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Productivity of Philippine Manufacturing

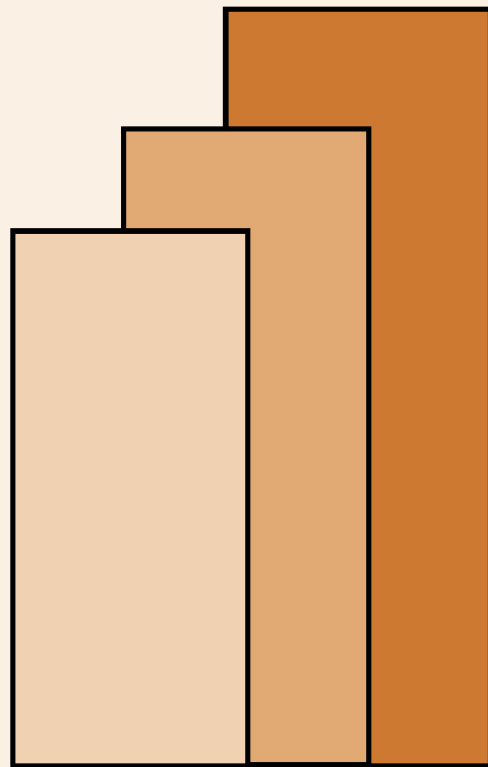
Caesar B. Cororaton and Rahimaisa Abdula

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Productivity of Philippine Manufacturing

Caesar B. Cororaton and
Rahimaisa Abdula

I. Introduction

The economic growth performance of the Philippines in the last 20 years has been highly unstable, with wide swings seen especially in the 1980s. In particular, the economy grew at 6.1 percent per year in the second half of 1970s. However, growth decelerated to 3.1 percent in the early 1980s and subsequently registered a big dip of -3.9 percent in the mid-1980s. The second half of the 1980s saw a recovery of an average growth of 6.0 percent, but lost steam in the early 1990s with a growth of 2.3 percent as the economy was battered with crises of all sorts: political (military coup attempts); economic (foreign exchange and energy crises) and natural calamities (typhoons, earthquake and volcano eruptions). The average growth of 5.4 percent in the last three years would indicate an economy recovery, which is largely attributed to the economic reforms instituted and the political stability attained in the present administration that have attracted substantial foreign capital and investment.

In spite of the recent growth improvement and economic reforms, however, nagging questions still remain especially in the light of the ongoing regional (ASEAN) foreign currency crisis. That is, given the unstable growth cycle of the past, one wonders whether the present growth momentum can be sustained. Simply put, are the effects of reforms strong enough to break the unstable growth cycle, weather out the present recessionary pressures, and therefore prevent another downturn?

The unstable growth pattern of the past has taken its toll in the standard of living of Filipinos. Figure 1 shows the cumulative growth of per capita GDP which increased steadily from the 1960s up to 1982. Instability in the mid-1980s, however, brought down the standard of living back to where it was in the early 1970s. Unsustained growth in the second half of the 1980s and in the 1990s has not been able to bring back per capita GDP to the 1982 level.

The unsatisfactory performance of the economy could be attributed to a number of factors, foremost of which is the unstable macroeconomic environment. Figure 2 presents the movement of real GNP growth and inflation. Extreme fluctuations in both dominate the entire period, with every troughs in the growth curve corresponding to periods of high inflation.

Another set of factors which resulted in the unsustained growth is the inherently weak structure of the economy that is characterized largely by: (i) persistent dualism in the production sector. The manufacturing sector which contributes to more than 20 percent of

value added, fails to absorb substantial amount of employment. For more than three decades now, the contribution of manufacturing sector to employment ranges dismally between 12 and 10 percent, with even lower rates in recent years. And with labor participation expanding faster than population growth, manufacturing sector's failure to generate jobs renders majority of the labor force to unproductive sectors.

Dualism is clearly evident from the standpoint of industry composition. Large firms are concentrated in manufacturing and export, while micro and small enterprises provide the bulk of employment. This structural dichotomy of large and small enterprises diminished the substantial contribution emanating from medium-sized enterprises which provide the critical link between small and large enterprises. Their presence are negligible in number. As this case of "missing middle" is highly pronounced in the domestic economy, full participation of small enterprises in export and economic growth has been thwarted. More so, this absence of linkages resulted in the divergence in the wages, productivity and profitability between the large and small enterprises. To cite some concrete examples, the effect of dualism is clearly manifested in the compression of employment in fewer number of large enterprises within the textile, garments and leather industries. However, many of the subcontractors, particularly homeworkers are unaccounted for. These homeworkers, together with the micro enterprises are found to have benefited minimally from export growth. In terms of productivity, quality of products and working conditions, they have fared inferior to counterparts (ILO, 1997).

Another factor that could have exerted enormous pull in the economy's performance is the decline in productivity. This conclusion has been borne out in numerous studies. Williamson (1969) revealed a declining TFP during the late 1940s to early 1960s. Martin and Austria(1992) confirmed the above findings and narrated the continued declining trend up to 1987.

Declining productivity has also encumbered the much envisaged growth originating from the industrial sector as pointed out by industry-level productivity studies. Manufacturing sector experienced a yearly decline of 1.9 percent from 1976-1980 (Holley, 1985). And the number of industries within the manufacturing sector with declining TFP increased from 12 in 1971-1980 to 14 in 1981-1992 (Cororaton, 1995). Few other sets of productivity studies focused on a related concept called technical efficiency. Technical efficiency of the packaging industry, agricultural machinery industry, appliance industry and shipbuilding/repair and boat building industry significantly dropped from their 1983 levels in 1988 (Medalla, et al, Volume II). The two other industries included in the above set of studies showed efficiency in resource allocation: the synthetic resin and plastic industry; and the textile and garments industry.

Estimates of sectoral TFP are limited. The paucity of data on the productivity of the industrial sector, compounded by the need to examine the declining contribution of the sector to employment and output calls for a further look at the movement of industry TFP and factors influencing these movements. "A knowledge of the determinants of the observed inter-industry growth differentials may assist governments in framing industry policy. And a detailed examination of the proximate causes of productivity growth differentials will provide

an indication regarding the productivity growth inducing or retarding effects of existing policy measures and point to the productivity growth effects of alternative options.”(BIE, 1985).

To address the above issues, the paper presents more recent estimates of TFP of 23 manufacturing industries, together with some estimates of technical efficiency coefficients of selected 5-digit industries. Also, results of regression analysis relating productivity indices to some macroeconomic variables and other factors are shown to get some idea of the possible determinants of productivity.

