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INDUSTRIAL CAPITAL UTILIZATION IN THE PHILIPPINES

By

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If physical capital is indeed scarce and the labor employment problem severe in most less developed countries (LDCs), increasing the utilization of existing capital would seem to provide a potentially significant avenue for promoting socially oriented economic growth. In developing this theme of the present study for the Philippines, we first examine the quantitative influences on capital utilization in Philippine manufacturing industries, using multiple regression analysis on data gathered from 400 establishments covered in the NEDA-World Bank Survey (cf. Bautista, 1975). The next section of this paper then looks into the non-quantifiable aspects of capital idleness, giving some institutional and policy-related reasons for underutilizing installed machinery and equipment peculiar to certain industries. After a brief discussion of "socially optimal" capital utilization, the concluding section draws some policy implications from the findings of the present study.

Quantitative Determinants of Time-Intensity Capital Utilization

The Survey data indicate that the average capital utilization rate (CUR) among manufacturing plants in the Philippines, measured by the proportion of time during the year that plant machinery and equipment were operating[1] in 1972, is 41.6 per cent. Weighted by plant capital, the average CUR increases to 60.6 per cent, owing to the higher utilization levels of larger-sized establishments. The pat-

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[1] Adjustment was made to take into account sectional differences in utilization rates within a plant.

tern of CURs is one of considerable variability across industries an to a lesser extent across firms in the same industry.[2] In inquiring int the reasons for the observed interplant and interindustry variations CURs, we first make use of quantitative information elicited fro the Survey, testing alternative specifications of a behavioral relatio ship explaining the level of capital utilization of a firm suggested by simplified economic model.

The rhythmic input cost explanation for optimal utilizatio provides a good starting point in the empirical investigation of th economic forces underlying the observed pattern of capital use. An given level of output (e.g., based on expected demand) can b produced with a large capital stock utilized at a low rate or with smaller capital utilized at a higher rate. Due to relative worker prefe ence for daytime work and/or a country's wage legislation, nigh time (and weekend) wage rates are higher than the normal daytim wage. Under this condition it may be profitable (and hence "opti mal" from the private viewpoint) to install a plant with built-i overcapacity so that most production could be done at daytim avoiding the higher cost of hiring labor services when wage premi over the daytime wage rate exist.

Assuming *zero* elasticity of factor-service substitution, the "pr vately optimal" (desired, planned) capital utilization rate is dete mined by relative factor prices, capital intensity of the productio process, and the amplitude of the wage rhythm. *Ceteris paribus*, higher cost of owning capital relative to labor service cost, penalizes capital idleness more and gives disincentive to underutilize the capit stock in order to avoid any given wage differential (e.g., between da and night shifts). The relevant capital cost measure is *not* the price a capital service flow but the price of owning a capital stock over specified period of time — a cost that is incurred whether it is bei used or not.

Capital intensity has also a positive relationship with utilizatio rate as it determines, jointly with factor prices, the relative impor ance of capital cost to the total cost of further operating the existi capital. More capital intensive processes imply a greater incentive t economize on the larger capital costs through higher utilization. C

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[2] See Tables 1 and 2 in Bautista (1975) for the means and standard deviatio of CURs by 3-digit and 4-digit ISIC.

[3] For a rigorous discussion, see Winston (1974).

the other hand, a labor intensive process may require low capital utilization to avoid paying the more important labor costs in night shifts and weekend work.

The relative cost of operating at different times over the production cycle is determined fundamentally by the amplitude of the wage rhythm. Indeed, if there is no fluctuation in wage rate, a cost-minimizing firm will plan to utilize capital stock fully under the above assumptions. The greater the wage differential, the greater is the incentive *ceteris paribus* to operate only during low wage periods (e.g., day-shifts).

Relaxing the assumption of fixed factor-service proportions, it becomes necessary to qualify the relationship given above between the level of capital utilization and relative factor prices. As long as the elasticity of factor-service substitution is less than one, which we expect to be the case for LDCs generally, relative factor prices will continue to affect factor shares, and hence capital utilization, positively. If the elasticity is greater than one, relative factor prices will affect factor shares negatively. An increase in the price of capital, for instance, will induce substitution of labor for capital to such extent that the share of capital in total cost will decrease (labor's share will rise), resulting therefore in a fall in the optimal utilization rate. With unitary elasticity, changes in factor prices will not affect factor shares because of the offsetting changes in relative factor use; hence, capital utilization is invariant with respect to factor prices.

The above theoretical considerations and the available Survey data suggest a regression equation explaining utilization in terms of the following variables:

Capital-Labor ratio (K/L) — defined here as the replacement value of capital (in thousand pesos) per worker on a day shift.

Relative price ratio (P_k/w) — the annual cost of owning capital[4] (in pesos) divided by the average hourly wage rate of the daytime production workers (in pesos).

Wage premia on night shifts (β_1) and Sunday (β_2) — expressed in percentage of the basic daytime wage rate.

K/L as defined above proxies for the factor-service proportions variable required by the theory and is deficient on two counts: (1) it

[4] See Appendices A and B below for the estimation of P_k in this study.

contains value of capital $K = P_m K$, rather than physical capital $\bar{K}$ (where P_m is the replacement price of a unit of homogenous capital); and (2) amounts of capital and labor are represented rather than factor-service flows. The first problem is inevitable in any empirical study that uses the idea of "capital". If P_m is constant, i.e., there are no interfirm or interindustry differences in the replacement value of *unit* capital, then changes in $\bar{K}$ will be reflected in K. As regards the second problem, the fact that nearly all sampled establishments operate fully the daytime shift makes reasonable the representation of factor-service flows by K/L, bearing in mind that L is daytime employment.

The measurement of the wage premium variables also presents some difficulty because a significant number of sampled establishments did not operate beyond the eight-hour daytime shift in 1972. The assumption is made here that these plants faced *ex ante* wage differentials equal to the average of those of the other firms under the same 4-digit industries which operated night shifts and Sunday work (and hence furnished information on wage premia). The alternative would have been dropping these plants in the regressions involving the wage premium variables.

