JOURNAL OF ECONOMIC DEVELOPMENT
Volume 16, Number 2, December 1991

Efficiency of Philippine Government vs Non-Government "Favored" Export-Oriented Firms: An Analysis with the Ray-Homothetic Production Function

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The purpose of this paper is to attempt to estimate optimal scale and factor intensity for each government "favored" export-oriented firm (GFEO-firm) as well as for each non-government "favored" firm (NGF-firm), classified by industry, in the Philippine manufacturing sector. A newly developed and superior production technique called the ray-homothetic production function is modified to empirically estimate the returns to scale for each firm, using Philippine manufacturing cross-sectional data (1973-1974) surveyed by the World Bank. The paper is able to determine the extent to which a group of firms, (GFEO-firms or NGF-firms) as well as a particular industry, are operating at the optimal scale level; and if they are not, by how much output could be increased (is now lost) if they did operate at optimal scale.

I. Introduction

Developing countries (DCs) are generally characterized by economic development economists as having a capital shortage and a labor surplus in their manufacturing sectors. In response, the influx of studies on capital utilization in the DCs' manufacturing sectors in the past few years has been enormous. Empirical evidence, with the help of various means of approximating capital utilization, shows that most (if not all) DCs have been faced with excess capacity in their manufacturing sectors, and consequently have been pursuing a policy of narrowing the divergence between actual and desired utilization (fuller utilization or full capacity) (Diokino, 1978). The case of the Philippine manufacturing sector is no exception;

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studies by Bautista (1974) and de Vries (1980) have shown that capital utilization in government "favored" export-oriented firms (GFEO) registered with the Philippine Board of Investment is significantly higher than that in non-government "favored" firms (NGF). The average capital utilization rate of the GEFO-firms is 53.47 percent, while it is only 37.70 percent for the NFG-firms.

Although the Philippines' capital utilization rate is quite high, especially for the GEFO-firms, when compared to the capital utilization rates in other developing countries (see Table 1), the former still wastes its already short capital. Hence, it is interesting to note further how the existing high rate of capital utilization for each Philippine manufacturing firm is close to its maximum potential capacity. In other words, how many outputs of the existing Philippine firms are forgone, in spite of the country's capital shortage and government support program to use capital more efficiently? This study, using a new technique called the ray-homothetic production function, hypothesizes that not all, but most, of the GEFO-firms with increasing returns to scale (not with decreasing returns to scale) are operating at a level near maximum capacity in contrast to the NGF-firms. If that is the case, the small number of GFEO-firms whose capital is under-utilized, as well as the large number of NFG-firms whose capital is under-utilized, should be the main focus of the government to encourage them to use their existing capacity more.

The purpose of this paper is, therefore, an attempt to estimate optimal scale and factor intensity for each GFEO-firm as well as for the all NFG-firms, classified by industry, in the Philippine manufacturing sector.

Table 1

A SUMMARY OF PREVIOUS STUDIES ON CAPITAL UTILIZATION IN DEVELOPING COUNTRIES

Country	Rate of Capital Utilization	Studied by
The Philippines		Batista, R.M. (1974)
GFEO	53.47%	
NFG	37.70%	
West Pakistan	14.00%	Winston, G. (1971)
India	53.00% (1961-1971)	Paul, S. (1971)
S. Korea	16.00% (1968-1970)	Kim and Kwon (1972)
Columbia	51.00%	Thomi, F. (1972)

a newly developed and superior production technique called the ray-homothetic production function will be modified to empirically estimate the returns to scale for each firm, using Philippine manufacturing cross-section data (1973-1974) surveyed by the World Bank. With this function returns to scale can vary with both the output level and factor intensity. Thus, it allows for the possibility of a single optimal scale of production. The fact that it allows the optimal scale to vary with factor intensity is also useful. This implies that firms which are highly capital intensive would tend to have larger optimal scales than firms which are labor intensive because many forms of fixed capital are indivisible by nature. Therefore, the main purpose of this paper will be to determine the extent to which a group of firms — GFEO-firms or NGF-firms — as well as a particular industry, are operating at the optimal scale level; and if they are not, by how much output could be increased (is now lost) if they did operate at optimal scale.

