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US FOREIGN DIRECT INVESTMENT (FDI) AND MANUFACTURING SECTOR IN MALAYSIA

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ABSTRACT

Utilising several manufacturing sub-sectors in Malaysia, this study attempts to investigate the spillover effect of US FDI on Malaysian economy. By identifying this issue, it could help in terms of selecting future FDI-related strategies in order to magnify the positive effect of FDI inflows. Applying seemingly unrelated regression (SUR) method, this study observes that there is no guarantee that FDI inflows into various sectors within manufacturing industry will generate positive externalities.

Keywords: spillover effect, US FDI, manufacturing sector

INTRODUCTION

According to World Bank (1996), foreign direct investment (FDI) is defined as an investment made in order to acquire or retain a lasting management interest in a business enterprise operating abroad. A minimum ordinary shares or voting stock requirement is 10%.[1] It can be in the form of greenfield investment or merger and acquisition (M&A). Greenfield investment, or sometimes also called mortar and brick investment, refers to new investment. M&A entails an acquisition of existing business in host country.

FDI is well accepted as contributing to long-term economic development. Regardless of the types, any inflows will induce higher economic growth to host economies. Bwalya (2006) highlighted three channels through which FDI may positively influence economic growth:

1. via providing fund (not debt) to finance investment in the host countries
2. via improving the technical level of host countries
3. via transferring new technology to host countries' domestic firms

Moreover, according to Carkovic and Levine (2002), the economic rationale for offering special incentives to attract FDI inflows is based on the general perception that FDI produces externalities in the form of technology transfer and spillover. Blomtstrom, Konan and Lipsey (2000) argued that technology transfer can take place either directly or internally from parent company to its affiliate(s) overseas or indirectly to domestically owned firms in the host country. The detail of channels of spillover effect is given by Blomström and Kokko (1998), Lim (2001), Hanson (2001) and Smarzynska (2002). Lim (2001) and Smarzynska (2002) suggested the vertical as well as horizontal linkages as the mechanisms of technology transfer and spillover to domestic economy. Vertical linkage refers to a situation in which affiliates deal with domestic suppliers, while horizontal linkage is reflected in the interaction between affiliates and firms in the same sector or industry. In addition, Blomström and Kokko (1998) and Hanson (2001) proposed another two channels of technology transfer or spillover. The first mechanism is through labour turnover, switching from affiliates to domestically owned firms. The second channel is via R&D internationalisation. On the empirical side, de Gregorio (2003) confirmed the benefit of FDI in spurring the economic growth through the introduction of new technologies and knowledge by testing empirically the experience of Latin American countries for the period between 1950 and 1985. De Gregorio (2003) found that relative to the impact of 1% increase in aggregate investment which leads to an improvement of GDP by 0.1% to 0.2% annually, FDI can generate a higher jump of GDP growth by approximately 0.6% for the same size of investment. In short, de Gregorio (2003) demonstrated that FDI is far more efficient that aggregate domestic investment.

Due to overwhelming arguments that have been made in favour of FDI inflows, many countries' policy makers started to aim at attracting more FDI to flow into their countries. Similarly, many economists are concentrating their researches on the factors that can help to boost FDI inflows. However, a high FDI does not necessarily mean the economic health is good or growing in strength. Hausmann and Fernández-Arias (2000) and Albuquerque (2000) pointed that a high share of FDI in total capital inflows may be a sign of a host country's weakness rather than its strength. There are some evidences that the FDI share is higher in countries where the quality of institutions is lower. One explanation is that FDI is more likely, compared with other forms of capital flows, to take place in countries with missing or inefficient markets. In such settings, foreign investors will prefer to operate directly instead of relying on local financial markets, suppliers, or legal arrangements (Loungani & Razin, 2001). The policy implications of this view, according to Albuquerque (2000, pg. 30), are "that countries trying to expand their access to international capital markets should concentrate on developing credible enforcement mechanisms instead of trying getting more FDI." In a similar view, Hausmann and Fernández-Arias (2000) argued that stipulating policies to attract and subsequently, to expand FDI share is unwarranted. Instead, they suggested that the efforts should be concentrating on improving the environment for investment and the functioning of markets to be rewarded with increasingly efficient overall investment and more capital inflows.

On another note, economists are also of different opinions when they discuss the channels through which FDI is expected to spur economic growth. According to Singh and Zammit (2009), although the second tier newly industrialising economies (NICs) of Malaysia, Indonesia and Thailand have been very successful in 1980s and 1990s in terms of GDP growth, there are questions about the sustainability of their growth record. In line with this argument, Singh and Zammit (2009) suggested that there are weaknesses in their national technological systems, such that their domestic firms are still lack of capacity to assimilate and develop technology. This renders the countries heavily dependent for their technological development on continuing large inflows of FDI. Nonetheless, if FDI reversal took place, these economies could be in a big trouble and collapse as local investors are unable to substitute the presence of multinational corporations (MNCs). Substitution issues revolve around the volume of investment necessary to support domestic economic development as well as the technology level – either managerial skills or up-to-date technology or both – which obviously are lacking. Loungani and Razin (2001) provided a framework from which FDI reversal could actually take place very quickly, beyond conventional believe that FDI is very loyal to host economy.

Consolidating both issues, we can argue that technology-enhancing effect of FDI on local economy remains as an unresolved issue. Surprisingly, this point has received very limited attention in the past. Study on the effect of FDI is very much concentrated in identifying the aggregate impact on GDP. The biggest hurdle that hampers most studies' aim in providing the most accurate picture about the extent of technology spillover is mainly due to unavailability of data. Therefore, unlikely one can find an appropriate method to be employed to address the issue. While we do face the same problem, taking into account the failure to fill in this research gap and by virtue of limited information available from the ASEAN Secretariat, we think the simple approach utilised in this study is sufficient to provide us with preliminary observation on the spillover effect of US FDI in Malaysian economy. US FDI is chosen because of its prolong presence in Malaysian economy and continues to be among the top FDI contributors in Malaysia.