Our findings indicate the superiority, in terms of statistical goodness of fit, of the logarithmic specification over the strictly linear form. Using Survey data for the 400 manufacturing establishments gives the following regression results:

$$(1)\quad \log CUR = 1.2721 + \underset{(1.94)}{.1816} \log \frac{P_k}{w} + \underset{(7.52)}{.1532} \log \frac{K}{L} - \underset{(-3.72)}{.0691} \log \beta_i$$

$$R = .532$$

$$(2)\quad \log CUR = 1.1997 + \underset{(1.66)}{.2176} \log \frac{P_k}{w} + \underset{(6.21)}{.1734} \log \frac{K}{L} - \underset{(-2.99)}{.0515} \log \beta_i$$

$$R = .509$$

The signs of the coefficient estimates conform to our expectations, and each of the estimated coefficients are also seen to be significantly different from zero to at least the 10 per cent level. The values of the coefficient of multiple correlation (R) indicate that less than 30 per cent of the interplant variation in capital utilization rates is explained. Among the three explanatory variables entered in the regression equations, the influence of the factor-price ratio appears the most potent in terms of the induced proportionate change in the

utilization rate. The factor proportions variable follows next and is not far behind; either of the two wage premia is observed to have a relatively weaker effect on the dependent variable.

Roughly similar inferences may be made from the results of regressions using average industry values of the capital utilization rate and the explanatory variables at the 4- and 3-digit ISIC levels, which are as follows:

4-digit industries

$$\log CUR = 1.2464 + \underset{(2.09)}{.1963} \log \frac{P_k}{w} + \underset{(5.63)}{.1704} \log \frac{K}{L} - \underset{(-2.38)}{.0784} \log \beta_1$$

$$R = .633$$

$$\log CUR = 1.1802 + \underset{(1.93)}{.2213} \log \frac{P_k}{w} + \underset{(5.54)}{.1868} \log \frac{K}{L} - \underset{(-1.98)}{.0594} \log \beta_2$$

$$R = .600$$

3-digit industries

$$\log CUR = 1.2917 + \underset{(2.32)}{.2311} \log \frac{P_k}{w} + \underset{(3.80)}{.1672} \log \frac{K}{L} - \underset{(-2.01)}{.0990} \log \beta_1$$

$$R = .693$$

$$\log CUR = 1.2279 + \underset{(2.13)}{.2483} \log \frac{P_k}{w} + \underset{(3.65)}{.1653} \log \frac{K}{L} - \underset{(-1.82)}{.0525} \log \beta_2$$

$$R = .687$$

The coefficient estimates for the three explanatory variables are seen to be slightly larger than those obtained from establishment data, except for the capital intensity variable in equation (4) using 4-digit industry data. There is also a noticeable increase in the R value as more aggregative data are used, which is understandable in view of the "smoothing out" of extreme interplant variations when industry average values are obtained.

The major implication of these results is that cost factors bear a significant relationship to capital utilization. However, the rather low explanatory power of the regressions indicates that other important influences on the utilization decision have been left out.

explanatory variables are presented, it is interesting to pursue t interpretation of the economic model estimated above. Recogniz that the factor-price ratio is a determinant of factor proportions, postulate the following relationship explaining the capital-la ratio:

$$(7)\quad \log \frac{K}{L} = b_0 + b_1 \log \frac{P_k}{w} + b_2 \log VA + b_3\, CP + b_4\, FT$$

where VA is value added (in thousand pesos) used here as a sc variable; CP is a dummy variable which equals one for continu process industries and zero otherwise; and FT is a dummy for fore technology taking on a value of one for foreign owned/control firms and zero otherwise. The coefficient for the factor price varia is expected to be negative and those for VA, CP and FT positive.

Our expectation of a significantly positive coefficient for FT h not been borne out by the regression results, suggesting that capi intensity in Philippine manufacturing is not influenced by fore ownership and management. The equations below, estimated b ordinary least squares,[5] indicate significance of the regression coef cients for the three other explanatory variables, which are also s to have the correct signs:

Firms

$$(8)\quad \log \frac{K}{L} = .4735 - \underset{(-2.46)}{.2096} \log \frac{P_k}{w} + .4453 \log VA + \underset{(6.71)}{.4114}\, CP$$

$$R = .543$$

4-digit industries

$$(9)\quad \log \frac{K}{L} = .1296 - \underset{(-2.74)}{.2264} \log \frac{P_k}{w} + \underset{(5.76)}{.5492} \log VA + \underset{(3.94)}{.5225}\, CP$$

$$R = .736$$

3-digit industries

$$(10)\quad \log \frac{K}{L} = .3085 - \underset{(-3.21)}{.2642} \log \frac{P_k}{w} + \underset{(6.31)}{.5056} \log VA + \underset{(2.74)}{.4821}\, CP$$

$$R = .831$$

[5] Two-stage least squares yielded roughly similar coefficient estimates.

Depending on the equation used, the elasticity of factor-service substitution[6] is estimated to be about .21 — .26. Based on average values of the relevant coefficient estimates in equations (1) — (6) and (8) — (10), a net percentage increase in the capital utilization rate of roughly 8.2 per cent can be expected from a 50 per cent increase in the factor-price ratio. This is obtained by subtracting from the direct effect of the change in relative factor prices on the utilization rate (10.80 per cent) the indirect effect due to the induced reduction in the capital-labor ratio (2.62 per cent).

By way of comparison we may examine the effect of an exogenous change in either of the two wage premium variables (which, like factor prices, can be considered to be policy-determined) on the CUR suggested by the average values of the coefficient estimates of β_1 and β_2 in equations (3) — (5) — computed at -.082 and -.065, respectively. The effect on the utilization rate of a 50 per cent increase in the night wage differential would be to raise it by 4.1 per cent; with a 50 per cent decrease in the wage premium for Sunday work, the corresponding increase is 2.7 per cent.

