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An Input-Output Analysis of the Total Factor Productivity Growth of the Malaysian Manufacturing Sector, 1983-2005

(Analisis Input-Output ke atas Pertumbuhan Produktiviti Faktor Keseluruhan di Sektor Pembuatan di Malaysia, 1983-2005)

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ABSTRACT

This paper examines total factor productivity (TFP) growth of the Malaysian manufacturing sector from 1983 to 2005. Unlike previous studies that use one source of data, this research uses two sources of data – Malaysian Input-Output Tables and Malaysian Industrial Manufacturing Survey. The motivation for this study was brought about due to the need to present a different method for estimating TFP growth by analysing TFP using the input-output methodology. The results from this study are compared with the results from other studies that use a different method to estimate TFP growth and the findings indicate that the TFP growth is relatively low. In addition, the major source of change in TFP of the manufacturing sector is contributed by intermediate inputs, while the contribution of labour and capital is substantially low.

Keywords: input-output method; manufacturing sector; total factor productivity growth

ABSTRAK

Artikel ini mengkaji pertumbuhan produktiviti faktor keseluruhan (TFP) bagi sektor pembuatan Malaysia dari 1983 hingga 2005. Tidak seperti kajian terdahulu yang menggunakan satu sumber data, kajian ini menggunakan dua sumber data iaitu, Jadual Input-Output Malaysia dan data Banci Industri Pembuatan Malaysia. Kajian ini dibuat atas motivasi untuk menganggar pertumbuhan TFP menggunakan kaedah yang berbeza iaitu, kaedah input-output. Hasil kajian ini dibuat perbandingan dengan hasil dapatan kajian lain yang menggunakan kaedah berbeza dalam menganggar pertumbuhan TFP. Dapatan kajian ini menunjukkan bahawa pertumbuhan TFP secara relatifnya adalah rendah. Seterusnya, sumber utama terhadap perubahan dalam TFP sektor pembuatan disumbangkan melalui input pertengahan, sementara sumbangan input buruh dan modal adalah rendah.

Kata kunci: kaedah input-output; sektor pembuatan; pertumbuhan produktiviti faktor keseluruhan

INTRODUCTION

Productivity is a major part of production, as it is important to measure the target as well as the performance of the economy for a country. This topic has received great attention, as the measures for TFP growth have always been debated among researchers. In Malaysia, a number of studies have been carried out to measure TFP growth, particularly in the manufacturing sector. However, the goal has been to identify the sources of TFP growth. The initial study by Maisom and Arshad (1992) analysed the TFP growth of the Malaysian manufacturing sector between 1973 and 1989. This study determined that the TFP growth was negative and the contribution from the manufacturing output growth to TFP was low. Another study found that although TFP growth was positive for the period 1986 to 1990, but that was also rather low (Tham and Choong 1995). This study also concluded that the intermediate inputs are a major source of growth for manufacturing output for the periods.

Tham (1996;1997) continued to re-estimate TFP growth and found that TFP growth for the overall manufacturing sector was substantially low, at 0.3 percent, for the period between 1986 and 1991. Furthermore, the primary source of growth for the manufacturing sector was derived from the growth of non-energy intermediate inputs, which demonstrated that the Malaysian manufacturing sector was still at the stage of being dependent on the input growth. However, the TFP growth for the overall economy was reportedly negative. The study extended into determinants of the productivity growth by the ordinary least squares (OLS) procedure, taking into account trade policies and industry characteristics. The findings revealed that the main factors that contributed positively to the TFP growth were the rate of change in output, the rate of change in exports and the characteristics of foreign investment.