II. Framework of Analysis

Productivity in the paper refers to total factor productivity (TFP) which is often estimated as a residual. However, in principle, TFP is the growth of output net of the combined growth of factor inputs such as capital, labor, raw materials. As such, this measure of productivity is a catch-all variable which approximates among others the shift of the production function, economies of scale, technological advances in knowledge and improved resource allocation, disembodied technological change, technical efficiency etc.. TFP also indicates the improvement of the “best practice” of an industry and gauges the maximum potential output under the current technology. Thus, TFP then alludes to the adoption of the right machineries and appropriate technology and bespeaks of the efficiency by which the technology is applied.¹

Approaches to TFP measurement may generally be classified into two broad categories: (a) the deterministic approach and (b) the stochastic approach. Deterministic approach may in turn be broken down into two branches: (i) index number approach which does not require any specifications of production function explicitly; and (ii) the growth accounting approach which requires specification of production function. Index number requires formulation of index number usually based on distance function, while growth accounting approach makes use of either factor share calculations or programming methods. Stochastic approach in the one hand is distinguished by its assumption of an unobservable production frontier function. Total output growth of the industry can be decomposed into input growth, technical change and technical efficiency using this approach. In this paper, the tradition growth accounting approach is employed.

The Growth Accounting Approach

Consider a Cobb-douglas production function

$$(1) Q_t = A(t) \prod_{k=1}^K (X_{kt})^{\alpha_k} \quad \alpha_k > 0$$

¹Developing the Technology for Global Competition. PIDS Development Research News, March-April 1997

where Q_t is output, $A(t)$ is a catch-all variable which captures technical progress, X_{kt} are factor inputs, k the number of factor inputs, and α_k are factor shares. Take time derivative of (1), divide the result by Q_t and rearrange terms

$$(2) \quad \dot{A}(t)/A(t) = \dot{q}/q - \sum_{k=1}^K s_k \dot{x}_k / x_k$$

where the bold letters represent the time derivatives, and the s_k represents the k^{th} the input's share of output. Usually, the time derivatives are proxied by period differences of logarithmic values of Q and X , which are represented by their small letters, q and x . The term in the left-hand side of the equation represents the growth in total factor productivity, which is the difference between the growth of output and the weighted growth of factor inputs.

Technical Efficiency Measurement

In the traditional growth accounting approach the observed output is assumed to be obtained by using the given technology to its full potential. This means that the realized or observed output level is the frontier output, which is 100 percent technically efficient. Therefore, the growth in $A(t)$ is interpreted as only the change in technology or shifts in the production function. In reality, however, an industry (or a firm, depending upon the unit of analysis) may not be operating along the production frontier. In cases where the industry operates below the frontier (this is also called the "best practice" frontier) the growth accounting method will give biased estimates of technical change. Moreover, in the traditional growth accounting approach, factors are assumed to be paid according to the values of their marginal products. If this assumption does not hold, it can create another source of bias in the estimates of total factor productivity.

Estimating technical efficiency does not only contribute more information on the status of the production technology applied by firms but also aides in the determination of whether the given technology has been utilized to its potential fullest. *"From the policy point of view, these information are essential because, without using the existing technology to its full potential, embarking on introducing new technologies is not meaningful"*²

Thus, a technically efficient firm is one which produces on its outer-bound production frontier to obtain the maximum possible output which is feasible using current technology.³ Technical efficiency is measured as the ratio of actual output to the potential output given by the outer bound production function for a given set of inputs and technology. More discussion of technical efficiency is presented in the Appendix.

² K.P. Kalirajan, M.B. Obwona, S.Zhao. On decomposing Total Factor Productivity

³K.P. Kalirajan and Y.K. Tse. Technical Efficiency Measures for the Malaysian Food Manufacturing Industry.

However, due to time limitation and difficulty in getting data, technical efficiency estimation is performed for selected manufacturing industries only, namely textile industry, garments, basic metal industry, chemicals and chemical products industry and food manufacturing industry.

II. Philippine Manufacturing: Assessment of Performance

Employment. Dualism in the country's industrial structure remains pervasive. The 12.3 percent contribution of the manufacturing sector to total employment in 1970 rolled down a couple of points rendering an even more dismal share of 10.1 percent in 1990. In 1995, this share barely improved to 10.2 percent, indicating the slow improvement in the employment absorptive capacity of the manufacturing sector.

Table 1

	1960	1965	1970	1975	1980	1985	1990	1995
Agriculture	61.2	56.7	53.7	53.5	51.4	49.0	45.2	43.5
Industry	12.6	11.3	12.6	12.1	11.6	10.7	10.7	16.1
Manufacturing	12.1	10.9	11.9	11.4	10.6	9.7	9.7	10.2
Services	26.2	31.5	32.1	34.1	36.5	40.2	44.0	40.5

Source : Cororaton, et al

Output. Manufacturing's share to gross domestic product moves within a narrow band of 25-25.6 percent for the past decade (see Table 2). In 1996, however, share to production declined from an average of 23 percent to 22.5 percent. Signs of reversal seem unlikely with its share in the first semester of 1997 down by 1 percent point from its contribution in the same semester of the previous year.

Table 2

	1980- 1985	1986- 1989	1990- 1992	1993- 1995	1995 1 st 2 nd	1995 1 st 2 nd	1996 1 st 2 nd	1997	
Agriculture	23.3	23.9	22.6	22.2	21.8	21.5	22.3	20.6	21
Industry	40.0	35.2	35.4	34.8	31.9	32.2	31.4	32	31
Manufacturing	26.3	25.2	25.6	25.0	23	23	22	23	21
Service	37.4	40.9	42.1	43.0	46.3	46.3	46.3	47.4	48

Source : Cororaton, et al, 1995 and National Income Accounts, August 1997

These figures warrant the extreme dualism in the economy with the manufacturing sector contributing to more than one-fifth of GDP while employing only one-tenth of the labor force. Industry, thus continues to shove majority of the labor force to jobs with low pay and poor productivity.

Exports. Overall export performance of the manufacturing sector on the one hand is impressive to a certain extent. Exports of manufactured goods have bequeathed relatively substantial export earnings as shown by its growing contribution to total exports and GDP. Table 3 shows almost 75 percent of total exports was accounted for by the manufacturing industry in 1992. This is more than double of manufacturing's share to exports in 1980. Upsurge on merchandise exports has been noted with its growth improved substantially from an average of 5.2 percent in the period 1990-1993 to 13.2 percent in the period 1994 to the first semester of 1997.

