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**Malaysian Manufacturing Industries**

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**ABSTRACT**

Malaysia has been among the major recipients of foreign direct investment (FDI) in the world. However, the benefits of FDI spillovers on skill upgrading in Malaysia remains ambiguous. This is particularly important to country like Malaysia as the volume of FDI inflows have kept on increasing over time recently. The present study adds to the literature investigating the effects of FDI as a spillover channel to foreign trade in enhancing the relative demand for skilled labour on 50 Malaysian manufacturing industries during the period of 2000-2008. Our empirical results based on the generalized method-of-moments system estimator reveal that the spillover effects via FDI are significant for skill upgrading, and in turn, lead to an increase in demand for skilled labour. Even though the coefficient for FDI indicates negative relationship between FDI and skilled labour demand, the effect of FDI is statistically positive and significant. This gives an indication that the spillover effects of FDI appears to be assimilated quickly by the workers in the Malaysian manufacturing industry through the “learning effect” and the fast pace is biased towards skilled workers. Nevertheless, this study finds no evidence of spillover effects via trade in influencing the demand for skilled labour. The findings from this study can potentially contribute to long-run FDI policy, especially to encourage FDI inflows into low receiving industries.

*Keywords***:**FDI, trade, skilled labour demand and spillover effects

# INTRODUCTION

A plethora of studies have documented the spillover effects of FDI and trade as their main channel. The literature covers both macro- and microeconomic evidence, including industry-level studies([Acemoglu, 1998](#_ENREF_1); [Coe & Helpman, 1995](#_ENREF_14)). The theory of spillover effects reveals that there are complementarities of technology diffusion, and hence the increase for the demand for skilled labour. The technology spillovers not only introduce and create new technologies to domestic usage, but it also expands the utilization of spillovers, thus induces organization improvement, which fosters the restructuring process and increases both the demand and supply of skills ([Bruno, Crinò, & Falzoni, 2012](#_ENREF_12)). As foreign ownership is often associated with skill-biased technology, advantages enjoyed by skilled workers tend to be higher than that of unskilled workers. It is due to the effective bargaining ability of skilled workers in foreign firms, causing a relative expansion of skill intensive sectors, and which improves the relative position of skilled workers as well as increases wage inequality ([te Velde, 2002](#_ENREF_38)). Nevertheless, how inward FDI influences human capital development in term of skill upgrading on the supply side is much less clear whether it is taking place at the micro-level or the macro-level ([Slaughter, 2002](#_ENREF_36)).

 With regards to Malaysia’s aim to enhance the number of skilled workers towards becoming a high income country, Malaysia recognizes the association between upgrading process of knowledge and skill with foreign technology spillovers through the channel of FDI and trade (World Bank, 2007).Since 1980s, multinational companies (MNCs) have been the main sources of investment that contribute to trade, capital formation and productivity. They also act as a catalyst in job creation and improvement of labour quality ([Ariff, Yokoyama, & Kenkyūjo, 1992](#_ENREF_8)). According to Minister of International Trade and Industry (MIDA), the number of FDI inflows rose sharply in Malaysian manufacturing industries since 2004 from RM 45.7 billion to RM RM61.6 billion in 2010. United Nations Conference on Trade and Development (UNCTAD) ranks Malaysia as a top host country for FDI in 2011-2013.

Despite being among the major recipients of FDI in the world, the benefit of FDI spillovers on skill upgrading in Malaysia remains ambiguous. This issue is particularly important for a country like Malaysia as the volume of FDI inflows has been increasing recently as shown in Table 1.1. In terms of the share of investment projects in the manufacturing sector (measured by approved investments projects),the Table 1.2 shows that the share of foreign investment registered the highest share compared to domestic investments during the period of 2000 to 2010(with the exception of 2009 and 2011)[[4]](#footnote-4).Projects involving foreign investment show an increased trend RM 19.84 billion in 2000 to RM 34.2 billion in 2011.Therefore, it raises a question regarding the real benefits of technology spillovers from FDI that Malaysia is able to reap from their presence.

Table 1.1: FDI Inflows in Malaysia (US$ Million)

|  |  |
| --- | --- |
| **Year** | US$ Million |
| 2000 | 6,324 |
| 2001 | 2,714 |
|  2002 | 3,203 |
| 2003 | 2,473 |
| 2004 | 4,624 |
| 2005 | 3,967 |
| 2006 | 6,072 |
| 2007 | 8,538 |
| 2008 | 7,248 |
| 2009 | 1,405 |
| 2010 | 9,155 |
| 2011 | 12,000 |

Source: UNCTAD, World Investment Report (1998, 2002, 2004, 2006, 2012).

Table 1.2: Approved Investment Project in the Manufacturing Sector, 2000-2011(RM billion)

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Domestic Investment (RM billion)** | **Share of Domestic Investment (%)** | **Foreign Investment (RM billion)** | **Share of Foreign Investment (%)** | **Total Capital Investment (RM billion)** |
| 2000 | 13.76 | 40.9 | 19.84 | 59.1 | 33.60 |
| 2001 | 5.24 | 24.7 | 16.11 | 75.3 | 21.35 |
| 2002 | 6.30 | 35.3 | 11.57 | 64.7 | 17.87 |
| 2003 | 13.50 | 46.3 | 15.64 | 53.7 | 29.14 |
| 2004 | 15.63 | 54.3 | 13.15 | 45.7 | 28.78 |
| 2005 | 13.17 | 42.4 | 17.88 | 57.6 | 31.05 |
| 2006 | 25.76 | 56.0 | 20.27 | 44.0 | 46.03 |
| 2007 | 26.51 | 44.2 | 33.43 | 55.8 | 59.94 |
| 2008 | 16.69 | 26.6 | 46.01 | 73.4 | 62.70 |
| 2009 | 10.49 | 32.1 | 22.14 | 67.9 | 32.63 |
| 2010 | 18.12 | 38.4 | 29.10 | 61.6 |  47.22 |
| 2011 | 21.9 | 55.4 | 34.2 | 44.6 | 56.07 |

