# PRODUCTIVITY GROWTH IN PHILIPPINE MANUFACTURING: RETROSPECT AND FUTURE PROSPECTS

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## FOREWORD

While the relationship between productivity advance and economic growth has long been recognized by both economic researchers and practitioners, at no time has the significance of such link been considered more crucially than today when greater productivity is taken to be a key element in the Philippines' current economic recovery program.

Taken in such light, the study presented in this monograph assumes greater relevance and importance. The study was prepared by Richard Hooley, Professor at the University of Pittsburgh and a Visiting Research Fellow at the Philippine Institute for Development Studies (PIDS) in 1984. It traces productivity change over the period 1956–1980 in the Philippine manufacturing sector as a whole and in two dozen individual industries at the three-digit level, analyzes the causal factors behind this change, and looks into the process of diffusion of productivity gains.

The findings of the study cannot be taken lightly. It indicates that productivity in Philippine manufacturing has been declining since the late fifties and that, accordingly, productivity gains in agriculture have been offset by productivity declines in the manufacturing sector in the last twenty five years or so. This should lead policymakers to take a second look at the industrial policy environment and institute early actions which can reverse the trend. Some leads into what these actions could be are provided by Hooley in this study.

FILOLOGO PANTE, JR.
President

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Richard Hooley

In recent years, we have witnessed an increased awareness of the importance of productivity growth to economic progress. This is reflected in the rapid expansion of the productivity literature which has dealt primarily with the developed countries of the western world. There has also been some work focusing on newly-industrializing countries of East Asia, such as South Korea and Taiwan. Studies, however, of productivity growth in less developed countries (LDCs) are still in a very early stage. This is unfortunate because, as Kuznets (1966) has repeatedly pointed out, an understanding of the pace and factors underlying changes in productivity is vital to our understanding of growth in per capita income. When undertaken on an industry basis, productivity studies provide a wealth of detail on output and inputs over time that are invaluable in making informed assessments of the effects of industrialization policies.

Initial efforts to measure and analyze productivity performance in the Philippines as well as other ASEAN countries focused on agriculture. The establishment of the International Rice Research Institute (IRRI) in 1960 was a milestone in this respect. Researchers at the Institute compiled both macro and micro data on rice productivity trends and performance over an extended period for a number of Asian countries (Hayami, Ruttan and Southworth, 1979; Herdt and Wickham, 1978). While the primary focus of work at IRRI is on rice, there has been a spillover toward efforts directed at measuring and analyzing productivity performance in agricultural production as a whole, as exemplified by work at the University of the Philippines at Los Baños. The postwar record in agriculture has been studied in depth by a number of scholars including Barker and Crisostomo-David (1979), Hooley and Ruttan (1969), Paris (1971) and Patalinghug (1980). Much less attention has been given to other sectors presumably because agriculture is considered the dominant industry in these economies. In addition, policymakers concentrated on productivity improvement in agriculture because of their perception that stability of food (i.e., rice) prices constitutes the vital linchpin between economic progress and political stability.

These perceptions are not justified by the facts. In 1950, agriculture contributed almost one-half of Philippine GNP while manufacturing contributed only one-fifth. By 1982, however, agriculture's share had dropped to 30 percent while the share of manufacturing exceeded that of agriculture by a slight margin. The prospects are that this increase in the relative importance of industry will continue in the immediate future. Price stability

as well as the efficiency of the macro-economic system is increasingly dependent on the performance of the manufacturing sector. The case for shifting attention to productivity change in industry is clear and unambiguous.

Several studies of productivity growth in Philippine industry have been carried out in the past. The earliest is that of Hooley (1968) which covered the period 1948 to 1961 and concluded that total factor productivity (TFP) in manufacturing advanced at a modest pace of about 2 percent per year. Williamson and Sicat (1968), using the Denison methodology, studied technical change in the period 1957-1968 and estimated the annual rate of advance for all manufacturing at approximately one percent. After accounting for aggregation effects, they concluded that intra-industry growth in TFP was nearer 1—½ percent per annum. The inference of the Hooley and Williamson/Sicat studies taken together is that industrial productivity was undergoing retardation for the period of the fifties and sixties. A recent study by Estanislao (1981) covering the period 1956—1978 concludes that TFP growth was high prior to 1970 but fell to 5 percent or less for most industries during the past decade. Unlike the previous studies which utilize census data, Estanislao's data base consists of time series constructed from a sample of the largest one thousand corporations. Questions can be raised about its comparability with data used for other studies, partly because it is limited to large corporations and also because it is based on enterprise rather than establishment data. Patalinghug (1980), utilizing census data, estimated TFP growth in manufacturing for 1956—1970 at 3.6 percent per year. He found that large firms registered a significantly more rapid rate than small firms. Finally, Sanchez (1983) estimated TFP in manufacturing at nearly - 5 percent per year for the period 1957—1978. Sanchez' estimates are based on *Survey of Manufactures* data but do not take account of the change in size of establishment underlying the census estimates after 1974. The enlargement of the *Survey* sample by inclusion of small firms (less than 10 workers) after 1974 overstates the rate of employment growth resulting in a downward bias in the productivity series and makes it difficult to interpret her results for extended time periods or to compare them with the findings of other investigators.

The purpose of the present study is threefold. First, we want to measure the rate of output growth, both for manufacturing as a whole as well as for two dozen individual industries for the period 1958 — 1980. Second, we wish to determine the role played by the increased use of traditional inputs, on the one hand, and technological change, on the other, in the growth performance of manufacturing industries. Finally, we wish to determine what policies are most appropriate for improving the contribution of productivity change in industrial growth.

The study employs a body of census data specially processed here, showing annual output and input data for individual manufacturing industries at the 3-digit ISIC level. We believe that our approach, focusing

as it does on a cross-section of industries constructed on a consistent basis over a 25-year period, makes possible an in-depth analysis of causal factors behind productivity change along with the process of diffusion of productivity gains. We also quantify intra- as opposed to inter-industry productivity change for subperiods. The industry disaggregation is very helpful in relating macro variables (e.g., capital utilization) with micro studies of industry performance. Finally, the estimates of industry performance are used to assess the impact of fiscal, monetary, and industrialization policies on the efficiency of manufacturing industries. The implications of the overall performance on the pace of Philippine development will also be analyzed.

## I. THE MODEL

To measure productivity, we utilize a model developed by Gallop and Jorgensen (1980) for measuring sectoral productivity change. The model posits an aggregate production function characterized by constant returns:

$$Q = F\ (L,K,X,t)$$

where Q represents production and L, K and X, inputs, while t denotes time. Moreover, the sector consists of n industries so that we have.

$$Q = \Sigma Q_i$$

$$L = \Sigma L_i$$

$$K = \Sigma K_i$$

$$X = \Sigma X_i \qquad (i = 1, 2, \ldots n)$$

Assuming profit maximization, producer equilibrium requires equality of the value shares of each input denoted v(L), v(K), v(X) and the elasticity of output with respect to a particular input:

$$v_L = \frac{P_L\ L}{qQ} = \frac{\partial\ \ln\ Q}{\partial\ \ln\ L}$$

$$v_K = \frac{P_K\ K}{qQ} = \frac{\partial\ \ln\ Q}{\partial\ \ln\ K}$$

$$v_X = \frac{P_X\ X}{qQ} = \frac{\partial\ \ln\ Q}{\partial\ \ln\ X}$$

where q is the price of production and P(L), P(K), and P(X) are the prices of labor, capital and intermediate inputs, respectively. As the sector consists of i industries, it is also necessary for producer equilibrium that there exists equality between each of the shares of individual inputs in the value of the corresponding aggregate and the elasticity of the aggregate with respect to the individual inputs:

$$v^i_L = \frac{P^i_L L^i}{P_L L} = \frac{\partial \ln L}{\partial \ln L^i}$$

$$v^i_K = \frac{p^i_K K^i}{P_K K} = \frac{\partial \ln K}{\partial \ln K^i}$$

$$v^i_X = \frac{p^i_X X^i}{P_X X} = \frac{\partial \ln X}{\partial \ln X^i} \qquad (i = 1, 2, \ldots, n)$$

Differentiation of the aggregate production function above with respect to time yields

$$\frac{d \ln Q}{dt} = \frac{\partial \ln Q}{\partial \ln K} \frac{d \ln L}{dt} + \frac{\partial \ln Q}{\partial \ln K} \frac{d \ln K}{dt} + \frac{\partial \ln Q}{\ln X} \frac{d \ln X}{dt} + \frac{\partial \ln Q}{t}$$

$$= v_L \frac{d \ln L}{dt} + v_K \frac{d \ln K}{dt} + v_X \frac{d \ln X}{dt} + v_t$$

where v(t), the residual, is the rate of change of total factor productivity.

In the above expression, the rate of growth of sectoral output is expressed in terms of sectoral aggregates of the various inputs. However, under the assumption of constant returns to scale, sectoral (i.e., aggregate) inputs can each be expressed as a weighted average of rates of growth of their components, with weights given by the corresponding value shares:

$$\frac{d \ln L}{dt} = \Sigma v^i_L \frac{d \ln L_i}{dt}$$

$$\frac{d \ln K}{dt} = \Sigma v^i_K \frac{d \ln K_i}{dt}$$

$$\frac{d \ln X}{dt} = \Sigma v^i_X \frac{d \ln X_i}{dt}$$

Gallop and Jorgensen have extended this methodology to incorporate data at discrete points of time. They suggest measuring technical change at any two points in time as the difference between successive logarithms of production less a weighted average of the difference between successive logarithms of sectoral labor, capital and intermediate inputs with weights derived as average value shares.

$$\ln Q_t - \ln Q_{t-1} = \bar{v}_i \left[\ln L_t - \ln L_{t-1}\right] + \bar{v}_K \left[\ln K_t - \ln K_{t-1}\right] + \bar{v}_X \left[\ln X_t - \ln X_{t-1}\right] + \bar{v}_t$$

where

$$\bar{v}_L = 1/2\left[v_{L_t} + v_{L_{t-1}}\right]$$

$$\bar{v}_K = 1/2\left[v_{K_t} + v_{K_{t-1}}\right]$$

$$\bar{v}_X = 1/2\left[v_{X_t} + v_{X_{t-1}}\right]$$

$$\bar{v}_t = 1/2\left[v_t + v_{t-1}\right]$$

This is the translog index of sectoral technical change.

The above index of technical change can also be obtained by the use of data at the individual industry level. In this case, we derive the difference between successive logarithms of sector inputs as the weighted average of differences between successive logarithms of industry inputs with weights given by average value shares. For example, labor input is:

$$\ln L_t - \ln L_{t-1} = \bar{v}^i_L \left[\ln 1^i_t - L^i_{t-1}\right]$$

and the other inputs are handled in a similar way.

## II. THE DATA BASE

For the basic data on output, labor, capital and intermediate inputs, we utilize the *Annual Surveys of Manufactures* along with the periodic *Census of Manufactures* from 1956 to 1980. These data provide a consistent set of measurements in the sense that totals for different variables are

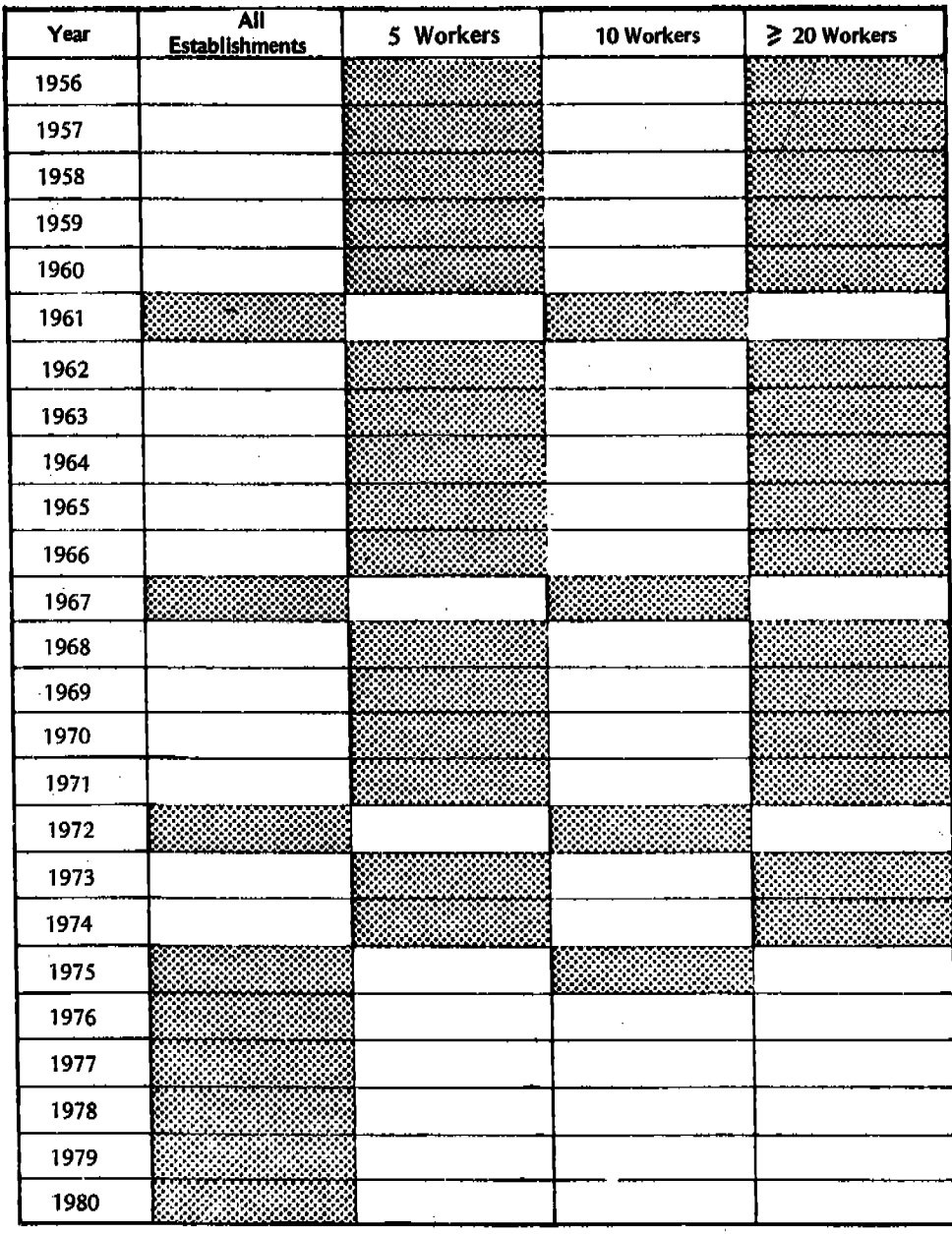
constrained to cover the same establishments. Moreover, the establishment data are presented at the 3-digit industry level, coded on the basis of the international standard industrial classification system. This yields a consistent set of annual data by industry for a continuous period of 25 years – long enough to provide us with a basis for making reliable inferences for the whole sector as well as individual industries.

There are, however, important adjustments to be made before these data can be utilized for productivity analysis. One of the most important relates to treatment of changes in the size of firms covered by the *Survey.* Up to 1975, the *Annual Surveys* covered establishments with 5 or more workers, with a separate tabulation for establishments with 20 or more workers. But during the census years (1961, 1967, 1972 and 1975), coverage was limited to establishments with 10 or more workers, with a separate tabulation (for a few variables) for all establishments regardless of size. Beginning in 1975, a further change took place: *Annual Survey* data coverage was extended to all establishments regardless of size and no separate tabulation was published for firms with five or more workers. The changing coverage of the manufacturing censuses and *Annual Surveys* is shown for each year in Chart 1.

These shifts in coverage create a nasty econometric problem. On the one hand, it is possible to develop a consistent time series from 1956 to 1974, using *Annual Surveys* and applying appropriate interpolation procedures for the census years of 1961, 1967, and 1972. On the other hand, there is no way to interpolate for firms with 5 or more or over 20 workers after 1974 because there is no benchmark to use. The shift in coverage from larger to smaller establishments (included in the all establishment total) after 1975 destroys the consistency in coverage between output and inputs which is so essential for our investigation due to the fact that the input/output structure of small firms differs substantially from that of large firms.

We decided to construct our time series of relevant variables for establishments with 20 or more workers. There are two reasons which persuaded us to restrict coverage to the larger establishments. The first is the conviction that as we descend to smaller establishments (certainly for establishments with less than 5 workers), we are faced with household production functions rather than with firm production functions. For very small firms, it is reasonable to view the production decision as an integral part of the household decision on the (household) allocation of time (Becker, 1965). In contrast, our model postulates the existence of an explicit production function and maximization behaviour within that context – an assumption which is reasonable for larger firms where production decisions are distinct from household decisions. A second reason is essentially statistical: we feel that by excluding the very small establishments, we obtain a higher quality data base because larger establishments are far more likely to keep

Chart 1
Census and Surveys of Manufacturers,
Coverage of Establishments



books along conventional accounting lines, yielding both better quality data and more detail on a greater variety of variables. Both these inferences are borne out by the *Survey:* data are available on a wider variety of variables for establishments with 20 or more workers and, where error measures have been calculated by the National Census and Statistics Office (NCSO), they are smaller for the larger establishments. [1/]

Our problem is to adjust the *Survey* data for all establishments by eliminating establishments with one to nineteen workers. Our task is complicated by the fact that the share of each variable accounted for by these smaller establishments follows a unique pattern, and in no case is it simply a mirror image of the proportion of the uncovered establishments.

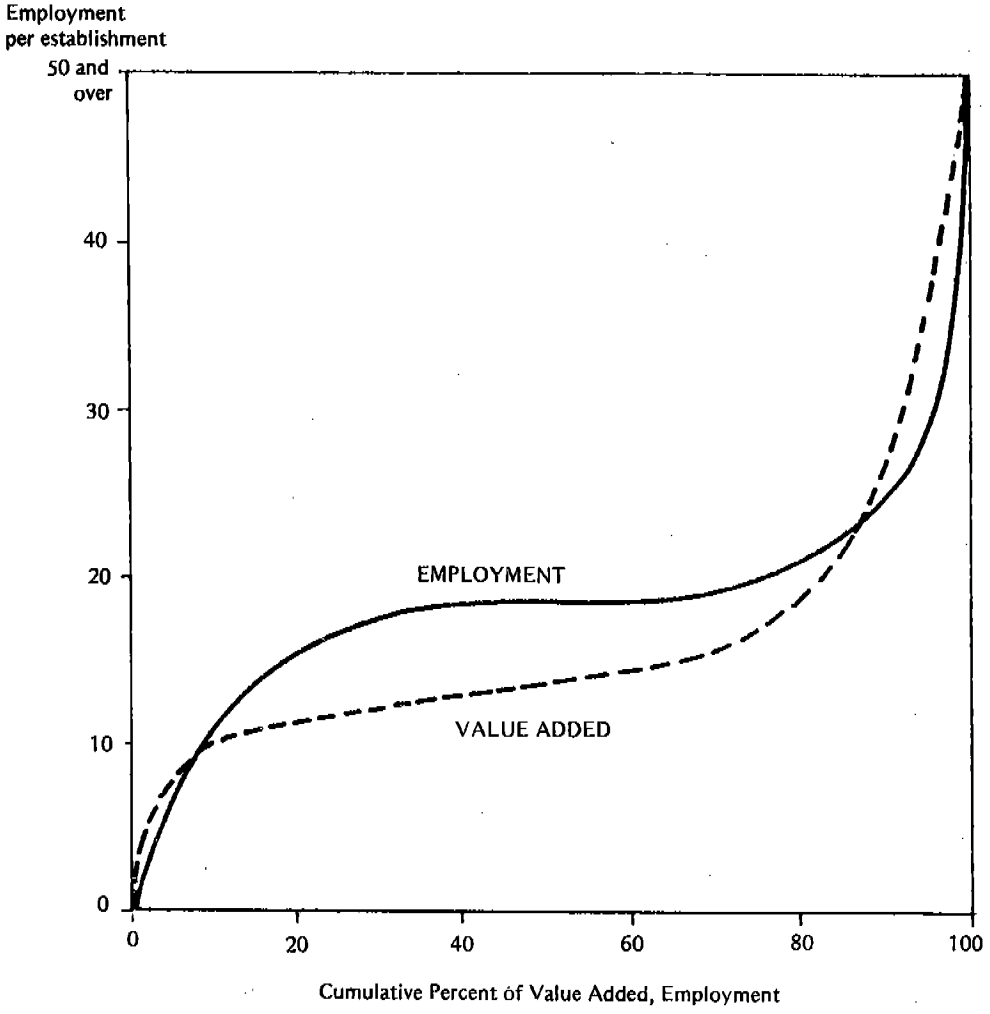
The shifting relationship between gross value-added, employment and size of firm is illustrated in Chart 2. The curves in the chart portray the cumulative fraction coverage for value—added and employment as we move from smaller to larger establishment. In general, establishments of, say, five workers or less account for a higher fraction of employment than value-added. For larger establishments, the reverse is the case. Unfortunately, these curves do not linearize when transformed into logarithms, although transformation does somewhat improve empirical fits.

Our estimating procedure involved making two separate estimates — one for the number of establishments and the other for the particular economic variable involved. First, we estimated the percent of all establishments included by restricting our attention to establishments larger than some given size. We did this by the use of an equation relating the cumulative percent of establishments covered to the average number of workers per establishment and the reciprocal of fixed assets per establishment. The second step was to convert cumulative establishment coverage to coverage of a given variable (percent of production, value-added, inventories, etc.). The nature of the model we are describing is shown in Appendix B. By focusing attention on firms with a labor force $>/20$ workers, we deal with only about 15 percent of establishments (i.e., we exclude about 85 percent) but we cover about 90 percent of production. This reflects the fact that concentration ratios are high in Philippine manufacturing. However, concentration ratios vary by item and by industry, so although the same general model is applicable to all variables, it must be estimated separately by variable and by industry group. Readers interested in additional details on this procedure should consult Appendix A where the equations are specified and illustrated by estimation of production for all manufacturing establishments with 20 or more workers for 1985. [2/]

[1/] Recent efforts of the NCSO in expanding *Survey* coverage to all establishments are, for the above reasons, unfortunate. At the very least, efforts should be made to show data on basic variables for large establishments as well as all establishments for selected years so that coverage by variable can be inferred.

[2/] Some industries have approximately the same curves, so it is possible to combine them into groups and thereby greatly reduce the task of fitting.

Chart 2
Relationship Between Size of Establishment,
Gross Value Added and Employment



The second major adjustment to the census data is for changes in prices. Most previous investigations of productivity change in Philippine industry have used the Central Bank wholesale price index as a deflator. From our standpoint, use of this index in its present form presents several problems. First, the breakdown of the index does not follow census industry categories, so that deflation of output at the industry level is impossible for most industries at the 3-digit ISIC level which makes use of the Central Bank Wholesale Price Index (CBWPI) unsuitable for our purpose. There are other reasons as well. The CBWPI includes unprocessed as well as manufactured goods (e.g., food grains, copper and other ores, etc.). Not only are some of these commodities not manufactures, but some, such as food grains, are heavily subsidized by the government further compromising the performance of the index even as a measure of the general price level of manufactured goods. Finally, the CBWPI was computed in recent years as a weighted geometric mean of prices. This tends to bias the index downward (and to correspondingly bias upward any series deflated by this index) due to the well-known tendency of the geometric average to minimize larger values.

For this study, we prepared a producers' price index by going back to the original Central Bank records and extracting the price and related specifications for all commodities produced by domestic manufacturers. Commodities were classified by industry and weighted by value-added produced in 1972. Twenty-four industries (at the 3-digit ISIC level) were then identified, and combined with 1972 value-added weights to obtain the overall index. The index is a Laspeyres with 1972 as base year. Further details on this industry index and details regarding its construction are shown in Appendix B.[3/]

The above constitute the major adjustments which we made to the published data to improve their consistency as measures of real flows over time. There is also a third adjustment. The *Survey* data exhibit a "stepwise" behaviour over time due to the adjustment of the *Survey* sampling frame after each Census. For most of the variables, this is not a major factor when considering long periods, because highs and lows (before and after each Census) average out. However, it is a problem when using the perpetual inventory approach to estimating capital stock because all errors in the annual investment estimates are cumulated in the capital stock series. We have eliminated this stepwise movement from the investment expenditure series by a process which we describe fully in Appendix D when explaining the construction of the capital stock series.

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[3/]We ran a sensitivity test by using 1975 base year weights. The results were essentially the same for the aggregate index as well as for individual industries.

## III. ESTIMATES OF OUTPUT, INPUT AND PRODUCTIVITY

### A. Output

We define output as gross production – i.e., deliveries from manufacturing establishments adjusted for inventory change. The *Census* estimate of gross output closely approximates gross production. It consists of the value of shipments adjusted for inventory change, plus contract and repair work done for others, along with receipts from resales of goods. The value of sales represents selling price f.o.b. plant, net of discounts, allowances and returns. We feel that while contract and repair work are legitimate manufacturing operations, resale of goods is not. However, we have not attempted to adjust the Census of figures of gross output for this item because if we were to adjust output, we ought to adjust inputs used in resales as well, which is not possible. Second, resales constitute only about 3 to 4 percent of the gross output of our sample of establishments with little change over time, too small to significantly affect the measures of output growth over long periods.

Our deflator consists of a producer price index constructed for this project for each 3-digit industry, and discussed in detail in Appendix B. Because of the way the price data were collected, the price index contains the effects of business taxes and subsidies. Thus, the price index contains an element of price change which implicitly measures changes in indirect taxes, including tariffs (by far the most important) to the extent they are passed on to purchasers. Because of the importance and complexity of the industry structure of indirect taxes and tariffs in this country, we think that removing the change in the business tax structure by an implicit method – i.e, by including the tax effects in the output deflator – represents the best and most feasible approach. [4/]

Estimates of average annual rates of growth of production by industry are shown in Table 1.

### B. Labor Input

Estimates of labor input series are based on the *Annual Survey of Manufacturing Establishments* totals. *Survey* data are limited to total employment, number of paid employees and the number of unpaid family workers. To be sure, there exists a separate labor force survey, the *Philippine Statistical Survey of Households (PSSH),* which contains additional data from which we can derive age/sex composition. However, the data from the *PSSH Labor Force Survey* are classified as agriculture/non-agriculture.

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[4/] We occasionally use gross value-added as a measure of output in this paper, though not for total productivity measures. For a discussion of procedures used to estimate gross value-added in constant prices, see the section on measurement of intermediate goods inputs.

# Table 1
## Annual Growth Rate of Production, by Industry, 1957–1980

| Industry | Code | 1957 | 1958 | 1959 | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Food | 311 12 | .006 | .164 | .072 | .159 | .04 | .178 | .155 | .064 | -.035 | -.071 | .221 | .061 | -.104 | .024 | .333 | -.045 | .262 | .183 | -.111 | -.186 | .112 | .088 | -.012 | .058 |
| Sugar Milling | 31181 | -.142 | .168 | .05 | .19 | -.203 | .272 | .138 | -.011 | -.124 | -.3396 | .39 | -.0237 | -.115 | .223 | .199 | .021 | .1246 | .416 | -.071 | -.649 | -.649 | -.649 | -.649 | .018 |
| Beverages | 313 | .077 | .094 | .105 | .054 | .068 | .12 | .149 | .157 | .088 | .148 | .297 | -.22 | .088 | .062 | -.099 | .173 | .191 | .167 | .755 | -.959 | .414 | -.066 | -.186 | .225 |
| Tobacco | 314 | .127 | .205 | -.065 | -.063 | .176 | -.068 | .201 | .091 | .027 | .16 | .909 | -.474 | .212 | .051 | .064 | .15 | .103 | .226 | .0115 | -.233 | .314 | .227 | .221 | .0094 |
| Textiles | 321 | .557 | .27 | .056 | .014 | .127 | .26 | .24 | -.203 | .09 | .092 | .252 | .079 | .024 | .151 | .15 | -.068 | .224 | -.077 | .14 | -.023 | .14 | .293 | .031 | 015 |
| Wearing Apparel | 322 | -.0097 | -.052 | .298 | -.371 | .051 | .01 | .053 | -.066 | -.0024 | .017 | .0795 | .032 | -.153 | -.104 | .095 | .469 | -.0074 | .092 | .246 | -.2175 | .247 | .46 | .234 | .162 |
| Leather | 323 | .3 | .12 | .198 | .435 | .211 | -.253 | .495 | -.395 | -.137 | -.0165 | .2003 | -.072 | -.026 | .047 | .0607 | -.274 | .39 | -.104 | -.097 | -.47 | .1306 | .712 | .104 | -.2975 |
| Footwear | 324 | .03 | -.044 | .342 | -.047 | .261 | -.67 | .134 | .028 | -.075 | .162 | -.066 | -.336 | -.042 | -.487 | -.203 | .853 | -.639 | -.198 | -.0033 | -.112 | .447 | .459 | .447 | |
| Wood Product | 331 | .287 | -.044 | .055 | .046 | .437 | -.014 | .038 | .086 | -.043 | .095 | .169 | .031 | -.096 | .071 | .073 | .458 | -.325 | -.361 | .079 | .029 | -.291 | .693 | .156 | .262 |
| F & F - Wood | 332 | .132 | -.127 | .179 | .055 | .182 | -.039 | .218 | .056 | -.056 | -.08 | 1.281 | -.307 | -.139 | -.665 | -.119 | .973 | -.24 | .019 | -.082 | -.413 | .396 | .405 | .156 | .655 |
| Paper Product | 341 | .24 | .128 | .303 | .312 | .092 | .098 | .214 | -.00045 | .09 | .147 | .299 | .024 | -.114 | .149 | .0175 | .162 | .0036 | -.0089 | -.363 | .531 | .12 | .379 | .156 | -.229 |
| Print'g & Publ'g | 342 | .317 | -.0145 | .024 | .137 | .175 | -.293 | .234 | -.0082 | .191 | .0012 | .046 | .125 | -.016 | .068 | .067 | .06 | .286 | .0032 | -.426 | .07 | .376 | .438 | .081 | .048 |
| Ind'l. Chemicals | 351 | .304 | .62 | .205 | -.021 | .459 | .0666 | .115 | .144 | -.03 | .397 | .703 | -.4905 | .0464 | .115 | .257 | .372 | .333 | -.114 | -.66 | .501 | .182 | .474 | .058 | -.305 |
| Other Chemicals | 352 | .126 | .197 | .145 | .111 | .179 | .0345 | .095 | .177 | .024 | .11 | .261 | .067 | -.00788 | .402 | -.0183 | -.107 | .039 | .1355 | -.203 | .0913 | .095 | -.0234 | | |
| Petroleum Prod't | 353 | | | | | | .072 | .21 | -.094 | .0149 | .0466 | .291 | .123 | .182 | .218 | .1075 | -.044 | .2315 | .0456 | .172 | -.1606 | -.1132 | .167 | .064 | -.0012 |
| Rubber | 355 | 1.235 | .334 | .141 | -.029 | .203 | -.174 | .0787 | .17 | -.063 | .181 | .049 | .134 | .0175 | .157 | -.0457 | .197 | .118 | -.043 | -.176 | -.173 | .135 | .554 | -.0757 | .2405 |
| Plastic | 356 | | .219 | -.026 | .108 | .377 | -.121 | -.077 | .0366 | .145 | .302 | .832 | -.168 | .505 | .099 | -.0712 | .5716 | .0909 | .0143 | .396 | -.021 | .465 | .206 | .116 | .122 |
| Non-Metallic Prod't | 361 | 1.261 | .164 | .1776 | .0792 | .2355 | -.035 | .0605 | .146 | .172 | .126 | .776 | -.4514 | .073 | -.196 | .425 | -.0955 | .338 | -.112 | .114 | -.064 | .024 | .343 | .086 | .09 |
| | 363 | | | | | | | | | | | | | | | | | | | | | | | -.138 | .0446 |
| | 369 | | | | | | | | | | | | | | | | | | | | | | | -.203 | .1885 |
| Glass | 362 | .25 | -.1 | .12 | .231 | .427 | -.0067 | .156 | -.076 | .048 | .072 | .24 | .1775 | .142 | .023 | .1115 | -.059 | .185 | -.204 | -.521 | -.074 | .339 | .18 | -.467 | .988 |
| Iron & Steel | 371 | | | | -.0012 | 1.038 | -.883 | .35 | .328 | .102 | .242 | .122 | -.0049 | .436 | .208 | -.2205 | .0094 | .506 | -.355 | .1256 | -.078 | .137 | .033 | -.082 | .6507 |
| N. Ferrous Metals | 372 | | | | .107 | .487 | 1.353 | -.385 | .246 | 1.594 | -.62 | 3.568 | .992 | .111 | -.263 | .0167 | .1435 | .003 | -.086 | -.964 | .933 | -.341 | .661 | .284 | -.116 |
| Fabricated Metals | 381 | .196 | .311 | .105 | .213 | .043 | -.165 | .227 | .087 | .096 | .157 | .0095 | .0556 | .03 | -.259 | .229 | .263 | .132 | -.287 | -.0163 | -.027 | .191 | .295 | -.307 | .437 |
| Machinery | 382 | .605 | .1555 | -.901 | .609 | .37 | -.231 | -.214 | -.404 | .0204 | -.015 | .919 | -.464 | .092 | .282 | .0543 | 1.091 | -.0244 | .413 | -.498 | .081 | .08 | .547 | .092 | -.143 |
| Elect'l Machinery | 383 | .407 | .295 | .933 | .102 | -.08 | .556 | .1914 | .079 | -.093 | .066 | .0393 | .0347 | .1014 | .098 | .087 | .0104 | .024 | .0813 | -.019 | -.056 | .453 | .265 | .0417 | -.24 |
| Trans Equip't | 384 | -.0027 | -.024 | .0797 | -.035 | .1504 | .335 | .286 | .091 | -.203 | .038 | .3606 | -.095 | -.17 | -.095 | .077 | .131 | .059 | .279 | -.15 | .097 | .268 | .135 | -.017 | -.125 |
| All Manufacturing | | .15 | .145 | .108 | .0985 | .178 | .069 | .171 | .0515 | -.012 | .063 | .202 | .071 | .0195 | .114 | .154 | .0027 | .191 | .05 | -.012 | -.096 | .21 | .129 | .04 | .07 |

Source: Appendix A

Even if one makes the heroic assumption that age and sex breakdowns for manufacturing are essentially the same as non-agriculture, this would still only produce information for the manufacturing sector as an aggregate, not for individual industries.

The procedure adopted here is to utilize the establishment data to produce totals for employment at the 3-digit industry level. We convert part-time and unpaid family workers to full-time equivalent workers (FTE) by using the conversion factors developed by Tidalgo (1976). The resulting estimates of labor input are FTE measures but use the Census benchmarks as control totals. We later introduce age, sex and educational dimensions of changes in labor input when dealing with productivity measures at the aggregate (sectoral) level, and then only within the context of the assumption of the similarity between trends in the manufacturing / non-agriculture aggregates mentioned above.

Labor income is available in the form of payroll data for establishments at the industry level. This provides the basis for weighting labor input, and is described more fully later under the discussion of input weights. Data on FTEs by industry and for all manufacturing are shown in Table 2.

### C. Capital Services

An index of capital input is developed from estimates of capital stock and the rate of return on capital. The estimates of capital stock at replacement cost were developed specifically for this study, and will be described in detail due to the obvious importance of this input in the final outcome – the estimates of total productivity.

The *Annual Surveys* provide two different pieces of information from which one can construct an estimate of fixed capital: the book value (i.e., depreciated value) of the stock of fixed assets as of January 1 each year and the volume of investment expenditures undertaken during the year. Some previous investigators have based their estimates of capital input on the depreciated book value of fixed assets (Hooley, 1968; Williamson, 1971; Williamson and Sicat, 1968; Patalinghug, 1980). More recently, Power (Bautista, Power and Associates, 1979) has shown that it is possible to develop estimates of gross undepreciated capital stock from the *Annual Survey* estimates of depreciated book value by introducing additional information on the depreciable life of assets. Finally, by adjusting undepreciated capital by an appropriate price deflator, he arrived at gross capital stock at replacement cost.

There is a problem, however, in basing fixed capital stock estimates on reported book value of fixed assets after 1960. During the decades of the sixties and seventies, the domestic price level underwent rapid inflation. This price rise was the result of the rise in international prices along with a

## Table 2
## Annual Growth Rate of Labor Input, by Industry, 1957–1980

| Industry | Code | 1957 | 1958 | 1959 | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Food | 311–12 | .05 | -.0049 | .032 | .051 | .04 | .015 | .032 | .057 | .0605 | -.053 | .129 | .0595 | .0016 | .014 | .089 | .182 | .102 | -.0675 | .036 | -.015 | .07 | .101 | .092 | .172 |
| Sugar | 31181 | .023 | -.028 | -.012 | .062 | -.039 | .044 | .093 | .048 | .12 | -.1105 | -.038 | -.0196 | .112 | .113 | .119 | .0905 | .044 | -.015 | .0575 | .04 | .04 | .04 | .04 | -.101 |
| Beverage | 313 | .1 | .012 | .046 | -.017 | .157 | .009 | .065 | -.009 | .036 | .024 | .081 | -.016 | .161 | .0067 | .046 | .074 | .035 | .077 | .416 | .762 | .107 | .1386 | .046 | .126 |
| Tobacco | 314 | .072 | -.072 | .098 | .089 | -.016 | -.016 | .024 | .075 | -.0073 | .077 | .162 | .072 | .072 | .113 | -.0595 | .0325 | .014 | -.009 | .08 | -.093 | .103 | -.025 | -.84 | .02 |
| Textile | 321 | .485 | .197 | .107 | .266 | .148 | .065 | .133 | .00866 | -.041 | .069 | .167 | .07 | .02 | .215 | -.2 | .403 | .1515 | .029 | -.186 | -.175 | .038 | .253 | .109 | .02 |
| Apparel | 322 | .033 | -.033 | .017 | -.213 | -.021 | -.021 | .121 | .1 | -.254 | -.093 | .063 | -.026 | -.347 | -.058 |  | .779 | .236 | .16 | .565 | .1466 | -.04 | .124 | .111 | .252 |
| Leather | 323 | .288 | .000 | .118 | .288 | .08 | .000 | .143 | .0645 | .172 | .0533 | .000 | .000 | .049 | -.405 | -.074 | .325 | -.118 | .118 | .105 | .000 | -.182 | .345 | .154 | .000 |
| Footwear | 324 | -.039 | -.062 | -.043 | -.069 | -.1 | -.027 | -.103 | -.025 | -.051 | -.054 | -.057 | -.061 | -.098 | -.232 | -.245 | .154 | .091 | .123 | .548 | -.169 | .169 | .085 | -.021 | .099 |
| Wood Product | 331 | .238 | .076 | -.142 | -.082 | .38 | .142 | -.19 | .169 | .054 | .029 | .091 | .043 | -.014 | -.0028 | .071 | .083 | .038 | -.119 | .153 | .409 | -.628 | .356 | .142 | .101 |
| F. & F. Wood | 332 | .251 |  | .042 | .000 | .154 | .069 | .262 | -.137 | .258 | -.147 | .653 | .209 | -.13 | -.758 | -.145 | .505 | .1886 | .075 | .254 | .116 | -.151 | .374 | .2715 | .024 |
| Paper Product | 341 | .143 | -.069 | .223 | .251 | .182 | .000 | .122 | .048 | -.048 | .063 | .06 | .029 | .068 | .026 | .165 | .179 | .053 | .017 | -.126 | .092 | .051 | .216 | .096 | .042 |
| Print'g & Publ'g | 342 | .112 | -.012 | .012 | .068 | .043 | .021 | .089 | .064 | -.0089 | .000 | .035 | .017 | -.0345 | .017 | -.017 | .068 | .032 | -.016 | -.0176 | .192 | .173 | .219 | .094 | -.049 |
| Indl. Chemicals | 351 | .182 | .348 | .111 | .1 | .133 | .0408 | .148 | .0339 | .033 | .23 | .026 | -.0267 | .078 | -.078 | .027 | .506 | .174 | .013 | -.013 | .236 | -.223 | .158 | .065 | .031 |
| Other Chemicals | 352 | .288 | .095 | .087 | .054 | .169 | .0645 | .061 | .121 | .0906 | .0156 | .117 | .06 | -.067 | .0138 | .215 | .069 | 0354 | .0147 | .0147 | -.0665 | .0515 | .0394 | .019 | .129 |
| Petroleum Prod't | 353 |  |  |  |  |  | .182 | .08 | -.08 | -.087 | -.0953 | .095 | .000 | .000 | .31 | .125 | -.268 | -.08 | .08 | .268 | -.3483 | .154 | .2513 | .154 | -.272 |
| Rubber | 355 | .325 | .288 | .08 | -.059 | .1155 | .053 | .129 | -.0308 | .0155 | .116 | .116 | .059 | -.0715 | .012 | .093 | 219 | .085 | .032 | -.314 | -.056 | -.217 | .3365 | .1135 | .147 |
| Plastic | 356 |  | .000 | .105 | .095 | .241 | .1335 | .0606 | .000 | -.0606 | .000 | .446 | .182 | .236 | .388 | -.1018 | .4115 | .156 | .0887 | .299 | -.244 | .381 | -.158 | -.0896 | .254 |
| Non-Metallic Prod't | 361, 363, 369 | .88 | .0706 | .128 | .0198 | .0194 | .092 | .1 | -.1 | .1466 | .114 | .115 | .047 | -.035 | .046 | .285 | .1936 | .081 | -.1025 | -.122 | -.237 | .237 | .312 | .128 | -.059 |
| Glass | 362 | 069 | -.069 | .194 | .1625 | .3 | .105 | .236 | -.054 | .08 | -.137 | .302 | .1226 | .092 | .084 | .107 | .000 | .000 | -.044 | -.905 | -.087 | .167 | .28 | .045 | .022 |
| Iron & Steel | 371 |  |  |  | .0984 | .09 | .028 | .178 | .0454 | .0435 | .0417 | .151 | .0345 | .2265 | .185 | 0652 | .2083 | .09 | .046 | -.467 | .348 | -.034 | .1303 | .066 | .152 |
| N. Ferrous Metals | 372 |  |  |  | .000 | 1.099 | .000 | .693 | -.693 | 1.099 | .000 | 2.398 | .31 | .125 | .057 | .000 | .288 | .118 | .0715 | -.969 | .969 | -.232 | .502 | .254 | 1335 |
| Fabricated Metals | 381 | .223 | .125 | .09 | .221 | .0422 | .0405 | .1054 | .049 | .097 | -.0062 | -.877 | 1.1085 | -.00494 | -.433 | .045 | .284 | -.0055 | 25 | .3395 | .0683 | -.1975 | .253 | .106 | .173 |
| Machinery | 382 | .28 | -.093 | -.823 | .636 | -.03 | .000 | -.0953 | -.034 | -.035 | .035 | .0984 | .0606 | .0572 | .13 | -.076 | .666 | .218 | .0933 | .334 | .298 | -.153 | -.117 | .135 | .0413 |
| Elect'l Machinery | 383 | .492 | .288 | .734 | .322 | .309 | .12 | .0094 | .179 | .031 | -.054 | -.0325 | -.017 | -.061 | .044 | .136 | .152 | .062 | .124 | .125 | .05 | .258 | .114 | .054 | .118 |
| Trans Equip't | 384 | .059 | .056 | .167 | -.149 | .318 | .122 | .088 | .128 | .0274 | -.0354 | -.0087 | .017 | .0255 | -.225 | -.128 | .122 | .0635 | .109 | .233 | .161 | .059 | .165 | .079 | .196 |
| All Manufacturing |  | .135 | .033 | .04 | .068 | .157 | -.008 | .082 | .063 | 0 | .027 | .009 | .113 | .073 | .004 | .058 | .132 | .122 | -.004 | .46 | .113 | .109 | .067 | .063 | .123 |

depreciation of the Philippine peso of approximately 1,000 percent between 1960 and 1984. By the mid-1960s, some firms had begun to show assets in their balance sheet at replacement rather than at original cost. At this time, the country's premier accounting firm, Sycip, Gorres and Velayo, was strongly recommending asset revaluation to its customers. In 1971, the Philippine Institute of Certified Public Accountants issued a special bulletin recommending that, in view of the substantial inflation in prices of capital assets, all public accounting reports show fixed assets at replacement value rather than at original cost. [5/] Since that time, the overwhelming majority of industrial firms have adopted the convention of revaluing their fixed assets periodically. Unfortunately, the procedures for revaluation are not standardized across firms. Reappraisal by a consulting engineering or accounting firm appears to be the most common method; not the use of a price index. Moreover, the date of reappraisals is generally not shown, so it is unclear whether a firm's assets are being expressed in terms of replacement cost of year t, or year t-1, or t-2, etc. Since the data collected from firms by the Census personnel are obtained from the interviewees' balance sheets, the published *Survey* data also contain these adjustments. Therefore, the industry aggregates of the book value of fixed assets published in the annual *Survey* already include an adjustment for asset price changes. However, the date and the nature of the adjustment procedure are both unknown.

