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Foreign Labours and Total Factor Productivity in Malaysia's Manufacturing

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ABSTRACT

This paper aims to examine the impact of the foreign labour as well as other determinants on the total factor productivity (TFP) among 15 sub- industries in Malaysia's manufacturing sector. The study applied the Data Envelopment Analysis (DEA) to calculate the values of TFP, followed by the Panel ARDL model, or Pooled Mean Group (PMG) estimation, to capture the long-run and short-run relationship among the variables during the year 1990 until 2008. The results showed that the aggregate number of the foreign and local labours have a positive impact to the growth of TFP in a long-run. Besides that, both skilled and low-skilled foreign labours have showed a significantly positive and negative impact to the growth of TFP in a long run. The study also revealed that the manufacturing sectors in Malaysia are operating below its efficiency level. Thus, the used of human capital especially the skilled local or foreign labours are essential to absorb the invested technology more efficiently. Other determinants such as capital intensity and openness of economy have showed a positive and statistically significant to the growth of TFP in the long-run.

Keywords: Foreign labour, domestic labour, Total factor productivity (TFP), Manufacturing sector, Malaysia.

ABSTRAK

Kajian ini dijalankan untuk mengkaji kesan buruh asing serta penentu lain kepada produktiviti faktor keseluruhan (TFP) bagi 15 sub-sektor pembuatan di Malaysia dari tahun 1990 hingga 2008. Kaedah Data Envelopment Analysis (DEA) yang berasaskan indeks Malmquist telah digunakan untuk mengira nilai TFP dan panel ARDL model ataupun dikenali sebagai Pooled Mean Group (PMG) untuk menganggarkan kesan jangka masa pendek dan jangka masa panjang bagi pembolehubah yang digunakan. Keputusan kajian menunjukkan bahawa dalam jangka masa panjang, buruh asing dan buruh tempatan secara agregatnya dapat memberi kesan yang positif kepada pertumbuhan TFP. Juga didapati bahawa buruh asing yang mahir dapat membantu dalam pertumbuhan TFP sedangkan buruh tempatan dan buruh asing yang kurang mahir akan menjejaskan pertumbuhan TFP dalam jangka masa panjang. Oleh itu, penggunaan buruh mahir adalah penting dalam proses pengeluaran supaya keadaan ketidakcekapan dalam sector pembuatan dapat diperbaiki. Penentu lain seperti intensiti modal dan keterbukaan ekonomi dapat memberi kesan yang positif dan signifikan kepada pertumbuhan TFP dalam jangka masa panjang.

Kata kunci: Buruh asing, Buruh tempatan, Produktiviti factor keseluruhan (TFP), Sektor pembuatan, Malaysia

INTRODUCTION

The manufacturing sector in Malaysia has achieved an impressive development since the independence in 1957 has become more important to Malaysia to achieve the high income and developed nation in the year 2020. Therefore, it is essential to look into the total factor productivity (TFP) growth of the manufacturing industries since it is one of the measurements to identify the sustainable output growth, given the diminishing returns nature of input growth in the long run. In this context, growth of TFP can be decomposed into technical efficiency (EFFCH) which was caused by the used of the existing technology and economics inputs more efficiently or technical change (TECHCH) by adopting the innovations such as used of new technology

During the 1980s, the structure of the economy in Malaysia has experienced a dramatic changed from the agriculture towards manufacturing and finally the services sectors. That was the time when the government started to encourage the employment of the foreign labours to involve the agriculture and construction sector. However, due to the shortage of labours in other sectors, foreign labours are now allowed to involve in agriculture, construction, services, and domestic helpers. Table 01 shows that the manufacturing sector recorded the highest used of foreign labours which about 323,299 or 30.28 % of the foreign labours during the year 2002. Until the year 2008, there are 728,867 or 35.2 % of the total foreign workers actively involved in manufacturing sector.

The motivation of this study is to analyze the impact of the foreign labours to the growth of TFP on manufacturing sector in Malaysia. Other determinants, namely, gross output, capital intensity of the industries and openness of the economic were also taken into account in order to analyze their impact to the growth of TFP. The remainder of this paper is organized as follows. Section two provides the literature review. Section three structures the methodology, which consists of source of data, TFP measures and the specification of the model by using the Pooled Mean Group (PMG) estimation method. Section four presents the results of the study. Finally, section five contains the summary and conclusions.

