Jurnal Teknologi

Full paper

Total Factor Productivity Growth Based on Resource and Non Resource Based Industries of the Manufacturing Sector, 2000-2005

Noorasiah Sulaiman[a*], Norfadila Fadzil[a]

[a]*School of Economics, Faculty of Economics and Management, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia*

*Corresponding author: rasiahs@ukm.my

Article history

Received : 27 May 2013
Received in revised form : 30 July 2013
Accepted : 15 August 2013

Abstract

This paper examines total factor productivity (TFP) growth in resource and non resource based industries of the Malaysian manufacturing sector. The growth in TFP is examined between 2000 and 2005. Unlike previous studies that use one source of data from Industrial Manufacturing Survey (IMS), this research combines two sources of data–Malaysian Input-Output Tables and IMS. The motivation for this study was brought about due to the need to present a different method for estimating TFP growth using the input-output methodology. The result from this study for resource and non resource based industries reveals that the TFP growth is relatively low for both industries. In addition, the major source of change in TFP of the both industries is contributed by intermediate inputs, while the contribution of labour and capital is substantially low

Keywords: Total factor productivity growth; input-output methodology; resource and non resource based industries

Abstrak

Artikel ini mengkaji pertumbuhan produktiviti faktor keseluruhan (TFP) bagi industri berasaskan sumber dan industri bukan sumber dalam sektor pembuatan Malaysia. Tempoh kajian adalah antara tahun 2000 dan 2005. Tidak seperti kajian terdahulu yang menggunakan sumber data daripada Banci Industri Pembuatan Malaysia, kajian ini menggabungkan 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. Dapatan kajian bagi industri berasaskan sumber dan bukan sumber menunjukkan pertumbuhan TFP secara relatifnya adalah rendah di kedua-dua industri. Selanjutnya, sumber utama terhadap perubahan dalam TFP di kedua-dua industri disumbangkan oleh input pertengahan, sementara sumbangan input buruh dan modal adalah rendah.

Kata kunci: Pertumbuhan produktiviti faktor keseluruhan; kaedah input-output; industri berasaskan sumber dan industri bukan sumber

1.0 INTRODUCTION

Productivity is a benchmark of economic performance, as it is essential to demonstrate an increase in productivity based on the efficient usage of factors of production and technology augmentation. Apart from raw material inputs, the quality of inputs such as labour and capital are the most important factors for the enhancement in productivity whereby all inputs can be utilized efficiently. This topic has received great attention as to the measures for total factor productivity (TFP) growth. Furthermore, the more important measure is to identify the sources of growth in TFP. In Malaysia, a number of studies have been carried out to measure TFP growth, particularly for the manufacturing sector. The study by Maisom and Arshad (1992) analysed the growth in TFP of the manufacturing sector during the period 1973 to 1989 and found that the growth in TFP was negative. On the other hand, Tham's study (1996, 1997) revealed the rate of TFP was positive for the period 1986 to 1990, but it was substantially low at 0.3 per cent, while the growth in TFP for the overall economy was reportedly negative.

Okamoto's study (1994), which is similar to Tham's study also found that the rate of TFP growth of the manufacturing sector was 0.3 per cent for the period of 1986 to 1990. However, Noriyoshi *et al.*'s (2002) study focused on the foreign firms relative to domestic firms of the manufacturing sector. The finding shows that foreign firms improved their productivity higher than the locals for the period of 1992 to 1996. Another study by Menon (1998) also examined the productivity

performance of domestic and foreign firms in the manufacturing sector for the period of 1988 to 1992. 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.

All studies have shown that the growth in real manufacturing output was driven by input growth and the contribution from the manufacturing output growth to TFP was low (Maisom & Arshad (1992), Tham (1996;1997). Furthermore, in Menon's study (1998), the growth in real manufacturing output was also driven by input growth, particularly the intermediate input for both domestic and foreign firms. From the literature, we conclude that the intermediate inputs are a major source of growth to manufacturing output for the periods. The primary source of growth for the manufacturing sector is derived from the growth of non-energy intermediate inputs, which shows that the Malaysian manufacturing sector is still at the stage of being dependent on the input growth.

Renuka (2001) decomposed growth in TFP to identify the sources of growth of the manufacturing sector for the period of 1981 to 1996. Further, the study decomposed the estimation of output growth into the contribution of input growth and TFP growth, and further extended the decomposition of the TFP growth into technical progress and technical efficiency. The results show that Malaysia's manufacturing sector is highly dependent on the input growth and that it is positively biased towards skilled labour. The result of Data Envelopment Analysis (DEA) shows that the growth in TFP was consistently positive (Renuka, 2001), while the result of Stochastic Frontier Analysis (SFA) was consistently negative over time during the study (Renuka, 2002). The SFA model shows that the growth in output is mainly driven from input rather than productivity. Although the results from both models are different, in general, the growth in TFP is quite low and sometimes negative.