Table 3

Share to total Exports	1980	1985	1992	1995
Manufacturing	34.5	41.4	74.7	79.5
Electronics	11.6	14.6	27.7	23.8
Garments	8.7	10.8	21.6	14.73
Non-Manufacturing	65.5	59.6	25.3	20.5

Source : Bangko Sentral ng Pilipinas, May 1997

Such remarkable increment to growth is however eroded by the expeditious expansion in imports. In 1995, trade deficit held up its ascent as exports prolonged along its lagged position. This phenomenon of burgeoning trade loss is in part ascribed to the high import content of Philippine manufactured exports. As shown by Table 3 , the two primary exports consist of electronics and garments. In both export goods, the Philippines adds a thin slice of value added to import components, and then re-export them.⁴ “ Thus the manufactured export sector is in effect an enclave with surprisingly little linkage to the domestic economy” (Krugman, et al, 1992).

As a result, the country compares itself unfavorably with its ASEAN neighbors. Table 4 indicates that the Philippines is fast losing its market share in the world market. In 1970, the country share accounted for 17.7 percent of ASEAN total export. This dropped to 6.9 percent in 1985 and further declined to 5.9 percent in 1990. A comparison of export growth of Indonesia, Thailand, Malaysia and Singapore, pointed out to the inferior performance of Philippines in boosting its exports growth. Malaysia, Thailand and Singapore managed an annual increase of 18 percent for the entire period 1980-1994 vis-a-vis the 10.8 percent annual growth of the Philippines. Indonesia seems to slack behind the other four countries. But in terms of registering a propitious trade position, only Indonesia has professed a positive balance in its merchandise trade in 1994 (Refer to Table 5).

⁴Cororaton et al (1995) . Estimation of Total Factor Productivity of the Philippine Manufacturing Industries : the estimates.

Table 4

	1970	1975	1980	1985	1990
Philippines	1064	2263	5788	4629	8186
Indonesia	1173	6888	21795	18527	26807
Malaysia	1640	3784	12868	15133	28956
Thailand	686	2177	6449	7059	22811
Singapore	1447	5110	18200	21533	50684
Total	6010	20222	65100	66881	137444

Table 5

	Merchandise trade in billion\$. 1994		Average annual growth rate
	Exports	Imports	1980-1994
Indonesia	39.5	31.5	7.3
Philippines	13.4	21.2	10.8
Thailand	42.8	47.2	18
Malaysia	57.0	57.8	18.4
Singapore	89.2	99.2	18.4

IV. Productivity Estimates

The manufacturing industry has evinced a dismal 0.052 percent TFP growth for the entire period 1958-1991. And as TFP growth denotes technological progress and improvements in the method of applying technology, such slow the growth for three decades connotes stagnancy in technological advancement. This conspicuously have placed the country to constant turmoil of unsustainable growth. For the entire period, extreme variation is palpable. This movement of TFP in Figure 3 shows the sensitivity of productivity to macroeconomic environment.

Trend Analysis. TFP during the period 1958-60 showed a rising trend with a period average of -2.5 percent. It is within this period wherein adoption of a protective tariff structure has been implemented⁵. The 1957 tariff changes lowered the duties on raw materials, intermediate foods and essential items which were not domestically available and raised the duties on nonessential, finished goods and items which could be domestically manufactured.

⁵The following discussion is lifted from Medalla et al “ Catching Up with Asia’s Tigers (1995) pp. 246-248

The following period 1961-1965 is characterized by a continuous expansion for the first half of the sub-period, that is up to 1963 and a decline in the second half beginning 1964. During 1960-1962, control on imports has been lifted but protection through tariff remained. 1964-1965 was a usual election atmosphere. Economic and political turmoil marked the succeeding period 1966-1970. Balance of payments gradually built up and triggered the crisis in 1969. In the effort to curtail the impending crisis the government enacted RA 5186 which granted incentives and guarantees to investments in the country. The latter effort seemingly had softened, if not thwarted the impact of the crisis on the sector with TFP gradually improving up to 1969, a year also characterized with massive protest. Decline in TFP only concurred in 1970.

As balance of payments exacerbated the crisis, an initiative to redirect investments away from import-substituting industries was undertaken. In 1970, the Export Incentives Act was enacted granting same incentives set by RA 5186. Export promotion heightened during the Martial Law regime. In 1972, PD 66 was legislated and paved way for the development of Export Processing Zones. Various measures were also implemented mitigating the control over foreign investments. TFP growth had generally risen with an average increase of 1.5 within the years 1971-1975. Decline took place in 1972 and 1975 as apparently influenced by the Martial law declaration and expiration of the Laurel Langley Agreement. The following period 1976-1980 totally offset TFP growth achieved during the previous period. Political turbulence heightened as the insurgency gained stronger influence and economic depression became widespread.

As Martial Law was lifted in 1981 and trade liberalization was implemented up to 1983, TFP growth substantially accelerated with an average annual rise of 4.1 percent. This was so far the highest per period average TFP growth. Other important events transpired during the period is the passage of the Omnibus Investments Code of 1981 and the amendment of PD 1789. The latter discarded the capital-cheapening measures such as accelerated depreciation and expansion reinvestment allowances which served to counter capital intensity in production. The assassination in the later part of 1983 of a prominent political figure propelled the reversal of the picture. Political and economic situation was at its bottommost state. The entire manufacturing industries was not spared and suffered the hardest hit. Productivity was at its lowest at an average of -8.3 percent for the period 1984-1986.

As democracy was restored in 1987, economic reforms facilitated the recuperation of industrial productivity. Annual growth of 1 percent ensued together with the recovery. Import liberalization has been revived. Investments have been promoted through the reinstatement of capital-cheapening measures. Preference over exports, however was abraded together with the change in the focus. The Investment code, thus no longer acts as a counterbalance to import-substitution bias of the protection system and has even been found to be biased in favor of capital-intensive investments.(Manasan, 1986 and Power 1989).