In view of these difficulties, we decided to use data on investment outlays as contained in the annual *Survey/Census* for constructing our estimates of capital stock. Because of the stepwise behaviour of the combined *Survey/Census of Manufactures* data due to the under-reporting of investment of new firms in the *Survey* estimates, these had to be adjusted for intercensal trend in the manner described in detail in Appendix D. Once this is done, it is possible to obtain estimates of gross capital stock by aggregating investment expenditures over time.

The estimate for gross fixed assets at replacement cost in year t is,

$$K_{g_t} = \sum_{i=1}^{n} (I/P)_{t-i}$$

where (I/P)t-1, (I/P)t-2, are investment expenditures in the years t-1, t-2, etc. deflated by a price index of investment goods for each year t-1, t-2, etc. The estimates of I are the adjusted investment expenditure data from the *Survey*. That is, they are adjusted for stepwise behaviour and deflated with an investment goods price index. Fortunateiy, we found access to

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[5/] Philippine Institute of Certified Public Accountants, *Generally Accepted Accounting Procedures*, Manila, 1978, Chapter 19.

data on *actual* depreciable life of assets, so that we did not have to assume a value of n, but had an observed value of depreciable life for each 3-digit industry in 1975. [6/]

If we know the depreciable life of assets to be n years, and the average actual life of assets in use, A, it is possible to derive the net stock from the gross stock of assets (Bautista, Power *et al.*, 1979):

$$K_{d_t} = K_{g_t} \left| \frac{n}{(n-A)} \right.$$

In this way, we derived our net stock of capital at replacement cost for each industry at the 3-digit level. This procedure involves the "sudden death" assumption of capital assets, but this primarily affects the smoothness with which the capital stock series changes rather than the average level of the stock over time.

Application of the perpetual inventory method of estimating capital stock to Philippine data is complicated by the effects of World War II. Manila, the center of most of the country's manufacturing industry before the war, was completely devastated during the War. The first post-war data on capital stock is contained in the 1949 *Census of Manufactures,* or three years *after* reconstruction was underway. It is unreasonable to extrapolate backwards using the 1949 benchmark through the war years to obtain estimates of annual investment expenditures during the war period. Such a procedure would ignore the wholesale destruction of the capital stock that took place during those years. In view of these considerations, we adopted an end-year 1955 book value of fixed assets as a benchmark and adjusted that figure for the difference in capital asset prices between the period 1950-1956 and 1972, our base year for replacement cost. This assumes that the capital stock existing in 1956 was constructed at prices of 1950-1956 which, given the circumstances of extensive war destruction, appears reasonable. This formed the benchmark from which the fixed capital stock was estimated on the basis of investment expenditures for subsequent years.

A separate estimate of inventory was developed by averaging beginning and ending inventories of each year for each industry as given in the various issues of the *Survey of Manufactures.* Annual estimates of capital input, for fixed assets and inventories, in 1972 prices, are given in Appendix D along with a detailed description of methods used.

The model we are using to measure capital input requires the estimation of the flow of capital services. Our estimate of capital service flows is derived as the product of net capital stock expressed at replacement cost and the rate of return. The rate of return is estimated as the rate excluding de-

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[6/] A special survey of depreciable life of assets, by industry, was undertaken by the NCSO in 1975.

preciation and after income taxes. Data for the latter were obtained from the year-end annual issues of *Business Day,* which lists the income of the 1,000 largest companies. We excluded non-manufacturing firms and reclassified the remainder according to industry. The results provided us with an estimate of net returns for all manufacturing and each individual industry. We feel that the results yield essentially accurate estimates of the net return by industry, since there is a substantial degree of overlap between our population of Census establishments and the manufacturing firms included in the *Business Day* survey. The latter survey focuses on the largest firms and these, we have shown previously, hold a disproportionately large share of the capital stock. [7/]

Table 3 presents estimates of capital service growth rates by industry for the period 1956 - 1980.

### D. Intermediate Inputs

The *Survey of Manufactures* defines total cost of all materials as supplies and fuels used in production, including the cost of goods for resale, as well as the cost of services supplied by others, including electricity. The relationship between production (Q), value added (VA) and intermediate inputs (M) can be written as $VA(t) = Q(t) - M(t)$. In countries where price data are plentiful, different price indices are used to deflate Q and M. In the Philippines as in most LDCs, due to the lack of appropriate price series to deflate intermediate inputs, production and value-added are both deflated by the same price series on final output. Then the constant price series for intermediate goods is determined as a residual, i.e.

$$M^*_t = Q_t/P_t - VA_t/P_t$$

where the asterisk denotes constant prices and P is a price index of final output.

The above procedure is acceptable to the extent that prices of final goods move with prices of intermediate outputs. In an open economy

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[7/] We estimate that about 500 of the *Business Day*, sample of firms fall into our classification of manufacturing establishments. Thus, about 15 percent of the largest manufacturing establishments from the *Survey* would be included in the *Business Day* sample. However, by using our asset distribution function by size of establishments, we estimate that the largest 15 percent of establishments in all manufacturing control 63 percent of the fixed assets of the entire manufacturing sector. Thus, the overlap of coverage for the two samples is high for capital stock even though it is low by number of establishments.

## Table 3 A. Fixed Capital
## Annual Growth Rate of Capital Input, by Industry, 1957–1980

| INDUSTRY | CODE | 1957 | 1958 | 1959 | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FOOD | 311–12 | -.023 | .188 | .065 | .027 | .074 | .029 | .178 | .081 | .020 | .038 | .273 | -.062 | -.194 | .054 | .261 | .016 | .202 | .246 | -.043 | -.232 | -.337 | .130 | -.398 | .187 |
| SUGAR | 31181 | -.093 | .196 | .079 | .097 | -.136 | .065 | .085 | .064 | -.061 | -.154 | .354 | -.185 | -.161 | .253 | .040 | .125 | .273 | .491 | -.091 | — | — | .447 | — | -.256 |
| BEVERAGE | 313 | .016 | .171 | .093 | -.099 | .016 | .087 | .075 | .116 | .037 | .148 | .481 | -.253 | .315 | .020 | -.022 | -.321 | .245 | .106 | .915 | -1.143 | .527 | .064 | -.955 | .414 |
| TOBACCO | 314 | .133 | .031 | -.095 | .198 | .234 | -.028 | .238 | .072 | .011 | .180 | .445 | -.205 | .014 | -.203 | .120 | .007 | -.058 | .074 | -.131 | .049 | .712 | -.124 | -.010 | .036 |
| TEXTILE | 312 | .449 | .631 | .448 | .222 | .366 | .230 | .280 | .120 | .047 | .040 | .020 | -.057 | -.118 | .161 | -.048 | -.279 | .276 | .252 | -.236 | .278 | .259 | .066 | -.120 | -.330 |
| WEARING | 322 | -.011 | .049 | .318 | -.179 | .097 | .141 | .079 | -.127 | -.016 | .014 | .151 | .121 | -.302 | -.197 | .256 | .110 | -.293 | -.035 | -.134 | -.010 | .233 | .469 | -.007 | .252 |
| LEATHER | 323 | -.066 | .318 | .258 | .166 | .067 | -.190 | .359 | -.250 | -.028 | -.001 | .073 | -.050 | .200 | -.008 | -.097 | -.243 | .477 | -.193 | -.570 | -.052 | .163 | .125 | .415 | -.191 |
| FOOTWEAR | 324 | .051 | .079 | .204 | -.083 | .091 | -.259 | .201 | .059 | -.051 | .108 | -.012 | .021 | -.198 | -.233 | -.048 | .504 | -.449 | .013 | -.175 | .015 | .226 | -.236 | -.061 | .084 |
| WOOD PROD | 331 | .251 | .118 | .158 | -.160 | .553 | -.058 | .077 | .315 | .018 | -.054 | .179 | .078 | -.084 | .248 | .038 | .468 | -.076 | -.669 | -.161 | .183 | -.365 | .499 | -.678 | .933 |
| F & F WOOD | 332 | -.007 | .346 | .351 | .005 | .131 | -.160 | .202 | .197 | .044 | -.073 | .982 | -.073 | -.004 | -.321 | -.021 | .869 | -.646 | -.527 | .003 | .333 | .566 | -.005 | .332 | -.284 |
| PAPER PROD | 341 | .052 | .522 | .454 | .362 | .080 | .004 | .676 | .231 | .333 | .027 | .276 | -.371 | -.346 | .081 | .100 | -.056 | .327 | .397 | -.806 | .661 | .333 | .326 | .168 | -.188 |
| PRINT & PUBLISH | 342 | .329 | .103 | .003 | .056 | .146 | -.133 | .108 | -.005 | .166 | .109 | .141 | -.047 | .014 | .038 | .039 | -.129 | .331 | .347 | -.303 | .118 | .284 | .007 | .307 | -.125 |
| INDUS. CHEMS | 351 | .350 | .104 | .339 | -.018 | .224 | .002 | .053 | .052 | .005 | .335 | .639 | -.225 | .014 | .093 | .078 | -.075 | .143 | .462 | -.526 | .176 | .083 | .212 | .384 | -.352 |
| OTHER CHEMS | 352 | -.149 | .362 | .104 | .083 | .092 | .005 | .084 | .110 | .068 | .093 | .158 | -.030 | -.124 | -.061 | .024 | .131 | .004 | -.047 | .019 | .047 | .068 | .003 | .196 | .136 |
| PETROLEUM | 353–4 | — | — | — | — | — | -.018 | .325 | -.022 | -.017 | -.003 | .169 | -.004 | .078 | .049 | -.583 | .169 | .060 | .017 | .033 | .177 | -.289 | -.216 | -.034 | .120 |
| RUBBER PROD | 355 | 1.300 | .574 | .162 | -.551 | .101 | -.162 | .085 | .161 | -.019 | .120 | .096 | -.087 | .124 | .199 | .202 | -.092 | .039 | -.257 | .152 | -.001 | .120 | .117 | .136 | -.084 |
| PLASTIC PROD | 356 | — | .272 | .145 | .015 | .031 | -.109 | .070 | .163 | .050 | .127 | .488 | .175 | .181 | .039 | .057 | .416 | .263 | -.246 | .426 | .259 | .079 | .208 | -.332 | .017 |
| NON–MET PROD | 361–3–4 | 1.080 | .455 | .310 | .046 | .176 | .275 | .122 | .202 | .060 | .187 | .678 | -.230 | -.116 | -.107 | .177 | .054 | .034 | .120 | -.008 | .183 | .192 | .060 | .167 | .024 |
| GLASS PROD | 362 | .310 | -.105 | .142 | .048 | .264 | .002 | .249 | .034 | .108 | .149 | .064 | .071 | .248 | .323 | -.112 | -.001 | .130 | -.190 | -.179 | .285 | .124 | -.217 | .371 | .395 |
| STEEL | 371 | — | — | — | -.038 | .434 | -.339 | .220 | .329 | .215 | .390 | .131 | -.143 | .085 | .702 | .506 | -.154 | .027 | .060 | -.351 | .052 | .310 | .069 | .025 | -.017 |
| NON FERROUS | 372 | — | — | — | -.206 | .788 | .445 | .140 | .066 | -1.142 | -.727 | 3.156 | -.012 | .494 | -.073 | .366 | .928 | -1.013 | .147 | .107 | .342 | -.193 | .277 | -.024 | .394 |
| FABR METALS | 381 | .038 | .477 | .128 | .121 | .020 | -.100 | .293 | .129 | .090 | .112 | .116 | .040 | -.118 | -.043 | -.001 | .143 | -.123 | -.083 | .066 | .190 | -.191 | -.158 | .221 | -.114 |
| MACHINERY | 382 | .520 | .036 | -.596 | .591 | .065 | -.069 | -.083 | -1.077 | .311 | .057 | 1.077 | -.218 | .150 | -.090 | .343 | .557 | .162 | .347 | -.400 | .013 | -.251 | -.335 | .185 | .586 |
| ELEC MACH | 383 | .272 | .410 | .623 | .199 | -.002 | .138 | .394 | .217 | .095 | .067 | .095 | -.096 | .110 | .527 | -.383 | -.232 | -.177 | -.086 | .035 | .403 | .043 | .296 | .359 | .114 |
| TRANSPORT EQ | 384 | .387 | -.408 | .057 | -.136 | -.016 | .055 | .062 | .097 | -.076 | .169 | .506 | -.127 | -.144 | -.366 | .458 | .077 | .270 | .754 | .301 | -.386 | -2.419 | -.908 | — | — |
| ALL MFG. | | .122 | .206 | .150 | .014 | .056 | .097 | .232 | .076 | .022 | .092 | .230 | .031 | .014 | .063 | .106 | .046 | .039 | .056 | .087 | .103 | -.057 | .011 | .224 | .040 |

## Table 3 B. Inventory
## Annual Growth Rate of Capital Input, by Industry, 1957–1980

| INDUSTRY | CODE | 1957 | 1958 | 1959 | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FOOD | 311–12 | .011 | .296 | .162 | .062 | -.138 | .183 | .104 | .035 | -.116 | -.211 | .242 | -.011 | -.252 | -.032 | .333 | .015 | .331 | .261 | -.176 | -.593 | -.215 | .202 | -.482 | .480 |
| SUGAR | 31131 | -.299 | .337 | .992 | .006 | -.400 | .250 | .167 | -.095 | -.217 | -.700 | -.480 | -.116 | -.392 | .087 | -.197 | -.081 | .120 | .757 | -.089 | — | — | .099 | — | -.218 |
| BEVERAGE | 313 | .190 | .172 | .264 | .073 | .096 | -.192 | .300 | .270 | .134 | .018 | -.030 | -.194 | .162 | .212 | .010 | -.139 | -.084 | .609 | .128 | -.861 | .485 | .005 | -1.187 | .477 |
| TOBACCO | 314 | .123 | .198 | .004 | .000 | .134 | -.197 | .240 | .090 | -.051 | .141 | .250 | .356 | .170 | .188 | -.216 | .458 | -.029 | -.114 | -.266 | -.056 | .628 | -.126 | .097 | -.112 |
| TEXTILE | 321 | .646 | .055 | .398 | .131 | .230 | .460 | .133 | .046 | .011 | .044 | .024 | .220 | .051 | .107 | .115 | .042 | .349 | -.682 | .138 | .363 | .260 | .156 | -.285 | -.330 |
| WEARING | 322 | .081 | .084 | .230 | -.394 | -.130 | -.497 | .109 | .070 | .034 | .063 | .228 | .225 | -.411 | -.221 | .323 | .110 | .139 | -.147 | -.052 | -.326 | .199 | .882 | .117 | .321 |
| LEATHER | 323 | .563 | -.357 | .332 | .476 | .259 | -.248 | .313 | -.225 | -.175 | .017 | .181 | .058 | .044 | -.302 | -.035 | -.586 | .550 | -.361 | -.517 | -.394 | .163 | .819 | .494 | -.569 |
| FOOTWEAR | 324 | .012 | .021 | .127 | -.133 | .010 | -.603 | .012 | .070 | -.125 | .059 | -.036 | .087 | -.374 | -.729 | -.294 | .430 | -.401 | -.395 | -.120 | -.221 | .451 | .790 | .106 | .332 |
| WOOD PROD | 331 | .504 | -.072 | .801 | -.172 | .300 | .021 | -.015 | .050 | -.077 | .032 | .203 | .339 | -.012 | .133 | .241 | .663 | -.545 | -.556 | -.396 | .050 | -.753 | 1.516 | -.705 | .889 |
| F & F WOOD | 332 | .164 | -.311 | .265 | -.061 | .072 | -.050 | .137 | .109 | .139 | -.046 | .990 | -.415 | -.181 | -.400 | -.062 | 1.299 | -.398 | -.517 | .122 | -.171 | .639 | .221 | .298 | -.368 |
| PAPER PROD | 341 | .380 | .096 | .455 | .406 | .144 | -.139 | .681 | .211 | .254 | -.036 | .291 | -.216 | -.291 | .135 | -.054 | -.043 | -.019 | .673 | -.136 | .649 | .447 | .590 | .134 | -.557 |
| PRINT & PUBLISH | 342 | .251 | .103 | .165 | .067 | .103 | -.099 | .102 | .108 | .055 | -.005 | .048 | -.131 | .027 | -.020 | .012 | -.158 | .479 | .082 | -.955 | .195 | .327 | .410 | .302 | -.629 |
| INDUS CHEMS | 352 | .652 | .860 | .477 | -.136 | .207 | .130 | .178 | .179 | .036 | -.031 | .627 | -.237 | .218 | .042 | .191 | .186 | .525 | .185 | -.382 | -.028 | -.045 | .466 | .327 | -.690 |
| OTHER CHEMS | 352 | .623 | .169 | .270 | -.010 | .182 | -.144 | .145 | .204 | -.078 | .137 | .352 | .013 | -.176 | .387 | -.054 | -.190 | .032 | .185 | -.276 | .017 | .076 | -.087 | .036 | -.194 |
| PETROLEUM | 353–4 | — | — | — | — | — | .049 | .184 | -.213 | -.030 | .062 | .353 | .357 | -.138 | .064 | -.598 | .116 | .250 | .259 | .056 | .110 | -.090 | .085 | -.137 | .222 |
| RUBBER PROD | 355 | 1.049 | .511 | .208 | -.177 | .283 | -.341 | .083 | .124 | -.136 | .155 | .126 | -.131 | .047 | .376 | .221 | -.141 | -.045 | .001 | -.379 | -.134 | .137 | .686 | -.186 | .070 |
| PLASTIC PROD | 356 | | .218 | -.081 | .117 | .451 | .223 | -.022 | .026 | -.022 | .179 | .268 | .486 | .318 | .054 | -.116 | .247 | .535 | -.197 | .117 | -.042 | .141 | .199 | -.542 | .112 |
| NON-MET PROD | 361–3–4 | 1.511 | .320 | .077 | .131 | .405 | -.280 | -.063 | .046 | .123 | .060 | .535 | -.705 | .036 | -.043 | .361 | -.203 | .524 | -.094 | -.329 | -.036 | .172 | .055 | .274 | .078 |
| PLASTIC PROD | 362 | -.142 | .484 | .083 | .233 | .570 | -.059 | .139 | -.223 | .023 | .052 | .619 | .228 | .025 | .027 | -.103 | .042 | .056 | .073 | -.522 | -.057 | .313 | -.245 | -.121 | 1.110 |
| STEEL | 371 | — | — | — | -.061 | .577 | -.556 | .187 | .449 | -.162 | .088 | .369 | .162 | -.594 | 1.127 | -.109 | -.362 | .628 | .271 | .850 | .419 | .400 | .146 | .082 | .304 |
| NON FERROUS | 372 | — | — | — | .392 | -.391 | 2.456 | -.506 | .374 | -2.773 | -.778 | 4.349 | 1.280 | .233 | -.035 | -.234 | -2.112 | 2.331 | -.112 | -2.282 | .984 | -.587 | .852 | .009 | -.777 |
| FABR METALS | 381 | .329 | .194 | .168 | .068 | .143 | -.128 | .190 | .029 | .055 | .038 | .075 | -.007 | -.111 | -.292 | .246 | .136 | .119 | -.094 | -.206 | .181 | -.100 | .141 | .068 | .010 |
| MACHINERY | 382 | .800 | .567 | -.136 | .716 | .464 | -.228 | -.111 | -1.112 | .272 | .015 | .970 | -.466 | .358 | .910 | -.459 | 1.673 | -.300 | .319 | -.407 | -.713 | -.405 | .044 | .474 | .284 |
| ELEC MACH | 383 | .494 | .370 | 1.017 | -.050 | .019 | .459 | .098 | .039 | -.030 | .034 | .089 | -.096 | .123 | .558 | -.184 | -.269 | -.062 | -.150 | -.040 | -.034 | .208 | .423 | .300 | .734 |
| TRANSPORT EQ | 384 | -1.828 | 1.961 | .163 | -.048 | .283 | .261 | .246 | .038 | -.298 | .087 | .377 | -.064 | -.429 | -.341 | .320 | .052 | .388 | .812 | -.105 | -.816 | 2.347 | -1.078 | -- | |
| ALL MFG | | .152 | .184 | .127 | .024 | .127 | .104 | .012 | .061 | .036 | .024 | .129 | .058 | -.078 | .174 | .083 | .122 | .094 | .112 | -.170 | .026 | .099 | .023 | .106 | .053 |

Source: Appendix D

such as this, one would expect a close relationship between aggregates of these two price series. [8/] However, for industries disaggregated at the 3-digit level, the same close relationship cannot be expected. Aside from variance among prices of imported commodities, a major reason is the shifting structure of tariffs which are far more variable by industry than they are for sectoral aggregates. Now to the extent that an industry has a tariff on its final output, the effects of the tariff on enlarging value-added will be removed by deflation with the final-price deflator because the tariff effects are implicitly registered in the price series. The same is not true, however, of the effects of tariffs on intermediate inputs which a particular industry uses. These are not caught by the final price series, and to the extent these are allowed to remain, they cause value-added to be over- or understated and, correspondingly, cause intermediate inputs to be under- or overstated.

In order to adjust for the changes in tariffs on intermediate inputs, we adjust our value-added series by use of a deflator which we denote by EPI (effective protection on intermediate inputs). [9/]

$$EPI_t = \frac{1 + EPR_j^t}{1 + T_j^t}$$

The net result of this operation is a value-added which is double deflated provided that the final goods prices and intermediate input prices of industry move together, aside from differences in protection rate changes on output and inputs. To the extent that they do not move together, we have an estimate of value-added (and therefore of intermediate inputs) which is semi-double deflated.

We developed estimates of EPI by use of the following procedure. We prepared estimates of EPI for the benchmark years of 1965, 1969, 1975 and 1980 based on the work of Medalla (1979), Power (1971), and Tan (1979), and using the input-output tables for 1965 and 1975 prepared

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[8/] A simple regression of the Central Bank wholesale price index of domestically produced goods on the wholesale price index of imported goods yields the fitted function DOM = 8.7 + .97 IMPORT with an r = .98 for the 26-year period 1949-1975. The value of the coefficient for the slope, together with the intercept significantly greater than zero, suggests that while domestic prices do move closely with prices of imports, other factors also have a significant impact on the general level of domestic manufacturers prices.

[9/] Erlinda Medalla developed this deflator. Details on its derivation and additional discussion of its significance can be found in Appendix E.

by the NCSO. We then linked these by interpolation, and extended them back to 1956 on information which we obtained directly from the economic research staff of the Central Bank as well as from Baldwin (1975).

The resulting estimates of intermediate input growth are shown in Table 4.

### E. Total Factor Productivity

We have described the construction of input and production estimates for manufacturing over the period 1956-1980, the sources of data, methods of deflation and other necessary adjustments to the data base. The net result is the generation of annual production and input year from 1956 to 1980, and for all manufacturing as an aggregate.

To construct an index of total factor productivity for each industry, we express sectoral output Z(t) as a translog function of labor input N(t), capital input K(t) and intermediate input M(t) for each industry:

$$TFP^i = \left[\ln Z_t^i - \ln Z_{t-1}^i\right] - \bar{v}_N^i \left[\ln N_t^i - \ln N_{t-1}^i\right]$$
$$- v_K^i \left[\ln K_t^i - \ln K_{t-1}^i\right] - \bar{v}_M \left[\ln M_t^i - \ln M_{t-1}^i\right]$$

where share weights v(N), v(K), v(M) are computed from data on the value of production, the value of labor input, the value of capital input and the value of intermediate inputs of the i(th) industry. The resulting indices of TFP are shown in Table 5 annually for each 3-digit industry.

## IV. OVERVIEW OF THE RECORD

This section provides a summary of the performance of Philippine manufacturing between 1956 and 1980. This consists of an overview of trends in growth of output and inputs, total and partial productivity measures for the sector as a whole followed by an analysis of the performance of individual industries.

The major trends in industrial productivity from 1956 to the present are summarized in Table 6. Over the entire period, TFP decreased by -.15 percent annually. This average conceals important differences during subperiods. Between 1956 and 1970, TFP increased at an annual rate of +.56 percent while from 1971 to 1980, the rate fell to -1.23 percent. Since 1975, TFP has been declining at an alarming two percent or more per year. The strongest performance was registered during the years 1966-1970; the weakest during the years after 1975. For the manufacturing sector as a

## Table 4
## Annual Growth Rate of Intermediate Input, by Industry, 1957–1980

| Industry | Code | 1957 | 1958 | 1959 | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Food | 311–12 | -.045 | .235 | .0795 | .18 | .019 | .051 | .204 | .0405 | -.203 | -.013 | .253 | .072 | -.066 | .216 | .357 | -.097 | .383 | .242 | -.163 | -.471 | .171 | .111 | .0093 | .063 |
| Sugar Milling | 31181 | -.204 | .14 | .0356 | .131 | -.318 | .544 | .043 | .0026 | .031 | -.451 | .352 | -.144 | .013 | .212 | .112 | -.085 | .0704 | .198 | .129 | -.17 | -.17 | -.17 | -.17 | -.0037 |
| Beverages | 313 | .216 | .187 | .1705 | .134 | .175 | .175 | .166 | .175 | .099 | .1605 | .283 | -.194 | .08 | .031 | .06 | -.174 | .076 | .023 | .29 | -.587 | .582 | -.072 | -.192 | .287 |
| Tobacco | 314 | .143 | .218 | -.056 | .059 | .102 | -.066 | .0204 | .093 | .026 | .161 | .906 | -.472 | .211 | .051 | .063 | .152 | 104 | .223 | .0095 | -.228 | .315 | -.223 | .215 | -.011 |
| Textiles | 321 | .569 | .266 | .085 | 019 | .08 | .328 | .237 | -.062 | -.281 | .144 | .265 | .022 | .056 | .149 | .165 | -.151 | .28 | -.054 | .225 | .217 | .259 | .108 | -.036 | .094 |
| Wearing Apparel | 322 | -.058 | -.043 | .1845 | .279 | .038 | -.0018 | -.035 | -.183 | -.019 | -.0345 | .224 | .086 | -.044 | -.125 | .029 | -.453 | .521 | .112 | -.5227 | .09 | .39 | .281 | .143 | .303 |
| Leather | 323 | .359 | -.052 | .297 | .392 | .194 | -.196 | .608 | -.469 | -.1385 | -.0124 | .238 | -.111 | -.029 | .057 | .0516 | -.627 | .705 | -.113 | -.122 | -.405 | .2 | .633 | .084 | -.324 |
| Footwear | 324 | .015 | -.104 | .113 | .024 | .2125 | -.612 | .0886 | -.0245 | -.174 | .183 | .039 | -.344 | .04 | -.556 | -.203 | .868 | -.595 | .26 | .111 | -.196 | .494 | .397 | .149 | .086 |
| Wood Product | 331 | -.085 | .086 | .034 | .126 | .487 | -.089 | .079 | .098 | -.058 | .065 | .164 | .031 | -.071 | .129 | .067 | .26 | -.147 | -.291 | -.07 | .292 | -.288 | .653 | -.105 | .441 |
| F & F – Wood | 332 | .162 | .198 | .131 | .12 | .234 | -.115 | .183 | .042 | -.005 | -.309 | 1.863 | -.659 | -.102 | -.712 | -.106 | .9018 | -.089 | .0273 | .073 | -.5003 | .6003 | .318 | .114 | -.274 |
| Paper Product | 341 | .238 | .077 | .34 | .377 | .174 | .103 | .192 | .072 | .037 | .161 | .313 | -.038 | -.124 | .229 | .0345 | .102 | .124 | -.045 | -.473 | .609 | .242 | .797 | .055 | .0037 |
| Print'g & Publ'g | 342 | .150 | -.020 | .131 | .14 | .224 | -.216 | .1 | .184 | .03 | .0225 | .251 | -.158 | .0066 | .134 | .047 | .117 | .441 | .048 | -.565 | .245 | .363 | .373 | .039 | -.219 |
| Ind'l. Chemicals | 351 | .416 | .870 | -.279 | .52 | .353 | .158 | .127 | .142 | -.013 | .495 | .811 | -.702 | .074 | .101 | .408 | .369 | .237 | .113 | -.9416 | .907 | .155 | .217 | -.0082 | -.00013 |
| Other Chemicals | 352 | .194 | .131 | .149 | .0975 | .22 | .0492 | .12 | .149 | .044 | -.162 | .41 | .116 | -.00705 | .584 | -.060 | -.143 | .0741 | .168 | -.1261 | .0302 | .215 | -.0848 | -.1075 | .1993 |
| Petroleum Prod't | 353 | | | | | | .1656 | .2464 | .0653 | .00755 | .0566 | .3047 | .0685 | .137 | .1984 | .1577 | -.1107 | .096 | .195 | -.2 | .0383 | .3003 | .197 | -.0965 | .066 |
| Rubber | 355 | 1.419 | .0028 | .1415 | .133 | .21 | -.187 | .14 | .083 | -.0277 | .162 | .033 | .134 | .0308 | .21 | .09 | .237 | .157 | .031 | -.165 | -.149 | .1585 | .543 | .0833 | .0565 |
| Plastic | 356 | | .135 | -.049 | .1804 | .432 | .057 | -.0042 | .069 | .12 | .414 | .832 | -.129 | .562 | .134 | -.0405 | .565 | .135 | .0305 | .3526 | .1002 | .464 | .153 | -.172 | .0475 |
| Non–Metallic Prod't | 361 | 1.245 | .133 | .129 | .027 | .2205 | -.137 | -.0275 | .029 | .0303 | .217 | .867 | -.527 | .1276 | -.107 | 398 | -1.07 | 1.275 | .0018 | .0315 | .162 | .204 | .12 | .28 | .197 |
| | 363 | | | | | | | | | | | | | | | | | | | | | | | | |
| | 369 | | | | | | | | | | | | | | | | | | | | | | | | |
| Glass | 362 | .205 | -.0295 | .224 | -.0076 | .686 | -.006 | .052 | -.104 | .1276 | .063 | .391 | .0457 | 216 | .016 | .048 | .072 | .0914 | .0404 | -.464 | .284 | .123 | -.012 | -.573 | 1.212 |
| Iron & Steel | 371 | | | | .021 | 1.242 | -1.0696 | .348 | .427 | .0835 | .252 | -.218 | -.075 | 523 | .169 | -.174 | -.169 | .568 | -.262 | .0646 | .0307 | .2704 | -.0204 | -.106 | .0012 |
| N. Ferrous Metals | 372 | | | | .0949 | .2506 | 1.94 | -.533 | .464 | 1.671 | -1.11 | 3.955 | .907 | 119 | -.368 | .178 | .109 | -.049 | -.097 | -1.334 | 1.57 | -.451 | .65 | .287 | -.2175 |
| Fabricated Metals | 381 | .203 | .213 | .169 | .225 | .0946 | -.146 | .24 | .103 | .0602 | .1614 | .055 | .04 | .0186 | .123 | .2015 | .2204 | .195 | -.2174 | -.173 | .168 | .211 | .2755 | -.313 | -.594 |
| Machinery | 382 | .553 | .192 | -1.123 | .3305 | .69 | -.511 | .1 | .350 | -.131 | .00176 | 1.1193 | -.690 | .0804 | .327 | .0392 | 1.195 | -.076 | .303 | -1.833 | 1.789 | .125 | .384 | .0515 | -.162 |
| Elect'l Machinery | 383 | .3386 | .233 | .928 | .16 | .038 | .532 | .188 | .125 | -.058 | .054 | .0084 | .0505 | .091 | .077 | .0975 | -.0285 | .073 | .051 | -.046 | .1503 | .5215 | .178 | .014 | -.518 |
| Trans Equip't | 384 | .091 | -.053 | .013 | .0063 | .232 | .333 | .243 | .16 | -.1083 | .033 | .328 | -.068 | -.0812 | .285 | .164 | .15 | .064 | .296 | -.413 | .375 | .331 | -.0056 | .0736 | .3243 |
| All Manufacturing | | .164 | .121 | .119 | .118 | .203 | .1265 | .174 | .0824 | .0008 | .0636 | .165 | .065 | .0075 | .162 | .194 | .0017 | .256 | .0935 | -.085 | .052 | .207 | .105 | .057 | .059 |

## Table 5
## Annual Growth Rate of Total Factor Productivity, by Industry, 1957–1980

| INDUSTRY | CODE | 1957 | 1958 | 1959 | 1960 | 1961 | 1962 | 1963 | 1964 | 1965 | 1966 | 1967 | 1968 | 1969 | 1970 | 1971 | 1972 | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FOOD | 311–12 | .025 | -.024 | -.008 | .057 | .025 | .132 | .003 | .019 | .027 | -.041 | -.016 | .048 | .013 | -.078 | -.058 | -.052 | -.004 | -.017 | -.024 | .055 | .229 | -.040 | .139 | -.252 |
| BEVERAGE | 313 | -.045 | -.037 | -.015 | .025 | -.027 | .039 | .023 | .036 | .017 | .039 | .173 | -.047 | -.028 | .013 | .068 | -.026 | .097 | .069 | .186 | -.171 | -.076 | -.065 | .067 | -.032 |
| TOBACCO | 314 | .009 | .086 | -.057 | -.070 | .046 | -.003 | .127 | .004 | .020 | .015 | .373 | -.176 | .070 | -.013 | .069 | -.017 | .042 | .115 | .090 | -.053 | .029 | .130 | .134 | -.003 |
| TEXTILE | 321 | .011 | .004 | -.075 | -.062 | -.015 | -.014 | .020 | -.170 | .075 | -.019 | -.047 | .047 | -.004 | -.008 | .074 | .038 | -.039 | -.050 | -.053 | -.160 | -.108 | .167 | .066 | -.014 |
| WEARING | 322 | .027 | -.023 | .137 | -.106 | .027 | .016 | .057 | .026 | .076 | .059 | -.075 | -.044 | -.025 | .019 | .035 | .387 | -.382 | -.016 | .254 | .329 | .032 | .223 | .111 | -.119 |
| LEATHER | 323 | .023 | -.102 | -.065 | .081 | .054 | -.103 | -.025 | -.079 | -.083 | -.022 | .024 | .003 | -.038 | .104 | .059 | .100 | -.150 | -.013 | .012 | -.156 | .026 | .150 | -.027 | -.047 |
| FOOTWEAR | 324 | .026 | .090 | .060 | -.035 | .146 | -.211 | .036 | .040 | .048 | .058 | -.074 | -.116 | -.018 | -.038 | -.008 | .191 | -.202 | -.054 | -.168 | .058 | .051 | .146 | .079 | -.044 |
| WOOD PROD | 331 | .013 | -.030 | .053 | .021 | -.032 | .008 | .023 | -.061 | -.015 | .057 | .016 | -.027 | -.039 | -.053 | -.062 | .158 | -.195 | -.020 | .203 | -.269 | .063 | .085 | .022 | .161 |
| F & F WOOD | 332 | -.043 | .001 | .021 | -.004 | -.009 | .027 | .017 | .047 | -.133 | .111 | -.350 | .021 | -.041 | -.045 | -.026 | .114 | -.101 | .043 | .026 | -.217 | -.100 | .117 | -.033 | -.020 |
| PAPER PROD | 341 | .027 | .028 | -.036 | -.041 | -.070 | .037 | -.075 | -.101 | -.012 | .032 | .019 | .124 | .026 | -.026 | -.039 | .075 | -.138 | -.118 | .182 | -.036 | .132 | .064 | -.007 | .046 |
| PRINT & PUBLISH | 342 | .163 | -.015 | -.047 | .037 | .033 | -.172 | .138 | -.134 | .160 | -.022 | -.126 | .199 | -.002 | -.006 | .047 | .001 | -.036 | -.078 | .005 | -.293 | .102 | .133 | -.031 | .092 |
| INDUS CHEMS | 351 | -.016 | .022 | .099 | -.313 | .183 | -.046 | -.004 | .035 | -.032 | -.002 | .028 | -.029 | -.027 | .047 | -.040 | .055 | .119 | -.277 | .027 | -.296 | -.063 | .249 | -.048 | .138 |
| OTHER CHEMS | 352 | -.078 | .029 | .000 | .045 | -.008 | .008 | -.012 | .031 | -.022 | .136 | -.037 | -.005 | .045 | -.021 | -.015 | .037 | -.015 | .014 | .096 | -.078 | .080 | .033 | -.034 | .063 |
| PETROLEUM | 353–4 | .. | .. | .. | .. | .. | -.033 | -.049 | -.132 | .016 | .006 | .014 | .057 | .078 | .059 | .103 | .010 | .193 | .126 | .10 | -.365 | .094 | -.034 | -.036 | .051 |
| RUBBER PROD | 355 | .017 | .078 | .011 | -.061 | .022 | -.019 | -.043 | .026 | -.037 | .036 | -.022 | .082 | -.016 | -.035 | -.167 | .055 | .004 | .016 | .045 | -.061 | .019 | .083 | -.017 | -.005 |
| PLASTIC PROD | 356 | .. | .102 | -.064 | -.015 | .051 | -.136 | -.096 | .046 | .103 | .047 | .177 | -.188 | .062 | -.073 | -.040 | .071 | -.083 | .006 | .061 | -.077 | .038 | .109 | .034 | -.055 |
| NON–MET PROD | 361–3–4 | .139 | -.074 | .018 | .041 | .058 | -.051 | .017 | .093 | .097 | -.049 | .144 | -.130 | -.015 | -.118 | .160 | .141 | .445 | -.127 | .118 | -.199 | .179 | .216 | -.071 | -.060 |
| GLASS PROD | 362 | .079 | -.088 | -.067 | .140 | -.055 | -.027 | -.004 | -.009 | -.052 | .050 | -.092 | .081 | -.026 | -.084 | .094 | .097 | .108 | -.199 | -.155 | -.336 | .203 | .190 | -.261 | -.048 |
| STEEL | 371 | .. | .. | .. | -.031 | .077 | -.199 | .068 | -.025 | .035 | -.019 | -.087 | .078 | .005 | -.072 | -.025 | -.143 | .145 | .062 | -.175 | .201 | .143 | .133 | .039 | .008 |
| NON FERROUS | 372 | .. | .. | .. | .052 | -.144 | -.357 | -.188 | -.110 | -.016 | .081 | .011 | .192 | -.048 | -.050 | -.108 | -.027 | -.224 | -.031 | -.134 | -.469 | .055 | .065 | .037 | .051 |
| FABR METALS | 381 | -.010 | .079 | -.039 | .010 | -.038 | -.061 | .011 | -.004 | .026 | .041 | .241 | -.245 | .059 | -.088 | .074 | .045 | .002 | -.064 | .022 | -.175 | .059 | .044 | -.093 | -.068 |
| MACHINERY | 382 | .128 | .036 | .019 | .059 | .025 | -.032 | -.213 | -.066 | .039 | -.037 | .092 | -.118 | -.013 | -.011 | .022 | .0190 | -.1 | .141 | -.132 | .. | .051 | .364 | -.026 | -.140 |
| ELEC MACH | 383 | .016 | .013 | .076 | -.076 | -.161 | .164 | .028 | -.058 | -.073 | .033 | .018 | .031 | .034 | -.114 | .080 | .010 | -.011 | .047 | -.014 | .204 | .007 | .074 | -.033 | .017 |
| TRANSPORT EQ | 384 | -.098 | -.053 | .009 | .014 | -.095 | .070 | .090 | -.052 | -.115 | -.003 | .091 | -.041 | -.092 | .181 | .102 | -.007 | -.032 | -.063 | -.013 | -.171 | .092 | .097 | .008 | .042 |
| ALL MFG | | 000 | .029 | .003 | .015 | .012 | -.022 | .017 | -.025 | -.018 | .004 | .046 | .012 | .003 | -.004 | .004 | -.035 | -.092 | -.026 | -.032 | -.162 | .044 | .041 | -.037 | .019 |

Source: Tables 1 through 4 and text.

Table 6
All Manufacturing
Annual Growth Rate, TFP and Selected
Partial Productivity Measures, 1956–1980
(All data in percent)

| Production per Unit of: | 1956–60 | 1961–65 | 1966–70 | 1971–75 | 1976–80 | 1981–83 | 1956–70 | 1971–80 | 1956–80 |
|---|---|---|---|---|---|---|---|---|---|
| Labor | 5.55 | 3.27 | 4.87 | 0.59 | –4.04 | –3.35* | 4.56 | –1.93 | 2.05 |
| Capital | 0.78 | 2.95 | 2.89 | 1.37 | 2.72 | .. | 2.21 | 2.04 | 2.15 |
| Intermediate goods | –0.51 | –2.58 | –0.26 | –1.50 | –1.86 | .. | –1.15 | –1.68 | –1.36 |
| TFP | 1.18 | –0.71 | 1.22 | –0.55 | –1.90 | –2.13* | 0.56 | –1.23 | –0.15 |
| Adjustments: labor hours & quality | | | | | | | | | |
| a. Hours | 0.0 | –0.81 | 0.54 | 0.92 | –1.01 | .. | –0.10 | –0.10 | –0.11 |
| b. Age/sex | 0.41 | 0.13 | 0.22 | 0.10 | 0.10 | .. | 0.36 | 0.10 | 0.21 |
| c. Education | 1.14 | 1.01 | 1.02 | 0.10 | 0.10 | .. | 1.01 | 1.00 | 1.01 |
| Total Adjustments | 1.55 | 0.32 | 1.78 | 2.03 | 0.09 | .. | 1.27 | 1.00 | 1.11 |
| TFP Ajusted (TFP less total adjustments) | –0.37 | –1.03 | –0.56 | –2.58 | –1.99 | .. | –0.71 | –2.23 | –1.26 |

Source: Growth rates for production and inputs from Tables 1 through 5. Adjustments for hours and labor quality based on data furnished by the Institute of Labor and Manpower Studies and Department of Labor, Yearbook of Labor Statistics, Various years.

Preliminary estimate. . . indicates data not available.

whole, the data paint a very clear picture — one of slow TFP growth during the late fifties and sixties, unmistakable retardation after 1970, with rates of advance after 1975 assuming significantly larger negative dimensions. When certain additional adjustments for labor quality improvements are made (which cannot be made on the disaggregated TFP totals due to data problems), the average annual rates are uniformly lower for the entire period as well as for all subperiods. [10/] How much importance should we attach to these results for industry in the aggregate?

That depends on two considerations. First, to what extent are the sector totals representative of performance of individual industries? This question can be answered readily with the help of the material presented in a later chart (Chart 4) which shows the distribution of TFP for twenty-five manufacturing industries. Half of these (13 industries) had annual rates of TFP growth less than zero. Of the remainder, only one had an annual average of over 2 percent. It is clear, therefore, that there is not enough dispersion in individual industry performance to challenge our impression of zero or negative growth reflected in the sector totals of Table 6.

There is still a question of the extent to which the productivity performance of the manufacturing sector is the result of an aggregation effect. Williamson and Sicat (1968; 1971) found that a substantial part of the retardation in productivity growth rates that they observed could be attributed to inefficient resource allocation among industries which they attributed to dysfunctional macro policies such as protective tariffs. So we now compare observed productivity growth of the manufacturing sector as shown in Table 6 with that which would have occurred if the industry structure of manufacturing had remained unchanged. The results are shown in Table 7 which decomposes sectoral productivity growth into that due to advances within industries and that accounted for by the shift in activity from one industry to another.

One conclusion to be drawn from the estimates presented in Table 7 is that inter-industry shift resulted in a net loss of productivity for the entire twenty-five year period and for both of the subperiods. In this respect, our findings agree with Williamson and Sicat (1968) who found a net loss in TFP growth (for the period 1956-1965) due to inter-industry shift. However, our evidence suggests that this net loss, while unquestionably significant, was not the whole story. Although within industry, TFP change is positive throughout, it also reflects significant retardation between subperiods. Hence, we conclude that inter-industry shift cannot by itself account for slow productivity growth in manufacturing.

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[10/] The adjustments for labor input — hours worked, age/sex composition and education levels — were made on the basis of data for non-agricultural employment. The use of the adjusted TFP estimates therefore requires the additional assumption that trends in these variables are the same for manufacturing and the rest of the non-agricultural labor force.

