Exploring the Philippine economic landscape and structural change using the input-output framework

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Abstract

Purpose – The purpose of this paper is to evaluate the degree of structural change of the Philippine economy and examine how linkages among sectors evolved during 1979-2000.

Design/methodology/approach – The authors use the input-output tables of the Philippines to draw the economic landscape of the Philippines and to examine the degree of structural transformation that the economy has undergone since the 1970s. They perform a linkage analysis of 11 major economic sectors and through the multiplier product matrix, plot the economic landscape of the Philippines for 1979-2000. This allows identification of the sectors that have exhibited the highest intersectoral linkages. The authors also undertake a more disaggregated analysis within manufacturing and consider export sophistication and competitiveness.

Findings – Manufacturing is consistently the key sector of the Philippine economy. Resource and scale-intensive manufacturing industries exhibit the highest linkages. The authors also find a growing impact on the economy of private services and transportation, communication and storage sectors, probably due to the globalization of these activities. But overall, compared to manufacturing, the service sector exhibits lower intersectoral linkages.

Originality/value – The economic landscape of the Philippines shows the structural changes that have taken place. The empirical findings lead to the conclusion that the Philippines cannot afford to leapfrog the industrialization stage and depend solely on a service-oriented economy, when the potential for growth still lies primarily on manufacturing. The results of this study can be used for government policy formulation. The government should institute policy reforms that directly target the industrial sector to accelerate economic growth.

Keywords Input/output analysis, Philippines, Economic development, Economic sectors

Paper type Research paper

1. Introduction

In the 1970s, average per capita income of the Philippines was close to those of Malaysia and the Republic of Korea (hereafter, referred to as Korea; Figure 1). During this decade, the three countries also had quite similar economic structures, with the agricultural sector accounting for close to 30 percent and industry for about 30-35 percent (Figure 2). About three decades later, however, both Korea and Malaysia were among the most

JEL classification – D57, L60, O11

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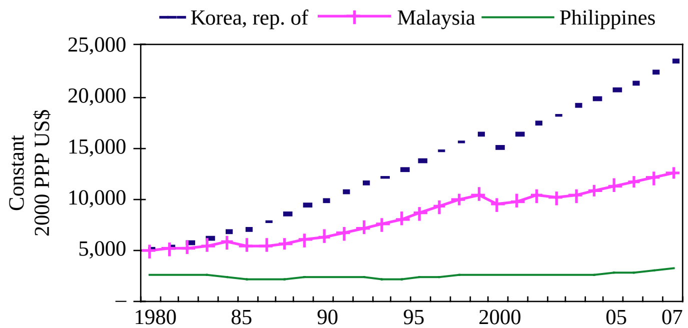
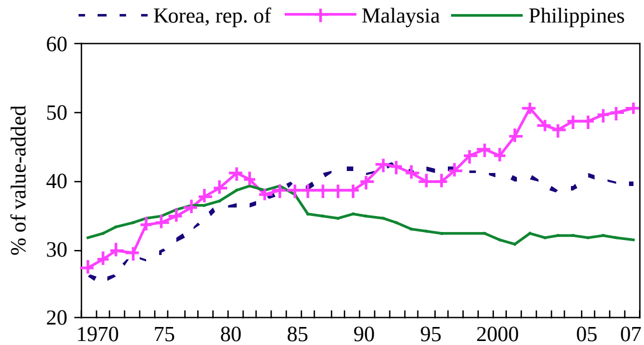


Source: World bank, world development indicators online, downloaded 19 November 2007

Figure 1.
Real gross domestic product (GDP) per capita



Source: World bank, world development indicators online, downloaded 19 November 2007

Figure 2.
Industry, percent of GDP

industrialized countries in Asia, leaving the Philippines far behind. Korea and Malaysia's real per capita income grew at annual rates of 5.5 and 3.9 percent, respectively, while that of the Philippines at only 1.1 percent. Further, between 1970 and 2000, the agricultural output share of the Philippines declined by 14 percentage points. In Korea and Malaysia, such decline occurred in only 15-20 years. Thus, compared to its key neighbors, the Philippines has experienced both slower structural transformation and growth.

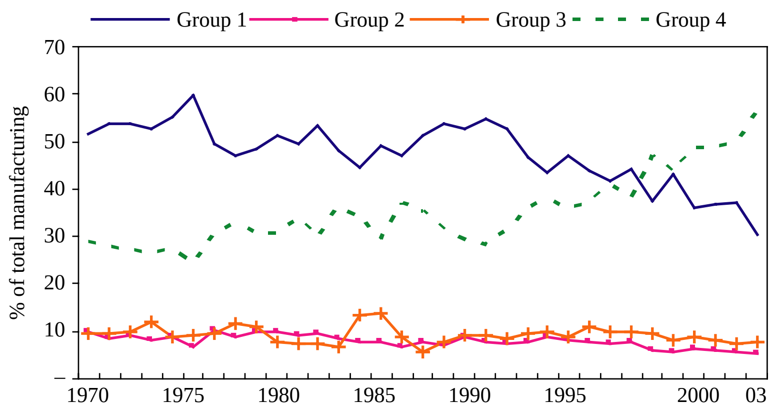
An important issue widely explored in the literature is why the Philippines has failed to industrialize, and whether this explains its slower overall growth *vis-à-vis* its neighbors' (Balisacan and Hill, 2003; Medalla, 1998). The Philippines' industrial sector has been almost stagnant over the last three decades. The industrial share achieved its peak during 1979-1984, averaging nearly 40 percent, before slowly receding to just around 30 percent by 2000. Given the limited expansion of the sector, much of the decline in agricultural output share was offset by a rising services sector. In recent years, the service sector has accounted for much of the country's overall growth. This is in stark contrast to the 1970s when the industry sector was the largest contributor to overall growth.

Within industry, the output share of manufacturing gradually declined over 1970-2007. The sector's structure has also evolved over time. The Philippines started off producing mostly manufacturing products with low economies of scale and low technology (Figure 3). The importance of these industries gradually tapered off over the last three decades. What emerged were manufacturing industries with high economies of scale and higher technology; by 2001-2003, these had become the dominant group, accounting for a little over 50 percent of total manufacturing value added. The drop in the output share of the low-technology group was largely due to the decline in the food and beverages industry; while the rise of the high-technology group was mainly accounted for by the expansion of the electronics industry.

The manufacturing sector has also evolved from being mostly resource-intensive to becoming more differentiated and science based (Figure 4). While resource-intensive manufacturing industries accounted for over 50 percent of total manufacturing output during the 1980s; by 2003, the share of this group had dropped to 36 percent. In contrast, the share of differentiated and science-based goods in total manufacturing output rose to 42 percent from 14 percent during the same period.

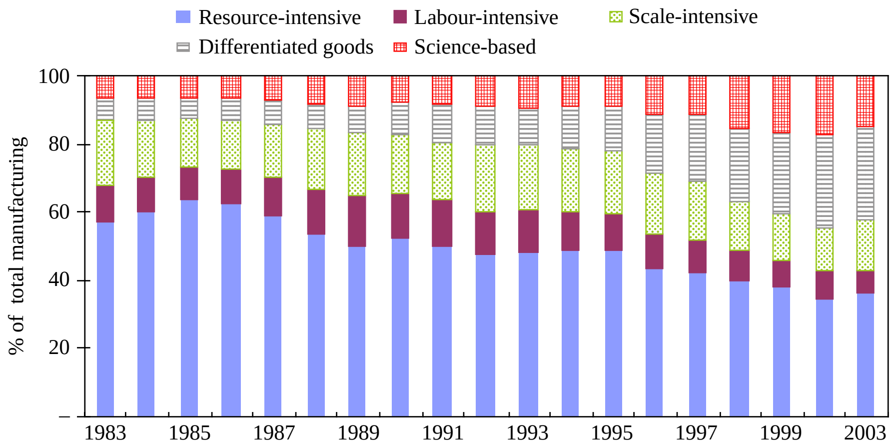
Structural change "refers to changes in input requirements, new products and changes in the relative size of sectors within an economy" (Ciobanu *et al.*, 2001). To better understand the depth of structural transformation in the Philippine economy in terms of input requirements, we analyze how linkages among economic sectors have evolved through time. This paper explores structural transformation of the Philippine economy over the period 1979-2000 using the input-output (I-O) tables. It aims at identifying which economic sectors exhibited the highest intersectoral linkages.