Okamoto's study (1994)was similar to Tham's, but the examination focused upon the impact of trade and foreign direct investment (FDI) liberalization policies on the productivity growth of the manufacturing sector. Surprisingly, their findings were similar, concluding that the rate of TFP growth of the manufacturing sector was 0.3 percent for the period of 1986 to 1990. However, the estimation of TFP growth at the sector level was not shown in Okamoto's study. The study on the effects of FDI on TFP growth was continued by Noriyoshi et al.(2002), but this study differed from Okamoto's (1994) and Tham's (1996;1997) studies as it focused on foreign firms in relation to domestic firms and covered the aggregate level of TFP growth. The findings showed a wide variation of FDI effects on the productivity between foreign and local firms for the period of 1992 to 1996. Regarding the aggregate level of TFP growth, this study found that foreign firms have a higher productivity than the locals both at the three and five digit levels of industrial classification.

Another study that examined the productivity performance of domestic and foreign firms in the manufacturing sector was conducted by Menon (1998). The study was comprised of an analysis of foreign and domestic firms in 53 subsectors of manufacturing for the period of 1988 to 1992. By using a growth accounting procedure, the study provides an estimation of the TFP growth using industry-level data from discrete time intervals. The findings were similar to Tham's and Choong's (1995) studies, whereby it was determined that the growth in real manufacturing output was driven by input growth, particularly the intermediate input for both domestic and foreign firms. Fatimah and Saad (2004) estimated the TFP growth in heavy and light industries and determined that heavy industries had a higher TFP growth compared to light industries. While, the average rate of TFP growth was found to be negative for the period of 1982 to 1986, the average rate of TFP growth was positive for the period between 1987 and 1997.

The convergence, or variation, in TFP growth for the manufacturing sector across Malaysian states was examined by Mansor (1997). This study developed a regional index and utilized the index as a tool to examine the manufacturing sector between 1985 and 1991. The source of input growth was found to be dominant over the output growth, and, although there is a wide variation of TFP growth across states, the convergence of TFP growth in the manufacturing sector between states did not appear to be a trend or pattern. Renuka (2001) identified the sources of TFP growth using the SFA (stochastic frontier analysis). The method estimated production function using panel data compiled from 28 subsectors of the manufacturing sector for the period of 1981 to 1996. The output growth was then converted into the contribution of input growth and TFP growth, and further extended the analysis of TFP growth to include technical progress and technical efficiency. The value-added output was utilised instead of the gross output as an output measure. The results showed that Malaysia's manufacturing sector was highly dependent on the input growth and that it was positively biased towards skilled labour.

By utilizing the same data on a different model to measure TFP growth, the results of the DEA (data envelopment analysis) model were compared to the SFA (Renuka 2002). The DEA model demonstrated that the TFP growth was consistently positive, while the SFA model was consistently negative during the period examined. The SFA model shows that the growth in output was mainly driven by input rather than productivity. Although the results from both models are different, the TFP growth is generally quite low and sometimes negative. Idris (2007) conducted a study on the period of 1971 to 2004 for the Malaysian economy and supported the previous findings, determining that the low TFP growth was due to the negative contribution from technical efficiency. By using panel data, the study revealed that the economy was able to shift its own frontier, based on innovations, and concluded that the presence of foreign companies in Malaysia was believed to be a major contributor to the TFP growth. Rahmah (1999) confirmed findings that the contributions of efficiency were rather small in certain subsectors of the manufacturing sector, especially in industries that were more labour-intensive.

From the results discussed above, this part concludes that the growth of the Malaysian manufacturing sector was governed by input-driven, rather than productivity-driven, growth, which led to the low TFP growth. In addition, the contribution of TFP growth to the output growth of the manufacturing sector was relatively low.

The purpose of this article is to estimate the TFP growth of the manufacturing sector for the period of 1983 to 2005 by employing a different method of TFP measure. Furthermore, the sources of growth to TFP during the study are also analysed. This study attempts to fill the gap of the TFP measure, with respect to Malaysia, in terms of the methodology used to measure TFP. Moreover, the primary data from the input-output tables, together with data from the Industrial Manufacturing Survey (IMS), are able to provide a different view of TFP in the context of the relationship between TFP and the economy as a whole. The remainder of this paper is divided into three sections. The next section outlines the methodology, which describes the sectoral productivity of TFP measures, data collection and input-output aggregations. The third section discusses the results of TFP growth and the contribution of input to growth in TFP. Finally, the last section contains the summary and conclusions.