Other studies also support the findings that the low growth in TFP for the Malaysian economy is due to the negative contribution from technical efficiency for the entire period of 1971 to 2004 (Idris, 2007). The study reveals that the economy is able to shift its own frontier based on innovation, and concludes that the presence of foreign companies in Malaysia is believed to be a major contributor to the growth in TFP. A related study by Rahmah (1999) strengthen the findings that the contribution of efficiency are rather small in some subsectors of the manufacturing sector, especially in industries that are more labour-intensive.

From the past studies discussed above, most studies have concentrated on the study of TFP growth of the manufacturing sector and their results conclude that the growth of the Malaysian manufacturing sector was governed by the input-driven rather than the productivity-driven growth, which led to the low growth in TFP. In addition, the contribution of TFP growth to the output growth of the manufacturing sector is relatively low. Study on the 145 countries also shows that the growth in TFP is an important proportion of growth in the average output. The average growth in TFP was about 0.13 percent per annum with 8.0 percent indicated output growth per labour (Baier *et al*., 2002).

The purpose of this article is to examine growth in TFP of the manufacturing sector, which is the first attempt to classify TFP growth into resource and non resource based industries for the period between 2000 and 2005. Both industries are actually important in terms of contribution to export and growth of the manufacturing sector. By employing an Input-Output analysis, this study used different method of TFP measure in order to fill the gap of the methodology used to measure TFP in Malaysia. Specifically, this study also analyzes the contribution of inputs to growth in TFP into resource and non resource based industries. 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 the TFP study in the context of the whole impact of the economy as well.

The remainder of this paper is divided into four sections. The second section presents an overview of the Malaysian economics based on resources and non-resource industries. The third section outlines the methodology, which describes the sectoral productivity of TFP measures, data collection and input-output aggregations. The fourth section discusses the results of TFP growth and the contribution of input to growth in TFP. Finally, the last section is reserved for summary and conclusions.

2.0 OVERVIEW OF THE MALAYSIAN ECONOMY BASED RESOURCE AND NON-RESOURCE INDUSTRIES

The most important industrial strategy is to classify industries into resource and non-resource based industries. The strategy conducted by Industrial Master Plan (IMP) began with the IMP in 1986-1995, and continued with the Second IMP (1996-2005), and currently the Third IMP (2006-2020). The classification of industry is to enhance the performance of the manufacturing sector.

As presented in Appendix 1, industries like food, beverages and tobacco, petroleum, chemical and chemical products, rubber, wood and nonmetal products are classified into resource-based industries. Meanwhile, textiles, electrical and electronics; basic metal; transport equipment and other manufactured goods are classified into non resource based industries. The statistics from Table 1 show that non resource based industries contributed a high percentage share of exports, which indicated more than 70.0 percent to the manufacturing export.

The high contribution of manufactured goods exports for non-resource based industries implies that this industry has a strong relationship with export-oriented industries. Industry such as textile, electrical and electronics, machinery and equipment are actually export-oriented industries (see also Appendix 1). Moreover, the largest contribution of manufacturing exports came from the electrical and electronics industry which registered more than 55.0 percent from 1990 to 2011 (Bank Negara Report, various years). The electrical and electronics product is actually dominated by multinational companies and it is convincing to say that foreign investment has been playing a significant role in Malaysian industrial development.

Table 1 Share of export in the manufacturing sector (%)

Type of industries	1981	1989	2000	2005
Resource based industries	25.1	17.9	13.9	18.0
Non resource based industries	74.9	82.1	79.4	73.8

Source: Bank Negara Report *(various years)*

From Table 1, non resource based industries registered a figure of 79.4% to the manufacturing export, while resource based industries exported only 13.9% in 2000. The share of

export for non resource based industries is also high in 2005, contributing 73.8%. The high contribution to the manufacturing export implies that these industries are involved in export-oriented industries. This implies that most foreign firms concentrate in non resource based industries, whereby these industries are also categorized as export-oriented industries (see Appendix 1). As such, the electrical and electronics industry has only registered 65.7% of the manufacturing export in 1995 and increased to 72.5% in year 2000. From 1990 to 2011, except for 2007, resource based industries indicated below 20.0 percent contribution to the exports of manufactured goods (Bank Negara Report, various years).

The low contribution of manufactured goods to exports for resource based industries does not mean that this industry is not essential in development plans. For resource based industries, since majority of these sub sectors are domestic-oriented market, some of them are also export-oriented industries, such as rubber, wood products, paper products and plastic products (see Appendix 1). These sub sectors are also export-oriented industries and are expected to create a higher value added for the manufacturing products and able to maximize the output potential produced by an increase in domestic input content in export. The production of resource based industries are also able to maximize the output potential produced by these industries, and a high content of domestic input in export may reduce a high deficit in the current account balance. Apart from that, resource based industries actually has high potential in terms of enhancing linkage. The domestic source of inputs implies that this industry has high potential to enhance linkage with the agricultural sector.