Table 7
Annual Growth Rate, TFP Within and Between Industry, All Manufacturing, 1956–1980
(Rates of change in percent)

| | (1) All Manufacturing | (2) Within Industry | (3) Between Industry |
|---|---|---|---|
| 1956–1980 | –.15 | .49 | –.64 |
| 1956–1970 | .56 | .77 | –.21 |
| 1971–1980 | –1.23 | .34 | –1.57 |

Source: Col. (1): Table 6.
Col. (2): Estimated using 1956 production weights.

Another inference made by Williamson and Sicat (1968;1971) concerning the dysfunctional role of macroeconomic policy, particularly import substitution, also deserves careful consideration in light of the aforementioned data. We do agree that the shift in manufacturing activity dictated by import controls and the protective tariff structure associated with import substitution brought about a significant decline in manufacturing productivity, by setting up the wrong inter-industry shifts. However, it was not just the policy of import substitution *as such* which caused the problem, but the particular industries targeted for expansion. That is to say, prior to 1956, the Philippines was already moving in the direction of a "natural" import substitution: the food processing, beverage, tobacco and apparel industries accounted for roughly fifty percent of total manufacturing production. By 1980, the share of these industries in production had fallen to only 29 percent. The gainers were industries like petroleum, paper, industrial chemicals, rubber, metal products, etc. Productivity growth in the former group has consistently led that in the latter group. Part of the reason for the absence of incentives for more rapid growth of what we call the "natural" import substitution industries lies in specific macroeconomic policies, and part is attributable to the adverse effects of certain international price trends which have had severe repercussions on some of these industries. For example, historically low sugar prices have had a devastating impact on the sugar refining industry, which produces both or export as well as for the domestic market. The net upshot of our results

is that while resource misallocation from an ill-conceived import substitution policy accounted for a significant part of the lackluster productivity performance in manufacturing, it was not the only factor and probably not the most important factor either. If these results hold generally, then a certain critical policy inference follows: the productivity gains associated with a movement towards optimal resource allocation are modest.

Turning now to an analysis of productivity change during subperiods, examination of the trends in Table 6 reveals that the year 1970 was a watershed in Philippine industrial productivity performance. During the period 1956-1970, TFP increased by an average rate of .56 percent. During the following decade (1971-1980), TFP declined by 1.23 percent per year. Substantial declines are reflected in the labor and intermediate partial productivity measures as well. Particularly notable is the very sharp decline in production per worker — from +4.56 percent in 1956-1970 to −1.73 percent in the 1971-1980 period. Growth of the other productivity measures also declined, although by smaller magnitudes.

Within the earlier period (1956-1970), there are several distinct subperiods. During 1956-1960, the establishment of new industries got underway primarily through import allocations and a substantially overvalued exchange rate which underpriced capital inputs. Output expanded rapidly and productivity gains were substantial. This was followed by a period (1961-1965) in which productivity measures in the 1961-1965 period is not difficult to explain. In 1960-1961, the peso was devalued, a move which had been widely discussed in the Philippine Congress and anticipated in business circles for at least two years previous. Businessmen reacted predictably by importing all the capital equipment and inventories that they could financially manage. From 1961 to about 1963, productivity fell as the new equipment was installed, old factories enlarged, etc. By the end of 1963, the output from much of this new investment was reaching optimum levels, and, productivity was on a correspondingly upward trend. TFP growth registered its best record in the 1966-1970 period.

During the following decade, however, all our industrial productivity measures indicate a fundamental change in trend. TFP declined by .6 and 1.9 percent annually in the next two five-year periods (when adjusted for changes in labor quality, the declines increase to 2.6 and 2.0 percent, respectively). The negative trends for 1971-1975 are all the more surprising because this period witnessed one of the truly major Philippine export booms of this century. Expansion of output is ordinarily associated with *rising,* not falling productivity, as pockets of excess capacity are eliminated and firms generally move toward optimum production levels, and increased tightness in factor markets helps improve resource allocation. That such an improvement did not take place is clear. Indeed, the data in Table 5 indicate that TFP registered negative values for *all* the years of this historic expansion — i.e., 1972 through 1975.

There are several developments in the organization of Philippine industry which are closely associated with the decline in TFP growth after 1970. One such development is the particularly dysfunctional inter-industry shifts after 1970. During the decade 1970-1980, inter-industry shift accounted for an annual decline of 1.57 percent in TFP, compared with only .21 percent annual loss in the period 1956-1970. This loss was due to macro policies which brought about the expansion of industries that were relatively poor "productivity performers." It reflects the national policy bias towards "heavy" import substitution industries (petroleum, iron and steel, transport equipment, etc.) associated with import substitution policy in this country. It also reflects the bias in policy implementation which pushed intermediate goods prices down below international levels. Another development is connected with the changing tariff structure. The tariff revision of 1973 not only raised protective rates across the board but also shifted the structure of protection *on inputs* for many manufacturing industries. As pointed out earlier, the effective protection given to manufacturing consisted of two components: a final goods component and an input component. The net effect of the latter was to reduce the prices paid by the manufacturing sector for intermediate inputs below what they otherwise would have been. Prices of inputs were reduced by five to ten percent between 1956 and 1969. The net effect of the tariff revision of 1973 was to reduce prices of intermediate inputs by another 25 percent between 1970 and 1980. This had a significant impact on the intermediate goods consumption per unit of output as can be seen from Table 6. From 1956 to 1970, production per unit of intermediate input declined at the rate of -1.15 per annum, reaching a peak of -1.86 percent during 1976-80, the highest rate of decline over the entire 25-year period.

This is not the whole story behind the decline in TFP growth after 1970, however, because production *per worker* also declined dramatically during the last decade — at the annual average rate of -1.73 percent. To understand this development, we must consider the rise of government-controlled and government-affiliated corporations since 1970. Based on data which we obtained from the Hooley-Moreno *Flow of Funds* study and the Central Bank, the relative shares of non-financial government corporations in total non-financial corporate assets for selected benchmark dates were estimated as follows:

| | |
|---|---|
| 1955 | 18.2 percent |
| 1960 | 14.9 percent |
| 1965 | 13.5 percent |
| 1980 | 27.1 percent |
| 1982 | 33.4 percent |

There was a decline in importance of government corporations in the fifties and sixties. This trend was reversed during the late sixties or early seventies. The above estimates attest to the magnitude of the expansion of the share of government non-financial corporate assets – growth of more than two and a half times between 1965 and 1980. We might add that our estimate of 33.4 percent of assets controlled by government corporations probably understates the relevant magnitude of asset control. This figure only refers to corporations in which ownership by the government or government agencies amounts to 51 percent of outstanding stock. Actually, however, many corporations are really government-affiliated through control by members of the military or close associates of powerful political/military families, and could, under alternative definitions, be classified as government-controlled. If the definition of government corporations were so extended, the share of non-financial corporate assets falling into this category would surely exceed 50 percent.

The significance of the expansion of government-controlled corporations for productivity trends lies in three characteristics. First, government corporations generally are not run primarily for profit. Many obtain their capital through the legislature which mandates that they put primary emphasis on public service. Second, their utility function is often drawn to make expansion of their employed labor force a primary goal of operations, taking precedence over profitability. Third, some government corporations are not audited by the General Auditing Office of the Philippine Government (GAO). Organizations officially designated as government corporations are audited by the GAO. But some "private" corporations in which the Philippine Government (or one of its agencies) holds over one-half of the outstanding stock may not be audited by the GAO. Overall, therefore, accountability standards are quite uneven, weakening further the traditional system of rational economic incentives.

The impact of this unusual collection of incentives and ambiguous legal and accountability environment can be seen in the productivity comparisons of government and private corporations presented in Table 8. TFP in private corporations was only 12.4 percent higher than in government corporations during the fifties. A decade later, however, it was 56.2 percent higher. So the shift of corporate assets from private to government-controlled must have had a significant downward impact on TFP performance for all corporations taken in the aggregate. Looking further at the partial productivity comparisons, production per worker was essentially the same for private and government corporations in 1950-1960. But from 1960-1970, the government sector recorded a particularly disappointing performance with production per worker falling to about one-fourth that in the private sector. On the contrary, it performed better than the private sector with regard to the use of intermediate inputs, and only somewhat more poorly in its use of capital.

Table 8
Comparison of Productivity Performance
Non-Financial Government Corporations and Privately–Owned Corporations
(All measurements in percent)

| Pvt. Corp. Productivity Measure / Govt. Corp. Productivity Measure | 1956–70 | 1971–80 |
|---|---|---|
| Production per worker | 99.1 | 406.2 |
| Production per unit of intermediate goods | 103.4 | 66.5 |
| Production per unit of capital | 414.2 | 520.0 |
| Total Factor Productivity | 112.4 | 156.2 |

Source: Data derived from Flow of Funds worksheets.

These results are precisely what would be expected given the economic environment as we have described it and the macro policy mix followed after 1970. The decline in production per worker is consistent with the experience in the Philippines as elsewhere, that government and government-affiliated corporations generally are burdened with the goal of maximizing employment rather than optimizing employment. Given this institutional framework, and considering the accelerated growth of the non-agricultural labor force since the late sixties, it was only natural for the government corporate sector to increase employment well beyond firm-optimum levels, with a correspondingly disastrous impact on labor productivity. On the other hand, since most government corporations (and many government-affiliated ones as well) were exempt from part or all of import duties anyway, the restructuring of the tariff system in 1970 did not affect their behaviour appreciably. That is why government corporate performance was superior to private corporate performance on this count. The somewhat poorer performance in output per unit of capital probably reflects the fact that many government and government-affiliated corporations received preferential treatment on borrowings from the large government financial institutions which had the effect of weakening incentives to operate the capital stock efficiently. Private corporations, on the contrary, were subject to sharply rising interest rates from 1970 on.

A third factor, but one of considerably less importance in our opinion, which may have had negative effects on productivity growth after 1970 was the oil crisis. Sharp oil price increases in 1970-1971 affected the cost structures of some industries more than others, and may have encouraged

some industry-specific shifting towards less optimum production positions. In addition, fuel shortages and associated "brownouts" throughout the early seventies undoubtedly resulted in significant declines in production per unit of input across a wide spectrum of industries. Of course, the crude oil shortages reduced productivity levels substantially in the petroleum refinery industry. However, most of this is already accounted for in our measure of capital services, which implicitly takes account of declines in capital utilization.

A fourth factor operating to deepen the industrial productivity crisis was a miscalculation of businessmen and policymakers concerning the likely duration of the recession of 1975-1978. As pointed out earlier, TFP registered a small annual decline even during the boom years of 1971-1975. No one in government or business was prepared for the shocking decline in manufacturing output of nearly 11 percent from 1975-1976. [11/] Indeed, the decline was not even widely discussed. The immediate cause was the collapse of the primary commodity boom in important Philippine manufactures such as sugar, plywood, etc. Sharp declines in non-manufactured primary exports (copper and other metals, unprocessed food products) exerted a significant downward multiplier effect on domestic income. Apparently, no one related the contraction in local industry to erosion in efficiency parameters. Most businessmen and government planners assumed that the situation was essentially temporary and would correct itself as soon as international commodity prices recovered. This interpretation of events is supported by the fact that in spite of the sharp decline in manufacturing production, the expansion of labor input and the rate of capital formation in manufacturing continued unabated through early 1977.

By late 1978, production began to recover and the investment rate immediately began to accelerate. But productivity had fallen significantly. Apparently, neither businessmen nor government officials realized the extent of the decline in real production nor, more importantly, the permanent damage done to the efficiency of the industrial system by external developments and by the decline in both labor productivity and TFP (which continued to decline). Foreign commercial banks, apparently the most uninformed of all, continued to flood the industrial sector (particularly government corporations) with ever larger loan funds, effectively expanding money supply, propping up effective demand and generally postponing the inevitable reckoning.

Finally, the information we have on research and development in industry suggests that little, if any, of the windfall gains from the boom of 1972-1974 were channeled into industrial research which would have made Philippine manufactures more competitive both domestically and internationally.

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[11/] These are our deflated production estimates based on the *Survey of Manufactures*. The decline was 1.2 percent in 1975, mostly in the fourth quarter, and 9.8 percent in 1976.

One factor behind the productivity decline during the seventies which we cannot measure but which we are convinced is of central importance is the increased centralization of economic decision-making. The evidence from numerous countries is that overcentralization leads to widespread inefficiencies and misallocation of resources. When decision-making becomes highly centralized, business reaction functions are altered in two ways. First, there is a slowing down of the tempo of reactions because economic actors must always make sure that any action will not be vitiated by decisions coming down from the top. Second, there is an inevitable politicization of economic activity since an obvious way to protect one's interests is to see to it that top decisions are made according to "appropriate" criteria. It is much more profitable to spend one's time talking to the top decision-makers than instituting measures to raise efficiency. This process affects participants in both the private and public sectors. Inevitably, the economic system ties itself in knots, as business executives and middle-level bureaucrats try to keep their options open, while the top policymakers are increasingly overwhelmed with minor problems and distracted by an unending dialogue with lobbyists.

The decline in industrial productivity has continued so long and is so pervasive among industries that it is now exerting significant negative impacts on other parts of the domestic economy. The financial system has been greatly weakened. The rate of return on manufacturing capital has declined markedly in recent years. In part, this was due to the narrowing of price-cost margins reflecting sharp declines in commodity prices (e.g., refined sugar) after 1975. But the decline in TFP of domestic industry was also a major factor in the decline of the rate of return on manufacturing capital. The Philippine financial system holds most of manufacturing sector debt. Much of this debt is now hopelessly behind in payments on principal and interest because the assets backing it are earning at very low rates, and in many cases not earning at all. Indeed, it is no coincidence that among the industrial loans giving the Development Bank of the Philippines the greatest financial trouble are those to industries which all display negative productivity (TFP) growth over the period 1956-1980: cement, textiles, and integrated paper mills. [12/]

The decline in the solvency of the domestic financial system, caused primarily by the decline in industrial productivity and the misallocation of resources, has posed a special problem for monetary policy. If the Central Bank "rescues" all of the unstable commercial banks, money supply targets are bound to be exceeded by a wide margin. So the poor productivity record eventually complicates the task of achieving price stability.

The dysfunctional effects of industrial productivity decline do not

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[12/] In Manila banking circles, the present situation is generally referred to as "liquidity crisis." It is nothing of the sort: It is *solvency* crisis.

end with the decimation of financial institutions. Because of the low rate of return on domestic industrial assets which consistently negative productivity growth has helped to produce, the flow of saving *into* the Philippine financial system is now being affected. Why should Filipino savers choose a financial system which is able to pay only a low deposit rate and is, in addition, financially unstable? The obvious answer for the nation's savers is to choose an alternative financial system. In Chart 3, we show the rate of return on manufacturing capital assets (at 1972 replacement cost) contrasted with the interest rate on U.S. Treasury Bills. The rate of return on capital invested in Philippine manufacturing actually fell below the U.S. Treasury Bill rate in 1978. Note that the relative rates of return and gross capital outflows from the Philippines do indeed move together. While we acknowledge that there may also be other reasons for the large capital outflow from the Philippines after 1975, we feel that the deterioration in productivity performance transmitted to the domestic financial system through the rate of return is a key element.

A major reason for the decline in the rate of return in the manufacturing sector has been the decline in the capital utilization rate. Our index of capital utilization (with 1972 as base year) is as follows:

| | |
|---|---|
| 1956 | 98.7 |
| 1960 | 106.0 |
| 1965 | 83.2 |
| 1970 | 91.1 |
| 1975 | 102.9 |
| 1980 | 77.7 |

During the commodity boom of 1971-1975, the capital utilization rate rose but never reached the level of 1960. This is surprising given the momentum of the worldwide boom in primary commodity prices. After the boom ended, it fell sharply between 1975 and 1980. At the present writing, it is very probably around 70 percent, and possibly below 60 percent. The decline enters into our estimate of the rate of return directly, through the estimate of the stock of capital in place. [13/] To conclude this section, we have argued that the steady decline in TFP, especially after 1970, greatly weakened the financial system partly through the portfolio effects of declining industrial asset quality, and partly by causing savers to shift funds to the rest of the world, setting up a major drain on the balance of payments.

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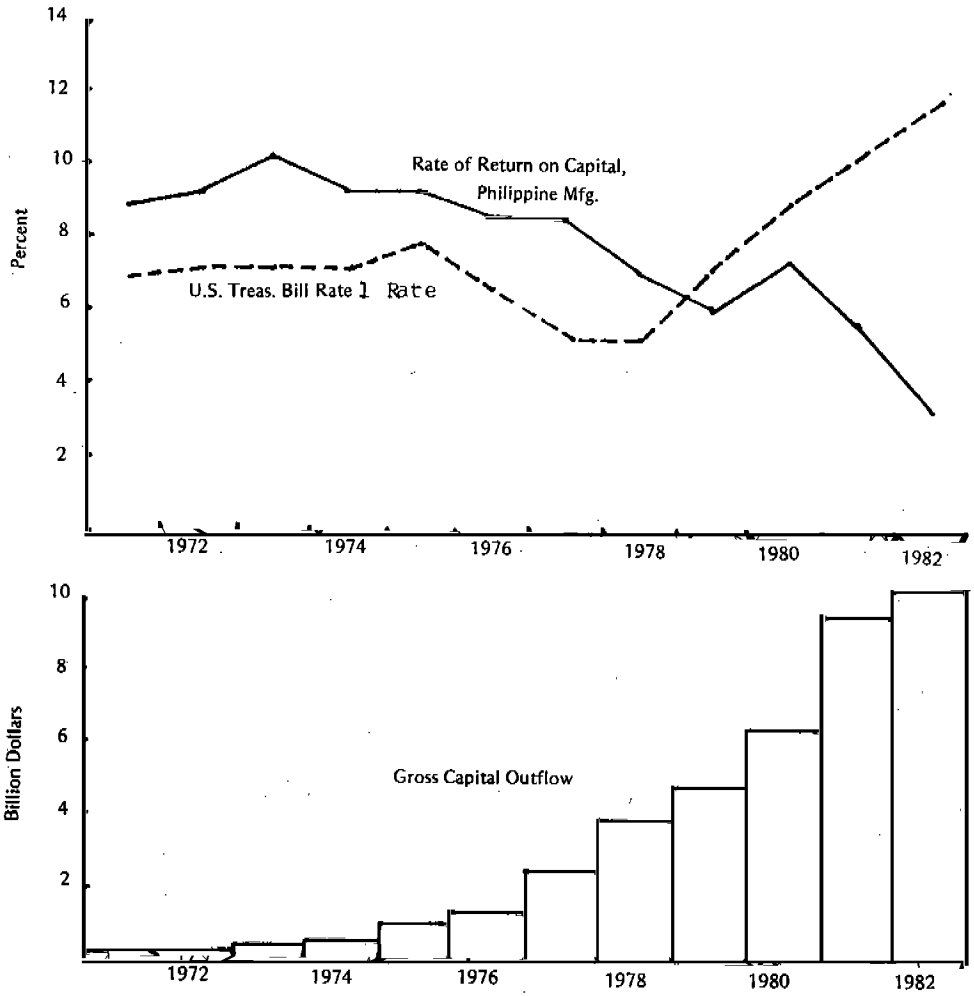
[13/] The capacity utilization index is composed of an index of capital in place – at replacement cost – divided by an index of power consumption of manufacturing establishments. For more details, see Appendix C.

Chart 3
Rate of Return on Capital Employed in Philippine Manufacturing, the U.S. Treasury Bill Rate and the Volume of Capital Outflows, 1972–1982




Source: Appendices A and D; capital flows from Philippine Statistical Yearbook, 1983 (Manila, NEDA, 1983).

*Capital includes fixed assets plus inventory. Rate of return is net income after taxes (1972 prices) dividend by capital of reproduction cost at 1972 prices.

## V. TOTAL FACTOR PRODUCTIVITY BY INDUSTRY

A summary of the record of individual industry performance at the 3-digit ISC level is shown in Chart 4. TFP growth for the period 1956-1980 varied widely among industries from less than -2 percent to over +2 percent per annum. The modal value is clearly negative, however, roughly —.5 percent. Industries falling above the mode are generally the older "natural" import substitution and export industries, such as food processing, apparel, tobacco and beverages. The laggards in productivity performance are generally the newer industries established under the "forced industrialization" policies of the post-war era, such as paper, basic metals, transportation equipment, and glass. In a real sense, therefore, the manufacturing sector has been very heavily dependent, for what increase in overall efficiency it has shown, on a small group of industries, many of which can trace their beginnings to the years before World War II. The fact that so many of the industries founded since 1955 have exhibited negative TFP growth rates is a major factor in explaining why the manufacturing sector has not grown faster and why it is so vulnerable to bottlenecks in input supplies.

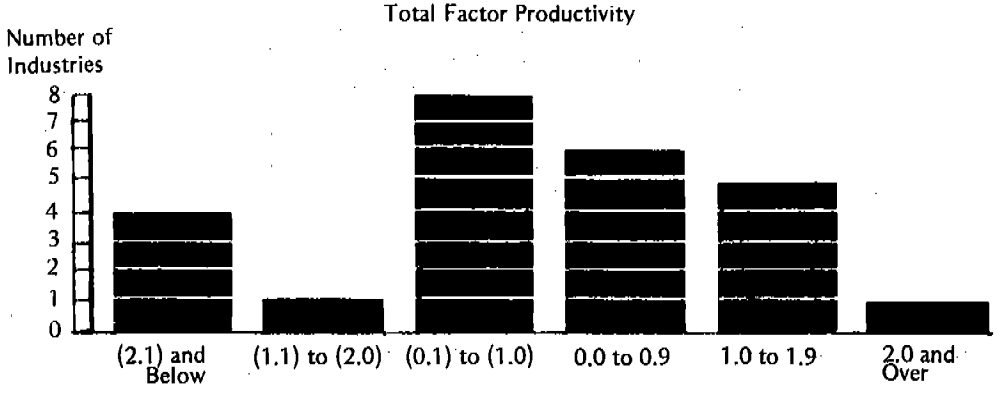
On the other hand, real production during the same period grew by a much more rapid rate — between 6 and 9 percent per year. Nearly half of all industries recorded annual rates of increase in real production of 10 percent or more. For comparison purposes, we also show real gross value-added. Although the modal value of the latter is higher than that of real production, the mean is lower because of the large number of industries which grew (on the value-added basis) at annual rates of between 0 and 6 percent per year. There are reasons for the tendency of production growth to outstrip growth of value-added which reflect shifts in input use, a subject to which we now turn.

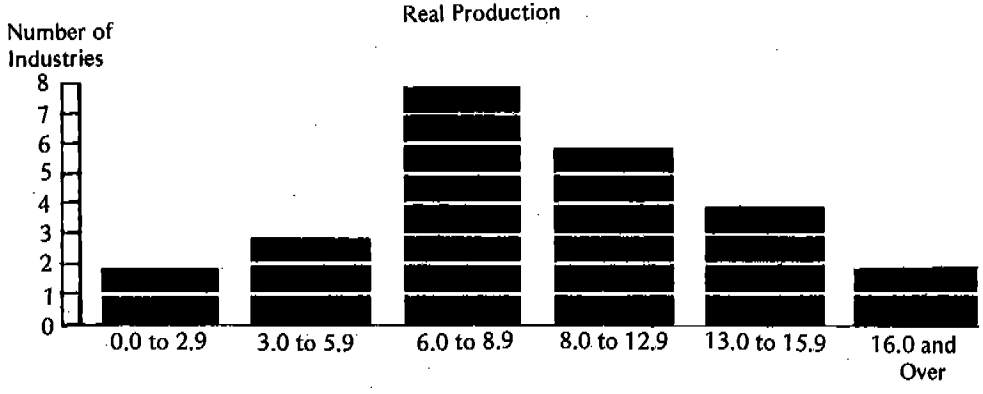
Real production per worker advanced at a modal rate of approximately 3 percent per year. Again, there was wide variation with some industries registering gains of as much as 6 percent or more, but with a much larger group of industries registering gains of less than 2 percent, and a number showing declines.

Since the annual growth of TFP is clearly below that of production per worker, substitution of some other factor(s) for labor must have taken place. [14/] It has often been correctly assumed that increases in production per worker could be explained by capital-labor substitution. There appears to have been a modest amount of capital-labor substitution. This is reflected in the lower modal rate of growth of production per unit of capital of between 0 and 2 percent (note that the lowest frequency class is open-

[14/] That is, assuming no changes in hours of work. The data we have on hours worked for non-agriculture support this assumption.

## Chart 4
## Annual Percent Change in Selected Variables, 1956–1980



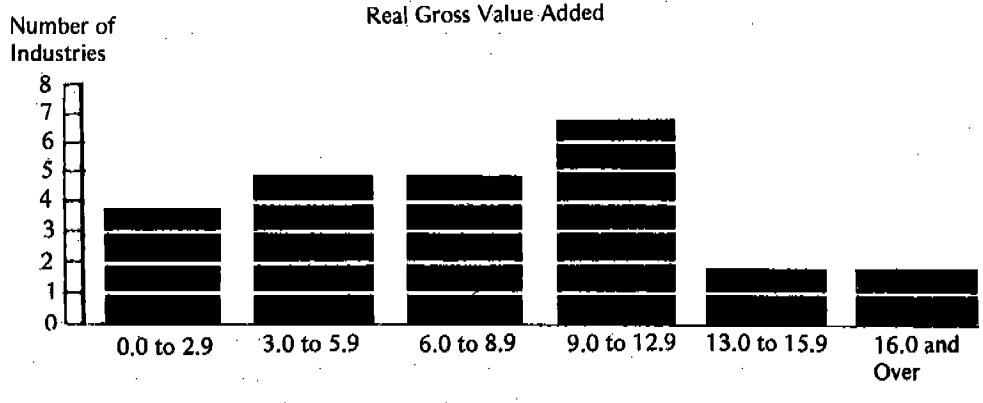
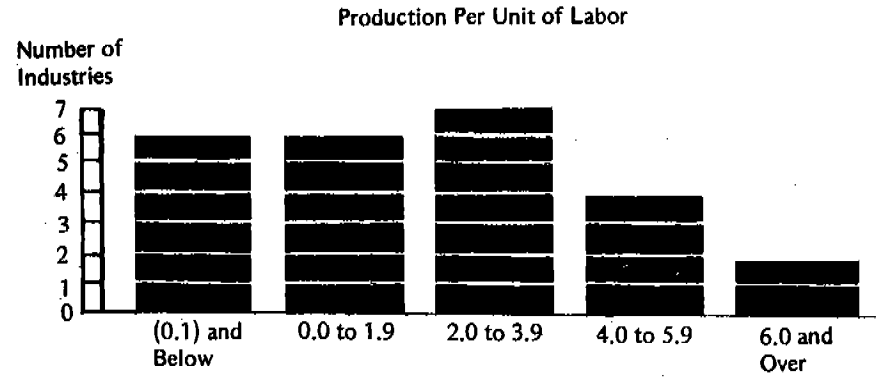
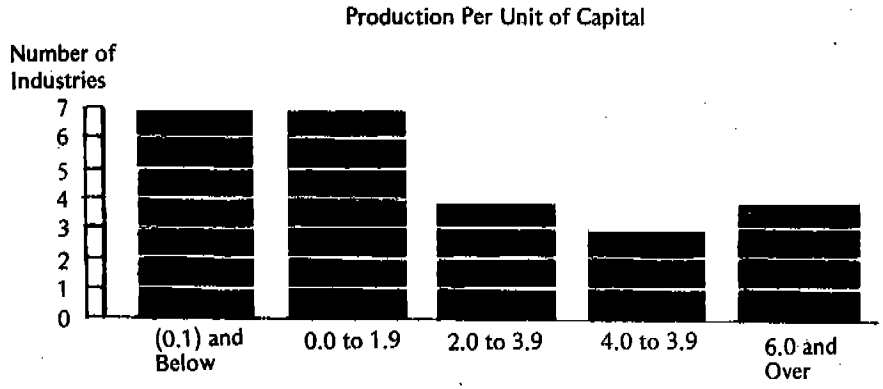
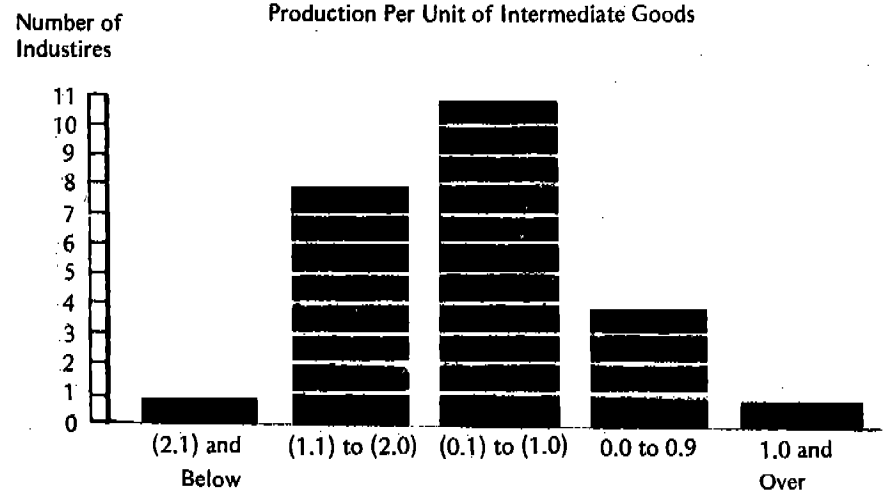



**Chart 4 (Continued)**




( ) Indicates Negative

## Chart 4a
## Indices of Production and Inputs of Twenty-four Manufacturing Industries, 1958–1980
## (At 1972 prices)

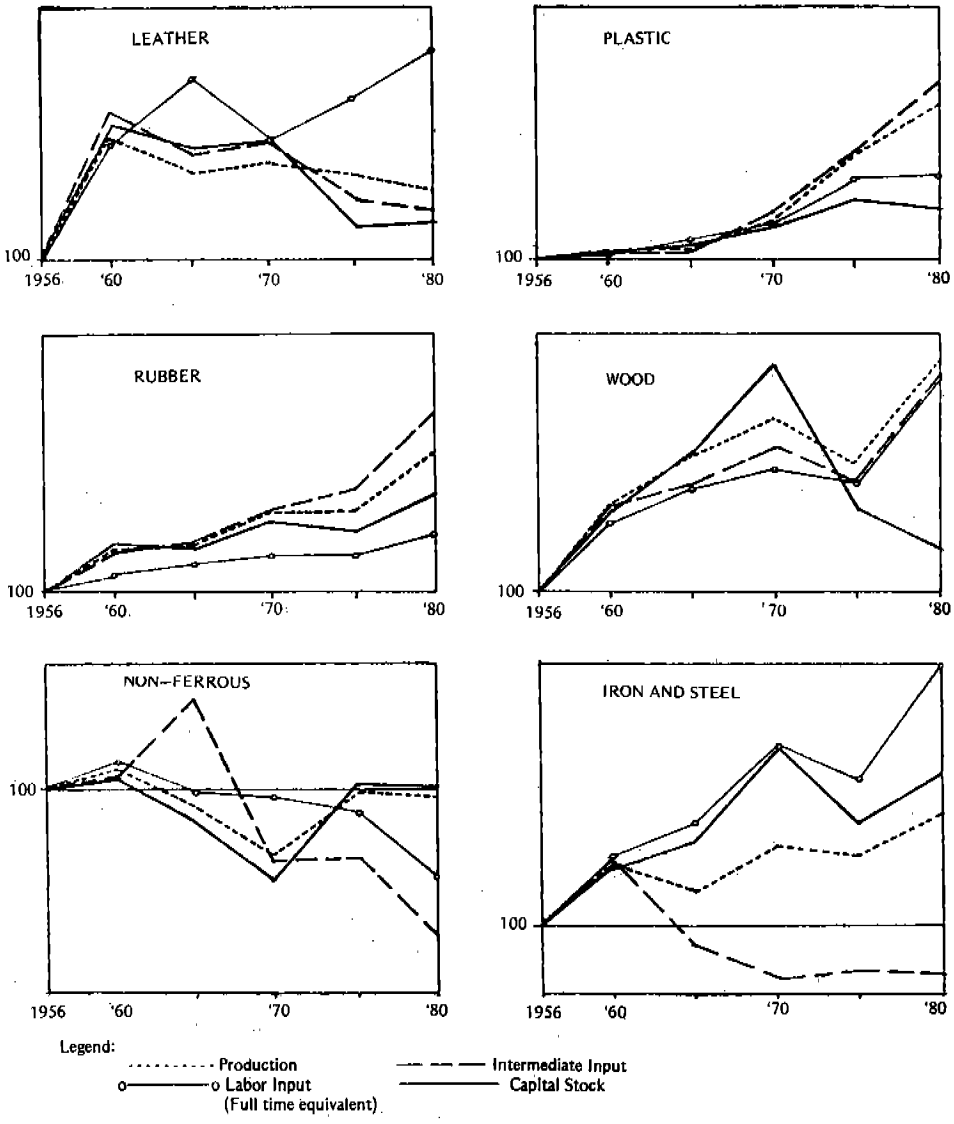
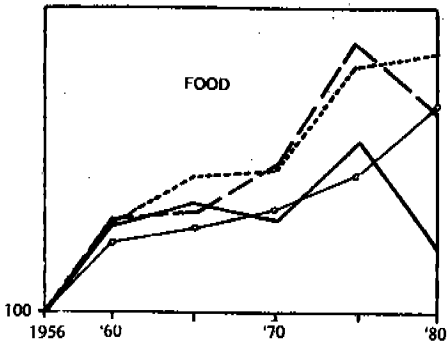
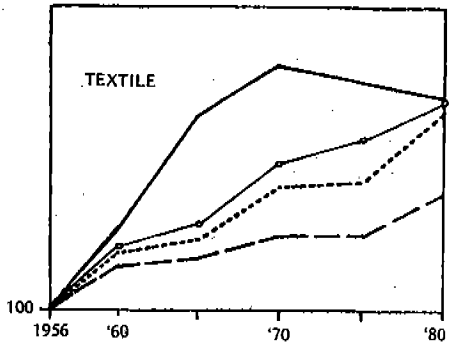
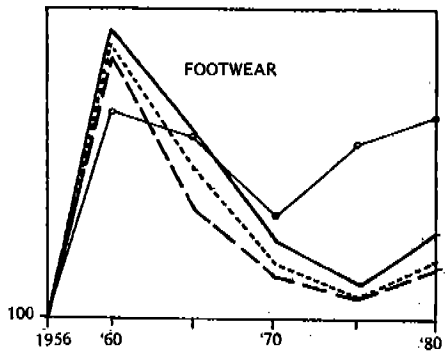
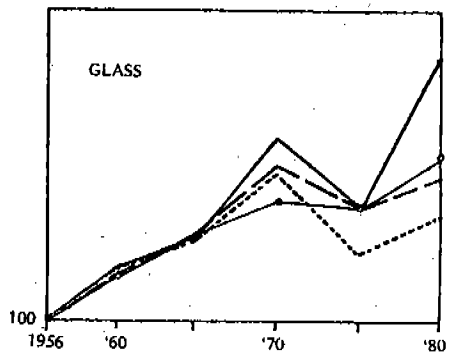


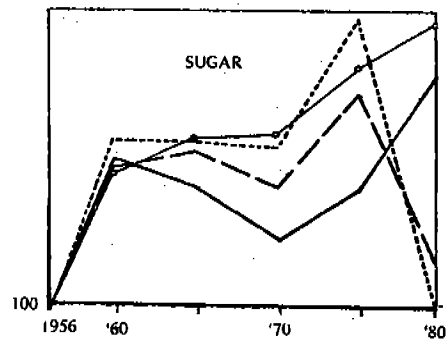
**Chart 4a (Continued)**



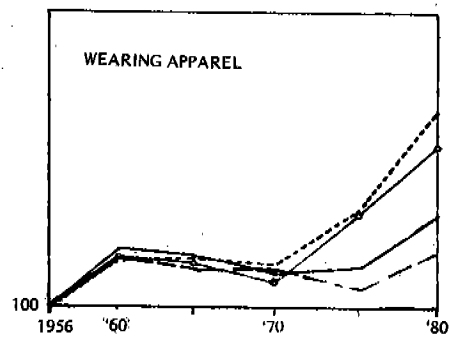



**Chart 4a (Continued)**

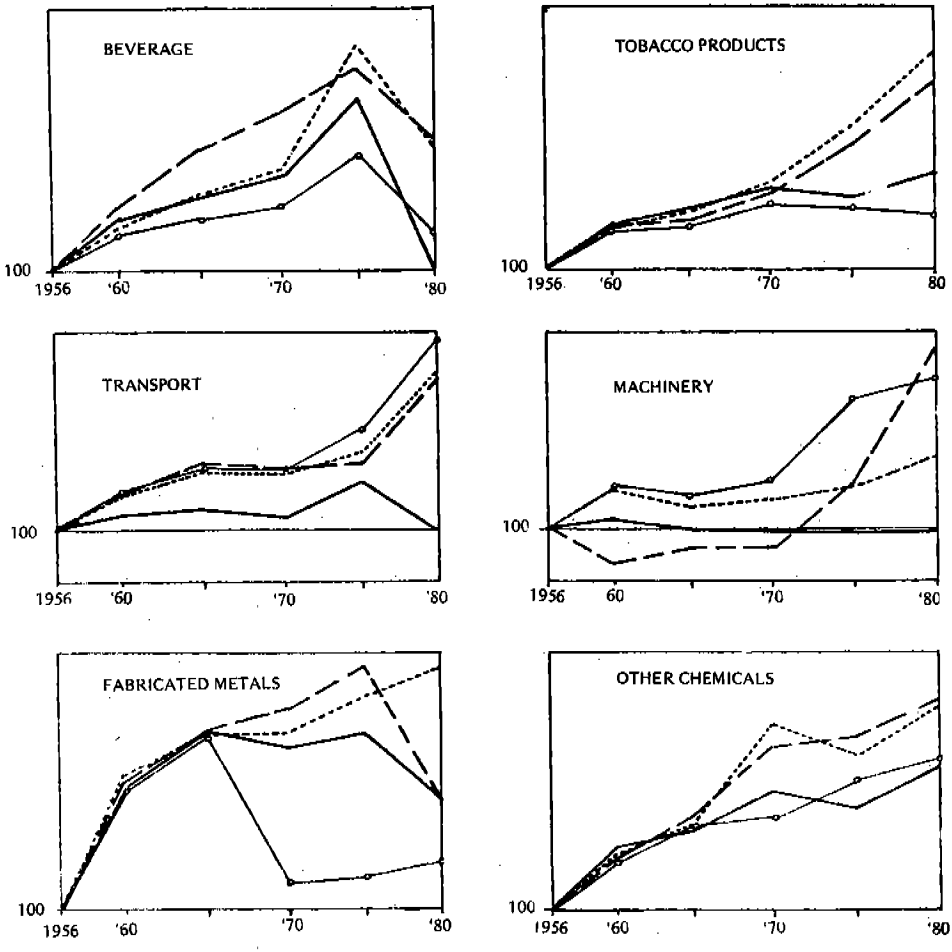
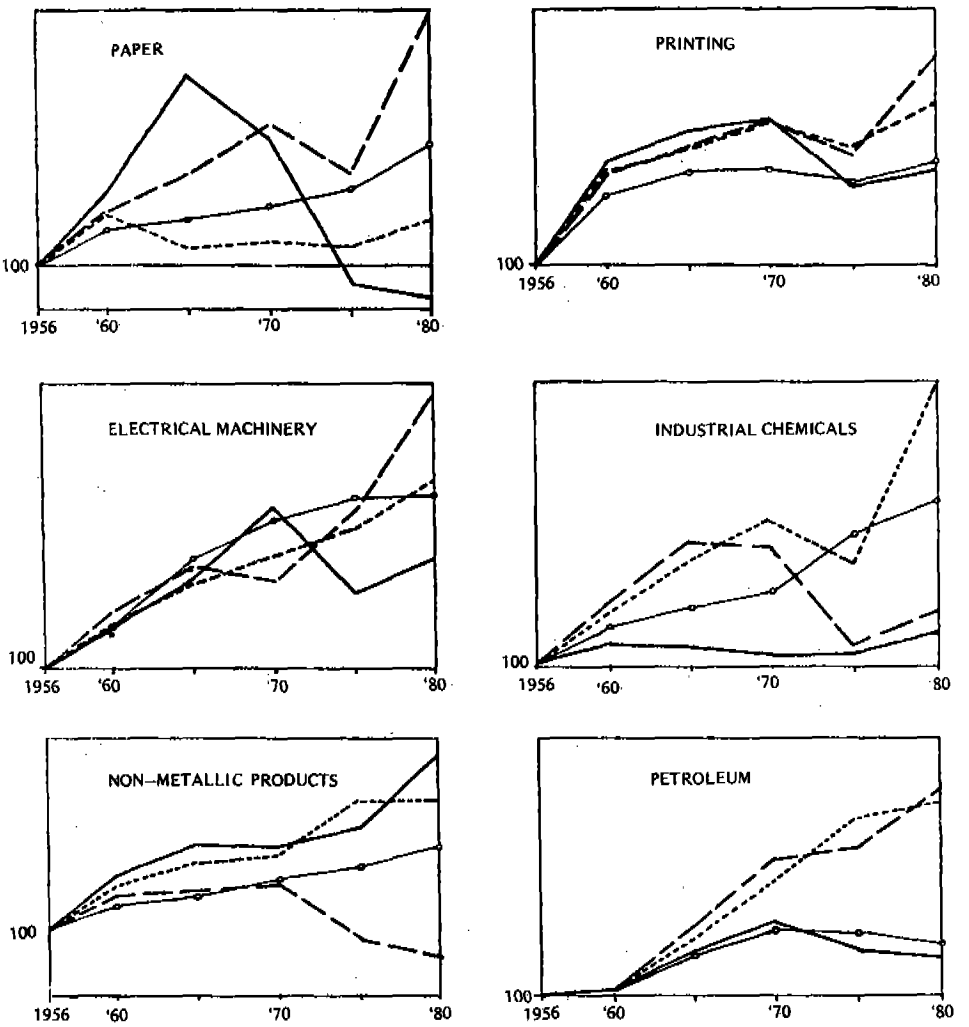


**Chart 4a (Continued)**



ended). However, there is a great deal of disparity in capital productivity, and it appears that there were quite a few industries which experienced little or no capital-labor substitution.

The matter is immediately clarified when we turn to the data on production per unit of intermediate goods. Here we see evidence of an astonishingly high rate of substitution of intermediate inputs for *both* labor and capital. The modal rate of annual growth of output per unit of intermediate goods is between —.1 and —1.0, with a mean annual growth rate of around —2.0 percent per year. Consumption of intermediate outputs has increased at a substantially more rapid rate than either labor or capital. This is additional evidence at the industry level of the effects of declining trends in factor prices — trends which were an unintended side-effect of government food subsidy and tariff policies. Increases in intermediate input usage impact decisively on TFP trends. Indeed, the reader may have noticed a similarity between the contour of the industry distribution of growth rates of production per unit of intermediate inputs and that of TFP (Chart 4). The reason is because of the heavy weight intermediate goods receive — they represent two-thirds or more of total input payments for most industries.

## VI. THE DISTRIBUTION OF PRODUCTIVITY GAINS

The evidence just reviewed shows that a number of industries achieved modest increases in total factor productivity during the period under review. How were these gains distributed? Theory suggests that in a free market economy, productivity gains are distributed through lower prices of final output. We tested this by regressing average annual rates of change in TFP against average annual rates of change in price of output for our cross-section of twenty-five industries at the 3-digit level. The initial results using only one explanatory variable were satisfactory, yielding the correct sign and a t-value of over 3. The fit was improved substantially, however, when we introduced a dummy variable to isolate industries which either (a) export over 50 percent of their output or (b) import over 50 percent of their intermediate inputs. In both these cases, price is hypothesized to be exogenously determined with respect to the domestic economy. The evidence supports this view because t-values are higher, the scatter about the regression line is reduced and explanatory power as measured by the correlation coefficient is improved. The elasticity of price with respect to TFP is —.75, implying a substantial impact of TFP on prices of manufactured goods, a fact to which price stabilization policy might well give serious attention. [15/]

[15/] Kendrick, estimating the same relationship for a group of U.S. Industries (but not limited to manufacturing), shows a coefficient of — .89, not too much different from the above, but different enough to suggest somewhat less price sensitivity to TFP change in the Philippines compared to the U.S.