THE METHODOLOGY

The input-output (I-O) framework provides a powerful system for the measurement of productivity growth (Wolff 1985; 1994); (Raa and Wolff 1991). The framework has an advantage for studying productivity growth in the context of the general economy by categorising sources of TFP growth into endogenous and exogenous factors. In Malaysian cases, all researchers employed a standard growth accounting model, namely, Solow residual (Solow, 1956) and econometric models in measuring TFP growth. Those who used Solow residual models include Maisom and Arshad (1992); Okamoto (1994); Tham and Choong (1995); Tham (1996,1997); Menon (1998); MPC (1999); Noriyoshi et al.(2002); and Fatimah and Saad (2004), while Nik Hashim (1998); Renuka (2001; 2002), and Idris (2007) utilized the econometric models (SFA and DEA).

The estimation of productivity growth in the present study will be based largely on the work by Raa et al. (1984) and Wolff (1985; 1994). However, a few minor modifications have been made in regards to the data in order to strengthen this work. It is important to note that intermediate input is classified into domestic intermediate input and imported intermediate input because the imported intermediate input has shown a large proportion of the total input in the context of Malaysian. In the I-O framework, industrial output is measured by gross commodity output, X, while the input consists of intermediate input, labour and capital. Thus, the derivation of the technical coefficient matrix, A will be based on the input matrix of the domestic intermediate input and the input matrix of imported intermediate input.

The definitions of variables are given below:
U = an input or 'use' commodity by industry flow matrix, where u_{ij} shows the total input of commodity i consumed by industry j;
V = an output or 'make' industry by industry flow matrix, where v_{ij} shows the total output of commodity produced by industry i;
$X = V^T 1$ = column vector showing the gross output of each commodity i;
Where: $V^T 1$: column vector, showing the gross output of each commodity. The superscript T refers to the transpose of the indicated matrix, ($X^1 = V1$) is a vector whose elements are the row sums of V, showing the total 'output' of each industry; 1 = vector with unit entries; and is a square matrix, that is, there are as many industries as commodities).

$Y = (V^T - U)1$ = column vector of final demand by commodity;
L_j = row vector of labour input, showing by total salary and wages by industry;
K_j = row vector of capital input by industry.

According to Raa et al. (1984) and Kop Jansen and Raa (1990), the matrix of technical coefficients, A should be derived from the commodity technology model. Wolff (1994) also made use of the commodity technology model to measure productivity growth. This model has the advantage of reducing TFP growth into a sectoral level rate of productivity growth (Wolff 1984). This model assumes that the number of activities must equal the number of commodities, where each industry has its own input structure, and each commodity is produced by the same technology, irrespective of the industry of production. In addition, industries are considered as an independent combination of outputs j, each with their separate input coefficients A_{ij}. Moreover, in the commodity technology model, prices can depend directly on the technical coefficients and are invariant with respect to changes in the final demand composition, as in a standard Leontief system.

As shown in Raa et al. (1984) and, Kop Jansen and Raa (1990), the coefficients matrix derived by commodity technology model is given by;

$A = U[V^T]^{-1}$ = matrix of inter-industry technical coefficients

Labour and capital inputs coefficients also derived similarly;

$l_j = L[V^T]^{-1}$ = row vector of labour coefficients by industry j; and
$k_j = L[V^T]^{-1}$ = row vector of capital input coefficients by industry j. ($j = 1, 2, 3, ..., n$);
In addition, we defined;
p_i = row vector of commodity prices in industry i;
p_j = row vector of output prices in industry j;
p_t = row vector of prices at time t, showing the price per unit of output of each industry;
w = the annual wage rate (a scalar), assumed constant across industries; and
r = uniform price of capital input (average lending rate of the economy) (a scalar), also assumed constant across industries;
n = total employment (a scalar) in the economy;
c = total capital stock (a scalar) in the economy;
$y_t = p_t Y_t$ = gross national product at current prices at time t.