Figure 1 and Figure 2 show the share of domestic and imported inputs used among sub-sectors of resource-based and non resource-based industry[1]. From these figures, majority sub-sectors of resource based-industries exhibits domestic input which used larger than imported input, while for sub-sectors of non resource based-industries display a larger usage for imported input. The total average shows that resource based industries registered more than 60.0% of the share of domestic input and less than 40.0% of imported input. In contrast, non resource-based industries have shown less than 50.0% of domestic input and more than 50.0% of imported input used. This implies that resource based industries are actually sourced by domestic inputs, while non resource based industries rely on the imported input.

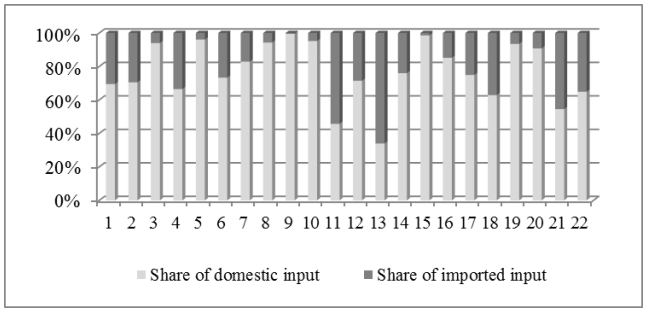

Figure 1 Share of domestic and imported inputs used among sub-sectors of resource based industries, 2005

[1] The classification of sub-sector is based on the 3-digit industrial classifications, which comprised of 31 sub-sectors of the manufacturing sector.

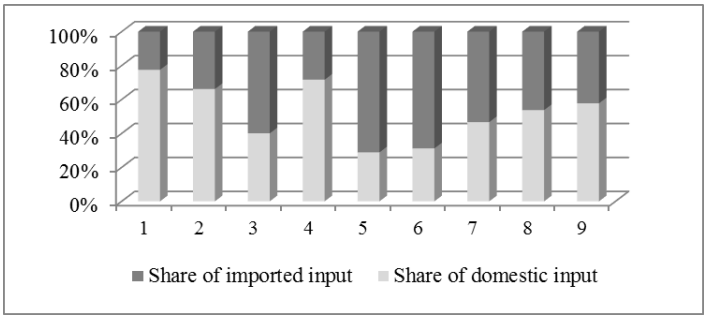

Figure 2 Share of domestic and imported inputs used among sub-sectors of non resource based industries, 2005. *Source*: Department of Statistics (DOS), Malaysian Input-Output Tables 2005

3.0 THE METHODOLOGY

The input-output (I-O) framework provides a powerful system for the measurement of productivity growth (Wolff, 1985&1994); (Raa & Wolff, 1991). The framework has an advantage for studying productivity growth in the whole context of the 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) who 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 on the data have been made in order to strengthen this work. It is important to note that in the Malaysian case, 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 I-O framework, industrial output is measured by gross commodity output, X, while the input consists of intermediate input, labour and capital. Thus, derivation of 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 j produced by industry i;

$X = V^T 1 =$ column vector, showing the gross output of each commodity i;

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 V 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[2]. 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[3].

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

$k_j = K[V^T]^{-1} =$ row vector of capital input coefficients by industry j; $(j = 1,2,3, \dots, n)$

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;[4]

$n =$ 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.

[2] Also, see Raa *et al*. (1984), Viet (1986) and Kop Jansen and Raa (1990) for more discussion of models of secondary production and the properties of such models.

[3] This is also true for most other models of secondary production. See Kop Jansen and Raa (1990) for more details.

[4] In this study, the author used average lending rate. It is implicitly assumed homogenous across industries.

3.1 Sectoral Productivity Growth

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

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

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).

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

Where: $\alpha_{ij} = p_i a_{ij}/p_j$, $\alpha_{Lj} = l_j p_j$, and $\alpha_{Kj} = r k_j p_j$. 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 π (the so called Tornqvist-Divisia index). Tornqvist-Divisia estimates the TFP growth using an I-O based (Wolff, 1985; 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: $\dot{a}_{ij} = \frac{\Delta a_{ij}}{a_{ij}}$; $\dot{l}_j = \frac{\Delta l_j}{l_j}$; $\dot{k}_j = \frac{\Delta k_j}{k_j}$

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

3.2 Data Collection and Input-Output Aggregations

This study has utilized data from two sources. The data were from the Malaysian Input-Output Tables and Industrial Manufacturing Survey (IMS) (DOS, 2000 & 2005). This work is the first attempt in measuring growth in TFP by using input-output data incorporating data from the IMS, unlike past studies, for both growth accounting and econometric methods which only utilized data from IMS (Maisom & Arshad, 1992; Tham, 1996;1997; Menon, 1998; Noriyoshi *et al.* 2002; Renuka, 2001; 2002; Fatimah & Saad, 2004; Idris, 2007).

