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Does Foreign Direct Investment Promote Skill Upgrading in Developing Countries? Empirical Evidence from Malaysia*

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Abstract

This paper aims to investigate how and to what extent FDI impacts the relative demand for skilled labor within firms in the case of developing countries. The analysis uses a sizeable micro-level dataset for Malaysian manufacturing industries using the System-GMM estimators to control the estimations' endogeneity problems. For this purpose, the study uses foreign equity share at the firm level to investigate foreign ownership effects at the firm level and the Horizontal FDI index by Smarzynska Javorcik (2004) to analyze FDI intra-industry linkages influence on the structure of labor demand for Malaysian domestic firms. Our findings indicate that foreign ownership increases the skilled demand within Malaysian manufacturing through the learning process, exclusively for small- and medium-sized firms (SMEs). Conversely for foreign-owned firms, changes in their skilled-labor share do not associate with changes in firm-level foreign equity share. We conclude that foreign ownership per se is not the major contributing factor for skill upgrading in Malaysian manufacturing firms. Furthermore, the competitive pressures caused by foreign firms' presence within the same industry – namely horizontal FDI – has a significant negative spillover effect on the level of skilled-labor share for domestic firms in the Malaysian manufacturing sector within periods of the understudies.

Keywords: Foreign Ownership, International Linkages, Spillover, Skilled Labor Demand, Malaysia

JEL Classification Code: F14, F16, F210, O24

1. Introduction

The host country is expected to benefit from inward foreign direct investments (FDI) through adding of capital stocks, creating job opportunity, and transferring advanced technology, which is vital for economic growth, particularly for developing countries. However, does FDI benefit the host country? Foreign firms typically enjoy higher productivity, are more capital intensive, pay higher wages and usually enjoy greater profitability than their domestic rivals (Conyon et al., 2002; Doms & Jensen, 1998; Lipsey & Sjöholm, 2004a). Furthermore, foreign firms are more skill-intensive than local firms since they possess advanced technology and use more sophisticated and high-quality inputs; hence demand the services of relatively higher-skilled workers. The presence of foreign firms, not only affects host country's economic growth, but also stimulates the spillover effects by generating higher competition, increase the efficiency of locally-owned firms, and promoting technological transfer (Hoang et al., 2021). While policymakers have adopted a generous policy toward inflows of FDI and liberation of trade policy, some economists contend that foreign presence may exacerbate skill downgrading within firms, mainly the domestic ones. The question, thus arises, whether inward FDI does involve superior technology and spillover the skill upgrading effects on locally-owned firms rather than being absorbed entirely by foreign-owned firms.

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This study therefore aims to investigate the association of inward of FDI with demand on skilled workers in the Malaysian manufacturing establishments for the period 2000 to 2005. Due to the comparative advantage in the low-skilled intensive stages of productions, Malaysia has become one of the attractive locations for multinational companies (MNCs) during this period. With the support of generous policy toward foreign investments and liberalization policies toward external trades, FDI inflows have shown rapid growth, particularly since 2000 when Malaysia became one of the highest recipients of FDI in the region (UNCTAD, 2018). Referring to Figure 1, between 2000 and 2017, 10% of FDI flow into ASEAN on average was destined for Malaysia.

Particularly within the period 2000–2005, 11.6% of FDI inflows on average were destined for the country. FDI was the primary catalyst that contributed to changes in trade orientation toward international production sharing or export processing trade structures for South-East Asian countries, including Malaysia. In 2019, FDI flows into the country expanded to RM31.7 billion, compared to RM30.7 billion in the previous year (DOSM, 2020).

There is however limited, though growing, a volume of empirical evidence on the relationship between foreign presence and skill composition, particularly for developing countries. Studies conducted in the Malaysian context, which explicitly used micro-level data are notably lacking. The recent study by Yunus et al. (2015), relating to FDI spillover effect on the relative demand for skilled labor using firm-level data, was conducted for the Malaysian manufacturing industries during the 2000–2008 period. They discovered a positive spillover effect of FDI on the relative demand for skilled labor, but no such effect from the international trade activity on such demand. In comparison, Jauhari and Khalifah (2018) focused on trade linkages as underlying factors for the change in demand for skilled labor in Malaysian Electric and Electronic (E&E) firms between 2000 and 2005. The study showed that trade fragmentation had led to skill downgrading within firms in the E&E industry. The result also showed a time lag taken by E&E firms in catching up with the sophisticated technology from FDI that entailed increased demand for skilled labor.

The presence of foreign firms may have raised the firm's relative demand for skilled labor through several channels. The direct effect is through investments in physical capital related to new technologies, as well as through indirect technology (Slaughter, 2002), i.e., FDI-technology spillover effect by giving domestics firms access to advanced technology through imitation, labor mobility and inter-linkages within and across industries. There is considerable empirical evidence on the significance of within-firm foreign technology transfer as means of increasing host country demand for high-skilled labor (Lee & Wie, 2015; Meschi et al., 2016; Tomohara & Yokota, 2011). However, the evidence is much more mixed and there is no consensus

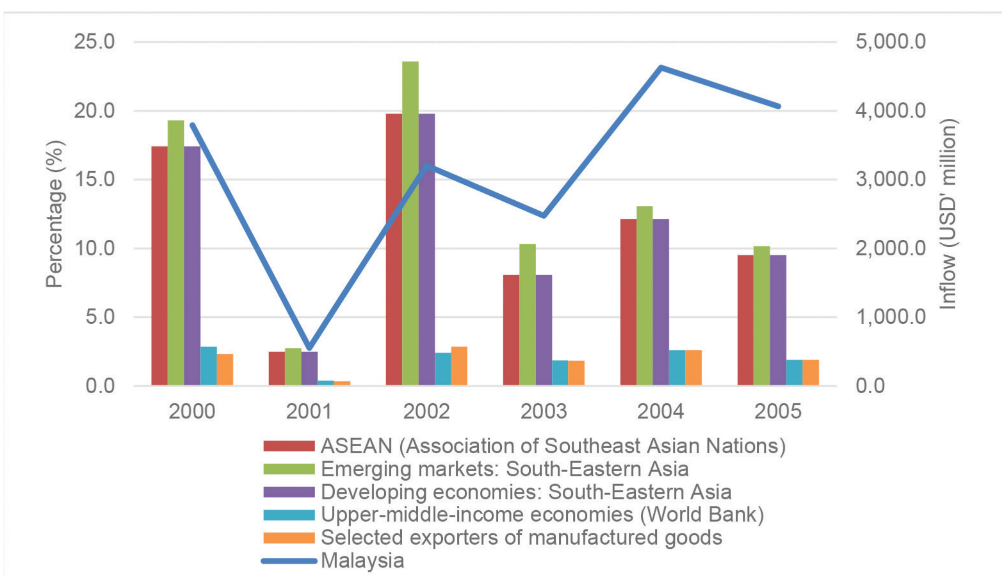

Figure 1: FDI Inflows Within Group Economy, 2000–2005

Source: UNCTAD (2018)

on complementary technology transfer or positive spillover effect of foreign presence to local-owned firms. Among others, Aitken et al. (1996) found that foreign presence only led to higher wages in domestic firm for the U.S., while no wage spillover was recorded for Mexico and Venezuela (less developed countries). In contrast, Lipsey and Sjöholm (2004b) provided evidence of wage spillover from foreign firms to local-owned plants in the Indonesian manufacturing sector. Additionally, the latest study by Saucedo et al. (2020), which utilized 32 Mexican's state industrial aggregated data, found that FDI inflows raised the demand for both low and high skilled employment in the manufacturing sector, while the effect was inconclusive for the service sector.