This paper is organized in four sections. Section II explains a framework, as well as a modification, of a more flexible production function (called ray-homothetic) to fit this paper. Several hypotheses concerning the optimal scale of the Philippine manufacturing firms and the impact of input intensity on optimal scale will be discussed. A description of the 1973-1974 Survey Data of the Philippines being used to fit the given function is discussed in Section III. Section IV will present the results of the empirical estimation and interpret them in light of the hypotheses made in Section II. Section V will give a brief summary of the paper.

II. The Ray-Homothetic Production Function

The ray-homothetic production function (Fare and Yoon, 1985) can be written as

$$(1) \qquad Y(\lambda X) = F\left(\lambda^{H(X/\|X\|)}\, G(X)\right),$$

where X = an input vector,

$Y(X)$ = the maximum output obtainable from the input vector, X,

$\|X\|$ = the norm of X, $\lambda \geqslant 0$.

F is a monotonically increasing transformation of $(\lambda^{H(X/\|X\|)}\ G(X))$. In addition, $G(X)$ has a property that

$$(2) \qquad G(\lambda X) = \lambda^{H(X/\|X\|)}\ G(X), \text{ with } H(X/\|X\|) > 0.$$

Equation 2 is the ray-homogeneous production function. Hence, the ray-homothetic function is a monotonic transformation of a ray-homogeneous function. If the function $H(X/\|X\|)$ is a positive constant for all values of X, equation 1 becomes a homothetic production function and Equation 2 a homogeneous production function. Therefore, the monothetic, homogeneous and ray-homogeneous functions are special cases of Equation 1.

The returns to scale for input vector X is the function coefficient of the elasticity of output (Nadiri, 1982, p. 439) and can be expressed as

$$(3) \qquad U(X) = \lim_{\lambda \to 1} (\lambda / Y(\lambda X))\ (\partial Y(\lambda X) / \partial \lambda)$$

The scale function for the ray-homothetic function of Equation 1 is equivelant to

$U(X) = U(K/\|X\|, Y(X)$, which implies that the function allows returns to scale to vary with relative input intensity $(X/\|X\|)$ and output.

To apply the ray-homothetic production function for this study, it can then be modified as

$$(4) \qquad Q = \ln a + b(K/(K+L)) \ln K + c(L/(K+L)) \ln L + e$$

where the parameters to be estimated are a, b, and c. Q, K, and L are output, capital, and labor, respectively, and e is the error term.

The returns to scale function can be derived as

$$(5) \qquad U(X) = (b\ (K/(K+L)) + c(L/(K+L)))/Q.$$

For the case of constant returns to scale, the optimal scale of output can be obtained by setting Equation 5 equal to one,

$$(6) \qquad OPT = b(K/(K+L)) + c(L/(K+L)).$$

Taking the derivative of Equation 6 with respect to K and L, it becomes

$$(7) \qquad \partial OPT/\partial K = (L(b-c))/(K+L)^2$$

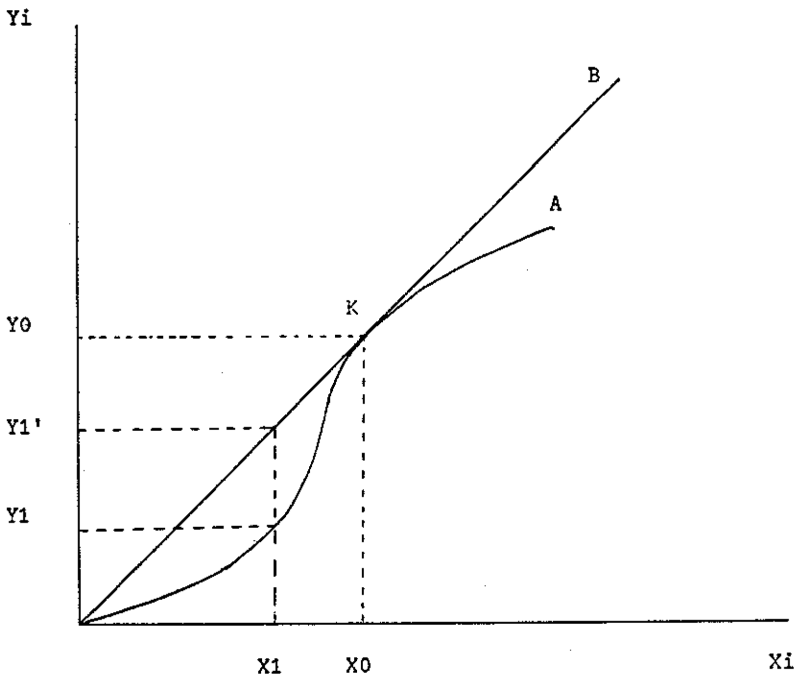
$$(8) \qquad \partial OPT/\partial L = (K(c-b))/(K+L)^2$$