Source: MIDA, 2000-2012

 Through past literatures on the effects of technological change on skilled labour demand, it is noted that the importance of technological change is undisputable. However, there are also significant effects of spillover from trade and FDI channels to explain the demand for skilled labour ([Araújo, Bogliacino, & Vivarelli, 2009](#_ENREF_5)).Nevertheless, both spillover effects of FDI and trade on relative demand for skilled labour is still absent from the empirical literature and is still under scrutiny, particularly in developing countries and at the industry level. Most previous studies mainly focus on the manufacturing sector at a high level of aggregation (Feenstra and Hanson, 1995, 1996, 1997a, 1997b, 2001; Berman *et al.*, 1994, Egger, Pfaffermayr & Wolfmayr-Schnitzer, 2001; [Cheung &Lin, 2004;](#_ENREF_86) Egger & Egger, 2005; Taylor and Driffield, 2005; [Fajnzylber & Fernandes,2009](#_ENREF_19)). Only, recently, studies start using firm-level data (Head &Ries, 2002; Pavcnik, 2003; Gorg & Hanley, 2005; Yamashita, 2008; Bandick & Hansson, 2009; Meschi et al., 2011, Agnese, 2012). However, most above mentioned studies focused on the developed countries.

 Malaysia is no different in this phenomenon, where the relationship between employment and FDI is not very substantial, especially in the long run and it has become an issue of current interest (Pinn et.al., 2011) This might be due to the fact that FDI could cause skilled-biased technological change in the country, causing minimal increment in demand for skilled labour in Malaysia. In this regard, we extend such work by adding FDI as a spillover channel of foreign trade to investigate to what extent the spillover effects of FDI may contribute to skill upgrading, and thus increase demand for skilled labour in the Malaysian manufacturing industry. The dataset provide by Department of Statistics Malaysia (DOSM) has the information on share of local workers in foreign firms to total employment (parents and affiliates) at establishment level which enable us to directly analyse whether the spillover effects of FDI contributes to skill upgrading and thus increase on skilled labour demand within the firms. Previous studies use dummy variable to measure the spillover effects of FDI on skilled labour demand[[5]](#footnote-5).

 To the best our knowledge, there is no study that empirically examines both spillover effects of trade and FDI on skilled workers demand particularly using establishment level data for Malaysian manufacturing industry. Studies by McNabb & Said (2013) and Devadason (2005, 2011) have focused on the effect of trade on skilled labour demand. McNabb & Said (2013) and Devadason (2005, 2011) have matched the SITC (Standard International Trade 4 Classification) trade data at 3-digit industry-level with the Household Income Survey and Annual Survey of Manufacturing Industries (ASMI), respectively. Only recently, study by Jauhari & Khalifah (2013) using the establishments-level data to analyse the different type of trade linkages including outsourcing intensity, export intensity as well as vertical trade intensity while controlling for foreign ownership (FDI)in the Malaysian E&E industry during the period of 2000-2005.In terms of spillover effects via FDI, [Fajnzylber and Fernandes (2004](#_ENREF_19),2009) used data from Investment Climate Surveys performed by the World Bank in Asia and Latin America to examine how the effect of international diffusion of technology through the channel of importing of intermediate inputs, exports and FDI on demand for skilled labour in Malaysia.

Many previous studies show the positive results of technology spillover effects on demand for skilled labour, but these results suffer from aggregation bias or failure to control for endogeneity due to limited panel data at the industry level and also difficulty to find instrumental variables ([Keller, 2004](#_ENREF_27)). Consequently, by using panel data at the industry level, we employ a more advanced dynamic panel econometric technique that formally addresses industry-specific effects and simultaneity bias. The method relies on the generalised method-of-moment (GMM) estimator, which has a number of advantages over the cross-section estimator.

# LITERATURE REVIEW

The importance of technology spillovers attracts considerable attention in theoretical and empirical works as an effective channel in increasing demand for skilled labour ([Acemoglu, 1998](#_ENREF_1); [Coe & Helpman, 1995](#_ENREF_14)). According to [Acemoglu (1998](#_ENREF_1)), international trade and FDI play a key role that contributes to skill upgrading through the spillover of skill-biased technology from industrial countries to developing countries. The mechanism of spillovers from one country to other countries is in line with the endogenous growth models that are extended from the Romer’s closed-economy framework to an open-economy setting.

 Theoretically, the spillover effects of MNCs contribute to the initial knowledge by introducing new technologies and products to domestic firms. In line with the evolutionary theory, [Blomström and Kokko (1998)](#_ENREF_54)outlined four ways in whichFDI spillover their technology and knowledge into local firms might influence the host country:(i) through the training effect that causes the movement of highly trained and skilled staff from foreign firms to domestic firms; (ii) through what is referred to as the“ demonstration-imitation effect” that arises from arm’s-length relationships between MNCs and domestic firms, thus enabling the domestic firm to learn and adopt superior production technologies and managerial and organisational skills; (iii) through the “competition effect” from domestic firms when competition from MNCs forces domestic rivals to upgrade production technologies and techniques in order to remain productive and competitive and iv) through the “linkage effect,” which is related to export spillovers by which the domestic firms can learn to export from the MNCs.This is a positive move, as it helps to improve the productivity and competitiveness of local firms, forcing them to operate efficiently by transforming the knowledge acquired into practical and commercial use; yet these gains cannot be internalized by these foreign firms (Lall,1978). These results are what is known as “spillover” effects (Fan&Warr, 2000).