SECTORAL PRODUCTIVITY GROWTH

The standard measure of TFP growth rate for industry is usually defined as;

$$\pi_j \equiv -\left(\sum_i p_i da_{ij} + dl_j + rdk_j\right) / p_j \qquad (1)$$

where: π is the corresponding row vector, and 'd' refers to proportionate change. Since for any variable, z, $dz = z\, d \log z$, where $d \log z = \frac{d_z}{z}$ is the proportionate change in technical coefficients. This measure is a continuous version of a measure of sectoral technical change proposed by Leontief (1953).

$$\pi_j \equiv -\left(\sum_i \alpha_{ij}(da_{ij}) - \alpha_{Lj}(dl_j) - \alpha_{Kj}(dk_j)\right) \quad (2)$$

where $\alpha_{ij} = p_i a_{ij}/p_j$, $\alpha_{Lj} = l_j pj$, and $\alpha_{Kj} = rk_j p_j$. These three terms give the current value shares of the respective inputs in the total value of output. Since productivity growth rate is measured over discrete time periods rather than instantaneously, the average value share of α_{ij}, α_{Lj}, and α_{Kj} over the sample period is normally used to measure (the so called Tornqvist-Divisia index). Tornqvist-Divisia estimates the TFP growth using an I-O based (Wolff 1985 and Jorgenson et al. 1987).

If we consider data at any two discrete points of time, say t and $t-1$, the growth of intermediate input can be expressed as a proportionate change in the technical coefficients. The proportionate change of intermediate input (da_{ij}), labour (dl_j), and capital (dk_j) are given by:

$$\dot{a}_{ij} = \frac{\Delta a_{ij}}{a_{ij}}; \dot{l}j = \frac{\Delta l_j}{l_j}; \dot{k}j = \frac{\Delta k_j}{k_j}$$

$$\pi_j = \left[\sum_i \bar{\alpha}_{ij}\dot{\alpha}_{ij} + \bar{a}_{Lj}(\dot{l}_j) + \bar{\alpha}_{Kj}(\dot{k}_j) \right] \qquad (3)$$

DATA COLLECTION AND INPUT-OUTPUT AGGREGATIONS

This study has utilized data from two sources: Malaysian Input-Output Tables and the Industrial Manufacturing Survey (IMS), published by the Department of Statistics (DOS), Malaysia.This work is the first attempt to measure the growth of TFP by using input-output data that incorporates data from the IMS, unlike past studies where both growth accounting and econometric methods utilized only data from the IMS (Maisom and Arshad 1992; Tham and Choong 1995; Tham 1996; 1997; Menon 1998; Noriyoshi et al. 2002; Renuka 2001; 2002; Fatimah and Saad 2004; Idris 2007).

This study employs the Malaysian Input-Output Tables for 1983, 1987, 1991, 2000 and 2005. The data is further sub-divided into sub-periods of 1983-87, 1987-91, 1991-2000 and 2000-05. Intermediate inputs of domestic and imports are collected from the Malaysian I-O Tables and deflated using the sectoral prices of domestic producer prices and import prices. Labour and capital were unpublished data taken from the IMS. Labour data is expressed in total salary and wages, bonus, cash allowances and overtime pay. Capital data was obtained from the value of net fixed assets as at the end of a calendar year (gross fixed asset – depreciation rate + gross fixed capital formation/capital expenditure). The capital consists of building and other construction, machinery equipment, transport equipment, and ICT tools such as computers. This input was deflated using domestic producer prices.

Both the labour and capital data at the 3 digit-level of the Malaysian Industrial Classification (MIC) have to be classified in accordance with the 5 digit-level industrial classification of the Malaysian Standard Industrial Classification (MSIC). Finally, both data have to be re-classified according to the requirement of the Malaysian I-O Tables. The producer price index (PPI), both domestic and import, were derived from weighted price indices by using a two digit-level of the commodity group (SITC), where the PPI of 1978 is used as a based year.