The organisation of this study is as follows: the next section briefly reviews past studies, followed by discussion on methodology adopted in this study. The section after the methodology section discusses the results of the analyses and the last section concludes.

LITERATURE REVIEW

Theoretical Review

Theoretically, Bwalya (2006) outlined that productivity spillovers can occur at least through three main channels: (1) through the movement of highly trained and skilled staff from foreign firms to domestic firms; (2) through what is referred to us "demonstration effect" arising from arm's length relationships between foreign and domestic firms, which enables the latter to learn and adopt superior production technologies and managerial and organisational skills; and (3) through "competition effects" from foreign firms, which may force rival domestic firms to upgrade production techniques in order to remain competitive and productive.

Castellani and Zanfei (2003) discussed the one oft-cited condition favouring a positive impact of inward investments on domestic firms' productivity has to do with the role of technological gaps between foreign and domestic firms. Some works suggest that the larger the productivity gap between host country firms and foreign-owned firms, the larger the potential for technology transfer and for productivity spillovers to the former. This assumption, which we label as the "catching up hypothesis", can be derived from the original idea put forward by Findlay (1978), who formalised technological progress in relatively "backward" regions as an increasing function of the distance between their own level of technology and that of the "advanced regions", and of the degree to which they are open to foreign direct investment. On the other hand, scholars have argued that the lower the technological gap between domestic and foreign firms, the higher the absorptive capacity of the former, and thus the higher the expected benefits in terms of technology transfer to domestic firms. We label this as the "technological accumulation hypothesis" (Cantwell, 1989). It is worth noting that the role of absorptive capacity is implicitly recognised also in the catching up tradition, when it is acknowledged that a sort of lower bound of local technological capabilities exists, under which foreign investment cannot be expected to have any positive effects on host economies. The "technological accumulation hypothesis" goes beyond this simplistic view of absorptive capacity and places a new emphasis on the ability to absorb and utilise foreign technology as a necessary condition for spillovers to take place.

Another crucial framework that can be used to explain the role of FDI in economic development is the so-called "flying-geese" model or paradigm which introduced by Akamatsu in the 1930s. The model has also evolved from the original framework of flying-geese (FG). The original FG model as described in Akamatsu (1961, 1962) involved a process from imports-domestic production-exports (IDE). The second generation of FG model is based on Vernon's product-cycle theory (Vernon, 1966). Product-cycle theory suggest three stages of life-cycle of each manufactured product, starting from novelty (or new product), followed by maturity and finally standardisation. The modern version of FG, which is propagated by Kojima (1973) and Ozawa (1991), perceives the orderly transformation of economic activities among participating economies, which relegates its obsolete economic activities to less industrialised. The role of MNCs is then to facilitate the process of restructuring of the economies of home and host. The interesting and important point under the third generation of FG model is that FG upholds an optimitis view that with the emergence of a hierarchically organised regional division of industrial labour, involved economies could avoid the situation of too many being engaged simultenously in export-oriented production for a narrow line of product group (Kasahara, 2004). Nevertheless, empirical evidence of what is known as the spillover literature has provided mixed signals on the effects of MNCs on local productivity.

Empirical Review

There have been an increasing number of empirical studies which focus on the spillover effects of FDI on host country economies. The results, however, have been mixed. Some studies find evidence supporting the theoretical prediction on the existence of spillover effect from FDI. Among the early studies on this issue are such as Caves (1974) on Australian manufacturing, Globerman (1979) on Canadian manufacturing, and Blomström and Persson (1983) on Mexican manufacturing industries. Three recent studies on Indonesia manufacturing industry (Blomström & Sjohölm, 1999; Sjohölm, 1999; Takii, 2005) all found supporting evidence of spillover effects from FDI. Perez (1997) argued that a moderate foreign presence is sufficient to generate positive spillovers, even when there is a relatively wide technological gap between the foreign and locally owned industry. Advanced technology in just a few foreign affiliates is sufficient to stimulate acquisition by local firms, while foreign skills and managerial practices may also be effectively transferred, for example, via original equipment manufacturing (Hsu & Chen, 2000). The mere existence of new entry into host markets provides enough incentive for allocative efficiency gains, while technical efficiency benefits from demonstration effects require only modest foreign investment (Haddad & Harrison, 1993). In contrast, a number of studies did not find significant spillover effects on domestic productivity from FDI. Nonetheless, in some studies, domestic productivity is found to be even negatively associated with the intensity of foreign presence. The examples include studies by Kokko, Tanzini and Zejan (1996) on Uruguayan manufacturing sector, Aslanoglu (2000) on Turkey manufacturing, Haddad and Harrison (1993) on Morocco manufacturing industries, and Aitken and Harrison (1999) on Venezuela industries.

Some recent studies are even unique as they found both in a single study such as Beugelsdijk, Smeets, and Zwinkels (2008), Buckley, Clegg and Wang (2007), and Castellani and Zanfei (2003). Alongside their findings, they did propose some underlying reasons for those results. For instance, Beugelsdijk et al. (2008), who studied the implication of US MNCs on 44 host countries for the period from 1983 to 2003, concluded that both types of FDI, horizontal (market-seeking) as well as vertical (efficiency-seeking) FDI, have brought about higher economic growth only to the host developed countries. Conversely, there is no evidence or significant effect can be observed in the case of host developing countries. Beugelsdijk et al. (2008) also found that out of the two, horizontal FDI tends to exert stronger impact on economic growth than vertical FDI. Buckley et al. (2007) found that the nationality of ownership of foreign investors significantly impacts upon productivity spillover effects, revealing a curvilinear relationship with foreign direct investment on data for overseas Chinese (Hong Kong, Macau and Taiwan) multinational enterprises, but not for other (Western) firms. Additionally, Buckley et al. (2007) suggested the use of curvilinear to predict the effect of spillovers in the future as it is likely a more powerful tool. Finally, Castellani and Zanfei (2003) examined the impact of foreign presence on the productivity of domestic enterprises by using a balanced panel of firm-level data on the manufacturing industry in France, Italy and Spain over the 1992–1997 period. Castellani and Zanfei (2003) found positive and significant externalities on Italian firms, negative impact on Spanish firms, and non-significant effects on French firms. Castellani and Zanfei (2003) continued the analysis to find anything that can be generalised to all countries by testing the implication of productivity gap between foreign and domestic firms, and absorptive capacity of domestic firms. The results demonstrated that high gaps tend to favour positive effects of FDI, while absorptive capacity, measured by local firms' average productivity levels, does not leverage productivity spillovers from FDI. Hence, Castellani and Zanfei (2003) confirmed the "catching up" hypothesis, which identifies a positive relation between the size of technological gaps and growth opportunities induced by foreign investments. Catching up hypothesis, on the other hand, would contradict the "technological accumulation" hypothesis which stresses the role of domestic absorptive capacity and of coherence between foreign and domestic technology as determinants of virtuous effects of inward investments.