The pattern of TFP growth observed from the point of view of the aggregate manufacturing industry is generally emulated by the individual industries. Figure 4 shows the

average TFP growth of individual industries. A summary of the movements can be indicated as follows :

1. A gradual growth of TFP characterized the late 1950's and early 1960's. This growth was propelled mostly by the transport equipment, furniture and fixtures, printing and publishing, iron and steel and food manufacturing industries. Transport equipment and food manufacturing industries are some of the industries accorded with high degree of protection.
2. As shown in figure 4, deceleration in TFP of almost all of the industries commenced in the period 1966-1970 with a negligible improvement in the following period 1971-1975. During the period, almost half of the industries under the study were still suffering from declining TFP. The oil crisis in the early 1970's can be cited to have triggered such decline. The wearing apparel, transport equipment, electrical machinery and food manufacturing suffered the most. Capital flight and inefficiencies could also have spurred the drop in TFP.
3. Substantial improvements begun to take shape in 1976-1980 and had been sustained until the period 1981-1983. Table 4 also indicates that almost one-third of the industries under study exhibited continuous growth in TFP for the two periods. Also, the number of industries with negative TFP sharply declined with almost all of the industries displaying positive TFP at the onset of 1981.
4. This scenario unfortunately had a reversal in the following period 1984-1986. Except for electrical machinery and leather products, all of the industries' productivity indices dropped to their lowest.
5. A recuperation from this extreme scenario in the last period has been shown in the results of the estimates. This is the period coinciding with economic recovery. Note that the sugar milling, rubber products, printing and publishing, wood and wood products, textiles and transport equipment industries catalyzed the improvement. Electrical machinery also demonstrated substantial improvement in TFP growth but slackened in the 1990-1991 period.

It has been apparent from the trends in both the aggregate and disaggregated levels how political and economic turmoil seriously impaired productivity of the manufacturing industry. TFP has also been responsive to changes with policies. What can be noted too, is the responsiveness of TFP to changes with policies. With the attempts to encourage investment and exports, improvement in TFP is discernible. The extent of its magnitude and duration however is confined by inconsistencies in policies, specifically the continued effort to protect import-substituting industries. Growth in productivity traced in the early stages of import-substitution tapered off immediately as protection induced rampant inefficient practices. High protection has afforded producers of import-substitutes to earn high profits, pay high wages and accommodate inefficiencies.

Deterioration in the efficiency of production industries is reflected in key manufacturing industries. The technical efficiency estimates of the electrical machinery, textile, basic metal, food manufacturing, and chemical industries declined. Figure 5 shows the technical efficiency coefficients of the above-mentioned industries. In 1983, a year of high growth, electrical machinery, garments, basic metal and food manufacturing industries exhibited efficiency in its production. After a decade, electrical machinery, basic metal and food manufacturing have only realized 80 percent, 64 percent and 71 percent of their potential outputs, respectively. Electrical Machinery which ranked the first in terms of efficiency up to 1991 had lost its lead. Garments, on the one hand, has not only emerged the most efficient in production, but also it has managed to sustain and even develop its efficiency. The enhancement in the TE of the ready-made clothing manufacturing and the women's, girls' and babies garments manufacture accounted for this improvement. Reduction in the efficiency of textile industry, on the other hand is modest as well as the decline in chemicals industry. A considerable portion of the decline in the efficiency of the basic metal is elucidated by the deterioration in rolling mills and galvanized steel. Both experienced reduction to almost half. In food manufacturing's case, efficiency deterioration accompanied the downward trend in the efficiency of milled sugarcane and crude coconut oil (including cake and meal).

Productivity , Industrial Policy and Investment Policy

The dwindling productivity and efficiency of the manufacturing industry is strongly linked to the protracted effects of import-substitution policy. This protection has led to misallocation of resources. As capital-cheapening measures were promoted, capital investment and thus capital-substitution to labor is motivated. This capital-intensive bias prompted utilization of embodied technology that is often suited to labor-scarce developed countries. And "substantial profit margins from selling failed to pressure firms to adapt machines to local conditions and factor proportions, further discouraging acquisition of domestic technological capability and eventual technological mastery." (Medalla et al, 1995).

Investment policies fared poorly in translating into the much needed technology appropriate to the country's setting and environment, particularly policy environment and stage of economic development. Foreign direct investment, the major vehicle of technology transfer is seen to be concentrated in manufacturing industries where high protection is accorded to. Machinery and equipment, chemicals and transport industries received more than 50 percent of the FDI in the total manufacturing industries. This is tantamount to the existence of an investment incentive system that tends to bolster heavy domestic-market orientation. Furthermore, the system is indented towards capital-intensive producers of import-substitutes (Manasan, 1986 & Power, 1989).

The import-substitution is culpable not only in creating such investment system, but also in the taxation of exporters and failure to develop backward linkages. As tariffs raise cost of domestically produced inputs, sourcing inputs locally is dissuaded. Exporters, therefore tend to rely on intermediate inputs derived from abroad. The raw materials of the electrical

machinery is said to top the list of imported goods as ample portion of subcontracted electronic devices are made from raw materials consigned abroad. Manufactured exports are also concentrated in garments on consignment. Inter-industry links instituted are also weak as export production is separated from the domestic economy through Export Processing Zones.

These declining productivity growth and efficiency of the manufacturing industry have evidently placed the country to such inimical position vis-a-vis neighboring countries for a prolonged time now.

The growth of the NICs has been claimed to be facilitated by their ability to assimilate technology⁶. World Bank estimates (1993) about a third of growth in East Asia accounted for by TFP. Japan, Korea and Hongkong have been cited as the productivity-driven economies. Hongkong has posited an average ranging from 4 to 5 percent TFP growth per annum for the period 1960-1989, while Japan and Korea recorded an average within the range of 3-4 percent. Even Krugman who pointed out no miracle behind Asian growth espouses on the relevance of productivity gains emanating from technological advance and organizational change in achieving sustainable growth. Growth hinged solely upon massive inputs of capital and labor and not on gains in efficiency, is said to be unsustainable as it renders the economy vulnerable to diminishing returns brought about by factor accumulation.

V. Determinants of TFP

Crucial to the analysis of the productivity of the manufacturing sector is the factors behind its growth or retrogression. The industry productivity performance is related to the following economic variables: foreign direct investment, inflation, ratio of research and development expenditure to GDP, growth in real minimum wage rate, period differences in tariff rates, growth in exports, and growth in imports.

The coefficients for the intercept, IMPORTS(-1), D(TARIFF), FDI (-2) and both INF and INF(-1) are all statistically significant at 5 percent level. Table 6 shows the statistical significance of the coefficients. The rate of growth in imports lagged one period is statistically significant at the 5 percent level. The coefficient however is negative, implying that technology embodied in imports have influenced productivity negatively. This findings seem to have some grounds as reflected by some studies pointing out to the inappropriateness of the technology adopted by industries. Such technology which functions merely as inputs and entails no repercussion on domestic science and technology has long been identified by Yap (1989).