 With regard to empirical evidence of the spillover effects of FDI in developed countries, a study by [Bandick and Hansson (2009)](#_ENREF_29) on 50 Swedish manufacturing firms during the period of 1993-2002 showed that demand for skilled labour tended to rise in non-multinational firms, but did not show any effect in multinational companies (MNEs). By using propensity score matching with difference-in-difference estimation, an interesting finding was observed in which the larger presence of foreign MNEs appeared to have a positive impact on the relative demand for skills in Swedish MNEs within the same industry, as well as the elasticity of substitution between skilled and less-skilled labour, which seemed to be lower in MNEs compared to non-MNEs. This was supported by [Figini and Görg (1999](#_ENREF_31)) and [Taylor and Driffield (2005)](#_ENREF_300)who asserted that there was a contribution of FDI inflows to skills upgrading and increasing wage dispersion in Irish manufacturing and in United Kingdom (UK) manufacturing. [Branstetter (2006)](#_ENREF_64) showed that capital investment acted as an effective channel for knowledge spillover from Japanese MNEs to firms in the United States. However, a study by [Blonigen and Slaughter (2001)](#_ENREF_55) on US manufacturing from 1977 to 1994 showed that the spillover effects of FDI insignificantly increased demand for skilled workers within the US manufacturing sector. This result indicated that FDI does not generate positive intra-industry spillovers for domestic firms in spite of FDI being a primary technology transporter to local firms in the US. A similar result was found by [Konings (2001)](#_ENREF_197), which showed a negative effect of FDI spillovers on domestic firms in Bulgaria and Romania, while there were no spillover effects of FDI in Poland.

Regarding the evidence of spillover effects via FDI in developing countries, a study by [Cheung and Lin (2004)](#_ENREF_86) in China showed that FDI impacts were positively associated with skills upgrading and increased local innovation in China through reverse engineering and the demonstration-imitation process. A similar study performed by [Zhao (2001)](#_ENREF_323) asserted that FDI could increase the relative wages of skilled labour through labour market segmentation and high labour mobility costs. They estimated the relative wages in Chinese state-owned enterprises (SOEs) and foreign-invested enterprises (FIEs) by correcting for possible sample selectivity caused by employment choice between SOEs and FIEs. Thenceforth, they investigated the employment choice in order to provide evidence of the costs of labour mobility. The overall results showed that the skill premium in a country with labour market distortions may increase faster as compared to skills upgrading, which was caused only by skill-biased technology. In terms of spillover effects of FDI by country, [Todo, Zhang, and Zhou (2009)](#_ENREF_307)found that Japanese MNEs do not contribute highly to knowledge spillovers, despite the increasing number of skilled workers in Chinese manufacturing firms. Nevertheless, they found that spillover effects from US MNEs were effective in enhancing the share of skilled labour in Chinese manufacturing firms. Meanwhile in Indonesia, TeVelde (2002) found evidence of sector bias in utilising skilled workers in a local Indonesian firm, resulting in 60% higher wages for skilled workers working in foreign-owned firms. In Thailand manufacturing firms, Matsuoka (2001) showed higher wage premiums paid to skilled workers in foreign-owned by 12% and 16% relative to unskilled workers in 1996 and 1998, respectively.

The spillover effects of trade on the demand for skilled labour are closely associated with fragmentation trade through imported input. [Duranton (1999)](#_ENREF_108) found that the fragmentation of intermediate goods was more effective in influencing the labour demand instead of final goods. This could be because the production of the final goods requires advanced production technology, which necessitates resorting to trade to acquire the high- quality intermediates abroad due to the scarcity of skilled labour locally rather than the intermediate goods. The import of intermediate input acts as a channel of technology diffusion in influencing demand for skilled labour in firms of developing countries through the use of these inputs that embodies state-of-the-art technology, especially if these inputs could not be acquired domestically ([Grossman & Helpman, 1991](#_ENREF_150); [Keller, 2004](#_ENREF_188)). Consistently,[Mei-ci (2010)](#_ENREF_230)asserted that technology spillovers through the import of intermediate goods that embodies knowledge are also skill-biased, which makes developing countries increase the relative demand for skilled labour in 28 Chinese manufacturing firms during the period of 1996-2006. [Mei-ci (2010)](#_ENREF_230) applied a translog cost function and firstly built up an endogenous technical progress model with imported intermediate goods from industrial countries. The result also showed that the effect of technology spillovers appeared differently across different types of manufacturing sectors. For technology-intensive sectors, the technology spillovers were skill-biased compared to labour-intensive sectors for which the technology spillovers were skill-neutral. However, this finding contradicts the tenet of the basic trade theory according to which trade liberalisation experiences a reduction of wage inequality in those countries with low-skilled labour-abundant economies (Stolper&Samuelson,1941). Stolper and Samuelson (1941) asserted that the relative wages of skilled labour can rise due to higher import of inputs.

Empirical evidence on skilled labour demand effect of fragmentation, measured by share of imported of capital good, provides a consensus of a positive association between the two variables. [Robbins (1996)](#_ENREF_277)showed that the import of capital goods such as machinery and components has contributed to increased skilled labour demand in several developing countries over the last two decades. This occurred through the adaption or adoption of these capital goods that embodied knowledge and modern technology. This technology has been used in most advanced countries, thereby showing a substantial increase in the demand for skilled labour within the developing countries ([Lee&Vivarelli, 2006](#_ENREF_204)). For instance, Mazumdar, Quispe-Agnoli and Atlanta (2002)in Peru revealed that increased import of machinery followed by liberalisation contributed to the rise in demand for high-skilled white-collar workers in the manufacturing industries in early 1990.This result was supported by [Milkman and Pullman (1991)](#_ENREF_233), who argued that the new processes using technologically complex machinery resulted in increased demand for skilled technicians, maintenance as well as engineers, particularly in automobile assembly plants. Nevertheless, it is important to note that the effect of trade liberalisation on skilled labour demand is greater in developing countries compared to industrialised countries and can be clearly seen when the gap between existing and newly imported technology is large ([O’Connor & Lunati, 1999](#_ENREF_248)).