METHODOLOGY

According to Bwalya (2006, p. 520), foreign presence can raise the productivity of local firms through technology diffusion, spillovers from foreign firms to local firms within the sector (intra-industry) and linkages with local firms in downstream or upstream sectors (inter-industry spillover). Foreign presence can also induce greater competition in both product and factor markets. On the negative note, it may force domestic firms to reduce their capacity utilisation, productivity and may eventually lead to shutdown. This phenomenon is also known as crowd-out effect. Nonetheless, on the positive note, this competitive environment can also be an incentive for domestic firms to become more innovative and productive, as in the case of South Korea (Wade, 1990) and Taiwan (Singh & Zammit, 2009). If succesfully designed, FDI inflows are expected to raise efficiency within the industry. In practice, the overall impact will depend on the relative magnitude of benefits generated through intra-industry spillovers and inter-industry linkages (Bwalya, 2006).

In this study, in order to gauge the potential spillover effects of FDI inflows on each manufacturing sector in Malaysia, we use simple correlation of FDI inflows into each sector and output of each sector as depicted in Table 1. Correlation analysis could be the weakest technique to detect the possible existence of spillover effect, but with limited information, it can serve as preliminary supporting evidence. Or at least, it can give us a hint whether or not we should continue to worry about the exaggerated benefit of FDI.

Table 1
Methodology – Correlation analysis

	OS01	OS02	...	OS18
FDIS01	α_1	$\beta_{1, 2}$	...	$\beta_{1, 18}$
FDIS02	$\beta_{2, 1}$	α_2	...	$\beta_{2, 18}$
:	:	:	:	:
FDIS18	$\beta_{18, 1}$	$\beta_{18, 2}$	...	α_{18}

In Table 1, *OS* denotes output of sub-sector and *FDIS* stands for FDI into sub-sector. Hence, *OS01* represents output of the first sub-sector in manufacturing sector and *FDIS01* reflects the amount of FDI inflows into manufacturing sub-sector 1. While ($\alpha_1, \alpha_2, ... , \alpha_{18}$) represents intra-industry correlation coefficients, the βs denote inter-industry correlation coefficients. The positive value of correlation coefficients demonstrates a positive spillover effects and conversely, the negative coefficients may potentially suggest a crowd-out effect. The list of manufacturing sub-sectors and their corresponding abbreviations are as in Table 2.

Since simple correlation does not tell us the direction of impact, we test the impact of FDI in various sectors on each sector within manufacturing by employing seemingly unrelated regression (SUR) method. A single model may contain a number of linear equations. In such a model it is often unrealistic to expect that the equation errors would be uncorrelated. A set of equations that has contemporaneous cross-equation error correlation (i.e. the error terms in the regression equations are correlated) is called a SUR system. At first look, the equations seem unrelated, but the equations are related through the correlation in the errors.

Table 2
List of sub-sectors in Malaysian manufacturing sector and abbreviations

No.	Sector		No.	Sector	
01	Food & beverages	[FB]	10	Rubber & plastic products	[RP]
02	Tobacco	[TO]	11	Other non-met mineral products	[MI]
03	Textile products	[TP]	12	Metal products	[MP]
04	Wearing apparel	[WA]	13	Non-electrical machinery	[NM]
05	Wooden products	[WP]	14	Electrical machinery	[EM]
06	Furniture & fixtures	[FF]	15	Motor vehicles	[MV]
07	Paper & printing products	[PP]	16	Other transport equipment	[OE]
08	Industrial chemicals	[IC]	17	Other manufacturing products	[OM]
09	Petroleum, coal products	[PC]	18	Other sectors	[OS]

Zellner (1962) developed the SUR estimator for estimating models with p > 1 dependent variables that allow for different regressor matrices in each equation (e.g. $X_i \neq X_j$) and account for contemporaneous correlation, i.e. $E\ (\varepsilon_{it}\varepsilon_{jt}) \neq 0$. In order to simplify notation, all equations are stacked into a single equation:

$$\begin{bmatrix} y_1 \\ y_2 \\ \cdots \\ y_n \end{bmatrix} = \begin{bmatrix} x_1 & 0 & 0 & 0 \\ 0 & x_2 & 0 & 0 \\ 0 & 0 & \cdots & 0 \\ 0 & 0 & 0 & x_n \end{bmatrix} \begin{bmatrix} \beta_1 \\ \beta_2 \\ \cdots \\ \beta_n \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \cdots \\ \varepsilon_n \end{bmatrix} \tag{1}$$

that can be re-written as $Y = X\beta + \varepsilon$, where the $Y = \left(y_1^{'}, y_2^{'}, \ldots, y_n^{'}\right)^{'}$ is a vector of all stacked dependent variables, X is a block diagonal design matrix with the i^{th} design matrix X_i on the ii^{th}, $\beta = \left(\beta_1^{'}, \beta_2^{'}, \ldots, \beta_n^{'}\right)$ is the vector of the stacked coefficient vectors of all equations, the total number of parameters estimated for all n submodels is $K = \sum_{i=1}^{n} k_i$ and $\varepsilon = \left(\varepsilon_1^{'}, \varepsilon_2^{'}, \ldots, \varepsilon_n^{'}\right)$ is the vector of the stacked error vectors of all equations.