There is no consensus in the results of previous studies related to this issue, particularly for developing countries. Hence, the objective of this paper is twofold. First, to empirically analyze the skills spillover effect of FDI within Malaysian manufacturing firms for the period 2000 to 2005. We were unable to extend our empirical study beyond 2005 as the data for the trade variable was not available at firm level. Furthermore, our dataset was unique as it covered the entire population of the manufacturing firms, but was however not currently available from the recent dataset since the Department of Statistics of Malaysia (DOSM) only provided 30 per cent of the population data. Therefore, in our research, we deviated from other previous studies, in the sense that we used data from a single source, which covered the real scenario of the Malaysian manufacturing sector. All our focus variables data, which comprised foreign equity share and trade, were at the firm level, which enabled us to analyze the direct effect of the degree of foreign ownership as well as the whole spectrum of trade activities on labor demand within the firms. Additionally, firm-level data sets mitigated for aggregation biases by allowing us to control some observable and unobservable firm-level characteristics (Andersson et al., 2016; Peluffo, 2015; Helpman et al., 2004).

Moreover, the great variety of the dataset enables us to calculate the degree of foreign ownership as opposed to the dummy variable for ownership status used in most previous studies. The firm-level trade data enabled us to utilize the vertical trade index developed by Khalifah and Azhar (2014), which differed from those of most previous studies that relied on the industrial level index proposed by Hummels et al., (2001).

Our second objective was to analyze the effect of FDI intra-industry linkages, known as horizontal FDI, on the structure of labor demand for Malaysian domestic firms. Specifically, we aimed to investigate the linkages among the domestically owned firms and foreign affiliates within the same industry regarding intensified skilled demand for domestic firms in Malaysian manufacturing industries. In doing so, we employed the Horizontal FDI index by Smarzynska Javorcik (2004). Since our dataset provided both the degree of foreign ownership and total sales at establishment-level, the calculated horizontal FDI index may accurately measure the differences in intensity of horizontal FDI or intra-industry linkages across the industry. Namely, the industry with a higher degree of foreign ownership where the linkages within industry were the more intense. The finding was fundamentally crucial to identify the beneficial effects of foreign presence that was attributable to foreign ownership and distinguished through what channels the firm's performance was affected, particularly among domestically owned firms.

In addition, this paper enriches the literature on the subject matter through examining the impact of firm's size in determining the relative demand for skilled labor. The findings along this objective are crucial for policy implication concerning decisions for adopting policies toward FDI in relation to the performance and survival of small- and medium-sized establishments (SMEs). To achieve the objective, we divided the sample into three groups comprising small, medium, and large-sized firms.

To sum up, our empirical analysis showed that foreign ownership per se was not the contributing factor to changes in the share of skilled workers in Malaysian manufacturing firms during the period of study. First, our empirical results suggest that increasing skilled-labor share within Malaysian manufacturing firms could be linked to the rise in the firm's foreign presence, mainly through learning effect. Second, foreign ownership has contemporaneous effects on skilled worker demand, but only for large firms, while for SMEs it is mainly through the learning process whereby these firms absorb advanced foreign technology, which affected demand for skilled labor. Third, for foreign-owned firms, the degree of foreign equity is not crucial in determining their demand for skilled labor. Finally, and most importantly, the competition between foreign and domestically owned firms within the same industry has a negative spillover effect on skilled demand in Malaysian domestic firms. Results of the present study are reliable as we employed dynamic panel data analysis, which is the System Generalized Methods of Moment (Sys-GMM). The Sys-GMM estimator reduces the endogeneity problem as well as caters to heterogeneity across the firms.

We organize the remainder of this paper as follows: In Section 2, we provide a review of previous theoretical and empirical studies of the determinants of skilled demand. In Section 3, we describe the estimation strategy and data. Section 4 discusses the empirical results and Section 5 provides the conclusion.

2. Literature Review

Numerous theories explained the changes in relative demand for skilled labor, including factors that relate to international linkages. The traditional trade theory, namely, the Heckscher-Ohlin and Stolper-Samuelson theorem, proposed that openness to trade will increase the relative price of exported goods, hence raising the relative demand for the inputs used intensively in the production process and ultimately the relative prices of those particular inputs. According to this theory, openness to trade should increase the relative demand for low skilled labor hence reduce the wage gap between high and low skilled workers within developing countries (Borjas et al., 1997). The traditional trade theory is well suited to the inter-industry changes in labor demand. However, this theory was not able to explain the recent phenomena of the intra-industry changes in labor demand, which was then explained by the skill-biased technological changes (SBTC) theory. This theory proposed that advanced technologies in the production process will induce changes in the relative demand for skilled workers in the whole sector and essentially within industries (Acemoglu, 2002; Berman et al., 1994; Machin & Van Reenen, 1998).

Trade economists, in the meantime, have pointed out those activities of foreign affiliates in the host country as the cause for the recent changes in relative demand toward skilled labor. FDI inflows contributed to the new trade pattern, which is trade in intermediate inputs, known as the international production sharing or export processing trade. The revolution in information and communication technology (ICT) together with improvement in transportation systems, enable producers to slice up their production process into several stages and permit multinational companies (MNCs) to relocate these in different geographic locations (Krugman et al., 1995) as necessitated by the labor content for each stage. Feenstra and Hanson (1996, 1997 & 1999) referred to the activities of foreign affiliates in the host country as foreign outsourcing or disintegration of production. In comparison, Hummels et al. (2001) referred to the phenomena as the vertical specialization that measures the share of imported inputs in the exported goods (import contents of export).

Developed countries normally located the low-skilled intensive stage of production to developing countries, and focused on the high-skilled intensive stage. Feenstra and Hanson (1996) asserted that the stage that was relocated to developing countries was assumed to be more high-skilled intensive in the perspective of these countries. It can be surmised that foreign outsourcing increases the relative demand for high-skilled labor in both developed and developing countries. The model suggests that relative demand shift occurs within-industries across all industries, i.e., it affects not only labor demand in import-competing industries, but also labor demand in the industries using the inputs (Feenstra et al., 2001). According to Markusen (2002), foreign MNCs in the host country presumably have access to some form of firm-specific asset that is unavailable to the host country's domestic rivals. Such asset owned by the MNCs commonly use sophisticated technology and is expected to influence demand on skilled labor and enhance the productivity of foreign affiliates compared to purely domestic firms.

These ideas explained the increase in relative demand for skilled labor in entire industries in these countries. However, most empirical evidence also suggests a positive causal effect of foreign ownership on skilled demand. The evidence for developing countries is somewhat inconclusive. The initial research by Aitken et al. (1996) postulated that foreign investment was associated with higher wages for both skilled and unskilled workers, but the effect on the former was more extensive for Mexico, Venezuela, and United States. The result was robust even after controlling for vintage effect and plant-specific factors, including the age and size of the plant. The study was also unable to provide explicit evidence on the importance of plant size toward demand for skilled labor. Regarding wage spillover effect of FDI, the result shows positive effect only for the developed country (United States), but not for developing countries like Venezuela and Mexico. Ghosh and Roy (2015) also provided similar evidence for manufacturing firms in post-2020 in India, which was also considered a developing country.

In contrast, Aitken et al. (1996) and Slaugher (2002) found a positive correlation between skill upgrading and the presence of U.S. affiliates for both developed and developing countries. More interestingly, the study provides a stronger correlation between demand for skilled labor and FDI for the sub-sample of developing countries. Meschi et al. (2016) provided recent evidence on the contribution of economic openness on demand of skilled labor for a developing country. Focusing on the role of FDI, they found that FDI enhanced skill demand in Turkish manufacturing firms over the period 1992–2001. A recent study on developing countries by Saucedo et al. (2020) analyzed the effect of FDI inflows on the employment and wages of low- and high-skilled employees in the manufacturing and service sectors in Mexico. The study was based on a quarterly panel dataset covering the 32 Mexican states from 2005 to 2018. Empirical evidence showed that FDI inflows created a positive effect in low- and high-skilled employment, but increased marginally in low-skilled wages, but not in high-skilled wages for the manufacturing sector. However, the effects of FDI inflows were inconclusive for the service sector. Giri et al. (2021) hypothesized trade globalization might increase the relative demand for low skilled labor (the abundant factors in developing countries), while and financial globalization and technological development tend to increase the demand for education and skills. Their results found that trade globalization had reduced Indian income inequality, while FDI had opposite effects.

