PROSIDING PERKEM VII, JILID 1 (2012) 400 - 408
ISSN: 2231-962X

Globalisation and Total Factor Productivity in the Selected Malaysian Construction Sector

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ABSTRACT

The construction sector has been growing dramatically in line with the expansion of other economic sectors in the Malaysian economy. This sector has been experiencing a tremendous growth and contributes significantly to the employment generation. The sustainability and competitiveness of this sector is very much dependent on its efficiency that can be measured from total factor productivity (TFP) growth. However, the globalisation process may give positive or negative affect on TFP growth of the construction sector, hence, influencing its competiveness in the global arena. This paper aims to investigate the effect of globalisation on TFP growth of the construction sector. Analysis is based on the data from the Construction Survey Malaysia for the period of 1990-2009 collected by the Department of Statistics Malaysia. There are four construction subsectors included in the analysis, namely, residential buildings, non-residential buildings, building installation and civil engineering. The results show that capital-labour ratio and the composition of professional workers are significantly positive. The globalisation indicators like foreign direct investment (FDI), foreign workers and economic openness are used as independent variables in the TFG growth model. The estimation results show that all globalisation indicators in the model affect TFP growth of the construction sector.

Keywords: total factor productivity, efficiency, globalisation, construction sector.

INTRODUCTION

The construction sector is one of the important sectors in Malaysia that contributes to economic growth. This sector has been experiencing transformation since the last decade and progressing in line with globalisation that has taken place heavily during that period. A tremendous change in the development of the Malaysian economy coupled with the relaxing in regulation to own property in Malaysia has contributed to increasing demand for property. The expansion of the construction sector can be observed from its product diversification from housing, shoplots, office buildings, schools, institutions and so on.

In general, the construction sector has been experiencing a moderate growth at about 3-4 percent for the period of 1990-2000 and the highest growth rate was achieved in 1995, at 4.4 percent. Economic prosperity before the 1997/98 crisis had attributed to this high growth. In terms of employment, the construction sector becomes the fourth important employment generating after the services, manufacturing and agriculture sector. The number of employment in the construction sector were highest in the Sixth Malaysia Plan (6MP), despite of decreasing number of employment in other sectors except the manufacturing sector. This is in line with high output growth experienced by this industry during the 6MP, or in 1995 in particular. However, after the 6MP, employment generating in the construction sector had been experiencing instability and achieved the lowest during the Ninth Malaysia Plan (9MP). Economic turmoil due to 2007/2008 crisis had contributed to this scenario.

The Malaysian construction sector is very much relevant in the context of globalisation because of its reliance on foreign workers. Most semiskilled and unskilled workers for this sector come from abroad as the locals are not attracted in working in this sector. Other globalisation indicators like economic openness and foreign direct investment may also affect the performance of the construction sector through various channels like obtaining intermediate inputs and skilled transfer. The present of foreign direct investment in producing parts for the construction sector will help the industry in getting intermediate inputs. Also, economic openness will facilitate this sector in terms of importing inputs that are not available locally. As such, globalisation will facilitate the construction sector to grow faster and be more competitive. On the other hand, globalisation may give negative effect on the construction sector through low quality of inputs, for example, low skills foreign workers which subsequently affect the output quality.

This paper will examine the effect of globalisation on TFP growth for the construction sector. This paper is organised into five sections. The following section discusses the literature reviews followed by the methodology and model specification. Section 4 analyses the results and section 5 is the conclusions.

LITERATURE REVIEW

Most single country studies using time series data showed that FDI had positive and significant effect on TFP growth (see for example Adhikary 2011 for a study in Bangladesh, Nuzhart 2009 for Pakistan, Hong & Sun (2007) for China; Anuwar & Nguyen 2009 for Vietnam). In these studies FDI spillovers generated strong positive impact on TFP through backward vertical linkages. Thiam (2006), compared eight East Asian economies in studying the linkage between FDI and TFP, they are China, Hong Kong, Indonesia, Malaysia, Republic of Korea, Singapore, Taiwan and China using Granger causality test and it is shown that only two countries reveal evidence of a one-way causality between inflows of FDI and TFP growth, ie- Singapore and Taiwan. The findings from this study is supported by Bruno and Koen (2009), Kien (2008), Bin and Eric (2005), Carkovic and Levine (2002), which showed that FDI had significant and positive effect on TFP growth. Tanna (2009), using a time series data for the period of 2000-2004, on the other hand, found that the inward FDI had a negative short-term effect but a positive long-term effect on TFP change.