The same estimates by separate single-equation ordinary least square (OLS) estimations can be obtained by an OLS estimation of the entire system of equations, i.e. β^{OLS} = $\left(X^{'}X\right)^{-1}X^{'}y$. The SUR estimator that accounts for interrelations between every single sub-model can be obtained by $\beta^{SUR} = \left[X^{'}\Omega^{-1}X\right]\left[X^{'}\Omega^{-1}Y\right]$, where Ω^{-1} is a weighting matrix based on the covariance matrix of the error terms Σ. This covariance matrix $\Sigma = [\sigma_{ij}]$ has the elements $\sigma_{ij} = E\ [\varepsilon_{in}\varepsilon_{jn}]$, where e_{in} is the error term of the n^{th} observation of the i^{th} equation. Finally, the inverse of the weighting matrix can be calculated by $\Omega = \Sigma \otimes I_N$, where I_N is an $N \times N$ identity matrix and denotes the Kronecker product. However, as the true error terms ε are known, they are often replaced by observed residuals, e.g. obtained from OLS estimates, i.e. $\hat{\varepsilon}_i = y_i - X_i\beta_i^{OLS}$ so that the elements of the covariance matrix can be calculated by $\hat{\sigma}_i = \frac{\hat{\varepsilon}_i^{'}\hat{\varepsilon}_j}{N}$. Thus, a SUR model is an application of the generalised least squares (GLS) approach and the unknown residual covariance matrix is estimated from the data.

Prior to the application of SUR model, we need to test that there is contemporaneous correlation among error terms, without which OLS is considered as valid and efficient estimator. The Breusch Pagan Test (also known as Lagrange multiplier (*LM*) test) is used to test the assumption that the errors across equations are contemporaneously correlated. The null hypothesis is no contemporaneous correlation or OLS is efficient estimator.[2] The alternative hypothesis is contemporaneous correlation. For a two-equation SUR model and after assuming normality, the test statistic is the following *LM* statistic that has a chi-square distribution with $M(M-1)/M$ degrees of freedom (Breusch & Pagan, 1980; Greene, 2003):

$$LM = \lambda = T\sum_{i=2}^{N}\sum_{j=1}^{i-1} r_{ij}^2 \sim \chi^2(M(M-1)/M); \qquad (2)$$

where r_{ij}^2 is the estimated correlation coefficient between $\varepsilon_{k,i,t}$ and $\varepsilon_{k,j,t}$ (for a given k and $i \neq j$) from individual OLS regressions. M is the number of equations in the system.

Although the methodology employed consist of simple correlation analysis and complemented with a simple highly aggregated level of regression analysis, the outcome of these analyses is still useful to provide preliminary picture about the extent of FDI contribution to Malaysian manufacturing sector. We noticed that very often researchers tend to report the positive impact of FDI on Malaysian industrialisation process such as what has been done by Masron and Yusop (2007) and Hassan and Masron (2011). The method employed could be by itself a limitation to the study such as in Hassan and Masron (2011). Hassan and Masron (2011) utilised input-output technique which from the coefficient estimated, the nature of the technique disallowed us to examine crowd-out effect. Although we do not have the evidence, we strongly believe that there should be some indications of negative implication. This study primarily devotes itself on this objective – apart from investigating the positive spillover effect, in addition to that this study aims at identifying the potential negative impact of US FDI on Malaysian manufacturing sector. The annual data are collected from the ASEAN Secretariat and Department of Statistics Malaysia for the period between 1999 and 2008.

RESULTS AND DISCUSSION

Before we discuss the main analysis of this study, we present the summary of statistics in Table 3 pertaining to the inflows of US FDI into each sector within manufacturing sector in Malaysia. The primary location of US FDI is in the paper and printing products which recorded the highest average value of USD 467.58 million for the period between 1999 and 2008. It is then followed by transport equipment (USD 307.76 million) and rubber and plastic product industry (USD 233.94 million). Two sectors recorded the least inflows of US FDI, namely wearing apparel (USD 7.26 million) and motor vehicles (USD 17.80 million).

Moving on to the correlation analysis as presented in Table 4, out of 18 sub-sectors, positive spillover effect for intra-industry or horizontal linkage is observed for majority sectors which is 14 sectors. However, textiles sector (OSTP) and metal product sector (OSMP) demonstrate a small and insignificant positive correlation, while moderate association in the case of tobacco sector (OSTO), furniture and fixtures sector (OSFF) and industrial chemicals sector (OSIC). Meanwhile, the likely crowding-out or negative spillover phenomenon is potentially occurring in the remaining four sectors with paper and printing products sector (OSPP) and other transport equipment sector (OSOE) are likely to suffer the most.

For the results of vertical linkage, we divide our analysis to two parts. Table 5 highlights those sectors with minimum negative spillover effect and Table 6 for those sectors with relatively suffering critically from negative spillover. The output of non-metal mineral products sector (OSNM) and motor vehicles sector (OSMV) is found to be the least adversely negatively associated with US FDI inflows to other sectors. Only FDI to three other sectors are likely to be negatively linked with output of OSNM and OSMV. These two are followed by the output of wearing apparels (OSWA), industrial chemicals (OSIC), rubber and plastic products (OSRP), other sectors (OSOS) with each of them is being negatively influenced by US FDI inflows into other four sectors.

