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CAPITAL COEFFICIENTS IN PHILIPPINE MANUFACTURING: AN ANALYSIS

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CAPITAL COEFFICIENTS IN PHILIPPINE MANUFACTURING: AN ANALYSIS*

Introduction

This paper examines the extent of capital use in Philippine manufacturing industries in comparison with corresponding industries in Japan and in the United States. While factor endowments suggest otherwise, some of our manufacturing industries seem to be capital intensive in character, as will be shown below. The possibility that some Philippine industries are actually employing factor-proportions different from that dictated by factor supply will also be suggested.

Part I describes the measure of capital intensity used in this study and the procedure in the derivation of the estimates of this measure for the various industries. Part II makes a statistical comparison of capital intensities found to prevail in Philippine industries with those which have been observed in the corresponding industries in Japan and in the United States. Some explanations to the observations noted in Part II are provided in the concluding part of this paper.

I

Some form of the capital coefficient[1] is often used to describe the

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[1]For the purpose of this paper, the term "capital coefficient" represents a technological parameter which relates the value of the existing stock of capital in a particular industry to the value of output producible from it for a given time period. Clearly, the capital coefficient can take many forms, depending on how the terms "capital" and "output" are defined; see [1, pp. 2-6].

degree of capital intensity in an industry. In this paper, our measure of the capital coefficient is the ratio of the book value of fixed assets (land excluded) to the value of capacity output of the industry for a particular year. Twenty-nine industries, consisting of the twenty (2-digit ISIC) major groups of manufacturing and the nine (3-digit ISIC) food groups are considered in this study.[2] Because of data limitations, the coefficient estimates have been derived only for the "large" establishments (employing ten or more workers).

The 1961 Economic Census publication for Manufacturing provides data for the large establishments on the book value of fixed assets[3] on January 1, 1961 and on the value of actual production[4] for 1961. The capital coefficient can be computed, therefore, once the capacity utilization rate in 1961 for the various industries are known. Estimates of the latter are derived using the results of a sample survey on capacity utilization.

The Sample Survey on Capacity Utilization

The population consists of the 4,085 manufacturing establishments which were classified as "large" in the 1961 Economic Census. A stratified random sample was designed using the individual establishment as the sample unit. Stratification was achieved to the level of the 4-digit ISIC. Generally, a sampling ratio of one-fifth was used. However, for industries composed

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[2] A detailed description of the ISIC Code can be found in [2].

[3] Consisting of buildings and structures, machinery and other production equipment, transportation equipment and other fixed assets; see Appendix 4, below.

[4] Consisting of total shipments plus the addition to finished products and in-process inventories; see Appendix 5, below.

of more than fifty establishments, the sample size was fixed at ten, while for industries of less than ten establishments, the sample size was fixed at two. Sample establishments were selected (from the 1961 list of the large manufacturing firms furnished by the Bureau of the Census and Statistics) systematically with the use of random start.

All selected establishments were sent the questionnaire with the accompanying instruction letter by mail.[5] Follow-up letters, telegraphic contacts and telephone calls were used to delinquent establishments.

The underlying assumption, which provides the rationale for the survey, is that entrepreneurs have an idea on how far they can stretch the level of production using the existing stock of capital if there were no problem of market demand for their products. Ideally, capacity - so defined - would be the level of output at which the short-run marginal cost curve intersects the horizontal line corresponding to the going market price.[6] (The implicit assumption is that firms seek to maximize profit.)

As can be gathered from the questionnaire form,[7] the respondents were asked for: (1) separate figures for 1961 production output and capacity, the latter necessarily in their own estimate, (2) maximum monthly production in 1961, and (3) their estimate of the 1965 capacity utilization rate. Using certain obvious assumptions, we can derive from the above information

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[5] See Appendices 2A and 2B, below.

[6] There seems to be no generally accepted definition - much less, measurement - of capacity among economists. [1, Ch. III] gives a unified synthesis of some of the definitions of capacity which have appeared in the economic literature.

[7] See Appendix 2, below.

three corresponding values of the 1961 capacity utilization rate[8] for each responding establishment: (1) as the ratio of the 1961 production output to the 1961 capacity output, (2) as the maximum monthly production in 1961 multiplied by 12, and (3) as the given estimate of the 1965 rate of capacity utilization. In cases where two or more of the above could be computed (only a few establishments actually submitted the complete information), personal judgment was used to decide on which figure to take.

As a next step, we computed for the arithmetic average of the CURs of the establishments under each 4-digit industry. These figures for the 4-digit industries in turn were averaged on a weighted basis[9] giving us the CUR for each 3-digit industry (group). Finally, the weighted average of the group's CURs were taken to yield the CURs for the 2-digit industries (major groups).[10]

Results of the Survey

Of the 564 establishments which were sent the questionnaire, only 196 turned in useful replies. The relatively small number is only partly explained by the high refusal rate. Since 1961, several establishments have either changed address, been burned down, or stopped operation. In addition, returns of dubious value - most of which were accomplished by clerks, secretaries and the like - amount to 8%. The refusal rate, despite the use

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[8] For multi-product establishments, the weighted average (based on the value of output) of the capacity utilization rates in the production of the different products.

From hereon, we shall use, for brevity, CUR to represent capacity utilization rate.

[9] Based on the relative contribution to total output of the 3-digit industry.