This study employs the Malaysian Input-Output Tables for 2000 and the latest publication of Input-Output Tables for 2005 published by the Department of Statistics (DOS) in 2010. 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 are expressed in total salary and wages, bonus, cash allowances and overtime pay. Capital data were 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 the domestic producer prices. Both the labour and capital data are at the 5 digit-level of the Malaysian Standard Industrial Classification (MSIC). 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), which is based on 2000 as its base 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, the aggregation process on the input-output tables was done. The tables are aggregated into 49 sub-sectors of the manufacturing sector and other sectors, which consist of services, agriculture, mining, construction, and other public sectors.

4.0 RESULTS AND DISCUSSION

4.1 TFP Growth

The use of data from the input-output tables, which incorporate data from IMS, makes the result from this study different from the results of many other researchers of TFP study in Malaysia, which merely used compiled data from IMS. Table 2 shows the rate of growth in TFP for the 29 sub-sectors of resource based industries and 20 sub-sectors of non resource based industries of the manufacturing sector during the period of 2000 to 2005. From the table, resource based industries exhibit that the manufacture of wine and spirits products grew at a rate of 17.37 per cent, while the growth of the manufacture of processed rubber was at -6.51 per cent. For non resource based industries, it can be seen that the rate of TFP growth between these sub-sectors can be quite broad with the manufacture of electrical appliances at a rate of 36.57 per cent, while the growth of the manufacture of leather products was at -14.35 per cent.

The weighted average of TFP growth estimates from this study were registered at a positive rate of 9.7 and 14.5 per cent during the period of study. This is not surprising, as different sources of data and methods of computation definitely yield different results for TFP measures. The studies on TFP growth in Singapore have also yielded different results (Wong, 1995). In terms of performance by industry, out of 29 sub-sectors of resource based industries, 58.6 per cent show a positive rate of TFP growth during the study. These include sub-sectors of wine and spirits products, meat and meat products, preserved fruits and vegetables and the manufacture of confectionary products. For non resource based industries, about 60.0 per cent sub-sectors indicated a positive growth in TFP. This can be seen for sub-sectors of electrical appliances, the manufacture of footwear products, the manufacture of cycles and motorcycles, and the manufacture of knitted fabrics and other textile products. The result shows that non resource based industries is slightly higher than resource based industries in terms of performance by sub-sectors.

Table 2 TFP growth in resource and non resource based industries of the manufacturing sector and other sectors, 2000-2005 (%)

Resource Based Industries	TFP growth
1. Meat and meat products	11.28
2. Dairy production	1.68
3. Preservation of fruits and vegetables	9.81
4. Preservation of seafood	3.80
5. Manufacture of oils and fats	-0.83
6. Grain mills	2.55
7. Bakeries	1.45
8. Manufacture of confectionary	4.78
9. Manufacture of ice and other food	1.17
10. Manufacture of animal feeds	1.27
11. Production of wine and spirits	17.37
12. Production of soft drinks	-0.56
13. Manufacture of tobacco	0.29
14. Sawmill	0.58
15. Manufacture of other wooden products	-0.50
16. Manufacture of furniture, paper and board industries	0.25
17. Printing	-0.42
18. Manufacture of industries chemical and other chemicals	0.32
19. Manufacture of paints and lacquers	-0.89
20. Manufacture of drugs and medicines	-5.81
21. Manufacture of Soap etc.	0.24
22. Petrol and coal industries	-1.51
23. Rubber processing	-6.51
24. Rubber industries	-1.05
25. Manufacture of plastic products	-0.62
26. China and glass industries	4.41
27. Manufacture of clay products	-1.64
28. Manufacture of cement etc.	0.50
29. Other non-metallic manufacture	-0.16
Weighted average of TFP growth in resource based industries	9.74
Non Resource Based Industries	**TFP growth**
1. Manufacture of yarns and cloth	-0.22
2. Manufacture of knitted fabrics and other textiles	3.64
3. Manufacture of wearing apparel	1.13
4. Leather industries	-14.35
5. Manufacture of footwear	22.07
6. Iron and steel industries	0.10
7. Manufacture of non-ferrous metals	-0.33
8. Manufacture of other fabricated metal and fixtures	-0.08
9. Structural metal industries	0.61
10. Manufacture of industries machinery	-1.82
11. Manufacture of household machinery	0.24
12. Manufacture of radio, television etc.	-1.08
13. Manufacture of electric appliances etc.	36.57
14. Manufacture of other electric machinery	0.22
15. Ships and boats building	0.96
16. Manufacture of motor vehicle	0.74
17. Manufacture of cycles and motorcycles	6.29
18. Manufacture of other transport equipment	-8.46
19. Manufacture of instruments and clocks	-0.63
20. Other manufacturing	0.40
Weighted average of TFP growth in non resource based industries	14.11
Other sectors	-0.46

