Malaysian Journal of Economic Studies 50 (1): 21-35, 2013 ISSN 1511-4554

Impact of Foreign Direct Investment & Domestic Investment on Economic Growth of Malaysia

Masoud Rashid Mohamed[a]
Zanzibar University, Tanzania

Keshminder Singh Jit Singh[b]
Universiti Technologi MARA, Malaysia

Chung-Yee Liew[c]
Universiti Putra Malaysia

Abstract: In this paper, we apply vector error correction modeling (VECM) to 1970-2008 data. The objective is to analyse the long-run causal relationship between foreign direct investment (FDI), domestic investment (DI) and economic growth in Malaysia. The presence of complementary/substitution effect between FDI and DI is also investigated using impulse response function and variance decomposition analysis. The results suggest a long-run bilateral causality between economic growth and DI. There is no evidence of causality between FDI and economic growth. On the other hand, the results suggest a short-run crowding-in effect between FDI and DI.

Keywords: Causality, domestic investment, economic growth, foreign direct investment
JEL classification: F21, O16. C22

1. Introduction

The impact of foreign direct investment (FDI) and domestic investment (DI) on economic growth has recently been the subject of intense debate (Maher and Christiansen 2001). The effect of FDI on economic growth depends on whether FDI compliments or substitutes DI (De Mello 1999). Some writers have stressed that FDI accelerates economic growth due to its complementary effect on gross domestic investment (GDI) while others found evidence that suggests a negative impact of FDI to recipient's economy because it crowds-out/ substitutes DI. For example, Ndikumana and Verick (2008) found evidence that supports a complementary effect of FDI on DI in African countries but Borensztein *et al.* (2008) found less robust complementarity of FDI and DI. However, Lumbila (2005) attests that FDI and GDI can complement each other and positively affect growth only if policy and the macroeconomic environment are sound.

The positive impact of FDI on DI and growth is realised when foreign firms provide new investment opportunities to domestic firms by introducing new technology and

[a] Department of Economics, Zanzibar University, P.O. Box 2440 Zanzibar, Tanzania. Email: *masoud@zanvarsity.ac.tz* (Correspondence author).
[b] Faculty of Business Management, Universiti Teknologi MARA, 40450 Shah Alam, Selangor, Malaysia. Email: *keshm967@salam.uitm.edu.my*
[c] Faculty of Economics and Management, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia. Email: *chungyee124@gmail.com*

machinery (Sun 1998); creating new demands for local inputs (Cardoso and Dornbusch 1989); and introducing new industries in the host economy. On the other hand, FDI may harm GDI and the growth of the host economy if foreign firms will compete with local firms in the use of domestic resources and reduce investment opportunities for local investors (Jansen 1995; Agosin and Mayer 2000). Therefore, in analysing the impact of FDI on growth, it is important to consider the linkage between FDI and DI so that policy implications can be established to maximise the benefits from FDI. In this regard, the goal of our paper is to apply the Vector Error Correction Modeling (VECM) to provide empirical evidence for the possible interaction between FDI, DI and economic growth by considering the case of Malaysia.

In Malaysia, FDI has played an important role in enhancing domestic capital formation and generating economic growth. Many studies have been done on the relationship between FDI and growth in Malaysia. However, the relationship between FDI and growth in Malaysia is not strong (Duasa 2007; Pradhan 2009). Nevertheless, it is also argued that FDI contributes positively in the stability of the economic growth of Malaysia.

It is worth noting that existing literature is much concentrated on investigating the broad impact of FDI on growth in Malaysia. However, not much work has been done on the impact of FDI on DI. We consider this important particularly because the effect of DI in promoting growth and creating employment has been firmly established. Much as DI is an important component of aggregate demand, it also expands the stock of private assets in the economy. Thus, it is crucial to consider the indirect effect of FDI on growth.