[10] The estimating equations used are presented in Appendix 1, below.

of the Bureau's facilities, remains a big 41%.

But even with such a small sample, it has been possible to derive estimates of the capacity utilization rates as outlined above. However, the small turnout of useful replies precluded any meaningful indication of statistical reliability of our estimates. (We could only compare them with some published figures, which is done below.) The results of the survey are shown in Appendices 3A and 3B. Table 1 presents the computed capacity utilization rates and the corresponding values of the coefficient of variation[11] for the 2-digit industries and the 3-digit food industries.

Comparison with PIA Estimates

Our estimates of capacity utilization rate admittedly carry a wide margin of uncertainty because of the small number of establishments that turned in useful replies. It is deemed necessary, therefore, to compare these figures with some other set of estimates. Unfortunately, no other set of across-the-board estimates for the manufacturing industries is available. The Program Implementation Agency[12] has written down some

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[11] Using the notation in Appendix 1:

$$C.V._{kl} = \frac{\sum_{j=1}^{n_k} y_j (u_{jkl} - u_{kl})^2}{n_k y_k} \quad \text{for the 3-digit industries,}$$

and

$$C.V._{l} = \frac{\sum_{k=1}^{n_l} y_k (u_{kl} - u_{l})^2}{n_l y_l} \quad \text{for the 2-digit industries.}$$

It must be noted that the coefficient of variation is a measure of dispersion and does not indicate statistical reliability of the estimates.

[12] Now the Presidential Economic Staff.

TABLE 1

RESULTS OF SURVEY ON CAPACITY UTILIZATION

ISIC No.	No. of Establishments Actual	Selected	S U R [a]	% Capacity Utilization	Coefficient of Variation
		3-digit food industries			
201	17	7	4	68	0.218
202	18	5	3	79	0.084
203	27	7	5	76	0.036
204	36	9	4	62	0.114
205	201	22	5	67	0.309
206	413	36	7	54	0.029
207	55	15	6	92	0.091
208	61	12	4	66	0.129
209	174	41	14	51	0.224
		Other manufacturing industries: 2-digit			
21	88	17	5	88	*
22	64	16	6	87	*
23	101	29	13	60	0.178
24	853	68	21	76	0.050
25	385	49	11	69	*
26	162	11	5	79	0.096
27	89	14	6	70	0.157
28	235	18	7	61	0.107
29	42	7	3	53	*
30	45	11	4	90	0.058
31	195	26	15	72	0.012
32	6	2	1	82	-
33	147	16	8	84	0.154
34	53	13	5	68	*
35	160	30	12	47	0.219
36	125	21	6	89	0.052
37	73	11	6	81	0.066
38	136	15	4	79	0.112
39	124	35	6	75	0.088
TOTAL	4085	564	196		

[a] Sent useful response.

* Less than 0.01.

figures representing the rate of capacity utilization in selected manufacturing industries. The latter estimates, together with our figures for the corresponding industries, are shown in Table 2.

Close similarity in the numerical values should not be expected because of the different periods involved and possible difference in concepts used. However, it is readily observed that, except for a few industries, the two sets of estimates are roughly of the same order of magnitude. Both sets of estimates thus permit the same inference on the extent of excess capacity prevailing in the manufacturing industries.[13]

Calculation of the Capital Coefficient

Dividing the industry's production output (obtained from Appendix 4, below) by the corresponding capacity utilization rate (see Table 1, above) gives the estimate of the capacity output. Table 3, Column (3) shows the estimated values of capacity output for the industries being considered.

The estimate of the capital coefficient for each industry is arrived at by dividing the book value of the industry's fixed assets (obtained from Appendix 4) by the corresponding value of the capacity output. The estimated values of the capital coefficient for the industries under consideration are presented in Table 3, Column (4).

II

Almost by definition, an underdeveloped country is characterized by scarce capital and relatively abundant supply of labor. The reverse

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[13] The results of the survey on capacity utilization does not seem to bear out the intuitive notion that little unused or underutilized capital assets exist in an underdeveloped economy. The problem of excess capacity in Philippine manufacturing industries is examined [1, pp. 80-87].

TABLE 2

COMPARISON OF ESTIMATES OF CAPACITY UTILIZATION IN SELECTED INDUSTRIES WITH PIA FIGURES

ISIC No.	Industry	Survey Estimates (1961), %	PIA Estimate (1964), %
2051	Rice milling	49	27
2052	Corn milling	42	42
2096	Animal feeds	64	58.44
211	Distilleries	89	77
213	Breweries	88	92
214	Soft drinks	88	52
2211	Cigars, cigarettes	66	95, 90
232	Knitting mills	80	89.8
27	Pulp and paper	70	66.8
291	Leather tanning	64	52.6
302	Rubber tires, tubes	93	100, 80.3
321	Petroleum refining	82	91.8
3722	Radio tubes, transistor	82	75, 82

Source:

All other PIA figures were obtained from "Outlook and Status of Selected Manufacturing Industries", Program Implementation Agency, Manila, August 30, 1965. (Mimeographed).

Survey estimates were derived from Appendices 3A and 3B.

