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TECHNICAL CHANGE AND RESOURCE ALLOCATION IN PHILIPPINE MANUFACTURING: 1957-1965

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1. Introduction

1.1 Background. This paper analyzes the magnitude and nature of productivity changes and of resource allocation in the Philippine industrial sector for the years 1957 to 1965. The period is an especially interesting one because it spans years in which two contrasting forms of economic policy were adopted in the Philippines. A policy of industrial import substitution was attempted a short while after Philippine independence in 1946. The most powerful policy instruments used to foster Philippine manufacturing growth after 1948 were (1) import and exchange controls, (2) tax-exemptions, and (3) low interest rates for long term industrial loans favoring the promoted industries.

The hardest years of the control period were 1957 to 1959 when the balance of payments steadily worsened. These circumstances initiated the gradual removal of controls by 1960. When a new president assumed office in 1962, all

forms of controls on foreign exchange transactions were lifted and the "decontrol" program was complete. Towards the beginning of decontrol, and especially afterwards, the tariff began to substitute for controls as the incentive mechanism for industrial promotion. Although tax-exemption subsidies became less important over the years, the long term lending policies of government institutions continued to exert their policy of promoting industrial development.

It may be useful to review briefly Philippine economic performance during the recent postwar period. From 1950 to 1962, the per annum growth of national income was about 6 to 7 per cent and 4 to 5 per cent from 1962 to 1965. Per capita growth rates appear to have been more substantial in the 1950's than in the early 1960's. The slackening in the overall growth rates was especially noticeable after 1957 when the balance of payments disequilibrium moved from bad to worse.

Nonetheless, throughout the postwar era as a whole the manufacturing sector kept expanding ahead of most other sectors. From 1950 to 1966, there was a considerable shift of total income originating from agriculture to manufacturing. The share of agriculture in total national income fell from 42 per cent to 32 per cent, that of manufacturing rose

from 8 to 18 per cent. By 1957, the manufacturing share in national income was 15 per cent, that of agriculture 37 per cent. On surface, these statistics may look impressive. But they require far deeper scrutiny than that exposed by this statistical facade.

Clearly, the most important force which triggered the decontrol of 1962 was the fundamental balance of payments disequilibrium which worsened progressively through the fifties. Even the growth rates of promoted industries were falling as foreign exchange became more scarce and overvaluation of the peso more marked.[1] In contrast, it is generally agreed that decontrol rationalized internal with external costs and had beneficial effects on the economy as a whole. Certainly the remarkable increase in total exports from 1962 to 1966 is in sharp contrast with their relative stagnation from 1957 to 1962.

Economists generally agree that, in character and depth, the Philippine experience with exchange controls and industrial policy is typically Latin American. Golay (1961) was perhaps the first to articulate a professional criticism

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[1]For a review of the economic policy up to 1961, see Frank H. Golay, The Philippines: Public Policy and National Economic Development (Cornell University Press, 1961).

of the exchange control policies which he believed acted as a deterrent to export (and thus domestic) growth.

A year or so later, Legarda (1962) saw in decontrol a redirection of income streams from "the new industrial entrepreneurs" back to "the traditional primary exporters." Treadgold and Hooley (1967) recently evaluated Legarda's predictions based on Philippine experience since 1962. They concluded that the manufacturing sector had, of course, been hit hard by decontrol, but that it had weathered the transition. Sicat (1967) analyzed the commodity composition of exports originating from manufacturing and discovered that despite the inducement of the new exchange rate, the exports arising from the manufacturing sector have not contributed much to manufacturing growth. This conclusion is not surprising, especially in view of the import substituting character of much domestic industrial development. The latter, of course, is encouraged by a tariff structure which has shielded industry throughout the post-decontrol period. Power's (1966) research on the structure of Philippine protection has confirmed the view that the effective rates of protection are strongly biased against the development of intermediate (and capital) goods industries and of exports.

A parallel form of inquiry at the macro level concerns technical change and other sources of economic growth in the Philippines, initiated by a paper of Lampman (1967). Williamson (1968) carried the analysis further by exploring the differences in sectoral rates of technical change, their resource implications in industry and agriculture, and measuring the contribution of education to growth.