One would expect that industries which exhibit price declines due to technological advances would also record corresponding increases in output. Charts 5 and 6 illustrate the extent to which this relationship holds in this country. The regression of price on quantity yielded an R(2) of only .06 in the first fit, so we introduced a dummy variable for export industries where quantity shipped is presumably independent of domestic price. The results were not markedly different. The R(2) rose only to .12. The coefficient of Q is negative as expected. However, while the T-value for both Q and the dummy variable are both greater than one, neither is statistically significant. There are several possible interpretations of this result. Our specification of the relationship between industry production and price may be faulty. [16/]

Or it may indicate that there has been substantial market intervention by the government to the extent of disturbing the underlying economic relationships. Finally, industrial markets may be characterized by monopolistic competition altering expected price-quantity relationships. [17/]

Chart 7 depicts the relationship between percent changes in TFP and production. We obtained an improved fit by isolating export industries and industries that experienced an increase in effective protective rates of 45 percent or more (Dum). In both these cases, we expect that the relationship between TFP and production will be altered. The coefficient of TFP is slightly above unity but the t-value is not significant at the .05 level of confidence. The t-value of Dum x is significant only at the .10 level of confidence, suggesting the possibility that export industries may exhibit unique behaviour in regard to the impact of TFP on quantity produced. The relationship between productivity change and production is, at best, weak.

In order to derive some idea of the impact of these developments on employment, we regressed percent change in employment on percent change in real production. As expected, the regression coefficient is positive and highly significant (t=11.44). However, the value of the coefficient is only .47. We feel this is rather low in view of the country's expanding labor force. In order to absorb its *pro rata* share of labor force growth of approximately 4 percent per annum, real production in manufacturing must grow by 8 percent. What is the potential contribution of TFP growth here? Given that (ceteris paribus) the elasticity of production growth to TFP is 1.08, the elasticity of employment expansion to TFP growth is .51 (.47 x 1.08). Thus, for every one percent growth in TFP, we may expect, *ceteris paribus,* a .51 percent growth in employment via the positive effects on output. For years, the growth of manufacturing employment has tended

[16/] That is, either the period covered – 1956-1980 – may be too long or relevant explanatory variables may have been omitted.

[17/] Romeo Bautista notes that since price change interacts with both supply and demand variables, a more complex model specification might improve the price-production relationship. I agree, but note that this simple model has yielded stronger results elsewhere (Kendrick, 1982).

Chart 5
Annual Percent Change in Price and
Total Factor Productivity, by Industry, 1956–1980

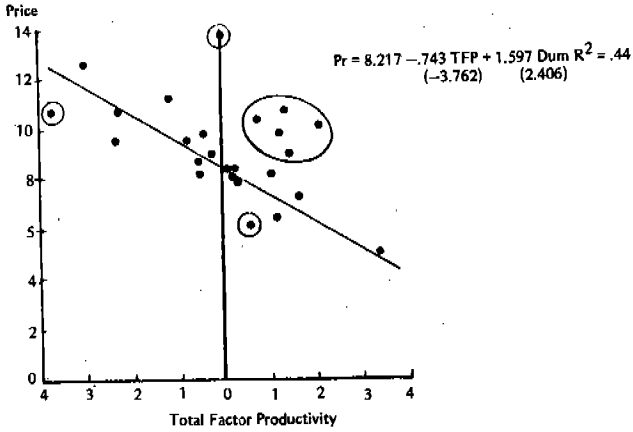



Chart 6
Annual Percent Change in Price and
Production, by Industry, 1956–1980

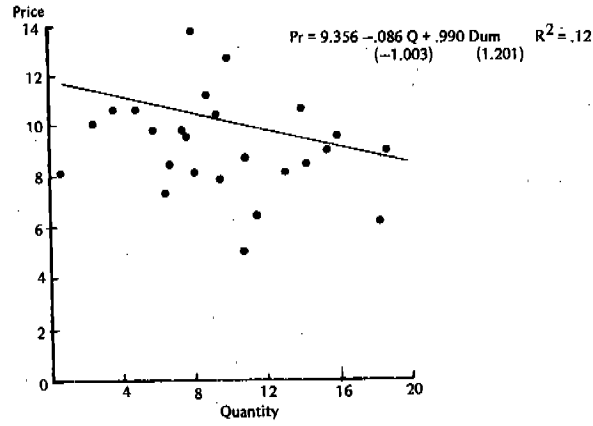
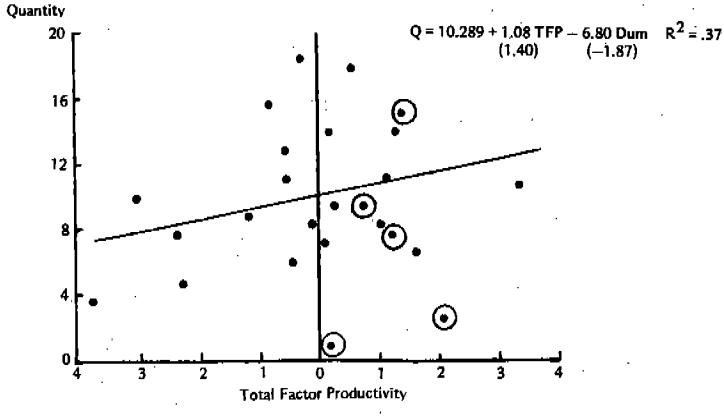


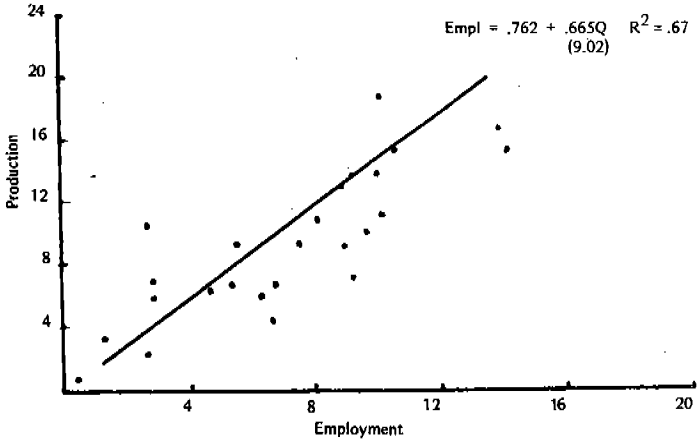

Chart 7
Annual Percent Change in Production and
Total Factor Productivity, by Industry, 1956–1980



to fall short of labor force growth. The above calculation suggests that even a TFP of 2 percent per year would suffice to raise the growth of manufacturing employment above that of the total economy-wide labor force if it were coupled with an annual increase in manufacturing production (sans productivity effects) of more than 6.3 percent. A major reason for the employment problem in the Philippines is the failure of TFP to advance at an acceptable rate.

To sum up, there is evidence of a direct and significant relationship between TFP and price of final output. This relationship is attenuated in the case of industries which either export most of their output or import most of their intermediate inputs. In either case, price is exogenous to the domestic economy. But for the remaining industries, the relationship seems stable and the size of the coefficient suggests impacts on price from TFP of significant size. There seems to be a relationship between TFP and quantity produced based on our industry cross-section data, but a much weaker one with correspondingly reduced explanatory power. We found a strong relationship between real production and employment (Chart 8) and, based on estimated coefficients, we conclude that the elasticity of employment with respect to TFP growth is approximately +.5. This indicates that TFP growth is an important potential contributor to the solution of the employment-growth problem.

**Chart 8**
**Annual Percent Change in Production and Employment, by Industry, 1956–1980**

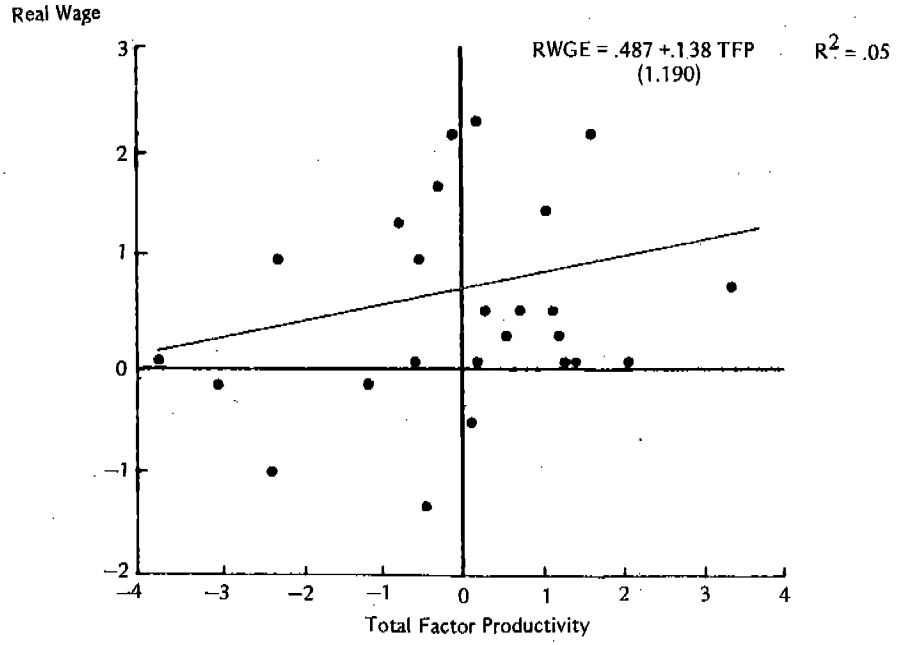



Source: Chart 5: Table 5 and Appendix C
Chart 6: Table 1 and Appendix C
Chart 7: Tables 1 and 5
Chart 8: Table 1 and Central Bank, Statistical Bulletin
Chart 9: Tables 1 and 2

Note: In the above charts production is expressed in constant price of 1972.

We also investigated the relationship between real wage rate changes and TFP (Chart 9) and concluded that while there might be some relationship, it is a weak one with little potential for a significant impact of TFP changes on real wage rates. Hence, the insignificant potential for distribution of productivity gains via changes in real wage rates. This result is what one would expect, given the large number of unemployed and underemployed workers in the labor force. If, contrary to recent experience, TFP gains were large and sustained over an extended period, the volume of unemployment/ underemployment would be steadily reduced, and a positive impact of TFP on real wages would emerge.

Chart 9
Annual Percent Change in the Real Wage Rate and
Total Factor Productivity, by Industry, 1956–1980




## VII. DETERMINANTS OF INTRA-INDUSTRY PRODUCTIVITY GROWTH

In recent years, increased attention has been given to designing policies to assist in productivity improvement. A branch of the Asian Productivity Organization provides advisory services on productivity improvement for individual firms. The National Productivity Commission, created by Executive Order in 1980, has as its main objectives the improvement of national productivity through research, dissemination of information and public promotions. More recently, a National Productivity Council has been formed. The Philippine Chamber of Commerce and Industries has also launched its own program of productivity improvement aimed at private firms in

the non-agricultural sector. Each of these organizations has a somewhat different perception of the type of policies needed to stimulate productivity growth. We feel it will be helpful to bring our data and findings to bear on the question of what policies are potentially most useful in improving productivity performance in the manufacturing sector. We do this by an examination of inter-industry differences in productivity performance.

We have selected 14 factors as potential explanatory variables for productivity differences among industries. The variables, together with their symbols, are:

| | |
|---|---|
| CSIZE. | Percent change in average size of establishments. |
| ECOST. | Change in percent energy cost to total production cost. |
| INGDS. | Change in percent intermediate inputs to total inputs. |
| MIGDS. | Change in percent of imported intermediate goods to total intermediate goods used. |
| MLA/T. | Change in percent of value added activity located in Metropolitan Manila compared to the entire country. |
| FEM/T. | Change in percent of female workers to the total workforce. |
| EX/TN. | Change in percent of workforce represented by executives. |
| PR/TN. | Change in percent of production workers to the total workforce. |
| SLVR. | Variability of salary scale, all employees, 1975. |
| R & D. | Research and Development activities. |
| EPR. | Percent change in effective protection rate between 1956 and 1975. |
| EX/PN. | Percent of production of each industry exported in 1980. |

Wherever possible, we have tried to regress the percent rate of TFP change on the percent change in the explanatory variable. There were four manufacturing Censuses taken during the period – 1961, 1967, 1972, and 1975. The 1967 Census omitted reports on all the employee variables (by industry) and therefore is not useful for our purposes. The 1972 and 1975 Censuses are too close to one another. In effect, this reduces us to observing changes between 1961 and 1975. For a few variables, the 1961 Census did not contain any information (e.g., on exports by industry). In such cases, we are left with the single alternative of calculating some index of the relative importance of that variable among industries for 1975. This is the explanation for not using percent change for two variables – R & D and export activities. The above list of variables does not exhaust the potential explanatory factors for productivity differences among industries, but is an optimum list in terms of the data constraints which confronted us. We would, for example, have liked to obtain a measure of education and average age of workers by industry; unfortunately, the Census does not report data on those variables. Labor force surveys do, but the

latter are not cross-classified by industry.

Some of the above factors are clear as to their expected impact on productivity change. Some are not. We now briefly discuss the rationale for including each factor and the expected sign of the regression coefficient.

**CSIZE.** The percent change in average (employment) size of establishments is used to determine what, if any, impact economies of scale have on TFP growth. Studies of manufacturing establishments in other countries suggest that there are significant scale economies as firms grow from small to medium size (Griliches and Ringstad, 1971). The expected sign is positive.

**ECOST.** The vulnerability of industries to the sudden increase in energy costs during the seventies is the reason for selecting this variable. It may also serve as a proxy for capital per worker. The first consideration would suggest a negative sign. However, to the extent that there is intercorrelation with capital per worker, this could be reversed to a positive sign.

**MLA/T.** The concentration of economic activity as measured by the share of production taking place in the Metropolitan Manila area is presumed to measure external economies of scale, and therefore the expected sign is positive.

**FEM/T.** The ratio of females to total workforce is essentially a proxy for age and educational level. The expected sign is negative.

**MIGDS and INGDS.** These two variables measure the ratio of intermediate inputs to production (INGDS) and the ratio of imported/intermediate goods to production (MIGDS). Both of these variables can be considered as measures of the vulnerability of industries to disruption from dependence on external markets for supplies. The MIGDS additionally measures any positive productivity effects derived from the improvement of intermediate inputs imported from abroad. For example, if improvements of imported chemical inputs to the pharmaceutical industry result in improved quality of final pharmaceutical products, there is a transmission of productivity improvement from the foreign supplier industry to the domestic industry. The expected sign for the "embodied" effect is positive; whereas the expected sign for the transmission of "disruptive" effects is negative.

**EX/TN.** We consider the ratio of executives to total workforce to be a reflection of internal management style. Our view of managerial models suggests a negative sign because some observers view many firms here as "top-heavy" in management. Note that this variable will probably be negatively correlated with production workers as a percent of total workforce.

**PR/TN.** The ratio of production workers to total workforce is, for reasons outlined above, likely to be positively related to TFP. The expected sign is positive.

**SLVAR.** Variation in salary (compensation) is measured by a variance coefficient based on earnings of executives, operators and non-operators. Generally, we feel that low relative wage levels for operators reflect a short-sighted approach by management which deemphasizes quality, training and experiences among operators. The expected sign is therefore negative.

**R & D.** Two measures of R & D activity are available. One consists of a tabulation of patents applied for in the Philippine Patent Office, compiled by industry for the decades 1961-1970 and 1971-1980 (Medalla, Mikkelsen and Evenson, 1982), broken down by industry. The second set of data consists of a survey of research work done for others by industry for 1975, compiled by the Census Office. Each of these measures has potential but also presents some problems. Patents represent identifiable improvements in an industry's products or the way of delivering it. Patents exclude, however, many research activities devoted to applying known techniques and ideas to a firm's production. For example, working out an optimum inventory plan or conducting research on the best methods of plant layout, etc. or in an apparel firm, conducting research on styles and market trends which significantly upgrade product quality. We are inclined to believe that in the early stages of manufacturing, it is precisely these latter type of research which are likely to be particularly important. Our data on research done for others also present problems. If firms perform research for others, then there is a reasonable implication that they are doing it for themselves as well. But the reverse is not necessarily true: absence of contract research does not necessarily indicate that no in-house research is going on. One advantage of the research survey over patent data is that although a patent is registered, there is no assurance that it is being used whereas we do not need to raise the same question for research expenditures. We decided to enter R & D as a dummy variable – i.e., 1 for industries which performed research for others and zero for industries which did not engage in such contract work. Hopefully, at some future date, there will be actual data on the value of R & D expenditures by industry. However, at the moment, we feel that this is the last best solution given the available information. The expected sign for the R & D dummy is, of course, positive.

**EPR.** This variable measures the percent change in effective protection rates. Tariff protection is viewed as antithetical to efficient allocation of resources and therefore an obstacle to productivity growth. We have argued above that the structure of tariff protection created incentives to use excessive amounts of intermediate inputs with correspondingly dysfunctional impacts on TFP. In addition, some economists believe that high tariffs lead to entrepreneurship behaviour patterns which exhibit complacency toward improvement in cost/efficiency and in product quality. Firms (industries) with low productivity are permitted to survive whereas many would be eliminated under competitive conditions. (Harberger, 1958; Scitovsky, 1968). The expected sign for EPR is negative.

EX. This variable measures the percentage of an industry's output which is exported. Following the same general rationale as in the discussion for the EPR variable, the presumption is that industries that export, operate in a more competitive environment, and are therefore more efficiency-conscious. The expected sign is positive.

Table 9 presents the results of a multiple regression of TFP against the explanatory variables listed above.

**Table 9**
**Multiple Regression Coefficients,**
**Total Factor Productivity and Selected Independent Variables**

| Independent Variable | Expected Sign | Regression Coefficient | T--Value | |
|---|---|---|---|---|
| CSIZE | + | .0064 | 3.043 | *** |
| ECOST | – | .0952 | –.871 | |
| MLA/T | + | 8.6925 | 2.541 | ** |
| INGDS | – | –.0949 | 1.687 | |
| MIGDS | (+,–) | .0953 | 1.000 | |
| FEM/T | – | –13.1000 | –2.772 | ** |
| EX/TN | – | 16.2681 | 1.803 | * |
| PR/TN | + | .2182 | 1.331 | |
| SLVAR | – | –39.7240 | –3.382 | *** |
| R & D | + | .7937 | 1.222 | |
| EPR | – | –.0084 | –1.495 | |
| EX | + | .0267 | 1.998 | * |
| | | R (2) = .74 | | |

The results of the cross-section regression shown above confirm a number of our hypotheses. First, notice that the coefficients of ten of the twelve independent variables have the expected sign. Five of the ten have t-values which are significant at the 5 percent probability level or better. Of the remainder, most have t-values greater than one. Three quarters of the inter-industry variation in TFP is "explained" by reference to the factors included here.

Economies of scale appears to be a significant determinant of TFP growth. This is true for both internal (CSIZE) and external (MLA/T) scale effects, which are statistically significant at the .01 and .05 probability levels, respectively.

Energy costs, while taking the right sign, does not exhibit a significant coefficient. The implication is that the dysfunctional effects of the energy price rise did not exert their effects through the production system. This is not to deny, however, that rises in energy prices may have significant impact on income levels, income distribution and on the pattern of inter-industry final demand.

The coefficient for intermediate goods usage is negative, as expected, but not significant at the .05 level. However, it is large enough (−1.69) to suggest the possibility of a negative relationship between changes in the *share* of intermediate goods in total input usage and TFP growth. On the other hand, changes in *imported* intermediate goods usage may be positively related to TFP growth. Again, the t-value in this case is only 1.0. But the implication, albeit weak, is that there may be some positive technological transfer effects for industries dependent on imported inputs. The transfer effects could be in the form of "embodied technology" or simply the improved quality of intermediate goods.

The coefficient of the share of females in the workforce is negative and significant at the .05 level. This variable is really a proxy for age and education and therefore we feel that this result indicates that the latter is positively associated with productivity improvement. This inference is in agreement with findings elsewhere.

Changes in the ratio of production workers to the workforce (PR/TN) are positively related to TFP performance, although the t-value is only 1.3. One possible interpretation of this result is to note that it is consistent with the inference made that dependence on purchased intermediate products work against TFP growth. Taken together, the two results seem to be implying that industries involved in only minor processing of materials are likely to be unimpressive in terms of their productivity performance. If true, this suggests that input *structure* is related to productivity performance.

The significant coefficient for salary variation of production workers (SLVAR) is evidence that wage structure which are tilted against production workers contain a hidden cost in terms of productivity improvement. This supports the view of some observers that managers here underestimate the effectiveness of well-designed wage structures in promoting plant efficiency. It can also be interpreted as supporting the impact of education and age on productivity change, since wage rates may be a proxy for age and education.

The coefficient of the R & D index is positive, greater than one, but not statistically significant. Given the deficiencies in our R & D data, this result is not wholly unexpected. We continue to feel that R & D is a significant determinant of TFP and we feel that given the data at our disposal, these results are the best one could expect. We should note that the variable EX/TN which measures the ratio of executives to the workforce is also

positive and carries a t-value significant at the .10 level. The unexpected positive sign *may* be interpreted as if EX/TN is a proxy for R & D. That is, industries with a higher ratio of executives to total workforce may also be those which conduct more R & D activities.

The last two variables deal with the impact of "outward" and "inward" looking policies on TFP change. The variable EX, the share of an industry's output exported, has a positive coefficient significant at the .10 level. Conversely, industries which have experienced large increases in protective tariffs (and hence are presumably domestic market-oriented) appear to fare poorly when measured against the criterion of productivity performance. The latter inference is somewhat ambiguous, however, because the elasticity coefficient is small (—.008) and the t-value is not statistically significant although it is greater than unity. This generally confirms our expectations. The relatively low t-value for degree of protection supports our view that tariff protection hinders productivity improvement not so much directly, but *indirectly* through its stimulation of intermediate input consumption as well as its tendency to reduce inducements to undertake R & D activities within the industry.

To sum up this discussion of factors affecting productivity change, we are really looking at three sets of factors. At the enterprise level, internal economies of scale, better wage structures and improved input structures all contribute to more rapidly rising TFP. At the industry or intermediate level, external economies and more expenditures on R & D are helpful. Finally, at the macro level, improved education and more outward looking policies in regard to export promotion, improvement in the competitive environment and reduction of tariffs (and import dependence) are all important ways to advance TFP performance. It is noteworthy that no single factor appears to dominate in explaining inter-industry differences in TFP. Indeed, if the empirical evidence is taken at face value, it points to the interaction of factors at all three levels — the micro or firm level, the industry level and at the macro level. Perhaps the most challenging task is not simply identifying the factors but finding institutional structures for coordinating the appropriate policy mixes.

## VIII. PRODUCTION PER UNIT OF INPUT

We have presented material on the pace and pattern of productivity change by industry for the period 1956-1980 and for subperiods. We have discussed a number of factors accounting for these trends. It is helpful to bring this discussion together by discussing the main trends in production per unit of input for manufacturing in the aggregate and by examining estimates of the quantitative contributions of each of these explanatory factors to the record as a whole. Since we have already determined that there are two major subperiods within the quarter-century covered by our

study, our discussion will concentrate on explaining trends within those two periods.

Estimates of production per unit of factor input are presented in Table 10. In the 1956-1970 period, production expanded at an annual rate of 10.2 percent, but inputs expanded faster – at 10.95 percent – so the residual is a negative –.74 percent. In the 1971-1980 period, production growth fell to 6.59 percent per annum, but total factor input continued to grow rapidly – at 8.91 percent – so that the residual expanded to a negative –2.32 percent per annum. What are the factors which account for these residuals and what is their relative importance?

**Table 10**
**Sources of Decline in Production per Unit of Input, 1957–1980**
**(Contribution to growth (decline) in percentage points)**

| | 1956–1970 | 1971–1980 |
|---|---|---|
| Production | 10.21 | 6.59 |
| Total factor input | 10.95 | 8.91 |
| Labor | 2.52 | 2.31 |
| Employment | 1.25 | 1.20 |
| Hours | –.10 | –.10 |
| Age/Sex | .36 | .21 |
| Education | 1.01 | 1.00 |
| Capital | 1.94 | 1.06 |
| Fixed Assets | 1.38 | .82 |
| Inventories | .56 | .24 |
| Intermediate foods | 6.49 | 5.54 |
| Production per unit of factor input | –.74 | –2.32 |
| Inter–industry shift | –.18 | –1.41 |
| Growth of government corporation's | –.02 | – .18 |
| Economies of scale–internal | .04 | .02 |
| Economies of scale–external | –.03 | .09 |
| Increase in tariff (EPR) rate | –.05 | –.28 |
| Intensity of demand effect-labor only | –.68 | –.26 |
| Changes in economic environment and advances in application of technical knowledge | –.18 | –.30 |

Source: Measurement methods and data sources described in text.

We have tried to answer this question by bringing forth our findings regarding the determinants of productivity change outlined in the previous

pages. First, we measured the effects of inter-industry shifts, i.e., changes within the industry composition of aggregate manufacturing which we have shown were away from higher productivity industries and toward the expansion of lower productivity industries. Using the methodology outlined in section IV, we estimate the effects of inter-industry shifts as −.18 percent in the earlier period and −1.41 percent in the later period. These shifts came about as the result of a number of policies, including exchange controls, changes in the structure of protection, and other types of intervention. By and large, the negative impacts of inter-industry shift were side effects of interventionist policies which were aimed at some other target. Hence, they were usually overlooked by policymakers.

The growth of government corporations is estimated to account for losses of .02 percent per year in the earlier period and .18 percent in the later period. This estimate is based on the share of corporate assets controlled at the close of each period together with the difference in government and private corporate productivity performance as measured (and discussed) in section IV. The growth in the negative contribution reflects both the expansion of government-controlled assets in the second period, along with a deterioration in the efficiency measures recorded by these same enterprises. Indirectly, it represents part of the hidden cost of growing unemployment in the society.

Economies of scale—internal and external—account for +.01 percent and +.11 percent contributions, respectively, to the residual in the two periods. The substantially larger contributions in the second period reflect the expansion of industry during the international commodity boom (and associated) multiplier effects for domestic industry during the period 1971-1976. After 1976, the situation changed completely, but the positive effects of the boom dominate the subperiod totals. The estimates are based on data for size of establishments combined with the cross-section elasticities derived in section VII.

Increases in the rate of effective protection are estimated to account for a decline of −.05 percent and −.28 percent, respectively, in the two periods. The much higher figure for the second period reflects the tariff revision of 1973 which brought about a large increase for manufacturing industries across the board. This effect is distinct from changes in the structure of protection by industry (within the manufacturing aggregate) which is caught in the inter-industry shift effect. We have based this estimate on Norma Tan's estimate of average EPR for all manufacturing in Power, Bautista *et al.* (1979) and on the index of changing manufacturing tariff rates for all manufacturing as prepared by Erlinda Medalla and contained in Appendix E. It represents the dysfunctional impact of tariffs on decisions for combining inputs in the production process and probably a "disincentive" impact on entrepreneurial behaviour as well.

We have included an estimate of intensity of demand effect for labor

estimated by a method to be described shortly. It was not necessary to make any estimate of the intensity with which capital and intermediate goods were used. In the case of capital, our input measure already contains implicit adjustments for quality and intensity of use. For intermediate goods, no adjustment is necessary because if there is any "slack," it will be reflected in inventory accumulation, which is already counted under capital. However, our labor input estimates require an adjustment for intensity of use for two reasons. First, we feel that our hours of work data are rough – they reflect only major changes in average work-week hours. Second, there is the propensity of entrepreneurs to "hoard" labor in slack times, which is well-known, to say nothing of the obvious pressure that many corporations (particularly government-affiliated) are under to provide employment, especially in time of economic stress. Our method is similar to that used by Denison, i.e., estimating intensity of demand by the ratio of worker payroll to value-added and using this to derive an estimate of changes in output per worker due to changes in intensity of demand. In this case, however, we adjust the residual only by the share of labor input to total factor inputs. The results show a –.68 percent and –.26 percent adjustment for the two subperiods, respectively. This reflects a chronic failure of demand pressure throughout the past quarter century. The smaller negative figure for the latter period is the result of the boom between 1971-1976 which was a considerable offset to the precipitous decline in effective demand in the years after 1976, resulting from the end of the boom; the piling up of foreign debt; and the near collapse of the domestic financial system.

When the above items are all deducted from production per unit of input, there remains a residual of +.18 percent and –.30 percent, respectively, to be explained for the two subperiods. We feel that this unexplained residual can be traced mainly to two factors which we have already discussed, but which we cannot quantify. One is the application of technical knowledge which we have indicated is undoubtedly of small magnitude but which is growing. This inference is justified by our own cross-section regression results which indicated a positive relationship between TFP and R & D expenditures. This inference is also supported by the findings of Medalla, Mikkelsen and Evenson (1982) in regard to the increase in domestic patents in recent years. On the other hand, we have already explained the reasons why increased intervention by the political authorities in recent years has had substantial dysfunctional effects on the incentive system to employ resources efficiently throughout the economy, particularly in manufacturing. In the earlier period, intervention was confined more to exchange controls and tariff changes. In later years, it became more wide-ranging and was embodied in the Board of Investment policies, and *ad hoc* intervention involving duty-free imports, special borrowing privileges, subsidized interest rates, and the like. Hence, the expanding significance of

this item. In short, we feel that the advances in knowledge application item was probably positive in both periods. However, in both periods, its positive effects appear to have been more than offset (particularly in the post - 1970 period), by *ad hoc* and extra-legal interventionist policies.

## IX. CONCLUSIONS

Total factor productivity growth in manufacturing, after adjusting all inputs for quality, averaged –.71 percent per annum during the period 1956-1970, and –2.23 percent from 1971-1980. Preliminary data for 1980-1983 indicate a further decline, probably to the –2.5 to –3.0 percent area. The implications of this for national development are clear and ambiguous. Considering that the average rate of TFP growth in agriculture from 1950-1970 was +0.7 percent and that this rate in all probability did not exceed 1.5 percent per year since 1970 even with the beneficial effects of the Green Revolution, then the clear implication is that the productivity gains in agriculture have been fully offset by productivity declines in manufacturing over the past quarter-century. From the mid-fifties through the sixties, there may have been a small net gain in agriculture and manufacturing combined. But since 1970, the annual productivity gains in agriculture have consistently been more than offset by declines in TFP in manufacturing. The implications for the entire economy are equally stark. Since manufacturing output is roughly the size of agricultural output, and since the available data on partial productivity indices indicate that productivity in the services sector is advancing no faster than manufacturing, and probably slower, then TFP for the economy as a whole has most likely been declining consistently since the early seventies. We cannot be sure of the exact date that this deterioration began, but it is somewhere between 1970-1974. The rate of decline accelerated significantly after 1975.

**Intra-industry Performance.** There was considerable dispersion in the productivity performance among industries. Food, beverages, tobacco, apparel and wood products all had average annual rates of growth of TFP of one percent or more per year. Wood products, footwear, other chemicals, and plastics recorded rates of about one-half of one percent or less. The rest – over one-half of the industries – registered negative rates of TFP growth. Some of the latter group showed remarkably large negative rates – like glass and leather with –3.3 and –2.4 percent, respectively. A small minority of industries with positive rates (food processing, tobacco, beverages, apparel and wood products) exerted greater weight on the sectoral total, however, because of their size. Together, they account for a third of total manufacturing production. On the whole, the performance of individual industries was substantially superior to that of the manufacturing sector taken as a whole, because of the existence of an inter-industry shift

effect which accounted for annual net declines in TFP of −.18 percent during 1956-1970 and −1.41 percent for the period 1971-1980.

Of the industries that performed better than average, some are import substitution and some are export-oriented. The successful import substitution industries include food, apparel, beverages and tobacco. These are what we have called "natural" import substitution industries producing goods for final demand with high income elasticities at current levels of Philippine per capita income. Their performance is in contrast to the remainder of import substitution industries (such as transport equipment, glass and fabricated metals) which either produce goods with low income elasticities or which produce for intermediate demand which is not growing rapidly and where the cascading tariff structure is often dysfunctional in its growth effects. The net upshot of the experience of individual industries is that some import substitution industries and some export industries performed better than average in regard to productivity performance; some of both also performed poorly.

**Government Corporations.** We have already pointed out the importance of inter-industry shift in explaining the difference between the performance of individual industries and all manufacturing. Another, but less appreciated shift, is the change in corporate ownership. Government-owned corporations, which controlled only 14 percent of corporate assets in the early sixties, increased their share to nearly one-third by 1982. But their record of output per unit of input has been declining steadily during the last decade relative to that of private corporations. Thus this ownership change also accounted for considerable drag on productivity growth in the manufacturing sector.

**Distribution of Productivity Gains.** Productivity gains are often distributed through the price system in the form of lower prices to consumers. That is, in those industries experiencing more rapid TFP advance, prices fall or rise less than average. The reverse is the case for productivity lagging industries. However, there are important exceptions to this rule. One is when the industry produces predominantly for export. In this case, prices are set in the export market, which generally means passing on most or all of the TFP gain to entrepreneurs in the form of windfall profits when export prices are favorable, and passing on the gains to consumers in the importing country when export prices are unfavorable. Industries with above average rates of TFP improvement also exhibit correspondingly larger increases in production via the decline in prices just noted. There are two important exceptions here. One is the case of industries exporting almost all of their output where shipments are under a quota, as in the case of sugar. The second is in industries with high rates of protection. This has the effect of allowing the entrepreneur to restrict output and yet maintain his dominant market position, thereby enabling him to retain a substantial share of the TFP dividend. The market situation here is similar to that in monopolistic

competition. TFP growth also exerts a powerful effect on employment expansion. However, we found no relationship between changes in real wage rates and TFP change. Actually, this last result was expected in view of the large volume of surplus labor existing in this economy. We conclude here that the distribution process for productivity gains — such as they are — is being disrupted partly by the intervention of government industrial protection, promotion and industry monopolization policies. The consistently negative TFP growth rates which we observed for the manufacturing sector have had two damaging consequences aside from their effect on national growth rates. The first is on domestic terms of trade between manufacturing and other sectors. Using our cross-section elasticities, we estimate that between 1956-1980, the average annual decline in TFP resulted in an average annual increase in manufacturing goods prices of .87 percent which over the entire twenty-five years amounts to an increase of 24.2 percent in prices of domestic manufactures. Assuming for the moment that productivity change in agriculture was +.7 percent per year, and that the elasticity coefficient of agriculture prices with respect to TFP was the same as in manufacturing, the terms of trade of agriculture would decline by 38 percent (24.2 + 13.8) over the entire period. This is in addition to the impact of other macro economic policies, such as tariffs, which could raise the prices of domestic manufactures relative to the prices of other goods.

**Impact of Tariffs on Industrial Growth and Productivity.** We have already referred to the adverse impact of industrial protection policies on the mechanism for distributing productivity gains. The conventional view is that protectionism produces its dysfunctional effects exclusively through its impact on entrepreneurial incentives. Inefficient enterprises with low productivity are permitted to survive which would be eliminated under competitive market conditions. The results of our investigation suggest to us that this is not the only and indeed probably not even the most important, dysfunctional impact of protection on manufacturing industries. We now wish to point to several other impacts, not previously mentioned and apparently not recognized in the literature on protection.

a) Depending on how the tariff is structured in regard to inputs of capital and intermediate goods, and the price movements (ex tariffs) for these inputs, the tarift will impact directly on the input structure of industries. In the Philippine case, decreasing effective protection rates on intermediate inputs coupled with a constant EPR for capital goods and a rapidly rising interest rates, shifted producers towards substitution of intermediate goods for *both* capital and labor. The result, in many industries, was a voracious demand for intermediate production, much of it imported, which helped create a foreign exchange bottleneck for *all* industry. This in turn created disruptions and discontinuities in input supply which were transmitted directly to industry output growth across the board and there-

fore on productivity change throughout the sector.

b) We have found that tariffs, by creating a monopolistic environment, interrupted the distribution of productivity gains to consumers via lower prices and allowed entrepreneurs in the protected industries to retain the TFP dividend. Unfortunately, the resulting windfall was not coupled with any requirement for directing the proceeds to research and development which would help raise productivity in the protected industry. Given the nature of the policy framework, the windfall had no positive effect on productivity growth. This is not the result of any "backward bending" entrepreneurial effort curve, but simply the result of government intervention of a poorly designed type. In every case we have seen, the Philippine entrepreneurs reacted rationally to the signals they received from the tariff structure. Unfortunately, they were often the wrong signals. Worse yet, in all cases we have seen, the price of the policy error was paid for by (a) consumers in the form of higher prices and/or restricted output, (b) labor in the form of a slower growth of employment than would otherwise have transpired and, (c) by supplying industries which would have been able to expand their deliveries faster had the demand of their customers grown more rapidly. In other words, slow productivity growth has greatly weakened the backward linkage effects of production growth of the manufacturing sector.

c) When value-added is estimated in real terms by the use of single deflation, the likely result is an overestimation of the value-added aggregate. This occurs because tariff protection affects the price of both final output and intermediate inputs, i.e., it raises final prices and lowers intermediate goods' prices below what they otherwise would be. This occurs because of the "cascading" nature of these protection systems. Where single deflation is used, the implicit tariff increase due to increased selling prices of final goods is eliminated; but the reduction in intermediate goods prices (due to reduced prices and sometimes negative protection) is not. We estimated resulting overstatement of value-added in the Philippine case as equal to 35 percent in 1980 compared to 1956. In our opinion, manufacturing value-added is overstated in the official statistics.

d) Where the industrial sector is a substantial part of national economic activity, growth will also be overstated, both for the sector and for the national income aggregate. The overstatement in the Philippine case amounts to about one and one-fourth percent per year for the manufacturing sector. Obviously, growth rates of individual industries will also be over- or understated in the absence of a correction applied to input prices, and probably to a larger degree than aggregate manufacturing because of the high degree of variability of tariff rates by individual industry.

**Contribution to Employment.** One of the major ways that productivity gains are distributed is through increases in employment. In an economy with widespread unemployment/underemployment, the potential in this direction is clear. Considering that TFP in manufacturing has been

zero or negative for much of the past quarter-century, it is not surprising that the annual increase in manufacturing employment has only been marginally above the growth rate of the non-agricultural labor force. For example, the non-agricultural labor force grew by nearly 5 percent per annum from 1970-1980. Employment in manufacturing grew by approximately 8 percent. However, production per worker fell by about 2 percent during the same period. Over the long-run, the deficit reflected in the excess of employment growth over labor productivity growth must be corrected, and that implies a period of labor absorption considerably lower than labor force growth. Actually, such a correction did take place during 1981-1984 when the rate of employment absorption in manufacturing became negative. This was accompanied by a rapid increase in unemployment. The main point here is that unless TFP in manufacturing rises to at least 2 percent per year, there is no possibility of the manufacturing sector making any significant contribution to the reduction in unemployment. The reason is clear: given an elasticity coefficient of employment with respect to production of less than unity, manufacturing production cannot secure non-labor inputs fast enough, in the absence of TFP growth, to expand employment much faster than labor force growth.

**Determinants of Intra-industry Productivity Change.** We investigated the relationship between TFP performance in two dozen industries at the 3-digit level and fourteen different factors which theory suggests might be significant in explaining movements in TFP. A number of these variables proved to be promising in explaining industry differences in productivity performance. Tariff protection emerged as negatively associated while export expansion was positively associated with superior TFP performance, lending further empirical support to our inferences derived from time series analysis. There appears to be significant internal and external economies of scale for most industries. The rise in energy cost was not the drag on TFP that we expected. These industries which are more dependent on energy inputs generally did not do as well as others, but they did not have markedly inferior records of TFP improvement. Improvements in labor quality — as measured by age, sex and education — are closely associated with TFP growth. Variation in salary levels, which *favors* operators, seems helpful in improving productivity. R & D activity appears positively related to TFP changes, though the evidence at this stage is not easy to interpret due to problems of measurement of R & D activities at the industry level.

**Rate of Return and Capital Utilization.** Our evidence on the net rate of return on manufacturing capital indicates a significant drop from about 15 percent in the late fifties to around 7-9 percent a decade later and then to a figure of 6 to 7 percent by the late seventies. These declines reflect two things: a decline in capital utilization rates and a drop in the quality of capital services. "Quality" as used here includes design of capital install-

ations, organization of capital inputs in production, etc. We separated utilization rate effects and found that these were responsible for about four percentage points (roughly one-half) of the overall decline in the rate of return from 1960 to 1980. The impact of falling capital utilization rates has been particularly apparent since 1975. It is difficult to explain the remaining decline of four percentage points. We feel, however, that this reflects mainly the impact of increased government intervention in the economy since the early seventies as well as the increased centralization of economic decision making.

**Productivity, Prices and the Balance of Payments.** Where a small open economy experiences a steady and significant deterioration in TFP, it will become virtually impossible to stabilize the external accounts. In the Philippines, TFP in manufacturing has been declining at the rate of roughly two percent per year since 1975. Output per unit of intermediate input (most of which is imported) has been declining at the same rate. We have shown that productivity declines of this magnitude are inevitably reflected in increases in domestic prices of nearly equal proportion. This process induces demand-switching by local consumers from local to imported products. Even though an appropriate fiscal/monetary policy mix may restrain growth in aggregate demand, the demand for imports will still rise. Of course, in the short-run, favorable international price movements may reduce domestic costs and raise those of foreign producers. But in the long-run, the effects of international price movements will be neutral at best. Then a steady deterioration of the domestic currency will emerge as the price of stable equilibrium in the current account.

Negative rates of TFP growth in manufacturing have also exerted adverse effects on the capital account of the balance of payments by triggering a capital outflow via a change in relative rates of return. To the extent that negative TFP growth rates are the result of misallocation of capital and intermediate good inputs, the rate of return to capital declines. This in itself should cause (ceteris paribus) an outflow on capital account if it is not offset by an equi-proportionate rise in the rate of return in another sector of the domestic economy of equivalent size. [18/] We have shown how the rate of return on manufacturing capital fell below the U.S. Treasury bill rate after 1978, and we argue that this was a major factor in explaining the dramatic outflow of long-and short-term capital from the Philippines in the late seventies and early eighties. The steady decline of industrial productivity in domestic industry was probably the main reason for this state of affairs by bringing about a fall in the rate of return in Philippine industry, to the point that it was below the U.S. Treasury bill rate after 1978.

[18/] Given the evidence, this seems quite unrealistic. Therefore, we proceed under the assumption that the decline in the manufacturing rate of return was representative of rates of return throughout non-agricultural industries.

## X. POLICY RECOMMENDATIONS

Despite the recent disappointing performance, TFP growth in the industrial sector can be raised substantially. There is a variety of measures that can be undertaken to improve industrial productivity in this country. Moreover, we are convinced that a dramatic turnaround is absolutely essential because no package of macroeconomic and/or monetary policies is likely to be effective in the absence of such a turnaround. However, we caution against the view that there is *one* key policy that will change productivity performance in industry. Our results demonstrate unequivocably that neither tariff reform *alone,* nor development of export industries *alone,* nor any other *single* policy is sufficient to change the present course of events. This is not to deny that some policies may be more important than others. It is just that an effective solution requires a well-balanced mix of policy changes.

(1) If productivity growth is to become an operational dimension of economic policy, an obvious first task is to develop the capability of *monitoring* productivity change. Occasional studies are not enough. Regular estimates of productivity change, at least by major sector, are necessary partly to track recent overall performance, and partly as a guide for assessment of growth in particular sub-sectors or industries of the larger economy. Monitoring implies up-to-date estimates, published periodically. The annual estimates of non-agricultural productivity change published by the American Productivity Center is an example of what we have in mind.

(2) In the past, macro investment decisions have been made largely if not entirely without reference to either the actual record or future prospects for productivity growth in different industries. Unless an industry can show prospects of significant TFP growth over the longer term, the channeling of investment funds to it can hardly be justified no matter what the expected foreign exchange savings, employment creation, etc. In the long run, all these anticipated social benefits of investment rely heavily on TFP growth to produce the desired effects. Therefore, we feel that investment strategies at the macro level must consider the potential for productivity improvement. In making macro investment policy, we must of course keep clear the distinction between productivity and profitability, the latter depending on price-cost relationships as well as the physical productivity of inputs. The findings of this study show that inter-industry shift, which has been orchestrated in considerable part by government investment policy, has had a dysfunctional impact on productivity growth in the past. We feel that this is both unfortunate and unnecessary, and could be corrected with a correspondingly favorable impact on the productivity performance of the aggregate manufacturing sector.

(3) We feel strongly that the poor record of productivity growth in manufacturing is intimately connected with the distress of this country's financial system. Too large a share of the system's credit resources have

been extended to industries whose productivity record is among the weakest in the entire manufacturing sector. Some way must be found to incorporate an assessment of potential productivity performance into the overall assessment of credit worthiness by financial institutions. This would provide additional incentive for non-financial enterprises to improve their performance. The Central Bank, too, is going to have to include this in its considerations regarding the restructuring of the country's internal and external debt positions since, as we have shown, poor productivity performance eventually affects rates of return which in turn react negatively on international capital flows and the country's balance of payments position.