The frequency distribution of TFP growth is presented in Table 3. From the table, most subsectors of resource based industries were in the range of 0.0 - < 10.0 per cent. The result is similar to non resource based industries. There were 51.72 per cent for resource based industries and 50.0 per cent for non resource based industries. Although most of them indicate positive rates of growth in TFP, the rates were relatively low. This implies that the manufacturing sector still has more room to increase its productivity by utilizing all factors of production at a potentially higher level.

Table 3 Frequency distribution of TFP growth, 2000-2005

Rate of growth (%)	Number of sub-sectors	
	Resource based industries	Non resource based industries
> -10.0	-	1
-10.0 - < -0.0	12	7
0.0 - < 10.0	15	10
10.0 - < 20.0	2	-
> 20.0	-	2

Source: from Table 2

4.2 Contribution of Inputs to TFP

Table 4 presents the contribution of input (domestic intermediate input, imported intermediate input, labour and capital) to growth in TFP during the period of the study. The table shows the contribution of the input growth of resource and non resource based industries of the manufacturing sector. This study shows that the contribution to growth in TFP of resource and non resource based industries for both intermediate input of domestic and import, ranged from 20 to 75 per cent. From this finding, intermediate input actually dominates the contribution of input to growth in TFP. The findings support the objective of industrial development for resource and non resource. The domestic intermediate input leads the contribution of input to growth in TFP for resource based industries, while imported intermediate input was more significant for resource based industries. In contrast, the contribution of labour and capital input to growth in TFP of the manufacturing sector was substantially low throughout the study. Moreover, the contribution of capital was rather low compared to the contribution of labour. The capital input was at 0.10 per cent for resource based industries, while 0.07 per cent registered for non resource based industries. The share of labour input for resource based industries indicated about 0.31 per cent, while 0.50 per cent for non resource based industries. Similar patterns are observed for the contribution of growth in TFP in terms of the total economy.

Table 4 Contribution of input to growth in TFP, 2000-2005 (%)

Inputs	Weighted average of contribution for		
	Resource based industries	Non resource based industries	Other sectors
Domestic intermediate input	74.95	45.65	52.17
Imported intermediate input	24.64	53.79	47.83
Total intermediate input	99.59	99.44	100.0
Labour	0.31	0.50	0.0
Capital	0.10	0.07	0.0
TFP	100.0	100.0	100.0

Source: From Appendix 2

The larger contribution in both domestic and import input shows that the intermediate input is the major component of growth in TFP for both resource and non resource based industries. This implies that the growth in TFP for both industries is dependent on the input growth. In other words, growth in TFP 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 Korean economy caught up with the process of the industrial performance predominantly by the input-led growth and TFP growth has been positively affected by the growth of labour productivity and output growth. Past studies on growth in TFP with respect to Malaysia also concluded that the input growth, particularly intermediate input, makes 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; and 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 growth in TFP in terms 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. As reported by the Annual Report of Bank Negara (2006), imported raw materials constituted 20 percent of the total raw materials utilized in resource based industries while in non resources-based industries it goes to as much as 60 percent. Furthermore, study by Noorasiah *et al.'s* (2012) find that non resource based industries are relatively efficient in using domestic and imported intermediate inputs compared to resource based industries during the period between 1983 and 2005. The study also shows that resource based industries are actually sourced by domestic inputs, while non-resource based industries rely on imported input, as well as FDI, in concentrated non-resource based industries in Malaysia.

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, Gan *et al.*'s (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 growth in TFP.

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 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 technological 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 was also low, which is reflected by the increase of capital-labour ratio in some industries of the manufacturing sector (Noorasiah *et al.*, 2012). 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 with the shortage of skilled labour, which may cause a serious constraint on capital utilization 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.

5.0 SUMMARY AND CONCLUSIONS

This study is the first attempt to examine TFP growth within an input-output framework with concern on the industrial basis of resource and non-resource based. Based on the above results, this study concludes with three main findings. Firstly, there is relatively low and negative growth of TFP in some sub sectors of the both industries. The results from this study show the negative TFP growth implies inefficiency in some industries of the manufacturing sector. This also indicates that the input usage in certain industries of the manufacturing sector is not utilized efficiently. The efficiency of input usage is actually also relied on technology. However, it should bear in mind that both technical efficiency and technical progress are a pertinent contribution to a higher growth of TFP. Therefore, firms need to take in account both aspects of technology and the usage of appropriate technology will assist to increase efficiency.