The rest of the paper is structured as follows. In Section 2, we present the I-O framework used to analyze linkages among sectors of the economy. Section 3 presents the results of the linkage analysis for the major economic sectors. Within manufacturing, a more disaggregated analysis is undertaken. The economic landscapes of the Philippines in 1979, 1985, 1990, 1994 and 2000 are discussed using the multiplier product matrix (MPM).



Notes: Percent of total manufacturing; Group 1 refers to low economies of scale/low technology; Group 2 refers to low economies of scale/medium technology or medium economies of scale/low technology; Group 3 refers to medium economies of scale/medium technology; Group 4 refers to medium or strong economies of scale/medium or strong technology, excluding medium economies of scale/medium technology (see Table AI for the list of specific manufacturing subsectors under each group
Source: UNIDO (2006, 2007)

Figure 3.
Manufacturing output shares by economies of scale and technology



Source: United Nations Industrial Development Organization (2007), INDSTAT4 (2007), Industrial Statistics Database, Four-digit Level of ISIC Code (Revision 2 and 3), Vienna, Austria

Figure 4.
Share of manufacturing value added

Section 4 provides a discussion of export sophistication and competitiveness. The paper ends with some conclusions and policy recommendations in Section 5.

2. Input-output framework

The I-O framework has been widely applied to study structural change in an economy over a particular period of time. The MPM and its resulting "economic landscape" have been used to study changes in the US economy between 1972 and 1996 (Guo and Planting, 2000). Linkage analysis and the MPM were applied to examine changes in China's economy over the period 1987-1997 (Guo and Hewings, 2001).

In this paper, we follow the matrix notation given below.

The basic I-O equation is given by:

$$X = AX + Y$$

where:

$X = (x_1, \ldots, x_n)'$ is the vector of gross output.

$A = (a_{ij})$ is the matrix of technical coefficients.

$Y = (y_1, \ldots, y_n)'$ is the vector of final demand.

From the above equation, gross output can be rewritten as:

$$X = (I - A)^{-1} Y \tag{1}$$

where $I - A$, the Leontief matrix, is non-singular and I is the identity matrix[1].

The matrix $B = (I - A)^{-1}$ is the Leontief inverse, which gives the direct and indirect sectoral output requirements to support one unit of final demand in each sector. Let b_{ij} denote the elements of the Leontief inverse matrix also known as total requirements coefficients.

The forward linkage is defined as $B_i. = \sum_{j=1}^{n} b_{ij}$, the sum of the elements in the ith row of the Leontief inverse matrix and the backward linkage is $B._j = \sum_{i=1}^{n} b_{ij}$, the sum of the elements in the jth column.

The forward linkage of a sector reflects the extent to which the sector's output is used by other sectors as input. Hence, the production of a sector with a high-forward linkage is more sensitive to changes in the other sectors' output. The backward linkage of a sector determines the degree by which its production depends on the inputs from the other sectors. An increase in the production of a sector with a relatively high-backward linkage will generate greater demand for inputs from other sectors (Guo and Planting, 2000).

One method of determining structural change is to look at changes in the linkages. Two indices are used to evaluate intersectoral linkages, the backward and forward linkage indices given below.

The global intensity of the Leontief inverse matrix is defined as the sum of the total requirements coefficients for all sectors given by:

$$V = \sum_{i=1}^{n}\sum_{j=1}^{n} b_{ij}. \tag{2}$$

Intersectoral comparisons can be made by computing the sensitivity of dispersion or forward linkage index, defined as:

$$FL_i = \frac{B_{i\cdot}/n}{V/n^2} = \frac{B_{i\cdot}}{V/n} \tag{3}$$

and the power of dispersion or backward linkage index, given by:

$$BL_j = \frac{B_{\cdot j}/n}{V/n^2} = \frac{B_{\cdot j}}{V/n}. \tag{4}$$

The forward linkage index or sensitivity of dispersion reflects the degree by which changes in the demand of the other sectors will affect the sector, while the backward linkage index or power of dispersion indicate the extent of the impact of changes in a sector on the other sectors.

It can be gleaned from the definition of these indices that a linkage index measures the average sectoral requirement, $B_{i\cdot}/n$ or $B_{\cdot j}/n$, relative to the overall average requirement, V/n^2.

Hence, if the forward linkage index of sector i is greater than one, then a unit increase in all sectors' final demand will require an above average increase in output from sector i; also, if the backward linkage index of sector j is greater than one, then a unit change in its final demand will stimulate an above average increase in activity in the rest of the economy. If both indices are greater than one, the sector is considered a key sector (Guo and Hewings, 2001). For policy and investment purposes, it is important to identify key sectors because expansion of these sectors will induce significantly more production in the economy. An increase in a key sector's demand will require substantially more inputs from the other sectors and growth in the rest of the economy will raise the demand for the key sector's output.

The I-O MPM is defined as:

$$M = \frac{1}{V}\begin{pmatrix} B_{1\cdot} \\ B_{2\cdot} \\ \vdots \\ B_{n\cdot} \end{pmatrix}\begin{pmatrix} B_{\cdot 1} & B_{\cdot 2} & \cdots & B_{\cdot n} \end{pmatrix} = [m_{ij}]. \tag{5}$$

Each element of the MPM is the product of a forward linkage and a backward linkage divided by the global intensity of the inverse matrix. Since the multiplier product encapsulates the effect of both forward and backward linkages, it gives a single quantitative measure of a sector's relationship with all the other sectors (Guo and Planting, 2000). The MPM can be presented graphically. It provides an "economic landscape" at a given point in time, and shows the structural relationships of the sectors through their backward and forward linkages. Hence, if MPMs are constructed for different periods, one can evaluate how the economic structure varies over time.

3. Empirical results

3.1 The data

The I-O tables used in this study are for the years 1979, 1985, 1990, 1994 and 2000[2]. The number of industries or sectors varies for each year (Table AII). To compare the five I-O tables, the sectors were aggregated into 11 major sectors, given in Table I. Figure 5 shows the shares of these 11 sectors over time.

In the second part of the analysis, and for the years 1979, 1990 and 2000, the manufacturing sector is further subdivided into five categories according to the Organization for Economic Cooperation and Development (OECD, 1987) classification: differentiated goods, labor-, resource-, scale-intensive and science-based manufacturing industries (see Figure 4 for the evolution of output shares of the five manufacturing subgroups). The various manufacturing industries under each category are listed in Table AIII. The 15 sectors are given in Table II.