In terms of input-output sectoral aggregations, the existing framework of national income account classification has governed the potential maximum size of the Malaysian Input-Output Tables. In order to focus on the manufacturing sector, an aggregation process was performed upon the input-output tables. The tables are aggregated into 31 subsectors of the manufacturing sector and other sectors, which consist of services, agriculture, mining, construction, and other public sectors.

RESULTS AND DISCUSSION

TFP GROWTH

The results of this study are different from the results of many other studies on TFP in Malaysia. The use of data from the input-output tables, which incorporates data from IMS, makes the result from this study different from previous studies which merely used compiled data from IMS.Table 1 shows the average annual rate of TFP growth for the 31 sub-sectors of the manufacturing sector during four sub-periods: 1983-87, 1987-91, 91-2000 and 2000-05. From the table, it can be seen that the range of annual rate of TFP growth between these sub-sectors can be quite broad with the manufacture of processed rubber attaining a rate of growth of 21.6 percent, while the manufacture of other transport equipment was at the other end of the spectrum, accounting for –17.7 percent for sub-period 1983-87. The sub-period 1987-91 exhibits that the manufacture of preserved food grew at a rate of 23.9 percent, while the growth of the manufacture of processed rubber was at –16.7 percent. The following sub-period of 91-2000 presents the growth of the manufacture of the non-electrical machinery industry, which was at 10.0 percent, and meat and dairy products which was at –3.3 percent. For the 2000-05 sub-period, bakeries and confectionary grew at a rate of 12.4 percent, while paper and printing grew at –10.1 percent.

The TFP growth estimates from this study were registered at a positive rate of 4.5, 2.2, 1.9 and 2.0 percent during four sub-periods, respectively. Even though these results are different from other studies (Okamoto 1994; Maisom, Mohd Ariff and Nor Aini 1993; Tham 1997; MPC 1999; Noriyoshi et al. 2002; and Fatimah and Saad 2004), the same pattern of TFP growth is observed to be low among the studies. This is not surprising, as different sources of data and methods of computation definitely yield different results for TFP measures. Different studies on TFP growth in Singapore have also yielded different results (Wong 1995). When the comparison is made with

TFP studies of other countries, the growth of TFP of the Malaysian manufacturing sector was relatively low for the period of study. For instance, the Singaporean manufacturing sector indicated a 9.6 percent growth in TFP during the period of 1970-79 (Tsao 1985), and 24.3 percent between 1981 and 1990 (Gan et al.1993).

In terms of performance by sub-sector, out of 31 sub-sectors of the manufacturing sector, 71.0 percent of the sub-sectors experienced positive annual rate of TFP growth for the periods of 1983-87 and 91-2000, respectively. The period of 1987-91 shows that the percentage of sub-sectors with a positive rate of TFP growth had decreased to 48.4 percent after the economic recession in 1985. The percentage increased to 77.4 percent for the sub-period of 2000-05. The detailed analyses shows that only 7 sub-sectors (25.8 percent) of the manufacturing sector had a positive growth rate in TFP for the whole period. These include the sub-sectors of tobacco, wearing apparel, furniture and fixtures, rubber industries, plastic products, non-electrical machinery and other manufacturing products. Other sub-sectors have shown inconsistent TFP growth during the study.

The frequency distribution of TFP growth is presented in Table 2. From the table, most subsectors were in the range of 0.0 - < 10.0%. There were 16, 21 and 22 subsectors during the period of 1987-87, 91-2000 and

TABLE 1. Annual Growth of TFP by Sub-sector for the Manufacturing Sector and Other Sectors, 1983-2005 (%)