These simulation results are, of course, only suggestive of the possible quantitative repercussions on the capital utilization rate of assumed changes in some exogenous variables. They should be interpreted with caution given the simplicity of the model and the wide range of the implied confidence limits of the regression results.

For one thing, it is necessary to take into account the possible divergence of actual from intended capital utilization rates, which could depend in part on certain plant characteristics. This is suggested by the discussion of Survey findings (Bautista, 1975), where high average utilization rates are shown to be associated with large-scale production, exporting firms and corporations, among others. Regression analysis allows us to examine the significance of these additional influences on utilization in terms of the extent to which they contribute to the explanation of the variation of observed CURs across firms and across industries.

These additional explanatory variables will be represented in our regression analysis as follows:

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[6] This assumes that (a) the replacement value of capital reflects accurately the price of capital-service flow when it is being operated, and (b) factor-service prices equal marginal products are equalized. The estimated elasticity values conform to the range 0 to 1 presumed in Winston and McCoy (1974), where it is also shown that less than unitary elasticity of substitution implies a positive relationship between the utilization rate and factor price ratio under profit maximization.

VA = value added, a measure of size

X = proportion of output exported

MS = market structure variable; 1 for monopoly, 2 for tight oligopoly, 3 for loose oligopoly and 4 for competitive

Dummy variables:

NC = 1 for noncorporations
0 for corporations

WS_1 = 1 for firms paying monthly wages
0 otherwise

WS_2 = 1 for firms paying wages on piece-work basis
0 otherwise

B = 1 for BOI-registered firms
0 for nonBOI-registered firms

A priori considerations and empirical evidence for other countr also provide justification for hypothesizing that these variables additional determinants of the capital utilization rate. Thus, s economies in technology and management favor higher capital u zation rates in the larger-sized firms. Particularly in the LDCs, f size is also positively related to political power which is someti necessary to get around problems bearing on utilization, e.g., th involving supply of raw material imports, short-term capital, enhancing the ability of firms to reach desired utilization lev Exporting enlarges the market and offers a means of removing demand bottleneck; hence, other conditions the same, exp oriented firms might be expected to utilize productive capacity m fully. In the case of the Philippines and other LDCs with a re history of import-substituting industrialization policy biasing inv ment against export industries, the influence of the export vari on the utilization rate should be even greater.[7] Average firm size export sales have been found to be significant determinants of in trial capacity utilization in West Pakistan (Winston, 1971). For So Korean manufacturing industries, the study by Kim and K (1973) indicates significance of the scale variable but not of exp

[7] Growth rate of export sales would have been a more appropriate measu the explanatory variable, but the necessary data were not available.

Industrial policy could have a strong influence on the degree of market control. The relationship between market structure and capital utilization therefore merits some attention. Our measure of market control is quite subjective, based as it is on each respondent's own view of the extent of market competition. But it is not necessarily a defect. What may seem unreasonable is the rather arbitrary nature of the (MS) values assigned to the various market categories. This could not be avoided, however.

The Survey findings indicate a significantly higher average CUR for corporations compared to non-corporations. It is, therefore, desirable to allow a shift of the regression plane by introducing a dummy variable that differentiates between these two types of firms. This variable has been considered the most important determinant of capital utilization in Colombian manufacturing (Thoumi, 1973). Greater "professionalism" in management is attributed to the corporate structure which overcomes some of the difficulties of increased shift work inherent with non-corporations.

Simple averaging of utilization levels of firms classified by wage scheme used has been shown to yield relatively lower capital utilization among those paying wages monthly and on piecemeal basis. We used four dummy variables to accommodate the alternative wage schemes in the regression and, anticipating the results to be presented shortly, found WS_1 and WS_2 retaining their significant influence on utilization in certain specifications.

The remaining dummy variable in the above list makes a distinction between firms registered and not registered with the Board of Investments (BOI). The average utilization rate of BOI-registered firms in our survey sample is 53.5 per cent, which is significantly higher than that observed for the non-registered firms (37.7 per cent). Use of the BOI dummy (B) in the regressions allows us to examine the importance of BOI benefits (e.g., preferential access to bank loans and import licenses) upon capital utilization jointly with the influence of the other variables.

Each specification considered in the regression trials has P_k/w, $1/t$, and either β_1 or β_2 in combination with a subset of the above explanatory variables and others (to be mentioned later) that did not turn out to be significantly related to the level of capital utilization. Regression results with at least one coefficient having a wrong sign for the three "must" variables were rejected. Those having at least two t-values less than 1.64 were likewise excluded. The specifications that passed such screening have each of the above-listed explanatory

variables appearing at least once. The following better-fitting specifications illustrate the general pattern of the statistically acceptable regression results:

Firms

$$\log CUR = 1.2180 + .1632 \log \frac{P_k}{w} + .1810 \log \frac{K}{L} - .0458 \log \beta_1$$
$$(1.73) \qquad (8.44) \qquad (-2.15)$$
$$- .0859\ NC - .1232\ WS_1 - .1824\ WS_2 + .120$$
$$(-2.23) \qquad (-2.00) \qquad (-1.93) \qquad (3.$$

$$R = .572$$

$$\log CUR = .8766 + .1712 \log \frac{P_k}{w} + .1425 \log \frac{K}{L} + .1046 \log VA$$
$$(1.82) \qquad (6.27) \qquad (4.81)$$
$$- .0314 \log \beta_2 - .1078\ WS_1 - .1649\ WS_2 + .1$$
$$(2.03) \qquad (1.79) \qquad (1.78) \qquad ($$

$$R = .581$$

(11)

$$\log CUR = .8545 + .1871 \log \frac{P_k}{w} + .1574 \log \frac{K}{L} + .0979 \log VA$$
$$(1.97) \qquad (6.97) \qquad (4.47)$$
$$- .0421 \log \beta_1 + .1284\ X + .1118\ B$$
$$(1.98) \qquad (2.55) \qquad (2.97)$$

$$R = .580$$

$$\log CUR = 1.1105 + .1706 \log \frac{P_k}{w} + .1954 \log \frac{K}{L} - .0334 \log \beta_2$$
$$(1.90) \qquad (9.30) \qquad (2.11)$$
$$+ .1571\ X - .0673\ NC + .1041\ B$$
$$(3.09) \qquad (-1.74) \qquad (2.71)$$