(4) Restructuring of the tariff system is another area where macro policy should be improved. In many cases, the highest protection was provided to those industries which had the least impressive records in regard to TFP growth. This was not *always* the case, e.g., we note that high levels of protection were given to the beverage industry which really did not need them. But the inverse relationship between protection rate and productivity performance was sufficiently pronounced to account for a significant share of productivity decline in manufacturing. Tariff protection, where used, should be limited to those industries which hold out genuine promise for substantial gains in TFP. This has always been a key element in the administration of tariffs from the standpoint of the infant industry approach.

(5) The conventional wisdom seems to hold out prospects for a dramatic improvement in TFP with a further expansion of the export-oriented industrialization policy. We believe that such a policy has the potential for favorable impacts on TFP growth. However, the evidence suggests that this policy mix alone will not produce effects of the magnitude generally believed necessary, and therefore should not be relied upon as the centerpiece of a solution. It is a necessary but not a sufficient condition for a successful re-industrialization policy.

(6) A framework of incentives for the improvement of overall efficiency must be developed for government corporations. Both government-owned and government-affiliated corporations appear to be operating under an incentive system that places profitability far behind provision of employment and perhaps other social/political objectives. But as have been clearly shown, pursuit of these objectives which allows output per unit of input to decline, is counter-productive in anything but the most trivially short period. Moreover, since audit procedures are uneven at best, measurement of resources going into these enterprises is extremely difficult, making even the productivity monitoring function nearly impossible in a number of cases. Government enterprises, even when producing socially desirable outputs, must be provided with an accounting framework and a set of fiscal incentives to improve their productivity record. This is particularly

important now that these units have become the owners of a significant share of manufacturing assets.

(7) The importance of research and development to productivity change is well-documented for a number of countries. In the past, Philippine manufacturing has relied heavily on imported technology, implemented in local plants with a minimum degree of change, resulting in a heavy dependence on imported inputs. The evidence presented here does not indicate that this is a promising strategy for TFP growth. Those industries most dependent on imported inputs do not have records of productivity growth superior to others as one would expect if productivity gains in American and Japanese industry were being transferred to local industry via the link of import-dependency. In fact, the import-dependent industries often have inferior records of TFP growth. Hence, the need to develop the country's internal capability for the adaptation of scientific and technological knowledge to industrial uses, and to encourage private industry to undertake research and development activities. The Philippines has the largest number of trained scientists per capita in all Southeast Asia. Yet these potentially valuable human skills are allowed to remain underutilized. Underemployment of trained technologists is so widespread that thousands emigrate each year to other countries in search of useful employment. A program can and should be developed to organize available domestic resources (human and non-human) to advance the technology-adaptative capability of domestic industry.

To accomplish such a task requires nothing less than the *institutionalization of R & D.* At present, some R & D is carried on, both within the government and in private industry, as demonstrated by the growth of patent applications. However, it is necessary to organize these sporadic efforts much better, so that technological improvement becomes both more widespread and more rapid. To accomplish this requires some institution-building. In short, it is necessary to establish an institution whose major function is the coordination of existing efforts (both private and government) at scientific research/adaptation for industrial purposes, and the undertaking of those functions not being undertaken by others. The following functions are essential to a successful R & D program:

a) Monitoring of foreign technology – This is different from the monitoring of technological change mentioned earlier. It involves tracking technological developments in other countries, bringing them to the attention of appropriate industrial leaders, assisting in working out the basics of adaptation as necessary (and, in conjunction with other institutions where possible).

b) Assessment of the economics of technological change and improvement – This involves the investigation of the economics of technical adaptation and development. Technologies which may indeed be superior in one economic environment may be inferior in another. Further, what changes

in domestic economic environment (pricing, incentive system. etc.) would be adequate and/or desirable to introduce certain types of technology?

c) Development of domestic R & D capacity and activities generally – R & D capacity in industry may require certain changes in awareness on the part of entrepreneurs, and some changes in attitudes among worker organizations. Where necessary, these matters have to be analyzed, considered and possible solutions discussed with the appropriate existing organizations.

d) Some changes in macro policy may be desirable in order to stimulate R & D activities by industrial firms – Such things as changes in the depreciation rates, various tax measures, and investment incentives related to the introduction of new technology may fall under this heading.

e) Monitoring of productivity change in non-agriculture – Since some efforts at productivity measurement are already on-going, this function may be limited to coordination of the work done by other institutions.

The institution created to house these various functions should be capable of extensive dialogue with both government agencies/personnel and private entities/personnel and with international organizations. This seems to preclude a purely government or privately-controlled institution. Instead, it should be an institution formally independent of government yet established with its approval. This set-up appears to be the most effective setting with respect to sponsorship.

These functions to be performed by such type of an institution brings to mind scientific and technologically-oriented institutions such as the International Rice and Research Institute (IRRI) at Laguna and the Korean Institute for Science and Technology (KIST) at Seoul. The parallels are there. But simple imitation has to be resisted because the object of what is being proposed is the creation of an organization that would serve industry's scientific-technical needs and not vice-versa.

(8) Economies of scale were shown to be particularly relevant to productivity growth. There is obviously tremendous room for improving external economies in this country. Judging from scattered evidence on the domestic cost of moving commodities – particularly in the major cities – the transport system is characterized by very high unit costs. Improvements in the physical facilities of the ports and the domestic transport system are needed, along with streamlining in their administration.

(9) Our conclusions regarding the importance of internal economies of scale suggest the need to assist firms in moving toward optimum size. This means much more, however, than simply enlarging establishments. It implies the review of available technology, adoption of appropriate organizational forms – both for physical plant and administrative functions – and review of other aspects of production. This should be done through the expansion of firm-level consultative activities, such as those now rendered by the Productivity and Development Center, as well as other semi-

government and private organizations.

(10) The abovementioned points are venues which the government and its agencies can take in order to help increase industrial productivity growth. There are also some things which the government should cease doing. That is the continuous intervention in the economic system, particularly the *ad hoc* kind of intervention which grants a duty-free import here and gives special encouragement for a particular loan there. Economic actors must have a body of rules to pattern their conduct on. Continuous changes in the rules or the granting of a continuous stream of exceptions, which amounts to the same thing will gradually paralyze both the government bureaucracy and private entrepreneurs. Decision making becomes exceedingly risky under such intervention and doing nothing often becomes the wisest course of action. This is not to say that operating rules of the system should not be improved whenever possible. Indeed, a number of suggestions for such improvements have been given. Still, day-to-day permanence of a consistent system has to stand and economic actors must be convinced of both its permanence and overall consistency in order for the economic system to function efficiently. Sociologists may question whether such a framework can evolve here, given the client-patron personal relationship structure in Philippine society. Nevertheless, a framework for economically consistent action remains an indispensable condition for improved industrial efficiency. In the long run, improved resource allocation provides the foundation for productivity improvement.

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## APPENDICES

A. Production and Inputs for Manufacturing Establishments with 20 or More Workers, by Industry, 1956–1980

B. Producers' Price Index for Manufacturing, by Industry, for Establishments with 20 or More Workers

C. Index of Capacity Utilization in Manufacturing, 1956–1980

D. Estimates of Capital Stock in Manufacturing, by Industry at Replacement Cost, 1956–1980

E. Adjustment of Intermediate Inputs for Changes in Effective Protection Rates, by Manufacturing Industry, 1956–1980. Erlinda Medalla and Richard Hooley.

# APPENDIX A

## PRODUCTION AND INPUTS FOR MANUFACTURING ESTABLISHMENTS WITH 20 OR MORE WORKERS, BY INDUSTRY, 1956–1980

## Appendix A

### Production and Inputs for Manufacturing Establishments with 20 or More Workers, by Industry, 1956 – 1980

The reason for this appendix is to explain in detail the procedure for estimating output and inputs for establishments of a given size over the period 1956–1980. As explained in the text, the size of establishment covered by the Census and *Surveys of Manufactures* has varied over time. In recent years in particular, the NCSO has shifted from reporting characteristics of firms with 20 or more workers (or 5 or more workers) to *all* establishments, i.e., with 1 or more workers. The task, then, is to delineate a method of converting output and inputs as reported for all establishments to the levels corresponding to firms with 20 or more (or 5 or more) workers.

This appendix would be unnecessary if the Census or Surveys reported, even for a few benchmark dates, the major economic variables for establishments of different employment size. Unfortunately, over a period of 25 years, there is not a single issue of the Census/Survey which reports the variables for all sizes of establishments, i.e., $\geqslant$20 workers, $\geqslant$ 10 workers, $\geqslant$ 5 workers and $\geqslant$ 1 worker. We were fortunate in being furnished a complete print-out of the results of the 1975 Census for all these size classes of establishments. Our efforts to secure the same breakdown for 1980 were unsuccessful, however, apparently because the 1980 results have not yet been completely computerized. In any event, we were faced with the task of developing a method to extend the 1975 results to the period 1976–1980, and possibly beyond.

The importance of securing reliable estimates for firm sizes is based on two considerations. First, any time series which ignores the size of establishment will contain significant bias depending on whether the employment size cut-off is being lowered or raised: an upward bias when the latter is lowered and a downward bias when employment size is raised. Such spurious shifts in output will create spurious shifts in any productivity measures derived from these estimates. Second, because the structure of inputs varies with size of firm, a change in size coverage is accompanied, *ceteris paribus,* with a shift in productivity. For example, output per worker varies positively with size of firm, while output per unit of capital tends to vary inversely.

In correcting the Census/Survey data for coverage, we followed three general principles which were formulated after extensive experimentation with the raw data: (1) the relationship between the share of output/input covered varies systematically (but not linearly) with the proportion of establishments covered, (2) the relationship between the proportion of establishments covered varies systematically but not linearly with employment size; and (3) both sets of relationships are unique for certain industries; hence, the necessity of estimation procedures which recognize the possibility of inter-industry differences in the above relationships. That is to say, we estimate these relationships for certain industries individually while for other industries, it is possible to treat them together as a group, because they are essentially homogeneous as regards size of establishment on the one hand and the proportion of significant economic variable coverage on the other.

We will now illustrate our estimation procedure for production of manufacturing firms with 20 or more workers for 1975. We will then compare this estimate to actual production of such firms as shown in the printout prepared for this project by the NCSO.

The first step is to isolate the three industries in which most of the small firms are

clustered. For these industries, we take a fixed ratio of large establishments to total establishments.

| Industry | Number – All Establishments | Number – Large Establishments ( 20 Workers ) | |
|---|---|---|---|
| Food (311–12) | 27,232 | 541 | (.0199) |
| Apparel (322) | 27,594 | 150 | (.0055) |
| Wood products (332) | 2,610 | 156 | (.0148) |
| TOTAL | 57,436 | 850 | (.0148) |

We have now estimated 850 establishments in the food, apparel and wood products industries as being in the "large establishments" group. This was done on the basis of fixed coefficients because the ratio of large to all establishments was so small. However, for the remainder of industries, the ratio is by no means small, and for these other industries, we need a more sophisticated technique.

We fit a function over a cross section of industries in which the cumulative percent of establishments excluded is a function of $(N/E)$ the number of workers per establishment and $(FA)$ the value of fixed assets. The resulting equation is

$$C = 25.128 \lg N/E + 5.424 \lg 1/FA^2$$

For establishments of average size 20 worker this yield

$$C = 25.128\ (3.0) + 5.424\ (2.338)$$
$$= 88.068$$

That is to say 88.068 percent of establishments in industries other than food, apparel and wood products are excluded from establishment total when considering only large establishments.

The total of large establishments for all industries is then computed as follows:

*For these three industries, the percentage of large establishments is so small that it is statistically not feasible to use an estimating function. Moreover, even if the percentages changes from period to period, the impact of such changes on the overall number of establishments is most likely to be insignificant.

| | |
|---|---|
| Large establishments in Food, Apparel and Wood Products | 850 |
| Large establishments in the remainder of industries (19,855) X (1 –.88086) | 2,366 |
| Total of large firms, all industries | 3,216 |

The estimate 3,216 compares to the NCSO printout figure of 3,244 or a difference of 0.8 percent.

Now we can proceed to estimate the share of production reported for all establishments represented by this proportion of large establishments. For this purpose, we utilized the following relationship derived from a cross section fit:

$$P_{ex} = \mathcal{L}(1 - C)$$
$$= .670\,(.119) = .079$$

Where $P_{ex}$ is the value of production excluded from the production of all establishments and $\mathcal{L}$ is an estimated coefficient. C is as defined above.

Total production of firms with 20 or more workers, therefore, is (1 – .079) multiplied by reported production of all establishments or (1 – .079) P55,470 = P51,088.5 million. Corresponding values of other variables such as value added, investment expenditures, etc., are obtained in a similar manner.

Estimates of the major variables for establishments with 20 or more workers by industry are shown in the following table.

## APPENDIX TABLE 1
## PRODUCTION AND INPUTS IN MANUFACTURING, BY INDUSTRY FOR FIRMS WITH 20 OR MORE WORKERS[a]

| YEAR | ESTAB-LISH MENTS | EMPLOYMENT TOTAL | EMPLO-YEES | PAYROLL | GROSS OUTPUT | COST OF MTLS | VALUE ADDED | FIXED ASSET | INVEST EXP | ENDING INVENTORY |
|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | 1883 | 150.8 | 149.3 | 278.5 | 1994.2 | 1074.6 | 919.6 | 737.5 | 92.6 | 423.7 |
| 1957 | 2075 | 172.7 | 170.8 | 322.3 | 2391.5 | 1301.8 | 1089.7 | 843.4 | 143.4 | 513.2 |
| 1958 | 1894 | 178.3 | 176.9 | 347.4 | 2757.3 | 1452.4 | 1304.7 | 960.8 | 170.3 | 572.3 |
| 1959 | 1858 | 185.5 | 184.3 | 386.4 | 3139.7 | 1666.2 | 1473.5 | 1011.8 | 164.3 | 657 |
| 1960 | 1884 | 199.1 | 197.9 | 422.7 | 3547.6 | 1915.9 | 1631.7 | 1182.1 | 246.5 | 756.8 |
| 1961 | 2108* | 243.7+ | 239.0+ | 488.3 | 4573.4+ | 2530.6+ | 2042.7+ | 1465.9+ | 429.3+ | 997.5 |
| 1962 | 2180 | 230.4 | 229.1 | 506.1 | 5104.2 | 3004.6 | 2079.5 | 1631.9 | 444.7 | 1297.9 |
| 1963 | 2219 | 250.1 | 248.7 | 574.2 | 6335.2 | 3724.9 | 2610.3 | 2144.4 | 332.3 | 1211.8 |
| 1964 | 2196 | 266.2 | 264.7 | 643.3 | 6961.3 | 4228.1 | 2733.2 | 2419 | 402.2 | 1378.3 |
| 1965 | 2152 | 273.4 | 272.1 | 709.2 | 7020.3 | 4314.2 | 2706.1 | 2747.6 | 428.9 | 1596.1 |
| 1966 | 2075 | 275.9 | 274.5 | 787.8 | 7713.3 | 4742.8 | 2970.5 | 3149.7 | 587.7 | 1754.9 |
| 1967 | 2282* | 303.7* | 307.2* | 918.3* | 9606.8* | 5792.1* | 3814.6* | 3704.5* | 850.9+ | 1797.1 |
| 1968 | 2385 | 325.1 | 323.6 | 983.5 | 10553.6 | 6316.8 | 4236.7 | 3977.9* | 611.6 | 2131.8 |
| 1969 | 2170 | 331.8 | 330.5 | 1060.3 | 11265.4 | 6646.5 | 4618.8 | 4201.3 | 806.2 | 2247.9 |
| 1970 | 2156 | 333.1 | 332.1 | 1193.2 | 15026.3 | 9071.6 | 5954.7 | 5439.1 | 1309 | 3465.2 |
| 1971 | 2045 | 353 | 352.3 | 1451.4 | 18604.4 | 11480.2 | 7124.2 | 6909.7 | 1161.2 | 3961.6 |
| 1972 | 2664* | 400.5+ | 395.3+ | 1743.3+ | 21095.5+ | 15257.7+ | 8494.2* | 8527.5+ | 1537.1+ | 4978 |
| 1973 | 2973 | 455.9 | 454.8 | 1958.1 | 30347.8 | 19475.2 | 10872.5 | 10371.3 | 1444.5 | 6561.2 |
| 1974 | 2843 | 454.2 | 453.3 | 2276.6 | 46656.2 | 31359.9 | 15296.2 | 10251.6 | 2120.2 | 10713.3 |
| 1975 | 3244 | 477.7 | 472.0+ | 2692.5 | 51688.5+ | 34923.7+ | 20681.1 | 12642.4+ | 3328.5 | 10228.2 |
| 1976 | 3268 | 532.8 | 531.7 | 3653.9 | 51702.7 | 39123.9 | 12578.8 | 17965.3 | 2753.6 | 11267.7 |
| 1977 | 3276 | 599.6 | 593.6 | 4812.1 | 70333.6 | 52937.9 | 17395.7 | 18402.2 | 3067.9 | 15246.1 |
| 1978 | 3410 | 641.3 | 634.9 | 5841.7 | 84962 | 61590.2 | 23371.7 | 23699.7 | 4240.3 | 17737.9 |
| 1979 | 3544 | 683.1 | 676.2 | 6871.3 | 99590.4 | 70242.6 | 29347.8 | 28997.2 | 5412.8 | 20229.9 |
| 1980 | 3549 | 772.3 | 764.6 | 9659.4 | 132028.7 | 91490.6 | 40538.7 | 39982.9 | 8483.2 | 26349.4 |

[a]Data in million pesos, except number of establishments.

+Estimated from 1975 Census.

*Interpolated as 2/3 the difference between surrounding years.

## FOOD MANUFACTURING

| YEAR | ESTAB-LISH MENTS | EMPLOYMENT TOTAL | EMPLO-YEES | PAYROLL | GROSS OUTPUT | COST OF M+Is | VALUE ADDED | FIXED ASSET | I EXP. | ENDING INVENTORY |
|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | 346 | 38291 | 38600 | 64.8 | 599.6 | 357.2 | 242.2 | 237.2 | 17.3 | 91.4 |
| 1957 | 357 | 40865 | 40554 | 66.6 | 659 | 407.8 | 251.3 | 232 | 21.7 | 95.9 |
| 1958 | 332 | 40666 | 40435 | 69.5 | 787.4 | 462.9 | 324.5 | 274.3 | 24.2 | 112.9 |
| 1959 | 329 | 41977 | 41748 | 77.4 | 870.2 | 509 | 361.1 | 238.7 | 27.2 | 137.5 |
| 1960 | 335 | 44188 | 43939 | 85.2 | 1028.5 | 591.8 | 436.7 | 270.6 | 33.4 | 155.3 |
| 1961 | 396 | 45924 | 45665 | 91.4 | 1228.7 | 719.7 | 508.9 | 324.8 | 59.3 | 153.9 |
| 1962 | 427 | 46792 | 46446 | 94.5 | 1547.6 | 992.8 | 554.8 | 323.4 | 67.8 | 238 |
| 1963 | 383 | 48263 | 47936 | 102.7 | 1943.3 | 1208.8 | 734.3 | 387.9 | 53 | 250.8 |
| 1964 | 388 | 50981 | 50658 | 120.2 | 2203.1 | 1393.3 | 809.9 | 438.7 | 96.8 | 289 |
| 1965 | 370 | 54544 | 54173 | 133.2 | 2116.8 | 1477.6 | 639.4 | 617.2 | 124.9 | 306.6 |
| 1966 | 352 | 51647 | 51583 | 144.9 | 2186.9 | 1481.8 | 705 | 31.1 | 142.9 | 307.5 |
| 1967 | 378 | 58817 | 58599 | 165.9 | 2379.5 | 1823.1 | 916.3 | 821.2 | 176.9 | 337.3 |
| 1968 | 391 | 62403 | 62108 | 176.4 | 3015.8 | 1993.8 | 1022 | 866.3 | 185 | 414.5 |
| 1969 | 326 | 62471 | 62179 | 192.8 | 3125 | 2017.7 | 1107.2 | 943.4 | 124.8 | 447.6 |
| 1970 | 323 | 63444 | 63204 | 223.3 | 3612.4 | 2175.7 | 1436.8 | 1109 | 234.8 | 541.3 |
| 1971 | 309 | 69273 | 69140 | 273.6 | 5432.9 | 2436.1 | 1996.8 | 1564 | 323.7 | 697 |
| 1972 | 422 | 83104 | 82944 | 347.7 | 6125.6 | 4322.7 | 2276.1 | 2338.1 | 234.5 | 815 |
| 1973 | 479 | 92020 | 91665 | 384.8 | 8886.3 | 5951.3 | 2934.9 | 2725.2 | 383.5 | 1171.3 |
| 1974 | 451 | 85959 | 85749 | 509.2 | 14165.3 | 9409 | 4756.2 | 2571.7 | 364.7 | 1693.9 |
| 1975 | 541 | 89932 | 87875 | 571.5 | 13256.3 | 9344.7 | 4677.5 | 3305 | 644.3 | 1722.5 |
| 1976 | 554 | 58581 | 86825 | 643.9 | 11560.2 | 10332.3 | 2249.3 | 4291.1 | 414.5 | 1317.3 |
| 1977 | 531 | 95118 | 92942 | 815 | 15645.3 | 13439.1 | 2206 | 4912.1 | 494.3 | 1713.4 |
| 1978 | 561 | 105226 | 102819 | 976.2 | 19063.8 | 16105.2 | 3945.3 | 5762.8 | 702 | 2053.4 |
| 1979 | 590 | 115344 | 112705 | 1137.5 | 22482.2 | 18771.3 | 5684.5 | 6613.4 | 910 | 2393.3 |
| 1980 | 585 | 136877 | 133746 | 1590.4 | 27235.1 | 22645.3 | 7096.6 | 10527.4 | 1004.4 | 2887.3 |

## SUGAR MILLING

| YEAR | ESTAB-LISH MENTS | EMPLOYMENT TOTAL | EMPLO-YEES | PAYROLL | GROSS OUTPUT | COST OF M+ls | VALUE ADDED | FIXED ASSET | I EXP. | ENDING INVENTORY |
|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | 31 | 17550 | 17545 | 33.7 | 304.9 | 140.2 | 164.7 | 177.5 | 9.8 | 59.9 |
| 1957 | 38 | 17910 | 17899 | 33 | 319.3 | 136.8 | 182.4 | 164.9 | 7.1 | 58.6 |
| 1958 | 36 | 17372 | 17362 | 34.7 | 374.5 | 155.8 | 218.7 | 183.1 | 7.8 | 66.8 |
| 1959 | 36 | 17237 | 17225 | 37.1 | 368.8 | 151.2 | 217.6 | 144.1 | 11.2 | 64.7 |
| 1960 | 31 | 18324 | 18317 | 39.9 | 447.7 | 172.1 | 275.7 | 168.1 | 12.2 | 60.5 |
| 1961 | 29 | 17608 | 17604 | 40.2 | 470.7 | 158.8 | 312.1 | 175.1 | 19.1 | 57.1 |
| 1962 | 38 | 18446 | 18433 | 43.2 | 658.9 | 303.2 | 355.7 | 171.5 | 19.8 | 82.7 |
| 1963 | 35 | 20199 | 20180 | 49.2 | 836.3 | 344.6 | 487.7 | 207.9 | 23.2 | 103.2 |
| 1964 | 34 | 21221 | 21206 | 58.6 | 887.8 | 373.9 | 573.9 | 217.2 | 53.6 | 112.2 |
| 1965 | 35 | 23884 | 23872 | 65.8 | 677.2 | 339.3 | 337.7 | 344.5 | 77.7 | 101.7 |
| 1966 | 32 | 21445 | 21436 | 67.9 | 604.2 | 267.8 | 336.4 | 401.5 | 43.4 | 80.4 |
| 1967 | 29 | 20631 | 20621 | 68 | 870.3 | 369.8 | 500.5 | | 58.6 | 95 |
| 1968 | 30 | 20212 | 20201 | 68.1 | 849.9 | 315.4 | 534.5 | 410.7 | 73.3 | 114.3 |
| 1969 | 29 | 22645 | 22639 | 81.6 | 984.2 | 422.1 | 562.1 | 466 | 40.5 | 122.3 |
| 1970 | 34 | 25270 | 25267 | 102.4 | 1429.4 | 619.7 | 814.6 | 594.7 | 151.8 | 139.1 |
| 1971 | 33 | 28461 | 28459 | 118.7 | 1809.8 | 719.7 | 1090.1 | 894.2 | 205.9 | 131.1 |
| 1972 | 36 | 31164 | 31163 | 144.2 | 2399.7 | 867.9 | 1531.8 | 1505.1 | 223.3 | 156.3 |
| 1973 | 38 | 32556 | 32556 | 157.3 | 2703.7 | 944.3 | 1759.4 | 1819.8 | 232.3 | 186.1 |
| 1974 | 35 | 32077 | 32077 | 199.2 | 4394.3 | 1366.3 | 3127.9 | 1573.9 | 142.8 | 245.2 |
| 1975 | 38 | 33999 | 33997 | 265.6 | 4447.6 | 1945.1 | 1792.3 | 1792.3 | 311.8 | 288.6 |
| 1976 | | | | | | | | | | |
| 1977 | | | | | | | | | 367.2 | |
| 1978 | | | | | | | | | 392.8 | |
| 1979 | 38 | 35654 | 35181 | 338.2 | 74.4 | 2507.3 | 1321.1 | 3423.9 | 442.5 | 501.5 |
| 1980 | 38 | 32353 | 31630 | 354.9 | 750.9 | 3067.8 | 1532.9 | 4721.7 | 112.6 | 613.6 |

## BEVERAGES

| YEAR | ESTAB-LISH MENTS | EMPLOYMENT TOTAL | EMPLO-YEES | PAYROLL | GROSS OUTPUT | COST OF M+Is | VALUE ADDED | FIXED ASSET | I EXP. | ENDING INVENTORY |
|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | 56 | 7612 | 7578 | 19.3 | 145.6 | 49.1 | 96.5 | 46.3 | 1.8 | 10.7 |
| 1957 | 63 | 8423 | 8404 | 23.1 | 157.2 | 53.4 | 103.9 | 43.9 | 4.2 | 13 |
| 1958 | 61 | 8486 | 8471 | 23.7 | 178.3 | 60.3 | 118 | 44.3 | 7.2 | 14.3 |
| 1959 | 63 | 8869 | 8850 | 25.9 | 198 | 66.2 | 131.8 | 44.1 | 8.3 | 18.9 |
| 1960 | 62 | 8837 | 8826 | 27.5 | 212.4 | 78.1 | 134.3 | 47.8 | 12.1 | 25.6 |
| 1961 | 88 | 10061 | 10201 | 31.1 | 227.5 | 81.7 | 145.9 | 56 | 15.1 | |
| 1961 | 63 | 10383 | 10370 | 30.3 | 230.9 | 83.2 | 147.7 | 56.3 | 15 | 31.3 |
| 1962 | 63 | 11144 | 11128 | 35 | 264.3 | 105.5 | 158.9 | 61.6 | 10.1 | 26 |
| 1963 | 61 | 10992 | 10975 | 37.2 | 327.9 | 125.6 | 202.3 | 67.2 | 8.4 | 36.4 |
| 1964 | 66 | 11378 | 11362 | 40.2 | 383.7 | 143.7 | 240.1 | 77.1 | 17.7 | 48.8 |
| 1965 | 64 | 11765 | 11745 | 44.1 | 418.9 | 149.7 | 269.3 | 84.6 | 16.8 | 60.5 |
| 1966 | 62 | 13245 | 13235 | 57 | 498.1 | 191.5 | 306.5 | 98.3 | 24.8 | 63.3 |
| 1967 | 63 | 12805 | 12795 | 53.3 | 745.1 | 268.9 | 481.5 | 110.4 | 37.4 | 45.2 |
| 1968 | 63 | 12589 | 12580 | 51.5 | 623.9 | 256.7 | 367.3 | 118.4 | 17.9 | 51.3 |
| 1969 | 66 | 14782 | 14770 | 60.3 | 687.5 | 270.9 | 416.7 | 180 | 30.3 | 60.5 |
| 1970 | 67 | 14856 | 14846 | 74.1 | 842.2 | 341.3 | 500.9 | 187.9 | 25.1 | 93.5 |
| 1971 | 65 | 15605 | 15599 | 84.3 | 1014.8 | 429.2 | 585.6 | 189.4 | 44.4 | 114.4 |
| 1972 | 72 | 16798 | 16792 | 80.7 | 882.8 | 573.3 | 429.8 | | 37.6 | 152.2 |
| 1973 | 76 | 17385 | 17371 | 110.7 | 1245.7 | 694.1 | 641.5 | | | |
| 1974 | 81 | 18265 | 18751 | 183 | | 883 | 876 | | | |
| 1975 | 81 | 28500 | 28478 | 180.5 | 3921.2 | 1284 | 2881 | 336.2 | 92.4 | 206.3 |
| 1976 | 119 | 13336 | 13326 | 163.6 | 2199.3 | 1459.4 | 1214.3 | 302.7 | 61.4 | 319.4 |
| 1977 | 117 | 14811 | 14800 | 212.2 | 3493.2 | 1860.5 | 1554.7 | 348.3 | 178 | 370.1 |
| 1978 | 115 | 16800 | 16400 | 290.4 | 3450.3 | 2137.7 | 1550.4 | 590.2 | 256.3 | 425.2 |
| 1979 | 112 | 17795 | 17782 | 329.5 | 3404.8 | 2227.6 | 1546.1 | 711.2 | 294.9 | 443.1 |
| 1980 | 113 | 20216 | 20201 | 473.4 | 5051.3 | 3964.7 | 2070.3 | 1743.2 | 841.3 | 788.6 |

## TOBACCO PRODUCTS

| YEAR | ESTAB–LISH MENTS | EMPLOYMENT TOTAL | EMPLO–YEES | PAYROLL | GROSS OUTPUT | COST OF M+Is | VALUE ADDED | FIXED ASSET | I EXP. | ENDING INVENTORY |
|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | 48 | 10753 | 10720 | 15.9 | 151 | 79.9 | 71.7 | 17.6 | 6.1 | 35.8 |
| 1957 | 53 | 11476 | 11442 | 18.3 | 171.5 | 74.5 | 7 | 22.7 | 6.2 | 41.6 |
| 1958 | 53 | 10744 | 10711 | 18.6 | 210.5 | 98.6 | 111.9 | 29.3 | 6.9 | 58.6 |
| 1959 | 56 | 11848 | 11808 | 20.2 | 197.2 | 107.4 | 89.9 | 35.2 | 5.7 | 75.2 |
| 1960 | 53 | 12906 | 12871 | 21.2 | 185.2 | 100.9 | 84.3 | 34.9 | 6.9 | 72.5 |
| 1961 | 52 | 12676 | 12642 | 20.9 | 220.8 | 102.8 | 117.9 | 34.5 | 8.0 | 75.7 |
| 1962 | 51 | 12562 | 12519 | 20.7 | 206.3 | 94.6 | 111.8 | 34.1 | 13 | 80.9 |
| 1963 | 51 | 12835 | 12801 | 22.3 | 252.2 | 139.4 | 112.8 | 43.3 | 8 | 85.7 |
| 1964 | 52 | 13846 | 13820 | 24.9 | 276.3 | 164.5 | 111.7 | 43.7 | 9.7 | 90.5 |
| 1965 | 48 | 13764 | 13729 | 24.5 | 324.2 | 172.6 | 151.6 | 53.9 | 13.2 | 95.3 |
| 1966 | 46 | 14830 | 14808 | 31.8 | 380.4 | 218.7 | 161.7 | 53.3 | 15 | 100.1 |
| 1967 | 49 | 17401 | 17375 |  | 944.0 | 373.6 | 577.0 |  | 10.5 | 104.9 |
| 1968 | 51 | 18668 | 18642 | 40.1 | 587.6 | 301.7 | 285.9 | 91.8 | 20.3 | 98 |
| 1969 | 47 | 20156 | 20116 | 48.9 | 731.5 | 334.3 | 397.1 | 99.5 | 11.9 | 116.6 |
| 1970 | 49 | 22484 | 22456 | 58.4 | 882.7 | 453.9 | 428.8 | 114.6 | 39.2 | 199.6 |
| 1971 | 45 | 21200 | 21188 | 68.7 | 994.6 | 450.8 | 543.8 | 140.5 | 42.3 | 195 |
| 1972 | 45 | 21874 | 21862 | 63.7 | 1222.9 | 955.1 | 534.6 |  | 63.3 | 369.2 |
| 1973 | 45 | 22206 | 22201 | 78.7 | 1505.7 | 964.2 | 541.5 | 203.2 | 52.2 | 469.8 |
| 1975 | 34 | 20310 | 20301 | 81.5 | 2486.2 | 1424.1 | 1360.9 | 223.7+ | 54.5 | 577.2 |
| 1976 | 35 | 18479 | 18471 | 106.2 | 2239.6 | 2027.4 | 604.9 | 228.4 | 48.5 | 587.1 |
| 1977 | 34 | 20508 | 20500 | 129.7 | 3203.7 | 2531.4 | 669.1 | 242.6 | 169.4 | 732.9 |
| 1978 | 36 | 19980 | 19979 | 162.4 | 4010.2 | 2653 | 1672.1 | 345.6 | 83.9 | 768.2 |
| 1979 | 38 | 19709 | 19701 | 179.3 | 4425.7 | 2702.2 | 188.9 | 398.7 | 39.7 | 782.5 |
| 1980 | 39 | 20124 | 20116 | 234.6 | 4697.8 | 2598.3 | 2656.9 | 439.9 | 130.3 | 752.3 |

## TEXTILES

| YEAR | ESTAB–LISH MENTS | EMPLOYMENT TOTAL | EMPLO–YEES | PAYROLL | GROSS OUTPUT | COST OF M+Is | VALUE ADDED | FIXED ASSET | I EXP. | ENDING INVENTORY |
|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | 80 | 8524 | 8508 | 15.9 | 115.4 | 73.4 | 41.9 | 31.2 | 20.4 | 38 |
| 1957 | 113 | 13863 | 13762 | 22.9 | 191.2 | 123.2 | 68 | 68.5 | 22.5 | 67.8 |
| 1958 | 74 | 16852 | 16786 | 28.9 | 228.7 | 46 | 82.7 | 97.4 | 40.6 | 54.7 |
| 1959 | 79 | 18743 | 18730 | 34.6 | 249.3 | 164.7 | 84.5 | 120.9 | 32.7 | 64.8 |
| 1960 | 81 | 24411 | 24400 | 42.2 | 276.6 | 174.7 | 101.9 | 170.6 | 67.4 | 91.8 |
| 1961 | 86 | 28266 | 28253 | 46.3 | 309.0 | 182.7 | 126.4 | 228.7 | 80.5 | 118.3 |
| 1962 | 89 | 30164 | 30159 | 52.4 | 385.2 | 248.4 | 136.8 | 321.8 | 86.7 | 185.4 |
| 1963 | 102 | 34523 | 34453 | 60.1 | 507.1 | 324.6 | 182.5 | 367.4 | 70.6 | 191.6 |
| 1964 | 105 | 34939 | 34695 | 62.2 | 471.1 | 302 | 109.1 | 440.3 | 43.8 | 197.9 |
| 1965 | 110 | 33398 | 33367 | 65.6 | 445.3 | 264.9 | 180.4 | 472.6 | 38.8 | 204.1 |
| 1966 | 105 | 35815 | 35872 | 77 | 506.3 | 323.5 | 182.9 | 457.9 | 51.9 | 210.4 |
| 1967 | 112 | 42240 | 42307 |  | 676.1 | 444.1 | 236.2 |  | 54.5 | 216.6 |
| 1968 | 115 | 45405 | 45376 | 108.1 | 758.7 | 456.6 | 302.2 | 552.7 | 70.7 | 281.2 |
| 1969 | 111 | 46334 | 46322 | 110.9 | 786.9 | 494.8 | 292.1 | 540.7 | 72.7 | 343.8 |
| 1970 | 107 | 51417 | 51403 | 124.7 | 1091.2 | 690.1 | 401.2 | 653.5 | 91.9 | 377.1 |
| 1971 | 113 | 47000 | 46983 | 146.4 | 1426.1 | 92.9 | 499.2 | 601 | 87 | 455.7 |
| 1972 | 200 | 70337 | 70312 | 162.5 | 1511.7 | 1177.5 | 622.3 |  | 128.8 | 653.7 |
| 1973 | 243 | 81831 | 81707 | 261.7 | 2583.5 | 1645.9 | 937.5 | 1005.5 | 190.9 | 875.5 |
| 1974 | 227 | 84257 | 84166 | 309.7 | 3469.1 | 2292.5 | 1176.6 | 1137.5 | 339.8 | 544.3 |
| 1975 | 275 | 69900 | 69824 | 283.2 | 3260.0+ | 2573.1+ | 1312.8 | 1471.6+ | 808.1+ | 1405.6 |
| 1976 | 260 | 58732 | 58669 | 362.9 | 3808.1 | 3679.1 | 943 | 1929.1 | 518.5 | 2009.7 |
| 1977 | 233 | 61059 | 60993 | 447.8 | 4767.1 | 4096.4 | 642 | 2427.3 | 297.8 | 2237.5 |
| 1978 | 295 | 78665 | 78580 | 703.5 | 6674.2 | 5314.8 | 2036.6 | 3749.6 | 821.1 | 2901.6 |
| 1979 | 327 | 87736 | 87641 | 865.5 | 7656.7 | 5942.5 | 2755.1 | 4430.8 | 1090.7 | 3246.5 |
| 1980 | 331 | 89523 | 89426 | 1016.5 | 8857.5 | 7356.5 | 2616.1 | 5516.7 | 913.9 | 1018.3 |

## WEARING APPAREL

| YEAR | ESTAB–LISH MENTS | EMPLOYMENT TOTAL | EMPLO–YEES | PAYROLL | GROSS OUTPUT | COST OF M+Is | VALUE ADDED | FIXED ASSET | I EXP. | ENDING INVENTORY |
|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | 378 | 11987 | 11513 | 12,086 | 78.27 | 55 | 23.3 | 11.8 | 1.2 | 16.4 |
| 1957 | 386 | 12356 | 11872 | 11.95 | 73.95 | 50 | 23.9 | 12.1 | 1.8 | 16.7 |
| 1958 | 355 | 11754 | 11329 | 11.917 | 71.721 | 49.3 | 2.4 | 15.2 | 1.4 | 18.9 |
| 1959 | 296 | 12120 | 11770 | 130483 | 102.026 | 64.1 | 37.9 | 28 | 5 | 24.6 |
| 1960 | 264 | 9802 | 9524 | 11.094 | 76.042 | 52.1 | 23.9 | 13 | 1.4 | 21.8 |
| 1961 | 250* | 9568* | 9308* | 10.929* | 81.900* | 55.9* | 25.9* | 13.7* | 2.2* | 19.1 |
| 1962 | 237 | 9451 | 9200 | 10.846 | 84.83 | 57.9 | 26.9 | 14.1 | 2.6 | 11.5 |
| 1963 | 237 | 10621 | 10394 | 12.683 | 91.537 | 58.9 | 32.6 | 15.8 | 1.6 | 13.1 |
| 1964 | 194 | 11636 | 11451 | 15.046 | 84.84 | 50.7 | 34.1 | 15.6 | 2.5 | 14.9 |
| 1965 | 164 | 9022 | 8856 | 13.866 | 79.831 | 47.9 | 32 | 17.2 | 1.5 | 16.5 |
| 1966 | 39 | 8306 | 8160 | 14.199 | 79.729 | 46.1 | 33.6 | 14.3 | 2.4 | 1.2 |
| 1967 | 145* | 7789* | 7618* | 13.44* | 87.291* | 55.6* | 31.5* | 15.7* | 2.0* | 19.9 |
| 1968 | 152 | 7530 | 7347 | 13.227 | 90.92 | 60.4 | 30.5 | 16.4 | 1.2 | 22 |
| 1969 | 118 | 5323 | 5172 | 8.73 | 77.639 | 55.8 | 21.8 | 13.6 | 4.5 | 21.4 |
| 1970 | 118 | 5040 | 4900 | 9.1 | 77.9 | 56 | 21.9 | 20.1 | 1.6 | 25.1 |
| 1971 | 101 | 5024 | 4912 | 10.5 | 95.4 | 66.7 | 28.7 | 21.9 | 1.6 | 30.1 |
| 1972 | 149* | 10881* | 10761* | 26.1 | 152.5+ | 91.9+ | 80.0+ | 29.6* | 8.8* | 24.2 |
| 1973 | 173 | 13810 | 13658 | 34 | 198 | 124.5 | 73.5 | 33.5 | 9.6 | 49 |
| 1974 | 169 | 16189 | 16080 | 46 | 282.1 | 83.6 | 98.5 | 38.8 | 8.6 | 61.5 |
| 1975 | 153 | 28811 | 28100+ | 106.8 | 414.7+ | 259.5+ | 214.8 | 134.4* | 45.3 | 96.8 |
| 1976 | 155e | 33427 | 32601 | 149.5 | 358.3 | 256.0 | 166.9 | 147.8 | 11.0 | 73.7 |
| 1977 | 156e | 32071 | 31278 | 181.4 | 504.1 | 284.6 | 219.6 | 160.5 | 15.2 | 81.8 |
| 1978 | 156e | 36336 | 35438 | 266.6 | 818.4 | 493.7 | 386.9 | 224.9 | 28.1 | 141.9 |
| 1979 | 156 | 40602 | 39599 | 351.9 | 1132.8 | 702.8 | 554.2 | 289.2 | 40.9 | 202.1 |
| 1980 | 156e | 52204 | 50913 | 594.2 | 1626.6 | 1047.9 | 753.1 | 461.5 | 63.9 | 301.3 |

## LEATHER PRODUCTS

| YEAR | ESTAB-LISH MENTS | EMPLOYMENT TOTAL | EMPLO-YEES | PAYROLL | GROSS OUTPUT | COST OF M+Is | VALUE ADDED | FIXED ASSET | I EXP. | ENDING INVENTORY |
|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | 11 | 560 | 555 | .7 | 6 | 3.5 | 2.5 | 1.5 | .7 | 1 |
| 1957 | 14 | 801 | 791 | 1.1 | 8.1 | 4.8 | 3.3 | 2.1 | .5 | 2.3 |
| 1958 | 14 | 770 | 762 | 1.1 | 7.1 | 4.4 | 2.7 | 2.5 | 1.3 | 1.8 |
| 1959 | 19 | 910 | 895 | 1.3 | 9.1 | 6.3 | 2.8 | 3.1 | .8 | 2.5 |
| 1960 | 21 | 1172 | 1157 | 1.9 | 14.9 | 9.3 | 5.6 | 4.7 | .7 | 4.1 |
| 1961 | 25 | 1281 | 1265 | 3.0 | 18.4 | 10.7 | 7.7 | 5.7 | .8 | 5.7 |
| 1962 | 27 | 1334 | 1312 | 2.4 | 15.3 | 9.6 | 5.7 | 5.4 | .6 | 6.3 |
| 1963 | 26 | 1504 | 1487 | 2.4 | 27 | 20.7 | 6.3 | 5.5 | .6 | 6.8 |
| 1964 | 29 | 1652 | 1632 | 2.8 | 18.4 | 11.8 | 6.6 | 7.4 | .7 | 7.3 |
| 1965 | 30 | 1900 | 1885 | 3.6 | 21.4 | 13.3 | 8.1 | 8.8 | 1.1 | 7.8 |
| 1966 | 30 | 1959 | 1943 | 3.6 | 21.5 | 13.5 | 8 | 9.4 | .3 | 8.2 |
| 1967 | 31 | 1970 | 1954 |  | 28.2 | 19.6 | 8.8 |  | .5 | 9.6 |
| 1968 | 31 | 1976 |  | 4.3 | 27.5 | 17.1 | 10.3 | 10.3 | .4 | 11 |
| 1969 | 32 | 2117 |  | 4.9 | 26.9 | 16.6 | 10.2 | 13.1 | .4 | 9.8 |
| 1970 | 27 | 1400 | 1378 | 3.5 | 29.7 | 19.7 | 10 | 11.1 | .4 | 8.7 |
| 1971 | 23 | 1298 | 1287 | 3.8 | 32 | 21.7 | 10.3 | 11.8 | 1.1 | 10.4 |
| 1972 | 26 | 1774 | 1759 | 3.1 | 29.2 | 19.1 | 19.1 |  | 1 | 8.5 |
| 1973 | 28 | 1652 | 1634 | 4.7 | 50.6 | 35 | 15.6 | 12.7 | 1 | 11 |
| 1974 | 32 | 1774 | 1751 | 5.3 | 54.6 | 39.1 | 15.5 | 12.4 | .5 | 12.4 |
| 1975 | 28 | 1969 | 1943 | 7.9 | 72.9 | 54.9 | 22.4 | 19.5 | 1.3 | 17.5 |
| 1976 | 29 | 1983 | 1957 | 10.4 | 71.3 | 64.5 | 17.5 | 25.5 | 3.1 | 16.8 |
| 1977 | 26 | 1690 | 1668 | 9.5 | 82.7 | 67.4 | 14.5 | 15.9 | 2 | 17.5 |
| 1978 | 28 | 2410 | 2378 | 18.1 | 169.6 | 132.8 | 43.2 | 32.1 | 4.2 | 34.5 |
| 1979 | 29 | 2781 | 2745 | 22.6 | 212.1 | 166.5 | 58.1 | 40.5 | 5.4 | 43.3 |
| 1980 | 29 | 2854 | 2817 | 29.5 | 179. | 141.2 | 53.5 | 62.5 | 7.8 | 36.7 |