For an Asian developing country like Indonesia, Lipsey and Sjöholm (2004a) found that foreign-owned firms did pay higher wages than domestic ones for a given quality of workers in the country's manufacturing industry in 1996. Using the same sample, Lipsey and Sjöholm (2004b) further found that foreign firms' presence generated the wage spillover effect for domestically owned Indonesian manufacturing plants within the same industry. Recent evidence from Lee and Wie (2015) concluded that both FDI inflows and import of intermediate inputs increased the demand for skilled labor and continually enhanced wage inequality within Indonesian manufacturing industries for 1990–2009. Similarly, Lipsey and Sjöholm (2004a, 2004b) and Chen et al. (2011) found that FDI contributes to the wage gap between domestically owned and foreign-owned firms in the Chinese manufacturing industry. However, they postulated that the home country of FDI was also crucial in determining the host country's wage spillover effect. They provided evidence that FDI from Hong Kong, Macao, and Taiwan produced a negative spillover effect on Chinese manufacturing firms' wage level.

Additionally, Tomohara and Yokota (2011) also revealed that FDI caused wage inequality for Thailand manufacturing establishments for the period 1998–2002, due mainly to both direct and spillover effects. However, when the investment was categorized by country of origin, they found that FDI from Japanese and Taiwanese sources did not contribute to skill-biased demand since the investment took the form of processing trade where the purpose of FDI was to seek for lower-cost unskilled labor. All the studies reviewed confirmed the conditional effect of FDI for skill upgrading, particularly for developing countries. Le et al. (2019) and Hoang et al. (2021) focus their study on the technological spillover and labor productivity effect of FDI for Vietnam. Using macro-level data within period 1986–2014, Le et al. (2019) provide strong evidence the positive effect of FDI on Vietnamese labor productivity. In contrast, survey on 3,166 enterprises in Vietnam manufacturing and processing industry in Hanoi shown there were limited impact of FDI on technology innovation for Vietnamese enterprises.

Several studies in Malaysia had focused on internal factors that determined the demand for skilled labor. Ismail and Zin (2003) among others, centered on human capital variables, which comprised education, training and experience to measure the determinants of earning differentials among skilled, semi-skilled and unskilled workers in the Malaysian manufacturing sector. The study utilized information from a survey on 2,065 workers in six major industries conducted in 1999. There were previous limited studies that focused on the demand for skilled labor as influenced by external factors mainly related to global determinants such as FDI and international trade. For example, Ismail et al. (2011) studied the intensity of globalization measured by international trade and FDI's inflows and outflows in determining the demand for skilled and unskilled labor for Malaysian manufacturing sector for the period 1985 to 2008. They found that FDI positively influenced the demand for labor. However, they provided insufficient evidence on FDI effect upon skilled labor. The study by Yunus et al. (2015) focused on the wage effect of FDI. They investigated the implications of both trade- and FDI-technology spillover on Malaysian manufacturing firms in 50 two-digit MSIC industries within the period 2000 to 2008. The study matched trade data from the official external trade data of the two-digit Standard International Trade Classification (SITC) level to the three-digit Malaysian Standard Industrial Classification System 2000 (MSIC 2000). Their empirical evidence suggested a positive spillover effect of FDI on the share of skilled demand.

There is however no trade-induced skill upgrading within firms for the Malaysian manufacturing industry. Using establishment-level trade data, Jauhari and Khalifah (2018) studied the implication of different types of international linkages, including foreign outsourcing, export and vertical trade while controlling for foreign ownership on employments for Malaysian E&E firms during the 2000–2005 period. The study revealed that vertical trade and foreign share exerted negative impact on the relative demand for skilled workers, while export and foreign outsourcing were not significant to determine the changes in the relative demand for skilled employment.

Further analyses on the problem, using firm-level data, had raised several econometric issues. Conyon et al. (2002) and Girma and Görg (2007) acknowledged the potential of simultaneity bias on the acquisition decision since multinationals may be attracted to more technology-intensive industries (Tybout, 2000), which were also more productive and offered higher wages. It created endogeneity problem in the estimation. As such the wage differential between foreign-owned and locally owned firms would be difficult to predict. A more recent study was by Peluffo (2015) who utilized the non-parametric difference-in-difference (DID) propensity score matching approach. The study analyzed the causal effect of FDI on productivity, demand for skilled labor and wage inequality for Uruguayan manufacturing firms from 1997 to 2005. He showed that FDI exerted influence on both productivity and demand for skilled labor.

In conclusion, empirical studies on the interrelationship between FDI and skill upgrading, particularly for developing countries, produced inconclusive results. Though the direct effects of foreign ownership on the relative demand toward skilled labor is in some way convincing, the skill upgrading spillover effect of foreign presence on domestic firms is much more uncertain. Accordingly, as contribution to the extant literature, we present the empirical evidence from the Malaysian manufacturing sector as an upper-middle-income economy (according to World Bank classification), based on firm-level dataset. Our specification equations are based on the translog cost function, and we employ the system of generalized method of moment's dynamic panel data estimator to control for endogeneity problems in our estimation procedures. The estimation strategy and empirical results are presented in the subsequent sections.

3. Methodology

3.1. Data and Measurements

We aim to investigate how and to what extent that the presence of FDI has affected the composition of skilled labor demand for Malaysian manufacturing plants using a population data on establishments. Our dataset was extracted from a consensus of Annual Survey of Manufacturing Industries (ASM), which was conducted by the Department of Statistics, Malaysia (DOSM) for 2000–2005. Although our data set was somewhat dated, it was unique as it covered the entire population of establishments from a total of 14 industries in the Malaysian manufacturing sector from the early period during the rise of global value change. Table 1 provides a list of Malaysian Standard Industrial Classification (MSIC) two-digit industry and the number of establishments for the year 2000 until 2005 for each sub-industry.

We extracted from the unbalanced panel establishments a total of 89,596 observations[1]. The data provided the necessary information at establishment-level, namely gross output, intermediate inputs, capital stocks, and information on total employments and on salaries and wages paid. Furthermore, in addition to the percentage of foreign equity share, this data set also comprised external trade data for each establishment, including exports of goods and imports of intermediate inputs. The data therefore enabled us to analyze the relationship between international linkages and demand for skilled labor using a single data source.

Table 2 summarizes the data and definitions for variables used in our regression model. The main objective of our analysis was to examine the implication of FDI on the relative demand in high-skilled labor of Malaysian manufacturing establishments.

The ASM by DOSM distinguished between production and non-production workers. We calculated our dependent variable as a share of the skilled workers by dividing the sum of (i) Managerial & Professional, and (ii) Technical & Supervisory personnel by the total number of full-time employees. The unskilled or production workers were the Production/Operatives Workers. Data on salaries comprised the amount of wages paid by each establishment during the reference year. The dataset provided by DOSM did not distinguish wage paid based on job category; thus, we were unable to separately construct the wages for skilled and unskilled labor or the wage skilled-labor ratio. Subsequently,

Table 1: The Number of Establishments Based on Two-Digit MSIC

Two-Digit MSIC	Industry	2000	2001	2002	2003	2004	2005	Total
15, 16	Food, Beverages, Tobacco	3,094	1,970	2,153	1,937	2,119	4,010	15,283
17, 18, 19	Textiles, Apparels, Footwear, Leather	2,503	1,806	1,727	1,638	1,220	4,072	12,966
20, 21, 22	Wood, Paper, Publishing	2,490	1,562	1,699	1,573	1,645	3,385	12,354
23, 24	Chemical, Petroleum	686	445	508	458	534	813	3,444
25	Rubber	1,556	898	1,068	929	1,034	1,712	7,197
26	Glass	846	598	659	565	632	1,191	4,491
27, 28	Iron, Metal	2,678	1,617	1,680	1,674	1,554	3,607	12,810
29	Machinery	1,118	676	671	659	650	1,104	4,878
30, 31, 32	Electrical, Electronics	941	601	711	644	602	923	4,422
33	Medical, Photographic	60	45	47	38	46	82	318
34	Automotive	277	188	201	193	200	285	1,344
35	Ship, Aircraft	203	151	171	155	163	263	1,106
36	Furniture	1,920	1,229	1,199	1,088	1,110	2,320	8,866
37	Waste, Scrap	10	7	12	13	20	55	117
Total		18,382	11,793	12,506	11,564	11,529	23,822	89,596