⁶PDFI. Science and Technology and Transfer and Assimilation of Foreign Technology. May 1994

Table 6

Variables	Results
Dependent Variable	TFP Growth
Constant	5.316 (27.267)
Exports(-1)	0.148 (8.581)
Imports(-1)	-0.519 (-18.522)
D(Tariff)	-1.740 (-33.438)
Wage	-0.126 (-9.353)
DRD(-1)	0.101 (9.845)
FDI(-2)	0.005 (19.009)
INF	-0.153 (-14.081)
INF(-1)	-0.468 (-23.083)

Adjusted $R^2 = .997$

DW = .65

F-stat = 448.63

where :

Exports(-1) : real growth of exports, lagged one period

Imports(-1) : real growth of imports, lagged one period

D (tariff) : period differential of average nominal tariff rates

Wage : growth of real minimum wage, (Minimum wage/CPI) *100

DRD(-1) : growth of research and development expenditure as a percentage of GDP, lagged one period

FDI(-2) : foreign direct investment

INF : inflation

INF(-1) : inflation, lagged one period

These pseudo-technology according to the author perpetuated complete technological dependence and placed huge burden on the country's foreign exchange resources. Superficial involvement of the disembodied technology is observed in the transfer of technology in the form of peripheral technologies (materials handling, storing, and packaging) which resulted to turnkey plants with no backward and forward linkages invoked.

The period differences of tariff rates is seen to have a significant negative impact on productivity. Period differences in tariff rates gauges the change in the protection vested upon the producer. Throughout the entire period 1958-1991, period differences in tariff rates barely changed. It is thus expected that the monopoly-induced inefficiencies cause deterioration in

TFP. Protection impels a firm to veer protection decision away from the competitive norm. Decision is set at a lower output level sold at a higher price. Given the same bundle of factor production, reduction in output would translate to reduced TFP.

Foreign direct investment gestated for two years time amounts to a significant positive impact on productivity. This provides a very important policy implication. Transfer of technology through foreign direct investment has effectively ushered in improvements in organizational and human skills, technical and commercial information. However, in a much shorter time frame, foreign direct investment posits a negative sign implying that capital-intensity biased-investments lead to substitution to labor. And as factor prices are distorted, allocative inefficiencies give rise to output losses (PDFI, 1994). Short-run costs in productivity is posed by FDI. Its gestation for a period of years manifest a rather slow mastery and assimilation of technology, which in turn pose important implication as to the quality of human capital. The growth of the NICs is said to be facilitated by a high level of human capital development.

The significant negative impact of inflation is borne out in the results of the regression. Current inflation and even the inflation during the previous year is seen to exert debilitating effect in the productivity of the manufacturing industry. Inflation, together with budget position are considered to be the two best indicators of conduciveness of macroeconomic polices to growth (Fischer, 1994). These macroeconomic factors work through uncertainty. Policy-induced macroeconomic uncertainty reduces the efficiency of the price mechanism. This uncertainty associated with high inflation or instability of the budget can be expected to reduce the level of productivity and in contexts where reallocation of factors is part of the growth process, also the rate of productivity.

Research and development expenditure and export growth entail positive impact on productivity. The coefficient however are significant at 1 percent level only. Severe data problem serves to impede deeper analysis of R&D expenditures impact on productivity. Few studies however established the importance of acquisition of knowledge and its transformation into prototype inventions of new materials, devices and processes which in turn enables the production of larger outputs and better quality products at cheaper costs. Its importance however have only been recently recognized. Under other instances, R&D expenditures have not been geared towards that end. Due to lack of competition and inefficiencies, firms focused their R&D on product differentiation rather than cost-minimization (Lanberte, 1989).

Export growth, on the other hand, has been traced to profess positive association with TFP as discussed in the trend analysis. Its magnitude however is thwarted by the import-dependence of manufactured exports and weak inter-industry linkages. Certain inefficiencies arise in the process which work against the positive impact of technological changes. Another possibility is that technology embodied in imports has not been assimilated and mastered by the low skilled and limited human capital.

Minimum wage growth, on the other hand, disclosed a negative though insignificant impact. Minimum wage induces increase in the cost of production as well as substitution to capital. Under new factor proportion, output growth has dropped together with the increase in capital growth and the decline in labor growth. This overinvestment in capital naturally turns out to be inefficient.

VI. Policy Implications

Productivity fluctuations in the industrial sector has been indubitably closely-knitted to the behaviour of the macroeconomy. Industries react and respond to changes in economic environment as well as affect and influence overall economic performance. Therefore, in order to achieve sustained growth, improvements on both side of the coin should be undertaken.

Macroeconomic Policies and Investment Policies. A sound macroeconomic environment which would stimulate investment and saving is fundamental to improving productivity in manufacturing sector. Stabilization policies, like managing inflation and budget deficits are necessary in fostering a good investment climate. As other sources of financing become more and more limited, the role of investment turns to be emphatic. More is expected to be drawn from investment to meet societal and economic goals of clearing market imperfections, increasing market access, underscoring comparative advantage, fortifying competition and facilitating transfer of technology. With the enormity of its conjectured contribution, mere establishment of stable macroeconomy is insufficient in enticing investment and translating it into improved productivity. Investment Policy should be

Trade Policy. The analysis of the industrial performance in response to the changing policy environment conveys the enormous crippling effect of the import-substitution strategy. Inefficiency became highly flagrant as protectionism inhibited competition. Reforms undertaken in the second half of the 1980s and in the 1990s, on the one hand are still far from complete. Protection to local industries remains high and tax evasion are still pervasive implying substantial inefficiencies in tax administration. More reforms to further liberalize are called for to increase efficiency in the production sector, especially manufacturing.

Developing Technological Capability. Move towards a liberalized trade policy is a tread towards abating the bias against labor and exports. But eliminating this bias is a long way beyond mere altering policies. Development of the technological capability of firms and industries should be the very first step to be undertaken in order for the country's human capital and materials compete and suit the needs and demands posed by domestic and international arena. With the lack of technological capability, embarking upon technology transfer is rendered meaningless as assimilation and efficient utilization of technology can hardly be realized. Moreso, attempts to shift production to high value-added products and to explore other production possibilities are rendered arduous.

Technology Policy. Central to technology capability development is a well-designed technology-policy and a strong government commitment to technology progress. The development of a technology policy at both the macro-level and industry-level requires the identification of technology issues, determination of the country's technology profile, and the analysis of the status of socioeconomic environment, status of physical infrastructure and support facilities, e.g., stock of S&T personnel and R&D expenditure, S&T scene in the production system, the academic S&T scene and macro-level commitment to S&T development. Ascertaining the technological profile approximates the country's technology climate. Technology content analysis, on the one hand, determines the contribution of the four components of technology: infoware, technoware, humanware and orgaware and reflects technology-related strengths and weaknesses. It enables monitoring of the transformation dynamics at the firm level. Analysis of the technology status plays integral part in technology planning as it aids in the measurement of technology gap and in the identification of optimal partners for technology transfer. Technology capability and needs analysis underscore strengths and weaknesses in the resource endowment and the institutional infrastructure, and leads to meaningful allocation of resources and program design.