LITERATURE REVIEW

Many studies have applied the Data Envelopment Analysis (DEA) to measure the TFP growth. Rahmah (1999) found that the contribution of efficiency is relatively small in some manufacturing sectors that required high labour intensity. Besides that, Idris (2007) and Mahadevan (2002a) have pointed out that the TFP growth on manufacturing sector in Malaysia did not reached a satisfactory level compared with other developing countries due to the negative contribution from technical efficiency. This indicates that the economy in Malaysia is operating below its maximum potential output. Most of the TFP growth was mainly due to the technical change or technical progress. Hashim and Basri (2004) using parametric stochastic frontier approach with translog production function to estimate the TFP growth of Malaysia's manufacturing sectors. The results found the efficiency changed was a major source for TFP growth except for chemical, paper and petroleum which recorded the highest technological progress.

Renuka (2001) decomposed growth of into the growth of input and growth of TFP in order to identify the sources of growth in the manufacturing sector during the year 1981 until 1996. The study also extended by decomposed the growth of TFP into technical progress and technical efficiency. The result showed that manufacturing sector in Malaysia was highly depend to the input growth and positively biased towards the skilled labour.

In terms of the foreign labour, Tsao (1985) found that the growths of TFP are low in Singapore's manufacturing sectors due to the wage policy and the inflow of the low skilled foreign labour. On the other hand, the skilled foreign labours at Denmark have showed the positive relationship to the growth of TFP, Evelyn and Chan (2009), Nikolaj et al (2011). The result was supported by Coury and Lahouel (2011). Peri (2012) in his study found that the foreign labours have a significantly positive impact to the TFP growth but negative relationship to the sectors that required higher technology.

Herowitz et al. (1999) applied the time-series data for the year 1960 to 1996 and found that the used of the foreign labour will only caused the negative impact to the growth of TFP in a short-run. This is because of the foreign labours they tend to need some times to adapt themselves when they entered the new country or new labour market. However, the growth of TFP will increase once the adaption has been completed in a long-run. Preibish (2007) stated that if foreign workers can be managed well and properly, their impact will be positive because it helps overcome the labours shortage, thus improved the country's GDP and production.

The openness of the economy reflects a reduction of the trade barriers and increasing the movement of goods between countries. Mahadevan (2002b), Jonsson and Subramanian (2001) found that there was a positive relationship of openness to the TFP growth on the manufacturing sector in Australia and South Africa. Besides that, the reduction in foreign exchange and trade barriers such as tariff have also led to the growth of TFP in India's manufacturing sector (Satish ,1999, Goldar and Anita ,2003). In addition, Mohamed et al (2005) measured the relationship between TFP and economic openness during the year 1983 to 1990 by using the data panel of six Tunisian manufacturing sub-sectors and OECD countries. The result showed that the economic openness has demonstrated a significant growth to the TFP in manufacturing sector.

While some studies show a positive relationship, other studies however, conclude the reverse. Harris and Kherfi (2001) found that trade openness has no significant impact productivity growth in the Canadian's manufacturing sector. Adhikary (2011), examines the relationship between TFP, FDI, trade openness, capital formation and economic growth rates in Bangladesh over a period 1986- 2008 and found that the degree of trade openness has negatively affect the growth of TFP.