TABLE 3

Estimates of 1962 Capacity Output and Capital Coefficient

ISIC No. (1)	Industry (2)	Capacity Output (₱1,000) (3)	Capital Coefficient (4)
	2-digit manufacturing industries		
20	Food manufactures	1,543,389	0.190
21	Beverages	256,933	.195
22	Tobacco products	311,698	.100
23	Textiles	496,427	.435
24	Footwear	197,419	.166
25	Wood products	498,043	.213
26	Furniture and fixtures	35,420	.207
27	Paper and paper products	175,256	.334
28	Printed and published materials	171,154	.266
29	Leather and leather products	31,023	.157
30	Rubber products	157,366	.314
31	Chemicals	662,840	.169
32	Petroleum products	406,574	.088
33	Non-metallic products	157,243	.622
34	Basic metal products	221,093	.201
35	Fabricated metal products	275,670	.134
36	Machinery	96,798	.241
37	Electrical machinery	101,130	.281
38	Transport equipment	131,801	.340
39	Miscellaneous manufactures	64,405	0.378
	3-digit food industries		
201	Meat products	16,001	0.133
202	Dairy products	68,628	.167
203	Canned and preserved fruits and vegetables	67,205	.103
204	Canned and preserved fish and other sea foods	8,753	.309
205	Grain mill products	287,146	.119
206	Bakery products	115,202	.073
207	Sugar mill products	489,720	.343
208	Cocoa, chocolate and sugar confectionery	36,579	.174
209	Miscellaneous food preparations	453,855	0.195

conditions hold in the case of the developed economy. One's expectation, therefore, would be that, in those industries where factor substitution is possible, the methods of production employed in the less developed economy will be less capital intensive, i.e., the capital coefficient in each industry will be at most equal to that of the corresponding industry of the economically more advanced country.

The capital intensities of Philippine manufacturing industries will now be compared with those of the corresponding industries in other countries which are at different levels of economic development. Using methods of statistical analysis, the capital coefficients derived above will be compared with those which have been obtained in the United States and Japan. While there are estimates of capital coefficients available for other countries, the extent of comparability of those sets of estimates with ours is rather limited. Since there have been studies which utilize fully such data,[14] the comparison of capital coefficients here is confined, as already mentioned, among the manufacturing industries in the Philippines, Japan and the United States.

Table 4 compares the size of the capital coefficient in the various 2-digit manufacturing industries in the Philippines, Japan and the United States. A comparison of coefficient estimates in each of the 3-digit food industries in the Philippines and in the United States is shown in Table 5.

Two sets of coefficient estimates for the 2-digit industries in the United States are presented. The 1939 estimates were derived from Leontief's interindustry study of the American economy for that year. The

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[14] See, for example, [3] and [4, pp. 83-97].

TABLE 4

COMPARISON OF CAPITAL COEFFICIENTS (BASED ON DEPRECIATED VALUE OF FIXED ASSETS, EXCLUDING LAND): 2-DIGIT MANUFACTURING INDUSTRIES

ISIC No.	Industry	United States (1961)[a]	United States (1939)[b]	Japan[c] (1955)	Philippines (1961)
20	Food manufactures	0.140*	0.147	0.131**	0.190
21	Beverages	-	.290	-	.195
22	Tobacco products	.054	.060	-	.100
23	Textiles	.018	.270	.295	.436
24	Footwear	.044	.117	.171	.165
25	Wood products	.325	.335	.293	.213
26	Furniture and fixtures	.117	.168	.288	.207
27	Paper and paper products	.420	.329	.245	.334
28	Printed materials	.161	.201	.147	.266
29	Leather and leather products	.068	.071	.122	.157
30	Rubber products	.180	.179	.154	.314
31	Chemicals	.381	.248	.293	.169
32	Petroleum products	.549	.321	.518	.088
33	Non-metallic mineral products	.352	.477	.329	.622
34	Basic metal products	.398	.330	.337	.201
35	Fabricated metal products	.352	.190	.123	.134
36	Machinery	.188	.220	.201	.241
37	Electrical machinery	.200	.117	.332	.281
38	Transport equipment	.157	.169	.294	.340
39	Miscellaneous manufactures	0.254	0.760	0.167	0.378

*Estimate for food manufactures and beverages.

**Estimate for food and kindred products.

Sources:

[a]Computed from data obtained from Appendix II, in Daniel Creamer, Recent Changes in Manufacturing Capacity (New York: National Industrial Conference Board, Inc., 1962); see Appendix 5, below.

[b]Wassily Leontief, et al., Studies in the Structure of the American Economy (New York: Oxford University Press, 1953), Appendix 1, pp. 436-491.

[c]M. Massaki, "Capital-Output Ratios by Industry of Japan", Indian Economic Review, V (February, 1960), Table II, p. 50.

TABLE 5

COMPARISON OF CAPITAL COEFFICIENTS (BASED ON DEPRECIATED VALUE OF FIXED ASSETS, EXCLUDING LAND): 3-DIGIT FOOD INDUSTRIES

ISIC No.	Industry	United States[a] (1939)	Philippines (1961)
201	Meat products	0.117	0.133
202	Dairy products	.147	.168
203	Canned and preserved fruits and vegetables	.150	.103
204	Canned and preserved fish and other sea foods	.150	.309
205	Grain mill products	.099	.119
206	Bakery products	.185	.073
207	Sugar mill products	.190	.284
208	Cocoa, chocolate and sugar confectionery	.437	.174
209	Miscellaneous food preparations	0.130	0.111

Source:

[a]Leontief, op. cit., Appendix 1, pp. 486-491.

estimates for 1961, on the other hand, were computed from the basic data made available by the National Industrial Conference Board.[15] For the 3-digit food manufacturing industries, only the 1939 set of estimates by the Harvard Economic Research Group is available. In all the above-mentioned sets of coefficient estimates, capacity output was used.