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 the local ones. The improvement in labor productivity may help increase the local value-added content of output produced, especially in the non resource-based industries.

Secondly, the major source of change in TFP of the both industries between 2000 and 2005 is contributed by the intermediate input (domestic and import). The share of imported intermediate input to growth in TFP is undoubtedly larger for non resource based industries during 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. This will result an adverse effect on the country's Balance of Payments due to heavy reliance on the import of raw materials. Therefore, both resource and non resource industries need to be proactive in creating and enhancing linkages as well as to reduce dependency on the imported inputs. This currently visible only in the economy's resource based industries, and should be extended to the non-resource based industries as well. Definitely, the country's industrial policy review should focus more upon strengthening inter industrial linkages, especially among the non resource based industries, to improve linkages between multinational corporations and their local vendors. Additionally, the incentives given to foreign companies should be revised in terms of encouraging development of links between indigenous industries and foreign companies. More importantly, the foreign parent company needs to be encouraged to establish research and development centers in Malaysia.

Thirdly, the low contribution of labour and capital input is most probably due to lack of skilled labour and inefficient usage of the capital input. 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 inefficient usage of capital input may be caused by several factors, such as low knowledge of technical operation and lack of skilled labour. 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 shortage of skilled labour has become one of the major factors that may negatively affect the productivity of 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). These constraints show that capital input is probably not used efficiently. This problem reflects the major challenge Malaysia is facing which is to upgrade the quality of human capital. In this case, both formal education and structured training are very important. The training not only involves general training, but specific training is more important because it relates to the needs of the industry, such as specific skills is can only be determined by industry.

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 TFP estimates cannot specifically be compared directly, but in general the results are comparable though researchers used different methodology, different sources of data sets and period covered, different classification of industries and 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 causes of change in TFP growth and appropriate suggestion to the government policy, makes this a challenge that should be undertaken in the near future.

References

Baier, S. L., Dwyer, G. P., & Tamura, R. 2002. How Important are Capital and Total Factor Productivity for Economic Growth? Working Paper. Federal Reserve Bank of Atlanta.

Bank Negara (various years). *Annual Report*, Kuala Lumpur: Bank Negara Malaysia.

Bank Negara 2006. *Annual Report 2005*. Kuala Lumpur: Bank Negara Malaysia.

Department of Statistics Malaysia. 2000 & 2005. Malaysian Input-Output Tables 2000 and 2005, Kuala Lumpur: Putrajaya.

Fatimah Said & Saad Mohd Said. 2004. Total Factor Productivity Growth in Malaysian Manufacturing Sector: Emphasis on Heavy Industries. *International of Economics and Management*,. 12(2): 131–164.

Gan W. B, F. C. Wong & Y. W. Tok. 1993. Total Factor Productivity in the Singapore Manufacturing Sector during the 1980s. Unpublished mimeo.

Idris Jajri. 2007. Determinants of Total Factor Productivity Growth in Malaysia. *Journal of Economic Cooperation*. 28(3): 41–58.

Jorgenson, D. W., Gollop, F. and Fraumeni, B. 1987. *Productivity and the U.S Economic Growth.* Amsterdam: North-Holland.

Kim, Jong-II. & Lawrence J. Lau. 1994. The Sources of Economic Growth of the East Asian Newly Industrialized Countries. *Journal of the Japanese and International Economies*. 8(3): 235–271.

Kop Jansen, P. S. M. & Raa, T. ten. 1990. The Choice of Model in the Construction of Input-Output Coefficients Matrices. *International Economic Review*. 31(1): 213–227.

Krugman, P. R. 1994. The Myth of Asia's Miracle. *Foreign Affairs*. 73(6): 62–77.

Leontief, W. 1953. Structural Change, *in*: Wassily Leontief *et al*. (eds.). *Studies in the Structure of the American Economy*. New York: Oxford University Press. 17–52.

Maisom Abdullah & Arshad Marshidi. 1992. Pattern of Total Factor Productivity Growth in Malaysia Manufacturing Industries, 1973-1989, Paper presented at HIID-ISIS Seminar, Kuala Lumpur.

Malaysian Productivity Corporation. 1999. Productivity Report 1998. Petaling Jaya: Ampang Press.

Menon, J. 1998. Total Factor Productivity Growth in Foreign and Domestic Firms in Malaysian Manufacturing, *Journal of Asian Economics*. 9(2): 251–280.

Nik Hashim Nik Mustapha. 1998. Output versus Productivity Growth in the Manufacturing Industry: An Experience for Sustainable Development Planning. Paper presented at Workshop of Faculty of Economics, UKM. 19-21 Jun, Port Dickson. Malaysia.

Noorasiah Sulaiman & Zakariah Abdul Rashid. 2013. Decomposition of Productivity Growth of the Malaysian Manufacturing Sector, 1983-2005. *Jurnal Ekonomi Malaysia*. 47(1): 65–74.