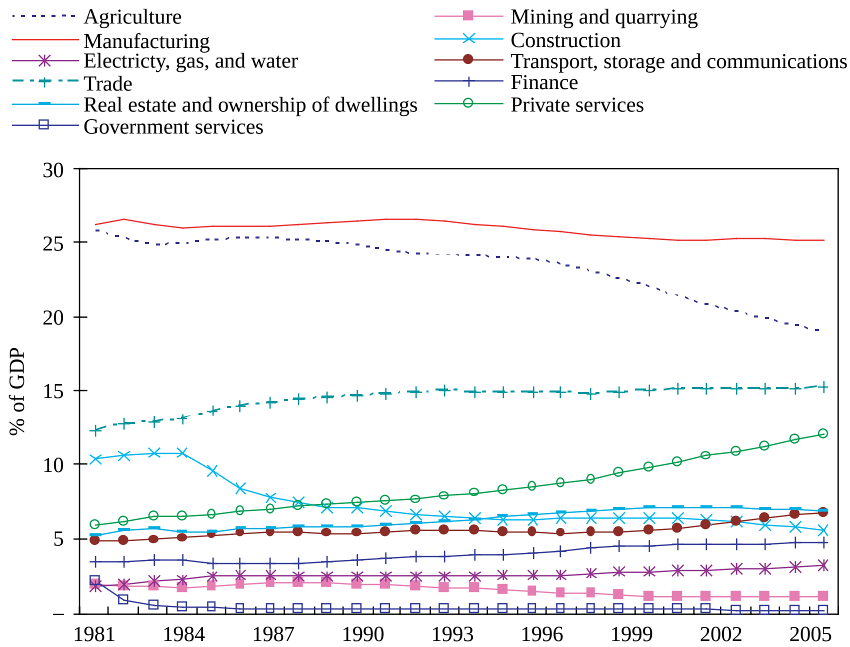
3.2 Sector analysis

The goal of key sector analysis is to identify the sectors that generate above average impact on the economy either when they expand, or as a result of changes in the other sectors (Sonis and Hewings, 1999).

To determine the key sectors over 1979-2000, the forward and backward linkage indices were calculated for each of the five I-O tables. The forward linkage index indicates how much a change in the rest of the economy will affect a sector. If it is greater than one then a unit increase in the final demand of the other sectors will have a larger impact on the output requirement of the key sector compared to the rest of the economy. The backward linkage index measures the extent by which changes in the sector will cause changes in the other sectors. If a sector has a backward linkage index

	Sector
1	Agriculture, fishery and forestry (AFF)
2	Mining and quarrying (MQ)
3	Manufacturing (Mfg)
4	Construction (Constr)
5	Electricity, gas and water (EGW)
6	Transportation, communication and storage (TCS)
7	Trade
8	Finance (Fin)
9	Real estate and ownership of dwellings (Real Est)
10	Private services (Priv Serv)
11	Government services (Govt Serv)

Table I. The 11 sectors of the economy



Source: CEIC Data 2007

Figure 5.
Share of GDP

Table II.
The 15 sectors of the economy

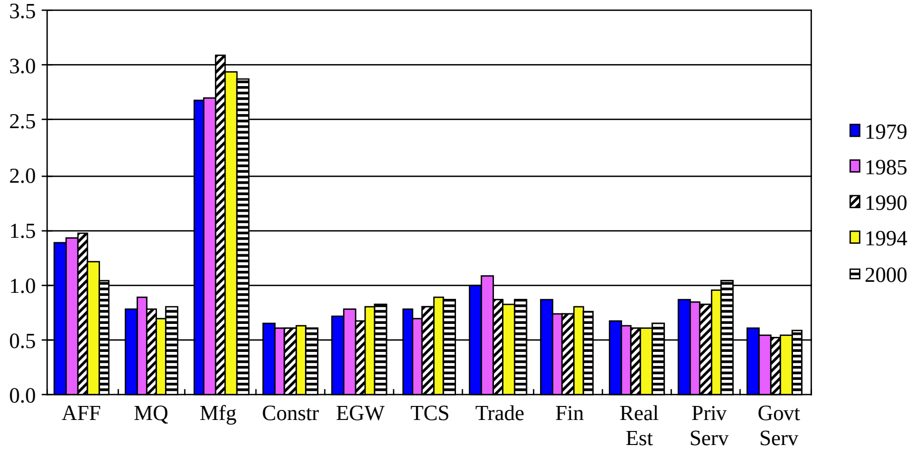
	Sector
1	Agriculture, fishery and forestry (AFF)
2	Mining and quarrying (MQ)
3	Differentiated goods manufacturing (Mfg DG)
4	Labor-intensive manufacturing (Mfg LI)
5	Resource-intensive manufacturing (Mfg RI)
6	Scale-intensive manufacturing (Mfg SI)
7	Science-based manufacturing (Mfg SB)
8	Construction (Constr)
9	Electricity, gas and water (EGW)
10	Transportation, communication and storage (TCS)
11	Trade
12	Finance (Fin)
13	Real estate and ownership of dwellings (Real Est)
14	Private services (Priv Serv)
15	Government services (Govt Serv)

greater than one, it means that an increase in the sector's final demand will stimulate relatively higher production in the other sectors.

The linkage indices for the 11 sectors are shown in Figures 6 and 7. The values of the indices are given in Tables AIV and AV. The sector with the highest forward and backward linkage indices is manufacturing. The manufacturing sector's forward index increased from 2.68 in 1979 to 2.88 in 2000, peaking at 3.08 in 1985. The high-forward indices reflect the sector's significant role as supplier of inputs to the rest of the economy. The manufacturing sector's backward index decreased in 1985 but climbed up in 1990 and 1994 and then dipped slightly in 2000. However, it is the only sector that has maintained its importance as a key sector throughout the 21-year period as indicated by the fact that its linkage indices have been always higher than one.

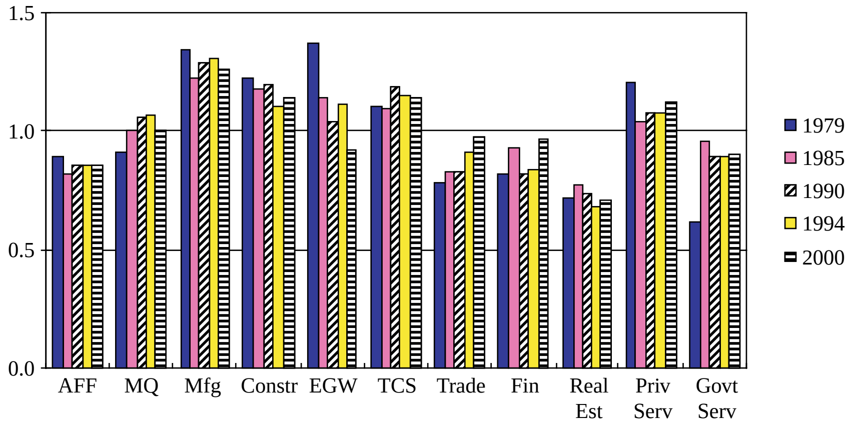
Agriculture, fishery and forestry is a sector with a relatively high-forward linkage. Although primary industry is an important input provider to the economy, its position declined in 2000 when it was overtaken by the private services sector, whose forward index increased to 1.06. The trade sector had an index slightly greater than one in 1985 but it declined thereafter.

Three sectors, construction; transportation, communication and storage and private services, are consistently backward linkage oriented, with indices greater than one between 1979 and 2000. Electricity, gas and water are also a backward



Source: Authors' estimates

Figure 6.
Forward linkage index (11 sectors)



Source: Authors' estimates

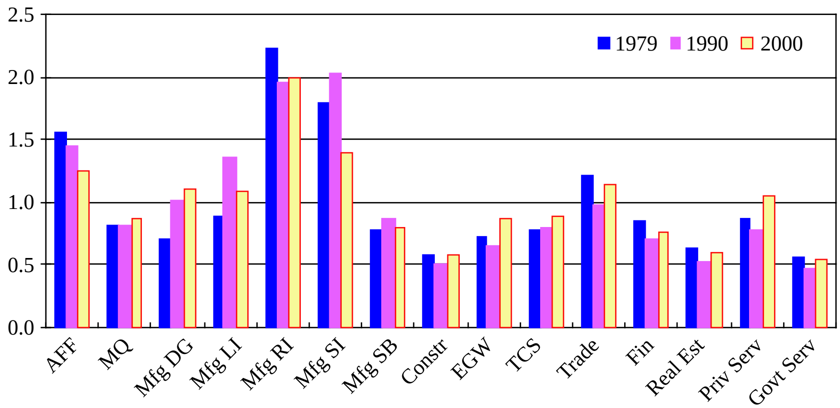
Figure 7.
Backward linkage index (11 sectors)

linkage-oriented sector, except for the year 2000. The mining and quarrying sector was a backward linkage-oriented sector as well between 1985 and 1994.