These equations indicate that the optimal scale of output depends on the overall capital and labor intensiveness of production. For almost every manufacturing firm in this study, the signs on Equations 7 and 8 are hypothesized to be positive and negative, respectively, the reasons being that: (a) as the capital intensiveness of production increases, the optimal scale of production rises, *ceteris paribus,* and (b) for Equation 8, as the labor intensity of the production process increases, the optimal scale of production declines, *ceteris paribus.*

For an empirical work, it is not unusual to find that not all of the firms are actually operating at optimal scale; therefore, a technique of measurement of output loss is needed. In order to determine this, a procedure can be developed to measure what the output would have been if each firm were operating at constant returns to scale. Figure 1 describes the X_i axis as a measurement of the vector of inputs, where movement to the right represents an equiproportional increase in all inputs, and the Y_i axis represents output. Production function A represents the variable returns to scale production functions estimated in Equation 4. If a firm

Figure 1

MEASURING SCALE EFFICIENCY



uses X_1 of inputs, it produces Y_1 actual output. B represents a production with constant returns to scale. Estimated RTS-1 then represents the percentage by which all input usage would have to increase to allow the firm to produce at the optimal scale shown by point K, using X_0 inputs and producing Y_0 output. In addition, (estimated RTS-1)/estimated RTS is the percentage by which inputs would have to be reduced in the movement from X_0 to X_1. If constant RTS prevailed like production function B for firms with increasing RTS, their output would be:

$$(9) \qquad Y_1' = Y_0 - ((\text{estimated RTS-1})/\text{estimated RTS})Y_0$$

Likewise, for firms operating at decreasing RTS, the output that could be produced by the firm if it were operating at constant RTS would be:

$$(10) \qquad Y_1' = Y_0 + ((1-\text{estimated RTS})/\text{estimated RTS})Y_0$$

Equations 9 and 10 would provide the figure for potential output to compare with the actual output. In other words, production loss, if that is the case, can then be calculated.

III. Data

To be consistent and shed some more light on the same issue of the comparison of optimal scale and factor intensity for GEEO-firms and for NGF-firms in the Philippine manufacturing sector, the Philippine data for the present analysis are taken from the *Survey on Industrial Capital Utilization: Cross-Sectional Data from 1973-1974,* which were used previously in Bautista's and Diokno's studies. The survey was jointly sponsored by the Philippine National Economic and Development Authority and the International Bank for Reconstruction and Development (World Bank).

A stratified random sample of 400 establishments was selected from the population consisting of manufacturing firms employing 20 or more workers in 1972. Stratification was done at the 4-digit industry ISIC level. The use of value added figures was carried out as a second-best procedure since reliable capital assets were not available when sampling was done.

In addition to the survey interview data, it was also possible to use some quantitative and qualitative information from the Philippine Board of Investment. For more accurate financial figures, specifically sales and capital assets, the data gathered during the survey interviews were compared with those of *Business Day's Top 1,000 Philippine Corporations*

(1973)

Of the 400 sampled establishments, 83 firms are categorized for the purpose of this study as government "favored" export-oriented-firms and 317 are non-government "favored" firms.

Once Equation 4 in Section II has been estimated with the above data for those GFEO-firms within the same category of an industry, and likewise done for the NFG-firms, the estimated parameters and input data for each firm can be substituted in Equations 5 and 6 for the returns to scale output and for the optimal scale of output for each enterprise, respectively. Likewise, Equations 7 and 8 can be calculated; this would indicate the effect of increased capital and labor intensity on the optimal scale production for each firm (either GEFO-firm or NFG-firm) in the manufacturing sector.