$$R = .551$$

4-digit industries

$$\log CUR = 1.4391 + .2151 \log \frac{P_k}{w} + .1924 \log \frac{K}{L} - .1999 \log \beta_1$$
$$(2.18) \qquad (6.01) \qquad (-2.73)$$
$$+ .3445\ X - .0441\ MS$$
$$(2.60) \qquad (-1.94)$$

$$R = .685$$

(12)

$$\log CUR = 1.6628 + .1772 \log \frac{P_k}{w} + .2076 \log \frac{K}{L} - .3064 \log \beta_2$$
$$(1.86) \qquad (6.17) \qquad (-3.94)$$
$$+ .3984\ X - .0612\ MS$$
$$(3.00) \qquad (-2.15)$$

$$R = .692$$

3-digit industries

$$\log CUR = 1.4895 + \underset{(3.41)}{.3664} \log \frac{P_k}{w} + \underset{(4.92)}{.2028} \log \frac{K}{L} - \underset{(-2.22)}{.2065} \log \beta_1 + \underset{(1.91)}{.3778} X - \underset{(-2.21)}{.0739} MS$$

$$R = .762$$

(13)

$$\log CUR = 1.6955 + \underset{(2.91)}{.2858} \log \frac{P_k}{w} + \underset{(4.97)}{.2097} \log \frac{K}{L} - \underset{(-2.31)}{.2977} \log \beta_2 + \underset{(2.01)}{.4123} X - \underset{(-2.44)}{.0829} MS$$

$$R = .766$$

One interesting observation to make is that the newly-introduced variables do not add very much to the explanatory power of the original specification involving only the factor-price ratio, factor proportions and one of the two wage premium variables. The regression results based on firm data indicate an increase in the coefficient of determination (R^2) of only about 5 percentage points; using 4-digit and 3-digit industry averages, the increments in R^2 are from 7 to 11 percentage points. As before, higher values of the correlation coefficient are produced in the industry regressions.

When firm data are used, the estimated coefficients of the original explanatory variables are observed to be of the same order of magnitude as in the earlier regressions based on the simplified model. Based on 4-digit and 3-digit industry average data, however, the regressions yield relatively higher coefficient estimates, particularly for the wage premium variables.

Also noteworthy is the lack of consistency in the significance of the estimated coefficients for the additional explanatory variables as more aggregative data are used. This is apparently due to the varying degrees of intercorrelation among variables at different levels of data aggregation. For instance, value added is shown above to have a highly significant coefficient in the regressions using firm data. The industry regressions, however, fail to produce t-values for the VA coefficient higher than 1.64, which is attributable to the much stronger correlation between K/L and VA at the 3- and 4-digit levels. There is also a noticeable tendency for the dummy variables to drop out in the "good" regression results based on industrial average data, suggesting the heterogenous nature of 3-digit and 4-digit industries in terms of firm characteristics represented by the dummies.

What emerges as a consistently significant additional influence o capital utilization is the export variable. The other explanatory var ables found significantly related to capital utilization at the firm leve are value added and the dummy variables for noncorporations, wag schemes and BOI registration. Based on the estimated coefficient the corporation dummy shows the weakest influence among th latter variables. Using industrial average data, the regressions yiel statistically acceptable results with exports and market structure the only additional explanatory variables having coefficients signifi cantly different from zero.

The negative influence on capital utilization of the market struc ture variable confirms the suggestion given by the pattern of simpl CUR averages classified by degree of market control. This woul seem to indicate that increasing competition leads to low utilizatio attributable in part to the observed overcrowding in certain highl protected industries spawned by trade and industrialization polici of the past. The negative coefficient of MS might have substitute also for the scale effect since VA does not appear in the estimate equation. We tried using a dummy variable for monopoly firm (instead of MS) in line with the significantly higher average CUR observed earlier for these firms. Such regression trials, however, di not produce "good" results using any of the three data sets.

Some explanatory variables that were also tried but did not sho significant coefficients in the regression results are: (1) dependen on imported raw materials, measured by the percentage of mater inputs that are imported; (2) age of plant, in years; (3) location plant, by population size grouping; and (4) product end-use. regard to (1), it is not so much the mere dependence on imports th forces a firm to underutilize capacity; the more relevant consider tion is the extent to which its import requirements are met. T observed invariance of the utilization rate with respect to the propo tion of raw materials imported would seem to indicate that t ability of Philippine firms to obtain adequate supply of import materials bears no relation to the degree of import dependen Thus, some garment and electronics firms whose products are int nationally subcontracted have no problem with respect to raw ma rial imports. Indeed, in recent years, export-oriented firms gener were well placed in the procurement of import requirement.

The lack of significance of the age of plant as an explanat variable suggests that "building ahead of demand" is not a gen characteristic of Philippine manufacturing establishments appare reaching planned production levels within a relatively short peri

This is supported by the pattern of average CURs of firms classified by age, which is as follows: less than 3 years — 36.1 per cent, between 3 and 6 years — 42.0 per cent, between 6 and 9 years — 43.3 per cent, and over 9 years — 42.1 per cent. Such result also does not support the view that the ability of firms to overcome obstacles to greater capital use improves with experience over time.

The location of plants likewise does not have an apparent influence on capital utilization. Since the distinction made is on the basis of population size, there would seem to be no additional difficulty associated with siting a plant in the outlying areas (of low population density) in terms of say, hiring managerial and skilled labor.

Introducing two dummy variables to differentiate among firms producing consumer, intermediate and capital goods, we found no strong relationship between product end-use and capital utilization in the regression results. This contradicts what is suggested by the simple averages of firm CURs which are relatively higher for firms producing intermediate goods and lower for capital good producers.