Table 2: Variables and Definition

Variable	Definition	Description
S	Skilled share	Ratio of skilled workers (non-production workers) to total employments.
W	Average wage per employee	Ratio of total salaries & wages paid to number of workers.
K	Capital	Ratio of capital stock to total sales (in thousands of Ringgit Malaysia).
Q	Scale	Value-added (firm's scale effects) measured by normalised value added (VN) $(VN_i = VA_i / VA_{an})$ where VA_i = VA for establishment i VA_{an} = average of VA for 5-digit industry
HQ	Herfindahl Hirschman Index	Calculated by squaring the market share (output) of each firm competing in a 5-digit industry and then summing the results numbers. The index ranges from 0 to 10,000.
X	Export Intensity	The ratio of exports of goods to total sales (in thousands of Ringgit Malaysia).
S	International Outsourcing Intensity	Ratio of import of intermediate inputs to total inputs, or ratio of import of intermediate inputs to value-added (in thousands of Ringgit Malaysia).
FS	Foreign Ownership	Establishments with 10% and above of foreign ownership.
H	Vertical Integration	The ratio of value-added to total sales (in thousands of Ringgit Malaysia).
SZ	Size	Based on the number of employees.
	Micro establishments	Establishments with less than 5 employees.
	Small establishments	Establishments with 10–50 of employees.
	Medium establishments	Establishments with 50–250 of employees.
	Large establishments	Establishments with 250 and above of employees.

we only calculated the average wage at the establishment level by dividing the total salaries and wages paid by the number of employees.

We have two specific objectives: First, to investigate the effect of foreign ownership at the firm level on the share of high skilled demand within the firm, regardless of their ownership status. A positive association between the degree of ownership and skilled demand ratio indicates that foreign ownership leads to skill upgrading within the firm. Second, we will analyze the skill spillover effect of foreign presence at the industry level on the share of high-skilled labor demand for the domestic firms within the same industry. Specifically, we regress the foreign share at industry level on skilled share for locally owned firms. The industry-level foreign share measures the horizontal spillover effect of FDI on skilled demand. The competition effect from intra-industry foreign presence may force domestic firms to be more competitive and boost its efficiency (Blomström & Kokko, 1998), hence leading to skill upgrading within the domestic firms. Nonetheless, the competition effect may also induce a negative spillover effect (Aitken & Harrison, 1999) as foreign affiliates have the incentive to prevent technology leakage and spillover from occurring by avoiding labor mobility. Cost-efficient foreign firms may draw demand from domestic firms; hence they may crowd out domestic firms from markets, possibly contributing to lower growth rates and unemployment problems. Therefore, FDI presence within the same industry will induce competition pressures, which in turn produce ambiguous results on the performance of domestic firms (Aitken & Harrison, 1999; Smarzynska Javorcik, 2004). For FDI horizontal linkages measures, we followed Smarzynska Javorcik (2004) in calculating the foreign share of the total output of a given industry j (5-Digit MSIC) at time *t*:

$$FH_{jt} = \frac{\sum_i FS_i * Q}{\sum_i Q} \quad (1)$$

where numerator is the total production of foreign firms weighted by foreign equity share in industry *j* at time *t*, and the denominator is the total output of industry *j* at time *t*.

In addition to foreign ownership effect on skilled demand, we also analyze the impact of the trade linkages on the demand. This study will investigate every aspect of trade linkage, including the export of goods, international outsourcing, and vertical trade (or export processing trade). As shown in Table 2, the export intensity is calculated by the ratio of export of goods to total outputs, while international outsourcing is the ratio of imported inputs to the total inputs[2]. According to Hummels et al. (2001) importing the intermediate inputs or exporting goods only represents just one side of international production network. Since the definition of vertical trade is import contents of export, which is measured by the share of imported inputs in the exported goods, the best indicator, should be able to integrate both activities in a single measurement. The availability of trade data at the firm level, both for exports of goods and imported inputs, provides us with an advantage to use most disaggregated and considerably adequate and direct measures compared industry-level measurement. Therefore, we utilized the vertical trade index developed by Khalifah and Azhar (2014), which can capture the intensity of vertical trade at the firm level. The index measures the overlapping of export (X) and imported inputs (Minp), as defined in equation (2):

$$V_i = 2 \min (X_i, \mathrm{Minp}_i) \tag{2}$$

where i indexes establishments, X_i is exported, and Minp_i is imported inputs of establishments i. VTQ measure is defined as the share of vertical trade in gross output of the establishment is as follows:

$$VQ_i = \frac{2\min\{X_i, \mathrm{Minp}_i\}}{Q_i} \tag{3}$$

where Q_i is the gross output of the establishment. The VTQ takes a value in the range [0, 2]. The lower bound indicates no overlap between exports and imported inputs values (equal to 0 means establishment is a one-way trader, either as an only exporter or only importer). The upper bound, or if the value is close to 2, shows a massive overlap of exports and imported inputs values relative to outputs, representing two-way traders or export processing trade.

3.2. Estimation Strategy

Our labor demand function originated from a translog cost function, introduced by Diewert (1974). We estimated the log-linear reduced labor demand function at the establishment-level to respond to two main objectives: First, to elucidate whether the intensity of foreign ownership was associated with an increase in firm's skilled-labor share, regardless of their ownership structure. Second, to elucidate whether the intensity of foreign presence in an industry affects skilled-labor share for intra-industry locally owned firms. We examined both hypotheses using regression equation represented as follows:

$$S_{it} = \alpha_1 + \alpha_w W_{it} + \alpha_q Q_{it} + \alpha_k K_{it} + \alpha_f F_i + \alpha_x X_{it} + \alpha_s S_{it} + \alpha_v V_{it} + \alpha_h H_{it} + \delta_i + \delta_t + \varepsilon_{it} \tag{4}$$

where represents the employer's share of skilled labor in establishment i at time t, denotes wages paid proxied by the average wage of total employment, and K are output and capital, proxied by the firm's value-added and the ratio of capital stocks. Our focus variables are FDI measures, denoted by F. For our first objective, FDI was proxied by foreign share equity (FS) to evaluate foreign ownership intensity at firm level and its relationship with skilled-labor demand within entire firms in the Malaysian manufacturing industries. For the second objective, following Smarzynska Javorcik (2004), we used horizontal FDI (FH) as a proxy for the intensity of FDI within the industry when assessing how and to what extent FDI has spillover benefits on domestically owned firms.

Additionally, we included all spectrum of trade linkages measures in the equation. In the export of goods, X represents the export intensity of the establishment proxies measured by the share of exported goods from total sales; international outsourcing (S) is indicated by the ratio of imported intermediate inputs from total inputs; and export processing trade (V) is proxied to the vertical trade index (Khalifah and Azhar, 2014).

We also include H, representing in-house production or vertical integration to capture the make or buy decision. Additionally, we include an establishment-specific effect and a time effect (or trend), respectively, to capture the technological differences among firms, which were expected to influence the demand for skilled-labor share (unobserved time-invariant heterogeneity firms), time-specific effect considering the technological changes and the macroeconomic shocks expected to affect each organization as a whole. And the is the error term.

A positive (or negative) sign of estimated indicates a change in average wages will alter labor composition toward more skilled (or less skilled) labour[3]. Estimates of indicate the potential effect of the firm's output or scale on skilled-labor share, the estimates of indicate whether skilled labor is complements ($\alpha_c > 0$) or substitutes ($\alpha_c < 0$) of capital within the firm's process of production.