IV. Results

Assume that the modified ray-homothetic function of Equation 4 has an error term with a mean and variance equal to E $(e_i) = 0$ and E $(e_i e_i) = \sigma^2$, respectively. The ordinary-least-squares regression technique was used to estimate the parameters of the function; fourteen equations (14) in total were estimated for eight (8) manufacturing industries — two equations for each industry (one for NGF-firms and another for GFEO-firms); however only one equation was estimated for each of these two industries — printing and steel — because neither has a sufficient number of the GFEO-firms. The number of observations actually used was 389, which is fewer than the sample survey of 400. The results of the estimation are presented in Table 2.

By examining the results, it can be seen that all parameters are significant, except parameter b of the GFEO-firms in three industries (three equations) — clothing, furniture, and machinery. The parameters b of these three equations must be interpreted with some caution.

Substituting the parameter estimates into Equation 6 and using the input data for each firm from the sample within its own category and industry, it is possible to determine the optimal scale or level of output for each of the manufacturing firms. The results are summarized in Table 3. As can be seen, most NGF-firms did not operate at the optimal scale or maximum output capacity (RTS$>$1.00) except the steel industry. On the other hand, most GEFO-firms operated at the optimal scale (RTS$<$1.00) except the clothing and plastics industries. The findings, therefore, support the proposition that most GEFO-firms are using scarce capital better

Table 2

PARAMETER ESTIMATES OF THE RAY-HOMOTHETIC PRODUCTION FUNCTION

Parameter Industry	ln a	b	c	R^2	Sample Size
(1) Food					
NGF	−80,349,95	32,401.46	7,057.17	.38	123
	(−7.24)*	(2.26)*	(8.51)*		
GFEO	−39.881.32	51,146.17	3,428.50	.37	14
	(−1.64)**	(2.39)*	(1.98)**		
(2) Clothing					
NGF	−31,900.85	52,123.93	2,704.00	.71	31
	(−71.0)*	(2.92)*	(8.13)*		
GFEO	−135,884.73	−61,877.65	10,072.73	.53	20
	(−3.95)*	(−0.26)	(4.39)*		
(3) Furniture					
NGF	−9,900.58	178,531.64	843.46	.90	22
	(−3.52)*	(8.01)*	(3.35)*		
GFEO	−31,211.50	62,091.60	2,579.26	.74	11
	(−4.06)*	(0.94)	(4.73)*		
(4) Printing					
NGF	−20,217.53	16,572.45	1,753.45	.44	21
	(−3.41)*	(1.60)*	(3.67)*		
GFEO	NA	NA	NA	NA	NA
(5) Plastic					
NGF	−19,903.72	18,969.48	1,877.86	.65	44
	(−2.60)*	(8.59)*	(2.94)*		
GFEO	−64,354.26	26,638.12	5,501.58	.50	17
	(−3.31)*	(1.87)**	(3.73)*		
(6) Cement					
NGF	−18,645.74	8,241.35	1,817.09	.47	15
	(−2.71)*	(1.69)**	(3.25)*		
GEFO	−37,866.57	23,909.52	3,102.56	.64	15
	(−3.63)*	(3.23)*	(4.27)*		
(7) Steel					
NGF	−10,818.67	25,537.31	997.17	.94	7
	(−5.84)*	(3.12)*	(6.46)*		
GFEO	NA	NA	NA	NA	NA
(8) Machinery					
NGF	−16,638.62	72,690.32	1,397.50	.91	34
	(−4.84)*	(17.03)*	(4.97)*		
GFEO	−36,469.18	70,569.02	3,155.74	.54	15
	(−3.04)*	(0.97)	(3.66)*		

t-ratios of the parameters are in parentheses.
* = significant at less than 5%.
** = significant at less than 10%. NA = insufficient data.