The estimates for the 2-digit industries in Japan reflect actual production output and hence, carry an upward bias. However, it has been claimed that the use of actual production figures would not unduly overstate the actual coefficient values since most Japanese industries operated at full capacity in 1955 - a year of recovery in Japan's business cycle. An additional qualification that needs mention is the possible change that might have occurred in the size of the capital coefficient in Japanese industries from 1955 to 1961. A convenient assumption would be that a downward bias was introduced by using 1955 estimates and that it is of such magnitude as to offset the upward bias created by the use of actual production output.

Even a cursory examination of Table 4 would reveal that the expected correlation between the level of economic development and the size of the capital coefficient in the industries cannot be established. For instance, in only four of the eighteen industries (FOOD MANUFACTURES, BEVERAGES and TOBACCO PRODUCTS being treated as one industry) are the Philippine coefficients lowest. Coefficient values for the United States, on the other hand, are lowest in seven industries.

It is possible the surprisingly high values of the estimates for

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[15] Reproduced in Appendix 5, below.

From hereon, unless indicated otherwise, the United States estimates which we shall use for the 2-digit industries refer to the 1961 values.

Philippine industries resulted from the exclusion of the small establishments in the estimation process. This can be easily investigated. Referring to Table 6, it is noted that small establishments contribute a relatively large share (more than 20% to total gross receipts in the industries producing furnitures and fixtures (ISIC No. 26), footwear (ISIC No. 24) and miscellaneous manufactures (ISIC No. 39). Only in the last mentioned industry is the capital coefficient unusually high for the Philippines. Therefore, taking into account the small establishments would not lead to a marked decrease in the generally high values of the coefficient estimates for the other industries.[16]

On the other side, mention may be made of the widespread understatement of book value of capital assets in local manufacturing industries.[17] On this account, the Philippine estimates carry a downward bias which - not a few would conjecture - can more than compensate for the effect of the non-inclusion of the small establishments mentioned earlier.

We are interested in discovering now whether the three sets of coefficient values for the three countries differ significantly. A variant of the Wilcoxon nonparametric test for paired samples may be used for this purpose.

Comparing first the coefficient values for the 2-digit industries in

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[16] The undetermined extent of unlicensed manufacturing activities, which the Census does not discover, renders this statement tentative.

[17] Among other reasons, Cole [5, p. 17] cites the "overdepreciation of capital" and the fact that "the cost of capital equipment . . . has been kept artificially low by means of an overvalued exchange rate and low taxes on capital . . . imports". The same point is stressed in [6, pp. 213-214].

TABLE 6

PERCENTAGE CONTRIBUTION OF SMALL ESTABLISHMENTS TO TOTAL GROSS RECEIPTS

ISIC No.	Industry	%
	2-digit manufacturing industries	
20	Food manufactures	11.0
21	Beverages	1.2
22	Tobacco products	0.9
23	Textiles	1.1
24	Footwear	26.0
25	Wood products	4.2
26	Furniture and fixtures	31.6
27	Paper and paper products	2.8
28	Printed and published materials	9.0
29	Leather and leather products	7.5
30	Rubber products	2.0
31	Chemicals	2.7
32	Petroleum products	0
33	Non-metallic mineral products	3.6
34	Basic metal products	1.4
35	Fabricated metal products	8.9
36	Machinery	6.2
37	Electrical machinery	7.9
38	Transport equipment	4.3
39	Miscellaneous manufactures	20.5
	3-digit food industries	
201	Meat products	16.7
202	Dairy products	5.6
203	Canned and preserved fruits and vegetables	1.8
204	Canned and preserved fish and other sea foods	30.9
205	Grain mill products	19.3
206	Bakery products	45.6
207	Sugar mill products	0.4
208	Cocoa, chocolate and sugar confectionery	7.7
209	Miscellaneous food preparations	5.8

Source of Basic Data: 1961 Economic Census, Vol. III (Manufacturing) Bureau of the Census and Statistics, Manila.

the Philippines and in the United States, let

x_{1i} = observed value of Philippine capital coefficient in industry i

x_{2i} = observed value of United States capital coefficient in industry i

Define the variable $D = x_1 - x_2$ for the sample, and Δ to mean the same thing for the population. D is treated now as if it were a single variable and assumed to be normally distributed with zero mean and unspecified variance. The usual two-sided test for the significance of the mean difference at the 95% level is applied.

$$H_o: \bar{\Delta} = 0 \qquad H_a: \bar{\Delta} \neq 0$$

$$\bar{D} = \frac{\Sigma D}{n} = 0.0297$$

$$s_D = \sqrt{\frac{\Sigma D^2 - \frac{(\Sigma D)^2}{n}}{n-1}} = 0.193$$

$$s_{\bar{D}} = \frac{s_D}{\sqrt{n}} = 0.0453$$

$$t = \frac{\bar{D}}{s_{\bar{D}}} = 0.655$$

$t_{\alpha=.025}$ (17 d.f.) = 2.110, which is greater than the computed value. Hence, we accept H_o and conclude that the industry coefficient values in the Philippines and in the United States do not differ significantly.