It is important to note that the private services sector[3] became a key sector in 2000 with its forward and backward linkage indices greater than one. This movement is an indication of the increasing impact of this sector on the Philippine economy. An expansion of this sector may well be advantageous to the Philippine economy since an increase in this sector's final demand may stimulate production in the other sectors, and growth in the rest of the economy may increase the demand for this sector's output.

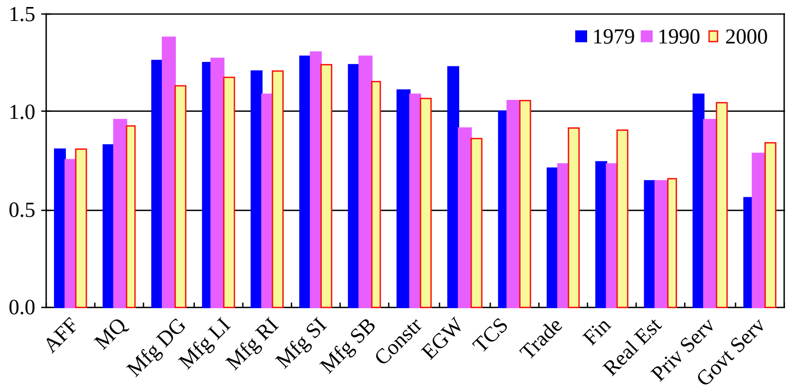
Since the manufacturing sector is the only sector that has consistently displayed high forward and backward linkages, we further disaggregated it into five subsectors in order to find out which specific type of manufacturing industry has a higher than average influence on the economy. Figures 8 and 9 show the linkage indices of the resulting 15 sectors (the values of the indices are given in Tables AVI and AVII)[4].

The resource- and scale-intensive manufacturing sectors have both backward and forward linkage indices consistently greater than one. Hence, these two manufacturing



Source: Authors' estimates

Figure 8.
Forward linkage index (15 sectors)



Source: Authors' estimates

Figure 9.
Backward linkage index (15 sectors)

sectors are the key sectors in the economy throughout the period of study. On the other hand, differentiated goods and labor-intensive manufacturing sectors were also significant sectors in terms of backward linkage throughout the period, but only became key sectors in 1990 and 2000. What is striking about these two manufacturing sectors is the significant increase between 1979 and 1990 in the shares of their output values sold to other processing sectors of the economy, 39 percent each, which was the highest absolute increase among the 15 sectors. There was no such marked increase for resource-intensive and scale-intensive manufacturing sectors as they already had the highest shares in 1979, and continued to rank highly in 1990 and 2000. While differentiated goods initially had low linkages with the rest of the economy as well as low-output shares (Figure 4), this has changed over time. If output share of differentiated goods could further increase, then it is expected to exert stronger stimulus to other sectors. This may not be the case, however, for labor-intensive industries, whose output shares have been declining.

Science-based manufacturing is backward linkage oriented as is evidenced by its high-backward linkage index, which is consistently greater than one. As a significant purchaser of inputs, increase in final demand for science-based manufacturing goods will boost production in the other sectors. Science-based industries are expected to play an important role in stimulating other sectors, not only because of their high-backward linkages, but also because they have exhibited rising output shares.

The importance of the manufacturing subsectors is further illustrated by the ranking of the linkage indices given in Table III. For 1990 and 2000, the top five places in terms of the backward linkage index were taken by the five manufacturing sectors. Note that the forward-linkage indices of both resource- and scale-intensive manufacturing sectors are consistently ranked either as first or second. The backward linkage index of the scale-intensive manufacturing sector is also ranked first or second, while that of the resource-intensive sector substantially moved up from sixth to second. The resource- and scale-intensive manufacturing sectors are evidently the most important in terms of their interdependence with the rest of the economy. Although these sectors have high

	Rank of forward linkage index			Rank of backward linkage index		
Sectors	1979	1990	2000	1979	1990	2000
AFF	3	3	3	11	12	14
MQ	8	8	9	10	8	9
Mfg DG	12	5	5	2	1	5
Mfg LI	5	4	6	3	4	3
Mfg RI	1	2	1	6	5	2
Mfg SI	2	1	2	1	2	1
Mfg SB	10	7	11	4	3	4
Constr	14	14	14	7	6	6
EGW	11	12	10	5	10	12
TCS	9	9	8	9	7	7
Trade	4	6	4	13	13	10
Fin	7	11	12	12	14	11
Real Est	13	13	13	14	15	15
Priv Serv	6	10	7	8	9	8
Govt Serv	15	15	15	15	11	13

Source: Authors' estimates

Table III.
Rank of linkage indices

backward and forward linkages, their capacity to harness growth in other sectors appears to have diminished over time. Between 1983 and 2003, their combined share in total manufacturing output declined by about 25 percentage points, and their total share in total GDP dropped by 7 percentage points.

Had the key manufacturing subsectors expanded rather than contracted, they could have stimulated more production in sectors of the economy with which they exhibit strong linkages. As the production of key sectors grows, production in sectors from which they purchase or provide inputs likewise expands. Take the case of scale-intensive industries, which had an output multiplier of 2.8 in the 1990 I-O table. This means that every dollar worth of new final demand in scale-intensive industries would have induced a total of $2.8 additional output from all sectors of the economy. While its output multiplier declined to 2.3 in 2000, still this was the highest multiplier among the 15 sectors.

Since the share of manufacturing in GDP has virtually been stagnant for the last two decades or so, the drop in the output shares of resource- and scale-intensive manufacturing has only been compensated by the rising shares of differentiated goods and, in some part, by science-based manufacturing[5]. In particular, the combined shares of differentiated goods and science-based manufacturing subsectors rose by 6.5 percentage points from 1983 to 2003, almost equal to the decline in the combined shares of resource- and scale-intensive manufacturing subsectors for the same period.

3.3 Structural changes using MPM

This section provides a visual representation of the changes in the structure of the Philippine economy in terms of how the economic landscape, given by the MPM, has evolved over the period 1979-2000. The economic landscapes are shown in Figure 10. The graphs show the MPM for the year 1979, 1985, 1990, 1994 and 2000.

Since each element of the MPM is the product of a forward and backward linkages divided by the global intensity of the Leontief inverse matrix, the height of the bars in the graphical representation of the MPM is contingent on the level of interdependence of the sectors in the economy. The larger the MPM value, the higher the bar representing it in the landscape and the greater the intersectoral relationship. If the landscape is flat or the height of the bars is identical, then the extent of intersectoral relationship is the same. A low and flat landscape indicates low linkages among the economic sectors.

To compare the economic landscape at different times, the MPM is calculated for each period. In this study, the MPMs for the years 1979, 1985, 1990, 1994 and 2000 were computed, and each is presented as a three dimensional bar graph. To facilitate comparison, 1979 is considered as the base year such that the 1979 hierarchy of the sectors was maintained for the MPM of the succeeding years in order to examine the changes in the landscape over the 21-year period.

For the 1979 landscape, the sectors are arranged in descending order in terms of the rank of their MPM values. The apex (highest bar) is the intersection of sectors 5 (electricity, gas and water) and 3 (manufacturing); while the lowest bar is for sector 11 (government services). With regards to the relative forward linkage, the top place goes to sector 3 (manufacturing); sector 1 (agriculture, fishery and forestry) is second and sector 7 (trade) is third. As for the relative backward linkage, sector 5 (electricity, gas and water) is the first; sector 3 (manufacturing) is second and sector 4 (construction) is the third. Having the lowest bars sector 11, government services, has the least impact on the economy in terms of providing inputs to and requiring inputs from other sectors.