Qualitative Influences on Capital Utilization

As should be evident from the low values of the coefficient of multiple correlation in the regression results, a large part of the inter-plant variation in capital utilization rates is attributable to factors which have not been included in our quantitative analysis. There is a need to examine, therefore, some of the non-quantifiable causes of capital idleness in Philippine manufacturing as disclosed in the survey interviews, paying attention to the pecularities of certain industries with regard to the prevailing policies and industry characteristics influencing capital utilization.

Firstly, the wide variation across industries in the seasonality of input supply and product demand has not been taken into account. Final consumption goods such as apparel, footwear, furniture and certain food products are demanded in relatively much larger amounts in November and December. Most producers find it necessary to have enough elbow room to handle orders adequately, operating plants at peak levels of production from early October to mid-December. Industries with forward linkage to the construction sector, e.g., cement, lumber (sawmills) and structural metal products, face seasonally low demands during the rainy season which runs from June to August in most parts of the country. Seasonal fluctuations in the supply of principal raw materials also affect capital utilization in some agriculturally based industries, e.g., sugar, rice and corn milling.

Sugar cane, for instance, is available in most sugar centrals for five six months only each year; throughout such milling season the sug mills are operated 24 hours a day, all equipment and machine being idle in the nonmilling period except for maintenance check-u

The influence on capital utilization of the seasonality factor is, course, a function of the perishability of the product and installe storage capacity. The survey inverviews provided information these two characteristics, which differ by industry and to a less extent by establishment, explaining in part the observed "bunching of the regression residuals in certain industries. Thus, actual utiliz tion rates are generally much lower than the "predicted" CUR value in sugar mills, which have a highly perishable principal raw materia while a lower incidence of such large deviations is observed amon sawmills, structural metal plants and cement factors with adequat warehousing facilities.

As it is well known, import substitution policy served to promot the growth of some intermediate good industries in the latter part o the 1960s. Based on simple averages, these industries generall showed higher-than-average utilization rates in 1972. It is a bit sur prising to observe, therefore, that some firms under such industry categories, e.g., industrial chemicals, iron and steel and non-ferrou metal, have negative regression residuals. This would seem to indicat some overinvestment beyond what is suggested by the artificially lower factor-price ratio (P_K/w) for these favored industries.

Flour milling is an import-substituting industry that was favored i the late 1950s. The very high level of effective protection accorde the flour industry attracted investments so much that substantia excess capacity appeared before long. Government-controlle imports of wheat, on which the flour mills are totally dependent were being allocated to seven firms in 1972. Changes in produc prices were jointly decided by these firms which comprise, therefor a collusive industry. With price inelasticity being assumed by flour based products, it is easy to see that they would operate at utiliza tion rates lower than that indicated by the industry characteristic represented in the regression equations.

Transport machinery (motor vehicles) is another import-substitut ing industry showing widespread capital underutilization (ave CUR = 24.07 per cent). High tariff rates on imported cars and trucks make it profitable to locally assemble knocked-down components imports of which are subject to a much lower tax. Overcrowding of the industry has resulted, as evidenced by the multiplicity of make

models of cars sold to the very limited domestic market, the protection and high prices making possible high rates of return investment even with substantial excess capacity. Some rationalization of the automotive industry limiting the number of firms to was initiated in 1972 by the Board of Investments.

Declining demand for certain products over time is another reason the existence of excess capacity which has not been included in quantitative analysis above. Manufacturers of cigars and cigarettes made of native tobacco, for instance, claim that their market (both domestic and international) has deteriorated over the years due the growing popularity of Virginia tobacco, forcing them to cut down on production. Some have shifted to using Virginia tobacco blends, but which faced strong competition, at least in 1972, from foreign-produced cigarettes being smuggled into the country in large quantities. Domestic producers of liquor and wine (except beer) were similarly placed, the substitution of imports facilitated by the existence of an active blackmarket for PX goods. The regression results, therefore, yield residuals for these establishments showing higher predicted utilization rates than the actual CUR values.

Some industries are observed to operate at higher utilization levels than what the regression equations predict. The notable ones are coconut oil mills, petroleum refineries and glass factories. They are continuous process industries in which a plant shutdown or even a brief interruption entails an opportunity cost far greater than that associated with capital idleness *per se.*, e.g., physical damage to products, costly reheating of furnaces to operating temperature, etc. That positive regression residuals generally appear for such establishments suggests that the capital intensity and relative factor-price variables have not captured the full measure of the cost factor involved.

Quite a few firms gave indication during the interview that operating night shifts on an irregular basis, e.g., only during periods of higher than-average demand, presents difficulties in the hiring of workers. Aversion to night work seems particularly strong among supervisory and skilled workers, which is understandable in view of their relative scarcity and hence employability for the preferred day-time work. Some firms in meat processing, wearing apparel, furniture and fixtures, and electrical machinery and appliances have admitted that inadequate work supervision in night shifts is the principal reason for the lower labor productivity compared to day shifts. Where the labor force consists mainly of women (e.g., in garment and cigarette factories), even production workers are hard to get for night shifts without providing safe transportation to their homes after

work. The observed disparity in CUR values between small and lar garment firms, for instance, is due in part to the ability of the latte to provide the necessary amenities of night work.

At least as perceived by firm owners and production managers, th wood and metal working industries seem particularly subject to severe scarcity of skilled workers. Again the smaller-sized plant appear to suffer relatively more, as evidenced by the frequency o complaints made in the interviews that most of their apprentices and young workers leave them eventually for the large establishments presumably attracted by the higher wage rates there. Asked why they would not offer the same pay scale if skilled workers really represent the bottleneck in production, the usual answer is that they cannot afford it. Such reply invariably makes little economic sense to the inverviewers, knowing that the consequence of not being able to hire additional workers is leaving idle more than one-half of the expensive machinery and equipment most of the time. We are led to suspect that poor management of these small- and medium-scale enterprises is the underlying reason for the observed underutilization of installed capital. Limited access to short-term credit to finance increases in working capital, which is another frequent claim of the small industrial firms as a dominant reason for capital underutilization (e.g., in garments and other made-up textile products), might in part be attributed also to inefficient management.[8]

Indeed, it seems safe to infer from our Survey results that production management generally must assume some part of the responsibility for the existence of substantial excess capacity in Philippine manufacturing. Our interviews reveal an almost irrational tendency for a large number of the sample firms not to operate during Sundays and holidays (representing at least 62 days every year), some plant managers asserting that the only reason is that it is "company policy" not to have their workers work on Sundays and holidays. Such conservative practices (certainly not profit-maximizing) may account in large part for the low explanatory power of the regression equations. While our quantitative analysis bears out the proposition that the large wage premium for work on Sundays and holidays encourage firms to avoid them, our qualitative evaluation does not preclude non-economic reasons for the extensive plant shutdowns observed.