THE METHODOLOGI

Source of Data

This study utilized the secondary data which obtained from Industrial Manufacturing Survey (IMS) published by Department of Statistics (DOS) and the National Productivity Corporation (NPC). The study includes a total of 19 times series from the period of 1990 to 2008, and the cross section contains 15 sub-sectors at 3 digit level according to the Malaysian Standard Industrial Classification (MISC 2000) that compose the total amount of 285 observations. The independent variables in this study consisted from real output of the manufacturing sector, capital intensity, economic openness, the aggregate number of local and foreign labour , local labour and foreign labour according to type of skill. Sources of data for exports, imports, gross domestic product (GDP) were obtained from the Ministry of International Trade and Industry (MITI). The data of foreign labour were obtained from the Department of Immigration. For the measurement of TFP, the value of output is used as the output of the manufacturing industry in Malaysia. The data for the value of output, labour and capital were unpublished data taken from IMS (DOS). The variables involved were deflated using the domestic producer price index, which is based on 2000 as its base year. Next, the TFP is calculated by using computer software called Deap version 2.1. When the TFP obtained, Stata 10.1 software will be used to analyze the PMG estimation model in this study. The study comprises 2 parts of estimation. First, using the aggregate number of foreign labour and then, divided into skilled and low skilled labour. Foreign and local labours that employed in professional occupations, and administrative, technical and supervision will be considered as skilled labour. As for the labours engaged in clerical, general employment and production will considered as low-skilled labour.

Theoretical Framework and Model Specification

The Data Envelopment Analysis (DEA) is a special mathematical linear programming model and test to assess efficiency and productivity. It allows the use of panel data to estimate changes in TFP and breaking it down into two components, namely, TECHCH and EFFCH. The analyses in this study begin with the adoption of the output-oriented approach of DEA-Malmquist to put greater weight on the expansion of output based on a given amount of inputs. Therefore, TFP index is a ratio of the weighted aggregate output to weighted aggregate input.

Fare *et al*. (1994) specify the Malmquist productivity change index as:

$$m_0(y_s, y_t, x_s, x_t) = \left[\frac{d_0^s(x_t,y_t)}{d_0^s(x_s,y_s)} \times \frac{d_0^t(x_t,y_t)}{d_0^t(x_s,y_s)}\right]^{0.5} \quad (1)$$

The above equation represents the productivity of the production point (x_s,y_s) relative to the production point (xt,yt). This index uses the period t technology and the other period s technology. A value greater than one will indicate a positive TFP growth from period t to period s while a value lesser than one will indicate a decrease in TFP growth or performance relative to the previous year.

As expressed by (Cabanda, 2012), the Malmquist index of total factor productivity change (TFPCH) can be decomposed into:

$$m_0(y_s, y_t, x_s, x_t) = \frac{d_0^t(y_t, x_t)}{d_0^s(y_s, x_s)} \times \left[\frac{d_0^s(x_t, y_t)}{d_0^t(x_t, y_t)} \times \frac{d_0^s(x_s, y_s)}{d_0^t(x_s, y_s)}\right]^{0.5} \quad (2)$$

The above equation also can be written as

TFPCH = EFFCH x TECHCH (3)

When the value of TFP is obtained, the analysis continues by using the Pooled Mean Group (PMG) or panel Autoregressive Distributed Lag (ARDL) which was introduced by Pesaran, Shin and Smith (1999) to examine the impact of the foreign labours on TFP growth in Malaysia manufacturing sector. These methods are well suited to the analysis of dynamic panels that have both large time and cross-section data fields. In addition, both estimators have the advantages to accommodate both the long run equilibrium and the possibly heterogeneous dynamic adjustment process. Following Pesaran et al. (1999), we base our panel analysis on the unrestricted error correction ARDL representation:

$$\Delta y_{it} = \phi_i(y_{i,t-1} - \beta_i x_{i,t-1}) + \sum_{j=1}^{p-1} \lambda_{ij} y_{i,t-j} + \sum_{j=0}^{q-1} y_{i,j} x_{i,t-j} + \mu_i + \mu_{it} \quad (4)$$

Where y_{it} is a scalar dependent variable, $\mathbf{x_{it}}$ is the k x 1 vector of regressors for group i, $\mu_i$represent the fixed effects, ϕ_i is a scalar coefficient on the lagged dependent variable, β'_i is the k x 1 vector of coefficients on explanatory variables, λ_{ij} is are scalar coefficients on lagged first-differences of dependent variables, andγ'_{ij} are k x 1 coefficient vectors on first-difference of explanatory variables and their lagged values. Assume that the disturbances μ_i 's are independently distributed across i and t, with zero means and variances $\delta^2 > 0$. Further assuming that error correction term (ec) $\phi_i < 0$ for all i and therefore there exists a long-run relationship between y_{it} and x_{it}.