Table 3
Summary of statistics (in million USD)

	Mean	Max	Min	S.D.
FDISFB	131.24	127.27	156.99	113.41
FDISTO	9.76	6.68	25.68	0.00
FDISTP	69.29	45.18	179.64	7.18
FDISWA	7.26	7.22	12.95	1.66
FDISWP	51.66	43.18	88.09	32.17
FDISFF	215.68	24.15	804.74	9.67
FDISPP	467.58	289.57	1260.78	30.40
FDISIC	143.80	142.45	196.35	93.97
FDISPC	163.59	152.86	252.14	96.51
FDISRP	233.94	243.93	421.90	26.02
FDISNM	344.40	111.81	1112.27	41.73
FDISMP	89.02	77.96	157.27	42.90
FDISNE	83.49	89.05	110.52	45.36
FDISEM	102.21	107.24	167.07	27.28
FDISMV	17.80	6.02	58.68	0.47
FDISOE	304.76	70.85	1040.61	36.73
FDISOM	15.66	13.92	28.12	6.69
FDISOS	12.98	13.85	21.23	2.99

Table 4
Correlation analysis – Horizontal linkage (Own sector)

FDIS	OSFB	OSTO	OSTP	OSWA	OSWP	OSFF
	0.944*	0.454*	0.257	0.967*	–0.172	0.556*
	[15.937]	[1.906]	[1.720]	[19.652]	[–1.164]	[3.729]
FDIS	OSPP	OSIC	OSPC	OSRP	OSNM	OSMP
	–0.536*	0.523*	–0.343	0.873*	0.931*	0.130
	[–2.984]	[2.281]	[–1.003]	[6.356]	[6.037]	[0.154]
FDIS	OSNE	OSEM	OSMV	OSOE	OSOM	OSOS
	0.895*	0.604*	0.897*	–0.582*	0.884*	0.895*
	[7.726]	[3.550]	[7.470]	[–3.031]	[5.432]	[6.715]

Note: To conserve space we do not denote the sector of which FDI is belong to. It should be treated in accordance to the sector. For instance, for sector OSFB, the corresponding FDIS is FDISFB. *denotes significant at least at 10% critical value which is based on Spearman rank.

Table 5
Correlation analysis – Vertical linkage (minimum negative spillover)

	OSFB	OSWA	OSFF	OSIC	OSRP	OSNM	OSNE	OSMV	OSOM	OSOS
FDISFB	HL	0.51* [2.26]	0.03 [0.12]	0.83* [5.61]	0.60* [2.85]	0.28 [1.10]	0.94* [9.42]	0.66* [3.30]	0.87* [6.44]	0.49* [2.08]
FDISTO	–0.15 [–0.59]	–0.15 [–0.57]	–0.99* [–8.67]	–0.09 [–0.34]	–0.53* [–2.39]	–0.74* [–4.13]	0.17 [0.66]	–0.62* [–2.96]	–0.03 [–0.01]	–0.84* [–5.69]
FDISTP	0.92* [9.21]	0.47* [2.01]	–0.08 [–0.33]	0.80* [5.09]	0.52* [2.28]	0.14 [0.53]	0.99* [4.18]	0.57* [2.62]	0.86* [6.36]	0.37 [1.48]
FDISWA	0.56* [2.58]	HL	0.12 [0.48]	0.95* [11.76]	0.04 [0.16]	0.62* [2.98]	0.51* [2.21]	0.19 [0.71]	0.26 [1.02]	0.56* [2.54]
FDISWP	–0.77* [–4.56]	0.12 [0.48]	–0.03 [–0.12]	–0.29 [–1.15]	–0.77* [–4.65]	0.07 [0.25]	–0.76* [–4.36]	–0.74* [–4.10]	–0.94* [–9.89]	–0.27 [–1.04]
FDISFF	0.46* [1.98]	–0.25 [–0.96]	HL	–0.01 [–0.44]	0.87* [6.71]	0.32 [1.25]	0.23 [0.89]	0.87* [6.62]	0.53* [2.32]	0.60* [2.81]
FDISPP	–0.59* [–2.74]	–0.45* [–1.93]	–0.85* [–6.03]	–0.52* [–2.33]	–0.72* [–3.92]	–0.83* [–5.56]	–0.30 [–1.18]	–0.83* [–5.49]	–0.40 [–1.65]	–0.98* [–6.94]
FDISIC	0.92* [9.01]	0.12 [0.47]	0.17 [0.64]	HL	0.85* [6.03]	0.18 [0.69]	0.85* [6.11]	0.85* [5.96]	0.98* [8.15]	0.49* [2.11]
FDISPC	0.56* [2.58]	0.98* [19.65]	0.12 [0.48]	0.95* [9.76]	0.04 [0.16]	0.62* [2.98]	0.51* [2.21]	0.19 [0.71]	0.26 [1.02]	0.56* [2.54]
FDISRP	0.95* [9.76]	0.23 [0.89]	0.26 [1.01]	0.59* [2.78]	HL	0.32 [1.24]	0.84* [5.82]	0.89* [7.12]	0.95* [8.38]	0.59* [2.76]
FDISNM	0.02 [0.07]	0.65* [3.22]	0.56* [2.54]	0.37 [1.53]	–0.04 [–0.16]	HL	–0.29 [–1.15]	0.07 [0.28]	–0.28 [–1.08]	0.64* [3.08]
FDISMP	–0.11 [–0.42]	0.21 [0.82]	0.90* [8.15]	0.85 [0.70]	0.22 [0.85]	0.79* [4.79]	–0.46 [–1.95]	0.32 [1.28]	–0.34 [–1.33]	0.69* [3.55]
FDISNE	0.75* [4.28]	0.11 [0.44]	–0.43 [–1.82]	0.50* [2.19]	0.37 [1.50]	–0.26 [–1.02]	HL	0.36 [1.44]	0.84* [5.69]	–0.05 [–0.18]
FDISEM	0.87* [6.81]	0.34 [1.37]	0.55* [2.52]	0.61* [2.89]	0.88* [7.01]	0.59* [2.70]	0.66* [3.25]	0.95* [9.04]	0.79* [4.79]	0.82* [5.31]
FDISMV	0.47* [2.02]	–0.14 [–0.53]	0.78* [4.79]	0.05 [0.20]	0.87* [6.71]	0.47 [1.96]	0.20 [0.75]	HL	0.49* [2.09]	0.71* [3.73]
FDISOE	–0.07 [–0.27]	0.48* [2.06]	0.72* [3.92]	0.21 [0.81]	0.05 [0.19]	0.85* [6.04]	–0.41 [–1.69]	0.16 [0.60]	–0.33 [–1.31]	0.68* [3.44]
FDISOM	0.93* [9.88]	0.55* [2.46]	–0.03 [–0.09]	0.85* [6.19]	0.51* [2.22]	0.24 [0.92]	0.96* [3.14]	0.59* [2.70]	HL	0.44 [1.81]
FDISOS	0.64* [3.15]	0.24 [0.93]	0.77* [4.65]	0.40 [1.64]	0.88* [7.23]	0.67* [3.33]	0.36 [1.45]	0.94* [9.15]	0.55* [2.46]	HL
No. of Negative	5	4	6	4	4	3	5	3	6	4