 In East Asian countries,[Yamashita (2008)](#_ENREF_321) found that the expansion of fragmentation trade with East Asia (developing countries) significantly upgrades the skills of Japanese manufacturing employment, while fragmentation trade with OECD (developed countries) had a skill downgrading effect; whichled to a 1.02% decline in the share of skilled workersover the period 1980-2000.The result was consistent with the argument put forward that component imports such as highly capital and technology-intensive content from high- income countries might substitute for domestic skilled workers. This result suggested that increased component imports from high-income countries require more unskilled workers for further processing. However, some evidence found the effect of trade-fragmentation on demand for skilled labour is still not clear cut, since there are cases of positive effects, no effects and negative effects. For instance, [Geishecker and Görg (2005)](#_ENREF_136) study for German industries data within the period 1991 to 2000 asserted that the impact of trade fragmentation on the host country was still unclear, particularly when labour mobility occurred between industries. Fragmentation in one industry may affect labour in other industries as workers move from the affected industries. Thus, the effects of trade fragmentation may not just be confined to changes in the demand between industries, but relative demand within industries ([Feenstra, 1998](#_ENREF_122); [Hijzen, Görg&Hine, 2005](#_ENREF_165" \o "Hijzen, 2003 #1236)).

Empirical evidence shows that the demand for skilled workers is also affected by international outsourcing. A study by [Hijzen, Görg and Hine (2005)](#_ENREF_166)investigated the impact of international outsourcing on labour demand by using import-use matrices of input-output tables for manufacturing industries in the UK for the period of 1982-1996. As international outsourcing is an important component in explanations of the changing skill structure of manufacturing industries in the UK, it shows a strong impact in influencing skill demand, but has a negative impact on unskilled labour demand. [Hsieh (2005)](#_ENREF_169)also showed an increasing demand for skilled workers in Hong Kong due to the outsourcing of unskilled-labour activities to mainland China.However, a study by Thangavelu and Chongvilaivan (2011) in Thailand manufacturing industries based on the aggregation of establishment-level data at 4-digit industrial classification, find that both intermediate inputs and service outsourcing are relatively skill-biased. Further, this results show that intermediate inputs outsourcing has negative impacts on the relative demands for skilled and unskilled workers, whereas service outsourcing shifts the demand towards skilled workers at the expense of unskilled workers. Agnese (2012) also focus on industry-level data in the Japanese manufacturing firms, however the study analyses both materials as well as services off shoring activities across occupation and across three major sectors of the economy (manufacturing, services and primary plus energy) for 1980-2005. The study concludes, highly skilled occupation gains from the services off shoring, while production workers (unskilled) benefit from materials.

 Consistent with the theory of endogenous growth, which stresses the importance of investigation upon the role of spillover effects from the channel FDI and trade, recently there have been an increasing number of studies investigating the spillover effects upon skilled labour demand in the certain types of countries. For instance, a recent study by Lee and Wie (2015) investigated the impact of technology diffusion of imports and FDI on skilled labour demand in the Indonesian manufacturing sector. This study uses the labour force survey data during the period of 1990–2009. Based on the supply–demand analysis, this study finds that both the between- and within-industry shifts of labour demand that favoured skilled workers contributed to the widening wage inequality since the early 2000s.Meanwhile, evidence from firm-level data in the manufacturing sector indicates that the diffusion of technology through imports and FDI caused demand to shift toward more skilled labour and increased wage inequality between skilled and unskilled workers. This study reveals that the estimated coefficient on FDI is positive, meaning that the demand for non-production workers would be increased by 5.2% if the domestic firms increased the share of FDI inflows in their total investments by10%. The coefficient on imported materials is also positive and statistically significant, thus showing a 10%increase in the import share of investment (other factors fixed) leads to a 4.5%increase in the share of non-production workers.

Fajnzylber and Fernandes (2004) examined how the international diffusion of technologyon demand for skilled labour through the channel of importing of intermediate inputs, exports and FDI in Brazil, China and Malaysia in 2004. They used data from Investment Climate Surveys performed by the World Bank in Asia and Latin America. To analyse the effects of international diffusion of technology on demand for skilled labour, this study using OLS with standard errors corrected for possible heteroskedasticity. The result showed that the effect of the import of intermediate input and FDI is significantly positive on demand for skilled labour in Brazilian and Malaysian firms. In contrast, both intermediate input and FDI have a negative effect on skilled labour in China. The negative effect of FDI and intermediate input is due to China’s production using more unskilled labour-intensive goods, and thus, the effect of skill-biased technology diffusion from both channels has reduced. Exports are negatively associated with demand for skilled workers in China and Malaysia, and, to a lesser extent, in Brazil. This result is consistent with international sales, leading to a greater degree of specialisation according to the comparative advantage of countries in unskilled labour- intensive goods. The overall finding in 2004 revealed that FDI and technology licensing act as an effective channel for the diffusion of skilled biased-technology in fostering demand for skilled labour in Brazilian and Malaysian firms.

[Fajnzylber and Fernandes (2009](#_ENREF_19)) extended their study in 2009, but they only focused on Brazil and China. A similar result was found as in 2004, which showed that the import of intermediate input and FDI were statistically positive, but the export shows a negative effect in influencing demand for skilled labour in Brazil and China. The result also indicated that the presence of FDI in Brazilian and Chinese firms led to increasing demand for workers in managerial, engineering and technical occupations and for those workers with tertiary education. The result also suggested that the presence of FDI led to an increase in the number of skilled workers of about 59% in Brazil and 51% in China when the FDI is measured based on wage bill share. If FDI is measured as an employment share, the number of skilled workers only increased by 38% and 29%, respectively, in Brazilian and Chinese firms. The overall changes of skilled labour demand in both Brazilian and Chinese firms are mostly due to variability across firms within industries rather than to variability between industries. A similar study conducted by [Bruno et al. (2012)](#_ENREF_68) in Poland, the Czech Republic and Hungary between 1993 and 2001. The result found that the presence of MNEs was statistically positive and significant in Poland, but was insignificant in Hungary and had a very small negative effect in the Czech Republic. Consistent with the standard neoclassical trade theory, the results showed that export of final goods led to a decrease in the share of skilled labour by about 3% to 4% for all three countries. The overall findings were consistently supported by [Coe & Helpman (1995](#_ENREF_90)) and [Potterie& Lichtenberg (2001](#_ENREF_263)), which showed that the technology spillovers through inwards FDI and the import of intermediate input acted as an effective channel of technology and knowledge diffusion compared to outwards FDI and export flow.