The same test is applied to the observed coefficient values for the 2-digit industries in the Philippines and in Japan, and the same conclusion emerges. The three sets of coefficient estimates, therefore, are not significantly different.

It may be noted, however, that the Philippine coefficient values tend to be higher than those for Japan and the United States. Using one-sided

tests, it is found that the probability that Philippine coefficients are actually higher than those for Japan is 0.73, and slightly higher when compared with United States coefficients. This appears to confirm the growing suspicion among investigators that there is "more likelihood of capital coefficients being higher in the underdeveloped countries than the developed ones and not vice versa" [4, p. 97].

III

Differences in Industrial Structure

Let us suppose that industries at some level of disaggregation exhibit identical values of the capital coefficient in the three countries. It is not unreasonable to expect that when these industries are combined in different proportions, as in a 2-digit classification, different product-mixes of these aggregated industries would arise. Grouped under each of these industries are lines of activities producing different kinds of products which require capital inputs in varying amounts. It is evident that differences in the extent of the contribution of the "sub-industries" will distort the overall relationship of the industry coefficients in these countries.

Consider, for example, the major group FOOD MANUFACTURES. In the Philippines, it is heavily dominated by the group producing sugar mill products (ISIC No. 207), the output value of which comprise about one-third of the major group's total. The same cannot be said of the United States and Japan. Because sugar milling is highly capital intensive (see Table 5), we find the capital coefficient for FOOD MANUFACTURES highest in the Philippines. It matters little whether the other food processing industries have high or low values of the capital coefficient. In the

United States, the relatively more important food manufacturing industries are those producing meat products (ISIC No. 201) and dairy products (ISIC No. 202) [9, p. 486], both of which are characterized by relatively lower capital coefficients (see Table 5). It is not due to chance, therefore, that the capital coefficient value for FOOD MANUFACTURES in the United States is lower compared to that in the Philippines.

A few more instances where the industry coefficient has been largely determined by the predominance of a particular sub-industry may be cited. TEXTILES consists of cotton yarn and cloth, silk and rayon products, and woolen and worsted manufactures in the United States [9, p. 488] and presumably, also in Japan. In the Philippines, output of the textile mill industry comes mostly from cotton mill products, the contribution of rayon products being insignificant and of silk, woolen and worsted manufactures nil. Since cotton textile mills are characterized by substantially higher capital coefficients [9, p. 488], it is understandable that the Philippine coefficient for TEXTILES is higher than those for Japan and the United States.

For the major group NONMETALLIC MINERAL MANUFACTURES, the Philippines is also observed to have a much higher coefficient estimate. This is explained by the fact that cement manufacture (ISIC No. 334), which contributes about one-half of the major group's output in the Philippines has an extremely high value of capital coefficient (about 0.84).

Similar statements would apply to the other 2-digit industries which exhibit higher values of the capital coefficient in the Philippines compared to those in the United States and Japan. Such industries as TRANSPORT EQUIPMENT and RUBBER PRODUCTS obviously carry different product-mixes

in the three countries.

It would be interesting to know the extent of differences in industrial structure at the 3-digit level of disaggregation in the three countries. Unfortunately, no comparable estimates of the capital coefficient are available for Japan in the 3-digit industries. In the United States, there are published figures for 1939. Table 5 presents the estimates in the food industries. In the hope that these estimates represent fairly well the size of the capital coefficient in the corresponding industries in 1961,[18] let us examine these values in comparison with the Philippine estimates derived above.

It is noted that a number of the 3-digit food manufacturing industries have coefficient values which are of the same order of magnitude for the two countries. A notable exception is SUGAR MILL PRODUCTS which has a wide difference in coefficient values for the United States and the Philippines. Again, the explanation lies in the dissimilarity in the structure of the sugar industry in the two countries. In the United States, sugar milling consists principally of cane sugar refining and beet sugar manufacture. Here, it is mostly raw cane sugar manufacture.

Finally, it may also be observed that in the industries where differences in industrial structure are not substantial, e.g., PETROLEUM PRODUCTS, WOOD PRODUCTS, and CHEMICALS for the 2-digit industries and COCOA, CHOCOLATE AND SUGAR CONFECTIONERY for the 3-digit food industries, the Philippine coefficients are consistently lowest.

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[18] This may not be very far-fetched. Using the Wilcoxon test, it is found that there is no significant difference between the independently obtained sets of United States estimates in the 2-digit industries for 1939 and 1961.

Technological Constraint

The preceding section has attempted to demonstrate that since some industries which are major contributors to total output of Philippine manufacturing are inherently capital intensive, the capital coefficient values for the more highly aggregated industries are bound to be large because of the weighted averaging procedure. The assumption is that the factors of production are complementary and must be employed in fixed proportions. This represents a technological constraint in the extent of factor use and prevents the full employment of the available labor supply in underdeveloped economies.

If the effect, therefore, of differences in industrial structure is cancelled, capital coefficient values in certain industries for different countries might be observed to exhibit roughly uniform values. The previously mentioned similarity of coefficient values for several 3-digit food manufacturing industries appears to bear out this suggestion. It would not be surprising to find in say, a flour mill here the same production equipment and technique as those used in the United States. In India, it has been observed that manufacturing entrepreneurs "seem to choose methods of production . . . more or less as do their Western brethrens" [7, p. xvi].