Note: HL refers to horizontal linkages as in Table 4, which is not the focus of this table. *denotes significant at least at 10% critical value which is based on Spearman rank.

Table 6 presents the results of spillover effect for those sectors which are being classified as moderately and highly affected. Output of wooden products (OSWP) and petroleum and coal products (OSPC) are the most severely affected sector within US FDI inflows. US FDI flows into 15 and 13 other sectors, respectively are identified probably exerting negative consequence on the sector's output or performance of OSWP and OSPC. Output of electrical machinery (OSEM) is the next after OSWP and OSPC to be negatively influenced by US FDI spillover from its presence in other eight sectors. The remaining sectors' outputs such as tobacco (OSTO), textile (OSTP), papers and printings products (OSPP), metal products (OSMP) and other electrical products (OSOE) are potentially having negatively associated with US FDI inflows into seven other sectors. In short, we observe a serious possible negative impact of US FDI inflows on manufacturing sectors as several sectors found to be suffering a lot from its presence.

Table 6
Correlation Analysis – Vertical Linkage (majority is negative spillover)

	OSTO	OSTP	OSWP	OSPP	OSPC	OSMP	OSEM	OSOE
FDISFB	0.66* [3.31]	0.47* [2.02]	–0.66* [–3.28]	–0.16 [–0.59]	–0.79* [–4.79]	0.49* [2.11]	0.45 [1.89]	0.68* [3.44]
FDISTO	HL	–0.52* [–2.28]	0.61* [2.89]	–0.75* [–4.20]	–0.46 [–1.92]	–0.39 [–1.59]	–0.32 [–1.27]	–0.26 [–0.99]
FDISTP	0.68* [3.51]	HL	–0.56* [–2.52]	–0.29 [–1.11]	–0.85* [–5.96]	0.44 [1.84]	0.41 [1.66]	0.67* [3.38]
FDISWA	0.64* [3.13]	–0.15 [–0.57]	–0.76* [–4.32]	0.38 [1.52]	–0.26 [–1.00]	–0.20 [–0.76]	–0.26 [–1.03]	–0.01 [–0.03]
FDISWP	–0.34 [–1.46]	–0.77* [–4.61]	HL	0.35 [1.41]	0.79* [4.79]	–0.84* [–5.68]	–0.86* [–6.19]	–0.94* [–9.42]
FDISFF	–0.28 [–1.17]	0.93* [9.88]	–0.41 [–1.69]	0.14 [0.52]	–0.08 [–0.31]	0.87* [6.62]	0.84* [5.68]	0.77* [4.57]
FDISPP	–0.02 [–0.11]	–0.62* [–2.96]	0.88* [6.81]	HL	–0.02 [–0.09]	–0.52* [–2.26]	–0.44 [–1.82]	–0.52* [–2.26]
FDISIC	0.45 [1.89]	0.80* [4.98]	–0.55 [–2.48]	–0.23 [–0.87]	–0.75* [–4.20]	0.82* [5.31]	0.79* [4.89]	0.94* [9.42]
FDISPC	0.64* [3.13]	–0.13 [–0.57]	–0.76* [–4.32]	0.38 [1.52]	HL	–0.20 [–0.76]	–0.26 [–1.03]	–0.01 [–0.03]
FDISRP	0.45* [1.89]	0.78* [4.74]	–0.65* [–3.18]	–0.11 [–0.41]	–0.70* [–3.64]	0.79* [4.75]	0.75* [4.24]	0.91* [8.15]

(*continued on next page*)

Table 6 (*continued*)

	OSTO	OSTP	OSWP	OSPP	OSPC	OSMP	OSEM	OSOE
FDISNM	0.05 [0.18]	–0.20 [–0.76]	–0.60* [–2.83]	0.93* [9.21]	0.47* [2.01]	–0.29 [–1.15]	–0.34 [–1.37]	–0.34 [–1.34]
FDISMP	–0.49* [–2.14]	0.17 [0.65]	–0.46 [–1.92]	0.89* [7.23]	0.68* [3.46]	HL	–0.02 [–0.07]	–0.12 [–0.47]
FDISNE	0.68* [3.51]	0.31 [1.25]	–0.14 [–0.54]	–0.57* [–2.62]	–1.00* [–8.68]	0.42 [1.72]	0.44 [1.85]	0.63* [3.05]
FDISEM	0.29 [1.15]	0.78* [4.74]	–0.79* [–4.89]	0.24 [0.94]	–0.44 [–1.85]	0.74* [4.13]	HL	0.81* [5.26]
FDISMV	–0.25 [–1.00]	0.90* [7.86]	–0.51* [–2.19]	0.29 [1.13]	–0.02 [–0.08]	0.82* [5.43]	0.78* [4.65]	0.73* [4.02]
FDISOE	–0.16 [–0.63]	–0.06 [–0.25]	–0.55* [–2.45]	0.99* [4.18]	0.59* [2.74]	–0.17 [–0.65]	–0.22 [–0.83]	HL
FDISOM	0.68* [3.51]	0.38 [1.56]	–0.62* [–2.94]	–0.18 [–0.68]	–0.81* [–5.15]	0.40 [1.63]	0.36 [1.44]	0.63* [3.01]
FDISOS	–0.01 [–0.02]	0.82* [5.37]	–0.76* [–4.36]	0.44 [1.82]	–0.09 [–0.34]	0.74* [4.17]	0.68* [3.46]	0.71* [3.79]
No. of Negative	7	7	15	7	13	7	8	7

Note: HL refers to horizontal linkages as in Table 4, which is not the focus of this table. *denotes significant at least at 10% critical value which is based on Spearman rank.

