms are more efficient than large-sized firms in most of these fast growing industries. Concisely, our results indicate that either the medium-size firms or the small-sized firms are more efficient than large-sized firms in Industries 32, 33, 34, 37, 38, and 39. Piecing the evidence together, it strongly supports our contention that small-scaled, labor-intensive industries are not necessarily technically inferior to large-scaled, capital-intensive ones.

The growth of the manufacturing sector in Taiwan was characterized by another feature in the use of unskilled labor. The skill composition of the labor force (as shown in Table 4) in the sector remained essentially unchanged between 1966 and 1971. The feature is most important and relevant to the issues related to distributional equity. If development programs and projects emphasize the use of the skilled worker, the development process will unavoidably lead to the creation of a class of an "elite" group within the labor force and at the

same time deny the gains from development to those unfortunate ones who are outside the "elite" group. The deterioration in the distributional equity in most LDC's may very well be explained by the simultaneous pressure of excess demand for the skilled and well educated and excess supply of the unskilled and poorly educated. The constancy of the skill composition of the labor force in Taiwan's manufacturing sector therefore appears to be a significant contributory factor in distinguishing the particular pattern of income distribution there from the common pattern found elsewhere in the LDC's.

Finally, the growth of Taiwan's manufacturing sector is featured by the high rate of growth in capital input, relative to the growth in labor employment. Yet, in the transitional period, the share of capital income declined, and the share of labor income rose accordingly for the manufacturing sector as a whole. This is not at all surprising in view of the low substitutability between capital and labor that our empirical estimates of the elasticity of substitution parameter suggest. Again, from the point of view of distributional equity, a low elasticity of substitution is contributory to improvement in income distribution if labor is the slower growing factor. This, of course, is true in Taiwan. It may further be argued that inequality in the size distribution of income is reduced if the labor share in income rises.

The evidence related to the Taiwanese experience leads to two conclusions. First, the fast growing industries in Taiwan's manufacturing sector are characterized by their labor-intensity character, and they are also industries in which the efficiency of resource utilization is not impaired by small-scaled operations. Therefore, the evidence here strongly suggest the potential of the small-scaled, labor-intensive industries as a development vehicle for the developing nations with similar socio-economic conditions. Secondly, the particular growth features

of Taiwan's manufacturing sector contribute significantly to the exceptional performance in the distributional aspect of Taiwan's growth experience. In my opinion, this particular model of growth is equitable by allowing a greater degree of participation of small proprietors and therefore a better distribution of ownership of productive resources. By emphasizing employment expansion for all categories of labor, the particular growth model has the commendable feature in reducing the pressure on excess supply of the unskilled and poorly educated.

The implications of the empirical findings for development policies are clear. First, development projects and programs all have their identifiable impact on the distribution of gains from development. The empirical results reported here suggest rather clearly that a limited substitutability exists between capital and labor within a given industry. Thus, choices of techniques in the development context are not as important, in terms of distribution impact, as choices of industries. The success in maintaining an appropriate balance between growth and equity in Taiwan may be largely attributable to the selection of a set of industries where the resources required are consistent with the economy's factor endowment. Secondly, it seems preferable that growth and equity issues be simultaneously dealt with as a related and joint issue in development planning. To consider these two issues separately and sequentially in any other order appears to be less expedient both politcally and economically. Once a socially unacceptable distribution pattern is formed through a biased development policy, the government in most LDC's may not have the necessary political nerve and power to redistribute income.

It should be pointed out that, in drawing other policy implications, the findings reported here are not intended as an empirical basis of screening industries for development in the LDC's, which would require a higher degree of

disaggregation of firms either at the 4-digit or 5-digit levels. The level of aggregation chosen here is particularly intended for the purpose of this study.

Finally, in the light of new evidence that factor intensity does vary between firms, the Seers-Land-Soligo proposition needs to be re-examined and the inconsistency in empirical results be reconciled. Simulation results using the findings shown here will be reported in another paper.

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