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[8] Although admittedly there exist some strong biases against small scale industry in the provision of institutional credit.

Policy Implications

Without examining the full repercussions on the national economy of increasing industrial capital utilization, it is of course not possible to state categorically that the social benefits from increased utilization will outweigh the social costs. However, considering the difficulties faced by presentday LDCs like the Philippines in generating the level of investment required to meet commonly stated development objectives, our presumption would be that it is socially desirable to utilize installed machinery and equipment to a greater extent than has generally been observed.

Viewed differently, any divergence between actual and social (shadow) prices due to existing market distortions would cause "socially optimal" capital utilization to differ from the utilization levels desired by individual firms for private profit. As indicated above, the basic determinants of a firm's optimal capital utilization rate are the relative factor price, factor-service ratio (which is determined in part by the relative factor price) and the wage premium variable. It is well known that the scarcity value of capital in the Philippines is higher than its market price and that shadow wage rates (at least, of unskilled workers) are lower than actual wage rates. On this account, therefore, one might expect the socially optimal capital utilization rate to be higher than what is privately optimal (since P_k/w is positively related to CUR). Similarly, the wage cost penalty of utilizing capital beyond the day-time shift or during Sundays and holidays does not accurately reflect the real cost to society. While part of the night wage premium might properly reflect physical difficulties of working at night, the incidence of lower productivity during night shifts is reportedly small (Farooq and Winston, forthcoming). It is also true that people would prefer to work in the day time rather than at night; however, this does not justify a substantial wage premium for night shifts because, in the context of a labor-surplus economy such as the Philippines, the choice is between night work and no work, not between day and night work. As a pioneer investigator has remarked, "policies that are undeniably humanitarian in their effect on *employed* workers probably have cruel effects on *unemployed* workers" (Winston, 1977, p. 36) to the extent that the wage premium is a deterrent for firms to operate during evenings, Sundays and holidays.

The foregoing discussion implies that there is a policy need to achieve greater utilization of existing industrial capital. This could be done in two complementary ways, relating to the two basic sources of capital underutilization. Firms may fail to achieve their *intended*

utilization levels, in which case policy efforts could be directed a removing supply bottlenecks (e.g., constraints on raw materia working capital, skilled and supervisory labor) and/or stimulati demand. The other major reason for capital idleness is that firm targets of full capacity operation, under existing conditions of fact market distortions, do not reflect what is *socially optimal.* Here, th implication for policy would be to do something about the wron information being conveyed by market prices concerning the relati scarcity of society's resources.

The findings of the present study suggest some guidance fo policy-making towards reducing capital wastage in Philippine manu facturing industries. Firstly, the important role of the factor pri ratio in the determination of the firm's desired level of utilizati needs to be recognized. It has a direct positive influence as well as a indirect effect, which is negative, via the capital intensity variabl From the policy viewpoint, the positive relationship between CU and the capital-labor ratio is meaningful only with the recognitio that the latter variable is determined in part by relative factor price Our empirical finding for Philippine manufacturing is that the dire effect of an exogenous change in relative capital cost on the utili tion rate outweighs substantially the negative effect due to th induced change in the capital-labor ratio. Thus, the existence o factor market distortions tending to underprice capital relative t labor is prejudicial to employment generation on two counts: (1) i biases technological choice toward capital-intensive processes an industries; and (2) it creates an economic incentive to underutili the installed capital stock. The policy implication, for a developi country suffering from a severe employment problem such as th Philippines, is that effective measures need to be adopted which wi eliminate or at least reduce the sources of factor price disequilibriu

A good starting point for policy action would be the restructuri of prevailing industrial incentives to remove their strongly capi cheapening bias. As described in Appendix A, economic inducem to promote industrialization in the Philippines during the postw period have had the effect of lowering the price of capital mu beyond its scarcity value. Currently, some of the benefits be provided industrial firms registered with the Board of Investme tend to add to the existing factor market distortions caused by lo interest and high wage policies, relatively low tariff rates on capi imports, advanced social security legislation, undue dependence o imported technology, etc. Such capital-cheapening incentives a accelerated depreciation allowances, tariff exemption of import machinery and equipment, tax deduction on expansion reinvestme

rents that do not distort relative factor costs. This would raise the opportunity cost of owning capital and serve as a disincentive to underutilize installed equipment and machinery.

Interest rate being a direct influence on capital cost, it seems advisable to reform the current low interest policy, particularly with respect to the supply of institutional credit, toward a flexible and realistic costing of available loanable funds. While the monetary authorities have deliberated on this issue in the past, only marginal changes have been allowed on the legal ceiling rates on bank deposits and loans. Currently, savings banks (but not commercial banks) are allowed to pay 7 1/2 per cent interest on savings deposits, representing an increase of only 1 1/2 per cent from the ceiling rate three years ago. Earlier, the ILO Employment Mission had recommended 12-14 per cent as *minimum* rates of interest on savings and time deposits, which would have reduced substantially the wide gap observed between short-term money market rates and bank deposit rates.

Capital good imports are taxed much less heavily than imported consumer goods in the Philippines, again contributing to the observed downward bias in the relative pricing of capital and providing an inducement for producers to overinvest in plant capacity. Making the tariff structure more uniform can be expected to contribute positively to the utilization of industrial capital, in addition to having a likely favorable effect on allocative efficiency by reducing disparities in effective protection rates between industries producing capital goods on the one hand and import-substituting consumer goods on the other.