Ram and Zhang (2002), used cross section time series data (panel data) for the period of 1990s and their findings showed that FDI had a significant and positive relationship on technologies and TFP growth. Simeon and Bernard (2000), investigated firm-level data for the Czech Republic to show that during 1992–96 foreign investment had the predicted positive impact on total factor productivity growth of recipient firms. This result is robust to corrections for the sample bias that arises because foreign companies tend to invest in firms whose initial productivity is above average. The study that used pooled and panel data is subject to endogeneity problem and this can be solved by dynamic panel data. Hong and Sun (2007), adopt a spatial dynamic model to assess the TFP effects from externalities generated by FDI. The result shows that the impact of FDI externalities on TFP growth is significant and positive in China over the period 1980-2005.

However, while some studies showed a positive relationship between FDI and TFP growth, other studies concluded the reverse. Busse and Groizard (2006), for example, found that no robust relationship between FDI and income growth including productivity had been established. In addition, Balasubramanyam et al. (1996), Aitken and Harrison (1999), Papi and Rovoltella (2003) found that FDI had no significant impact on TFP growth in the countries they studied.

Economic openness has changed pattern of sectoral output towards higher value- added, which subsequently leads to increasing in total factor productivity. The export-import activities will enlarge the market channel and supply chain of a country. These activities will lead to higher productivity of a sector and product diversification may easily take place. Many studies on the effect of economic openness on TFP growth had shown significant and positive results. These include study by Yan, Yihong and Findlay (2010), Eanindita (2011), Pedro and Alberto (2009), Andre (2008), Kim,Lim and Park (2007), Alessandra (2007), Ousmanou and John (2011), Andrei, Romain and Mathias (2007), Bin and Eric (2005), Anderson (2001), Mahadevan (2002), Jonsson and Subramanian (2001), Edward (1998) and Felipe (1997).

Many earlier studies on the trade-growth nexus imply import and export enhance productivity growth because firms exposed to international competition tend to absurd best-practice technology. Kim,Lim and Park (2007), investigate the effect of import and exports via openness economy on TFP in Korea during 1980-2003 and the Granger causality from openness economy are significantly positive effect on TFP growth. However, their empirical results suggest that lower trade barriers and higher imports would have been beneficial for Korea's productivity growth.

The China's openness policy had strongly positive effect on TFP growth, efficiency improvement and technological progress at an annual rate 3.9 percent, 1.6 percent and 2.3 percent respectively (Yan, Yihong & Findlay, 2011). Trade liberalization and service outsourcing leads to a significant increase in TFP of located in east China by using a panel dataset of Chinese manufacturing firms over period from 1998 to 2007. These finding is similar with the Ousmanou and John (2007) who study firm–level data of Cameroon manufacturing were used to assess the effects of trade liberalization on firm-level TFP growth. Result show that significant productivity gains from outward-orientation, and import competition had a positive effect on driving TFP growth.

Mahadevan (2002), Jonsson and Subramaniam (2001) examined the impact of trade liberalization and openness on TFP growth and technologies progress and for manufacturing industries. Their study showed that trade liberalization had a positive and significant impact on TFP growth in the Australian and South Africa manufacturing industries. Their study also showed that there was a positive long run relationship between TFP and openness. Linda Anderson (2001), used industry level data for Swedish manufacturing during the period 1980-1995 and found that domestic R&D intensity does not contribute to the growth rate of TFP. Instead, openness to international markets, which helps facilitate technology spillovers, contributes to the growth of total factor productivity.