1.2 Objectives of this Paper. There are many significant and still unanswered questions for which this paper hopes to provide some partial answers. The most fundamental among these questions concerns the relative efficacy of the industrial development policies pursued by the Philippines in the postwar period. We address ourselves to the following questions: Firstly, there remains the question of segregating the increases in productivity which cannot be simply explained by changes in factor inputs in the manufacturing sector and in specific manufacturing industries. Second, and more important, we pose the question of whether the economy, and the manufacturing sector in particular, has been moving towards or away from a position of optimal resource use. Thirdly, we tackle directly the test of whether the instruments of industrial policy associated with foreign exchange controls and the decontrol program had beneficial

effects on the economy in terms of improved resource allocation.

These questions are central to the main problems of economics. The rapid development of growth theory, especially after the mid-fifties, has helped us attack these questions more directly. The principal tool of analysis is the production function, which, in its neo-classical Cobb-Douglas version, is able to guide us into territories previously unknown.[2] In answering these questions, we utilize the models developed by Johansen (1961), by Denison (1961), Solow (1957), and by Massel (1961), all of which depend on the Cobb-Douglas specification.

The present writers are the first to admit that this paper represents only a beginning. The enormous data on Philippine manufacturing industries are still to be (and shall be in the near future) subjected to more rigorous analysis. But this attempt should provide tentative answers to the important and still unresolved questions which have been posed by recent Philippine experience.

1.3 Summary of Findings. In general, technical change, or the growth of total factor productivity, contributes posi-

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[2]For a review of the developments in production function research and their relevance to developing countries, see J.G. Williamson (1968).

tively to the growth of the Philippine manufacturing sector although rates of technical change differ considerably by industry. In terms of the broad groups of industries we pooled together in order to perform an analysis utilizing Johansen's model, all rates of productivity increases are positive. By two-digit disaggregation and utilizing the Denison-Solow approach, we discovered a few industries with negative rates of technical change, but by and large the many industries with positive rates of productivity increases dominated the performance of the whole manufacturing sector.

These positive rates of "pure" technical change, however, are offset to a considerable degree by a large misallocation of economic resources. Utilizing Massel's disaggregation of technical change, we find that rates of intra-industry technical change, i.e., productivity improvements within specific industries, were quite high. But inter-industry rates of technical change, i.e., productivity increases resulting from industry to industry interaction, have been negative for the manufacturing sector. While specific industries have had relatively high rates of technical change, when added together, and because of a misallocation of resources into industries with low productivity, the observed rates of technical change for Philippine manufacturing as a whole are much reduced.

Furthermore, we find that from 1957 to 1962, the manufacturing sector suffered from a higher rate of resource misallocation than later. Considerable evidence is presented documenting a large reduction in the rate of resource misallocation within the Philippine economy after decontrol. These findings are consistent with recent results of Williamson concerning industry-agriculture interrelationships within the Philippine economy in the postwar period. While the manufacturing sector was hard hit by the readjustments made necessary by the decontrol program, improved resource allocation within the sector -- and in the economy as a whole -- had large beneficial effects on the growth rate in both the long and short term.

The most serious misallocation of economic resources within the economy has been in the use of capital resources. There has been an industry-wide increase in both the capital intensity of production activities and the substitution of capital for labor. Perhaps even more seriously, capital has been allocated into industries where its productivity was low. In contrast, the sectoral reallocation of labor inputs contributed positively to technical change. Most important, ample evidence is available to confirm that these results are not the errors of entrepreneurs, but of economic policy. Entre-

preneurs have responded very quickly to changing factor costs and to other incentives. The decision of industrial entrepreneurs have always been strongly influenced by the low price of capital services brought about by a government policy of low interest rates, tax deductions and exemptions. Quite clearly, these incentives have been biased against the utilization of labor. The issue which remains, of course, is precisely how important these policies have been quantitively. The sections which follow supply an answer.

2. The Johansen Model: 1957-1962

The capital stock data reported in the Annual Survey of Manufactures is of questionable quality especially when applied to time series analysis. The Survey reports the book value of fixed assets and a number of independent researchers have indicated the weaknesses in these estimates as a measure, assuming we can agree on an appropriate measure, of the real value of the capital stock.[3]

Recently, Eloisa Franco (1968) constructed estimates of undepreciated capital stock in manufacturing at the 2-digit level. These estimates of fixed assets are given for 1961 and

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[3]See Eloisa Franco (1967, 1968) and Romeo M. Bautista (1966). For the most recent review of the theory underlying capital stock measurement see L. Johansen and A. Sørsveen (1967).