High labor costs serve as a deterrent to increasing capital utilization. While it is recognized that market wage rates of unskilled and semi-skilled laborers in the Philippines exceed their shadow prices, real wage incomes not having recovered fully yet from the sharp reductions during the inflationary period 1970-74 (Bautista, 1977) would seem to preclude any policy changes that will further reduce the real earnings of workers. Indeed, the national government has found it necessary to initiate in 1974, which became mandatory for all employees eventually, the granting of an emergency allowance of fifty pesos per month for every employee with a monthly income of 500 pesos or less. This was followed by a ten per cent salary increase for all national government employees effective July 1, 1974.

It is perhaps in the additional labor costs of operating plants beyond the usual utilization pattern where certain policy changes

might be feasible. The revised Labor Code of the Philippines, effective November 1, 1974, has already made possible Sunday work at regular wage rates. Employers are given the right to determine which day to assign as an employee's rest day for every week. Sundays and holidays are considered working days, although work done on a legal holiday (but not a Sunday unless it is the rest day) must be compensated with a 30 per cent premium on top of the normal wage. The premium is increased to 50 per cent if the holiday in which the employee is made to work happens to be his rest day. As before, extra compensation for overtime and night shift work consists of 25 per cent of the regular wage. Clearly there is room for further reducing incremental labor costs incurred in improving the utilization of existing capital.

The availability of workers for night shifts has also been mentioned above as a problem among firms unable to provide transportation facilities and other night work amenities. In view of the significant scale economies in the provision of such services, a case could be made for improving public transportation and police protection at night, particularly in areas of industrial concentration by the small and medium-scale enterprises. This could well provide the basis for repealing the provision in the Labor Code prohibiting women, presumably on grounds of safety, from working "in any industrial undertaking . . . between ten o'clock at night and six o'clock in the morning of the following day."[9]

The high cost of skilled and supervisory labor for night work found in certain industries suggests that a utilization-oriented policy should make special efforts at increasing the supply of these types of workers and at weakening their aversion to working at night. Government subsidy to firms hiring such workers at more than the usual wage premia in order to increase shift work would be justifiable in the short run if they constitute the real bottleneck, on the ground that private profitability understates the social desirability of running shifts. Likewise, industrial apprenticeship programs, on-the-job training, vocational education and technical institutes contributing to the limited supply of labor skills merit active encouragement.

Increased capital utilization in small- and medium-scale enterprises needs to be given particular attention because of its potential

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[9] Quotation from Article 128 of the new Labor Code. The prohibition does not apply in cases "where the woman employee holds a responsible position of managerial or technical nature" and others defined in Article 129.

significant impact on industrial labor absorption. Based on the qualitative results of the Survey interviews, this would require the elimination of existing biases against small-sized enterprises in the access to short-term credit and assistance in the training of technical and managerial skills.

Certain industries appear to have been overcapitalized as a result of planning and policy mistakes of the past. The lesson to be gained is that favoring particular industries in resource pricing and allocation without regard to efficiency considerations could lead eventually to substantial underutilization of installed capital. The possibility cannot be ruled out that productive capacities in favored industries are being augmented through subsidies and other incentives at the expense of leaving the capital stock utilized inadequately. Perhaps government agencies performing such allocation function need to be reminded every now and then of the resource wastage and resulting social costs associated with idle machinery and equipment.

The final point should be made that the decision on the extent of capital utilization rests ultimately with the individual firm owners and managers. While policies can be changed to make it more expensive to underutilize existing capital, there is no certainty that a substantial improvement in the overall utilization rate will come about. The policy measures indicated above would be necessary, and it is difficult to imagine any significant increases in utilization without them; however, such policy changes ought to be complemented by a well-publicized campaign to educate industrial plant owners and managers, workers and the general public on the social need to avoid capital wastage from underutilized capacity. The objective is to reduce popular distate for night and week-end work, which in turn will facilitate a significant response to the economic inducements for increased utilization.

APPENDIX A

Industrial Incentives and Factor Price Distortion in the Philippines

Economic policies in the Philippines providing incentives industrial investment have taken various forms over the post period but the general direction of factor use bias appears to h remained the same.

In the 1950s the imposition of foreign exchange and imp controls and the overvaluation of the domestic currency oriented pattern of industrial development toward industries favored by priorities of the control system. The "essentiality" rule governing allocation of foreign exchange conferred private benefits to importation of capital equipment and machineries which w obtainable at artificially low prices. Such policy represented, th fore, an effective discrimination against labor employment in favo industries with scope for factor substitution. Another powe incentive that showed clear bias toward capital use was the prefe tial access to industrial loans from government financial institut which, due to the low interest rates charged, had the effect of pressing the cost of acquiring capital beyond its scarcity value. Fi ly, exemption from all taxation granted "new and necessary" in tries (for a period of 4 years from date of organization) may also presumed to have distorted the incentive structure against labor since such tax subsidies were directly related to the acquisition capital.

With the lifting of controls in the early sixties and policy efforts make the exchange rate of the Philippine peso more realistic, burden of industrial promotion fell on tariff policy and governm lending to favored industries. As argued in Power and Sicat (19 the highly protective tariff structure of the 1960s only served perpetuate the biases of the control system instituted in the previ decade.

The Investment Incentives Act of 1967 and the Export Incent Act of 1970 probably represent the two most important piece postwar economic legislation concerning inducements for indus investments ostensibly preferred from the standpoint of nati development. They are comprehensive in scope, the benefits of to both domestic and foreign enterprises being administered by Board of Investments (BOI) which also determines the prefe

of investment through its Investment Priorities Plan (IPP) and its Export Priorities Plan (EPP).

Five items in the package of BOI incentives are readily seen to have a capital-cheapening effect. These are:

(1) Tax exemption on imported capital equipment within seven years from the date of registration of the enterprise. This reduces the cost of acquiring imported capital, given present tariff rates and compensating tax, from 10 to 20 per cent depending on the type of capital good.