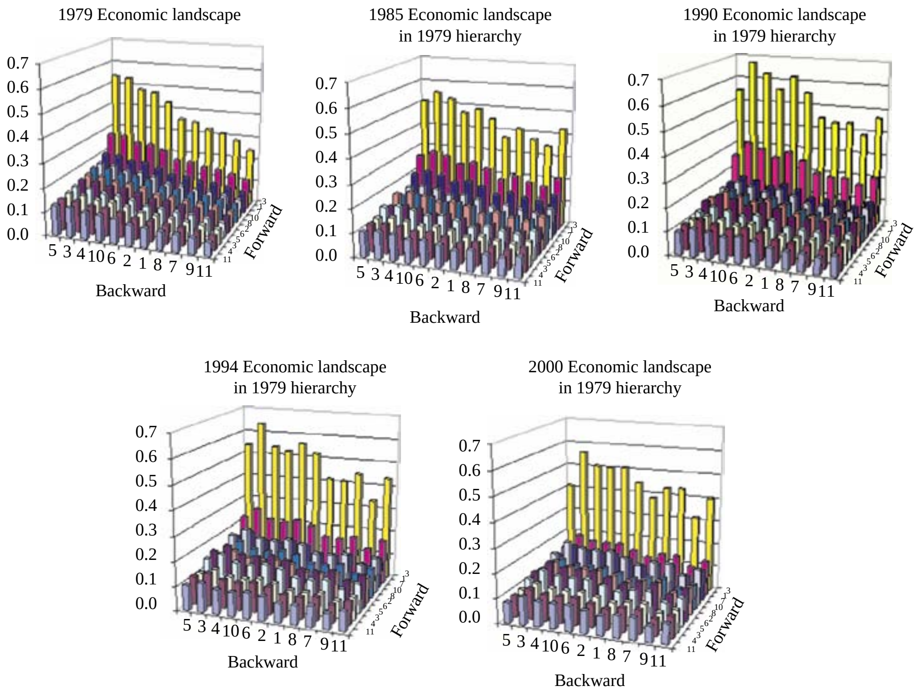


Figure 10.
Philippine economic landscape (11 sectors)

If the economy does not undergo structural change, the landscapes will look the same over the period under study. Figure 10 shows that there are differences among the five successive landscapes. Changes in the height of the bars between years indicate a shift in the degree of interdependence between the respective sectors. Economic landscapes of any two consecutive years reveal only slight changes. However, the 1979 and 2000 landscapes exhibit significant differences. The 2000 landscape is more uneven. The apex has shifted to the manufacturing sector reflecting the high significance of the sector's linkages. A considerable increase in the height of the forward MPM bars of the following sectors can be observed: sector 2 (mining and quarrying); sector 3 (manufacturing); sector 5 (electricity, gas and water); sector 6 (transportation, communication and storage) and sector 10 (private services). This means that there was an upsurge in the importance of these five sectors as suppliers of inputs to the economy. On the other hand, the height of the forward MPM bars of sector 1 (agriculture, fishery and forestry) has decreased substantially which indicates a diminishing role of this sector as input supplier.

With regard to the backward MPM, there is a general increase in the height of the bars of sectors 7 (trade), 8 (finance) and 11 (government services) though the increase in height is not as pronounced as those of the forward MPM previously discussed. Hence, the relative impact of these three sectors on the economy has increased. In contrast, the height of sector 5 (electricity, gas and water) decreased, which indicates a decline in the sector's impact on the economy.

Spearman rank correlation analysis applied on the 1979 and 2000 MPM showed that the two landscapes are indeed significantly different.

With manufacturing disaggregated into five sectors, the MPM for the 15 sectors was obtained for the years 1979, 1990 and 2000. The resulting landscapes, shown in Figure 11, reveal significant structural change in addition to that discussed above.

It is important to note that the landscape is generally higher in 1990 than in 1979. This means that the linkages among sectors became stronger in 1990. Although still higher than the 1979 base year, the average height in 2000 is lower than in 1990. However, the variation among the bar heights in 2000 is the least among the three landscapes, which implies that the disparity among the intersectoral relationships has diminished.

Regarding the forward MPM of the manufacturing sectors, the height of the bars increased over the 21-year period for differentiated goods and labor-intensive manufacturing. For the labor-intensive industries, there was a significant surge between 1979 and 1990 but the level decreased in 2000 (though still higher than that of 1979). For differentiated goods, the increase in height between 1979 and 1990 is also substantial although there is no significant difference between the 1990 and 2000 levels. As for the scale-intensive manufacturing sector, there was a considerable increase between 1979 and 1990. However, the level in 2000 is slightly lower than that of 1979. For science-based manufacturing, the forward linkage relationships expanded in 1990, but in 2000 went down to almost the same level as in 1979. And for the resource-intensive

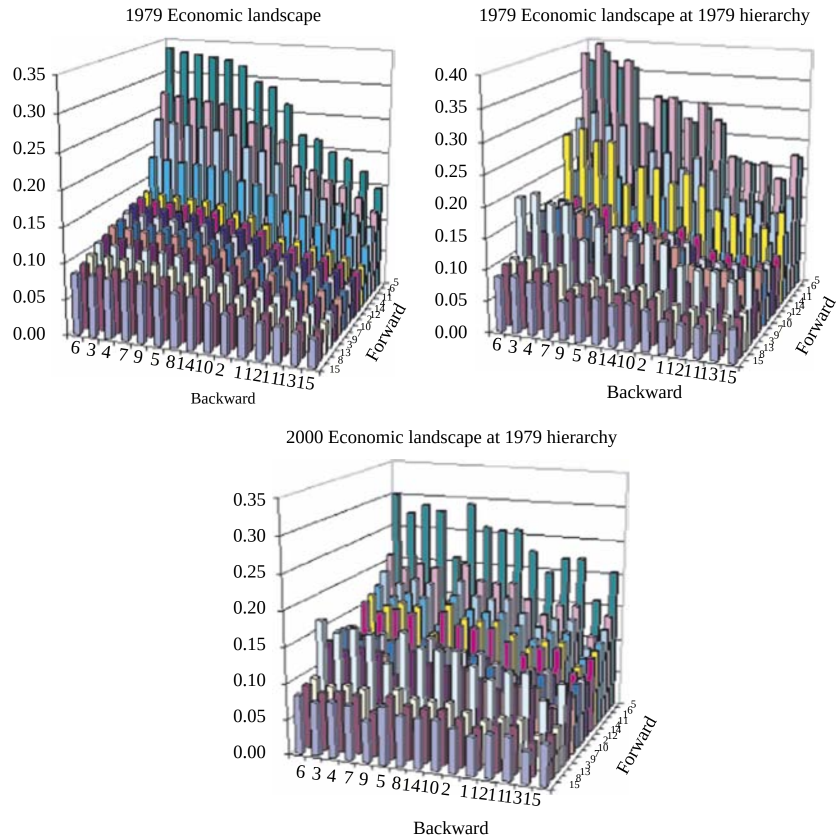


Figure 11.
Philippine economic landscape (15 sectors)

industries, in 2000, there was a marginal decrease with respect to the 1979 level. These changes reflect the varying importance of the manufacturing sectors as suppliers of inputs, particularly, the increasing significance of differentiated goods and labor-intensive manufacturing.

For the backward linkage MPM, there was a slight increase in the height of the bars, signifying stronger linkages, between 1979 and 1990 for all the five manufacturing sectors. However, the shift in the 2000 level compared to that in 1979 is marginal. This implies that the impact of the manufacturing sector on the economy has remained the same after 21 years.

Past economic policies apparently have failed to induce significant changes in the manufacturing sector or, more importantly, to drive manufacturing as an engine of overall growth. Felipe (2010) argues that the problems underlying Philippine industrialization include an uncompetitive cost structure, fast liberalization and poor infrastructure, as well as distributive conflicts and dysfunctional institutions that prohibited the development of the proper institutional prerequisites for sustained growth.

Note that relative to per capita income, the size of the Philippines' manufacturing output share is just within its expected level, while those of its more well-off neighbors like Korea, Malaysia and Singapore are higher than their expected levels (Felipe and Estrada, 2008). Unfortunately, what is evident for the Philippines is a process of "de-industrialization" occurring at low per capita income (Hill, 2003). Although the government has implemented policies that support liberalization, privatization and investment reforms especially in the 1980s and 1990s, still the Philippines has yet to have a clear industrial policy, which can put its industrial sector at a level comparable to that of its neighbors.