1965 and they relate to large scale establishments (employing 20 or more workers). Not only are these capital stock figures useful in their own right, but they also indicate how weak the Survey's book value data are for intertemporal production function analysis. Chart 1 illustrates the divergence between the capital stock growth rate measures which these two estimates produce. For example, the petroleum industry (relatively young and acquiring much of its capital stock during the recent period of rising prices) generates far higher capital stock growth rates using book value data. The opposite seems to be the case of the transport equipment during the 1950's. Given these results, it seems useful to search for methods which minimize their reliance on adequate capital stock estimates.

Leif Johansen (1961) recently developed a model which does not require direct observations on the capital stock and which seems, potentially at least, applicable to the Philippine setting. It should be pointed out, of course, that the questionable quality of our capital stock estimates is not unique to the Philippines. In fact, in terms of available working data from which capital stock and other economic magnitudes may be estimated, the Philippines seems to be more fortunate than many less developed countries because of the wide variety of census and other statistics that date back to 1900. Nor is the Johansen

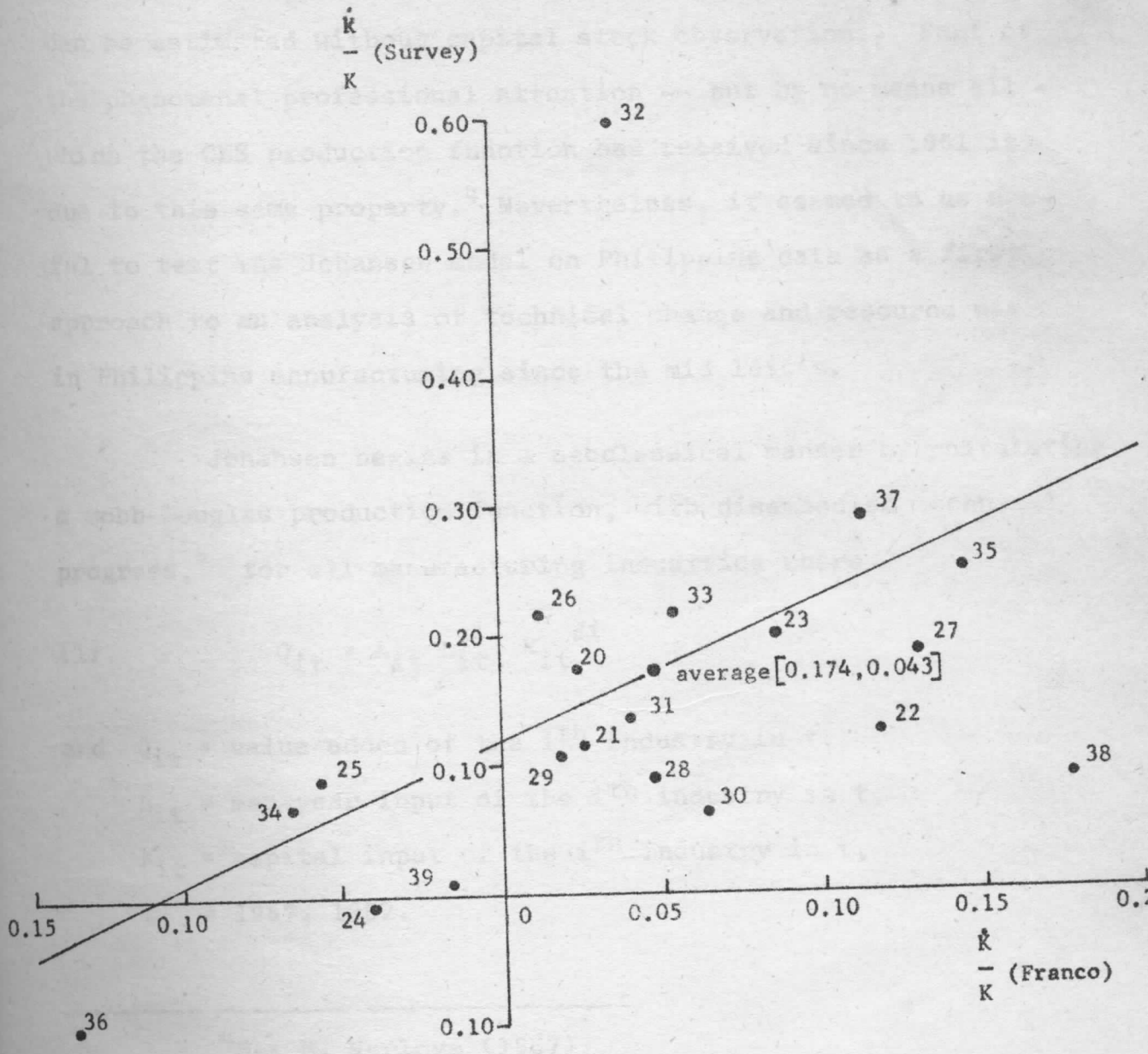

Chart 1. The Rate of Growth of Franco's Real Capital and the Survey's Book Value of Capital Compared; 1961 - 1965 (by 2-digit classification)