## FOOTWEAR

| YEAR | ESTAB-LISH MENTS | EMPLOYMENT TOTAL | EMPLO-YEES | PAYROLL | GROSS OUTPUT | COST OF M+Is | VALUE ADDED | FIXED ASSET | I EXP. | ENDING INVENTORY |
|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | 144 | 5335 | 5090 | 5.5 | 29.3 | 20.2 | 9.2 | 5.2 | .2 | 7.2 |
| 1957 | 133 | 5146 | 4867 | 5.3 | 30.2 | 20.4 | 9.8 | 6.8 | .3 | 7.1 |
| 1958 | 108 | 4839 | 4612 | 5.3 | 28.9 | 18.3 | 10.5 | 2.5 | .5 | 7.1 |
| 1959 | 102 | 4609 | 4408 | 5.1 | 33.3 | 20.7 | 12.7 | 5.7 | 1 | 7.9 |
| 1960 | 101 | 4311 | 4092 | 5.2 | 32.6 | 21.6 | 11 | 6.4 | .8 | 8.4 |
| 1961 | 151 | 3990 | 3524 | 6.1 | 43.4 | 27.5 | 16.0 | 9.6 | 1.3 | 9.1 |
| 1962 | 104 | 3832 | 3599 | 4.3 | 27.1 | 18 | 9 | 7 | 1.6 | 8.5 |
| 1963 | 104 | 4233 | 3939 | 5.1 | 31.5 | 20.2 | 11.4 | 9.5 | 2 | 8.4 |
| 1964 | 72 | 4078 | 3826 | 4.9 | 32.4 | 19.7 | 12.8 | 9.7 | .8 | 8.4 |
| 1965 | 72 | 3927 | 3704 | 4.8 | 30.3 | 16.6 | 13.7 | 10 | .8 | 8.3 |
| 1966 | 70 | 3752 | 3530 | 5.2 | 36.3 | 20.3 | 16 | 7.7 | .3 | 8.3 |
| 1967 | 79 | 3499 | 3292 |  | 34.3 | 21.4 | 13.0 |  | .7 | 8.2 |
| 1968 | 83 | 3374 | 3079 | 4.8 | 24.5 | 15.1 | 9.4 | 6.9 | .3 | 8.6 |
| 1969 | 68 | 3058 | 2831 | 4.2 | 23.5 | 15.7 | 7.8 | 8.9 | .5 | 7.3 |
| 1970 | 58 | 2345 | 2245 | 3.4 | 8.7 | 11.7 | 7 | 12.1 | 2 | 6 |
| 1971 | 44 | 1798 | 1727 | 3 | 16.1 | 10.1 | 6 | 12.9 | .2 | 5.1 |
| 1972 | 52 | 2152 | 2067 | 4.7 | 37.8 | 27.8 | 13.7 |  | 2.0 | 5.1 |
| 1973 | 55 | 2327 | 2266 | 4.4 | 25.5 | 17 | 8.5 | 10.5 | .4 | 6.4 |
| 1974 | 54 | 2129 | 2066 | 4.4 | 26.7 | 16.8 | 9.9 | 12.7 | .5 | 5.8 |
| 1975 | 54 | 2615 | 2546 | 6.9 | 34.6 | 21.9+ | 10.3 | 22.1+ | 1.3 | 7.6 |
| 1976 | 59 | 4562 | 4356 | 11.4 | 36.6 | 29.5 | 12.9 | 43.9 | 5.2 | 7.6 |
| 1977 | 53 | 3842 | 3669 | 11.9 | 62 | 39.7 | 20 | 24.3 | .7 | 10.2 |
| 1978 | 55 | 4616 | 4408 | 21.5 | 114.4 | 77.7 | 41.4 | 67.2 | 2.3 | 20 |
| 1979 | 56 | 5015 | 4789 | 26.5 | 141.5 | 97.4 | 52.5 | 89.3 | 3.1 | 25.1 |
| 1980 | 56 | 4868 | 4648 | 29.2 | 183.9 | 135.5 | 53.6 | 60.5 | 4.7 | 34.9 |

## WOOD PRODUCTS

| YEAR | ESTAB-LISH MENTS | EMPLOYMENT TOTAL | EMPLO-YEES | PAYROLL | GROSS OUTPUT | COST OF M+Is | VALUE ADDED | FIXED ASSET | EXP. | ENDING INVENTORY |
|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | 174 | 16093 | 15999 | 28.5 | 125.6 | 72.8 | 52.8 | 44 | 6.6 | 16.5 |
| 1957 | 261 | 20363 | 20241 | 31.4 | 162.4 | 92.3 | 70.1 | 63.9 | 9.8 | 24.2 |
| 1958 | 221 | 21937 | 21840 | 34.6 | 144.3 | 78.3 | 66 | 77.2 | 10.6 | 22.5 |
| 1959 | 182 | 19078 | 19004 | 32 | 160.1 | 84.9 | 75.3 | 73.4 | 10.5 | 23.3 |
| 1960 | 180 | 17531 | 17466 | 30.4 | 167.6 | 97.2 | 70.4 | 83.6 | 10.1 | 25.7 |
| 1961 | 317 | 25657 | 25562 | 37.6 | 257.0 | 157.8 | 99.4 | 104.2 | 25.1 | 28.1 |
| 1962 | 385 | 29660 | 29332 | 46.7 | 276 | 155.4 | 120.4 | 110.8 | 20.3 | 38.1 |
| 1963 | 221 | 24464 | 24396 | 45 | 310.2 | 183.1 | 127 | 113.7 | 24.2 | 42.7 |
| 1964 | 236 | 28965 | 28897 | 56.7 | 366.2 | 219.1 | 147.1 | 144.7 | 50.9 | 47.3 |
| 1965 | 228 | 30501 | 30419 | 64.9 | 352.2 | 207.3 | 144.9 | 159.4 | 33.4 | 51.9 |
| 1966 | 232 | 31444 | 31357 | 69.4 | 394.9 | 224.7 | 170.2 | 186 | 48.3 | 56.5 |
| 1967 | 248 | 34448 | 34353 | 81 | 486.2 | 276.7 | 209.5 | 229.2 | 129.6 | 61.1 |
| 1968 | 256 | 35927 | 35814 | 87.1 | 533.2 | 303.6 | 229.7 | 251.5 | 19.9 | 82.6 |
| 1969 | 231 | 35410 | 35301 | 91.5 | 499.6 | 292.4 | 207.2 | 202.6 | 47.2 | 100.2 |
| 1970 | 217 | 35337 | 35243 | 98.5 | 630.6 | 389.1 | 241.6 | 267.3 | 66.7 | 120.7 |
| 1971 | 191 | 37900 | 37837 | 121.9 | 747.1 | 452.3 | 294.7 | 373.3 | 74.5 | 168.5 |
| 1972 | 263 | 41212 | 41143 | 186.7 | 1195.7 | 751.1 | 632.8 |  | 170.7 | 250.4 |
| 1973 | 298 | 42843 | 42716 | 143.8 | 1155.4 | 663.8 | 491.6 | 495.2 | 105.8 | 207.1 |
| 1974 | 280 | 38008 | 37904 | 143,7 | 1226.4 | 765.5 | 460.9 | 493 | 109.1 | 332.1 |
| 1975 | 269 | 32673 | 32576 | 199.8 | 1352.8 | 1076.5+ | 656.9 | 543.9+ | 245.6+ | 316.1 |
| 1976 | 271 | 49169 | 49034 | 407.1 | 1677.5 | 1445.1 | 469.8 | 2290.6 | 138.2 | 361.2 |
| 1977 | 195 | 26219 | 26147 | 199.6 | 1548.5 | 1100 | 429.8 | 548.4 | 71.3 | 275 |
| 1978 | 227 | 37406 | 37304 | 363.4 | 3122.2 | 2421.9 | 975.6 | 1209.7 | 165 | 605.4 |
| 1979 | 244 | 43170 | 43052 | 447.8 | 3933 | 3102.9 | 1256.8 | 1550.4 | 213.3 | 775.7 |
| 1980 | 244 | 47769 | 47638 | 641.8 | 9683.8 | 3798.7 | 4676.4 | 1710.8 | 285.6 | 949.6 |

## FURNITURE AND FIXTURES

| YEAR | ESTAB–LISH MENTS | EMPLOYMENT TOTAL | EMPLO–YEES | PAYROLL | GROSS OUTPUT | COST OF M+Is | VALUE ADDED | FIXED ASSET | I EXP. | ENDING INVENTORY |
|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | 39 | 2073 | 2039 | 3.4 | 11.6 | 6 | 5.4 | 2.3 | .6 | 3.3 |
| 1957 | 54 | 2690 | 2628 | 4 | 12.6 | 7 | 5.6 | 3.2 | .1 | 4.1 |
| 1958 | 47 | 2328 | 2288 | 3 | 11 | 5.9 | 5.3 | 4.3 | 2.7 | 4.8 |
| 1959 | 46 | 2403 | 2366 | 3.3 | 13.2 | .5 | 6.7 | 4 | .3 | 5.1 |
| 1960 | 45 | 2393 | 2362 | 3.4 | 13.9 | 7.4 | 6.5 | 4.2 | – | 5.1 |
| 1961 | 53* | 2797* | 2760* | 4.3* | 16.6* | 8.7* | 7.2 | 11* | .4 | 5.2 |
| 1962 | 57 | 2999 | 2959 | 4.7 | 18 | 9.4 | 8.6 | 14.5 | .5 | 7.1 |
| 1963 | 58 | 3888 | 3842 | 5.4 | 24.6 | 12.3 | 12.2 | 17.8 | 1.3 | 8.4 |
| 1964 | 57 | 3390 | 3339 | 5.9 | 26.9 | 13.5 | 13.5 | 16.6 | 4.7 | 9.7 |
| 1965 | 60 | 4388 | 4331 | 6.6 | 25.9 | 13.8 | 12.2 | 19.2 | .8 | 11 |
| 1966 | 57 | 3793 | 3776 | 7.5 | 26.3 | 13.8 | 15.5 | 11.3 | 1 | 12.3 |
| 1967 | 111* | 7308* | 7236 | 15.7* | 101.4+ | 78.6+ | 22.9+ | 26.2* | 2.9+ | 13.7 |
| 1968 | 139 | 9066 | 8966 | 19.9 | 74.6 | 39.6 | 35.1 | 33.7 | 2 | 10.7 |
| 1969 | 117 | 7896 | 7820 | 18.3 | 64.9 | 35.8 | 29.1 | 33.8 | 1.4 | 7.3 |
| 1970 | 58 | 3689 | 3657 | 8.6 | 35.3 | 18.4 | 16.9 | 13.7 | .6 | 7.7 |
| 1971 | 51 | 3211 | 3188 | 8.6 | 34.4 | 18.2 | 16.3 | 13.8 | .5 | 8.4 |
| 1972 | 89* | 5355* | 5316* | 16.2* | 94.9+ | 61.2 | 49.1 | 21.7* | 2.2 | 13 |
| 1973 | 109 | 6427 | 6375 | 20.1 | 92.1 | 52.5 | 39.6 | 25.7 | 2.4 | 20.6 |
| 1974 | 103 | 6913 | 6860 | 24.5 | 138.9 | 83.1 | 55.8 | 27.2 | 3.6 | 30.5 |
| 1975 | 156 | 9014 | 8769+ | 29.3 | 183.5+ | 135.4+ | 74.8 | 52.4 | 13.4 | 38 |
| 1976 | 162 | 10183 | 9906 | 46.9 | 130.9 | 103.1 | 60.7 | 50.2 | 5.8 | 29.4 |
| 1977 | 148 | 8763 | 8525 | 45.1 | 193.7 | 131.0 | 62.6 | 38.1 | 10.2 | 37.3 |
| 1978 | 177 | 12716 | 12370 | 86.8 | 310.7 | 210.4 | 120.1 | 100.5 | 19.4 | 60 |
| 1979 | 207 | 16669 | 16215 | 128.6 | 427.7 | 289.8 | 177.6 | 163.0 | 28.5 | 82.6 |
| 1980 | 207 | 17035 | 16571 | 142.9 | 493.3 | 325.8 | 219.2 | 181.1 | 35.4 | 92.9 |

## PAPER AND PAPER PRODUCTS

| YEAR | ESTAB-LISH MENTS | EMPLOYMENT TOTAL | EMPLO-YEES | PAYROLL | GROSS OUTPUT | COST OF M+Is | VALUE ADDED | FIXED ASSET | I EXP. | ENDING INVENTORY |
|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | 35 | 2592 | 2575 | 4.5 | 39.8 | 23.3 | 16.5 | 15.7 | 3.4 | 7.7 |
| 1957 | 42 | 2982 | 2946 | 5.6 | 52.6 | 30.3 | 22.3 | 18 | 1.9 | 13.3 |
| 1958 | 41 | 2820 | 2806 | 6.8 | 61.6 | 33.2 | 28.4 | 20.4 | 13.2 | 4.2 |
| 1959 | 48 | 3531 | 3520 | 9.3 | 87 | 48.4 | 38.5 | 34.1 | 2.8 | 21.3 |
| 1960 | 57 | 4498 | 4487 | 11.6 | 113.9 | 68.3 | 45.5 | 63.5 | 19.9 | 32.3 |
| 1961 | 61 | 5357 | 5344 | 12.7 | 129.9 | 85.4 | 44.6 | 66.1 | 13.5 | 42.7 |
| 1962 | 63 | 5381 | 5366 | 13.8 | 141.2 | 92.8 | 48.4 | 78.8 | 15.2 | 45.8 |
| 1963 | 68 | 6125 | 6106 | 16.5 | 168 | 107 | 61 | 119.3 | 9.7 | 48.4 |
| 1964 | 61 | 6445 | 6436 | 17.1 | 174.6 | 120.7 | 53.9 | 117.4 | 8.1 | 51 |
| 1965 | 59 | 6111 | 6104 | 17.1 | 190.7 | 123.2 | 67.5 | 123.9 | 15.9 | 53.6 |
| 1966 | 62 | 6540 | 6526 | 20.8 | 221.6 | 145.6 | 76 | 152.3 | 8.4 | 56.2 |
| 1967 | 66 | 6949 | 6934 |  | 300.4 | 206.7 | 101.6 |  | 13.3 | 58.9 |
| 1968 | 68 | 7151 | 7125 | 24.7 | 307.2 | 190.3 | 116.9 | 166.6 | 10.8 | 70.5 |
| 1969 | 64 | 7597 | 7575 | 28.1 | 314.6 | 192.6 | 122 | 166 | 10.4 | 83.4 |
| 1970 | 67 | 7856 | 7839 | 35.1 | 452 | 299.7 | 152.3 | 180.2 | 56.1 | 128.8 |
| 1971 | 69 | 9052 | 9487 | 49.5 | 584.1 | 389.1 | 195 | 312.3 | 37.4 | 141.3 |
| 1972 | 82 | 10742 | 11258 | 71.1 | 717.8 | 558.7 | 289.3 |  | 436.6 | 238.5 |
| 1973 | 88 | 11575 | 11555 | 64.3 | 1053.3 | 736.4 | 316.8 | 705.8 | 41 | 253 |
| 1974 | 85 | 11840 | 11819 | 69.6 | 1571.4 | 1024.8 | 546.6 | 680.3 | 57.1 | 516.8 |
| 1975 | 79 | 10457 | 10438 | 65.5 | 1099.9 | 876.9+ | 498.3 | 1213.3+ | 184.4 | 361.1 |
| 1976 | 86 | 11358 | 11339 | 89.3 | 1893.5 | 1374.6 | 716.9 | 1005.6 | 145.2 | 420.3 |
| 1977 | 79 | 12058 | 12037 | 109.1 | 2347.7 | 1752.1 | 589.6 | 1444.9 | 104.4 | 535.8 |
| 1978 | 90 | 14951 | 14925 | 168.6 | 3500.5 | 2541.1 | 1186.9 | 1815.9 | 202.1 | 777.1 |
| 1979 | 95 | 16442 | 16413 | 199.3 | 4094.4 | 2947.6 | 1494.7 | 2007.1 | 252.5 | 901.4 |
| 1980 | 98 | 17082 | 17052 | 248.7 | 4252.5 | 3302.6 | 1326.9 | 2138 | 290.4 | 1009.9 |

PRINTING AND PUBLISHING

| YEAR | ESTAB-LISH MENTS | EMPLOYMENT TOTAL | EMPLO-YEES | PAYROLL | GROSS OUTPUT | COST OF M+Is | VALUE ADDED | FIXED ASSET | IEXP* | ENDING INVENTORY |
|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | 83 | 7608 | 7515 | 19.3 | 55.5 | 26.8 | 28.7 | 26.4 | 4.4 | 12.4 |
| 1957 | 96 | 8549 | 8498 | 23.1 | 76.2 | 31.1 | 45.1 | 28.4 | 4.5 | 13.3 |
| 1958 | 93 | 8427 | 8363 | 22.9 | 75.1 | 30.5 | 44.7 | 32.3 | 2.7 | 14.3 |
| 1959 | 89 | 8540 | 8514 | 26.9 | 76.9 | 34.8 | 42.2 | 29 | 4.8 | 19.9 |
| 1960 | 93 | 9123 | 9099 | 24.9 | 88.2 | 39.9 | 48.3 | 32.9 | 6 | 23.5 |
| 1961 | 108 | 9512 | 9487 | 28.5 | 120.6 | 57.3 | 63.3 | 50.0 | 7.2 | 27.2 |
| 1962 | 116 | 9713 | 9655 | 28.4 | 105.9 | 54.4 | 57.5 | 47.9 | 4.9 | 32.7 |
| 1963 | 134 | 10630 | 10569 | 39 | 135.5 | 60,8 | 74.7 | 57.2 | 8.4 | 36.4 |
| 1964 | 128 | 11353 | 11298 | 36 | 141.2 | 76.8 | 64.3 | 71 | 10 | 46.1 |
| 1965 | 125 | 11185 | 11139 | 38.3 | 171 | 80.1 | 90.9 | 70.7 | 14.1 | 48.1 |
| 1966 | 126 | 11211 | 11165 | 38.2 | 171.2 | 81.9 | 89.3 | 81.4 | 13.9 | 49.1 |
| 1967 | 134 | 11602 | 11554 |  | 179.3 | 106.1 | 74.3 |  | 14.7 | 47.8 |
| 1968 | 138 | 11795 | 11724 | 46.5 | 206.7 | 91.5 | 115.2 | 88.1 | 11 | 47.3 |
| 1969 | 127 | 11405 | 11347 | 48.8 | 210 | 93.8 | 116.2 | 76.9 | 6.3 | 50.8 |
| 1970 | 134 | 11622 | 11587 | 52.5 | 260.1 | 124.2 | 136.1 | 82.8 | 5.9 | 58.8 |
| 1971 | 125 | 11386 | 11371 | 62.1 | 294.3 | 137.5 | 156.8 | 88.1 | 14.9 | 59.5 |
| 1972 | 167 | 12181 | 12165 | 46.0 | 313.1 | 216.3 | 166.8 |  | 23.1* | 68.7 |
| 1973 | 188 | 12572 | 12545 | 57.8 | 452.8 | 262.6 | 190.1 | 128.4 | 30.1 | 95.2 |
| 1974 | 175 | 12433 | 12399 | 65.9 | 637.7 | 389 | 248.7 | 150.8 | 30.5 | 107.3 |
| 1975 | 174 | 10420 | 10391 | 58 | 531.8 | 315.1 | 247.5 | 132.8+ | 114.1+ | 83.1 |
| 1976 | 187 | 12664 | 12629 | 103.5 | 605.3 | 543.9 | 168.3 | 235.9 | 56.6 | 112.5 |
| 1977 | 165 | 10567 | 10538 | 104.1 | 903.1 | 638.4 | 258.7 | 239.5 | 59.9 | 132 |
| 1978 | 186 | 13197 | 13160 | 175.5 | 1413.7 | 1075.3 | 466.6 | 397.5 | 88.2 | 222.4 |
| 1979 | 197 | 14552 | 14512 | 212.4 | 1676.8 | 1300.4 | 573.8 | 478.9 | 102.8 | 268.9 |
| 1980 | 199 | 13789 | 13751 | 205 | 1549.2 | 1280.9 | 442.9 | 539.7 | 130.5 | 264.9 |

## INDUSTRIAL CHEMICALS

| YEAR | ESTAB-LISH MENTS | EMPLOYMENT TOTAL | EMPLO-YEES | PAYROLL | GROSS OUTPUT | COST OF M+Is | VALUE ADDED | FIXED ASSET | I EXP. | ENDING INVENTORY |
|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | 11 | 1015 | 1013 | 2.2 | 12 | 4.1 | 7.9 | 25.9 | 1.2 | 5.3 |
| 1957 | 16 | 1173 | 1171 | 2.8 | 16.5 | 6.4 | 10.1 | 28 | 1.8 | 3.7 |
| 1958 | 24 | 1754 | 1741 | 4.7 | 30.6 | 15.7 | 14.9 | 29.5 | 11.6 | 11.6 |
| 1959 | 24 | 1890 | 1887 | 5 | 37.5 | 11.5 | 26 | 35.5 | 2.4 | 14.3 |
| 1960 | 27 | 2136 | 2133 | 5.6 | 36.9 | 20.2 | 16.7 | 37.5 | 6.1 | 14.8 |
| 1961 | 28 | 5407 | 2404 | 6.2 | 60.7 | 29.8 | 30.9 | 39.1 | 5.5 | 18.1 |
| 1962 | 28 | 2540 | 2536 | 6.4 | 61 | 33 | 28 | 34.4 | 5.4 | 22.8 |
| 1963 | 32 | 2866 | 2863 | 7.8 | 81.6 | 44.7 | 36.8 | 40.2 | 7.2 | 30.3 |
| 1964 | 32 | 3040 | 3037 | 8.9 | 98.1 | 54 | 44.2 | 67 | 9.8 | 37.8 |
| 1965 | 35 | 3071 | 3069 | 10.4 | 95.2 | 53.3 | 41.9 | 86.6 | 17 | 45.3 |
| 1966 | 35 | 3873 | 3873 | 15.8 | 141.6 | 87.7 | 53.9 | 211.3 | 67.5 | 52.8 |
| 1967 | 34 | 3778 | 3778 |  | 307.0 | 214.1 | 94.8 |  | 46.5 | 60.4 |
| 1968 | 34 | 3731 | 3731 | 17.7 | 189.5 | 105.6 | 83.9 | 256.1 | 24.1 | 62.8 |
| 1969 | 35 | 4022 | 4022 | 18.5 | 198.9 | 114 | 84.9 | 286 | 9 | 80.9 |
| 1970 | 35 | 3782 | 3782 | 23.2 | 268.9 | 151.9 | 116.9 | 281.2 | 15.2 | 98.1 |
| 1971 | 32 | 3854 | 3854 | 24.2 | 366.2 | 241.7 | 124.6 | 268.4 | 16.7 | 124.2 |
| 1972 | 51 | 6326 | 6326 | 37.1 | 559.0 | 249.7 | 191.1 |  | 42.9 | 183.7 |
| 1973 | 61 | 7549 | 7549 | 52.9 | 1336.9 | 799.8 | 537.1 | 481.2 | 102.8 | 285.8 |
| 1974 | 56 | 7616 | 7616 | 56 | 1794.5 | 1350.3 | 444.2 | 381.4 | 88.1 | 421.9 |
| 1975 | 66 | 7503 | 7503 | 65.7 | 1078.8 | 874.6+ | 467.5 | 445.0 | 87 | 588.9 |
| 1976 | 66 | 9478 | 9478 | 103.8 | 1703.4 | 1623.8 | 251.3 | 812.1 | 260.4 | 645.8 |
| 1977 | 48 | 7590 | 7590 | 106.9 | 1938.1 | 1601.4 | 329.4 | 904.9 | 177.2 | 636.9 |
| 1978 | 60 | 8875 | 8875 | 158.7 | 3423.2 | 2460.5 | 1233 | 1213.9 | 196.1 | 978.6 |
| 1979 | 68 | 9538 | 9538 | 185.5 | 4202 | 2903.1 | 1698.6 | 1373.2 | 205.9 | 1154.6 |
| 1980 | 70 | 9814 | 9814 | 212.1 | 5221.3 | 3550.4 | 2066.8 | 1613.2 | 568.3 | 1412.1 |

## OTHER CHEMICALS

| YEAR | ESTAB–LISH MENTS | EMPLOYMENT TOTAL | EMPLO–YEES | PAYROLL | GROSS OUTPUT | COST OF M+ls | VALUE ADDED | FIXED ASSET | I EXP. | ENDING INVENTORY |
|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | 52 | 4504 | 4484 | 15.3 | 132.2 | 34.3 | 61.9 | 33.1 | 7.6 | 14.4 |
| 1957 | 61 | 6017 | 6002 | 17.8 | 156.1 | 90.9 | 65.2 | 47.2 | 8.8 | 38.1 |
| 1958 | 59 | 6611 | 6590 | 23 | 198.4 | 95.3 | 92.3 | 49.2 | 11 | 40 |
| 1959 | 64 | 7205 | 7191 | 24.5 | 238.5 | 128.4 | 110.1 | 51.8 | 6.2 | 53.9 |
| 1960 | 67 | 7644 | 7635 | 24.2 | 271.6 | 143.7 | 127.8 | 48.1 | 9.6 | 60.4 |
| 1961 | 75 | 8958 | 8947 | 32.9 | 328.6 | 179.8 | 144.6 | 61.5 | 14.8 | 75.5 |
| 1962 | 80 | 9635 | 9623 | 37.4 | 358.1 | 198.5 | 153.4 | 8.5 | 17.5 | 83.4 |
| 1963 | 82 | 10243 | 10228 | 45.1 | 406.1 | 240.2 | 165.8 | .9 | 1.3 | 100.1 |
| 1964 | 82 | 11657 | 11642 | 51.8 | 494.2 | 283.6 | 211.6 | 82.1 | 15.5 | 119.1 |
| 1965 | 86 | 12734 | 12726 | 58.1 | 529.4 | 291.8 | 218.1 | 91.3 | 27.8 | 122.5 |
| 1966 | 86 | 12864 | 12854 | 64.3 | 574.8 | 321.3 | 340.5 | 109.4 | 18 | 134.9 |
| 1967 | 102 | 14525 | 14460 | 77.8 | 737.5 | 398.7 | 368.4 | 201.5 | 23.7 | 167.4 |
| 1968 | 110 | 15381 | 15354 | 84.8 | 821.4 | 438.7 | 382.8 | 249 | 26.6 | 184.2 |
| 1969 | 105 | 14394 | 14368 | 90.9 | 816.2 | 431.4 | 379.9 | 166.2 | 18.7 | 181.1 |
| 1970 | 105 | 14567 | 14545 | 107.6 | 1534.7 | 889 | 516.5 | 191.1 | 42 | 373.3 |
| 1971 | 126 | 18130 | 18119 | 113.3 | 1680.5 | 995.3 | 645.6 | 246.8 | 84.4 | 448.2 |
| 1972 | 135 | 19428 | 19416 | 142.7 | 1937.5 | 979.9 | 703.9 | 251.1 | 82.1 | 387.7 |
| 1973 | 139 | 20067 | 20059 | 163.2 | 2841.1 | 1143.7 | 793.8 | 254.1 | 80.9 | 497.5 |
| 1974 | 136 | 20468 | 20460 | 207.2 |  | 1731.2 | 1109.9 | 288.5 | 64 | 871.7 |
| 1975 | 129 | 19662 | 20653 | 222.3 | 2888.8 | 2517.9+ | 903.1 | 336.6+ | 69.4 | 795.3 |
| 1976 | 120 | 18887 | 18880 | 276.8 | 3613.7 | 2904.6 | 1355.3 | 399.2 | 96.4 | 929.6 |
| 1977 | 138 | 19938 | 19930 | 329.2 | 4130.7 | 3083.6 | 1036.1 | 393.9 | 124.1 | 986.8 |
| 1978 | 152 | 20701 | 20706 | 375 | 4247.9 | 3344 | 1347.8 | 623.7 | 166.2 | 1070 |
| 1979 | 160 | 21072 | 21064 | 398.6 | 4308.4 | 3478.2 | 1508.4 | 742.2 | 187.9 | 1113 |
| 1980 | 167 | 23986 | 23977 | 601.1 | 6179.6 | 4759 | 2417.1 | 1085.2 | 342.1 | 1522.9 |

## PETROLEUM PRODUCTS

| YEAR | ESTAB–LISH MENTS | EMPLOYMENT TOTAL | EMPLO–YEES | PAYROLL | GROSS OUTPUT | COST OF M+Is | VALUE ADDED | FIXED ASSET | I EXP. | ENDING INVENTORY |
|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | | | | | | | | | | |
| 1957 | | | | | | | | | | |
| 1958 | | | | | | | | | | |
| 1959 | | | | | | | | | | |
| 1960 | | | | | | | | | | |
| 1961 | | | | 5.7 | 338.4 | 179.9 | 158.4 | 37.8* | 129.7 | 34.5 |
| 1962 | 9 | 1212 | 1212 | 7.8 | 392.6 | 232 | 160.2 | 75.9 | 101.6 | 61.4 |
| 1963 | 10 | 1330 | 1330 | 11.2 | 506.6 | 310.1 | 196.5 | 273.7 | 5.5 | 55.8 |
| 1964 | 7 | 1198 | 1198 | 9.8 | 461.2 | 350.7 | 110.4 | 254.5 | 5 | 45.6 |
| 1965 | 7 | 1054 | 1054 | 8.7 | 469.9 | 350.2 | 119.5 | 237.9 | 7.1 | 45.6 |
| 1966 | 7 | 1035 | 1035 | 9.8 | 504.9 | 382.1 | 122.8 | 231.4 | 20.5 | 52.1 |
| 1967 | 8 | 1083 | 1083 | – | 677.3 | 526.9 | 154.3 | | 83.7 | 71.2 |
| 1968 | 8 | 1106 | 1106 | 12 | 765.8 | 545.3 | 220.6 | 294.5 | 20.4 | 106 |
| 1969 | 10 | 1100 | 1100 | 13.3 | 928.5 | 617.1 | 311.4 | 291.8 | 11.4 | 87.5 |
| 1970 | 11 | 1499 | 1499 | 16.9 | 1373.3 | 927.5 | 445.8 | 275.9 | 173.4 | 135.3 |
| 1971 | 9 | 1663 | 1663 | 21.7 | 1757.4 | 1316.9 | 440.6 | 467.7 | 176.8 | 179.1 |
| 1972 | 8 | 1327 | 1327 | 18.9 | 1686.7 | 1277.1 | 463.9 | | 114.8 | 190.6 |
| 1973 | 8 | 1161 | 1161 | 17.9 | 2518.8 | 1696.4 | 819.3 | 515.4 | 82.9 | 288.3 |
| 1974 | 9 | 1276 | 1276 | 25.5 | 6314 | 5033.6 | 1280.4 | 802.3 | 87.7 | 712.3 |
| 1975 | 7 | 1727 | 1727 | 41.2 | 8476.2 | 5712.2+ | 3221.4 | 916.5+ | 74 | 878.9 |
| 1976 | 7 | 1211 | 1211 | 28.6 | 8599.4 | 7472.6 | 1286.1 | 969.3 | 44.5 | 769 |
| 1977 | 7 | 1378 | 1378 | 32.9 | 8191.6 | 8153 | | 1059.3 | 63.6 | 839 |
| 1978 | 9 | 1759 | 1759 | 62.7 | 9925.7 | 10124.7 | 798.4 | 1003.5 | 98.8 | 1041.9 |
| 1979 | 8 | 2070 | 2070 | 91.2 | 11461.3 | 11893.9 | 767.7 | 907.5 | 130 | 1224 |
| 1980 | 8 | 1633 | 1633 | 59.6 | 22471.8 | 20779.4 | 2366.4 | 787.3 | 154.4 | 2138.4 |

## RUBBER PRODUCTS

| YEAR | ESTAB-LISH MENTS | EMPLOYMENT TOTAL | EMPLO-YEES | PAYROLL | GROSS OUTPUT | COST OF M+Is | VALUE ADDED | FIXED ASSET | I EXP. | ENDING INVENTORY |
|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | 17 | 2581 | 2573 | 3.8 | 18.4 | 9.9 | 8.4 | 7.6 | .5 | 4.8 |
| 1957 | 20 | 3578 | 3569 | 8 | 60.8 | 31.7 | 20.1 | 44 | 20.6 | 14.2 |
| 1958 | 29 | 4757 | 4748 | 10.3 | 83.1 | 36.1 | 47 | 44.9 | 4.3 | 15.7 |
| 1959 | 27 | 5169 | 5162 | 12.4 | 101.9 | 43.3 | 58.6 | 45.1 | 3.8 | 19.9 |
| 1960 | 30 | 4950 | 4940 | 13.9 | 116.5 | 60.7 | 55.8 | 46.3 | 7.8 | 23.2 |
| 1961 | 33 | 5523 | 5512 | 14.1 | 178.7 | 92.7 | 86.1 | 54.5 | 4.9 | 33.8 |
| 1962 | 34 | 5805 | 5802 | 14.5 | 153.7 | 77.1 | 76.7 | 38.1 | 12.6 | 37.2 |
| 1963 | 38 | 6643 | 6640 | 17.2 | 166.3 | 89.7 | 76.6 | 61.3 | 7.8 | 41.2 |
| 1964 | 39 | 6406 | 6404 | 18 | 185.7 | 94.8 | 90.9 | 64.2 | 9.2 | 43.5 |
| 1965 | 41 | 6530 | 6523 | 18.8 | 174.3 | 92.7 | 81.7 | 67.5 | 9.9 | 42.5 |
| 1966 | 42 | 7267 | 7260 | 21.1 | 208.8 | 107.8 | 101 | 91 | 13.6 | 49.5 |
| 1967 | 47 | 8227 | 8219 |  | 219.2 | 111.9 | 108.7 |  | 6.0 | 51.4 |
| 1968 | 49 | 8700 | 8693 | 27.1 | 252.7 | 127.4 | 125.3 | 85.3 | 14.7 | 53 |
| 1969 | 47 | 8068 | 8058 | 26.8 | 257.2 | 132.4 | 124.8 | 92.4 | 10.5 | 54.4 |
| 1970 | 50 | 818 | 8166 | 31.2 | 371.9 | 183.9 | 188.1 | 89.9 | 10.9 | 82.3 |
| 1971 | 50 | 9052 | 9037 | 33.9 | 372.7 | 217.7 | 155 | 91.1 | 23.5 | 98.8 |
| 1972 | 71 | 11168 | 11149 | 38.1 | 453.7 | 307.4 | 183.9 |  | 28.0 | 105.1 |
| 1973 | 81 | 12210 | 12201 | 48.9 | 551.9 | 341 | 210.8 | 131.1 | 44.4 | 150.1 |
| 1974 | 81 | 12629 | 12623 | 59.7 | 799.7 | 482.8 | 316.8 | 171.4 | 27.8 | 204.6 |
| 1975 | 66 | 9220 | 9215 | 56.8 | 813.7 | 547.2+ | 305.5 | 171.8+ | 42.6 | 149.9 |
| 1976 | 54 | 8674 | 8670 | 69.6 | 756.1 | 575.7 | 250.2 | 207.5 | 102.1 | 172.7 |
| 1977 | 60 | 6961 | 6958 | 82.6 | 872.5 | 620.8 | 248.8 | 268.7 | 25.5 | 186.2 |
| 1978 | 73 | 9788 | 9783 | 143.2 | 1571.5 | 1149.3 | 482.1 | 406.7 | 46.6 | 344.7 |
| 1979 | 89 | 11245 | 11240 | 174.4 | 1931.7 | 1421.6 | 602 | 477.8 | 57.5 | 426.6 |
| 1980 | 88 | 17044 | 17036 | 281.1 | 2579.4 | 1805.1 | 967.6 | 625.6 | 95.1 | 541.6 |

## PLASTIC PRODUCTS

| YEAR | ESTAB-LISH MENTS | EMPLOYMENT TOTAL | EMPLO-YEES | PAYROLL | GROSS OUTPUT | COST OF M+Is | VALUE ADDED | FIXED ASSET | I EXP. | ENDING INVENTORY |
|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | | | | | | | | | | |
| 1957 | 22 | 883 | 876 | 1.6 | 9.4 | 4.7 | 4.7 | 4.5 | 1.3 | 2.4 |
| 1958 | 18 | 896 | 892 | 1.9 | 11.7 | 5.3 | 6.5 | 5 | 1 | 2.7 |
| 1959 | 19 | 980 | 978 | 2.1 | 11.4 | 4.8 | 6.6 | 5.4 | .7 | 2.4 |
| 1960 | 22 | 1143 | 1140 | 2.5 | 12.7 | 5.8 | 6.9 | 5.4 | .7 | 2.9 |
| 1961 | 28 | 1419 | 1415 | 2.5 | 18.4 | 9.1 | 9.4 | 9.6 | 1.3 | 4.9 |
| 1962 | 31 | 1555 | 1552 | 3 | 16.3 | 8.6 | 7.7 | 8.7 | 1.6 | 8.3 |
| 1963 | 31 | 1689 | 1688 | 2.9 | 16.1 | 9.2 | 6.8 | 9.1 | 1.1 | 8.3 |
| 1964 | 35 | 1680 | 1678 | 2.9 | 16.7 | 8.2 | 8.5 | 8.3 | 2 | 8.1 |
| 1965 | 32 | 1609 | 1607 | 3.2 | 19.3 | 9 | 10.3 | 11.7 | 2.3 | 8.5 |
| 1966 | 32 | 1597 | 1591 | 3.7 | 26.1 | 11.5 | 11.7 | 13.6 | 2.8 | 11.9 |
| 1967 | 41 | 2530 | 2520 | | 60.0 | 33.4 | 26.9 | | 4.2 | 8.9 |
| 1968 | 45 | 2989 | 2985 | 6.7 | 50.7 | 29.7 | 21.1 | 22.2 | 2.7 | 13.1 |
| 1969 | 52 | 3804 | 3796 | 9.7 | 84 | 53.2 | 30.8 | 27.4 | 9.9 | 19.4 |
| 1970 | 59 | 5618 | 5605 | 16.4 | 150.1 | 96.7 | 53.3 | 44.3 | 13.8 | 36.7 |
| 1971 | 59 | 5463 | 5449 | 18.9 | 167.3 | 109.8 | 57.5 | 55.2 | 15.5 | 42.5 |
| 1972 | 86 | 8304 | 8283 | 27.3 | 296.3 | 201.0 | 109.4 | | 14.5 | 41.9 |
| 1973 | 100 | 9703 | 9682 | 32.1 | 324.5 | 215.5 | 108.9 | 105.9 | 14.9 | 68.2 |
| 1974 | 111 | 10615 | 10587 | 46.2 | 522.3 | 349.4 | 172.9 | 133.1 | 41.7 | 135.8 |
| 1975 | 127 | 14286 | 14248 | 68.1 | 701.9 | 591.8+ | 271.2 | 182.1+ | 66.6 | 133.1 |
| 1976 | 66 | 11253 | 11223 | 70.2 | 603.4 | 546.6 | 135.9 | 169.1 | 29.4 | 112.5 |
| 1977 | 104 | 16422 | 16379 | 104.8 | 960.3 | 741.3 | 216.7 | 263.2 | 70.8 | 152.7 |
| 1978 | 108 | 14044 | 14006 | 111.6 | 1179.6 | 883.6 | 350.9 | 326.2 | 69.8 | 182 |
| 1979 | 110 | 12808 | 12774 | 115.2 | 1292.7 | 937.6 | 442.9 | 350.1 | 68.1 | 193.1 |
| 1980 | 29 | 16501 | 16457 | 187.8 | 1611.3 | 1203.2 | 546 | 565.6 | 75.5 | 247.8 |

## NON–METALLIC MINERAL PRODUCTS

| YEAR | ESTAB–LISH MENTS | EMPLOYMENT TOTAL | EMPLO–YEES | PAYROLL | GROSS OUTPUT | COST OF M+Is | VALUE ADDED | FIXED ASSET | I EXP. | ENDING INVENTORY |
|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | 32 | 1716 | 1705 | 3 | 15.3 | 7.1 | 8.3 | 6.8 | 1.2 | 3.4 |
| 1957 | 38 | 4104 | 4085 | 9.4 | 55.3 | 25.6 | 29.7 | 48.1 | 13.2 | 15.4 |
| 1958 | 46 | 4440 | 4415 | 9.7 | 64 | 28.8 | 35.2 | 51.1 | 6.5 | 18.1 |
| 1959 | 56 | 4986 | 4961 | 11.8 | 75.4 | 31.7 | 43.7 | 54.4 | 10.9 | 21.2 |
| 1960 | 54 | 5157 | 5127 | 12 | 75.5 | 30.2 | 45.2 | 66.9 | 17.5 | 33.2 |
| 1961 | 57 | 5172 | 5142 | 13.7 | 95.5 | 41.3 | 53.9 | 81.7 | 5.4 | 45.4 |
| 1962 | 59 | 5179 | 5655 | 14.2 | 101 | 39.6 | 61.4 | 93 | 9.2 | 32.2 |
| 1963 | 64 | 6339 | 6317 | 16 | 117.3 | 45.6 | 71.6 | 104.2 | 24 | 37 |
| 1964 | 61 | 5688 | 5653 | 16.3 | 146.5 | 56.8 | 89.8 | 137.7 | 42.6 | 46.1 |
| 1965 | 61 | 6643 | 6617 | 21.7 | 175 | 69.3 | 105.6 | 176.1 | 19.4 | 56.3 |
| 1966 | 61 | 7438 | 7401 | 23.6 | 198.4 | 87.1 | 111.3 | 198.4 | 67.5 | 70.8 |
| 1967 | 72 | 8302 | 8261 |  | 426.4 | 207.7 | 221.7 |  | 84.7 | 77.1 |
| 1968 | 77 | 8728 | 8680 | 30.7 | 266.8 | 114.8 | 152 | 357.4 | 99.1 | 60.5 |
| 1969 | 65 | 8443 | 8414 | 30.4 | 270.1 | 122.6 | 147.5 | 425.1 | 29 | 60.6 |
| 1970 | 11 | 8793 | 8780 | 32.1 | 232.1 | 121.4 | 110.7 | 612.4 | 115.5 | 87.7 |
| 1971 | 65 | 11740 | 11725 | 49.7 | 428.2 | 230.9 | 197.2 | 997.5 | 53.1 | 128.9 |
| 1972 | 89 | 14197 | 14179 | 44.1 | 433.0 | 345.5 | 323.9 |  | 43.6 | 112 |
| 1973 | 102 | 15407 | 15388 | 66 | 676.3 | 377.7 | 298.5 | 1587.8 | 67.8 | 221.3 |
| 1974 | 98 | 14009 | 13984 | 67.5 | 1138.2 | 719.9 | 418.3 | 1597.5 | 334.1 | 341.6 |
| 1975 | 96 | 12348 | 12325 | 69.8 | 1300.1+ | 943.5+ | 535.7 | 1698.8+ | 79.2 | 264.5 |
| 1976 | 89 | 9724 | 9707 | 89.1 | 1509.5 | 1296.1 | 442.8 | 1716.4 | 335.1 | 299 |
| 1977 | 70 | 12315 | 12293 | 115.4 | 1639.3 | 1334.1 | 298.6 | 1752.7 | 80.3 | 307.9 |
| 1978 | 89 | 16834 | 16805 | 199.5 | 2424.1 | 1480.8 | 784.4 | 2212.3 | 119.1 | 341.8 |
| 1979 | 99 | 19163 | 19129 | 242.8 | 2828.5 | 2174.8 | 1034.7 | 2449.1 | 139.1 | 501.9 |
| 1980 | 112 | 17981 | 17949 | 285.3 | 3743.9 | 3045.9 | 1110.1 | 2051.1 | 439 | 703 |