4. Export sophistication and competitiveness

The previous sections have highlighted manufacturing as a key sector in stimulating production in other economic sectors, through both backward and forward linkages, as well as how such linkages have evolved over time. This section examines two important and related aspects in the structural transformation of the manufacturing sector, namely, export orientation and product sophistication.

In the early 1980s, the value of manufacturing exports was almost equal to the value of agricultural and agro-based exports. By 1990, however, manufacturing goods became the dominant export group, accounting for about 70 percent of the value of all exports. Manufacturing goods have since then accounted for the bulk of exports.

Table IV shows the export shares of the top 20 exported commodities as of 2006 based on the four-digit level of product disaggregation, sorted by product sophistication. The table shows that the top 20 exports, mostly manufacturing, accounted for 76 percent of all exports in 2006. Moreover, differentiated goods manufacturing accounted for three-fourths of the top exported commodities. Resource- and scale-intensive manufacturing contributed marginally, as they accounted for a combined share of only 6 percent of the top exported commodities. Thus, differentiated goods have exhibited growing significance not only in terms of their backward and forward linkages, but also through their export dominance in recent years.

Exports of electronics increased significantly between 1995 and 1996, when the shares of electronic microcircuits and some other electronics took off. The share of electronic microcircuits peaked at 44.37 percent of total exports in 1999, but since then it has declined significantly and in 2006, it represented 17.90 percent of total exports.

Table IV.
Export share of the top 20 exported commodities of the Philippines as of 2006

Commodity	Manufacturing type	Product sophistication (PRODY)	Export share (%) 1980	1985	1990	1995	1996	1997	1998	1999	2000	2005	2006
Parts (n.e.s.) of and accessories for apparatus of telecommunications, sound recording and reproducing equipment	DG	21,063	0.16	0.04	0.31	1.12	1.44	1.03	1.14	1.00	1.20	1.28	1.25
Electronic microcircuits	DG	21,008	0.55	3.82	2.88	6.54	25.81	29.76	39.84	44.37	39.68	18.79	17.90
Parts (n.e.s.) of and accessories for calculating, accounting, cash registers, ticketing and automatic data processing machines and units	DG	20,514	0.00	0.00	0.09	0.99	8.14	7.80	7.03	6.67	6.65	8.70	6.96
Other electric power machinery, parts (n.e.s.)	DG	20,262	0.00	0.01	0.21	0.16	0.15	0.13	0.17	0.15	0.20	0.20	1.25
Other parts and accessories, for vehicles of tractors, passenger motor vehicles, lorries and special purposes motor vehicles and road motor vehicles (n.e.s.)	SI	20,168	0.52	0.45	0.25	1.19	1.37	1.43	1.14	1.26	1.51	3.33	3.01
Crystals and parts (n.e.s.) of electronic components of thermionic, microcircuits, transistors, valves, etc.	DG	19,619	0.13	0.26	0.94	0.36	0.69	0.92	0.99	1.54	1.74	1.90	1.64
Glass (n.e.s.)	SI	19,516	0.02	0.03	0.08	0.03	0.02	0.02	0.13	0.18	0.20	0.61	0.84
Peripheral units, including control and adapting units	SB	19,469	0.00	0.00	0.75	1.12	4.94	8.55	8.13	8.89	10.55	8.40	7.12

(continued)

Commodity	Manufacturing type	Product sophistication (PRODY)	1980	1985	1990	1995	1996	1997	1998	1999	2000	2005	2006
			Export share (%)										
Complete digital data-processing machines	DG	18,621	0.00	0.00	0.00	0.00	0.01	0.02	0.00	0.01	0.13	1.63	2.91
Diodes, transistors, photocells, etc.	DG	17,368	0.10	1.16	1.05	2.20	3.32	4.02	2.99	2.80	2.84	16.21	16.96
Switches, relays, fuses, etc.; switchboards and control panels (n.e.s.)	DG	16,541	0.02	0.02	0.03	0.07	0.48	0.55	1.22	1.09	1.27	1.37	1.67
Builders' carpentry and joinery, including prefabricated	RI	16,496	0.25	0.57	0.81	0.39	0.46	0.28	0.21	0.22	0.45	0.27	1.34
Other electrical machinery and equipment (n.e.s.)	DG	16,435	0.04	0.08	0.03	0.19	0.13	0.14	0.18	0.18	0.38	5.75	3.21
Photographic cameras, flashlight apparatus, parts and accessories (n.e.s.)	SB	15,777	0.09	0.06	0.01	0.13	0.82	0.55	0.46	0.18	0.28	0.86	1.09
Women's, girls', infants' and outerwear, textile and other outer garments not knitted or crocheted	LI	8,585	0.23	0.54	0.71	0.81	1.69	1.44	1.33	1.08	1.28	1.08	0.98

(continued)

Table IV.

Table IV.

Commodity	Manufacturing type	Product sophistication (PRODY)	Export share (%) 1980	1985	1990	1995	1996	1997	1998	1999	2000	2005	2006
Outerwear knitted or crocheted, not elastic nor rubberized; other, clothing accessories, non-elastic, knitted or crocheted	LI	8,119	0.09	0.29	0.48	1.38	1.79	1.47	1.08	0.88	0.90	0.88	1.17
Insulated electric wire, cable, bars, etc.	DG	8,102	0.04	0.00	1.93	2.68	2.50	2.29	1.61	1.62	1.72	2.00	1.95
Copper and copper alloys, refined or not, unwrought	LI	6,556		3.63	3.43	2.33	1.67	1.16	0.60	0.76	0.64	0.89	2.66
Banana, plantain, fresh or dried	na	6,466	2.00	2.47	1.82	1.28	1.15	0.86	0.74	0.69	0.77	0.89	0.87
Coconut (copra) oil	RI	3,463	9.79	7.50	4.41	4.73	2.78	2.67	2.39	0.98	1.23	1.62	1.24
Subtotal			14.03	20.93	20.22	27.7	59.36	65.09	71.38	74.55	73.62	76.66	76.02
Sophistication, country level (EXPY)			10,298	12,690	13,558	15,474	15,679	16,404	17,299	17,992	17,921	17,120	16,777

Notes: PRODY and EXPY figures are in 2005 constant \$, PPP adjusted; commodity classifications are based on SITC Rev2 Aggregation 4; under manufacturing type, DG is differentiated goods, LI is labor intensive, SI is scale intensive and SB is science based; "n.e.s." means not elsewhere stated; "na" pertains to non-manufacturing
Source: UN COMTRADE

Table IV also shows the level of sophistication of these exports, denoted PRODY (Hausmann *et al.*, 2005). For reference, the highest value that PRODY takes in our data set (constructed for about 800 products) is almost 40,000. This means that the Philippines exports products with a significant share (at least 1 percent of total exports) that rank in the middle of the sophistication distribution. This is not bad for a country with the level of income of the Philippines.

The country's level of export sophistication is represented here by EXPY (Hausmann *et al.*, 2005)[6]. The higher the value of the index, the greater is the level of export sophistication. The index broadly represents the income level associated with the country's export mix. Thus, the more a country's exports resemble those of the high-income countries, the higher the country's EXPY index will be.

The bottom of Table IV shows the continuous rise in the country's level of export sophistication between 1980 and 1999-2000, and the stagnation thereafter. Thus, while the country was successful in moving toward the export of more sophisticated manufacturing goods until the late 1990s, in recent years, the pattern has changed. Table IV indicates that the stagnation in total export sophistication has been due in part to the fall in the export share of electronic microcircuits, which are differentiated manufacturing goods with high sophistication[7].