Appropriate Regulatory Environment. Substantive restraints on the discretion of the government should be embedded in the regulatory system (Jones, 1993). Government role has to be limited to the confines of establishing and maintaining a competitive and liberalized environment, of supplying support services, and of bridging technology information gap. Competition is still an optimal regulatory policy that is expected to reap appropriate technology and proper utilization of resources. Instituting competition necessitates reduction in tariff protection, dismantling of government barriers and breaking up of large existing enterprises (Jones, 1993). Access to financial services, on the other hand can be achieved through reasonable interest rates and obtainable credits. Provision of infrastructure and financial services smoothen operation and catalyze expansion. Providing information on the existing technologies would lessen incidence of adopting inappropriate technology.

Technology Acquisition, Assimilation, and Mastery. In the drive to entice technology transfer, discreet attention should be given to the appropriateness of technology being acquired and adopted. Technology to be appropriate should be suitable and adaptable with the state of the economy. For it to be befitting, it should make use of the available resources in the given environment. Since technology is location specific, input requirement of technology is an important consideration as well as the suitability to the market it is intended for. Imports which merely serve as inputs to production and entails no repercussion in domestic economy should be discouraged while foreign direct investment, which carries with it the capital, skills and organizational expertise should be promoted. An open trade and investment regime is the best way of luring FDI and improving its dispersion among sectors and industries.

Education and training of present and future stock of human capital is fundamental in advancing technological capability, technological assimilation and, mastery. A strong science and technology background beginning in the primary education is vital in ingraining a more

appreciative behaviour towards the field and in achieving far-reaching results. Emphasis on improving current state of technical education in the country should be given prime consideration as it serves as the bailiwick for the creation of technology suited to country's resource endowment and stage of development.

The role of R&D in technology development is fast gaining grounds yet given minute attention and commitment by the government, private sector and academe. Redirection of funds should be channeled to R&D undertakings. A set of incentives in R&D undertakings , consistent with a non-interventionist framework should be designed.