(2) Tax credit on domestic capital equipment equivalent to 100 per cent of customs duties and compensating tax that would have been paid on imports of such items.

(3) Accelerated depreciation allowances, as a deduction from taxable income. This permits fixed assets to be depreciated up to twice as fast as the normal rate if expected life is 10 years or less or depreciated over at least 5 years if expected life is more than 10 years.

(4) Tax deduction of expansion reinvestment to the extent of 25 to 50 per cent in the case of non-pioneer projects and 50 to 100 per cent in the case of pioneer projects.

(5) Preference in grant of government loans. This permits BOI-registered firms to have preferential access to low interest credit.

There is one incentive provision that appears to favor labor employment, namely, the deduction from taxable income of one-half of the expenses on labor training (not exceeding 10 per cent of direct labor wage). But this would be true only in cases where the labor that is acquired can substitute for, rather than be complementary to, capital services. Exporting firms, moreover, are provided a wage subsidy equal to the direct labor cost in the manufacture of export products but not to exceed 25 per cent of the export revenue.

Other benefits afforded registered enterprises relate less directly to the relative costing of factors. The following incentives seem neutral with respect to factor use: (1) deduction from taxable income all organizational and pre-operating expenses; (2) deduction of net operating loss incurred in any of the first 10 years of operations; (3) exemption from all internal taxes, except income tax, to a diminishing extent over time; (4) for pioneer enterprises, post-operative tariff

protection up to 50 per cent of the dutiable value of imported it similar to those being produced; and (5) for exporting enterpri tax credit equivalent to the sales, compensating and specific ta and duties on supplies and materials used in the manufacture of export products. It should be noted, however, that the distributi of benefits obtained from BOI registration is highly skewed tow large-sized firms*, which are inherently the more capital-using. Th indirectly, such subsidies to favored industries also tend to acc tuate the existing bias against labor use. In estimating the annual of owning one dollar's worth of capital (P_k) for the establishments our sample (cf. Appendix B), we assume that these indirect effe are insignificant relative to the impact of the BOI incentives lis earlier that directly reduce capital price.

APPENDIX B

Estimation of the Annual Cost of Owning Capital

We follow Jorgenson (1971) in assuming that firms seek to ma mize the present value of net revenue after taxes. The stream future profits resulting from the acquisition of capital goods normally be taxed at rate u but subject to modification by ot existing tax policies. Bearing in mind the major fiscal incentives gi to BOI-registered firms as discussed in Appendix A, let us denote, any firm i,

u_i = profit tax rate

d_i = rate of depreciation

v_i = ratio of tax deductible depreciation charges to actual depreciation

y_i = share of the cost of capital exempted from profit tax

r_i = interest rate used to discount future net revenues

The implicit annual cost, in terms of the domestic currency, owning one dollar's worth of imported capital is given by

$$P_{ki} = \frac{Z(1 + T_{ki})}{1 - u_i} \left[(1 - u_i v_i)\, d_i + (1 - u_i y_i)\, r_i \right]$$

*A similar bias toward large volume borrowers is evident in the distributi of low interest industrial loans by government financial institutions.

where Z is the exchange rate applicable to capital imports and T_{ki} is the tariff rate on capital goods imported by firm i. We use Z = 6.29, representing the three-year average dollar buying rate (regardless of import commodity end-use) for 1972. A tariff rate of 10 per cent *ad valorem* applies to the majority of capital goods (75 out of the 126 commodity items classifiable as capital machinery and equipment in the 1965 Tariff Code), with most of the remaining capital goods being levied less than 30 per cent. For present purposes, we assume an average of 15 per cent to apply to each importing non-BOI registered firm, ignoring the fact that the average tariff rate on capital imports may vary across industries. For BOI firms in our sample, T_{ki} = 0. To be able to evaluate P_{ki} it remains to assign values to u_i, d_i, v_i, y_i and r_i, which is done *seriatim* in what follows.

u_i: Corporate income tax in the Philippines is 25 per cent and 35 per cent on taxable incomes up to and over P100,000, respectively. Firms in our sample are classified into these two categories, using the 1969 proportion of payrolls to value added at the 3-digit ISIC level to derive estimates of firm profit incomes from our survey data on value added.

d_i: Depreciation rates based on the guideline length of useful life of machinery and equipment among 3-digit ISIC industries in the *Asset Depreciation Range System* (July 1971) of the U.S. Department of Treasury are used.

v_i: The accelerated depreciation incentive implies $v_i = 2$ for BOI-registered firms with expected plant life (n) of 10 years or less, $v_i = n/5$ for BOI-registered firms with $n < 10$. For the remaining firms in the sample (not registered with the BOI), $v_i = 1$.

y_i: Reinvested earnings are deducted from taxable income to the maximum extent of 50 per cent in the case of non-pioneer BOI-approved projects and 100 per cent in the case of pioneer projects. Taking these maximum figures, we set $y_i = 0.5$ and 1.0 for these two classes of BOI-registered firms, and y = 0 for non-BOI firms.

r_i: Assuming that firms discount future earnings by the rate of interest on loanable funds charged on them, we set $r_i = .12$ for the "large" establishments (somewhat arbitrarily, those employing at least 100 workers) and BOI-registered firms in our sample and r_i =

.14 for the "small" firms (with less than 100 workers).* T recognizes the widely held view that more liberal credit terms made available to the larger-sized enterprises.**

Values of P_{ki} ranging from .42 to 3.49 have been computed f the 400 sampled firms, the average for "all manufacturing" bei 2.16 pesos.

*Notice that r_i is expressed in nomal rather than in real terms. This is sistent with a previous finding of the insignificance of the capital gains vari in investment behavior in Philippine manufacturing (Williamson, 1971) Hughes *et al*, (1976), the influence of capital gains in the user cost of capi included, with the result that the coefficient estimate for the factor price able in the regressions for capital utilization in Philippine manufacturing be insignificant.

**As revealed, for example, by the findings of the Greater Manila Surve four small-scale industries conducted for the ILO Employment Mission in July 1973 (cf. ILO, 1974).

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