Eanindita (2011) aimed to find out how economic openness and human capital influence the growth of TFP in the three regions of Indonesia, with analysis of panel data from 1993 to 2002. Based on estimation results in this study indicate that the ratio of export to the GRDP and high educational attainment have positive and significant effect on TFP. While terms of trade, inflation rate, capital stock growth and labour force growth have significantly negative effect on the growth of TFP.

However, while some studies show a positive relationship, other studies conclude the reverse. Harris and Kherfi (2001) found that trade openness had no significant impact on the rate of productivity growth in the Canadian manufacturing sector. Adhikary (2011), examines the linkages between TFP, FDI, trade openness, capital formation and economic growth rates in Bangladesh over a period 1986-2008 and finds that the degree of trade openness have negatively affect TFP growth.

THEORETICAL FRAMEWORK, MODEL SPESIFICATION AND THE DATA

DEA Framework

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 total factor productivity and breaking it down into two components, namely, technical change (TECHCH) and technical efficiency change (EFFCH).

TFP growth measures how much productivity grows or declines over time. When there are more outputs relative to the quantity of given inputs, then TFP has grown or increased. TFP can grow when there is improvement in innovations such as product design, and this is referred to technical change (TECHCH). TFP can also grow when the existing technology and economic inputs are utilized more efficiently. This subsequently will lead to higher production and is referred to technical efficiency change (EFFCH).

The analysis in this article adopts the output-oriented approach of DEA-Malmquist to put greater weight on the expansion of output from a given amount of inputs. Therefore, TFP index is a ratio of the weighted aggregate output to weighted aggregate input. Input and output quantities of the industries are the set of data used to construct a piece-wise frontier over the data points. Efficiency measures are then calculated relative to this frontier that represents an efficient technology. The best-practice industry determines the production frontier, that is, those that have the highest level of production given a level of economic inputs.

Since many inputs are used, and shared outputs may be produced, the Malmquist approach was developed to combine inputs and outputs and then measure changes. The Malmquist index measures the total factor productivity change (TFPCH), between two data points over time, by calculating the ratio of distances of each data points relative to a common technology.

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

$$m_o(y_{t+1}, x_{t+1}, y_t, x_t) = [\frac{d_o^{t+1}(y_t, x_t)}{d_o^{t+1}(y_{t+1}, x_{t+1})} x \frac{d_o^t(y_{t,} x_t)}{d_o^t(y_{t+1,} x_{t+1})}]^{\frac{1}{2}} \qquad (1)$$

The above equation represents the productivity of the production point (x_{t+1},y_{t+1}) relative to the production point (x_t,y_t). This index uses period t technology and the other period t+1 technology. TFP growth is the geometric mean of two output-based Malmquist-TFP indices from period t to period t+1. A value greater than one will indicate a positive TFP growth from period t to period t+1 while a value lesser than one will indicate a decrease in TFP growth or performance relative to the previous year.

The Malmquist index of total factor productivity change (TFPCH) is the product of technical efficiency change (EFFCH) and technical change (TECHCH) as expressed (Cabanda, 2001):

$$TFPCH = EFFCH \times TECHCH \qquad (2)$$

The Malmquist productivity change index, therefore, can be written as:

$$M_0 (y_{t+1}, x_{t+1}, y_t, x_t) = EFFCH \times TECHCH \qquad (3)$$

Technical efficiency change (catch-up) measures the change in efficiency between current *(*t) and next *(*t+1) periods, while the technical change (innovation) captures the shift in frontier technology.

As expressed by Squires and Reid (2004), technical change (TECHCH) is the development of new products or the development of new technologies that allow methods of production to improve and results in the shifting upwards of the production frontier. More specifically, technical change includes new production processes, called process innovation and the discovery of new products called product innovation. With process innovation, firms figure out more efficient ways of making existing products allowing output to grow at a faster rate than economic inputs are growing. The cost of production declines over time with process innovations, ie. new ways of making things.

Technical efficiency change, on the other hand, can make use of existing labour, capital, and other economic inputs to produce more of the same product. An example is increase in skill or learning by doing. As producers gain experience at producing something they become more and more efficient at its labour finds new ways of doing things so that relatively minor modifications to plant and procedures can contribute to higher levels of productivity.