Sub-sectors	1983-87	1987-91	91-2000	2000-05
1. Meat and dairy products	-4.6	15.1	-3.3	10.13
2. Preserved food	1.6	23.9	-3.2	9.57
3. Oils and fats	-2.9	-7.8	0.8	2.70
4. Grain mills	-0.9	-7.2	0.6	3.38
5. Bakeries and confectionary	10.8	-9.3	2.2	12.39
6. Other foods production	0.8	-5.6	1.6	4.60
7. Animal feeds	0.9	19.4	-2.1	0.28
8. Beverages	4.4	-7.8	6.1	-7.52
9. Tobacco*	6.4	21.2	0.9	9.52
10. Textiles	6.1	-3.7	-0.6	-7.51
11. Wearing apparel*	16.6	0.9	1.0	3.22
12. Sawmills	6.9	-7.1	-1.5	-3.13
13. Furniture and fixtures*	2.9	18.9	3.8	3.74
14. Paper and printing	5.8	-2.2	2.3	-10.11
15. Industrial chemicals	19.1	-3.4	-0.6	6.64
16. Paints and lacquers	-2.4	1.4	4.2	-0.45
17. Other chemical products	6.3	-2.7	5.9	-0.89
18. Petroleum and coal	-11.6	-7.2	5.4	2.76
19. Rubber processed	21.6	-16.7	1.7	1.72
20. Rubber industries*	0.8	1.0	3.5	1.19
21. Plastic products*	9.2	1.0	3.2	2.73
22. China, glass and clay	-5.5	6.1	5.5	3.81
23. Cement, lime and plaster	2.0	-6.2	0.5	8.64
24. Other non-metal mineral	3.3	-0.9	-1.2	2.83
25. Basic metal products	-2.6	-7.6	-0.2	2.25
26. Other metal products	0.4	5.8	0.5	-2.06
27. Non-electrical machinery*	7.3	11.9	10.0	0.88
28. Electrical machinery	20.2	15.4	-1.0	2.10
29. Motor vehicles	-17.0	16.3	0.6	4.45
30. Other transport equipment	-17.7	-1.2	1.2	4.25
31. Other manufacturing*	19.5	5.1	1.7	3.38
Numbers of sub-sectors indicated positive rate of TFP growth	22 (71.0%)	15 (48.4%)	22 (71.0%)	24(77.4%)
32. Other sectors	3.4	-4.3	1.4	7.77
Weighted average of annual growth rate in TFP for the manufacturing Sector	4.5	2.2	1.9	2.0
Weighted average of annual growth rate in TFP for total economy	3.8	-1.3	1.7	4.1

Note: * indicates positive rate of growth during four sub-periods of the study.

TABLE 2. Frequency Distribution of TFP Growth, 1983-2005

Rate of growth (%)	number of industries			
	1983-87	1987-91	91-2000	2000-05
> -10.0	3	1	-	1
-10.0 - < -0.0	6	15	9	6
0.0 - < 10.0	16	7	21	22
10.0 - < 20.0	4	6	1	2
> 20.0	2	2	-	-

Source: from TABLE 1.

2000-05, and only 7 subsectors for the period of 1987-91. Although most of them indicate positive rates of TFP growth, the rates were relatively low. This implies that the manufacturing sector could increase its productivity by utilizing all factors of production at a potentially higher level.

CONTRIBUTION OF INPUTS TO TFP

Table 3 presents the contribution of input (domestic intermediate input, imported intermediate input, labour and capital) to TFP growth during four sub-periods of the study. The table shows the contribution of the input growth of the manufacturing sector and the total economy. This study shows that the contribution to TFP growth of the manufacturing sector during all sub-periods of the study, for both intermediate input of domestic and import, ranged from 42 to 56 percent. The share of domestic intermediate input was slightly larger than the imported input. From this finding, intermediate input actually dominates the contribution of inputs to TFP growth. In contrast, the contribution of labour and capital input to TFP growth of the manufacturing sector was substantially low throughout the study. Moreover, the contribution of labour was rather low compared to the contribution of capital. The share of labour input ranged from about 0.1 to 0.2 percent, while the capital input ranged from 1.0 to 4.0 percent of the TFP growth during the period of study. Similar patterns are observed for the contribution of inputs to TFP growth in relation to the total economy.