Vertical linkages based analysis, similar to horizontal linkage case, successfully highlight the potential threat of US FDI inflows into Malaysian manufacturing sector. However, it is worth to caution that this finding requires a careful treatment as correlation is basically investigating the co-movement without specifically telling us the direction. Therefore, a more sound analysis definitely needs to be conducted to reconfirm this study. Nonetheless, albeit its limitation and simplicity, this study could hint something against the conventional norm or believe that FDI is absolutely development-enhancing investment. To certain degree, this study complement and support several studies which questioned and skeptical about the existence of technology transfer or spillover to host country such as Stancik (2007).

In order to permit SUR model with a limited data, we pooled the sectors into three categories only. We regrouped the 18 sectors into food-based sector, simple manufacturing-based and heavy industry-based sector. Food sector includes food and beverages (*FB*), tobacco (*TO*) and other sectors (*OS*). Simple manufacturing sector comprises of textile products (*TP*), wearing apparel (*WA*), wooden products (*WP*), furniture and fixtures (*FF*), paper and printing products (*PP*), rubber and plastic products (*RP*), other non-metal mineral products (*MI*), and other manufacturing products (*OM*). Heavy sector group is then will have the remaining sectors as listed in Table 2. We represent the correlation analysis based on three groups in Table 7. The results of correlation analysis based on regrouping and after taking log, demonstrate a better picture than the segregated information. The correlation between US FDI in each sector and output of that particular sector suggest potential positive outcome of US FDI inflow. Nevertheless, the correlation coefficients do not necessarily significant in all equations. For instance, investment in food sectors (*FDISFOOD*) is significantly and positively associated with output of own sector (*OSFOOD*) as well as heavy industry sector (*OSHEAVY*) but insignificant association with output of simple manufacturing sector (*OSSIMPLE*). Similarly, FDI in heavy sector (*FDISHEAVY*) has also two significant positive links, namely with food sector and simple manufacturing sector but failed to exert significant connection with its own sector's output. Finally, US FDI in simple manufacturing sector (*FDISSIMPLE*) has a significant positive association with its own sector's output but produce no link with other sectors' output. On the correlation among the FDI in the three sectors, it is observed that US FDI in food (*FDISFOOD*) has negative coefficient with respect to *FDISSIMPLE* and *FDISHEAVY*, indicating potential substituting effect between *FDISFOOD* and *FDISIMPLE* as well as *FDISHEAVY*. In other words, US MNCs has to make a choice between low-technology oriented sector such as food sector or medium-technology (such as simple manufacturing) and high-technology (such as heavy industry) oriented sectors. More importantly, the correlation coefficients suggest that there is no serious multicollinearity problem among independent variables.

Table 7
Correlation analysis –Three groups

	lnOSFOOD	lnOSSIMPLE	lnOSHEAVY	lnFDISFOOD	lnFDISIMPLE
lnFDISFOOD	0.65* [3.23]	–0.22 [–0.86]	0.73* [3.99]	1.00	
lnFDISSIMPLE	0.21 [0.80]	0.89* [7.12]	0.21 [0.80]	–0.40 [–1.63]	1.00
lnFDISHEAVY	0.61* [2.89]	0.86* [6.19]	0.19 [0.73]	–0.09 [–0.33]	0.50* [2.78]

Note: Figure in [ ] stand for *t*-value of Spearman rank-order.

The result of regression analysis based on seemingly unrelated regression analysis is shown in Table 8. Before the outcome of SUR estimation is discussed, the most important point to highlight is the validity of the use of SUR application. This can be done via the test of contemporaneous correlation if each equation is estimated by using ordinary least square (OLS). Contemporaneous correlation can be understood by referring back to the concept of time-specific heterogeneity. It is possible that all sectors can be affected by the same event at the same time (Worrall & Pratt, 2004). Contemporaneous correlation is basically the same thing, but with the possibility that less than all sectors are affected. If, for example, there was a sudden and unexpected flash flood, then food sectors could be affected by the destruction of supply of agricultural inputs but this effect would probably not manifest itself in a larger scale such as at the whole industry in Malaysia as many other sectors may not demand agricultural inputs. Alternatively, contemporaneous correlation can refer to differing levels of correlation between all units of analysis during the same time period as opposed to the same level of correlation that dummy variables for time assume (Worrall & Pratt, 2004). The results of Breusch-Pagan Lagrange Multiplier (BP-LM) test at the bottom of Table 8 confirmed that there is a presence of contemporaneous correlation and hence, validate the use of SUR approach.

The result is a bit consistent with the results of correlation analysis. While FDI inflows into certain sector generate positive spillover to that particular sector's output, FDI inflows into other areas do not seem to support or produce positive spillover. For instance, FDI in heavy industry does not significantly affect output in food sector and FDI in food sector does not have significant impact on output in simple manufacturing sector. It means that there is no guarantee that FDI flows into any sector (although it is able to boost output of the sector) will also generate positive spillovers to other sectors. Surprisingly, besides insignificant impact of US FDI in simple manufacturing sector on the output of heavy industry sector, we also observed a potential negative spillover of FDI in simple manufacturing sector on output of heavy industry. Contradicting to what has been observed when correlation coefficients are referred to in the earlier discussion, the SUR model outcomes suggest that the option between simple manufacturing and heavy industry has been among the trade-off in US MNCs decision to invest in Malaysia. This finding surely carries huge implication to Malaysian policy on FDI inflows in order to push Malaysian economy to another high level of economic development. As Malaysia has been for long-time standing or relying on simple assembly and manufacturing activities, leading to middle-income trap, FDI policy should be more on attracting high-technology FDI. In another word, Malaysia should be ready to receive lower FDI in simple manufacturing sectors in order to allow for more high-tech oriented FDI inflows. Simple manufacturing activities should be encouraged among local investors to undertake the responsibilities.