When the value of TFP is obtained, the TFP growth model is established. The independent variables for this model include four globalisation indicators besides other variables. Adopting Cobb-Douglass non-constant returns to scale and adding the globalisation indicators, the TFP growth function can be specified as follows:

$$TFP_{it} = f(Y_{it}, \frac{K}{L_{it}}, \frac{Lp}{TL_{it}}, \frac{Lt}{TL_{it}}, FL_{it}, FDI_t, OPN_t) \qquad (4)$$

The estimation model for TFP growth is as follows.

$$TFP_{it} = \alpha + \beta_1 lnY_{it} + \beta_{2\,i}(K/L)_{it} + \beta_{3\,(}Lp/L)_{it} + \beta_4(Lt/L)_{it} + \beta_5 lnFL_{it} + \beta_6 lnFDI_t + \beta_7 OPN_t + \varepsilon_{it} \qquad (5)$$

$i = 1, \ldots .N$ *are construction subsectors* $\qquad$ $t = 1, \ldots .T$ *are years*

where TFP_{it} is total factor productivity of subsector *i* at period *t*, Y_{it} for a vector of subsector real output, $\frac{K}{L}\,it$ is real capital –labour ratio, L_{it} is total labour Lp_{it} is professional labour, Lt_{it} is technical labour, FL_{it} is foreign labour, FDI_t is national real foreign direct investment, OPN_t is national economic openness and ε_{it} is the error term. α and β, are the parameter estimates. The natural logarithm is applied to all variables except the ratio.

Source of Data

Analysis in this paper uses panel data from the Contraction Survey conducted by the Department of Statistics Malaysia. This approach combines time series and cross sectional data. Data Envelopment Analysis (DEA), is used to measure TFP growth. The study covers 20 observations by times series, from 1990 to 2009 and 4 sub-industry observations making the total of 80 panel data observations. A multi regression model is used to investigate the relationship between TFP and several independent variables, namely, capital intensity, professional labour, technical labour, foreign workers, foreign direct investment, technology agreement an economic openness. These data are gathered from Ministry of International Trade and Industry (MITI), Immigration Department, Malaysian Industrial Development authority (MIDA) and Economic Planning Unit (EPU).

RESULTS

Table 1 shows some important indicators for the contraction subsectors. The subsector of building installations had the highest value added, capital and labour throughout the study period from 1990-2005. However, in line with the lucrative business activities overtime, in the 2009, the subsector non-residential buildings had demonstrated the highest value of these three indicators. Table 2 shows the descriptive statistics of the variables. Overall, the construction sector has experiencing a negative TFP with the mean value of 0.65. The mean value for real output is RM10.2 billion and the capital-labour ratio is RM16, 616.2. This sector has small percentage of professional workers and technical workers at the average of 4.9 percent and 5.7 percent respectively. On average, number of foreign workers involved in the construction sector is about 44,735 persons and FDI of RM 181 billion. The degree of openness for the Malaysian economy stands for 1.727 on average under the study period.

Before we estimate the models, data stationary is checked to avoid spurious regression. The panel unit root test result using Phillips Peron (PP) is shown in Table 3. The result shows that all variables are stationary at level I(0)and this verifies that all variables are integrated of order zero. Therefore, we do not have to perform co integration analysis to check the long run relationship.

The estimation results of equation (5) are summarized in Table 4. The redundant test for Pooled Least Squared (PLS) and Fixed Effect (FE) models is conducted and the results are shown in Table 4. The Random Effect (RE) model is not tested because the number of cross section is less than the number of regressors (4 verses 7). Therefore, it is not appropriate to use RE in analyzing panel data. From the result, it is confirmed that we reject the null hypothesis at 1% significance level. This implies that the FE estimation is more appropriate than the PLS. We also check for autocorrelation. The results show no problem of autocorrelation based on the value of Durbin Watson (DW) of 1.81 and 2.06 in PLS and FE models respectively.