Noorasiah Sulaiman, Zakariah Abdul Rashid & Khalid Abdul Hamid. 2012. Productivity Improvement in the Utilization of Domestic and Imported Inputs in Resource and Non Resource Based Industries: 1983-2005. *International Journal of Management Studies*. 19(1): 87–114.

Noriyoshi, O; NorAini Mohd Amdzah; Zainon Bakar; Rauzah Zainal Abidin & Mazlina Shafii. 2002. Productivity of Foreign and Domestic Firms in the Malaysian Manufacturing Industry. *Asian Economic Journal*. 16(3): 215–228.

Okamoto, Y. 1994. Impact of Trade and FDI Liberalization Policies on the Malaysian Economy. *The Developing Economies*. 32(4): 460–478.

Raa, T. ten & Wolff, E. N. 1991. Secondary Products and the Measurement of Productivity Growth. *Regional Science and Urban Economics*. 21(4): 581–615.

Raa, T. ten, Debesh, C. & Anthony, S.J. 1984. An Alternative Treatment of Secondary Products in Input Output Analysis. *Review of Economics and Statistics*. 66(1): 88–97.

Rahmah Ismail. 1999. Contribution of Input Quality to Labour Productivity in the SMIs in Malaysia. Paper presented at *Workshop of Department of Statistics Economy*, Faculty of Economics, Universiti Kebangsaan Malaysia. Port Dickson.

Renuka, M. 2001. Assessing the Output and Productivity Growth of Malaysia's Manufacturing Sector. *Journal of Asian Economics*. 12(4): 587–597.

---------. 2002. Is There a Real TFP Growth Measure for Malaysia's Manufacturing Industries? *ASEAN Economic Bulletin*. 19(2): 178–190.

Solow, R. 1956. A contribution to the Theory of Economic Growth. *Quarterly Journal of Economics*. 70(1): 65-94.

Tham, S. Y. 1996. Productivity, Growth and Development in Malaysia. *The Singapore Economic Review*. 40(1): 41–63.

----------.1997. Determinants of Productivity Growth in the Malaysian Manufacturing Sector. *ASEAN Economic Bulletin*. 13(3): 333–343.

Tham, S. Y. & Choong, P. Y. 1995. Total Factor Productivity in the Malaysian Manufacturing Sector: Some Preliminary Results. *Jurnal Ekonomi Malaysia*. 29: 9–35.

Tsao, Y. 1985. Growth without Productivity: Singaporean Manufacturing the 1970s. *Journal of Development Economics*. 19(1–2): 25–38.

Viet, V. Q. 1986. Study of Input-Output Tables: 1970-1980, Geneva: United Nation Statistical Office.

Wolff, E. N. 1985. Industrial Composition, Inter-Industry Effects and the U.S Productivity Slowdown. *Review of Economics and Statistics*. 67(2): 268–277.

----------. 1994. Productivity Measurement within an Input-Output Framework. *Regional Science and Urban Economics*. 24(1): 75–92.

Young, A. 1994b. Lessons from the East Asian NICs: A Contrarian View, *European Economic Review*. 38(3–4): 964–973.

Appendix 1

Classifications of Industries

Resource based industries	Non resource based industries
Vegetable, animal oils and fats	Textiles, wearing apparel and leather
Other food processing, beverages and Tobacco	Electronics
Rubber processing and products	Basic metal industry
Paper and paper products, printing and publishing	Metal products
Industrial chemicals, fertilizers and plastics products	Transport equipment
Wood products including furniture	Manufacture of machinery
Petroleum products, crude oil, coal	*(except electrical)*
Non metallic mineral products	Electrical machinery
Off-estate processing	
Domestic-oriented industries	**Export-oriented industries**
Food products, beverages and tobacco	Electrical and electronic product
Paper and paper products	Rubber products
Plastic products	Wood, wood products
Chemical and chemical product	Textiles, wearing apparel and leather
Transport equipment	Petroleum products
Basic metals and fabricated metal	Machinery and equipment
Non metallic mineral	Scientific instruments
	Off-estate processing

Source. Malaysia (2006)
Note. These classifications are based on the Economic Planning Unit.