Our interest was on the estimated coefficients of FDI. A positive (or negative) sign of estimated indicating foreign ownership intensity will alter the composition of labor toward a higher share of skilled labor (or less share of skilled labor, i.e., the ratio of skilled labor decreases with the increment in foreign share). Bear in mind that this coefficient measures the direct within-firm effect of foreign ownership intensity on the firm's decision in hiring labor, i.e., the foreign ownership effects on firm's internal structure of production. It determines whether foreign ownership possesses advanced technology and uses more sophisticated inputs which would then increase the share of skilled demand within the firms ($\alpha_{fs} > 0$), or vice versa ($\alpha_{fs} < 0$). Whereas the parameter of estimated specifies the existence and the extent to which FDI transmits their innovative technology to domestic firms within the five-digit industry. The parameter represents the external factors that contribute through foreign-owned firms' activities within the same industry or intra-industry linkages that may influence the performance of the domestic firm. For instance, labor mobility creates a market for specific and sophisticated inputs and knowledge of doing business through networking between firms that positively affect the performance of domestic firms ($\alpha_{fh} > 0$), or vice versa ($\alpha_{fh} < 0$).

Parameters , and represent the effect of engaging a firm in world market activities of skilled demand. Estimate of represents the direct effect of foreign technology, through imported inputs, on the share of skilled labor. Namely, it indicates that the foreign-technological change is biased toward high-skilled labor ($\alpha_s > 0$) or toward unskilled labor ($\alpha_s < 0$). A positive sign of estimated and indicates a change in the intensity of trade-measure (export or vertical trade) rise in relative demand for high-skilled labor. Briefly, foreign technology and trade linkages lead to skill upgrading if the measures are associated with shifts in the composition of labor toward skilled labor, and conversely, they represent skill downgrading if the estimated coefficients are negative.

Equation (4) represents a static model of the equation on share of labor demand. We added a dynamic element in our model as a slow adjustment in the labor demand to any shocks (Van Reenen, 1997; Acharya, 2017). Accordingly, we included lag-dependent variable (LDV) as well as lagged variable for average wages (W) to cater to the cost adjustment in labor demand. As shown in the empirical result section, our LDV was always significant which suggested that adjustment cost was involved in the equation during estimation.

In our procedure on estimation, we considered several econometric issues. First, we omitted variable problem or unobserved firm-level heterogeneity. The omitted variables comprised the error term in the labor equation, which was expected to influence the dependent variable (skilled-share) and the choice of other explanatory variables[4]. Second, simultaneity bias, which was simultaneous causality of skilled-share (employment) and trade measures, was affected by establishment-level shocks to demand and productivity. It was inter-connected between productivity, imported inputs and the firm's skilled share workers who determined the firm's absorptive capacity (Augier et al., 2013; Okafor et al., 2017). As such, we estimated our model (Equation (4) using Sys-GMM estimator to provide for detailed study into the causal relationship while controlling for endogeneity problems. Thereby, we obtained:

$$\Delta S_{it} = \alpha_1 + \sum_{j=1}^{2} \alpha_l \Delta S_{it-j} + \alpha_w \Delta W_{it-1} + \alpha_q \Delta Q_{it} + \alpha_k \Delta K_{it} + \alpha_f \Delta F_{it} + \alpha_x \Delta X_{it} + \alpha_s \Delta S_{it} + \alpha_v \Delta V_{it} + \alpha_h \Delta H_{it} + \Delta\delta_t + \Delta\varepsilon_{it} \quad (5)$$

4. Results and Discussion

This section presents the empirical evidence on the linkages between foreign presence and skilled-labor demand within establishments (firms) in Malaysian manufacturing industries. Tables 3 to 7 present estimated results of employment share for skilled labor in Malaysian Manufacturing establishments for the period 2000–2005 (for familiarity reasons, the term establishment will be replaced with the word 'firm' while explaining our empirical results as per the practice in previous papers). We also included variables HQ and SZ in estimating equation (5), which represents the market concentration, to account for market competition as a different type of output's market structure. The change is expected to introduce a different process of decision making in hiring workers. The firm's size is proxied respectively to the Herfindahl-Hirschman Index and the number of employees.

First, we discuss the regression results showing the association of within-firms foreign ownership and skilled-labor demand for entire firms irrespective of their ownership status. Table 3 and 4 report the estimated results for whole firms in order to investigate the importance of foreign equity share, together with trade linkages measures and other control variables, on skill-share labor within firms in Malaysian manufacturing industries regardless of their ownership. This should establish whether foreign ownership matters and provide explanation as through what channel FDI could affect changes in skilled demand for Malaysian manufacturing firms. In the second part, as shown in Table 5, we will present the empirical evidence on whether there exist FDI spillover effect on skilled demand for domestically owned firms.

For the robustness analysis, we regressed our estimation equation only for foreign-owned firms, in order to support our present evidence on the association between foreign share and within firm's skilled demand (Table 6). Additionally, we divided the sample by size to analyze the importance of FDI for SMEs and large firms (results on the estimates are displayed in Table 7).

4.1. Baseline Results

Table 3 and Table 4 present the estimation of equation (5) for a full sample. Model (1.1) to (1.4) in Table 3 are our baseline models, with estimates of basic characteristics of firms excluding the global linkages variables. In Model (1.2) and (1.3), we added industry fixed effects (sub-industry and 2-digits MSIC group), while Model (1.4) is the control for firm size. Relating to Model (1.1) through (1.4), the employment share of high-skilled labor increases with the firm's scale, Q. The estimated coefficient for contemporaneous Q is positive and statistically significant thus indicating that the

Table 3: Estimation Results of Employment Share for High-skilled Labour in Malaysian Manufacturing Firms

Dependent Variable ($S_{i,t}$)	(1.1)	(1.2)	(1.3)	(1.4)
$S_{i,t-1}$	0.434***	0.436***	0.448***	0.451***
	(0.108)	(0.116)	(0.117)	(0.092)
$W_{i,t}$	–0.594	–0.489	0.150	–0.867
	(1.682)	(2.115)	(2.054)	(1.409)
$W_{i,t-1}$	0.251	0.147	–0.303	0.504
	(1.301)	(1.576)	(1.543)	(1.087)
$Q_{i,t}$	0.279**	0.265**	0.248*	0.283***
	(0.118)	(0.131)	(0.131)	(0.104)
$Q_{i,t-1}$	0.088	0.113	0.103	0.040
	(0.123)	(0.130)	(0.130)	(0.101)
$K_{i,t}$	–0.825	–0.854	–0.889	–0.647
	(0.516)	(0.541)	(0.553)	(0.432)
$K_{i,t-1}$	0.710	0.727	0.747	0.556
	(0.465)	(0.486)	(0.496)	(0.389)
S.Z.				–0.483**
				(0.209)
HQ	0.0001 ***	0. 00009**	0. 00009**	0. 0001***
	(0.000)	(0.000)	(0.000)	(0.000)
Trend	–0.001	0.000	–0.003	–0.001
	(0.014)	(0.015)	(0.015)	(0.012)
Sub-Ind	No	Yes	No	No
2-Digits	No	No	Yes	No
Constant	0.729	0.710	0.462	1.225
	(0.917)	(1.206)	(1.357)	(0.792)
Observations	47,350	47,350	47,350	47,350
No. of ID	16,378	16,378	16,378	16,378
No. of Instruments	13	26	35	14
Wald-test	294.37***	1464.34***	1628.68***	606.29***
AR(2)	0.273	0.276	0.253	0.289
Hansen test	0.222	0.243	0.186	0.063

Robust standard errors in parentheses, and ***, **, * refer to 1%, 5% and 10% significant levels.

firm's scale increased demand for skilled-labor and effected changes in the firm's labor demand composition toward skilled labor. The estimated value is within range 0.25 and 0.28, which shows a 10% point increase in the firm's scale, on average, and associated with 2.5 to 2.8% point increase in high-skilled labor share within the firm.

The estimation results also suggest that there is no statistically significant relationship between the demand for skilled workers and average wages (W) and capital intensity (K). For capital intensity, the results are specifically robust for all specification, thus indicating that changes in skilled-labor share within firms are not associated with the changes in the firm's capital ratio. However, the estimated coefficient for market concentration (HQ) is positive and highly statistically significant (through all models), indicating that firms with higher market share are associated with greater demand for high-skilled labor thus implying that high market competition leads to a lower share of skilled-labor within firms.