All variables in the FE model are shown to be significant in affecting TFP growth except the ratio of technical workers. The coefficient of determination R^2 is 0.6721, which shows 67.21 percent of the variation in the TFP can be explained by the independent variables. Value of output, capital-labour ratio and share of professional workers are significantly positive in affecting TFP in the construction sector. This reflects the more capital intensive is the sector, the higher is the TFP, which indicates the importance of level of technology. Also, the higher the share of professional workers out of total labour, the higher will be the TFP. These two ratios give a clear signal to the policy makers that any policy direction should embed enhancing capital utilization and skills.

Globalization variables like foreign labor, FDI, and economic openness show positive and significant relationship with TFP growth in Malaysian construction sector. It shows that an increase of 1 percent of foreign labor will increase TFP by 0.0048 point. This study is supported by Nikolaj. et al (2011), Peri 2010, and Everlyn and Chan (2009). Meanwhile, an increase in 1 percent of FDI and economic openness will increase TFP by 0.0008 point and 0.37 point respectively. These findings are consistent with Adhikary (2011) for study in Bangladesh, Hong and Sun (2011) for china, and Anuwar and Nguyen (2009) for Vietnam. Study by Andre (2006), Kim, Lim and Park (2007), Yan, Yihong and Findlay (2011), and Eanindita (2011) who found that economic openness, foreign trade, imports and exports are positive and significantly affect TFP growth.

CONCLUSION

The results from this study demonstrate the positive relationship between output, capital intensity, professional workers, foreign labor, FDI and degree of economic openness with TFP growth for the selected construction subsectors. This means all globalization indicators have affected TFP positively and enhancement in these variables is needed. The construction sector needs to be more capital-intensive and employing more professional workers. The ratio of professional workers in the construction sector is noticeably low as shown by the data (less than 5 percent). Therefore, an increase in these types of workers is required for example through increasing number of engineers and architects.

All globalization indicators have positive and significant effect on TFP. This implies that globalization encourage the construction sector to be more efficient and productive. The government cannot stop the present of foreign workers in the construction sector, because the locals are not interested in this sector. Apart from this, at present Malaysia still relies on foreign expertise in building up high rise buildings and giant construction projects. Therefore, in the short-run the inflow of expatriates to facilitate the construction sector cannot be avoided, however, in the long-run, Malaysia must lessen its dependency on foreign expertise by enhancing its human capital.

The FDI should be encouraged for investment in the potential subsectors that have direct relationship with the construction sector like producing parts and machineries. Economic openness will definitely increase trade especially in terms of imports of goods and services for the construction sector. Many of the intermediates inputs are still imported especially high quality inputs like roofing and tiling. When these inputs can be produce locally, the price is expected to be lower and this will help the sector to reduce cost of production and be more competitive.

As a conclusion, the importance of the construction sector cannot be deniable. The demand for the construction products of all kinds is continuously increasing and greater efficiency from the supply side is certainly needed. TFP growth, which reflects efficiency, must keep positive and this is deemed important for the construction sector. The negative TFP growth displayed by the construction sector throughout the study period is quite alarming and this needs a proper policy to counter the problem. Any policy direction must cater the important determinants of TFP as found in this study.

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APPENDIX

TABLE 1 : Important Indicators for Construction Subsectors Development and TFP

Year	Industry	Value Added RM ('000)	Capital RM ('000)	Labor ('000)
1990	**Cons1**	911,712	284,525	682,885
	Cons2	817,271	402,004	574,177
	Cons3	1,596,406	908,109	840,943
	Cons4	623,498	269,847	462,659
1995	**Cons1**	2,011,064	746,508	1,452,300
	Cons2	3,395,169	1,421,468	2,327,236
	Cons3	5,225,629	2,327,925	2,685,730
	Cons4	1,654,553	766,063	1,246,535
2000	**Cons1**	2,909,055	1,149,904	2,137,328
	Cons2	3,289,425	1,229,510	2,232,791
	Cons3	4,849,143	3,067,664	2,863,279
	Cons4	2,176,770	1,241,100	1,488,900
2005	**Cons1**	4,590,913	1,549,669	2,951,993
	Cons2	3,570,195	1,233,340	2,381,620