The problem of limitation in the technological choices for some industries,[19] however, is not as simple as the mere absence of alternative production processes. Even if the state of technology permits factor

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[19] For a systematic presentation of the so-called "technological restraint" hypothesis (but oriented towards labor-unemployment in underdeveloped areas), see [10].

substitution in some industries, there is the possibility that producers in the underdeveloped countries may not be aware of it. The empirical finding in India mentioned earlier demonstrates the possible intensitivity of businessmen in an underdeveloped economy to the range of choice in production processes actually available in the manufacturing industries.

Plant engineers, too, have a hand in this deplorable situation for they are the ones being consulted on matters of technology. Also, they have been unable to do research and development work relating to alternative processes and equipment which are more appropriate technically and economically to the conditions in the underdeveloped areas. This could have been the result of an educational training which is oriented towards Western technology. Or, it could be that the inability to address their talents to the development of more suitable production techniques and equipment is made compulsory by the scarcity of technical resources in the underdeveloped country. Such work will necessarily draw away a fair amount of skilled labor from activities which are also short of technical hands, e.g., in plant management and in actual production.

Technological restraint is also implied in the inability of some industries to overcome the "lumpiness" of capital. A firm in an underdeveloped country, for example, may be constrained to use a type of equipment which produces less output per unit value of capital invested because the other type, which has a lower capital coefficient, is not suitable (technologically or economically) for small-scale operation. (The situation becomes doubly difficult to entrepreneurs faced with strong competition from domestic and foreign producers. In this case, the local market - small as it is - has to be shared in varying proportions and a wastage

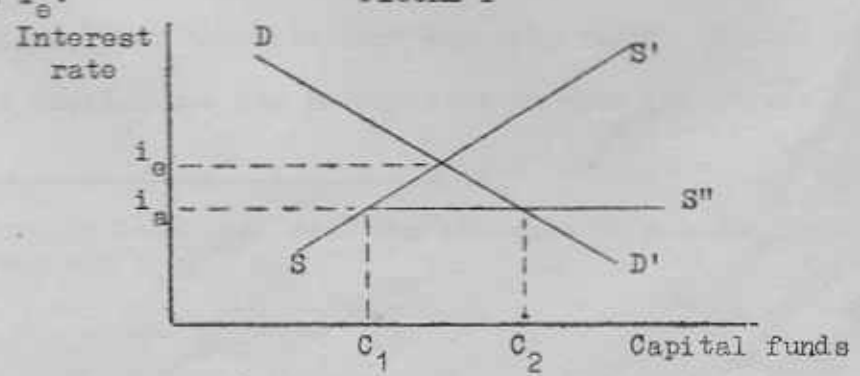
of capital is foreseeable.)

Factor Market Imperfections

There is another possible explanation for the generally high capital coefficient values of Philippine industries. Allowing now for substitutability of factors, there is the possibility that, contrary to what factor endowments dictate, some of these industries are using production processes which can compare in the extent of capital use with those employed in the corresponding industries in Japan and the United States. There is, of course, little likelihood that Filipino manufacturing entrepreneurs actually make use of more modern techniques and equipment than their American and Japanese counterparts. However, there are strong reasons to suppose that the factors of production employed in local manufacturing industries has not been that which factor supply would suggest.

Assume, for simplicity, that technology, tastes, and resources are constant. Entrepreneurs in each industry would demand capital funds to the extent that the so-called "marginal efficiency of capital" exceeds the prevailing market rate of interest, of which only one kind is assumed to exist. The financial institutions can be looked upon, for the purpose of our analysis, as the supplier of capital funds. An aggregate demand curve and an aggregate supply curve for capital funds can thus be set up as in Figure 1. The equilibrium interest rate under perfectly competitive conditions is i_e.

FIGURE 1



In actuality, the capital funds market is hardly ever competitive. The Central Bank sets an arbitrary level of interest rate which the financial institutions are required to follow when they extend loans to businessmen. Normally, the prescribed interest rate would fall short of the equilibrium rate. Hence, the supply schedule is transformed from S-S' to S-S", indicating perfect elasticity above a certain volume of capital funds. (Strictly speaking, S-S" cannot be called a supply curve since the latter is defined only for the purely competitive market.)

The market interest rate, therefore, does not indicate "true availability" of funds. Since the extent of use of the factors of production - assumed to be only capital and labor - depends only on their relative prices (and, of course, the existing technology), then with capital being priced artificially low, there will be a tendency to adopt production processes which are more capital intensive than what factor endowments would suggest.

Note that at the prescribed level of interest rate i_a, demand for capital funds exceeds supply by the amount (C_2-C_1).[20] Not all investment plans are carried out and businessmen begin to feel a "credit squeeze". Capital expenditures will then be geared to the availability of funds, and industries which have access to the money-lending institutions - whether government or private - acquire capital assets at an artificially low price.

If we add to the above an overvalued exchange rate and import tax exemptions to some favored industries, we have indeed a case of capital being priced lower than its true scarcity value. Hence, a relatively large extent of capital use may be expected in some industries.

---

[20] Foreign loans can ease the shortage of capital funds, narrowing the gap between C_1 and C_2.