# DATA DESCRIPTION

The main data used in this study are obtained from the DOSM based on a survey on manufacturing industries for the variables, namely; Research and Development (R&D) investment, value added, physical capital stock (gross fixed capital formation), depreciation value of physical capital stock, number of workers in foreign firm as well as number of employment by job position. Meanwhile, datasets that contain imports of intermediate and capital goods are gathered from Malaysia’s official external trade data and are compiled by the Department of Statistics, Malaysia. These data are published at the two-digit Standard International Trade Classification level in inter alia, the Department of Statistics’ publication, Malaysia External Trade Statistics. These data, which are classified according to the three digit Standard International Trade Classification (SITC) level, have then been matched to the three-digit Malaysian Industrial Classification System (MSIC), 2000.

 The present study focuses on manufacturing industries since technology spillovers have been associated with the manufacturing sector for a long period of time. In line with Malaysia’s aim to become a high income country by 2020, manufacturing sectors will be given special attention by the government. This sector will be supported by private investments and the regulatory framework will be changed in order to attract both domestic and foreign investments and thus potentially contributing to economic growth. For instance, the government has focused on the E&E industry as part of the strategy towards greater specialisation as E&E is the largest single contributor to the manufacturing sector. E&E accounted for 26.1 % of manufacturing output and shows potential to create high-income as the multi-national companies that dominate the E&E scene move into more R&D ([EPU, 2010](#_ENREF_114)).

 This study covers the period of 2000-2008, considering FDI inflows and import of capital and intermediate goods volumes are large during the period, particularly after the launch of the Eighth Malaysian Plan (2000-2006) and the Ninth Malaysia Plan (2006-2010). Limitation of coverage is due to the Malaysia industrial classification system (previously known as the MSIC, 1972: revised in 1979). After 2008, the MSIC code is revamped by DOS. To balance out the panel data between industries and variables, this study applies a sample of 50 three digit levels of manufacturing industries. The summary of statistics for the variables used in this study is shown in the Appendix.

 In this study, employment refers to the number of paid employees (full-time) per year. Following[Hollanders and Ter Weel (2002](#_ENREF_25)), skilled workers in this study refer to high-skilled workers comprised of legislators, senior officials and managers, professionals, technicians and associate professionals[[6]](#footnote-6).Therefore, the dependent variable in this study is the share of skilled workers in total employment within each firm.

# EMPIRICAL METHODOLOGY

The purpose of this section is to estimate the impact of both technology spilloversthrough the channel of FDI and trade on firm-level skilled labour demand for the period of 2000-2008. We follow the [Hollanders and Ter Weel (2002](#_ENREF_25)) approach in constructing a translog model to the relative demand for skilled labour. We assume the employment share of *group’s* as *s*= *f*(*lnx1, lnx2…lnxs*). Expanding this function in a second-order Taylor series around the mean of the respective *x’s* and interpreting the derivatives as coefficients, the following function is obtained:

$s=B\_{o}$+$\sum\_{q=1}^{Q}B\_{q}lnx\_{q}$+$\frac{1}{2}\sum\_{q=1}^{Q}\sum\_{r=1}^{Q}γ\_{q^{r}}lnx\_{q}lnx\_{r}$+$ε$ (1)

where; *s* is the employment share of skilled labour and the group of *x’s* one might think of are: capital stock (*Kit*), value added (*Yit*), stock of technology (TECH) such as R&D intensity and spillovers from trade and FDI, and relative wages for skilled and unskilled workers$\left(\frac{w^{s}}{w^{u}}\right)$. In particular, the function that explains the share of skilled labour ($s$) in industry *i* in year *t* is:

$s\_{it}$=$α\_{0}$+$B\_{1 }lnK\_{it}$+$B\_{2}lnY\_{it}+B\_{3}TECH\_{it}+B\_{4}ln\left(\frac{w^{s}}{w^{u}}\right)\_{it}$ (2)

where, *Kit* is physical capital stock, *Yit* is value added and *TECHit* is a stock of technology and $\frac{w^{s}}{w^{u}}$ is wage rates for skilled and unskilled workers. Capital and technology stocks are assumed to be quasi-fixed (see, e.g. Adams, 1999). As a common practice in many empirical works, we use the perpetual inventory method (PIM) to measure physical capital and technology stock (local R&D stock) as suggested by [Griliches (1980](#_ENREF_21)) .The formula for physical capital and local R&D are as follows:

$K\_{t}=\left(1-γ\right)K\_{t-1}+IK\_{t}$ (3)

$RD\_{t}=\left(1-δ\right)RD\_{t-1}+IRD\_{t}$ (4)

where $γ$ and $δ$ are the depreciation rates for physical capital and R&D stock with 5% and 15% respectively as utilized by [Adam(1999](#_ENREF_2)). He assumes the rates of depreciation do not substantially change the estimation results. $IK\_{t} $and$ IRD\_{t}$ refer to gross fixed capital formation and R&D investment. Assuming capital and output grow at the same rate, the initial level of the capital investment and R&D investment are determined using the following formula:

$K\_{0}$= ($IK\_{1}$)/($ γ$ + 0.05) and $RD\_{0}$= ($IRD\_{1}$)/($ δ$ + 0.05) (5)

 As being documented, technology stock comes from two sources; i) local R&D, and ii) international technology through the participation in international trade and inwards FDI ([Hollanders & Ter Weel, 2002](#_ENREF_25)). In line with the empirical work of [Coe and Helpman (1995](#_ENREF_14)), we use R&D investment as proxy for local R&D. To capture the effect of local R&D on demand for skilled labour, [Machin and Van Reenen (1998](#_ENREF_29)) suggest to lag R&D expenditure as a 1- year lag in all specification[[7]](#footnote-7). Thus, domestic R&D is measured as a proportion of value added with 1- year lag. There is a positive and significant correlation with the degree of skill upgrading and R&D intensity in almost every specification and it indicates the changes in the technology stock and employment structure ([Hansson, 2005](#_ENREF_23);[Hollanders & Ter Weel, 2002](#_ENREF_25);[Machin & Van Reenen, 1998](#_ENREF_29)).