Table 3

RETURNS TO SCALE FOR EACH MANUFACTURING FIRM CLASSIFIED BY INDUSTRY AND BY MEMBER OF THE BOARD OF INVESTMENT

Industry	Number of firms in various Range of RTS values				Total Number of Firms Tested	%RTS 1.00 / %RTS 1.00
	0<-0.50	0.50<-1.00	1.00<-1.50	1.50<-∞		
(1) Food (ISIC = 31)						
NGF	26 (21%)	24 (29%)	11 (9%)	61 (50%)	123	41/59
GFEO	5 (36%)	3 (21%)	0 (0%)	6 (43%)	14	57/43
(2) Clothing (ISIC = 32)						
NGF	8 (26%)	4 (13%)	1 (3%)	18 (58%)	31	39/61
GEFO	4 (20%)	3 (15%)	4 (20%)	9 (45%)	20	35/65
(3) Furniture (ISIC = 33)						
NGF	2 (9%)	0 (0%)	2 (9%)	18 (82%)	22	9/91
GFEO	3 (27%)	3 (27%)	0 (0%)	5 (46%)	11	54/46
(4) Printing (ISIC = 34)						
NGF	1 (5%)	4 (19%)	3 (14%)	13 (62%)	21	24/76
GFEO	NA	NA	NA	NA	NA	
(5) Plastic (ISIC = 35)						
NGF	13 (30%)	8 (18%)	5 (11%)	18 (41%)	44	48/52
GFEO	3 (6%)	2 (12%)	2 (12%)	10 (59%)	17	28/72
(6) Cement (ISIC = 36)						
NGF	4 (27%)	1 (7%)	0 (0%)	10 (66%)	15	34/66
GFEO	9 (60%)	3 (20%)	2 (13%)	1 (7%)	15	80/20
(7) Steel (ISIC = 37)						
NGF	3 (42%)	2 (29%)	0 (0%)	2 (29%)	7	71/29
GFEO	NA	NA	NA	NA	NA	
(8) Machinery (ISIC = 38)						
NGF	3 (9%)	11 (31%)	8 (25%)	12 (35%)	34	40/60
GFEO	5 (33%)	3 (20%)	0 (0%)	7 (47%)	15	53/47

than the NFG-firms; the government support program for the GEFO-firms is basically working. However, if one looks closely at the relative percentage of firms with RTS<1.00 to the percentage of firms with RTS>1.00 (see the last column of Table 3), GFEO-firms are not doing substantially better in terms of capital utilization than NFG-firms; there is a significant number of NGF-firms that are already operating at the optimal scale, while there is a significant number of GFEO-firms still not operating at the optimal scale.

Table 4 presents a summary of the average of output, capital, and labor used by GFEO-firms and NGF-firms in each manufacturing industry and at each level of RTS given in Table 3. As can be seen, it is the large firms (either GFEO-firms or NGF-firms), in terms of capital, that also use greater quantities of labor input and are characterized by decreasing returns to scale. alternatively, the small firms in terms of capital also tend to use smaller quantities of labor and are characterized by increasing returns to scale. However, when GFEO-firms are compared with NGF-firms within the same industry and at the same level of RTS, no pattern was found whether GFEO-firms with increasing returns to scale consistently used capital and labor more or less than NGF-firms. No pattern was found with the case of decreasing returns to scale either.

It appears that a large number of firms are not operating at optimal scale. To measure output lost of those firms, the procedure described earlier in this paper and arrived at with Equations 9 and 10 is used. Table 5 presents the results of potential output (see Column 2) if all inputs were utilized at constant returns to scale, i.e., optimum scale. Comparing this to the total actual output (see Column 1) and taking the ratio of actual to potential, Column 3 then provides a measure of the percentage of actual output relative to potential output (note that the ratios are compatible with other studies' findings as presented in Table 1). In almost all studied industries, NGF-firms with IRTS have, as expected, a higher ratio of actual output/potential output than NGF-firms with DRTS, except the printing industry (no existing of GFEO-firms). Also, GFEO-firms with IRTS have a higher ratio than GFEO-firms with DRTS in all studied industries. However, when GFEO-firms with IRTS are compared with NGF-firms (with IRTS), the GFEO-firms have a higher ratio than the NGF-firms in four out of six available industries, but a lower ratio in two industries — furniture and plastics; an indication that government support programs to those firms are not quite working in the last two industries. Furthermore, GFEO-firms with DRTS have a higher ratio than NGF-firms in all industries. Overall, GFEO-firms appear to show less potential lost or forgone output than NGF-firms, but not by much. In general, there is still a number of firms in both categories in all industries studied produc-