The competitiveness of the top 20 exported products as measured by the index of revealed comparative advantage is shown in Table V[8]. It is worth noting that before 1996, the Philippines had significant revealed comparative advantage (an index greater than one) in only a few products (clearly in copper and copper alloys, banana and coconut oil). However, after 1996, the Philippines has gained significant comparative advantage in some of its top exports, including electronic microcircuits; parts and accessories for machines of calculating; glass; peripheral units; diodes, transistors and photocells; photographic cameras, flashlight apparatus; women's and girls' outwear and copper alloys, banana and coconut oil show very high comparative advantage.

These results indicate that the Philippines has been able to develop during the last decade a "capability set" (this includes inputs, knowledge, technology and institutions) that allow the country to export these products and be a significant player in the international market.

The challenge for the Philippines in the coming years is to discover and jump into (i.e. gain comparative advantage) activities with a higher level of sophistication. These should be activities that require for their export a capability set similar to the one used in the activities where the Philippines already has significant presence. This is an exercise to be undertaken jointly by private and public sectors with a view to identifying the different inputs (especially, those the public sector has to provide) that are necessary to export successfully these products.

These inputs are clearly product specific, and one should go beyond generic inputs, or improvement in the so-called investment climate. While it is true that inadequate infrastructure, high transport and electricity costs are issues to be resolved, the truth is that some export industries are doing well, in spite of these problems. This means that the development of new exports with comparative advantage requires an analysis of constraints at the product level. Indeed, exporting successfully electronics requires a very specific set of capabilities, very different from those required to export successfully textiles or agricultural products.

Table V.
Revealed comparative advantage of the top 20 exported commodities of the Philippines as of 2006

Commodity	Manufacturing type	1980	1985	1990	1995	1996	1997	1998	1999	2000	2005	2006
Parts (n.e.s.) of and accessories for apparatus of telecommunications, sound recording and reproducing equipment	DG	0.31	0.05	0.41	1.02	1.32	0.90	0.99	0.82	0.85	0.91	0.87
Electronic microcircuits	DG	1.94	5.96	2.11	2.31	9.57	10.65	14.33	13.93	10.97	6.91	6.75
Parts (n.e.s.) of and accessories for machines of calculating, accounting, cash registers, ticketing and automatic data-processing machines and units	DG	0.00	0.00	0.06	0.56	4.65	4.06	3.50	3.00	2.73	4.25	3.52
Other electric power machinery, parts (n.e.s.)	DG		0.05	0.97	0.49	0.44	0.33	0.43	0.35	0.43	0.51	3.07
Other parts and accessories, for vehicles of tractors, passenger motor vehicles, lorries and special purposes motor vehicles and road motor vehicles (n.e.s.)	SI	0.27	0.18	0.10	0.54	0.63	0.65	0.50	0.54	0.69	1.49	1.41
Crystals and parts (n.e.s.) of electronic components of thermionic, microcircuits, transistors, valves, etc.	DG	0.43	0.70	5.33	1.39	2.65	3.45	3.84	4.98	4.78	8.43	6.98
Glass (n.e.s.)	SI	0.21	0.32	0.90	0.30	0.18	0.20	1.38	1.75	2.02	7.12	10.99
Peripheral units, including control and adapting units	SB	0.00		0.88	0.76	3.29	4.94	4.54	4.98	6.19	5.91	5.62
Complete digital data-processing machines	DG			0.02		0.03	0.07	0.01	0.03	0.40	2.63	4.51
Diodes, transistors, photocells, etc.	DG	0.55	6.16	4.70	5.93	9.39	10.80	7.84	7.02	6.14	33.94	33.63
Switches, relays, fuses, etc.; switchboards and control panels (n.e.s.)	DG	0.02	0.03	0.03	0.07	0.47	0.53	1.13	1.00	1.15	1.21	1.49

(*continued*)

Table V.

Commodity	Manufacturing type	1980	1985	1990	1995	1996	1997	1998	1999	2000	2005	2006
Builders' carpentry and joinery, including prefabricated	RI	2.82	7.34	5.59	2.29	2.67	1.66	1.21	1.23	2.91	1.64	8.07
Other electrical machinery and equipment (n.e.s.)	DG	0.11	0.17	0.06	0.21	0.17	0.19	0.24	0.23	0.41	7.13	4.03
Photographic cameras, flashlight apparatus, parts and accessories (n.e.s.)	SB	0.58	0.34	0.10	0.80	5.14	3.30	2.73	1.09	1.71	12.78	21.63
Women's, girls', infants' and outerwear, textile and other outer garments not knitted or crocheted	LI	1.38	2.01	1.75	2.37	4.69	3.81	3.43	2.75	3.19	2.62	2.62
Outerwear knitted or crocheted, not elastic nor rubberized; other, clothing accessories, non-elastic, knitted or crocheted	LI	0.74	1.78	1.58	4.16	5.39	3.60	2.77	2.23	2.42	2.45	3.55
Insulated electric wire, cable, bars, etc.	DG	0.15	0.00	5.28	5.07	4.43	3.88	2.63	2.62	2.79	3.44	3.09
Copper and copper alloys, refined or not, unwrought	LI		15.23	11.46	7.35	5.77	3.93	2.51	3.38	2.76	2.91	5.45
Banana, plantain, fresh or dried	n.a.	53.16	51.96	28.87	15.01	13.74	8.70	7.70	7.86	11.22	15.51	16.19
Coconut (copra) oil	RI	208.01	171.42	249.14	209.31	142.20	112.92	112.02	69.88	78.66	112.24	122.10

Notes: Under manufacturing type; DG is differentiated goods; LI is labor intensive; SI is scale intensive; SB is science based
Source: UN COMTRADE

5. Conclusions

It is evident from the results of the linkage analysis that manufacturing is consistently the key sector in the Philippine economy. It ranks first as input supplier and its role in stimulating production in the rest of the economy is highly significant. In particular, the scale-intensive and resource-intensive manufacturing industries take on the lead as having the largest impact on the economy. Although agriculture, fishery and forestry are still an important input supplier, its forward linkage is declining. On the other hand, in 2000 the private services sector emerged as a key sector which reflects its growing positive influence on the economy.

The economic landscapes of 1979, 1985, 1990, 1994 and 2000 obtained by computing the MPM, portray the changes in the economic structure. The 1979 landscape was dominated by the following sectors: manufacturing; electricity, gas and water; construction; agriculture, fishery and forestry and trade. The 1990 landscape exhibited higher elevation for most sectors indicating a higher sectoral interdependence. The average height decreased slightly in 2000 but the variation was also reduced which means that there was a decrease in disparity among the sectors linkages.

Manufacturing continues to play the leading role in the economy. In general, the degree of its interrelationship with the other sectors has not changed significantly between 1979 and 2000. However, within the manufacturing sector changes have occurred. Although resource- and scale-intensive industries are still at the forefront, the importance of science-based and labor-intensive manufacturing is evident, but more so differentiated goods manufacturing, whose level of forward linkage increased significantly between 1979 and 2000.

Given its high backward and forward linkages, had the manufacturing sector's output share increased, its capacity to stimulate overall economic growth would have been more significant. An expansion of the manufacturing sector would have led to higher production in the other sectors with which the manufacturing sector has high linkages. Unfortunately, the sector's output share has been virtually stagnant for the past several decades. And within manufacturing, although resource- and scale-intensive industries have the highest backward and forward linkages, their shares in total GDP have declined over time.

With the failure to industrialize, the services sector is the one that has provided the largest contribution to overall growth, especially in recent years. The 2000 landscape shows the growing impact on the economy of the private services and of the transportation, communication and storage sectors, which is probably due to the globalization of these activities. Still, compared to manufacturing, the services sector exhibits lower intersectoral linkages. The strong potential to stimulate growth in the other sectors still lies primarily on manufacturing.