 To measure stock of technology from the international source, this study uses trade and FDI as a main channel of technology diffusion or spillover. Trade (i.e import) and FDI are widely viewed as important channels for knowledge spillovers (Grossman & Helpman,1991). Following [Meschi et al. (2011](#_ENREF_31)), the spillover effects from trade is measured as a share of imported input (total import of intermediate and capital goods) to import of total input at sectoral level. In the case of technology spillovers from FDI is measured based on a share of local employment in foreign firms to total employment (parents and affiliates) ([Blonigen & Slaughter, 2001](#_ENREF_56); [Figini & Görg, 1999](#_ENREF_129); [Girma et al., 2001](#_ENREF_139)). To examine whether FDI facilitates technological change and allows workers to assimilate knowledge over time through “learning effect”, we consider using the quadratic effects technique that has been applied by [Figini & Görg (1999](#_ENREF_20)) and [Taylor & Driffield (2005](#_ENREF_37))[[8]](#footnote-8).

 However, there are some problems estimating the equation (1.1) in relation to relative wages term. Wages are endogenous and the estimation and interpretation of the result should be done meticulously. As a common practice in literature, the relative wages term is replaced by time dummies ([Machin & Van Reenen, 1998](#_ENREF_285)). A time dummy is efficient in capturing the real variation in wages instead of the relative wage terms, but it is less appropriate to be applied in our study as we do not have a rich panel data([Chennells & Van Reenen, 1999](#_ENREF_110)). For this reason, we follow [Meschi et al. (2011](#_ENREF_31)) to drop the wage term by using lagged dependent variable. Hence, the equation for estimation as follows:

$lns\_{it=}α\_{o}+B\_{1}lns\_{it-1}+B\_{2}lnK\_{it}+B\_{3}lnY\_{it}+B\_{4}ln\left(\frac{RD}{Y}\right)\_{it-1}+B\_{5}lnRf\_{it}^{Trade}+ B\_{6}lnFDI+B\_{7}lnFDI^{2}+ε\_{it}$ (6)

where: *i* is industry and *t* is time index, *sit*refers to the share of share of skilled workers from the total employment ([Hollander et al., 1994](#_ENREF_45)).$ s\_{it-1}$is lagged share of skilled workers$;K$ is physical capital stock[[9]](#footnote-9); $Y$is value added[[10]](#footnote-10);$\frac{RD}{Y}$ is local R&D per value added. $Rf\_{it}^{Trade}$is share of import of capital and intermediate goods to Malaysia’s total import in manufacturing sector. *FDI* denotes shares of local employment in foreign firms from total employment in manufacturing sector. *FDI2* represents the route of technological change of learning process[[11]](#footnote-11). $ε\_{it }$is the error term.

The present study employs the Generalized Method of Moments (GMM) technique as being proposed by[Arellano and Bover (1995](#_ENREF_7)) to estimate the labour demand function during the period of 2000-2008. The data covers 50 industries in the manufacturing sector. There are at least two reasons for choosing GMM estimator, be it Different-GMM (DIFF-GMM) or System-GMM (SYS-GMM). First is to control for industry-specific effects, which cannot be done with industry-specific dummies due to the dynamic structure of the regression equation. Second is to control for a simultaneity bias caused by the possibility that some of the explanatory variables may be endogenous. It can be done by using the lagged levels of the regressor as an instrument.Some authors, for example, have found that FDI is likely to be endogenous as higher output may attract more market seeking FDIs which tends to overstate the effect of spillovers (Azman-Saini, Baharumshah & Law, 2010).

However, it is well documented that theDIFF-GMMestimator has very poor finite sample properties in terms of bias and precision. Consequently,Blundell and Bond (1998) propose the use of extra moment conditions in the SYS-GMM estimator due to a lower bias and higher efficiency. In addition, the basic advantages of the SYS-GMM, as compared with the DIFF-GMM, are due to the valid instrumental variables for the untransformed equations in levels. The SYS-GMM not only increases the efficiency of the estimates, but also allows for the exploitation of all of the variable information at the level and difference equations (Arellano & Bover 1995).In the present study, the application of the SYS-GMM is more appropriate than the DIFF-GMM since the time series for the observations are small (450 observations) and consist of short panel data (N=50).

1. **EMPIRICAL RESULTS**

The GMM estimators are typically applied in one- and two-step variants (Arellano and Bond, 1991). The analysis begins with estimation of the labour demand model by using SYS-GMM at one and two-step variants as shown in Table 1.3. The results in column (1) reveal that, at one-step estimator, all of the endogenous variables insignificantly influence the demand for skilled workers except for the lagged share of skilled labour. Meanwhile, at the two-step estimator, the result reveals that the lagged share of skilled labour, value added and local R&D have a significant effect upon demand for skilled workers. These results in column (2) show that the two-step estimates of the standard errors tend to be downward biased because it uses the so-called optimal weighting matrices where the moment conditions are weighted by a consistent estimate of their covariance matrix (Arellano and Bond, 1991; Blundell and Bond, 1998). This makes the two-step estimators asymptotically more efficient than one-step estimators. However, capital intensity, import of intermediate and capital goods, FDI and FDI2 statistically failed to achieve significance at both variants. These results clearly indicate that the use of the two-step estimator in small samples, as in this study, has several problems. These come as a result of the proliferation of instruments.

In a simulation analysis, Windmeijer (2005) show that the two-step GMM estimation with numerous instruments can lead to biased standard errors and parameter estimates in some variables. Moreover, Bowsher (2002) and [Roodman (2009](#_ENREF_282))show that numerous instruments may lead to weakened over-identification test. It is indicated by the Hansen test that when the *p*-value equals to 1 or very close to 1, it is seen as a warning of the instrument proliferations problem. Hence, this study does not fail to reject the null hypothesis for over identifying the restriction which implies endogeneity elements in the instruments and insignificant statistics.