Table 4

SUMMARY OF AVERAGE AMOUNT USED BY FIRM AT VARIOUS RANGES OF RETURNS TO SCALE

		RTS			
Average Amount		0<–.50	.50<–1.00	1.00<–1.50	1.50<–∞
(1) Food					
	Output	35,443	10,392	6,347	1,427
NGF	Capital	13,051	9,678	2,525	752
	Labor	3,960,165	1,131,634	741,034	174,385
	Output	22,147	5,754	NA	1,090
GFEO	Capital	11,910	5,434	NA	754
	Labor	2,315,164	2,486,408	NA	284,697
(2) Clothing					
	Output	15,594	4,070	2,090	509
NGF	Capital	21,442	2,532	1,773	370
	Labor	9,824,738	3,819,690	801,600	211,438
	Output	51,309	12,780	8,677	1,993
GFEO	Capital	35,204	16,062	11,043	689
	Labor	28,816,740	14,056,400	6,949,080	1,288,485
(3) Furniture					
	Output	9,750	NA	836	289
NGF	Capital	5,809	NA	282	78
	Labor	1,452,408	NA	171,161	95,161
	Output	12,172	4,047	NA	590
GFEO	Capital	4,533	2,606	NA	258
	Labor	7,498,016	2,048,768	NA	219,316
(4) Printing					
	Output	14,076	2,791	1,517	628
NGF	Capital	7,263	2,282	3,057	327
	Labor	3,427,200	336,420	622,127	201,491
GFEO		NA	NA	NA	NA
(5) Plastic					
	Output	13,403	3,213	1,586	663
NGF	Capital	19,403	2,744	1,200	348
	Labor	571,205	791,417	210,488	84,144
	Output	24,579	8,238	5,379	1,859
GFEO	Capital	11,568	4,197	4,763	1,053
	Labor	1,934,128	1,228,760	1,062,906	204,184

Table 4 (Continued)

Average Amount		RTS			
		0<-.50	.50<-1.00	1.00<-1.50	1.50<-∞
(6) Cement					
	Output	10,863	2,800	NA	516
NGF	Capital	7,714	13,170	NA	388
	Labor	1,958,640	491,040	NA	123,873
	Output	10,132	5,367	2,912	970
GFEO	Capital	17,131	8,329	5,069	118
	Labor	2,555,517	1,056,683	1,213,920	133,600
(7) Steel					
	Output	4,266	1,422	NA	422
NGF	Capital	6,365	490	NA	168
	Labor	1,380,480	147,002	NA	43,230
GFEO		NA	NA	NA	NA
(8) Machinery					
	Output	16,182	2,277	1,4309	501
NGF	Capital	7,662	1,127	824	217
	Labor	2,530,480	364,355	286,815	108,023
	Output	13,120	4,807	NA	995
GFEO	Capital	2,983	1,344	NA	378
	Labor	2,323,730	1,891,200	NA	181,349

ing much less than their potential output.

To test whether the optimal scale of output depends on the overall capital and labor intensity, the estimated parameters in Table 2 and the input data for each firm from the sample within its own category and industry are substituted in Equations 7 and 8. The results show appropriate signs as hypothesized in Section II. The signs confirms for every firm in the sample that (a) as the capital intensity of production increases, the optimal scale of production rises (a positive sign in Equation 7), *ceteris paribus,* and (b) as the labor intensity of the production process increases, the optimal scale of production declines (a negative sign in Equation 8), *ceteris paribus.*

V. Conclusion

In this paper an attempt has been made to examine and compare the

Table 5

POTENTIAL AND ACTUAL OUTPUTS OF NGF FIRMS AND GFEO FIRMS, CLASSIFIED BY INDUSTRY, BY INCREASING RETURNS TO SCALE (IRTS), AND BY DECREASING RETURNS TO SCALE (DRTS)