The larger contribution in both domestic and import inputs shows that intermediate input is the major component of TFP growth for the manufacturing sector. This implies that the TFP growth of the manufacturing sector is dependent on the input growth. In other words, TFP growth is actually led by the 'input driven' economy. This might be true as other studies found that the miracle of the East Asian economy may be characterized by the `input-led' growth (Krugman 1994; Young 1994b; Kim and Lau 1994). These studies revealed that the positivie growth in the TFP of the Korean economy has been predominantly achieved by input-led growth, which is contributed by the growth in labour productivity and output growth. Past studies on TFP growth with respect to Malaysia also concluded that the input growth, particularly intermediate input, make a larger contribution to the output growth than the contribution of TFP to the output growth (Okamoto 1994; Maisom, Mohd Ariff and Nor Aini 1993; Tham 1996; 1997; MPC 1999 & Noriyoshi et al. 2002).

The contribution of input may be comparable with results from other studies although it cannot be compared directly. From this study, the contribution of intermediate input to the TFP growth of the manufacturing sector can be compared with the results from other studies. The relatively larger contribution of intermediate input to the growth in manufacturing output was also obtained in several other studies. For example, Tham (1995; 1996) found that, in general, the average value shares of intermediate input in the Malaysian manufacturing output growth between 1986 and 1990 were the highest among all the inputs. Tsao (1985) also found the same results for Singapore between 1970 and 1979, where the average value shares of intermediate input in the output growth were the highest among all inputs. Similarly, Nishimizu and Robinson (1984) also indicated the same results for Japan between 1955 and 1973, Korea (1960-1977), Turkey (1963-1976) and Yugoslavia (1965-1978). In the same way, Gan et al. (1993) study on the Singaporean manufacturing sector yielded a similar result, in which the major source of growth of output between 1986 and 1990 was the growth in material input. Moreover, in all these studies, input growth has contributed relatively more to the output growth than the contribution to the rate of TFP growth.

The low contribution of labour reflects that the shortage of skilled labour has become one of the major factors that may negatively affect the productivity of

TABLE 3. Contribution of Input to TFP Growth (%)

Inputs	Weighted average of							
	the manufacturing sector				the total economy			
	83-87	87-91	91-2000	2000-05	83-87	87-91	91-2000	2000-05
Domestic intermediate input (1)	49.5	55.9	51.4	51.4	56.0	59.4	56.0	56.0
Imported intermediate input (2)	46.8	42.0	47.5	47.5	42.0	38.6	42.9	42.9
Total intermediate input	96.5	97.9	98.9	98.9	96.0	98.0	98.9	98.9
Labour (3)	0.04	0.07	0.20	0.20	0.07	0.09	0.20	0.20
Capital (4)	3.6	2.0	0.9	0.9	2.0	1.9	0.9	0.9
TFP (5)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

labour. The shortage of skilled labour to operate more sophisticated technology and to adopt new technology has become an urgent issue since 1996, due to the promotion of the export of high technology products in the Seventh Malaysian Plan (1996-2000). The problem of labour input may involve the lack and lag of skilled labour. Apart from the lack problem, which involves the shortage of skilled labour, the lag problem always relates to the comparative skills of labour, particularly skilled labour between developed and developing countries.

The contribution of capital input is slightly higher than labour, which is reflected by the increase of capital-labour ratio in some industries of the manufacturing sector (Noorasiah 2010). This indicates that a rapid increase in capital, in response to the buoyant growth in the economy, will lead to the probable underutilization of capital. The underutilization of capital has a strong relation to the shortage of skilled labour, which may cause a serious constraint on capital utilization (Salim 1979). Furthermore, skilled labour is required to operate the new technologies embodied in new plants and equipment so that the current capital stock may be utilized efficiently (Zarina and Shariman 1994).