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Figure 1

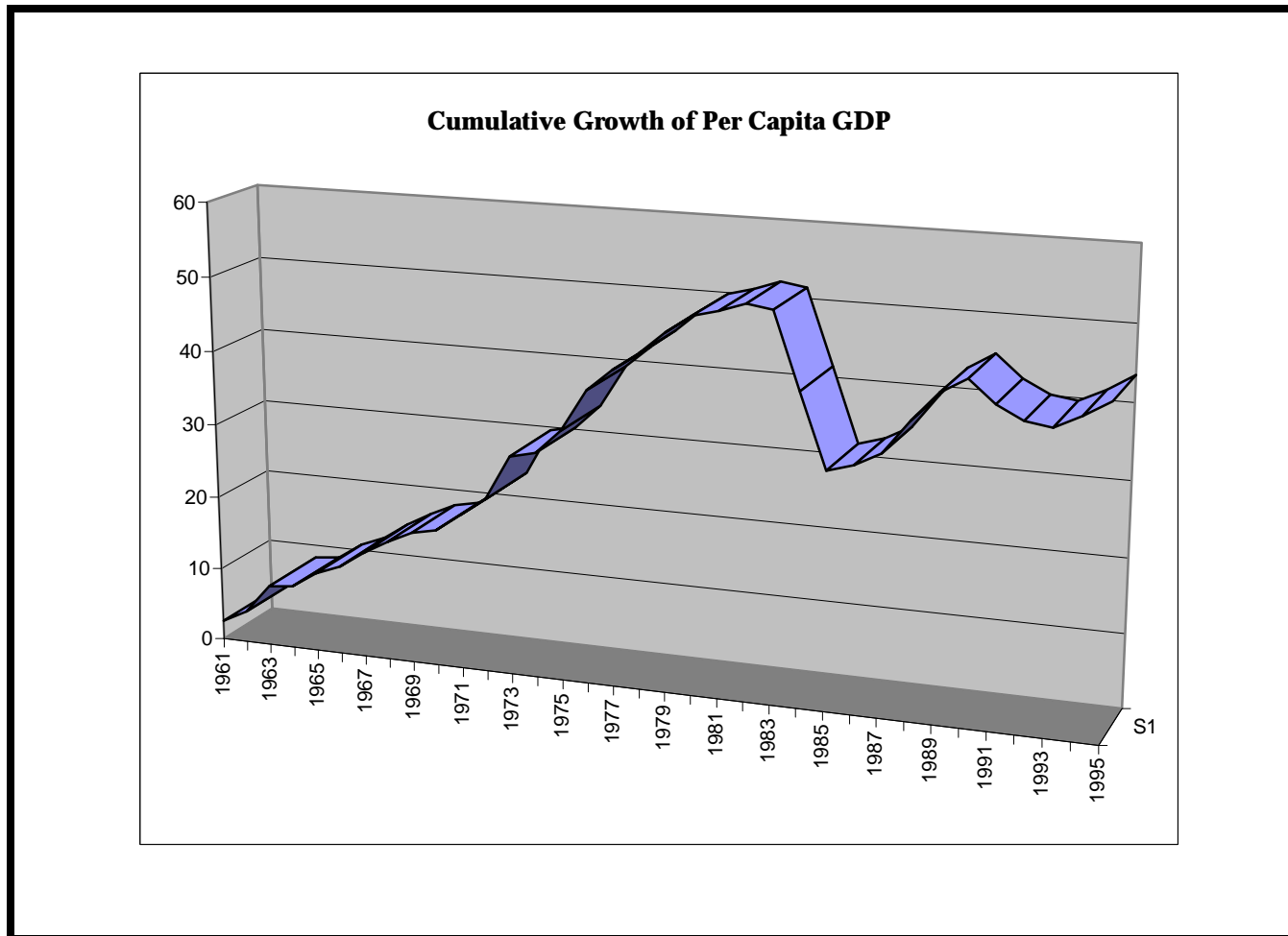


Figure 2

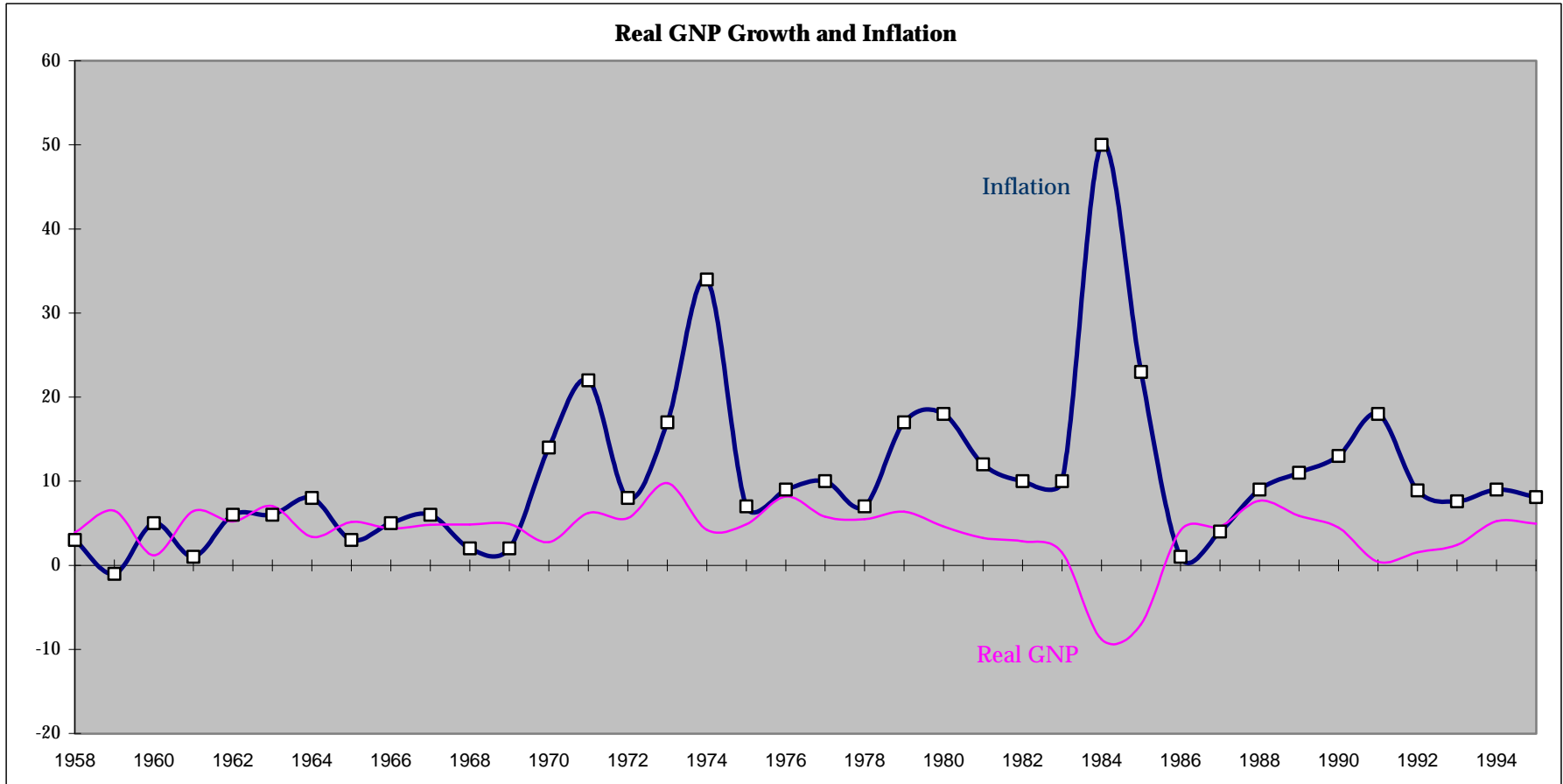
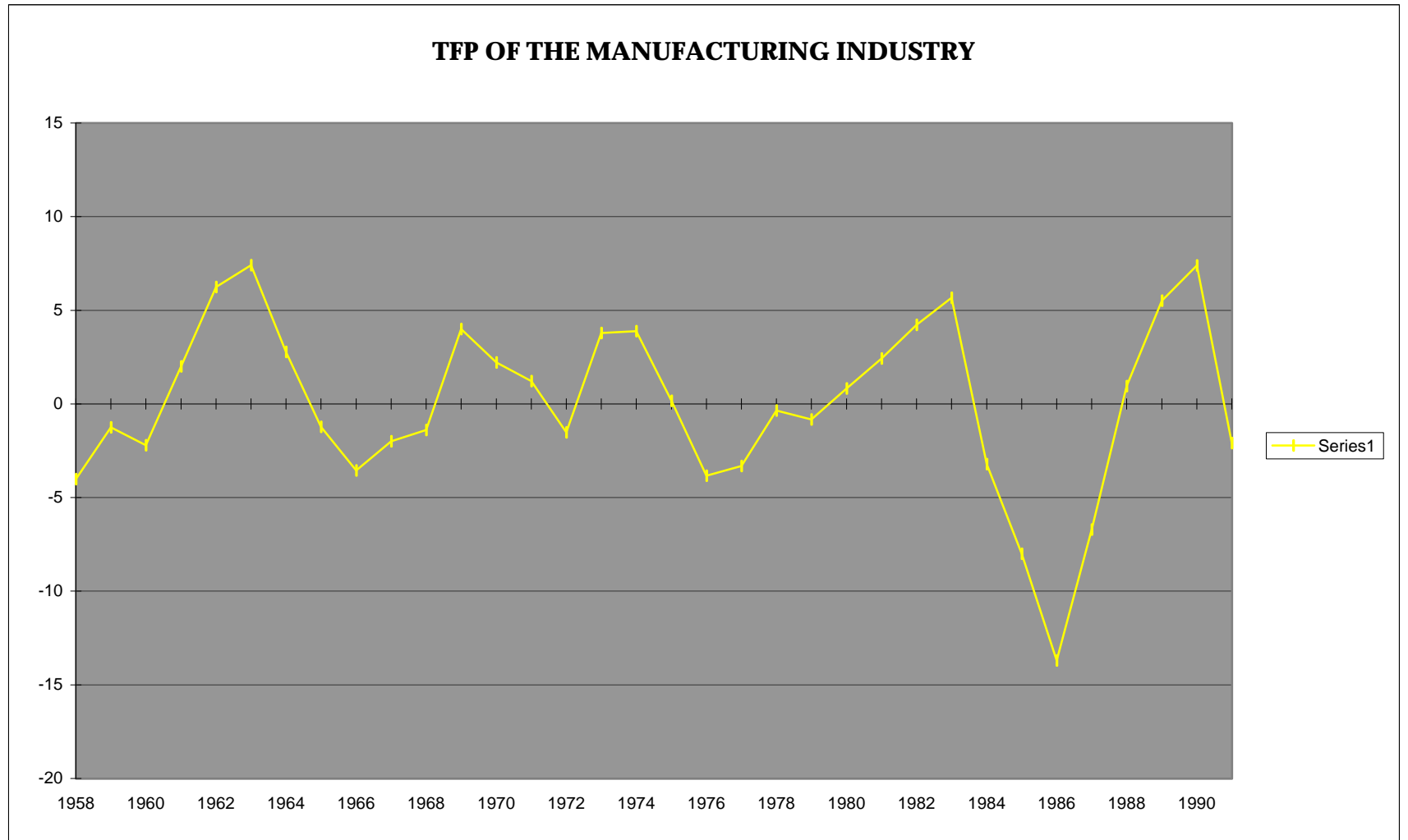