model the only means by which a two factor production function can be estimated without capital stock observations. Part of the phenomenal professional attention -- but by no means all -- which the CES production function has received since 1961 is due to this same property.[4] Nevertheless, it seemed to us useful to test the Johansen model on Philippine data as a first approach to an analysis of technical change and resource use in Philippine manufacturing since the mid 1950's.

Johansen begins in a neoclassical manner by postulating a Cobb-Douglas production function, with disembodied technical progress,[5] for all manufacturing industries where

$$Q_{it} = A_{it} L_{it}^{\alpha i} K_{it}^{\beta i} \quad \{1\}$$

and Q_{it} = value added of the i^{th} industry in t,

L_{it} = man-year input of the i^{th} industry in t,

K_{it} = capital input of the i^{th} industry in t,

t = 1957, 1962.

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[4]See M. Nerlove (1967).

[5]Murray Brown (1966) has recently shown us that if our net capital stock is properly depreciated to include obsolescence, then the Solow embodiment model and the disembodiment model become two different ways of conceptualizing the same economic phenomena. They yield the same results if we assume the usual stringent competitive assumptions. The trouble arises in our actual measurement of the flow of services emanating from the capital stock. See Brown (1966), ch. 6.

If we then assume constant returns to scale for all industries, average labor productivity can be written as

$$a_{it} = \frac{Q_{it}}{L_{it}} = A_{it} L_{it}^{\alpha i - 1} K_{it}^{\beta i} = A_{it}\left(\frac{K_{it}}{L_{it}}\right)^{\beta i}$$

One of the authors has investigated this assumption.[6] Utilizing cross-section data from the Survey of Manufactures for 1956-59, the Cobb-Douglas production function was not found inferior to the more general constant-elasticity-of-substitution production function, and furthermore very little evidence was discovered to contradict our assumption of constant returns to scale. Furthermore, in a still unpublished study of production functions of two-digit ISIC industries, the fit of the Cobb-Douglas constant returns to scale specification has been found to be adequate for many, if not most, Philippine manufacturing industries.[7] On the basis of this independent evidence, the initial assumptions of the Johansen model seem quite realistic when applied to the Philippine case.

The second assumption of the Johansen model is somewhat more restrictive. Johansen assumes that β_i and α_i are

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[6] G.P. Sicat (1963).

[7] G.P. Sicat (1968).

constant over time. If we accept this assumption, then it follows that

$$\{2\} \quad \frac{a_{i,62}}{a_{i,57}} = \frac{A_{i,62}}{A_{i,57}} \left(\frac{K_{i,62}/L_{i,62}}{K_{i,57}/L_{i,57}} \right)^{\beta_i} = \frac{A_{i,62}}{A_{i,57}} \left(\frac{K_{i,62}/K_{i,57}}{L_{i,62}/L_{i,57}} \right)^{\beta_i}$$

It turns out that this assumption is sharply challenged by the data over the periods 1957-1962 and 1960-1965 due to the powerful effects of decontrol by 1962 and the significant variations in relative factor prices over the period. This secular instability in the capital shares creates difficulties further on in this paper. It is due primarily to changing profit conditions in Philippine manufacturing over their period of commercial policy shift. The most significant variations in β_i occurs, predictably, between 1960 and 1962. Nevertheless, it seemed useful to pursue the Johansen model as an econometric beginning to a study of technical change and factor use. Table 2-1 presents estimates of β_i for 1957, 1960, 1960 and 1965 for a large number of Philippine manufacturing industries.

Johansen further develops his model by defining

$W_{i,t}$ = annual wage rate in industry i at t,

$R_{i,t}$ = annual cost of one unit of capital in industry i at t.