Table 4: Estimation Results of Employment Share for High-Skilled Labour Controlling for International Linkages

Dependent Variable ($S_{i,t}$)	**(2.1)**	**(2.2)**	**(2.3)**	**(2.4)**	**(2.5)**
$S_{i,t-1}$	0.487*** (0.094)	0.482*** (0.083)	0.462*** (0.133)	0.481*** (0.095)	0.586*** (0.065)
$W_{i,t}$	–0.737 (1.197)	–0.907 (1.176)	–0.599 (1.558)	–0.749 (1.268)	–1.149 (1.293)
$W_{i,t-1}$	0.485 (0.935)	0.602 (0.905)	0.381 (1.219)	0.468 (0.971)	0.907 (1.005)
$Q_{i,t}$	–0.001 (0.220)	0.108 (0.130)	–0.065 (0.271)	0.038 (0.228)	–0.091 (0.177)
$Q_{i,t-1}$	0.203* (0.122)	0.102 (0.151)	0.276 (0.219)	0.198 (0.147)	0.061 (0.180)
$K_{i,t}$	–0.369 (0.613)	–0.351 (0.501)	–0.554 (0.914)	–0.426 (0.634)	0.471 (0.395)
$K_{i,t-1}$	0.321 (0.536)	0.302 (0.443)	0.482 (0.803)	0.369 (0.557)	–0.410 (0.341)
$FS_{i,t}$	–0.867 (0.570)	–0.707** (0.291)	–1.005 (0.655)	–0.811 (0.606)	–1.163*** (0.441)
$FS_{i,t-1}$	0.738* (0.388)	0.627*** (0.212)	0.833* (0.451)	0.708* (0.412)	0.890*** (0.343)
$S_{i,t}$		0.112 (0.116)			
$S_{i,t-1}$		–0.088 (0.093)			
$X_{i,t}$			–0.499 (0.661)		
$X_{i,t-1}$			0.132 (0.346)		
$V_{i,t}$				0.030 (0.421)	
$V_{i,t-1}$				–0.059 (0.273)	
$H_{i,t}$					–0.013 (0.099)
$H_{i,t-1}$					0.149** (0.075)
HQ	0.00007* (0.000)	0.00007** (0.000)	0.00007 (0.000)	0.00007** (0.000)	0.00002 (0.000)
Trend	–0.001 (0.011)	–0.009 (0.014)	0.007 (0.020)	–0.001 (0.014)	–0.012 (0.015)
Constant	0.328 (0.756)	0.453 (0.694)	0.211 (0.936)	0.423 (0.808)	0.221 (0.743)
Observations	47,350	47,350	47,350	47,350	47,350
No. of ID	16,378	16,378	16,378	16,378	16,378
Instruments	15	17	17	18	18
Wald-test	515.68***	556.44***	375.08***	482.85***	490.55***
AR(2)	0.152	0.186	0.340	0.198	0.070
Hansen test	0.285	0.205	0.317	0.421	0.632

Robust standard errors in parentheses, and ***, **, * refer to 1%, 5% and 10% significant levels.

4.2. Does the Degree of Foreign Ownership Contribute to Skill Upgrading?

Table 4 displays the estimation results, which include the firm-level international linkages measure, namely, foreign ownership intensity, FS in Model (2.1), international outsourcing intensity, S in Model (2.2), export intensity, X in Model (2.3), and export processing trade index, T in Model (2.4). Additionally, in Model (2.5), we control for vertical integration (H), which presents the in-house production (make versus to buy or outsourcing decisions).

Unexpectedly, estimation results in Model (2.1) through (2.5) demonstrate a negative association between skilled demand and contemporaneous foreign share (FS), if we control international outsourcing (Model 2.1) and vertical integration (Model 2.5). The estimated coefficient for lagged FS turned out to be positive and statistically significant in all specifications.

Numerous studies provided evidence that foreign presence increased the demand for skilled labor. Our current findings indicate that there is a delay before Malaysian manufacturing firms are able to learn and absorb the advanced technology, and subsequently benefit from foreign ownership within the firm. Thus, its appears that while we accept the intuition of positive effect of foreign ownership at the firm level on skilled demand within Malaysian manufacturing firms, the catching-up on advanced technology however is attained through the learning process (Farole & Winkler, 2012; Girma & Görg, 2007; Okafor et al., 2017; Wu & Hsu, 2012; Yunus et al., 2015) ABC is defined as the natural logarithm of a firm's total factor productivity (TFP).

The results in model (2.2) to (2.4), respectively, show that the skill demand for Malaysian manufacturing firms is not statistically related to firm-level international trade activity over the period 2000–2005 (all estimated coefficients are statistically not significant). The findings are close to those in Yunus et al. (2015) and Andersson et al. (2016). The results thus indicate that importing foreign technology and expanding market shares through exports may not necessarily create jobs for high-skilled labour within Malaysian manufacturing firms. This outcome is consistent with the findings by Jauhari and Khalifah (2018). Firms engaged in foreign markets are mostly involved in low value-added activities or unskilled intensive stage of production. Therefore, the hypothesis of trade-induced SBTC (Ekholm & Midelfart, 2005; Giri et al., 2021) does not apply for Malaysian manufacturing firms within the period of studies.

Further, the specification in Model (2.5) reveals that the estimated coefficient for lagged vertical integration (VI) is positive and significant at 5% level. Our evidence indicates that in-house production may have induced skill accumulation through the learning process within firms. The results strengthen our earlier findings on the importance of the learning process among workers in Malaysian manufacturing firms. The magnitude of lagged FS is highest in Model (2.5) and increases further once we include the VI term in our specification.

This result shows that increased in-house production or intra-firm transaction through VI has intensified the skill upgrading process due to foreign presence. Since the dataset as received does not distinguish between arms-length and intra-firm trade, we were unable to investigate the issue extensively. Additionally, previous studies did not account for the issue of VI explicitly while investigating the FDI-skill demand nexus.

4.3. Skill Spillover Effect from FDI

Table 5 displays the estimation results following an investigation on the spillover effect of FDI, particularly its impact at the industry level on a skilled-labor share within locally owned firms. FH measures the FDI horizontal spillover effect or intra-industry linkages on skilled demand. In contrast to the findings by Yunus et al. (2015), the presence of foreign firms in this study showed a negative horizontal spillover effect on the skill-labor composition of local-owned firms within the same industry. The estimated coefficient of FH was negative and significant, particularly in Model (3.1), (3.2) and (3.5). The presence of foreign firms within the same industry may have created competitive pressure with local firms in both outputs markets and inputs market.

In contrast to horizontal FDI, positive FDI spillover are most likely to occur through contacts between domestic suppliers of intermediate inputs and their multinational buyers, namely, the vertical FDI linkages (Smarzynska Javorcik, 2004). The significance and positive value of estimated HQ also indicate that market power will increase the skilled labor demand.

The results of this study are in line with the conclusions by Hoang et al. (2021) that examine the impact of FDI on innovation among Vietnamese firms. The study claims FDI is not the main source of technological innovation among firms as the technology brought in by foreign firms is relatively outdated, while the linkages between local and foreign firms are still considered weak to enable technology transfer and the ability to absorb technology among workers is still low.

Hence, the locally owned firms in the Malaysian manufacturing sector need to strengthen their market power to enhance the demand for skilled labor, catching-up with the sophisticated technology and benefit from intra-industry FDI linkages.

4.4. Robustness Analysis

To analyze in-depth whether firm-level foreign ownership enhances demand for skilled-labor, we ran the regression for foreign-owned firms, as shown in Table 6. The estimation results in Model (4.1) to Model (4.5) suggest that this study is unable to provide empirical evidence on the significance of firm-level foreign share (FS) in determining the demand for skilled-labor within foreign-owned firms.

The results showed that foreign equity share was not the primary determinant that influence demand for high-skilled labor among foreign firms. In addition, the activities of international trade also did not contribute to changes in skilled-labor demand. The only variable that was statistically significant was average wages (W) as shown in Model (4.1) and Model (4.4).

Result unchanged even after controlling for size and 2-digits group industries.