Figure 3

TFP

1958	-4
1959	-1
1960	-2
1961	2
1962	6
1963	7
1964	3
1965	-1
1966	-4
1967	-2
1968	-1
1969	4
1970	2
1971	1
1972	-2
1973	4
1974	4
1975	0
1976	-4
1977	-3
1978	0
1979	-1
1980	1
1981	2
1982	4
1983	6
1984	-3
1985	-8
1986	-14
1987	-7
1988	1
1989	6
1990	7
1991	-2

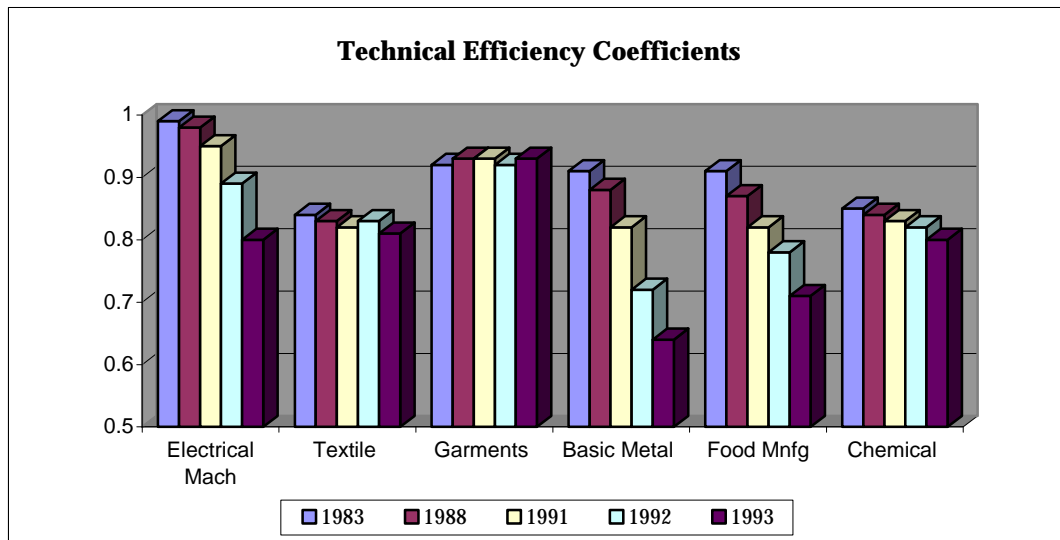


Period Averages							
1958-1960	1961-1965	1966-1970	1971-1975	1976-1980	1981-1983	1984-1986	1987-1991
-2.5	3.8	0.3	1.5	-1.5	4.1	-8.3	1.0

Figure 4
Average Growth Rate of Total Factor Productivity

Year	Beverages	Food Manufacturing	Footwear	Fabricated Metals	Electrical Machinery	Furniture & Fixtures	Glass Products	Industrial Chemicals	Iron & Steel Basic Industry	Leather Products	Machinery	Non-metallic Mineral	Paper Products	Petroleum Refineries	Plastic	Printing & Publishing	Rubber Products	Sugar Milling	Textiles	Tobacco Products	Transport Equipments	Wearing Apparel	'Wood Products
1958-60	-8.04	2.78	-5.36	3.44	-23.23	13.51		-1.31	8.23	5.91		-1.38	-10.44		4.69	-6.09		-6.41	-4.61	8.56			1.94
1961-65	3.62	3.22	2.75	4.95	-2.20	2.18		3.96	7.79	1.47	5.83	3.95	8.26		3.99	1.19		2.71	8.79	9.05			0.54
1966-70	-1.28	-0.77	-3.67	3.88	3.03	1.53		0.44	-6.93	-1.79	4.27	-1.45	0.42		6.08	0.98		3.52	6.51	1.69			4.87
1971-75	-0.93	2.26	-4.24	5.58	-3.59	3.62	1.39	3.05	6.72	-9.27	2.25	5.00	5.14	-2.48	-0.41	2.31	1.13	17.51	-3.22	7.57	-1.58	-19.48	0.79
1976-80	0.24	-1.64	4.99	4.96	-0.05	2.24	0.80	4.71	-3.86	-2.05	1.95	-2.06	0.48	-9.83	-3.41	4.70	2.77	9.64	0.45	3.17	-3.20	1.45	2.21
1981-83	2.98	2.40	5.54	10.61	2.78	19.70	0.37	3.84	5.02	1.44	7.28	2.53	9.24	3.76	1.66	4.98	5.47	7.36	-2.26	4.89	9.59	5.50	6.59
1984-86	-14.37	-7.18	-17.54	-7.42	8.39	-4.38	-2.33	-9.52	-6.22	6.75	-14.32	-2.53	-6.48	-12.86	-6.04	-5.89	-2.40	-14.30	-6.77	-4.35	-5.97	-10.11	-14.85
1987-91	-0.15	2.94	0.96	6.69	-4.19	3.88	-1.37	1.79	-0.24	-22.62	0.82	1.04	5.23	0.20	-0.48	4.99	5.18	14.32	1.57	3.45	-1.68	-5.72	4.65

Figure 5



TECHNICAL EFFICIENCY COEFFICIENTS

Industry	1983	1988	1991	1992	1993	Ave.
Electrical Machinery	0.99	0.98	0.95	0.89	0.80	0.92
Textile	0.84	0.83	0.82	0.83	0.81	0.83
Garments	0.92	0.93	0.93	0.92	0.93	0.93
Basic Metal	0.91	0.88	0.82	0.72	0.64	0.79
Food Manufacturing	0.91	0.87	0.82	0.78	0.71	0.82
Chemical	0.85	0.84	0.83	0.82	0.80	0.83

Figure 6