We shall next assume that firms minimize total costs so that the least cost condition is satisfied where the ratios

Table 2.1

THE PROPERTY SHARE IN VALUE ADDED: PHILIPPINE MANUFACTURING, 1957 AND 1962

Industry	β_{i57}	β_{i60}	β_{i62}	β_{i65}
20 Food	.731	.794	.838	.780
21 Beverages	.761	.780	.787	.828
22 Tobacco	.798	.744	.797	.820
23 Textiles	.607	.534	.622	.620
24 Footwear	.421	.480	.657	.540
25 Wood and cork	.464	.493	.586	.520
26 Furniture	.377	.496	.434	.471
27 Paper	.722	.710	.727	.730
28 Printing	.463	.450	.546	.571
29 Leather	.571	.556	.517	.540
30 Rubber	.685	.733	.875	.760
31 Chemicals	.698	.764	.786	.740
32 Petroleum	n.a.	n.a.	(a)	.920
33 Non-metallic	.656	.698	.751	.760
34 Basic metals	.532	.619	.626	.760
35 Metal products	.475	.646	.632	.590
36 Machinery	.333	.615	.791	.500
37 Electrical machinery	.610	.654	.756	.670
38 Transport equipment	.423	.528	.778	.630
39 Miscellaneous	.905	.906	.633	.610
Group I	.763	.792	.810	.690
Group II	.438	.508	.549	.610
Group III	.482	.557	.581	.620
Group IV	.694	.751	.743	.743
Group V	.460	.651	.636	.691
Group VI	.594	.627	.638	.740
All industry	.675	.715	.753	.727

Source: Basic data is taken from the Annual Survey of Manufactures, 1957, 1960, 1962 and from worksheets at the Bureau of the Census for 1965.

Notes : The industry groups I-VI are identified below. The property share, β_i, is defined as the ratio of non-wage income to value added. Non-wage income is derived as a residual after the wage bill had been inflated by an imputed wage and salary component going to unpaid family workers and staff.

of the marginal physical productivities of factors to their per unit prices are equated. This traditional assumption in price theory results, where only two factors of production are considered, in the equality

$$\frac{\partial Q_{i,t}/\partial L_{i,t}}{W_{i,t}} = \frac{\partial Q_{i,t}/\partial K_{i,t}}{R_{i,t}}.$$

Now from the production function in (1) we have

$$\alpha_i = \left(\frac{\partial Q_{i,t}}{\partial L_{i,t}}\right)\left(\frac{L_{i,t}}{Q_{i,t}}\right)$$

$$\beta_i = \left(\frac{\partial Q_{i,t}}{\partial K_{i,t}}\right)\left(\frac{K_{i,t}}{Q_{i,t}}\right).$$

Then the least cost conditions can be written as

$$\frac{\partial Q_{it}/\partial L_{it}}{W_{it}} = \frac{W_{it}\, L_{it}}{\alpha_i\, Q_{it}}$$

$$\frac{\partial Q_{it}/\partial K_{it}}{R_{it}} = \frac{R_{it}\, K_{it}}{\beta_i\, Q_{it}}$$

and thus

$$\frac{W_{it} L_{it}}{\alpha_{it}} = \frac{R_{it} K_{it}}{\beta_{it}}.$$

Between 1957 and 1962, for example, we have

$$\frac{W_{i62}\, L_{i62}}{W_{i57}\, L_{i57}} = \frac{R_{i62}\, K_{i62}}{R_{i57}\, K_{i57}}$$

since we have assumed above that $\beta_{i57} = \beta_{i62}$ and thus that $\alpha_{i57} = \alpha_{i62}$. Furthermore, we can rearrange terms such that

$$\frac{K_{i62}/L_{i62}}{K_{i57}/L_{i57}} = \frac{W_{i62}/W_{i57}}{R_{i62}/R_{i57}} = \omega_i < 1$$

where ω_i is defined as the relative increase in wages. For Philippine manufacturing between 1957 and 1962, we have $\omega_i < 1$ when: (a) real wages have decreased, as apparently they did for skilled and unskilled labor in Manila and suburbs;[8] (b) the price of capital goods increased relative to consumption goods, as apparently they did in the Philippines (for machinery, transport equipment, and construction materials);[9] (c) the rate of interest increased, as it has in the Philippines at least since 1966.[10] Since 1962, this trend has at least been

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[8] Central Bank, Statistical Bulletin, Vol. XVIII, no. 4 (December 1966), Tables 119 and 120, pp. 297-300. (See Table 2.3, below).

[9] Ibid. Tables 106-115, pp. 276-286; these data are reproduced in Table 2.2 in this paper.

[10] Ibid. Table 19, p. 52. We have computed a weighted average of interest rates on average outstanding loans of "other banks" for the years 1956-1966. The results are the following (in per cent per annum):

1956	6.34	1960	8.64	1964	9.51
1957	6.35	1961	8.57	1965	10.05
1958	7.11	1962	8.93	1966	10.40
1959	7.87	1963	9.10		