$$y_{it} = \theta'_{ij} x_{ij} + \Pi_{ij} \qquad i = 1,2,\ldots..N; t = 1,2,\ldots..T \quad (5)$$

Where $\theta'_{ij} = -\frac{\beta_i'}{\phi_i}$ is the k x 1 vector of the long-run coefficients, and Π_{ij} 's stationary with possibly non-zero means (including fixed effects). Equation (4) can be rewritten as VECM system as:

$$\Delta y_{it} = \phi_i \Pi_{i,t-1} + \sum_{j=1}^{p-1} \lambda_{ij} \Delta y_{i,t-1} + \sum_{j=0}^{q-1} y_{i,j} \Delta x_{i,t-j} + \mu_i + \mu_{it} \quad (6)$$

Where $\Pi_{i,t-1}$ is the error correction term, hence ϕ_i is the error correction coefficient measuring the speed of adjustment towards the long-run equilibrium.

The relationship between TFP and independent variables in the multivariate model can be specified as follows:

TFP_{it} = f(Y_{it}, K/L_{it}, OPN_{it}, LL_{it} , FL_{it}) (6a)
TFP_{it}= f(Y_{it},K/L_{it}, OPN_{it}, $MSKILL_{it}$, $MLSKILL_{it}$, $FSKILL_{it}$, $FLSKILL_{it}$) (7a)

For the econometric analysis, equation (3) is expressed as a semi log-linear regression, where the variables are the natural log of the respective uppercase variables. The empirical model can be summarized as follows:

$$TFP_{i,t} = \alpha_i + +\beta_{1i} lnY_{i,t} + \beta_{2i} KL_{i,t} + \beta_{3i} OPN_{i,t} + \beta_{4i} ln\, LL_{i,t} + \beta_{5i} lnFL_{i,t} \quad (6b)$$

$$TFP_{i,t} = \alpha_i + +\alpha_{1i} lnY_{i,t} + \alpha_{2i} KL_{i,t} + \alpha_{3i} OPN_{i,t} + \alpha_{4i} ln\, MSKILL_{i,t} + \alpha_{5i} lnMLSKILL_{i,t} + \alpha_{6i} lnFSKILL_{i,t} + \alpha_{7i} lnFLSKILL_{i,t} \quad (7b)$$

i = 1,2,…….n ; t = 1,2,…..,t

Where, TFP represent the total factor productivity of manufacturing sectors, KL represent the capital intensity. OPN denotes the openess of the economy, LB and FL denotes aggregate number of local and foreign labour. MSKILL and MLSKILL denote aggregate number of local skilled labour and unskilled labour. FSKILL and FLSKILL denote the aggregate number of foreign skilled and unskilled labour.

Besides that, α and β are the parameters and vectors of the parameters to be estimated. *i* is an industry divided into 15 industries of the manufacturing sector, *t* is a time period.

RESULF AND DISCUSSION

Growth of TFP in Manufacturing Sector

The result of the study reveal that during the years of 1990 to 1999 and 2000 to 2008, TFP of the manufacturing sector has registered a negative growth of 1.09 point and 0.97 point in average. Between the year 1990 and 2008, TFP growth of the Malaysia manufacturing sector has not been encouraging due to the negative contribution from technical efficiency (See Table 02 and Table 03). Most of the manufacturing sectors were operated under the technical efficiency level. In addition, a conflict that can be seen through the index is an increasing of the technical change has resulted in pure technical efficiency only recorded 0.975 point. It means that the manufacturing sector in Malaysia is operating below the maximum potential level of output and had a problem to absorb the used of existing technology. However, the value for TFP growth index showed 1.033 indicates that the level of technology and technology absorption could be improved if the manufacturing sector move to the production with high value added. Therefore, the used of human capitals are important so that the sophisticated technology can be absorbed optimally.