## GLASS PRODUCTS

| YEAR | ESTAB–LISH MENTS | EMPLOYMENT TOTAL | EMPLO–YEES | PAYROLL | GROSS OUTPUT | COST OF M+Is | VALUE ADDED | FIXED ASSET | I EXP. | ENDING INVENTORY |
|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | 17 | 1442 | 1433 | 3.5 | 19.1 | 7.1 | 12.1 | 12.3 | .5 | 2.7 |
| 1957 | 14 | 1463 | 1457 | 3.8 | 25.1 | 8.7 | 16.4 | 11 | 1.5 | 1.9 |
| 1958 | 15 | 1431 | 1418 | 3.7 | 22.3 | 8.2 | 14 | 11.3 | 1.3 | 3.7 |
| 1959 | 19 | 1697 | 1685 | 4.6 | 24.8 | 10.3 | 14.5 | 11.8 | 1.4 | 3.9 |
| 1960 | 18 | 2026 | 2014 | 5.4 | 28.9 | 11.6 | 19.8 | 17.3 | 6.4 | 6.6 |
| 1961 | 21 | 2697 | 2681 | 7.9 | 44.3 | 18.5 | 25.7 | 22.4* | 7.8 | 11.3 |
| 1962 | 23 | 3028 | 3022 | 7.9 | 48.2 | 20.2 | 28 | 26.6 | 5.2 | 13 |
| 1963 | 23 | 3794 | 3788 | 9.5 | 61.6 | 22.6 | 38.9 | 49.5 | 6.1 | 14.6 |
| 1964 | 20 | 3649 | 3643 | 10 | 61.6 | 21.9 | 39.8 | 34.3 | 8.6 | 14.2 |
| 1965 | 18 | 3937 | 3931 | 9.8 | 65 | 25.1 | 39.9 | 38.9 | 10.9 | 16.3 |
| 1966 | 15 | 3396 | 3390 | 12.1 | 70.9 | 27.1 | 43.8 | 48.1 | 10.2 | 17.6 |
| 1967 | 16 | 4591 | 4583 |  | 90.1 | 41.6 | 49.0 |  | 7.1 | 33.2 |
| 1968 | 17 | 5179 | 5171 | 17.7 | 107.6 | 42.1 | 65.5 | 57 | 8.9 | 42.5 |
| 1969 | 19 | 5667 | 5656 | 21.5 | 124 | 52.9 | 71.1 | 76.5 | 27.2 | 43.8 |
| 1970 | 17 | 6192 | 6183 | 27.1 | 191.1 | 83.1 | 108.1 | 81.4 | 40.3 | 53.8 |
| 1971 | 18 | 6886 | 6878 | 34.2 | 233.5 | 98.6 | 134.9 | 111.3 | 37 | 68.8 |
| 1972 | 23 | 6907 | 6899 | 33.7 | 227.2 | 151.3 | 114.9 |  | 23.5 | 80.2 |
| 1973 | 25 | 6918 | 6913 | 37.6 | 341.2 | 159.4 | 181.8 | 130.3 | 23.5 | 90.7 |
| 1974 | 20 | 6610 | 6607 | 43.8 | 416.9 | 248.5 | 168.5 | 129.8 | 28.5 | 178.2 |
| 1975 | 21 | 5962 | 5959 | 49 | 323.4 | 254.4+ | 120.4 | 130.4+ | 40.8 | 151.2 |
| 1976 | 16 | 5543 | 5540 | 53.1 | 306.2 | 301.4 | 38.4 | 143.4 | 34.5 | 139.9 |
| 1977 | 17 | 6503 | 6500 | 76.3 | 574.4 | 405.5 | 163.7 | 242.3 | 39.9 | 188.2 |
| 1978 | 26 | 8640 | 8621 | 96.9 | 742.5 | 474.7 | 297.6 | 259.3 | 113.8 | 220.4 |
| 1979 | 32 | 9049 | 9045 | 107.7 | 880.9 | 524.8 | 401.8 | 250.3 | 176.2 | 243.6 |
| 1980 | 33 | 9204 | 9200 | 143.4 | 1119.9 | 851.4 | 373.1 | 577.5 | 118.2 | 395.2 |

## IRON AND STEEL BASIC INDUSTRIES

| YEAR | ESTAB-LISH MENTS | EMPLOYMENT TOTAL | EMPLO-YEES | PAYROLL | GROSS OUTPUT | COST OF M+Is | VALUE ADDED | FIXED ASSET | I EXP. | ENDING INVENTORY |
|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | | | | | | | | | | |
| 1957 | | | | | | | | | | |
| 1958 | | | | | | | | | | |
| 1959 | 19 | 2943 | 2940 | 7.2 | 52.9 | 27.6 | 25.3 | 28.3 | 4.3 | 22.2 |
| 1960 | 21 | 3234 | 3231 | 8.5 | 53.4 | 29.3 | 24.2 | 30.2 | 2.9 | 23.6 |
| 1961 | 26 | 3458 | 3455 | 12.2 | 152.3+ | 108.5 | 43.9 | 46.9 | 6.4 | 30.1 |
| 1962 | 27 | 3569 | 3564 | 8.8 | 63.7 | 36.7 | 26.9 | 32.1 | 6.4 | 29 |
| 1963 | 36 | 4330 | 4323 | 18.4 | 90.4 | 52.9 | 37.5 | 43.2 | 22.9 | 42.6 |
| 1964 | 36 | 4497 | 4489 | 11.9 | 129.8 | 86 | 43.9 | 95.2 | 3.6 | 49.2 |
| 1965 | 37 | 4727 | 4719 | 12.7 | 163.4 | 107.3 | 56.1 | 63.1 | 29.9 | 56.4 |
| 1966 | 45 | 4833 | 4927 | 4.4 | 212.1 | 146.9 | 65.3 | 88.3 | 26.9 | 52.7 |
| 1967 | 48 | 5593 | 5813 | | 236.8 | 182.5 | 55.7 | | 5.7 | 65.8 |
| 1968 | 49 | 5918 | 5906 | 19.2 | 240.6 | 171 | 69.6 | 102 | 8.7 | 93.4 |
| 1969 | 46 | 7387 | 7375 | 30 | 386.3 | 300.8 | 85.6 | 107.9 | 313.2 | 139 |
| 1970 | 46 | 8904 | 8892 | 39.4 | 761.2 | 571.2 | 190 | 670.5 | 261.9 | 416.6 |
| 1971 | 49 | 9517 | 9506 | 42 | 621.1 | 490.3 | 130.7 | 749.8 | 44.1 | 201.7 |
| 1972 | 62 | 11715 | 11701 | 34.0 | 611.0 | 462.9 | 204.9 | | 18.5 | 170.6 |
| 1973 | 68 | 12798 | 12789 | 62.6 | 1660.1 | 1179.7 | 480.3 | 842.3 | 36.1 | 461.6 |
| 1974 | 63 | 13379 | 13376 | 72.5 | 1902.2 | 1485.8 | 416.4 | 338.6 | 145.2 | 969.9 |
| 1975 | 54 | 8424 | 8420 | 44.4 | 2150.4 | 1618.1 | 565.7 | 200.1 | 81.2 | 636.9 |
| 1976 | 85 | 11934 | 11931 | 81.7 | 2281.4 | 2216.5 | 416.5 | 390.9 | 54.6 | 1075.1 |
| 1977 | 85 | 11478 | 11475 | 91.9 | 2720.3 | 2526.3 | 192.1 | 435.7 | 89.2 | 1225.3 |
| 1978 | 154 | 13146 | 13143 | 134.4 | 3079.4 | 2925.8 | 360.6 | 797.7 | 86.1 | 1419.1 |
| 1979 | 190 | 14006 | 14003 | 156.3 | 3261.5 | 3131.7 | 447.5 | 984.3 | 79.3 | 1518.9 |
| 1980 | 181 | 16256 | 16252 | 203.2 | 7550.4 | 3851.1 | 4022.5 | 1669.2 | 1018.4 | 1867.9 |

## NON–FERROUS BASIC INDUSTRIES

| YEAR | ESTAB–LISH MENTS | EMPLOYMENT TOTAL | EMPLO–YEES | PAYROLL | GROSS OUTPUT | COST OF M+Is | VALUE ADDED | FIXED ASSET | I EXP. | ENDING INVENTORY |
|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | | | | | | | | | | |
| 1957 | | | | | | | | | | |
| 1958 | | | | | | | | | | |
| 1959 | 5 | 121 | 121 | .3 | 1.5 | .6 | .8 | .8 | .2 | .4 |
| 1960 | 4 | 133 | 133 | .3 | 1.7 | .8 | .9 | .9 | .1 | .8 |
| 1961 | 5 | 268 | 268 | .4 | 2.8 | .9 | 1.8 | 1.1 | 3.7 | .9 |
| 1962 | 6 | 335 | 334 | .7 | 9.5 | 7 | 2.5 | 2.9 | .4 | 7.5 |
| 1963 | 9 | 623 | 619 | 1.6 | 6.8 | 4.3 | 2.5 | 5.7 | .2 | 4.3 |
| 1964 | 6 | 269 | 267 | .6 | 9.3 | 7.5 | 1.8 | 3 | .5 | 7.5 |
| 1965 | 3 | 109 | 107 | .2 | 2 | 1.5 | .5 | 1 | .03 | 1.5 |
| 1966 | 4 | 114 | 111 | .3 | 1.1 | 1.4 | .6 | 1 | .02 | 1.4 |
| 1967 | 8 | 1075 | 1047 | | 38.2 | 26 | 12.4 | | | 4.6 |
| 1968 | 9 | 1548 | 1545 | 6.8 | 100.9 | 62.5 | 38.4 | 26.4 | 3.9 | 26.9 |
| 1969 | 10 | 1713 | 1713 | 8.3 | 120.1 | 75.7 | 45.1 | 26 | 4.2 | 29.8 |
| 1970 | 12 | 1754 | 1747 | 9.3 | 135.1 | 77.1 | 57.9 | 26.9 | 11.8 | 50.8 |
| 1971 | 14 | 1846 | 1842 | 11.7 | 153 | 103.8 | 49.3 | 30.6 | 16.7 | 48.6 |
| 1972 | 19 | 2390 | 2385 | 1.4 | 173 | | 58 | | .2 | 2.4 |
| 1973 | 21 | 2658 | 2650 | 17.2 | 250.5 | 161.3 | 89.2 | 47.4 | 14.5 | 86.1 |
| 1974 | 15 | 2945 | 2937 | 21.3 | 366.9 | 237.6 | 129.3 | 54.3 | 11.9 | 113.6 |
| 1975 | 17 | 1116 | 1112 | 6.7 | 137.5 | 73.7 | 71.3 | 19.7+ | 4.4 | 11.7 |
| 1976 | 21 | 2922 | 2914 | 27 | 394.7 | 366 | 74.5 | 132.1 | 7.5 | 40.5 |
| 1977 | 21 | 2266 | 2260 | 22.9 | 288.1 | 211.8 | 75.4 | 88.3 | 11.1 | 25.7 |
| 1978 | 48 | 3987 | 3765 | 45.5 | 637.1 | 557.7 | 171.3 | 202.3 | 44.4 | 67.8 |
| 1979 | 52 | 4930 | 4917 | 67.2 | 973.5 | 892.5 | 260.3 | 312.2 | 76.7 | 108.5 |
| 1980 | 53 | 5597 | 5582 | 87.8 | 1092.2 | 919. | 357.6 | 223 | 86.1 | 111.7 |

## FABRICATED METAL PRODUCTS

| YEAR | ESTAB-LISH MENTS | EMPLOYMENT TOTAL | EMPLO-YEES | PAYROLL | GROSS OUTPUT | COST OF M+Is | VALUE ADDED | FIXED ASSET | I EXP. | ENDING INVENTORY |
|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | 70 | 6021 | 5985 | 13.5 | 75.4 | 43.3 | 32.1 | 26.8 | 4.4 | 21.7 |
| 1957 | 82 | 7469 | 7432 | 17.4 | 94.9 | 55.4 | 39.5 | 30.1 | 5.2 | 33.8 |
| 1958 | 92 | 8551 | 8517 | 19.5 | 131.8 | 66.8 | 65 | 31.8 | 6.3 | 30.2 |
| 1959 | 99 | 9296 | 9268 | 22.7 | 153 | 85.9 | 67.1 | 33.5 | 7 | 38.5 |
| 1960 | 115 | 11581 | 11557 | 28.4 | 206.3 | 118.7 | 87.6 | 47 | 13.1 | 49.1 |
| 1961 | 120 | 12277 | 11986 | 30 | 243.9 | 152 | 92 | 69.9 | 21.2 | 71.3 |
| 1962 | 122 | 12636 | 12607 | 30.9 | 263.5 | 169.2 | 94.3 | 81.8 | 25.4 | 106.5 |
| 1963 | 127 | 13968 | 13941 | 34.6 | 299.5 | 196.6 | 102.9 | 88.1 | 15.5 | 106.8 |
| 1964 | 132 | 14759 | 14728 | 39.5 | 339.1 | 228.2 | 110.7 | 98.1 | 13 | 107 |
| 1965 | 136 | 16241 | 16216 | 49.1 | 353.1 | 228.1 | 125.1 | 101.4 | 10.6 | 107.3 |
| 1966 | 125 | 16118 | 16099 | 49.2 | 410:0 | 266.3 | 143.7 | 93.9 | 13.2 | 107.6 |
| 1967 | 148 | 6668 | 6656 | 63.7 | 451.5 | 280.4 | 171.2 | 112.9 | 14.9 | 107.9 |
| 1968 | 159 | 20309 | 20267 | 71.3 | 472.9 | 287.6 | 185.3 | 122.7 | 15.9 | 103.5 |
| 1969 | 155 | 20169 | 20134 | 68.7 | 485.3 | 276.7 | 208.6 | 124.2 | 18.1 | 111.9 |
| 1970 | 151 | 13160 | 13135 | 45.3 | 452.5 | 314.4 | 143.1 | 111.5 | 14.2 | 118.1 |
| 1971 | 128 | 12172 | 15170 | 70.1 | 632.6 | 418.3 | 214.3 | 143.6 | 16.8 | 171.3 |
| 1972 | 177 | 16161 | 20141 | 60.6 | 856.8 | 593.6 | 318.8 |  | 20.3 | 180.1 |
| 1973 | 201 | 18126 | 18070 | 82 | 1080.2 | 736.6 | 343.5 | 187.4 | 21.8 | 260.6 |
| 1974 | 187 | 14086 | 14040 | 67.7 | 1203.7 | 898.8 | 306.9 | 163.9 | 25.5 | 360.6 |
| 1975 | 218 | 19872 | 19807 | 117.9 | 1289 | 1060.8+ | 499.3 | 237.3+ | 63.6 | 315 |
| 1976 | 218 | 21189 | 21120 | 127.8 | 1296 | 1112.6 | 283.5 | 269.8 | 39.1 | 217.2 |
| 1977 | 194 | 17419 | 17362 | 138.5 | 1570.6 | 1250.6 | 313 | 328.8 | 45.3 | 244.2 |
| 1978 | 265 | 22394 | 22320 | 201.5 | 2182.9 | 1819.1 | 475.8 | 399 | 61.5 | 355.3 |
| 1979 | 302 | 24957 | 24875 | 234 | 2498.4 | 2112 | 559.6 | 435.2 | 69.8 | 412.5 |
| 1980 | 304 | 29647 | 29550 | 320.2 | 2356.1 | 1667.6 | 851 | 695.3 | 43 | 325.7 |

## MACHINERY

| YEAR | ESTAB–LISH MENTS | EMPLOYMENT TOTAL | EMPLO–YEES | PAYROLL | GROSS OUTPUT | COST OF M+Is | VALUE ADDED | FIXED ASSET | I EXP. | ENDING INVENTORY |
|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | 38 | 3409 | 3400 | 6.5 | 24.9 | 12.4 | 12.5 | 16.6 | 4.2 | 7.6 |
| 1957 | 47 | 4478 | 4458 | 10.4 | 46.2 | 21.8 | 24.4 | 16.4 | 2.1 | 10.8 |
| 1958 | 36 | 4145 | 4133 | 10.9 | 54.7 | 27.7 | 26.9 | 17.4 | 2.9 | 20.2 |
| 1959 | 33 | 1826 | 1811 | 4.6 | 22.5 | 8.7 | 13.9 | 7.0 | .9 | 9.5 |
| 1960 | 42 | 3396 | 3385 | 9 | 41.9 | 11.1 | 30.8 | 16.8 | 1.9 | 11.0 |
| 1961 | 42 | 3354 | 3343 | 9.5 | 64.1 | 27.6 | 36.4 | 24.0 | 10.9 | 20.5 |
| 1962 | 42 | 3333 | 3314 | 9.3 | 51.9 | 16.3 | 35.6 | 16.6 | 3.2 | 18.9 |
| 1963 | 42 | 2967 | 2949 | 9.2 | 42.6 | 20.3 | 22.3 | 13.9 | .9 | 18.0 |
| 1964 | 50 | 2864 | 2837 | 7.1 | 28.9 | 15 | 13.9 | 16.0 | 1.6 | 17.8 |
| 1965 | 48 | 2816 | 2795 | 7.6 | 29.5 | 13.4 | 16.1 | 17.2 | 2.0 | 17.5 |
| 1966 | 47 | 2925 | 2898 | 7.8 | 30.5 | 14 | 16.4 | 7.6 | 3.3 | 17.5 |
| 1967 | 55 | 3228 | 3198 |  | 76.4 | 43.9 | 33.0 |  | 4.0 | 17.9 |
| 1968 | 59 | 3377 | 3347 | 10 | 47.6 | 21.9 | 25.7 | 32.4 | 2.7 | 14.2 |
| 1969 | 65 | 3650 | 3625 | 11.4 | 53 | 24.1 | 28.9 | 27.1 | 2.2 | 18.1 |
| 1970 | 63 | 4123 | 4104 | 14.8 | 82.8 | 40.1 | 42.6 | 42.0 | 6.5 | 63.4 |
| 1971 | 60 | 3805 | 3790 | 16.1 | 92.2 | 45.0 | 47.3 | 57.3 | 3.9 | 31.7 |
| 1972 | 94 | 7446 | 7417 | 37.3 | 283.6 | 199.5 | 135.6 |  | 22.4 | 111.6 |
| 1973 | 110 | 9239 | 9220 | 45.1 | 307.8 | 162.8 | 145 | 80.1 | 11.2 | 83.9 |
| 1974 | 104 | 10064 | 10044 | 57.9 | 598.1 | 292.6 | 305.5 | 120.2 | 58.0 | 1488 |
| 1975 | 186 | 14132 | 14103 | 73.3 | 430.6 | 427.3+ | 32.4 | 197.4+ | 41.8 | 184.5 |
| 1976 | 64 | 12070 | 12046 | 89.9 | 503.9 | 422.8 | 1624 | 238.7 | 37.4 | 119.0 |
| 1977 | 57 | 10374 | 10353 | 93.1 | 591.6 | 413.4 | 174.2 | 186.9 | 40.9 | 116.3 |
| 1978 | 76 | 14502 | 14473 | 199.8 | 1097.2 | 772.9 | 427.2 | 313 | 69.7 | 217.6 |
| 1979 | 86 | 16629 | 16596 | 254.9 | 1357.6 | 957.8 | 557.6 | 376.5 | 84.5 | 269.6 |
| 1980 | 86 | 17336 | 17302 | 245.8 | 1283.3 | 871.4 | 539.9 | 658.5 | 60.7 | 245.3 |

## ELECTRICAL MACHINERY

| YEAR | ESTAB–LISH MENTS | EMPLOYMENT TOTAL | EMPLO–YEES | PAYROLL | GROSS OUTPUT | COST OF M+Is | VALUE ADDED | FIXED ASSET | I EXP. | ENDING INVENTORY |
|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | 19 | 1115 | 1111 | 2.3 | 16.1 | 8.5 | 7.6 | 5.3 | 2.4 | 5.2 |
| 1957 | 27 | 1826 | 1819 | 4.1 | 24.4 | 12.0 | 12.4 | 7.4 | 2.5 | 8.6 |
| 1958 | 28 | 2417 | 2407 | 5.4 | 33.2 | 15.3 | 17.9 | 11.6 | 2.9 | 10.3 |
| 1959 | 42 | 5028 | 5012 | 10.9 | 86.2 | 39.6 | 46.6 | 21.8 | 6.5 | 25.0 |
| 1960 | 49 | 6883 | 6870 | 15.2 | 101.5 | 49.8 | 57.8 | 28.7 | 9.5 | 30.7 |
| 1961 | 64 | 9375 | 9357 | 12.1 | 107.7 | 59.8 | 47.9 | 33.2 | 4.4 | 36.6 |
| 1962 | 72 | 10602 | 10582 | 24.3 | 197.1 | 106.8 | 90.2 | 51.2 | 15.0 | 77.7 |
| 1963 | 74 | 10668 | 10648 | 26.7 | 261.3 | 141.5 | 119.8 | 64.5 | 13.5 | 77.9 |
| 1964 | 74 | 12797 | 12780 | 32.5 | 290.9 | 165.7 | 125.3 | 68.9 | 22.6 | 91.1 |
| 1965 | 82 | 13228 | 13154 | 35.6 | 280.2 | 165.6 | 114.5 | 87.2 | 10.0 | 91.0 |
| 1966 | 73 | 12527 | 12519 | 38.9 | 298.4 | 174.3 | 124.1 | 95.5 | 10.0 | 95.9 |
| 1967 | 87 | 12103 | 12095 | 39.0 | 322.2 | 209.7 | 139.9 |  | 11.7 | 101.8 |
| 1968 | 94 | 11894 | 11879 | 39.1 | 334.2 | 192.2 | 142.0 | 98.5 | 10.4 | 102.2 |
| 1969 | 82 | 11213 | 11200 | 39.0 | 351.5 | 200.0 | 151.5 | 107.6 | 11.6 | 100.6 |
| 1970 | 78 | 11715 | 11702 | 47.8 | 496.6 | 278.8 | 217.8 | 101.0 | 48.2 | 162.0 |
| 1971 | 85 | 13444 | 13432 | 59.3 | 604.3 | 345.6 | 258.7 | 123.0 | 40.0 | 227.0 |
| 1972 | 100 | 15560 | 15546 | 62.2 | 610.6 | 447.8 | 252.1 |  | 46.7 | 236.9 |
| 1973 | 107 | 1602 | 16585 | 80.0 | 805.4 | 500.6 | 304.8 | 154.3 | 31.4 | 300.6 |
| 1974 | 103 | 18809 | 18787 | 106.0 | 1197.6 | 726.6 | 470.9 | 189.8 | 45.1 | 416.3 |
| 1975 | 114 | 21347 | 21322 | 122.6 | 1309.9 | 1074.9+ | 538.0 | 265.3+ | 72.8 | 475.5 |
| 1976 | 114 | 22379 | 22353 | 150.0 | 1358.1 | 1190.4 | 384.8 | 288.3 | 79.1 | 396.1 |
| 1977 | 108 | 29022 | 28988 | 257.6 | 2402.4 | 1826.4 | 564.1 | 395.5 | 119.6 | 602.7 |
| 1978 | 131 | 32537 | 32499 | 340.8 | 3509.4 | 2762.9 | 1037.1 | 507.8 | 185.0 | 911.7 |
| 1979 | 144 | 34349 | 34309 | 383.7 | 4079.9 | 3254.4 | 1280.9 | 565.7 | 218.7 | 1070.9 |
| 1980 | 158 | 38650 | 38605 | 512.2 | 3485.5 | 2428.0 | 1628.1 | 865.4 | 828.3 | 801.2 |

## TRANSPORT EQUIPMENT

| YEAR | ESTAB-LISH MENTS | EMPLOYMENT TOTAL | EMPLO-YEES | PAYROLL | GROSS OUTPUT | COST OF M+Is | VALUE ADDED | FIXED ASSET | I EXP. | ENDING INVENTORY |
|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | 42 | 4935 | 4918 | 12.9 | 83.6 | 49.7 | 33.9 | 33.3 | 1.8 | 19.9 |
| 1957 | 48 | 5169 | 5143 | 13.4 | 85.5 | 55.5 | 30.0 | 33.5 | .6 | 0.3 |
| 1958 | 52 | 5544 | 5515 | 14.7 | 90.1 | 56.8 | 33.4 | 33.6 | .4 | 4.4 |
| 1959 | 59 | 6491 | 6462 | 17.0 | 102.5 | 60.3 | 42.3 | 40.4 | 4.4 | 30.2 |
| 1960 | 55 | 5650 | 5676 | 16.4 | 123.7 | 75.4 | 48.3 | 36.7 | 5.9 | 7.7 |
| 1961 | 79 | 7698 | 7665 | 20.2 | 171.9 | 113.6 | 58.5 | 52.9 | 4.5 | 52.9 |
| 1962 | 91 | 8707 | 8682 | 23.9 | 262.0 | 172.0 | 90.0 | 57.9 | 5.7 | 72.4 |
| 1963 | 95 | 9515 | 9494 | 28.6 | 381.4 | 239.1 | 142.3 | 70.0 | 6.6 | 100.6 |
| 1964 | 114 | 10822 | 10777 | 31.7 | 423.6 | 284.4 | 139.2 | 78.1 | 14.3 | 119.7 |
| 1965 | 111 | 11103 | 11058 | 35.2 | 381.6 | 281.7 | 99.9 | 75.2 | 13.9 | 118.5 |
| 1966 | 107 | 11797 | 11222 | 37.5 | 401.8 | 295.2 | 106.6 | 91.9 | 9.4 | 124.3 |
| 1967 | 120 | 11675 | 11106 |  | 600.8 | 430.4 | 174.0 |  | 16.0 | 131.8 |
| 1968 | 126 | 11615 | 11567 | 44.9 | 557.5 | 407.4 | 150.1 | 91.5 | 24.1 | 160.0 |
| 1969 | 102 | 11932 | 11885 | 44.0 | 525.8 | 384.9 | 104.9 | 114.0 | 19.0 | 140.7 |
| 1970 | 92 | 9462 | 9439 | 42.1 | 584.5 | 386.3 | 198.1 | 139.0 | 8.4 | 181.3 |
| 1971 | 88 | 10846 | 10825 | 48.1 | 766.1 | 554.4 | 211.7 | 150.5 | 16.1 | 267.3 |
| 1972 | 88 | 12248 | 12230 | 60.4 | 1031.8 | 762.2 | 259.1 | 178.1 | 28.5 | 305.7 |
| 1973 | 88 | 12968 | 12954 | 66.8 | 1168.9 | 869.3 | 298.6 | 192.4 | 35.0 | 421.1 |
| 1974 | 79 | 14542 | 14533 | 93.4 | 1872.1 | 1413.2 | 450.9 | 223.6 | 80.2 | 687.5 |
| 1975 | 163 | 18288 | 18276 | 123.5 | 1640.3 | 1466.6+ | 782.2 | 448.4+ | 284.6 | 742.8 |
| 1976 | 159 | 21484 | 21471 | 173.1 | 2357.3 | 20598 | 529.3 | 608.8 | 93.5 | 606.4 |
| 1977 | 137 | 22823 | 22809 | 223.9 | 3250.1 | 2670.4 | 567.6 | 748.0 | 146.3 | 786.2 |
| 1978 | 168 | 27001 | 2684 | 336.8 | 4129.7 | 3166.5 | 1162.7 | 1042.2 | 448.2 | 932.3 |
| 1979 | 184 | 28154 | 29136 | 394.9 | 4582.8 | 3622.2 | 1469.3 | 1193.8 | 604.0 | 1066.4 |
| 1980 | 192 | 35397 | 35375 | 590.4 | 7003.6 | 5806.3 | 2251.2 | 1995.3 | 637.5 | 1709.5 |

## APPENDIX B

## PRODUCERS' PRICE INDEX FOR MANUFACTURING, BY INDUSTRY, FOR ESTABLISHMENTS WITH 20 OR MORE WORKERS

## Appendix B

### Producers' Price Index for Manufacturing, by Industry, for Establishments with 20 or More Workers

Census and *Survey of Manufactures* data on production are in current prices. For purposes of productivity measurement, we need to convert them into constant prices. Previous investigators have utilized the wholesale price index of the Central Bank (WPICB) for purposes of deflating manufacturing output. However, this index has several shortcomings as a manufacturing deflator. They are: (a) its breakdown follows a commodity classification which cannot be converted into an industry classification (for most industries) on the basis of available information; (b) it includes both manufactured as well as non-processed commodities (e.g., copper ore, cereal grains); (c) the weights used reflect the volume of transactions in wholesale markets rather than the output of manufacturing industries; and (d) it is computed by a formula which is not consistent with our method of measuring output.

The national accounts show an implicit price index for manufacturing for recent years. The implicit index is the result of a combination of price and physical quantity series for all manufacturing and individual industries at the two-digit level. However, little information is available on the procedures used to derive either the specific physical quantity and price series used or the methods employed to combine them. Since our primary need was for a deflator at the three-digit level, and because the actual price records were available, we constructed a producers price index for individual and all manufacturing annually for the period 1956-1980.

The index is a Leypeyres type with 1972 base year weights. We chose 1972 as the base year because there was a Census of Manufactures taken then. We could have used 1961, 1967, or 1975. We felt that 1961 was a little early. That leaves three to choose from. We decided on 1972 because (a) it catches some of the petroleum price increase, but not all and (b) it is not the crest of a boom (as in 1975). The index is given by the well-known formula:

$$I_{t+1} = \frac{\sum_i p^i_{t+1} \; Q^i_t}{\sum_i p^i_t \; Q^i_t}$$

where I is the price index, P and Q are price and quantity, respectively, of the $i^{th}$ commodity and the subscripts indicate time. The commodity prices were obtained from the Economic Research Department of the Central Bank. These were converted to price relatives (1972 = 100) for each of the approximately 300 commodities. Commodities were combined by industry (at the 3-digit level) by the use of weights based on gross value added as obtained from the 1972 Census of Manufactures. Each industry price index was weighted by the ratio of industry value added to value added for all manufacturing from the same census and combined into a general price index for all manufacturing. The classification of commodities by industry followed the cross classification code of the Central Bank relating commodities to industries. We tested the resulting index for sensitivity to weights by calculating index using 1975 and 1967 weights for

the period of dramatic price rise, i.e., 1972 to 1980. The difference between both the 1972/1975 and 1972/1967 was less than five percent in each case.

The difference between our producer price index and the WPICB is, however, not insignificant. Generally, ours rises faster. For example, with 1972 as the base year, ours rises to 378.7 while the WPICB increases for 347.1 in 1980 – a difference of 1.1 percent per year. Part of this difference is because food grains are subsidized and rise rather slowly; part is due to the difference in weights. A third reason is the difference in formula. The WPICB is computed (for an individual industry) as a weighted geometric mean of price relatives (Statistical Bulletin, 1978, p. 21).

## Producer Price Index
## (1972 = 100)

| YEAR | ALL MFG | FOOD (311–12) | BEVE-RAGES (313) | TO-BACCO (314) | TEXT-ILES (321) | APPA-REL (322) | LEA-THER (323) | FOOT-WEAR (324) | WOOD PRODT (331) | PAPER PRODT (341) | PRINT'G & PUB-LISH'G (342) | INDUS-TRIAL CHEM (351) | PETRO-LEUM PRODT (353–4) | OTHER CHEM (352) | RUBBER (355) | PLAS-TICS (356) | NON-METALLIC PRODUCTS (361 & 66) | GLASS (362) | IRON & STEEL (371) | NON-FERROUS METALS (372) | FABRI-CATED METALS (381) | MACHI-NERY (382) | ELECT'L MACHI-NERY (383) | TRANS EQUIPT (384) | F & F-WOOD (332) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1955 | 44.99 | 34.54 | 55.47 | 67.86 | 50.52 | 66.62 | 37.62 | 53.91 | 52.75 | 40.64 | 50.81 | 57.15 | 42.77 | 48.10 | 48.71 | 50.01 | 66.77 | 51.64 | 32.72 | 35.29 | 46.19 | 57.02 | 44.51 | 18.75 | 57.2 |
| 1956 | 46.19 | 33.21 | 55.47 | 67.86 | 51.6 | 63.32 | 39.51 | 54.12 | 54.67 | 48.24 | 50.81 | 56.06 | 43.62 | 48.53 | 50.82 | 46.77 | 62.94 | 48.68 | 45.43 | 39.97 | 47.15 | 61.49 | 44.51 | 20.4 | 57.2 |
| 1957 | 47.65 | 36.28 | 55.47 | 67.86 | 48.97 | 60.41 | 39.51 | 54.12 | 53.07 | 50.16 | 50.81 | 56.85 | 50.37 | 50.49 | 48.85 | 48.38 | 64.44 | 49.84 | 54.35 | 48.84 | 48.76 | 62.32 | 44.92 | 20.92 | 54.47 |
| 1958 | 47.53 | 36.79 | 57.21 | 67.86 | 44.7 | 61.32 | 39.04 | 54.12 | 49.27 | 51.66 | 50.81 | 56.73 | 50.33 | 52.72 | 47.79 | 48.38 | 63.29 | 48.95 | 52.57 | 51.43 | 49.61 | 63.16 | 45.49 | 22.59 | 53.99 |
| 1959 | 48.59 | 37.84 | 57.29 | 67.86 | 46.09 | 65.16 | 41.04 | 54.12 | 51.72 | 53.86 | 50.81 | 56.65 | 52.17 | 54.79 | 50.88 | 48.38 | 62.43 | 48.29 | 48.67 | 55.69 | 51.83 | 63.99 | 46.47 | 23.73 | 54.19 |
| 1960 | 49.75 | 38.13 | 58.2 | 67.86 | 50.45 | 70.35 | 43.51 | 55.53 | 51.7 | 51.6 | 50.81 | 56.95 | 54.82 | 55.86 | 59.89 | 46.38 | 57.75 | 44.65 | 49.19 | 56.71 | 56.48 | 64.83 | 49.41 | 29.65 | 54.02 |
| 1961 | 53.69 | 48.76 | 59.11 | 67.86 | 49.6 | 71.98 | 45.51 | 50.94 | 51.21 | 53.68 | 58.3 | 59.21 | 61.91 | 56.48 | 74.99 | 48.38 | 57.72 | 44.65 | 49.7 | 57.37 | 61.97 | 68.49 | 56.78 | 33.45 | 53.73 |
| 1962 | 55.90 | 46.15 | 60.01 | 67.86 | 47.47 | 73.77 | 46.39 | 69.46 | 55.79 | 57.99 | 68.65 | 59.62 | 66.82 | 59.46 | 76.8 | 48.38 | 63.23 | 48.99 | 50.26 | 50.28 | 61.51 | 69.86 | 59.61 | 36.63 | 60.63 |
| 1963 | 58.47 | 49.6 | 64.13 | 67.86 | 49.38 | 75.53 | 50.12 | 70.59 | 60.37 | 58.81 | 69.52 | 66.39 | 69.92 | 61.33 | 76.8 | 51.12 | 69.12 | 53.47 | 50.26 | 52.92 | 73.84 | 71.03 | 65.26 | 42.24 | 66.62 |
| 1964 | 61.02 | 52.77 | 64.13 | 67.86 | 56.22 | 74.79 | 50.71 | 70.59 | 65.36 | 52.63 | 73.04 | 69.11 | 69.92 | 62.54 | 76.8 | 51.62 | 74.57 | 57.68 | 51.97 | 56.59 | 76.63 | 72.22 | 67.46 | 42.84 | 68.86 |
| 1965 | 62.29 | 52.49 | 64.13 | 77.51 | 58.15 | 70.54 | 67.62 | 71.15 | 65.63 | 52.74 | 73.04 | 69.1 | 70.14 | 65.41 | 76.8 | 51.62 | 74.98 | 58.00 | 59.09 | 59.94 | 77.49 | 72.23 | 71.02 | 47.28 | 70.13 |
| 1966 | 64.25 | 54.22 | 65.75 | 77.5 | 60.31 | 69.07 | 72.47 | 66.94 | 52.89 | 73.04 | 69.13 | 69.13 | 71.98 | 63.6 | 76.8 | 51.62 | 74.94 | 58.87 | 60.21 | 61.3 | 71.95 | 75.83 | 70.81 | 47.94 | 77.14 |
| 1967 | 65.38 | 58.46 | 73.06 | 77.47 | 62.61 | 70.04 | 74.15 | 73.16 | 69.58 | 54.23 | 73.04 | 74.18 | 72.17 | 62.85 | 76.8 | 51.62 | 74.89 | 58.87 | 59.47 | 60.95 | 72.45 | 75.79 | 73.51 | 49.96 | 82.58 |
| 1968 | 66.9 | 60.56 | 76.23 | 77.47 | 64.92 | 70.68 | 77.71 | 73.18 | 73.96 | 53.07 | 74.29 | 74.78 | 72.17 | 65.45 | 77.45 | 51.62 | 74.97 | 58.87 | 60.72 | 58.82 | 71.78 | 76.65 | 73.65 | 51.02 | 82.58 |
| 1969 | 70.03 | 69.65 | 76.95 | 77.98 | 65.73 | 70.32 | 78.02 | 73.18 | 76.29 | 60.92 | 76.67 | 74.93 | 72.94 | 65.55 | 77.46 | 51.62 | 71.17 | 58.87 | 63.03 | 62.66 | 71.5 | 77.86 | 69.99 | 57.04 | 82.58 |
| 1970 | 83.5 | 78.62 | 83.57 | 89.45 | 78.36 | 78.26 | 82.19 | 94.76 | 89.68 | 75.19 | 88.73 | 90.27 | 86.74 | 82.42 | 95.71 | 83.55 | 75.72 | 88.67 | 100.87 | 91.66 | 86.41 | 91.77 | 89.65 | 69.75 | 87.34 |
| 1971 | 88.43 | 84.75 | 96.69 | 94.54 | 88.15 | 87.19 | 83.34 | 100.00 | 94.81 | 95.73 | 93.85 | 95.05 | 99.69 | 91.92 | 100.00 | 100.00 | 89.40 | 96.91 | 102.61 | 102.09 | 96.04 | 96.39 | 100.00 | 84.66 | 95.89 |
| 1972 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 | 100.00 |
| 1973 | 118.86 | 111.62 | 116.57 | 111.06 | 136.6 | 130.8 | 117.27 | 127.78 | 133.68 | 146.21 | 102.1 | 117.14 | 118.47 | 113.41 | 108.12 | 100.00 | 113.1 | 124.76 | 153.84 | 144.36 | 110.48 | 111.21 | 128.81 | 106.81 | 123.39 |
| 1974 | 173.82 | 148.13 | 139.19 | 126.49 | 198.2 | 170 | 140.47 | 163.00 | 203.63 | 220.07 | 143.33 | 257.98 | 283.74 | 145.22 | 163.49 | 158.67 | 214.29 | 186.87 | 267.76 | 230.4 | 164.07 | 142.97 | 176.58 | 129.43 | 189.67 |
| 1975 | 192.67 | 154.88 | 145.82 | 144.67 | 214.16 | 195.49 | 206.62 | 212.03 | 297.38 | 221.52 | 183.09 | 300.09 | 320.71 | 180.89 | 198.36 | 143.51 | 221.06 | 244.17 | 266.97 | 226.35 | 178.59 | 169.37 | 196.11 | 154.4 | 230.9 |
| 1976 | 214.57 | 162.75 | 213.46 | 164.59 | 244.41 | 209.95 | 323.43 | 250.82 | 280.81 | 224.34 | 225.53 | 287.01 | 382.07 | 206.54 | 219.16 | 126.01 | 272.24 | 248.51 | 306.17 | 255.56 | 184.49 | 182.77 | 215.12 | 173.67 | 249.08 |
| 1977 | 236.49 | 196.97 | 223.98 | 172.03 | 265.99 | 230.67 | 329.22 | 271.77 | 308.64 | 246.6 | 229.1 | 272.31 | 407.59 | 214.67 | 221.03 | 126.01 | 292.34 | 332.68 | 318.41 | 262.3 | 184.75 | 198.04 | 241.58 | 182.53 | 246.13 |
| 1978 | 251.15 | 319.78 | 236.22 | 171.55 | 277.86 | 236.48 | 331.16 | 316.72 | 311.23 | 291.66 | 231.35 | 300.04 | 417.86 | 225.99 | 228.69 | 126.01 | 308.46 | 359.06 | 348.49 | 299.33 | 191.18 | 212.61 | 271.29 | 202.62 | 265.51 |
| 1979 | 306.36 | 262.43 | 281.01 | 190.56 | 309.06 | 359.01 | 373.23 | 332.6 | 431.95 | 271.4 | 259.02 | 344.55 | 541.63 | 247.24 | 257.96 | 158.56 | 441.56 | 679.45 | 400.91 | 344.16 | 297.42 | 239.96 | 302.49 | 228.65 | 342.56 |
| 1980 | 378.89 | 300.06 | 332.59 | 204.18 | 352.17 | 346.31 | 424.12 | 332.61 | 552.69 | 395.77 | 342.58 | 420.45 | 940.41 | 278.81 | 344.75 | 189.01 | 524.58 | 321.66 | 484.18 | 433.55 | 434.36 | 261.59 | 331.96 | 252.34 | 453.44 |

# APPENDIX C

## INDEX OF CAPACITY UTILIZATION IN MANUFACTURING, 1956–1980

## Appendix C

### Index of Capacity Utilization in Manufacturing 1956 – 1980

This appendix describes the methods used to derive the capital utilization index and briefly discusses the meaning of the results. The index is based on data indicating expenditure for fuels and for electric power found in various issues of the Manufacturing Census and of the Survey of Manufactures. Expenditures in current prices are deflated to derive expenditures of manufacturing establishments for fuels and electric power in 1972 prices, annually for the period 1956 to 1980. The price index used to deflate fuels is the producer price index for petroleum as shown in Appendix B. The price index for electric power is based on the schedule of commercial/industrial rates as furnished by MERALCO. The latter index is shown in column (1) of the table that follows. Deflation by use of these indices results in the estimates of expenditures for fuels and electric power in constant (1972) prices which are shown in columns (2) and (3).

Columns (2) and (3) are then combined to obtain aggregate expenditures for energy in constant prices, and the result is shown in column (4). Note that in some years, NCSO did not report fuel and/or electric power expenditures, making it necessary to interpolate. The interpolations have been made after taking into consideration the changing mix of fuels and electric power inputs. This was done with the help of data on fuel and electric power prices, whereby the fuel/power input mix was made a function of the fuel price/power price ratio.

From this point, we move directly to the desired capital utilization index. First, we convert our expenditures for energy (column 4) into an index with 1972 as base year. This is shown in column (5). Then we convert our estimate of capital stock into an index, also with 1972 as base year. This is shown in column (6). By dividing column (5) by column (6) we arrive at the index of capital utilization, which is shown in column (7). It is important to observe that the index shown in column (7) shows only *changes* in the capital utilization rate. It does not indicate the *level* of capital utilization. For example, when the index declines from 100.0 in 1972 to 77.7 in 1980, there was a decline of 22.3 percent in capacity utilization during that period. The index does not, however, say anything about what the level of capacity utilization was in, say, 1980. The level might have been either more or less than 77.7 percent.

Bautista (1974) has investigated the level of capital utilization for selected industries and for all manufacturing. He utilized electric motor utilization rates which he then converted to capital time utilization rates. His most recent time utilization rate for 1972 is 61.7 percent. If we link our capital utilization index to his time utilization rate, the result is the following:

| Year | Time Utilization Rate of Capital Stock All Manufacturing (in percent) |
|---|---|
| 1972 | 61.7 |
| 1973 | 62.5 |
| 1974 | 63.2 |
| 1975 | 63.5 |
| 1976 | 60.2 |
| 1977 | 57.5 |
| 1978 | 53.8 |
| 1979 | 51.2 |
| 1980 | 47.9 |

These estimates are revealing in two respects. They indicate that the time utilization rate rose during the commodity boom of 1972–1975, but only modestly, peaking at 63.5 percent in 1975. Thereafter, the decline was sharp and consistently downward, falling under 50 percent in 1980. Considering the precipitous fall in industrial production between 1980–1984, we estimate the time utilization rate at between 30 and 35 percent by 1985, and probably closer to 30 percent. This easily puts it at the lowest level compared to any other year since 1950.