As part of robustness test, the extension of the SUR model in Table 8 is estimated by including growth rate of each sectors' output (*YGROWTH*) in the equation. The results are presented in Table 9. Firstly, *LM* test also suggests that there is contemporaneous correlation and therefore, the use of SUR method is valid. Secondly, apart from *YGROWTH* entering positively and significantly in all equations, the results of the remaining coefficients are remained intact in terms of significant level as well as sign of effect. Albeit changing size a bit, overall conclusion about the effect of US FDI in each sector on sectoral output is still consistent with the findings in Table 8.

Table 8
Result of Seemingly Unrelated Regression (SUR) Analysis

	Dependent Variable = Sectoral Output (OS)		
	lnOSFOOD	lnOSSIMPLE	lnOSHEAVY
Constant	–15.7866***	33.8585***	–11.4440***
	[–5.4818]	[–11.3137]	[3.2290]
lnFDISFOOD	1.9410**	1.8454*	0.4752
	[10.5901]	[2.1562]	[1.1194]
lnFDISSIMPLE	1.1835*	3.9852***	–0.0674
	[1.8850]	[6.5273]	[–1.2296]
lnFDISHEAVY	0.4224	0.1885**	0.6563***
	[1.1143]	[2.4514]	[9.4054]
		Model Criteria	
Adjusted-R^2	0.4022	0.4000	0.3972
S.E. of Regression	0.2998	0.3743	0.3955
BP-LM test		81.9408 {0.6523}	

Note: ** and *** denote significant at 10%, 5% and 1%, respectively. Figure in [ ] stands for *t*-value and figure in { } denotes *p*-value.

Finally, as mentioned earlier that this study warrant a more sound future study in order to firmly conclude the existence of negative spillover of US FDI in particular as well as FDI in general. One possible avenue is to combine with the conclusion made by Carkovic and Levine (2002). Carkovic and Levine (2002) argued that the pace of technological change in the economy as a whole will depend on the innovative and social capabilities of the host country, together with the absorptive capacity of other enterprises in the country. Hence, it is important for future study to identify the connection between FDI and economic growth by taking into account the innovative and social capabilities of host country. On the other hand, if the statement of Smarzynska (2002) that MNCs tend to locate their operation in highly productive industries is in fact valid or applicable to explain the negative or low spillover effect of US FDI, the exit of less productive domestic firms could be the answer. Hence, in response to this phenomenon of crowded-out domestic private investors, Malaysia shall focus on the strategy to develop local investors' competitiveness.

Table 9
Result of Seemingly Unrelated Regression (SUR) Analysis – Extension

	Dependent Variable = Sectoral Output (OS)		
	lnOSFOOD	lnOSSIMPLE	lnOSHEAVY
Constant	–15.7866***	–33.8585***	–11.4440***
	[–5.4818]	[–11.3137]	[3.2290]
YGROWTH	0.1653*	0.2473*	0.5418*
	[2.3781]	[1.9873]	[3.4718]
lnFDISFOOD	1.2117**	0.7124*	1.5004
	[3.1770]	[3.1390]	[0.4461]
lnFDISSIMPLE	1.0349*	3.9852***	–0.0674
	[2.1650]	[6.5273]	[–1.2296]
lnFDISHEAVY	0.6172	0.2041**	0.6048***
	[1.6379]	[2.1944]	[3.7011]
		Model Criteria	
Adjusted-R2	0.4997	0.4106	0.4331
S.E. of Regression	0.2014	0.3246	0.3175
BP-LM test		65.8955{0.5671}	

Note: *, ** and *** denote significant at 10%, 5% and 1%, respectively. Figure in [ ] stands for *t*-value and figure in { } denotes *p*-value.

CONCLUSION

This study investigates the prolonged issue inherent in the area of FDI – whether or not FDI generates spillover effect to the whole host country. Focusing on Malaysian manufacturing sector for the period from 1999 to 2008, this study estimates the effect of FDI in one sector to the output of other sector within manufacturing sector. This study found that while we observe positive spillover effect to take place, at the same time, we also noticed that FDI inflows in certain sector likely to exert a negative consequence on its own sector as well as to other sector. Although this study could have limitation considering the methodology employed is merely a simple correlation analysis, in its current setting, it still contributes to the body of the literature by diverting our focus from too much appreciating the inflows of FDI into a more serious and strategic plan in attracting FDI. Spillover effect could take place but the likely crowding-out or immiserizing growth effect that prevails is also required further attention.

Low technology oriented sectors such as agricultural sector, simple manufacturing sector and so on can be regarded as declining sector in terms of their contribution to GDP as well as exports. However, they might be crucial to indirectly support the growth of another high-end sector such as high-technology oriented sector by supplying crucial ingredient inputs for productions or food security, either to high-end users or for public at large. The best strategy could be then to focus and attract high-technology oriented MNCs to develop further technology development in this country while leaving domestic entrepreneurs to develop or undertake the task to promote other sectors. Domestic entrepreneurs can be given incentives, similar to MNCs but with a strict condition to be competitive and able to shoulder huge responsibilities to promote those sectors left by MNCs after certain period of time.

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NOTES

1. If a firm owned less than 10% of ordinary share, the investment is called as portfolio investment.
2. To be precise, the null hypothesis is $\mathrm{H}_0 : \mathrm{cov}(\varepsilon_{\mathrm{k\,i,t}}, \varepsilon_{k,j,t}) = 0$ and the alternative hypothesis is $\mathrm{H}_1 : \mathrm{cov}(\varepsilon_{\mathrm{k\,i,t}}, \varepsilon_{k,j,t}) \neq 0$ for at least one pair of $i \neq j$.

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