Due to the generating of too many instruments, this study reduces the number of instruments by collapsing the instrumental variable matrix as suggested by [Calderon et al. (2002](#_ENREF_72)), and the results are tabulated in column (3) to column (5).To control the possibility endogeneity of value-added and physical capital that simultaneously impact the labour demand, both capital and value-added variables will be lagged when estimating in levels ([Machin & Van Reenen, 1998](#_ENREF_216)).This is a command approach to deal with endogeneity when estimating the translog cost function where it is difficult to find convincing instruments.

Table 1.3: SYS- GMM Estimates: Demand for Skilled Labour, 2000-2008



The result tabulated is as shown in column (3).However, the result is largely unaffected, because it still exist simultaneity between value added and physical capital in spite of experimenting with longer lags (in this case, lagged at *T-4*) and only the variable FDI and FDI2 insignificant in influencing the demand for skilled labour.

 In line with the contribution in this study to examine the technology spillover effects of FDI on skilled labour demand, this study conducts the robustness test. First, this study did not lag both physical capital and value-added as practiced in column (3) and then, it dropped both variables FDI and FDI2 from the model. The result is indicated in column (4). The result revealed that, by excluding the FDI and FDI2 variables from the model, only the lagged share of the dependent variable and value added are significant. In the next step, we re-estimated the model by including the FDI and FDI2 variables into the model as shown in column (5). The main econometric outcome clearly reveals that the local R&D becomes significant by including the FDI and FDI2 variables into the model. This result is supported by [Hejazi and Safarian (1999)](#_ENREF_162), who argued that the spillover effects derived from FDI to host countries are larger, and the effect of FDI tends to influence the overall or other spillovers compared to inclusion of spillover effects via trade alone into the model. The previous literature has been recognized, as there is a strong association effect of FDI on the local R&D ([Blomström & Kokko, 1998](#_ENREF_54))This result indicates that the inflow of FDI should be encouraged to gear up Malaysian local R&D as these R&D activities conducted by Malaysian enterprises are domestic market oriented and are involved in relatively low technology, in biased demand for semi-skilled and low-skilled workers. Such a condition makes the firm enterprises less “pressured” to be innovative and competitive and thus restrict the utilization of skilled workers (MASTIC, 2008). The main contribution to these factors are due to the low capacity to absorb new technology, especially in the Malaysian manufacturing sector, and thus, it becomes a main hindrance to the local R&D firm to the internationalization of R&D activities in the international markets (MASTIC, 2008; OECD, 2011). Therefore, the significant presence of MNCSs is geared toward the R&D activity from “domestic market orientation” towards internationalization of R&D activitythrough the several ways.These include providing the fastest and most effective way to deploy new technologies in local firms; acting through the process of technology transfer; providing international linkage for Malaysian local firms; and becoming an important source of knowledge transfer in technology, management skills and development of the technical capabilities of the locals R&D (Ismail&Yussof,2003).

 Afterward, attention now is on the spillover effects derived from FDI upon relative demand for skilled labour. Despite the negative relationship shown by FDI on skilled labour demand with coefficient (9.390), the effect of FDI2 is proven to be statistically positive and significant at 10%. This result clearly indicates that the spillover effects of FDI are indicated by FDI2 appear to be assimilated quickly by labour skilled workers in the Malaysian manufacturing industry through the learning effect. The results found in this study are also consistent with [Taylor and Driffield (2005)](#_ENREF_300), who show that the assimilation of technology from FDI through “learning effect” is shown to be quicker when the FDI is specified as quadratic rather than time lags.

 One possible reason for the negative correlation between technology spillovers via FDI and demand for skilled labour is the existence of the crowding-out effect ([Masron, Zulkafli, & Ibrahim, 2012](#_ENREF_30" \o "Masron, 2012 #1470)).The effect of crowding- out tends to occur when countries practice open or liberal economic policies, which allow MNCs to outsource their inputs from other efficient countries([Aitken & Harrison, 1999](#_ENREF_3);Hu &Jefferson, 2002).Another possible cause that can be related with the negative relationship is the concentration of FDI inflows in some selected industries[[12]](#footnote-12). Those industries which receive higher FDI inflows will enjoy better technology and lower production cost, which hence increase their productivity due to positive spillover effects. Unfortunately, this will depress other non-FDI industries due to increased competition that is induced by the increased presence of FDI in domestic industries. This situation may force inefficient domestic firms to exit and surviving firms to improve their performance. This result is strongly consistent with the current Malaysian manufacturing industry in which most foreign investments focus on the capital-intensive industry, especially in the E&E and machinery industries, to intensify in-house R&D and Design and Development (D&D) activities as compared to the labour-intensive industries such as paper and printing, metal and wood. (EPU, 2010; Masron et al., 2012).

Nevertheless, we do not find any evidence that the trade spillovers are statistically significant in increasing demand for skilled labour. Our finding is empirically supported by [Hejazi and Safarian (1999)](#_ENREF_162) who argued that spillover effects ofFDI on host countries are larger, hence the importance of trade channel is much reduced once FDI is controlled. The result is strongly consistent with the theory of traditional trade as expressed in the Heckscher-Ohlin theorem and in Stolper-Samuelson (HOSS). According to this theorem, the distinction between sectoral and factoral dimensions in industries or firms leads to different types of skills ([Wood, 1994](#_ENREF_318)). Hence, in the case of Malaysia, the abundance of unskilled workers at various production stages and low absorptive capacity of local firms are found to be severe problems, holding back Malaysia’s ability to imitate the imported intermediate inputs which embody technological knowledge (EPU, 2010). Furthermore, based on the Economic Transformation Programme (ETP) Annual Report 2011, the abundance of unskilled workers due to many industries including E&E industry still focused on the assembly of low value added task or stage production. This would induce the opposite effect on demand for skilled workers. Another possible explanation for this result would be that the high levels of FDI enjoyed by Malaysia have been associated with capital investment that focuses on intermediate rather than on high value-added production. As a result, the overall impact of imported intermediate input biased to unskilled labour (McNabb & Said, 2013).