A parallel analysis has been applied to the labor market to explain unemployment and underemployment in underdeveloped countries [10]. Due to trade union pressures, immobile labor force, minimum wage legislation, and elaborate social security schemes, the prospect of wage rate higher than the equilibrium rate under competitive conditions is faced by the entrepreneurs. As in the above, there will be a tendency to adopt factor proportions different from that dictated by factor supply because of the increased price of labor relative to capital.

Thus in an underdeveloped country like the Philippines where the imperfections in the factor markets discussed above actually take place, it should not be surprising to find some industries which can compare in the extent of capital use with the corresponding industries in the more advanced countries.

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APPENDIX 1

ESTIMATING EQUATIONS FOR 1961 CAPACITY UTILIZATION RATE

$$u_{jkl} = \frac{\sum_{i=1}^{n_j} u_{ijkl}}{n_j} \cdot \quad u_{kl} = \frac{\sum_{j=1}^{n_k} y_j u_{jkl}}{n_k y_k} \cdot \quad u_{l} = \frac{\sum_{k=1}^{n_l} y_k u_{kl}}{n_l y_l}$$

where

u_{ijkl} = capacity utilization rate of the ith establishment under the jth 4-digit industry, the kth 3-digit industry and the lth 2-digit industry.

u_{jkl} = capacity utilization rate of the jth 4-digit industry under the kth 3-digit industry and lth 2-digit industry.

u_{kl} = capacity utilization rate of the kth 3-digit industry under the lth 2-digit industry.

u_{l} = capacity utilization rate of the lth 2-digit industry.

$i = 1, 2, \ldots, n_j$ $\qquad$ $k = 1, 2, \ldots, n_l$

$j = 1, 2, \ldots, n_k$ $\qquad$ $l = 1, 2, \ldots, 20$

n_j = number of establishments under the jth 4-digit industry.

n_k = number of 4-digit industries under the kth 3-digit industry.

n_l = number of 3-digit industries under the lth 2-digit industry.

y_j, y_k, y_l = value of output of: jth 4-digit industry, kth 3-digit industry, and lth 2-digit industry, respectively.

REPUBLIC OF THE PHILIPPINES
DEPARTMENT OF COMMERCE AND INDUSTRY
BUREAU OF THE CENSUS AND STATISTICS
MANILA

_____
Date

_____
_____
_____

Sir/Madam:

This office is conducting a study on the capacity utilization of manufacturing industries in the year 1961. We are, therefore, soliciting your help in providing us the necessary data from your establishment for that year.

Please accomplish the attached form and, using the accompanying self-addressed envelope, mail it (postage free) back to this office as soon as possible. Because of the urgency of this study, we would appreciate very much your sending us the accomplished form within one week upon your receipt of it.

Production output refers to the quantity of products (expressed in physical units of measure) which your establishment actually produced in 1961.

By capacity output is meant here the quantity of products which your establishment could most profitably produce with the existing fixed assets in 1961. (Suppose you were assured of 100% sales of your products at the going market price, how much would your establishment have produced in 1961?)

If production output and capacity output are expressed in the same physical unit of measure, the percentage capacity utilization is simply the ratio of production output to capacity output multiplied by 100.

Be assured that the data which you will furnish us are to be held in the strictest confidence. They will be used only for statistical purposes without any reference to a particular person or entity.

Thank you for this and other past favors.

Very truly yours,

(Sgd.) TITO A. MIJARES
Director

Department of Commerce and Industry
BUREAU OF THE CENSUS AND STATISTICS
M A N I L A

(1) Name of Product (Do not include by-products.)	(2) Unit of Measure 1/	(3) Production Output	(4) Capacity Output	(5) 2/ Highest Monthly Production	
				Month (a)	Quantity (b)
1.					
2.					
3.					
4.					
5.					
6.					

(Please attach sheet if space provided is not enough.)

What is your best estimate of the percentage capacity utilization of your establishment during the current year (1965)? _____%.

Footnotes: 1/ If the physical unit of measure is not convenient for any product listed in column (1), indicate the value of the product (in pesos) for columns (3) and (4).

2/ If monthly production figures (1961) are available, indicate in column (5) the month with the highest production output (a) and the quantity of actual production for that month (b). If quantity figures are not available, give the corresponding value (in pesos) of actual production.

Name and position of person who accomplished this form:

_____
(Print or type)

_____
(Signature)

APPENDIX 3A

SURVEY ESTIMATES OF PERCENTAGE CAPACITY UTILIZATION OF RESPONDING ESTABLISHMENTS: FOOD INDUSTRIES

201 Meat products

2012: 81, 89

2013: 42

2014: 59

202 Dairy products

2021: 70, 64

2024: 83

203 Canned and preserved fruits and vegetables

2031: 76, 78, 74

2032: 70

2033: 82

204 Canned and preserved fish and other sea foods

2042: 63, 77, 63

2044: 53

205 Grain mill products

2051: 51, 47, 50

2052: 42

206 Bakery products

2061: 53, 49, 56, 61, 46

2062: 66

207 Sugar mill products

2072: 99, 94, 95, 75, 100, 89

208 Cocoa, chocolate and sugar confectionery

2081: 58, 62

2082: 76

2083: 77

209 Miscellaneous food preparations

2091: 66, 72, 43

2093: 54, 53, 43, 63

2094: 83, 85

2095: 69, 43

2096: 64

2097: 38, 60

APPENDIX 3B

SURVEY ESTIMATES OF PERCENTAGE CAPACITY UTILIZATION OF RESPONDING ESTABLISHMENTS: OTHER INDUSTRIES

21 Beverages
2111: 89
2121: 88
2141: 92, 88, 84

22 Tobacco products
2211: 66, 69, 62
2219: 78, 84
2221: 67

23 Textiles
2314: 64, 58, 41
2315: 52
2318: 15, 71, 45
2321: 89
2323: 69
2329: 68, 88
2331: 74, 80

24 Footwear
2411: 84, 88, 85
2412: 70, 67, 62
77
2431: 64, 72, 78
68, 59
2433: 83, 79, 86
2435: 86, 95
2441: 75, 67, 71

25 Wood products
2511: 83, 61, 70
65
2512: 62, 60
2513: 64, 76, 66
67
2532: 78

26 Furnitures and fixtures
2611: 85, 86, 85
2612: 64
2613: 74

27 Paper and paper products
2712: 83
2713: 85
2722: 66
2723: 50, 67
2724: 65

28 Printed materials
2811: 68, 41
2821: 69
2822: 67, 62, 70

29 Leather and leather products
2911: 64
2931: 68, 61

30 Rubber products
3011: 82, 78
3021: 91, 94

31 Chemicals
3111: 83, 88
3114: 54, 63
3117: 87
3131: 73
3191: 90, 84
3193: 83
3194: 81, 82
3195: 88
3197: 70

32 Petroleum products
3211: 82

33 Non-metallic mineral products
3311: 91
3322: 64
3332: 75
3341: 90, 97
3391: 68, 81
3392: 80

34 Basic metal products
3411: 68, 64, 71
3421: 80
3422: 66

35 Fabricated metal products
3521: 39, 48, 60
3532: 40, 36, 43
3549: 70
3559: 45, 45
3581: 78

36 Machinery
3622: 85
3631: 50
3651: 40
3672: 95
3673: 89, 50

37 Electrical machinery
3722: 82, 87, 78
3731: 82
3732: 86
3749: 64

38 Transport equipment
3811: 40
3831: 82, 83

39 Miscellaneous manufactures
3923: 94
3942: 74
3951: 83
3953: 90
3994: 88
3997: 69

APPENDIX 4

Book Value of Fixed Capital: January 1, 1961;
1961 Value of Production Output

ISIC No. (1)	Industry (2)	Book Value of Fixed Capital: Jan. 1, 1961 ₱1,000 (3)	1961 Value of Production Output ₱1,000 (4)
	2-digit manufacturing industries		
20	Food manufactures	293,911	1,082,510
21	Beverages	50,015	226,101
22	Tobacco products	31,093	208,888
23	Textiles	216,216	297,856
24	Footwear	32,697	148,064
25	Wood products	106,240	243,650
26	Furniture and fixtures	7,334	27,980
27	Paper and paper products	58,610	122,679
28	Printed and published materials	45,606	104,404
29	Leather and leather products	4,870	16,442
30	Rubber products	49,535	142,088
31	Chemicals	112,351	477,245
32	Petroleum products	35,709	333,391
33	Non-metallic mineral products	97,764	132,084
34	Basic metal products	44,378	150,343
35	Fabricated metal products	36,813	129,565
36	Machinery	23,328	86,150
37	Electrical machinery	28,465	81,915
38	Transport equipment	44,778	104,123
39	Miscellaneous manufactures	24,325	48,304
	3-digit food industries		
201	Meat products	2,133	10,881
202	Dairy products	11,581	54,216

APPENDIX 4 (continued)

203	Canned and preserved fruits and vegetables	6,925	51,076
204	Canned and preserved fish and other sea foods	2,709	5,427
205	Grain mill products	34,313	192,387
206	Bakery products	8,400	62,371
207	Sugar mill products	167,986	450,542
208	Cocoa, chocolate and sugar confectionery	6,344	24,142
209	Miscellaneous food preparations	50,504	231,466

Source:

1961 Economic Census, Vol. III (Manufacturing), Bureau of the Census and Statistics, Manila.

APPENDIX 5

NICB Estimates of 1961 Output, Fixed Capital and Capacity Utilization Rates of U.S. Manufacturing: 2-Digit Industries

ISIC No.	Peak Output*		Book Value of Fixed Capital ($ Million)	% Capacity Utilized at Peak Operation
	1954 Prices ($ Million)	Price Deflator		
20 } 21 }	69,115	103.0	10,002	100
22	4,823	113.5	392	75
23	15,588	99.2	2,831	100
24	15,359	102.1	709	98
25	9,517	98.3	3,044	100
26	5,749	106.0	714	100
27	11,655	111.3	5,854	93
28	8,858	124.1	1,838	96
29	3,414	118.2	293	94
30	7,851	109.8	1,688	92
31	30,711	101.9	11,933	100
32	38,028	106.0	22,590	98
33	10,325	114.6	4,966	84
34	24,520	122.3	15,302	78
35	18,246	116.7	4,173	96
36	22,667	127.2	6,342	91
37	21,238	120.3	3,697	99
38	27,329	122.0	10,229	70
39	14,093	116.6	4,434	94

*Reflects the level of operations in the peak quarter and adjusted for inventory and price changes.

Source:

Appendix II, Tables A-2, A-3, A-4 and A-6 in Creamer, op. cit.