Foreign Labours and Other Determinants on TFP Growth

This section reports the result from the estimation models to analyze the impact from the foreign labours and other determinants to the growth of TFP on manufacturing sector in Malaysia. Table 4 present the results of the Pool Mean Group and Mean Group (MG) using ARDL (0,0,2,1,2,1) and (0,0,2,2,0,0,2,2) for estimation model 01 and model 02 respectively. The table also shows the long-run and short run coefficient, and the speed of adjustment for the variables during the study period. In order to determine the most preferred estimation method between PMG and MG, Hausman test was being applied for testing the hypothesis of long-run elasticity's to be equal across all panels as stipulated by PMG model. Based on the calculated Hausman statistics which were 0.9956 and 1.000 for estimation model 01 and 02, it is conclude that the PMG estimator, the efficient estimator under the null hypothesis, is favorable. The speed of the adjustment reflected by the coefficient of convergence are -0.90 and -0.99 and statistically significant, indicating that there is no omitted variables bias.

The result for model estimation 01 revealed that the variables such as capital intensity, openness of the economic and the aggregate number of local and foreign labours have a positive relationship to the growth of TFP in the long-run and statistically significant at 10 percent and 5 percent. In terms of the local and foreign labour, 1 percent increase in the aggregate number of local and foreign labour will generate 0.0013 points and 0.0005 points respectively to the growth of TFP in the long-run. However, the gross output has showed a negative relationship and statistically significant at 1 percent to the growth of TFP. It appears again that perhaps the technology was not properly absorbed in manufacturing sectors (Idris Jajri, 2007).

The analysis continues with estimation model 02 by divided the local and foreign labour into skilled and low-skilled. The results found that the relationship between the local and foreign low-skilled labours to the growth of TFP is negative and statistically significant at 1 percent and 5 percent respectively. In other words, 1 percent increase in the used of local and foreign low-skilled labours will decrease the growth of TFP by 0.0034 point and 0.0018 points. On the other hand, the capital intensity and foreign skilled labours can contribute positively to the growth of TFP in the long-run and statistically significant at 1 percent. The gross output, openness of economics and local skilled labours were however, did not achieve the level of significant in the long run.

Besides that, the study also found that the impacts from the aggregate number of foreign labours to the TFP growth were smaller compared to the aggregate number of local labours. This can be shown by the smaller value of coefficient for foreign labours compared with the local labours in the short run and long run. On the other hand, the local unskilled labours have greater negative impacts compared to the foreign low-skilled labours because of the larger coefficient value of local low-skilled labours compared to the foreign low-skilled labours.

CONCULSION

Based on the estimated results, the study concludes that the local and foreign labours can positively influence to the growth of TFP in the long-run. Besides that, the skilled foreign labours are found to have a significantly positive impact and the low-skilled foreign workers have a significantly negative impact to the growth of TFP in a long run. However, the local low-skilled labour shows a significantly negative relationship to the TFP growth. Furthermore, the gross output has showed a negative relationship to the growth of TFP which revealed that the manufacturing sectors in Malaysia are operating below its efficiency level. Therefore, Malaysia needs to enhance their productivity- based catching-up capability by specifically used of the human capital in labour market effectively to absorb the invested technology. The quality of the foreign workers was found to be important especially for those who have higher skilled level. (Evelyn and Chan, 2009). The manufacturing sector in Malaysia should be more concerned with the involvement of the skilled labor so that the invested capital can be absorbed more efficiently.

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TABLE 01: Total Number O Foreign Labours According To The Sector, 2002- 2008.

Sector	2002	2004	2006	2008
Domestic Worker	232,282	285,442	310,662	291,359
Manufacturing	323,299	475,942	646,412	728,867
Plantation	298,325	382,473	354,124	333,900
Construction	149.342	231,184	267,809	306,873
Services	64,281	93,050	166,829	212,630
Agriculture	-	-	123,373	186,967
TOTAL	1,067,529	1,470,090	1,869,209	2,062,596

Sources: Kementerian Dalam Negeri

TABLE 02: Tfp Growth Index For Manufacturing Sectors In Malaysia

TIME PERIOD	EFFCH	TECHCH	PECH	SECH	TFPCH
1990-1999	1.008	1.002	0.988	1.020	1.010
2000-2008	1.001	1.089	0.992	0.976	1.056
1990-2008	0.966	1.069	0.975	0.991	1.033