CONCLUSIONS

This study is the first attempt to examine TFP growth within an input-output framework, as previous studies have utilized the growth accounting procedures and the econometrics methods. Based on the above results, there are three main findings. Firstly, there is relatively low and negative TFP growth in some industries of the manufacturing sector. Also, the negative growth of TFP indicates that the input usage in certain industries of the manufacturing sector is inefficient. The analysis of productivity should bear in mind that productivity measures how productive/efficient the inputs are used in order to produce the maximum outputs. The efficient usage of inputs may also rely on technology. Both technical efficiency and technical change are a pertinent contribution to a positive rate of growth in TFP.

Secondly, the major source of change in TFP of the manufacturing sector between 1983 and 2005 was primarily related to intermediate input (domestic and imported intermediate input). The share of imported intermediate input to TFP growth is undoubtedly larger in the period of the study. This demonstrates that the largest component of cost in the Malaysian manufacturing sector is the cost of imported input, especially raw materials. Heavy reliance on the import of raw materials will have an adverse effect on the country's Balance of Payments. As reported by the Annual Report of Bank Negara (2005), imported raw materials constituted 20 percent of the total raw materials utilized in resource based industries, while constituting as much as 60 percent in non resources-based industries.

Thirdly, the low contribution of labour and capital input is most probably due to lack of skilled labour and the rapid increase in capital in response to the buoyant growth in the economy, thereby leading to the probable underutilization of capital. These two inputs are actually related to each other. The upsurge in the growth rate of capital input most probably far exceeded the rate of growth of output for that period. It is possible that excess capacity will emerge when the increase in capital input exceeds the increase in output. The underutilized capital input actually presents an inefficient usage of capital that may be caused by several factors, such as low knowledge of technical operation and lack of skilled labour. This problem reflects the major challenge Malaysia is facing in relation to its ability to upgrade the quality of human capital. In this case, both the public and private sectors should be more proactive to encourage formal education and training. Additionally, firms have to encourage more training on the specific skills, which is more important to the needs of the industry. The results from this study show the negative TFP growth implies inefficiency in some industries of the manufacturing sector. To increase efficiency, industries must grow bigger to benefit from the economies of scale as larger operation will reduce average cost and increase workers' productivity, hence firms' efficiency. Undeniably, the efficient use of material inputs is, to a large extent, the result of improvement in labour productivity, particularly among skilled workers, and the more intensive use of physical capital. These are observed frequently in foreign firms as opposed to local firms. The improvement in labour productivity may help increase the local value-added content of output produced, especially in the non resource-based industries.

Apart from that, technical progress is also important in order to obtain a higher rate of TFP growth. Therefore, an enhancement of research and development will spur technological development and progress. By increasing research and development expenditure, firms are able to venture in product development through diversification. Consequently, local industries will be able to expand their markets.

A large dependence on the imported input is normally a characteristic of multinational companies operating in a host country. It must be recognised that the Malaysian economy is an open economy driven primarily by FDI and export growth. Therefore, as most foreign parent companies bring along their subsidiary firms into the host country, it is more encouraging if the subsidiary firms that supply parts and components utilize domestic intermediate inputs from the host country. This can also improve the country's balance of payments, in regards to imported inputs and the volatility of foreign currency. Additionally, the incentives given to foreign companies should be revised in terms of encouraging the further development of links between indigenous industries and foreign companies. More importantly, the foreign parent company needs to be encouraged to establish research and development centres in Malaysia.

In conclusion, the estimates of change of TFP growth in this study are different from other past studies in respect to Malaysia. Although the results of specific TFP estimates cannot be compared directly, the results are generally comparable despite the use of different methodology by different researchers; different sources of data sets and periods covered; different classification of industries;and the aggregation of sub-sectors. The advantage of the I-O model in estimating TFP is that it can capture the information concerning intermediate input as detail, as it displays in the transaction matrix in the I-O table. However, over and above the measurement and methodological issues, the causes of change in TFP growth are still unknown and, therefore, remain a critical vacuum in the understanding of manufacturing growth in Malaysia. The remaining challenge regarding the causes of change in TFP growth in Malaysia is to better understand its relationship with manufacturing growth in an effort to better guide government policy in the manufacturing sector in the near future.

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