Foreign firms generally offer higher wages, which may attract away quality workers or conversely prevent local firms from raising their wages to attract them (Chen et al., 2011)Macao and Taiwan (HMT. The scenario is consistent with our findings in Table 6 (mainly for Model 4.1 and 4.4), which indicate that average wages are positive and significantly associated with higher demand for skilled-labor by foreign-owned firms. The foreign firms may also have provided incentive to prevent information leakage

Table 5: Estimation Results of Employment Share for High-skilled Labour in Local-owned Firms

Dependent Variable ($S_{i,t}$)	(3.1)	(3.2)	(3.3)	(3.4)	(3.5)
$S_{i,t-1}$	0.473*** (0.079)	0.481*** (0.076)	0.408*** (0.142)	0.472*** (0.085)	0.522*** (0.055)
$W_{i,t}$	–1.405 (1.166)	–1.030 (1.193)	–1.025 (1.915)	–1.398 (1.300)	–0.994 (0.777)
$W_{i,t-1}$	0.884 (0.966)	0.603 (0.982)	0.555 (1.582)	0.886 (1.058)	0.675 (0.629)
$Q_{i,t}$	0.224** (0.113)	0.138 (0.112)	0.211 (0.171)	0.222 (0.147)	0.098 (0.092)
$Q_{i,t-1}$	0.136 (0.103)	0.241* (0.143)	0.252 (0.230)	0.131 (0.167)	0.117 (0.096)
$K_{i,t}$	–0.406 (0.409)	–0.403 (0.398)	–0.830 (0.872)	–0.410 (0.536)	–0.019 (0.307)
$K_{i,t-1}$	0.357 (0.368)	0.353 (0.358)	0.730 (0.776)	0.360 (0.476)	0.013 (0.274)
$FH_{i,t}$	–0.101* (0.057)	–0.147** (0.069)	–0.142 (0.095)	–0.096 (0.072)	–0.108** (0.049)
$FH_{i,t-1}$	–0.007 (0.018)	–0.000 (0.018)	–0.001 (0.028)	–0.007 (0.019)	–0.014 (0.012)
$S_{i,t}$		–0.214 (0.150)			
$S_{i,t-1}$		0.175 (0.113)			
$X_{i,t}$			–0.835 (0.995)		
$X_{i,t-1}$			0.336 (0.484)		
$V_{i,t}$				0.064 (1.200)	
$V_{i,t-1}$				0.004 (0.703)	
$H_{i,t}$					0.227*** (0.082)
$H_{i,t-1}$					0.191*** (0.066)
HQ	0.00016*** (0.000)	0.00017*** (0.000)	0.00020** (0.000)	0.00015*** (0.000)	0.00011*** (0.000)
Trend	0.021 (0.014)	0.036** (0.018)	0.038 (0.031)	0.019 (0.025)	0.020* (0.012)
Constant	1.267** (0.517)	1.119** (0.510)	1.248 (0.804)	1.237** (0.589)	1.132*** (0.350)
Observations	39,840	39,840	39,840	39,840	39,840
No. of ID	14,556	14,556	14,556	14,556	14,556
Instruments	15	17	17	17	16
Wald-test	569.13***	594.77***	283.97***	571.24***	1117.39***
AR(2)	0.454	0.403	0.377	0.449	0.801
Hansen test	0.331	0.509	0.682	0.332	0.079

Robust standard errors in parentheses, and ***, **, * refer to 1%, 5% and 10% significant levels.
Result unchanged even after controlling for size and 2-digits group industries.

that could be used to enhance the performance of their local competitors.

Further, to compare the foreign ownership-skilled labor demand nexus, between SMEs and large-firms, we divided the samples according to firm size. Model (5.1) to (5.5) in Table 7 presents the estimation results in employment share of high-skilled labor for small- and medium-sized firms (SMEs), while Model (6.1) to (6.4) shows the estimation results for employment share of high-skilled workers for large-sized firms.

Model (5.1) to (5.5) shows that the estimated coefficient for lagged FS is significant and positive in all models. The

Table 6: Estimation Results of Employment Share for High-skilled Labour in Foreign-owned Firms

Dependent Variable ($S_{i,t}$)	(4.1)	(4.2)	(4.3)	(4.4)	(4.5)
$S_{i,t-1}$	0.421*** (0.096)	0.399*** (0.079)	0.350** (0.147)	0.412*** (0.086)	0.437*** (0.123)
$W_{i,t}$	2.112** (0.933)	1.603 (0.975)	1.919 (1.278)	1.746** (0.698)	2.504 (1.812)
$W_{i,t-1}$	–1.200* (0.637)	–0.849 (0.680)	–1.042 (0.856)	–0.944* (0.497)	–1.470 (1.311)
$Q_{i,t}$	–0.009 (0.099)	0.020 (0.210)	0.223 (0.391)	–0.036 (0.312)	–0.103 (0.248)
$Q_{i,t-1}$	0.044 (0.097)	0.048 (0.189)	–0.051 (0.207)	0.075 (0.205)	0.088 (0.237)
$K_{i,t}$	–0.001 (0.271)	–0.052 (0.209)	–0.054 (0.359)	–0.034 (0.244)	0.085 (0.301)
$K_{i,t-1}$	0.062 (0.169)	0.073 (0.135)	0.095 (0.224)	0.069 (0.158)	0.022 (0.200)
$FS_{i,t}$	–0.021 (0.036)	–0.004 (0.048)	–0.022 (0.048)	–0.013 (0.040)	–0.039 (0.068)
$FS_{i,t-1}$	–0.034 (0.164)	0.023 (0.150)	–0.002 (0.224)	–0.006 (0.149)	–0.081 (0.235)
$S_{i,t}$		0.024 (0.109)			
$S_{i,t-1}$		0.019 (0.135)			
$X_{i,t}$			0.665 (1.08 8)		
$X_{i,t-1}$			–0.622 (0.848)		
$V_{i,t}$				–0.082 (0.694)	
$V_{i,t-1}$				0.083 (0.468)	
$H_{i,t}$					0.091 (0.145)
$H_{i,t-1}$					0.017 (0.147)
HQ	–0.0000 (0.000)	0.0000 (0.000)	0.00001 (0.000)	–0.000 (0.000)	–0.000 (0.000)
Trend	–0.020 (0.018)	–0.016 (0.018)	–0.036 (0.035)	–0.013 (0.036)	–0.018 (0.021)
Constant	–3.647*** (0.824)	–3.372*** (0.730)	–3.654*** (1.055)	–3.396*** (0.885)	–3.733*** (1.002)
Observations	7,510	7,510	7,510	7,510	7,510
No. of ID	2,514	2,514	2,514	2,514	2,514
Instruments	15	17	17	17	17
Wald–test	130.38***	171.55***	85.78***	167.98***	102.76***
AR(2)	0.729	0.707	0.432	0.777	0.745
Hansen test	0.913	0.538	0.907	0.741	0.863

Robust standard errors in parentheses, and ***, **, * refer to 1%, 5% and 10% significant levels.
Result unchanged even after controlling for size and 2-digits group industries.

results indicate that SMEs require FDI's injection to absorb and catch up on advanced technology through the learning process and to upgrade their skills.

In large firms, the positive effect of FDI on skilled-labor demand is immediately absorbed due to the significance of contemporaneous FS parameter as demonstrated in Model (6.1) and Model (6.2). Additionally, the skilled share is statistically significant and associated with international outsourcing SMEs (Model 5.2). For larger firms, export-processing trade was also statistically significant in the shift in labor demand toward skilled labor (Model 6.3).

To have a more robust inference on the role of foreign ownership, we further divided the sample for the SMEs as well as the large firms into local-owned and foreign-owned firms. All estimated coefficients discussed previously were found not significant in all specifications (results available upon request).

The comparison in estimation results within Table 8 indicates that the contributing sources for skilled changes in SMEs differ from those in the large-sized firms. For SMEs, FDI can only raise skilled demand through the learning process. This finding is essential as guidelines and provides relevant implications for policy regulation.