Based on these empirical results, it looks like the Philippines cannot afford to leapfrog industrialization and depend (exclusively) on a service-oriented economy. The Philippine economy is still largely influenced by the manufacturing sector despite the developments in the private services sector. Hence, the government should implement policy reforms that advance industrialization so that the economy can progress at a faster rate. This means not only addressing the long-standing issues besetting the industrial sector such as high regulatory burden, poor infrastructure and endemic corruption, but also implementing policies that directly target the industrial sector.

Notes

1. For details regarding input-output analysis see Miller and Blair (1985).
2. Obtained from the National Statistical Coordination Board.
3. Private services include private education, health and social services, business services, hotels and restaurants, recreational services, personal services and other private services.
4. It is evident from the I-O framework (in Section 2 of this paper) that linkage indices are not additive since they are functions of the Leontief inverse. This means that different disaggregations of the I-O table would result in different values for the linkages. Hence, the 11-sector linkage index table and the 15-sector table give different values for the same sector.
5. The decline in the output share of labor-intensive manufacturing in total output has been minimal, at only 1 percentage point between 1983 and 2003.
6. Export sophistication is derived by first constructing a commodity-specific index as the weighted average of the per capita GDPs of the countries exporting a given product (where the weights are the revealed comparative advantage of a country's exports). This is denoted PRODY. It thus represents the income-level associated with the product. Next, an EXPY index is constructed which is the weighted average of this index, where the weights are the value shares of the products in the country's total exports (Hausmann *et al.*, 2005). ADB (2007) finds that the export complexity of Philippines has risen over time and is comparable with those of its ASEAN countries, namely, Indonesia, Malaysia and Thailand, but is way below those of Korea, and Singapore.
7. Note that between 1995 and 1996, there was only a marginal increase in EXPY despite a large increase in the shares of top exported goods with high sophistication: electronic microcircuits and some parts of and accessories for calculating, accounting, ticketing and automatic data processing machines. The increase in their export shares was offset by the drop in the share of commodities under special transactions and those not classified under any category (not shown in Table IV) to less than 1 percent in 1996 from 38 percent in 1995. Since the level of sophistication of this type of commodities is close to those of the top three exported commodities, at around US$20,000, its substantial decline had a marked impact on the value of EXPY.
8. The revealed comparative advantage is the ratio of a product's share in the country's export to the product's share of world exports and estimated as: $(X_{ij}/X_{it})/(X_{wj}X_{wt})$, where X_{ij} and X_{wj} are the values of country i's exports of product j and world exports of product j and where X_{it} and X_{wt} refer to the country's total exports and world total exports.

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Further reading

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Appendix

Classification	Economies of scale	Technology
Group 1: low economies of scale/low technology		
Wearing apparel	Low	Low
Footwear	Low	Low
Furniture	Low	Low
Textiles	Low	Low
Wood products	Low	Low
Leather products	Low	Low
Food products	Low	Low
Beverages	Low	Low
Tobacco	Low	Low
Group 2: low economies of scale/medium technology or medium economies of scale/low technology		
Other manufactured products	Low	Medium
Plastic products	Low	Medium
Rubber products	Low	Medium
Printing and publishing	Medium	Low
Paper products	Medium	Low
Group 3: medium economies of scale/medium technology		
Fabricated metal products	Medium	Medium
Pottery and china	Medium	Medium
Glass products	Medium	Medium
Non-metallic mineral products	Medium	Medium
Iron and steel	Medium	Medium
Group 4: medium or strong economies of scale/medium or strong technology		
Professional equipment	Medium	High
Electrical machinery	Medium	High
Non-electrical machinery	Medium	High
Petroleum and coal products	High	Medium
Non-ferrous metal	High	Medium
Petroleum refining	High	Medium
Transport equipment	High	High
Other chemicals	High	High
Industrial chemicals	High	High

Source: Ng (2002)

Table AI. Classification of manufacturing subsectors by economies of scale and technology

Year	Number of sectors
1979	196
1985	177
1990	177
1994	229
2000	240

Table AII. Input-output table

Table AIII.
Classification of manufacturing industries

Category	Industries
Differentiated goods	Engines and turbines; agricultural machinery and equipment; metal and woodworking machinery; special industrial machinery and equipment; machinery and equipment except electric not elsewhere classified; electrical machinery, apparatus, appliances and supplies; photographic and optical goods, watches and clocks
Labor intensive	Textile, wearing apparel and footwear; furniture and fixtures except primarily metal; metal scraps from manufactures of fabricated metal products and fabricated metal products excluding machinery and equipment; other manufacturing industries
Resource intensive	Food, beverages and tobacco; leather manufacture except footwear and wearing apparel; wood, wood and cork products except furniture; pulp, paper and paperboard; petroleum refineries; miscellaneous products of petroleum and coal; other non-metallic mineral products; non-ferrous metal basic industries
Scale intensive	Paper, paper products, printing and publishing; industrial chemicals; rubber products; plastic products not elsewhere classified; pottery, china, earthenware, glass and glass products; iron and steel basic industries; transport equipment excluding aircraft
Science based	Other chemical products; office, computing and accounting machinery; professional, scientific, measuring and controlling equipment; aircraft

Table AIV.
Forward linkage index

11 sectors	1979	1985	1990	1994	2000
AFF	1.376	1.435	1.472	1.226	1.031
MQ	0.790	0.890	0.798	0.709	0.816
Mfg	2.678	2.715	3.082	2.942	2.878
Constr	0.651	0.610	0.601	0.640	0.629
EGW	0.725	0.783	0.678	0.819	0.824
TCS	0.769	0.692	0.807	0.893	0.886
Trade	0.997	1.078	0.855	0.827	0.880
Fin	0.855	0.748	0.735	0.811	0.762
Real Est	0.680	0.644	0.601	0.613	0.648
Priv Serv	0.858	0.849	0.830	0.973	1.058
Govt Serv	0.620	0.557	0.540	0.548	0.587

Table AV.
Backward linkage index

11 sectors	1979	1985	1990	1994	2000
AFF	0.892	0.826	0.860	0.852	0.862
MQ	0.915	1.004	1.057	1.068	1.000
Mfg	1.346	1.231	1.290	1.308	1.265
Constr	1.223	1.176	1.201	1.104	1.138
EGW	1.368	1.140	1.047	1.112	0.921
TCS	1.102	1.095	1.188	1.149	1.138
Trade	0.788	0.830	0.829	0.913	0.975
Fin	0.822	0.923	0.824	0.841	0.970
Real Est	0.717	0.775	0.739	0.683	0.703
Priv Serv	1.205	1.045	1.075	1.076	1.127
Govt Serv	0.620	0.954	0.891	0.893	0.901

15 sectors	1979	1990	2000
AFF	1.553	1.453	1.257
MQ	0.822	0.825	0.887
Mfg DG	0.706	1.031	1.109
Mfg LI	0.897	1.359	1.088
Mfg RI	2.220	1.945	1.990
Mfg SI	1.792	2.036	1.395
Mfg SB	0.774	0.880	0.798
Constr	0.595	0.527	0.589
EGW	0.722	0.671	0.877
TCS	0.786	0.795	0.899
Trade	1.210	0.987	1.140
Fin	0.847	0.701	0.764
Real Est	0.639	0.538	0.613
Priv Serv	0.873	0.783	1.049
Govt Serv	0.562	0.470	0.547

Table AVI.
Forward linkage index

15 sectors	1979	1990	2000
AFF	0.810	0.760	0.807
MQ	0.831	0.968	0.934
Mfg DG	1.263	1.376	1.129
Mfg LI	1.254	1.276	1.182
Mfg RI	1.203	1.083	1.204
Mfg SI	1.281	1.313	1.239
Mfg SB	1.244	1.285	1.152
Constr	1.115	1.082	1.066
EGW	1.233	0.914	0.860
TCS	1.000	1.064	1.064
Trade	0.714	0.735	0.910
Fin	0.746	0.732	0.904
Real Est	0.650	0.650	0.655
Priv Serv	1.093	0.965	1.054
Govt Serv	0.562	0.797	0.841

Table AVII.
Backward linkage index

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