TABLE 03. Malmquist Index Of Manufacturing's Sub-Sectors In Malaysia, 1990-2008

SUBSECTOR	EFFCH	TECHCH	PECH	SECH	TFPCH
1	0.967	1.070	1.000	0.967	1.034
2	0.969	1.054	1.018	0.952	1.022
3	1.022	1.089	1.019	1.003	1.113
4	0.843	1.062	0.921	0.916	0.896
5	0.968	1.067	0.966	1.002	1.033
6	1.000	1.035	1.000	1.000	1.035
7	0.991	1.054	0.980	1.012	1.045
8	0.952	1.077	0.986	0.966	1.025
9	0.989	1.064	0.969	1.021	1.052
10	0.991	1.070	0.971	1.021	1.061
11	0.962	1.075	0.962	1.000	1.034
12	1.010	1.073	0.993	1.018	1.084
13	0.952	1.064	1.000	0.952	1.013
14	0.945	1.085	0.949	0.996	1.026
15	0.942	1.069	0.901	1.046	1.032

TABLE 04: Pmg And Mg Estmation Results

	Model 01: ARDL (0,0,2,1,2,1)		Model 02: ARDL (0,0,2,2,0,0,2,2)		
DEPENDENT VARIABLE: TFP	PMG	MG	**DEPENDENT VARIABLE:** TFP	PMG	MG
Short-run Effect ΔlnY	0.73719 (0.22334)**	0.58061 (0.25260)**	**Short-run Effect** ΔlnY	0.92418 (0.20794)***	3.22419 (1.79446)*

ΔKL_{t-2}	0.00140 (0.00208)	0.00325 (0.00402)	$\Delta KL_{t\ t-2}$	-0.00450 (0.00204)**	0.02175 (0.02821)
ΔOPN_{t-1}	-0.04477 (0.02340)	0.07015 (0.31375)	ΔOPN_{t-2}	-0.23867 (0.15543)	-2.4990 (1.55915)
$\Delta lnLB_{t-2}$	-0.19716 (0.09575)**	0.16494 (0.19883)	Δ lnMSKILL	-0.30219 (0.23558)	-1.3090 (1.08338)
$\Delta lnFL_{t-1}$	-0.04985 (0.02825)*	-0.14975 (0.04636)***	Δ lnMLSKILL	-0.08644 (0.07271)	-0.74050 (1.27471)
-	-	-	Δ lnFSKILL $_{t-2}$	0.03523 (0.12497)	0.99887 (0.75563)
-	-	-	Δ lnFLSKILL $_{t-2}$	0.01558 (0.04378)	-0.17310 (0.18333)
Error Correction Term (EC)	-0.90442 (0.21435)***	-1.1115 (0.11600)***	**Error Correction Term (EC)**	-0.99025 (0.20917)***	-2.0133 (0.63319)
Long-run Effect ln Y	-0.09848 (0.02067)***	-1.15913 (0.67630)*	**Long-run Effect** ln Y	-0. 00511 (0.20698)	1.79348 (0.88726)**
KL	0.00025 (0.00006)***	0.00982 (0.00461)**	KL	0.00017 (0.00004)***	-0.00359 (0.00592)
OPN	0.07439 (0.44789)*	0.89880 (0.54480)*	OPN	-0.04930 (0.05224)	0.73390 (0.63640)
lnLB	0.13889 (0.04440)***	0.96684 (0.73691)	lnMSKILL	0.00172 (0.03087)	-1.55119 (0.77571)**
lnFL	0.05384 (0.01237)***	0.44431 (0.23521)*	lnMLSKILL	-0.03425 (0.01465)**	-0.22361 (1.0418)
-	-	-	lnFSKILL	0.04372 (0.00817)***	-0.08210 (0.17694)
-	-	-	lnFLSKILL	-0.01815 (0.00647)***	-0.27145 (0.25800)

Note: Lag order was choose based on AIC (Akaine Information Criteria). Upper value showed the value of coefficient, value in the bracket showed standard error . *** Significant at 1% level of significance, ** Significant at 5% level of significance * Significant at 10% level of significance.