	Cons3 **Cons4**	5,742,043 3,070,061	3,044,560 1,658,949	3,599,529 1,934,523
2009	**Cons1** **Cons2** **Cons3** **Cons4**	5,239,840 5,388,971 3,597,803 1,845,522	1,919,118 2,078,780 1,651,608 1,218,926	3,457,280 3,769,524 2,113,686 1,170,798

TABLE 2: Statistic Descriptive of the Variable

Variable	**Mean**	**Median**	**Maximum**	**Minimum**	**Standard Deviation**	**N**
TFP	0.655925	0.729500	1.00000	0.001000	0.346748	80
Y	10198515	9629744	21181561	2273622	4981063	80
K/L	16.6162	15.6478	38.9682	0.4166	7.5735	80
LP/TL	0.0489	0.0426	0.1995	0.0058	0.0278	80
LT/TL	0.0572	0.0532	0.2192	0.0049	0.0315	80
FL	44735.47	39806.50	430114.2	2658.000	48573.89	80
FDI	181.3043	16347.70	48098.80	6287.000	10579.27	80
OPN	1.727	1.715	2.75	1.33	0.3001	80

Notes:
Y = Real value gross output of construction sector (RM '000)
K/L = Capital intensity/ value of real capital per total of labour in the construction sector (RM'000)
LP/TL= Ratio of professional labor per total of labour in the construction sector
LT/TL = Ratio of technical labour per total of labour in the construction sector
FL = Number of foreign labour in construction sector (unit of labour)
FDI = real value of national foreign direct investment (RM billion)
OPN = Degree of openness economic for overall Malaysia (ratio)

TABLE 3 : Philips Peron (PP) in Unit Root Test

Variable	**At level I(0)**	
	Constant+ trend	**Constant + Trend**
TFP	40.4551***	31.6217***
LnY	23.4283***	26.9369***
$\frac{K}{L}$	27.7307***	35.8596***
$\frac{Lp}{TL}$	22.2151***	29.3016***
$\frac{Lt}{TL}$	13.6169*	19.3016***
LnFL	52.7524***	45.4191***
LnFDI	21.1614***	18.6502**
OPN	15.7831**	22.8486***

TABLE 4 : Estimation Result of TFP Equation

Dependent Variable : TFP	**Model I**	
	Pooled Least Squared	**Fixed Effect**
Independent Variable		
C	11.7671 (3.1694)***	12.9574 (3.4216)***
lnY	0.0231 (2.4738)**	0.0254 (2.7158)***
$\frac{K}{L}$	0.0248 (2.7398)***	0.0252 (2.5641)**
$\frac{Lp}{TL}$	0.5273 (3.6788)***	0.0255 (2.2166)***
$\frac{Lt}{TL}$	-0.4302 (-0.5651)	-0.4254 (-0.5411)
LnFL	0.3849 (1.9156)*	0.4879 (3.4144)***
LnFDI	0.0234 (2.5146)**	0.0874 (1.8775)*
OPN	0.4978 (3.0585)***	0.3746 (1.8879)*
R-Squared	0.6149	0.6721
F-Statistic	21.0840	17.5583
ρ-value	{0.0000}	{0.0000}
Cross section Effect		
Cons1		0.0779
Cons2		-0.1362
Cons3		0.2666
Cons4		-0.2083
DW – Statistic	1.8139	2.0583
Redundant Test		Pooled VS Fixed Reject H0 (FCritical>FTable)
F-Wald Test		4.8325
F (5%)		2.79
F (1%)		4.13

Notes: - Numbers in ( ) and { } are t value of coefficient β and ρ-values respectively, *, ** and *** denoted significance at the 10%, 5% and 1% level respectively.

- Cons1: Residential Buildings; Cons2: Non-Residential Buildings; Cons3: Building Installation (Including Repairs); Cons4: Civil Engineering