Table 7: Estimation Results of Employment Share for High-Skilled Labour for Small, Medium and Large Firms

Dependent Variable ($S_{i,t}$)	Small Medium Establishments					Large Establishments			
	(5.1)	**(5.2)**	**(5.3)**	**(5.4)**	**(5.5)**	**(6.1)**	**(6.2)**	**(6.3)**	**(6.4)**
$S_{i,t-1}$	0.513*** (0.049)	0.548*** (0.037)	0.526*** (0.044)	0.546*** (0.038)	0.507*** (0.037)	0.536*** (0.091)	0.558*** (0.097)	0.520*** (0.090)	0.503*** (0.092)
$W_{i,t}$	–1.997*** (0.773)	–1.338*** (0.509)	–1.695** (0.662)	–1.479** (0.684)	–1.171*** (0.429)	1.298* (0.768)	0.943 (0.663)	1.075* (0.642)	1.661* (0.988)
$W_{i,t-1}$	1.176* (0.612)	0.603 (0.406)	0.932* (0.525)	0.623 (0.465)	0.648* (0.335)	–1.084*** (0.409)	–0.934** (0.388)	–0.865*** (0.334)	–1.011** (0.458)
$Q_{i,t}$	–0.038 (0.058)	0.013 (0.044)	–0.021 (0.051)	0.041 (0.045)	–0.003 (0.047)	0.114 (0.082)	0.154* (0.079)	0.180** (0.081)	0.111 (0.097)
$Q_{i,t-1}$	0.047 (0.036)	0.079** (0.032)	0.056* (0.032)	0.110** (0.045)	–0.020 (0.058)	–0.050 (0.034)	–0.092* (0.050)	–0.073* (0.037)	–0.068 (0.084)
$K_{i,t}$	–0.055 (0.076)	–0.032 (0.061)	–0.047 (0.070)	–0.052 (0.066)	–0.150** (0.075)	–0.327 (0.242)	–0.414 (0.264)	–0.189 (0.159)	–0.396 (0.351)
$K_{i,t-1}$	0.071 (0.062)	0.041 (0.047)	0.060 (0.056)	0.057 (0.052)	0.119** (0.059)	0.193 (0.186)	0.209 (0.205)	0.099 (0.126)	0.290 (0.287)
$FS_{i,t}$	–0.052 (0.055)	–0.056 (0.045)	–0.057 (0.050)	–0.038 (0.048)	–0.073 (0.046)	0.167* (0.099)	0.169* (0.100)	0.123 (0.079)	0.196 (0.130)
$FS_{i,t-1}$	0.164** (0.071)	0.156*** (0.059)	0.162** (0.068)	0.141** (0.059)	0.178*** (0.064)	–0.081 (0.061)	–0.085 (0.067)	–0.058 (0.053)	–0.096 (0.073)
$S_{i,t}$		–0.019 (0.049)					0.104 (0.080)		
$S_{i,t-1}$		0.040* (0.021)					–0.016 (0.029)		
$X_{i,t}$		0.061 (0.085)					0.053 (0.122)		
$X_{i,t-1}$		–0.021 (0.026)					–0.003 (0.042)		
$V_{i,t}$			0.030 (0.141)					0.303* (0.181)	
$V_{i,t-1}$			–0.009 (0.041)					–0.073 (0.053)	
$H_{i,t}$				0.065 (0.058)	0.109** (0.055)				–0.096 (0.108)
$H_{i,t-1}$				–0.071 (0.051)	–0.024 (0.040)				0.021 (0.096)
HQ	–0.000 (0.000)	0.00002 (0.000)	0.000 (0.000)	0.00004* (0.000)	–0.000 (0.000)	0.00003 (0.000)	0.00006 (0.000)	0.000 (0.000)	–0.000 (0.000)
Trend	0.025*** (0.009)	0.025*** (0.007)	0.024*** (0.008)	0.030*** (0.011)	0.008 (0.008)	–0.006 (0.019)	–0.006 (0.022)	–0.020 (0.021)	–0.018 (0.026)
Constant	1.205** (0.504)	1.143*** (0.405)	1.121** (0.454)	1.482*** (0.567)	0.691** (0.292)	–1.262 (2.242)	–0.342 (2.226)	–1.272 (2.063)	–2.716 (2.774)
Observations	34,712	34,712	34,712	34,712	41,471	5,879	5,879	5,879	5,879
No. of ID	12,567	12,567	12,567	12,567	15,112	1,780	1,780	1,780	1,780
Instruments	21	29	25	25	25	21	29	25	25
Wald-test	488.27***	616.43***	547.73***	577.90***	612.91***	297.48***	205.98***	273.35***	334.94***
AR(2)	0/172	0.213	0.184	0.240	0.128	0.228	0.203	0.490	0.307
Hansen test	0.819	0.372	0.611	0.706	0.903	0.435	0.738	0.570	0.781

Robust standard errors in parentheses, and ***, **, * refer to 1%, 5% and 10% significant levels.
Result Model (5.1) to (5.4), we estimate specifications for SMEs without micro-sized firms, and Model (5.5) display the estimation results after micro-sized firms included in our samples.

5. Conclusion

This paper presents empirical evidence on the relationship between FDI and the relative demand for skilled labor in Malaysian manufacturing firms. We investigated the role of foreign presence on skilled demand by estimating the equation of employment share of skilled labor demand using the one-step Sys-GMM estimator. Our results revealed that foreign ownership have contributed to skill upgrading in Malaysian manufacturing firms through the learning path, particularly for SMEs. However, our results also showed that foreign ownership per se does not contribute to skill upgrading for Malaysian manufacturing firms within the period under study. Within foreign firms as well as large-sized firms, wages are the primary sources for changes in skilled demand. FDI may have changed the labor market structure for skilled labor due to efficiency wage motivation (Tomohara & Yokota, 2011). Ultimately, higher competition effect exerted by the presence of foreign firms within the same industry has led to the decrease in relative demand for skilled labor in domestic firms. This consequence represents the negative spillover effect of horizontal FDI.

This research is not only of academic interest, but is also highly relevant for policy regulation. The impact of FDI presence in local networks, their effects on competitiveness of domestic firms, their competency in catching-up and absorbing the sophisticated and advanced technology from rival MNCs, should be of interest to policymakers. If the quality of FDI and their inter-linkages are crucial to the performance of local firms, it is vital to have selected policy for this investment, in lieu of the survival of the SMEs. The design and adoption of FDI promotion policies should be carefully strategized and combined with fair labor and education policies to attain sustainable and inclusive economic growth in Malaysia. Small market share and higher market competition have reduced the relative demand for skilled labor by domestic firms. Therefore, the expansion and fortification of local firms, particularly the market share in both outputs and inputs markets of SMEs, are crucial since these firms contribute a large share to domestic employments and the GDP.

Further study is recommended to quantify the contrasting effect of FDI spillover on horizontal and vertical linkages as well as the forward and backward spillover since every linkage have different channels and magnitude. Due to data limitation, our analysis did not differentiate the imported intermediates inputs into arm-length and intra-firms' transactions, as well as the source country for the inputs. In addition, the datasets did not provide information on the source country for the FDI inflows. It would be interesting for future research to differentiate the skilled demand effects of international linkages on the manufacturing sector of developed countries and the linkages with less developed countries.

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Endnotes

[1]The data initially covered 20,455 firms in 2000 (census year), 13,934 firms in 2001, 13,482 firms in 2002, 13,672 firms in 2003, 12,451 firms in 2004, and 28,257 firms in 2005 (census year). We dropped observation from the sample with negative value-added, zero capital stocks and real wages less than RM100.

[2]Our dataset did not distinguish between arms-length and intra-firm trade and did not report on the industrial classification of the imported inputs. Therefore, we were unable to distinguish between broad and narrow measurements of international outsourcing as conducted by Feenstra & Hanson (1999).

[3]Since we replaced relative wages by average wage, were unable to interpret estimated as the elasticity of substitution between the two factors of production.

[4]For example, current productivity, which was realised by firms but not econometrician may determine the decision in development expenditure and engage in trade linkages (import the intermediate inputs and export their goods). Refer to Melitz (2003) and Kasahara et al. (2016).