More important findings report that the spillover effects of FDI, local R&D intensity, value added and physical capital are more robust through the use of the alternative two-step SYS-GMM by collapsing the instrumental variable. This technique is found to be an efficient technique to mitigate the problem of many instruments by using the level of the regressor as instruments as proposed by [Arellano & Bond (1991](#_ENREF_20)). This is valid under the assumption in the model that the error term is not serially correlated, and the lag of the variables is weakly exogenous. This can be evidenced by two tests. First, the Arellano-Bond test shows that AR (2) failed to reject the null. Meaning that, there is no serial correlation problem in the model. Secondly, the Hansen test which tests for validity of the instrument, also show that there is no evidence of too many instruments as the number of instruments (27) is substantially smaller than *N* (50). Failure to reject the null of both tests provides support to the estimated model.

# CONCLUSIONS

This study investigates the spillover effects of FDI and trade on skill upgrading in 50 Malaysian manufacturing industries for the period from 2000 to 2008. After controlling for endogeneity by using the SYS-GMM estimator, the results confirm that the spillover effect from FDI is significant for skill upgrading and in turn leads to an increase in demand for skilled labour. Even though the FDI coefficient indicates a negative correlation between FDI and skilled labour demand, but the effect of technology spillovers via FDI as indicated by FDI2 is statistically positive and significant. This gives an indication that the effect of technology spillovers via FDI appears to be assimilated quickly by the workers in the Malaysian manufacturing industry through “learning effect” and the fast pace is biased towards skilled workers. Our empirical results suggest that the “learning effect” from FDI spillovers can be further enhanced when MNCs provide training of employees and hands-on learning as a result, increasing the labour productivity of skilled workers. In regards to the possibility of crowding-out effect from FDI spillovers in Malaysian manufacturing industry, effort must be further intensified to encourage and promote FDI inflows into low receiving industries as proposed by [Aitken and Harrison (1999)](#_ENREF_3). Special attention also needs to be put in place related to the long-run FDI policy to ensure FDI works for skill development for all types of workers ([Masron et al., 2012](#_ENREF_48)). This is in parallel to the government’s aim to ensure the function of FDIs’ transfer of knowledge to labour that must be based on Key Performance Indicators (KPIs).

This study finds no evidence of spillover effects of trade in influencing the demand for skilled labour. Our results suggest that Malaysia needs to seek for better market access by further reduction of tariffs and non-tariff particularly in E&E industry and for R&D leader country such as the European countries. The demand for skilled labour could be raised by reduction of input tariff, which in turn could induce the import of technologically-advanced inputs ([Machin &Van Reenen ,1998](#_ENREF_29)). Lastly, in an effort to fasten the assimilation process of foreign spillovers into local workers, reducing regulatory constraints (labour, business and credit) is also importance to maximise FDI spillover ([Kohpaiboon, 2006)](#_ENREF_196). For example, fewer regulations in hiring and firing worker will encourage labour mobility across firms. Therefore, workers who have previously worked with MNCs are more able to transfer their knowledge and experience regarding new technologies to domestic firms.

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# Appendix

Appendix 1: Summary Statistic

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Variable** | **Obs** | **Mean** |  **Std. Dev** |  **Min** |  **Max** |
| Share of Skilled Labour | 50 | 3.27 | 0.40 | 1.61 | 4.84 |
| Value added | 50 | 15.68 | 2.90 | 6.30 | 22.95 |
| Gross Fixed Capital Formation | 50 | 21.28 | 1.32 | 16.92 | 25.15 |
| Local R&D Intensity | 50 | 1.42 | 3.02 | -7.26 | 7.26 |
| Import of intermediate input | 50 | -1.31 | 2.10 | -8.52 | 3.54 |
| FDI | 50 | 2.91 | 1.04 | -1.14 | 4.51 |
| FDI² | 50 | 5.83 | 2.07 | -2.30 | 9.02 |

Note: All variables are in natural logarithmic form.

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4. The share of foreign investment decline in 2009 is due to the rise in outflows of capital from Malaysia and is affected by the global economic crisis. Meanwhile, in 2011, the share of domestic investment was higher than foreign investment by 21.7% due to the greater response from the domestic direct investments (DDI) to spearhead the Economic Transformation Programme (ETP). [↑](#footnote-ref-4)
5. Meshi *et al*. (2011) use dummy variable (>10% foreign firms). Fajnzylber&Fernandes (2009) use both foreign share and dummy variables. [↑](#footnote-ref-5)
6. This is not a standard definition of skill levels in Malaysia (EPU& World Bank, 2012). [↑](#footnote-ref-6)
7. [Katz and Autor (1999](#_ENREF_26)) expected that high R&D activities involve the employment of high skilled workers. Through measure stock R&D as a proportion value added is enabled to estimate in level and first differences, rather than using merely R&D expenditure in level equation into a differenced equation. [↑](#footnote-ref-7)
8. To measure the “learning effect” from FDI spillovers, some empirical studies have lagged FDI2 to measure the effect of FDIas a route of technological change([Taylor & Driffield, 2005](#_ENREF_94)). This is due to the spillover effects of FDI, trade and technology change which are likely to involve a lagged time period. However, in this study, the FDI variable could not be lagged because we do not have a vast panel data. [↑](#footnote-ref-8)
9. Physical capital stock is the stock of fixed assets which comprises net book value of land and land improvement, building, transport equipment, computer, machinery and equipment at the end of each reference year. [↑](#footnote-ref-9)
10. Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. It is calculated without making deductions for depreciation of fabricated assets or depletion and degradation of natural resources. The origin of value added is determined by the International Standard Industrial Classification (ISIC), revision 3. [↑](#footnote-ref-10)
11. FDI2 is obtained by squared the share of local employment in foreign firms to total employment. [↑](#footnote-ref-11)
12. A study by [Masron et al. (2012](#_ENREF_30)) shows a crowding-out phenomenon is potentially to occur in labour intensive sector such as paper and printing products, apparel product and metal product. These sectors receive the least amount of FDI inflows. [↑](#footnote-ref-12)