Derivation of Capital Utilization Index

| Year | (1) Price Index El. Pwr. (1972= 100) | (2) Exp. Fuels Mill. P (1972 Prs.) | (3) Exp. Elec. Mill. P (1972 Prs.) | (4) Total Exp. Fuel & El. Mill. P (1972 Prs.) | (5) Index of Tot. Pwr Consptn. (1972= 100) | (6) Index of Cap. Stk. in Place (1972= 100) | (7) Index of Capital Utilization (1972=100) |
|---|---|---|---|---|---|---|---|
| 1956 | 49.3 | 65.5 | 17.1 | 82.6 | 16.1 | 16.3 | 98.7 |
| 1957 | 48.3 | 79.8 | 25.9 | 105.7 | 20.6 | 18.4 | 111,9 |
| 1958 | 48.0 | 77.1 | 34.4 | 111.4 | 21.7 | 20.9 | 103.8 |
| 1959 | 46.9 | 88.4 | 44.4 | 132.7 | 25.9 | 23.2 | 111.6 |
| 1960 | 47.0 | 92.8 | 49.6 | 142.4 | 27.8 | 26.7 | 104.1 |
| 1961 | 46.8 | .. | .. | 166.3* | 32.4 | 31.3 | 103.5 |
| 1962 | 46.6 | 118.9 | 71.2 | 190.1 | 37.0 | 37.7 | 98.1 |
| 1963 | 46.4 | .. | .. | 201.1* | 39.2 | 41.7 | 95.6 |
| 1964 | 46.1 | .. | .. | 212.2* | 41.4 | 46.7 | 88.7 |
| 1965 | 54.6 | 133.9 | 89.2 | 223.0 | 43.5 | 52.3 | 83.2 |
| 1966 | 56.6 | .. | .. | 258.5* | 50.3 | 59:9 | 83.9 |
| 1967 | 56.6 | .. | .. | 293.9* | 57.3 | 66.8 | 85.7 |
| 1968 | 56.0 | 181.8 | 147.7 | 329.4 | 64.2 | 71.7 | 89.5 |
| 1969 | 56.1 | 215.7 | 156.4 | 372.1 | 72.5 | 79.6 | 91.1 |
| 1970 | 70.2 | 215.1 | 167.8 | 382.8 | 74.6 | 89.0 | 83.8 |
| 1971 | 81.0 | 281.4 | 206.7 | 468.0 | 91.2 | 94.1 | 96.9 |
| 1972 | 100.0 | .. | .. | 513.1* | 100.0 | 100.0 | 100.0 |
| 1973 | 104.8 | .. | .. | 558.2* | 108.7 | 107.3 | 101.3 |
| 1974 | 265.9 | .. | .. | 603.2* | 117.6 | 114.7 | 102.5 |
| 1975 | 299.4 | 383.9 | 264.4 | 648.3 | 126.3 | 122.7 | 102.9 |
| 1976 | 327.6 | .. | 316.6 | 662.4 | 129.1 | 132.3 | 97.6 |
| 1977 | 336.2 | .. | 328.1 | 676.0 | 131.7 | 142.6 | 92.4 |
| 1978 | 342.5 | .. | .. | 689.9* | 134.5 | 154.3 | 87.2 |
| 1979 | 366.3 | .. | .. | 704.7* | 137.3 | 165.5 | 83.0 |
| 1980 | 549.4 | 205.0* | 512.6 | 717.6 | 139.9 | 180.1 | 77.7 |

.. Indicates data not available

* estimated

Source: NCSO, Survey of Manufacturing Establishments, and Appendices B. and D.

# APPENDIX D

## ESTIMATES OF CAPITAL STOCK IN MANUFACTURING, BY INDUSTRY AT REPLACEMENT COST, 1956–1980

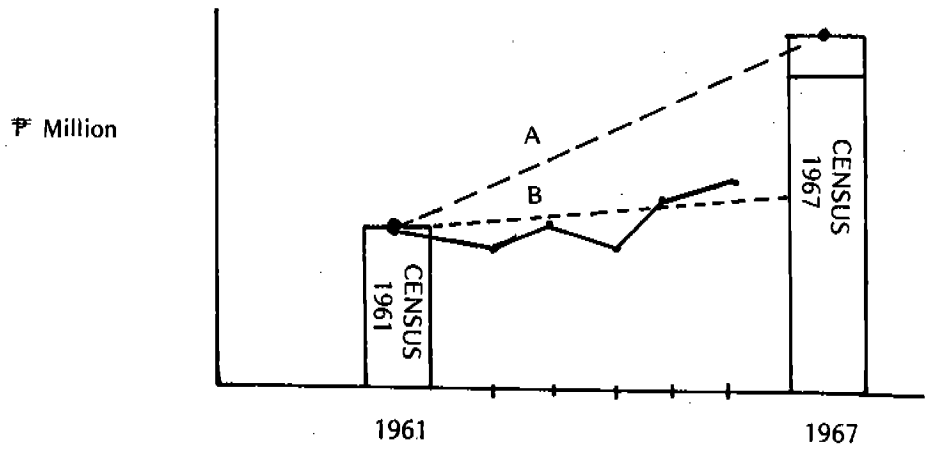
## Appendix D

### Estimates of Capital Stock in Manufacturing, by Industry at Replacement Cost, 1956 – 1980

Some investigators have estimated capital stock by adjusting fixed assets shown at depreciated values in various issues of the *Survey of Manufactures.* We have eschewed this approach mainly because since 1970, it has become standard practice for accountants to carry fixed assets not at original costs but at values inflated by a revaluation conducted by a consulting engineer which reflects his subjective evaluation of the replacement cost of the assets. The revaluation is done periodically but not necessarily annually, so that not only the method of revaluation but also the date of revaluation

We have adopted the perpetual inventory method. To use this method, we first must refine the annual investment expenditure data. The *Survey* records the additions of fixed assets by establishments annually – additions in the form of both used and new assets, including the value of own account construction. However, one defect in the *Survey* reports is that apparently the sampling frame omits investment expenditures of new firms, and thereby underestimates total investment expenditures. We therefore were required to adjust for this undercoverage because failure to do so would incorporate such errors of understatement into our estimates of capital assets *on a cumulative basis.*

The underreporting of new firms' investment expenditures can readily be seen by comparing *Census* expenditure estimates with the *Survey* estimates of the year immediately preceding the census. Over time, this traces out a "stepwise" pattern whereby the *Census* estimate almost invariably exceeds the trend implicit in the *Survey* estimates by a wide margin. The following diagram illustrates the pattern.



The trend of the *Surveys* is the B trend which is significantly below that implied by A, a straight line drawn connecting the two census estimates. We derived the *Survey* trend line, B, by fitting a least squares trend to observed *Survey* values. Then we computed the ration of this to the implicit trend line A obtained by connecting Census estimates, correcting the intercensal *(Survey)* observations by the ratio (A/B) for each year. In this way we obtained a set of corrected annual values consistent with Census benchmarks. The latter are then deflated by the use of an investment price deflator to obtain annual investment expenditures in constant (1972) prices. The investment price index is based on data shown in Power (1979), updated to 1980 and using fixed weights for combining machinery and equipment (.75) and construction costs (.25).

The resulting investment price index for inflating investment expenditures is shown below.

**Investment Goods Price Deflator**
**(1972 = 1.00)**

| | | | |
|---|---|---|---|
| 1946 | 3.451 | 1964 | 1.704 |
| 1947 | 3.448 | 1965 | 1.689 |
| 1948 | 3.448 | 1966 | 1.656 |
| 1949 | 3.451 | 1967 | 1.636 |
| 1950 | 3.178 | 1968 | 1.585 |
| 1951 | 2.598 | 1969 | 1.496 |
| 1952 | 2.476 | 1970 | 1.241 |
| 1953 | 2.680 | 1971 | 1.074 |
| 1954 | 2.828 | 1972 | 1.000 |
| 1955 | 2.843 | 1973 | 0.680 |
| 1956 | 2.897 | 1974 | 0.880 |
| 1957 | 2.757 | 1975 | 0.653 |
| 1958 | 2.578 | 1976 | 0.605 |
| 1959 | 2.377 | 1977 | 0.564 |
| 1960 | 2.113 | 1978 | 0.520 |
| 1961 | 1.965 | 1979 | 0.441 |
| 1962 | 1.845 | 1980 | 0.388 |
| 1963 | 1.716 | | |

We derive gross capital stock by summing over the depreciable life of assets. That is, we take depreciable life as our estimate of actual life. Hence, we have

$$K_{g_t} = \sum_{l=1}^{n} (I/P)_{t-l}$$

where $K_g$ is gross capital stock, $(I/P)_{t-1}$ investment in time period $t-1$ deflated by the investment goods price index of the same period, and real investment is cumulated over the $n$ years of asset life. We adopt the sudden death assumption whereby assets drop out of the capital stock after $n$ years of use.

We do not have to guess at $n$. The *Census* gives actual values of $n$ used in each industry for 1975. We have used these and extrapolated them backwards to 1956 and forward to 1980 by utilizing data on the composition of fixed assets, as shown in various issues of the *Census*, and using weights implicit in Bulletin F for different asset classes. Average asset life for fixed assets of manufacturing industries is given in the following table.

**Depreciable Life of Assets by Industry, 1975**
**(In years)**

| | | | |
|---|---|---|---|
| All Manufacturing | 14.28 | Transport Equipment | 20.01 |
| Food | 10.62 | Glass | 13.65 |
| Sugar Milling | 15.66 | Fabricated Metals | 14.84 |
| Beverages | 20.20 | Rubber Products | 16.80 |
| Tobacco | 8.16 | Petroleum Refining | 15.15 |
| Textiles | 9.91 | Industrial Chemicals | 17.34 |
| Wearing Apparel | 17.17 | Other Chemicals | 12.72 |
| Printing & Publishing | 15.45 | Iron & Steel | 12.00 |
| Paper Products | 20.60 | Non–Ferrous Metals | 16.32 |
| Footwear (ex. rubber) | 15.83 | Non–Metallic Mineral Products | 17.34 |
| Wood Products | 10.60 | Machinery (ex. electricity) | 16.64 |
| Furniture & Fixtures | 11.88 | Electrical Machinery | 9.18 |
| Leather Products | 20.00 | | |
| Plastic Products | 12.84 | | |

Since we now have $K_g$, we can derive net fixed capital stock for each industry by the equation

$$K_{d_t}^{j} = K_{g_t}^{j} \Big/ \frac{n^j}{n^j - A^j}$$

$n^j$ is depreciable life of assets in the $j^{th}$ industry and $A$ is derived using the Census reported value of $K^j_{d_t}$. We then substitute into the above equation the derived value of $A$, and obtain $K^j_{d_t}$ for each year for each of our j industries. The result is capital stock net of depreciation expressed at replacement cost in 1972 prices.

Net capital stock at time $t$ is $K_d^{*j} = K_{d_t}^j + I_t^j$ where I is inventory held by large firms for any given year, deflated by an index which combines prices of finished goods for industry $j$ an index of the cost of factory labor and the general price index of processed inputs. For purposes of productivity measurement, however, we consider $K_d$ and $I$ as separate and distinct types of inputs.

Estimates of fixed capital at replacement cost and inventory, by industry, are shown in Annex D.

## Annex D

## Net Capital Stock, 1972 Prices
## (For Firms with 20 or more Workers)
## (Values in Million Pesos)

| YEAR | PRODUCER'S PRICE INDEX (1972=100) | ALL MANUFACTURING | | FOOD (311–12) | | | | TOBACCO (314) | | TEXTILES (321) | | WEARING APPAREL (322) | | LEATHER (323) | | FOOTWEAR (324) | | WOOD PRODUCT (331) | | PAPER PRODUCT (341) | | PRINTING & PUBLISHING (342) | | INDUSTRIAL CHEMICALS (351) | | PETROLEUM (353) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | F. A. | INV. | F.A. | INV. | F.A. | INV. | F.A. | INV. | F.A. | INV. | F.A. | INV. | F. A. | INV. | F.A. | INV. | F.A. | INV. | F.A. | INV. | F.A. | INV. | F.A. | INV. | F.A. | INV. |
| 1956 | 46.19 | 1910.8 | 992.3 | 470.6 | 241.6 | 120.8 | 23.4 | 51.4 | 70.5 | 111.8 | 85.8 | 33.8 | 33.5 | 5.0 | 2.5 | 13.7 | 15.9 | 82.8 | 36.3 | 36.8 | 17.9 | 63.0 | 28.2 | 62.4 | 11.5 | | |
| 1957 | 47.65 | 2154.3 | 1153.2 | 476.0 | 245.2 | 120.6 | 27.8 | 59.2 | 80.4 | 164.2 | 153.4 | 37.2 | 34.2 | 6.1 | 5.7 | 13.8 | 15.4 | 93.5 | 52.8 | 29.8 | 29.2 | 71.5 | 29.6 | 63.2 | 7.8 | | |
| 1958 | 47.53 | 2449.8 | 1283.2 | 487.7 | 297.9 | 127.9 | 29.5 | 69.2 | 111.1 | 267.3 | 125.7 | 39.5 | 37.6 | 9.2 | 4.4 | 14.5 | 15.0 | 106.3 | 49.6 | 68.7 | 30.6 | 75.1 | 31.1 | 91.3 | 24.0 | | |
| 1959 | 48.99 | 2176.9 | 1391.9 | 506.8 | 320.4 | 136.3 | 37.3 | 77.2 | 136.9 | 344.1 | 140.2 | 52.3 | 45.6 | 11.1 | 5.7 | 16.6 | 15.9 | 120.6 | 48.1 | 96.9 | 43.2 | 85.0 | 41.4 | 93.8 | 28.3 | | |
| 1960 | 49.75 | 3139.1 | 1547.7 | 535.0 | 359.3 | 149.9 | 48.9 | 88.6 | 128.9 | 501.0 | 186.4 | 54.2 | 38.1 | 12.6 | 8.8 | 18.0 | 16.4 | 131.0 | 51.6 | 139.2 | 64.9 | 97.3 | 47.5 | 106.3 | 28.5 | | |
| 1961 | 53.69 | 3674.2 | 1944.4 | 613.5 | 324.7 | 165.5 | 58.5 | 100.8 | 132.7 | 688.7 | 223.7 | 58.0 | 32.5 | 14.3 | 12.1 | 20.6 | 17.3 | 168.4 | 55.7 | 167.2 | 83.1 | 109.3 | 51.1 | 116.9 | 33.7 | 355.5 | 63.1 |
| 1962 | 55.90 | 4426.7 | 2359.8 | 712.2 | 465.7 | 170.9 | 45.9 | 120.6 | 135.3 | 877.5 | 358.5 | 62.5 | 38.5 | 15.4 | 12.3 | 23.7 | 14.1 | 191.3 | 69.3 | 197.4 | 85.1 | 112.5 | 54.4 | 126.6 | 41.5 | 544.9 | 103.4 |
| 1963 | 58.47 | 4892.2 | 2092.9 | 759.2 | 461.2 | 179.9 | 60.5 | 123.6 | 138.9 | 1001.1 | 352.8 | 63.6 | 39.4 | 16.4 | 12.5 | 27.2 | 13.4 | 220.3 | 72.8 | 207.6 | 88.2 | 121.5 | 58.4 | 133.2 | 49.5 | 541.7 | 89.3 |
| 1964 | 61.02 | 5484.5 | 2312.6 | 885.2 | 513.2 | 204.4 | 80.2 | 126.9 | 145.2 | 1048.7 | 343.2 | 61.7 | 22.9 | 16.9 | 13.2 | 26.5 | 13.2 | 290.9 | 77.1 | 217.5 | 90.6 | 133.1 | 71.6 | 142.5 | 60.1 | 530.4 | 72.2 |
| 1965 | 62.29 | 6114.6 | 2625.1 | 1046.6 | 539.2 | 227.4 | 98.3 | 132.5 | 142.5 | 1092.7 | 345.1 | 65.9 | 25.7 | 18.4 | 12.4 | 27.9 | 12.9 | 334.7 | 83.6 | 237.3 | 94.1 | 153.5 | 73.9 | 163.8 | 71.3 | 530.4 | 71.3 |
| 1966 | 64.25 | 7036.5 | 2809.8 | 1291.0 | 510.1 | 253.4 | 100.0 | 142.4 | 147.2 | 1085.8 | 344.2 | 68.6 | 28.1 | 18.5 | 12.7 | 27.6 | 12.6 | 325.3 | 88.6 | 259.4 | 96.6 | 172.7 | 74.2 | 270.7 | 81.7 | 544.9 | 79.2 |
| 1967 | 65.38 | 7831.8 | 2828.2 | 1446.5 | 554.5 | 297.9 | 67.8 | 137.6 | 153.2 | 1088.3 | 346.6 | 68.7 | 30.4 | 18.7 | 14.3 | 27.6 | 12.3 | 335.4 | 93.6 | 265.7 | 99.6 | 183.2 | 71.7 | 301.8 | 90.0 | 622.2 | 147.3 |
| 1968 | 66.90 | 8410.8 | 3319.3 | 1666.2 | 671.9 | 312.6 | 75.5 | 149.4 | 143.1 | 1057.0 | 443.9 | 68.2 | 33.5 | 18.9 | 16.1 | 27.1 | 12.9 | 339.6 | 123.1 | 272.3 | 120.7 | 195.7 | 70.4 | 317.3 | 93.5 | 645.6 | 159.7 |
| 1969 | 70.03 | 9331.9 | 3360.1 | 1760.2 | 670.1 | 342.9 | 66.8 | 148.6 | 166.3 | 1059.2 | 527.0 | 72.4 | 31.9 | 19.2 | 14.0 | 26.8 | 10.7 | 370.5 | 144.2 | 282.6 | 131.7 | 200.0 | 72.9 | 324.6 | 117.3 | 644.7 | 128.5 |
| 1970 | 83.30 | 10438.8 | 4200.3 | 1926.0 | 672.2 | 360.6 | 110.6 | 161.4 | 267.1 | 900.4 | 468.8 | 72.5 | 31.2 | 19.5 | 10.6 | 28.4 | 6.9 | 407.9 | 141.5 | 330.4 | 162.5 | 202.1 | 69.5 | 335.0 | 115.1 | 798.3 | 161.5 |
| 1971 | 88.43 | 11042.3 | 4342.6 | 2068.9 | 777.1 | 381.7 | 120.9 | 176.0 | 208.1 | 853.8 | 499.8 | 72.2 | 33.2 | 20.2 | 11.7 | 27.5 | 5.3 | 415.4 | 176.6 | 355.5 | 150.0 | 205.2 | 68.7 | 342.9 | 132.2 | 937.9 | 186.9 |
| 1972 | 100.00 | 11729.1 | 4978.0 | 2107.1 | 815.0 | 400.6 | 152.2 | 148.9 | 369.2 | 861.1 | 653.7 | 77.7 | 24.2 | 20.7 | 8.5 | 28.9 | 5.1 | 486.5 | 250.4 | 627.7 | 268.5 | 211.3 | 68.7 | 367.9 | 183.7 | 1087.1 | 248.5 |
| 1973 | 118.86 | 12586.8 | 5141.6 | 2347.0 | 1032.7 | 443.4 | 121.3 | 217.3 | 415.0 | 941.8 | 709.4 | 84.4 | 40.5 | 21.5 | 9.5 | 28.6 | 5.3 | 524.3 | 169.4 | 657.4 | 199.1 | 230.6 | 86.9 | 443.6 | 247.2 | 1137.2 | 331.3 |
| 1974 | 173.62 | 13460.0 | 6381.3 | 2415.3 | 1080.0 | 481.1 | 217.8 | 232.7 | 368.8 | 994.5 | 805.2 | 86.3 | 37.0 | 21.7 | 8.1 | 28.4 | 3.5 | 507.6 | 183.8 | 689.4 | 275.2 | 239.7 | 69.3 | 491.7 | 296.8 | 1187.2 | 351.8 |
| 1975 | 192.67 | 14396.9 | 5279.6 | 2488.1 | 973.4 | 513.6 | 105.8 | 241.7 | 334.7 | 1471.3 | 692.4 | 106.8 | 49.7 | 22.1 | 8.7 | 28.4 | 3.7 | 552.1 | 158.0 | 763.4 | 175.11 | 291.5 | 43.8 | 503.4 | 244.6 | 1180.9 | 351.8 |
| 1976 | 214.57 | 15516.9 | 5267.9 | 2528.7 | 690.0 | 548.2 | 149.7 | 245.6 | 306.2 | 1727.1 | 885.1 | 102.6 | 34.8 | 22.9 | 6.4 | 32.1 | 3.3 | 627.9 | 157.3 | 849.3 | 192.6 | 317.1 | 51.6 | 663.1 | 262.7 | 957.8 | 267 |
| 1977 | 236.49 | 16772.1 | 6636.4 | 2512.6 | 807.2 | 630.3 | 165.1 | 319.1 | 365.7 | 1296.7 | 921.8 | 109.6 | 36.0 | 22.9 | 6.4 | 31.9 | 4.2 | 634.4 | 108.6 | 899.9 | 228.7 | 342.9 | 58.3 | 743.8 | 259.4 | 808.1 | 274.9 |
| 1978 | 251.15 | 18093.3 | 7270.0 | 2692.6 | 892.2 | 725.4 | 179.1 | 321.5 | 367.7 | 2038.2 | 1144.4 | 120.6 | 59.7 | 22.0 | 12.3 | 31.9 | 7.4 | 678.4 | 273.8 | 961.7 | 318.2 | 371.3 | 94.6 | 819.9 | 368.5 | 845.9 | 328.1 |
| 1978 | 251.15 | 19405.6 | 6958.1 | 2894.9 | 881.9 | 808.8 | 158.4 | 305.6 | 326.5 | 2335.6 | 1112.1 | 133.5 | 74.9 | 22.3 | 13.5 | 30.7 | 8.3 | 697.7 | 224 | 1023.6 | 327.3 | 393.4 | 99.6 | 882.4 | 372.7 | 885.4 | 310.2 |
| 1979 | 306.56 | 21120.5 | 7478.7 | 2993.4 | 899.7 | 1030.0 | 237.5 | 303.9 | 272.9 | 2473.9 | 1179.5 | 154.4 | 92.7 | 23.4 | 9.8 | 30.6 | 10.6 | 720.8 | 221.5 | 1070.2 | 319.6 | 410.4 | 80.6 | 1035.5 | 380.9 | 922.8 | 356.9 |
| 1980 | 378.69 | | | | | | | | | | | | | | | | | | | | | | | | | | |

Annex D (Continued)

| YEAR | OTHER CHEMICALS (352) F.A. | INV. | RUBBER (355) F.A. | INV. | PLASTICS (356) F.A. | INV. | POTTERY, CHINA (361) F.A. | INV. | NON-METALLIC MINERALS (369 & 63) F.A. | INV. | IRON & STEEL (371) F.A. | INV | GLASS (362) F.A. | INV. | NON-FERROUS MATERIALS (372) F.A. | INV. | FABRICATED METAL PRODUCT (381) F.A. | INV. | ELECTRICAL MACHINERY (383) F.A. | INV. | MACHINERY (EX. ELECT'L) (382) F.A. | INV. | TRANSPORT EQUIPMENT (384) F.A. | INV. | FURNITURE & FIXTURES (352) F.A. | INV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1956 | 103.5 | 33.5 | 17.0 | 10.9 | 11.3 | | | | 17.1 | 7.0 | | | 18.2 | 6.3 | | | 65.8 | 51.0 | 14.6 | 12.5 | 58.4 | 15.7 | 103.8 | 62.6 | 5.4 | 7.0 |
| 1957 | 121.6 | 85.1 | 64.6 | 32.2 | 14.1 | 5.5 | | | 48.4 | 30.5 | | | 19.6 | 4.3 | | | 73.9 | 76.6 | 19.0 | 20.2 | 61.3 | 21.8 | 104.9 | 61.5 | 5.6 | 8.8 |
| 1958 | 148.5 | 85.6 | 75.0 | 35.1 | 16.2 | 6.0 | | | 64.5 | 35.5 | | | 20.7 | 8.2 | | | 84.9 | 66.4 | 24.4 | 23.5 | 65.5 | 39.6 | 106.4 | 70.4 | 12.7 | 10.2 |
| 1959 | 159.2 | 108.4 | 84.3 | 41.3 | 17.3 | 5.1 | | | 91.9 | 40.1 | 72.0 | 46.9 | 22.0 | 8.2 | 2.0 | 0.8 | 97.5 | 79.3 | 37.8 | 33.9 | 63.2 | 17.8 | 110.1 | 81.0 | 13.9 | 10.3 |
| 1960 | 180.2 | 117.4 | 101.1 | 43.7 | 18.4 | 6.0 | | | 133.8 | 63.6 | 76.1 | 48.4 | 31.5 | 14.1 | 2.2 | 1.6 | 122.7 | 94.6 | 56.5 | 62.8 | 62.7 | 20.0 | 114.6 | 92.1 | 14.6 | 10.1 |
| 1961 | 201.7 | 143.8 | 108.7 | 56.4 | 19.9 | 9.9 | | | 142.9 | 85.7 | 82.5 | 60.5 | 39.0 | 23.7 | 7.6 | 1.7 | 147.4 | 128.5 | 61.2 | 69.5 | 75.1 | 35.7 | 110.8 | 120.0 | 15.6 | 10.1 |
| 1962 | 240.5 | 147.8 | 135.3 | 58.7 | 23.0 | 15.9 | | | 161.6 | 55.6 | 93.1 | 54.9 | 45.1 | 24.9 | 8.5 | 14.2 | 193.2 | 163.2 | 110.5 | 128.4 | 72.3 | 28.5 | 123.3 | 155.5 | 20.3 | 13.7 |
| 1963 | 258.4 | 109.4 | 145.7 | 63.1 | 23.9 | 15.1 | | | 211.2 | 59.5 | 136.5 | 77.9 | 53.1 | 26.1 | 8.8 | 7.7 | 217.8 | 166.6 | 150.9 | 146.8 | 73.0 | 27.8 | 153.1 | 228.8 | 31.0 | 15.4 |
| 1964 | 274.8 | 197.8 | 158.2 | 66.0 | 26.3 | 14.5 | | | 297.4 | 70.9 | 136.6 | 87.9 | 63.9 | 24.3 | 9.5 | 12.9 | 234.7 | 162.5 | 164.9 | 141.5 | 73.7 | 27.0 | 180.7 | 216.3 | 31.4 | 17.2 |
| 1965 | 317.5 | 197.5 | 171.8 | 63.8 | 29.3 | 15.0 | | | 338.1 | 85.5 | 195.4 | 94.7 | 78.8 | 27.5 | 9.4 | 2.5 | 247.7 | 165.4 | 177.1 | 147.0 | 76.6 | 26.9 | 200.7 | 221.3 | 32.2 | 18.1 |
| 1966 | 322.5 | 216.1 | 190.1 | 73.1 | 32.6 | 17.6 | | | 475.5 | 105.7 | 240.6 | 86.2 | 91.9 | 29.1 | 9.1 | 2.3 | 263.7 | 163.6 | 184.6 | 152.2 | 78.0 | 26.4 | 223.2 | 216.4 | 34.3 | 19.4 |
| 1967 | 339.1 | 267.5 | 190.3 | 75.4 | 35.3 | 15.3 | 4.8 | 5.0 | 593.4 | 114.3 | 236.2 | 107.4 | 98.6 | 54.4 | 9.0 | 7.5 | 272.8 | 162.4 | 185.1 | 152.6 | 78.8 | 20.8 | 267.9 | 276.4 | 36.6 | 14.6 |
| 1968 | 351.3 | 289.4 | 204.1 | 77.4 | 38.0 | 22.5 | 6.8 | 5.8 | 762.8 | 89.7 | 245.0 | 151.2 | 107.8 | 69.6 | 14.6 | 44.3 | 275.1 | 156.3 | 179.8 | 150.2 | 79.4 | 25.8 | 293.5 | 227.7 | 29.9 | 10.1 |
| 1969 | 355.7 | 277.9 | 215.7 | 75.7 | 48.0 | 32.6 | 8.6 | 3.4 | 804.9 | 89.9 | 691.9 | 216.6 | 135.6 | 70.1 | 19.9 | 46.5 | 289.5 | 165.6 | 221.4 | 190.7 | 83.7 | 73.9 | 295.9 | 235.5 | 29.4 | 9.2 |
| 1970 | 372.3 | 454.9 | 224.9 | 92.2 | 59.7 | 44.5 | 11.0 | 5.2 | 936.2 | 110.5 | 977.5 | 467.6 | 165.6 | 63.6 | 24.4 | 59.2 | 294.5 | 141.1 | | | | | | | | |
| 1971 | 427.6 | 483.6 | 214.4 | 103.0 | 70.6 | 44.3 | 13.0 | 5.9 | 984.4 | 140.6 | 804.4 | 208.0 | 187.4 | 72.6 | 37.7 | 50.2 | 296.1 | 181.6 | 225.1 | 236.6 | 84.6 | 33.5 | 307.2 | 297.8 | 29.7 | 8.9 |
| 1972 | 466.5 | 382.7 | 258.9 | 105.2 | 79.6 | 41.9 | 15.2 | 7.5 | 1018.9 | 112.0 | 812.1 | 170.6 | 198.4 | 80.2 | 37.7 | 2.4 | 295.8 | 180.1 | 233.9 | 236.9 | 92.3 | 111.6 | 323.2 | 305.7 | 30.2 | 13.0 |
| 1973 | 517.0 | 435.9 | 250.9 | 93.8 | 90.9 | 62.7 | 30.7 | 12.4 | 1083.3 | 194.1 | 836.9 | 338.6 | 203.6 | 186.4 | 50.1 | 90.4 | 297.5 | 230.7 | 220.0 | 249.9 | 97.3 | 74.1 | 354.6 | 377.7 | 31.6 | 17.4 |
| 1974 | 526.6 | 560.5 | 258.6 | 125.2 | 116.1 | 84.2 | 34.4 | 16.1 | 1304.4 | 184.4 | 991.2 | 465.8 | 210.2 | 102.7 | 57.9 | 80.7 | 286.9 | 220.2 | 231.0 | 246.2 | 129.7 | 96.2 | 408.9 | 461.9 | 31.3 | 17.4 |
| 1975 | 533.7 | 422.1 | 268.7 | 76.4 | 145.6 | 77.4 | 137.3 | 30.9 | 1329.2 | 128.4 | 927.1 | 281.5 | 217.6 | 74.5 | 59.5 | 7.6 | 286.8 | 168.1 | 246.6 | 243.8 | 147.5 | 108.5 | 559.5 | 420.7 | 28.7 | 18.2 |
| 1976 | 575.6 | 442.6 | 321.1 | 80.0 | 163.4 | 64.4 | 151.1 | 25.9 | 1576.9 | 125.0 | 963.6 | 422.7 | 228.7 | 55.7 | 64.7 | 17.4 | 267.4 | 108.2 | 289.5 | 185 | 170.7 | 62.5 | 634.1 | 310.2 | 31.9 | 12.8 |
| 1977 | 597.1 | 459.4 | 329.1 | 83.5 | 201.7 | 84.4 | 175.7 | 29.8 | 1588.4 | 121 | 959.3 | 460.8 | 235.3 | 69.1 | 66.0 | 10.7 | 266.3 | 118.0 | 344.4 | 259.6 | 179.9 | 56.4 | 726.0 | 381.8 | 36.8 | 15.9 |
| 1978 | 649.0 | 420.5 | 328.4 | 147.2 | 232.0 | 96.3 | 196.6 | 30.1 | 1647.9 | 126.9 | 953.0 | 494.6 | 264.7 | 75.6 | 87.3 | 25.5 | 273.0 | 163.2 | 421.1 | 360.5 | 209.3 | 95.8 | 978.8 | 434.5 | 44.1 | 24 |
| 1979 | 696.9 | 493.7 | 336.4 | 158.4 | 254.4 | 85.6 | 213.3 | 28.6 | 1690.9 | 146.9 | 980.6 | 456.9 | 306.4 | 53.5 | 117.1 | 35.2 | 280.1 | 143.7 | 459.1 | 370.5 | 241.6 | 103.1 | 1246.6 | 415.7 | 53.7 | 28.1 |
| 1980 | 772.0 | 560.5 | 349.9 | 157.0 | 275.7 | 92.2 | 213.4 | 27.3 | 1807.3 | 168.8 | 1340.1 | 468.5 | 331.4 | 72.2 | 144.4 | 29.7 | 270.9 | 86.4 | 697.8 | 241.4 | 259.0 | 81.5 | 1490.8 | 576 | 65.1 | 31.3 |

# APPENDIX E

## ADJUSTMENT OF INTERMEDIATE INPUTS FOR CHANGES IN EFFECTIVE PROTECTION RATES, BY MANUFACTURING INDUSTRY, 1956–1980

(Erlinda Medalla and Richard Hooley)

## Appendix E

### Adjustment of Intermediate Inputs for Changes in Effective Protection Rates, by Manufacturing Industry, 1956 – 1980

(Erlinda Medalla and Richard Hooley)

The Census defines gross value added as gross production less the value of intermediate inputs. How intermediate inputs are valued therefore has a critical impact on measures of inputs use as well as the magnitude of value added. In this study, we derived estimates of intermediate goods consumption as $P^*_t - VA^*_t = M^*_t$ where $P$, $VA$, and $M$ denote gross production, gross value added and intermediate goods consumed, respectively, and the asterisks indicate deflated values.

We have described in Appendix C the derivation of the producer price index used to deflate manufacturing production in this study. We could proceed to deflate value added also with this index. This would constitute the single-deflated procedure commonly utilized to derive real value added both in this country and in most LDCs. However, where tariffs on manufactured goods are prevalent, single deflation of value added is likely to result in significant upward bias in the deflated value added series, and a corresponding downward bias in the resulting intermediate goods series.

When tariffs are applied to manufactured goods, the resulting structure almost inevitably manifests a "cascading" character. Effective protection rates are highest on manufacturing production for final use and lowest on production destined for intermediate consumption (Bautista, Power and Associates, 1979). The effective protection experienced by an industry consists of an increase in the price of final production, which causes the level of producers prices to rise at a rate equal to the rate of increase in the nominal tariff.* The price of the corresponding intermediate inputs often rises at a lesser rate, and may even fall, because of a reduction of protection on imported inputs. The first element should be caught by the producers price index – since the rise in the price of domestic production due to the tariff change is implicit in quoted prices of shipments ex factory. The second element, however, is not measured by the final goods price index. If this element is not dealt with explicitly, value added will generally be overstated and intermediate input consumption understated.

To illustrate, suppose $P^t_j$ is the tariff inclusive price at time $t$ per unit of output $j$, $P^t_i$ the tariff inclusive price at time $t$ per unit of input $i$, $a_{ij}$ the physical input-output coefficients, $T^t_j$, the implicit tariff on output and $T^t_j$ the implicit tariff on input $i$. Obviously, changes in $T$'s will affect the $P$'s and thus $VA$, i.e., with everything else constant, over time $VA_t$ would change if the $T$'s change.

One adjustment we want to make is to eliminate the effects of changes in $T$'s on value-added. That is, we want

$$VA^{+1} = \frac{P^t_j}{1 + T^t_j} - \Sigma \frac{P^t_j \; a_{ij}}{1 + T^t_i}$$

*On the assumption that producers raise selling prices to the new entry-level prices of competing imports.

where $VA^{+1}$ is value added adjusted for difference in tariffs on output and input. Now,

$$1 + EPR_j^t = \frac{P_j^t - \Sigma P_i^t a_{ij}}{P_j^t / 1 + T_j^t - \Sigma P_i^t a_{ij} / 1 + T_i^j}$$

where $EPR_j$ is the effective protection rate on the $j^{th}$ unit of output. Thus:

$$VA^{+1} = \frac{VA^t}{1 + EPR_j^t}$$

We also want $VA$ in real terms, i.e., we want to deflate $VA$ by the change in prices other than that caused by tariff changes. To do this, we deflate $VA$ also by producers price index.

$$VA^{*t} = \frac{VA^{+1}}{P_j^t / P_j^o}$$

This implies, however, that input prices exclusive of tariffs change proportionately as the output exclusive of tariff. This is probably the most reasonable assumption to make, especially for cases with high $VA$. Furthermore, with a number of intermediate inputs involved per output, input price changes could average out to be approximately the same as output price.

Hence, combining both adjustments, we have

$$VA^{*t} = \frac{VA^t}{\frac{P_j^t}{P_j^o} (1 + EPR^t)}$$

However, as we noted, $P_j^t / P_j^o$, our price index, already includes changes in tariffs. Hence, to avoid double-counting, we take this out in our final formula, which is:

$$VA^{*t} = \frac{VA^t}{\frac{P_j^t}{P_j^o} \left(\frac{1 + EPR^t}{1 + T_j^t}\right)}$$

*We estimated tariff levels for 1956 from data in Robert Baldwin (1975) as well as from information supplied by personnel of the Department of Economic Research at the Central Bank.

It is virtually impossible to estimate ***EPR*** for each year from 1955-1980. What we propose is to simply take three points in time where ***EPR*** has already been estimated or can more easily be estimated. First, we choose 1955 as our base year when tariffs were minimal and hence close to unity.* The work by Norma Tan on ***EPR*** provided us with benchmark for 1974. Finally, a middle point chosen is 1969 where an I-O table with corresponding implicit tariffs by I-O sector is available (implicit tariffs for 1969 from Norma Tan). Using these three points, we interpolated the remaining years.

In our calculation of the ***EPR*** index, we encountered the problem of averaging within groups of commodities and for all manufacturing, specifically what weights to use. Previous studies, such as Tan's, used free trade value-added per unit of output. However, we found that a few sectors such as rice, corn, etc. would dominate because of their relatively very high value added per unit and very low value added of others. So we revised the weights to be the *total* free trade value-added by the sector. This is done by multiplying the free trade value-added rates by the value of output (in border prices, i.e., deflated by $1 + T$).

The following table contains our estimates of value-added adjustment by the industry.

## Index of (1 + EPR)/(1 + Tj)
## For all Manufactures and by Industry, 1956 – 1980

| Industry | 1956 | 1957 | 1958 | 1959 | 1960 | 1961 | 1962 | 1963 | 1964 | 1965–69 | 1970 | 1972 | 1973 | 1974–80 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Food | 100.1 | 100.2 | 100.3 | 100.4 | 100.4 | 100.5 | 100.6 | 100.7 | 100.8 | 101.0 | 108.8 | 124.5 | 132.5 | 140.5 |
| Sugar | 99.0 | 99.0 | 99.0 | 99.0 | 99.0 | 99.0 | 99.0 | 99.0 | 99.0 | 99.0 | 97.92 | 95.76 | 94.68 | 93.6 |
| Beverages | 147.7 | 161.4 | 175.1 | 188.8 | 202.5 | 216.3 | 230.0 | 243.7 | 257.4 | 271.1 | 238.4 | 173.1 | 140.5 | 107.8 |
| Tobacco | 759.0 | 1,264.0 | 1,769.0 | 227.4 | 2,778.9 | 3,283.9 | 3,283.9 | 4,293.9 | 4,798.9 | 5,303.9 | 5,130.2 | 4,782.7 | 4,608.8 | 4,435.2 |
| Textiles | 109.6 | 110.2 | 110.4 | 111.5 | 112.1 | 112.7 | 113.3 | 114.0 | 114.6 | 115.2 | 113.6 | 110.5 | 109.0 | 74.4 |
| Footwear ecl. Rubber | 95.1 | 95.3 | 95.4 | 95.5 | 95.7 | 95.8 | 95.9 | 96.0 | 96.2 | 96.3 | 95.9 | 95.1 | 94.8 | 94.4 |
| Wearing Apparel | 93.4 | 91.8 | 90.3 | 88.7 | 87.1 | 85.5 | 83.9 | 82.4 | 80.8 | 79.2 | 76.3 | 70.5 | 67.6 | 64.7 |
| Plywood & Veneer | 99.6 | 99.2 | 98.8 | 98.4 | 98.0 | 97.6 | 91.2 | 96.8 | 96.4 | 96.0 | 98.2 | 102.7 | 104.9 | 107.1 |
| Furniture & Fixture | 99.6 | 99.2 | 98.8 | 98.4 | 98.0 | 97.6 | 97.2 | 96.8 | 96.4 | 96.0 | 96.6 | 97.8 | 98.4 | 99.0 |
| Wood Products | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 100.0 | 102.1 | 105.8 | 107.6 | 109.4 |
| Paper & Paper Products | 100.9 | 101.8 | 102.6 | 103.5 | 104.4 | 105.3 | 106.2 | 107.0 | 107.9 | 108.8 | 113.1 | 121.7 | 126.0 | 130.3 |
| Printing & Publishing | 94.98 | 94.6 | 94.4 | 94.92 | 94.9 | 94.88 | 94.86 | 94.84 | 94.82 | 94.8 | 94.3 | 93.2 | 92.7 | 92.2 |
| Leather Products | 103.8 | 112.6 | 121.4 | 130.2 | 139.0 | 147.7 | 156.5 | 165.3 | 174.1 | 182.9 | 169.4 | 142.5 | 129.0 | 115.5 |
| Rubber Shoes & Slippers | 98.7 | 102.5 | 106.2 | 109.9 | 113.7 | 117.4 | 121.1 | 124.8 | 128.6 | 132.3 | 156.9 | 206.1 | 230.7 | 255.3 |
| Rubber Products | 96.8 | 98.5 | 100.3 | 108.2 | 103.0 | 105.6 | 107.3 | 109.1 | 110.8 | 112.6 | 129.0 | 162.7 | 178.0 | 194.4 |
| Other Chemicals | 108.8 | 108.6 | 108.4 | 110.0 | 108.1 | 107.9 | 107.7 | 107.5 | 107.3 | 107.1 | 110.7 | 118.0 | 121.6 | 125.2 |
| Industrial Chemicals | 99.8 | 99.5 | 99.3 | 101.6 | 98.8 | 98.6 | 98.4 | 98.2 | 97.9 | 97.7 | 97.6 | 97.3 | 97.1 | 97.0 |
| Petroleum Products | 98.8 | 102.5 | 106.3 | 110.0 | 113.8 | 117.5 | 121.3 | 125.0 | 128.8 | 132.5 | 121.0 | 98.0 | 86.5 | 75.0 |
| Glass | 100.4 | 100.8 | 101.2 | 101.6 | 102.0 | 102.0 | 102.6 | 103.2 | 103.6 | 104.0 | 101.6 | 96.7 | 94.2 | 91.8 |
| Non–Metallic Products | 238.5 | 223.5 | 207.5 | 192.0 | 176.1 | 161.0 | 145.4 | 129.5 | 114.5 | 100.0 | 94.6 | 85.7 | 81.6 | 77.3 |
| Iron & Steel | 120.7 | 118.4 | 116.1 | 113.8 | 111.5 | 109.2 | 106.9 | 104.6 | 102.3 | 100.0 | 98.7 | 96.0 | 94.7 | 93.4 |
| N. Ferrous Metals | 120.6 | 118.2 | 115.9 | 113.5 | 111.1 | 108.7 | 106.3 | 104.0 | 101.6 | 99.2 | 96.2 | 91.9 | 89.4 | 87.0 |
| Fabricated Metals | 122.0 | 120.9 | 119.9 | 118.9 | 117.9 | 116.8 | 115.8 | 114.8 | 113.7 | 112.7 | 112.2 | 111.1 | 110.6 | 110.1 |
| Machinery | 120.5 | 118.0 | 115.5 | 113.0 | 110.5 | 108.0 | 105.5 | 103.0 | 110.5 | 98.0 | 96.3 | 93.0 | 91.4 | 89.7 |
| Elect'l Machinery | 99.8 | 99.6 | 99.4 | 99.2 | 99.0 | 98.8 | 98.6 | 98.4 | 98.2 | 98.0 | 97.0 | 94.9 | 93.9 | 92.9 |
| Trans Equip't | 99.5 | 95.9 | 96.4 | 96.9 | 97.4 | 97.8 | 98.3 | 98.8 | 99.2 | 99.7 | 99.1 | 98.0 | 97.5 | 96.9 |
| Plastic | 101.5 | 103.0 | 104.4 | 105.9 | 107.4 | 108.9 | 110.4 | 111.8 | 113.3 | 114.8 | 121.8 | 135.9 | 143.0 | 150.0 |
| All Manufacturing | 100.6 | 101.2 | 101.9 | 102.5 | 103.1 | 103.7 | 104.3 | 105.0 | 105.6 | 106.2 | 112.0 | 123.6 | 129.4 | 135.2 |