Industry	Actual Output (1)	Potential Output (2)	Percent of Output to Potential (3)
(1) Food			
NGF-IRTS	156,920	272,218	57.64%
-DRTS	836,553	8,214,723	10.18%
GFEO-IRTS	6,540	11,022	59.33%
-DRTS	90,280	370,190	24.38%
(2) Clothing			
NGF-IRTS	11,248	25,251	44.54%
-DRTS	118,548	1,721,256	6.88%
GFEO-IRTS	52,637	76,119	69.15%
-DRTS	179,060	921,569	19.62%
(3) Furniture			
NGF-IRTS	6,880	10,740	64.05%
-DRTS	19,500	537,616	3.63%
GFEO-IRTS	2,950	6,225	47.38%
-DRTS	48,654	478,314	10.17%
(4) Painting			
NGF-IRTS	12,720	16,960	75.00%
-DRTS	13,955	16,315	85.53%
GFEO	NA	NA	NA
(5) Plastics			
NGF-IRTS	19,849	26,726	74.26%
-DRTS	163,905	2,503,389	6.54%
GFEO-IRTS	29,352	40,536	72.40%
-DRTS	65,830	223,730	29.42%
(6) Cement			
NGF-IRTS	5,160	9,220	56.03%
-DRTS	33,895	313,530	10.81%
GFEO-IRTS	6,792	7,425	91.47%
-DRTS	107,292	325,236	32.98%

Table 5 (Continued)

Industry	Actual Output (1)	Potential Output (2)	Percent of Output to Potential (3)
(7) Steel			
NGF-IRTS	844	1,194	70.68%
-DRTS	15,640	82,900	18.86%
GFEO-IRTS	NA	NA	NA
(8) Machinery			
NGF-IRTS	17,460	21,380	55.64%
-DRTS	42,812	1,068,340	4.00%
GFEO-IRTS	9,664	14,568	66.33%
-DRTS	75,215	989,240	7.60%
All Industries			
NGF-Firms			
-IRTS	231,081	383,689	60.22%
-DRTS	1,244,808	14,458,069	8.60%
GFEO-Firms			
-IRTS	107,935	155,895	69.23%
-DRTS	566,331	3,299,279	17.16%

NA = no existence of government "favored" export-oriented firms.

factor intensity on the optimal scale of production of government "favored" export-oriented firms (GECO) and non-government "favored" firms (NGF) in the Philippine manufacturing sector. The paper also determines the extent to which the GFEO-firms are actually operating at the optimal scale more often than the NGF-firms; the discrepancy should shed some light on the effectiveness of the government's support program of the GFEO-firms. In order to do this a newly developed function, called ray-homothetic-production function, was modified and estimated, using cross-sectional data taken from the *Survey on Industrial Capital Utilization: Cross-Sectional Data from 1973-1974,* which was jointly sponsored by the Philippine National Economic and Development Authority and the World Bank.

The results showed that, for both groups of firms and by industry, as the capital intensity of production increases the optimal scale rises, and as the labor intensity of production increases the optimal scale declines. Furthermore, it was found that most of the NGF-firms in seven out of the

8 industries tested did not produce at the optimal scale (except the steel industry, which does not have GEFO-firms in it). However, most of the GFEO-firms in only four out of six industries tested produced at the optimal scale; the GFEO-firms appeared to do better than NGF-firms, but not much better. The larger firms in both types tended to experience decreasing returns to scale and the smaller firms increasing return to scale. It was determined that the overall small firms producing at increasing returns to scale did remarkably well by producing between 44.54 and 75.00% (it varies by industry, see Table 5 Column 3) of their potential output for NGF-firms and between 47.38 and 91.47% of their potential output for GFEO-firms, while the larger firms experiencing decreasing returns to scale produced only between 3.63 and 18.86% (except printing firms) of their potential for NGF-firms and between 7.60 and 32.98% of their potential for GFEO-firms. Overall, NFG-firms and GFEO-firms with IRTS were producing at an average of 60.22 and 69.23%, respectively. In contrast, NGF-firms and GFEO-firms with DRTS were producing at an average of 8.60 and 17.16% of their potential, respectively. The results of this study further support the earlier studies (see Table 1) and provide more detailed information on the capital utilization rate of each manufacturing firm in the Philippines, by manufacturing category — GFEO and NGF-firms — as well as by industry.

The above analysis seems to indicate a significant degree of inefficiency of the manufacturing firms in the Philippines, regardless of the type of firm — GFEO-firms or NGF-firms. Until additional research can be completed, this paper should be viewed with caution because there is a number of factors that may account for this conclusion or modify any other conclusions drawn.

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