Appendix 2

Contribution of input to growth in TFP based on resource and non resource based industries of the manufacturing sector and other sectors, 2000-2005 (%)

Resource Based Industries	Domestic intermediate input	Imported intermediate input	Labour	Capital	TFP growth
1. Meat and meat production	5.57	5.71	0.0021	0.0003	11.28
2. Dairy production	0.91	0.77	-0.0001	-0.0002	1.68
3. Preservation of fruits and vegetables	4.65	5.09	0.0293	0.0437	9.81
4. Preservation of seafood	1.70	2.10	0.0001	-0.0002	3.80
5. Manufacture of oils and fats	-0.44	-0.39	0.0001	-0.0001	-0.83
6. Grain mills	1.37	1.18	0.0004	-0.0001	2.55
7. Bakeries	0.69	0.76	0.0003	-0.0001	1.45
8. Manufacture of confectionary	2.45	2.32	-0.0001	-0.0004	4.78
9. Manufacture of ice and other food	0.60	0.58	0.0001	-0.0001	1.17
10. Manufacture of animal feeds	0.70	0.57	0.0001	-0.0002	1.27
11. Production of wine and spirits	10.18	7.15	0.0414	0.0052	17.37
12. Production of soft drinks	-0.32	-0.24	0.0001	-0.0004	-0.56
13. Manufacture of tobacco	0.11	0.18	-0.0001	-0.0002	0.29
14. Sawmill	0.30	0.28	0.0001	-0.0001	0.58
15. Manufacture of other wooden products	-0.26	-0.24	0.0002	-0.0001	-0.50
16. Manufacture of furniture, paper and board industries	0.14	0.12	0.0001	-0.0001	0.25
17. Printing	-0.23	-0.19	0.0003	-0.0001	-0.42
18. Manufacture of industries chemical and other chemicals	0.19	0.14	-0.0001	-0.0001	0.32
19. Manufacture of paints and lacquers	-0.43	-0.46	0.0012	-0.0001	-0.89
20. Manufacture of drugs and medicines	-2.55	-3.25	-0.0003	-0.0007	-5.81
21. Manufacture of Soap etc.	0.13	0.12	0.0002	-0.0003	0.24

Resource Based Industries	Domestic intermediate input	Imported intermediate input	Labour	Capital	TFP growth
22. Petrol and coal industries	-0.58	-0.94	-0.0001	-0.0001	-1.51
23. Rubber processing	-3.69	-2.82	-0.0001	-0.0002	-6.51
24. Rubber industries	-0.52	-0.52	-0.0001	-0.0001	-1.05
25. Manufacture of plastic products	-0.26	-0.36	0.0001	-0.0001	-0.62
26. China and glass industries	2.32	2.09	0.0021	0.0003	4.41
27. Manufacture of clay products	-0.87	-0.77	0.0002	-0.0002	-1.64
28. Manufacture of cement etc.	0.27	0.24	0.0001	-0.0003	0.50
29. Other non-metallic manufacture	-0.08	-0.07	0.0002	-0.0001	-0.16
Weighted average by input of the resource based industries	7.30	2.40	0.03	0.01	9.74
Non Resource Based Industries	**Domestic intermediate input**	**Imported intermediate input**	**Labour**	**Capital**	**TFP growth**
1. Manufacture of yarns and cloth	-0.12	-0.11	0.0011	0.0003	-0.22
2. Manufacture of knitted fabrics and other textiles	1.93	1.71	0.0004	-0.0001	3.64
3. Manufacture of wearing apparel	0.59	0.53	0.0010	0.0006	1.13
4. Leather industries	-6.65	-7.73	0.0109	0.0199	-14.35
5. Manufacture of footwear	11.68	10.39	0.0011	-0.0009	22.07
6. Iron and steel industries	0.05	0.05	-0.0001	-0.0001	0.10
7. Manufacture of non-ferrous metals	-0.15	-0.19	0.0001	-0.0001	-0.33
8. Manufacture of other fabricated metal and fixtures	-0.05	-0.04	-0.0001	-0.0001	-0.08
9. Structural metal industries	0.31	0.30	0.0001	-0.0001	0.61
10. Manufacture of industries machinery	-0.99	-0.83	0.0001	-0.0001	-1.82
11. Manufacture of household machinery	0.12	0.12	0.0001	0.0001	0.24
12. Manufacture of radio, television etc.	-0.56	-0.52	-0.0001	-0.0001	-1.08
13. Manufacture of electric appliances etc.	18.98	17.59	-0.0001	-0.0004	36.57
14. Manufacture of other electrical machinery	0.11	0.11	-0.0001	-0.0001	0.22
15. Ships and boats building	0.50	0.46	-0.0002	-0.0002	0.96
16. Manufacture of motor vehicle	0.37	0.37	-0.0001	-0.0001	0.74
17. Manufacture of cycles and motorcycles	3.28	3.00	0.0095	0.0023	6.29
18. Manufacture of other transport equipment	-4.17	-4.29	-0.0010	0.0001	-8.46
19. Manufacture of instruments and clocks	-0.38	-0.25	-0.0002	-0.0002	-0.63
20. Other manufacturing	0.19	0.20	0.0004	0.0001	0.40
Weighted average by input of the non resource based industries	7.6	6.45	0.07	0.01	14.13
Other sectors	-0.24	-0.22	-0.00004	0.00004	-0.46