Ever since Malaysia gained independence, it experienced strong economic performance, with an average growth rate of 6 per cent per annum between 1970 to 1980. However, in mid 1980s, the Malaysian economy suffered a sharp decline in output. Economic recovery began in the year 1986. Economic growth reached an average of 9 per cent per annum from 1990 to 1996. However, the 1997 Asian financial crisis adversely affected the economy of Malaysia which reached an all-time low of -7 per cent rate of growth. For about four years (1998 - 2001), there was a slow pace in recovery and then the economy returned to its normal path, sustaining an average growth rate of 5 per cent from 2001.

From the year 1970 to 1980, DI contributed about 30 per cent of GDP. Thereafter, its share declined to an average of 26.4 per cent and then increased in the early1990s. For more than five decades, DI has been contributing more to Malaysian GDP than FDI. In 1980, Malaysia adopted an open policy towards foreign trade and investment thus recognising the significant contribution of FDI to the economic growth of the country. As a result, Malaysia ranked first among Asian developing countries in receiving FDI in 2003 (UNCTAD 2004).

The results of this study indicate a long-run bilateral causality between economic growth and domestic investment in Malaysia. However, no causality is found to exist between FDI and DI and directly between FDI and economic growth. We also found evidence of short-run complementary effect of FDI on DI and temporary impact of FDI on economic growth.

The rest of the paper is organised as follows. Section 2 contains the literature review; Section 3 presents methodological aspects including data sources, variables and their measurement and the empirical approach taken. The final section presents study findings, discussion and conclusion.

2. Literature Review

There is conflicting literature on the relationship between FDI and economic growth. The direct effect of FDI on economic growth is attached to its contribution to capital accumulation and transfer of new technology to the host country. FDI can directly spur economic growth when the transfer of technology leads to acquisition of additional stock of knowledge through labour training, skills development, new management practices, and new organisation styles (De Mello 1999). From the neo-classical point of view, FDI can increase the rate of economic growth only in the short-run because of long-run diminishing returns of capital. According to this view, long-run economic growth is only possible under the exogenous growth of labour force and technological progress. Contrary to the neo-classical perspective, Barro and Sala-i-Martin (1995) who have made an immense contribution to endogenous growth theories have provided an avenue for FDI to have long-run impact on growth through permanent knowledge transfer brought about by foreign firms. Positive external and spillover effects from new knowledge will account for non-diminishing returns that lead to long-run growth (De Mello 1997). Thus, if growth factors (including FDI) are made endogenous in the model, the long-run impact of FDI will follow.

Nonetheless, empirical literature suggests that the growth impact of FDI is highly dependent on the degree to which it complements or substitutes DI and other country-specific characteristics. According to Buckley *et al.* (2002), FDI contribution to economic growth depends on socio-economic conditions in the host country with countries having an open trade regime, high savings rate, and high level of technology likely to benefit more from FDI. On the contrary, FDI may have an adverse effect on growth if it results in substantial reverse flows in the form of remittances, dividends, and if foreign firms obtain substantial concessions from the host country (Buckley *et al.* 2002). In order to benefit from long-term capital inflow, the host country should have sufficient infrastructure, adequate level of human capital development, a stable economy and liberalised markets (Bengoa and Sanchez-Robles 2003).

With regard to empirical links between FDI, DI and growth, results from several previous studies are generally mixed. The supporters of a positive link between FDI and growth argue that FDI enhances growth through technology diffusion and human capital development (De Mello 1999; Shan 2002a; Liu *et al.* 2002; Kim and Seo 2003). This is particularly possible when foreign firms have vertical inter-linkage with local firms or regional/sub-national clusters of inter-related activities. FDI also promotes growth by overcoming the capital shortage thereby complementing DI especially when the investment is allocated in high risk areas or in the sectors that DI is limited (Noorzoy 1979). When FDI is allocated in resource industries, DI in related industries will be stimulated. Also, FDI may stimulate export demand from the host country, thus attracting investment in the export sector. These arguments are further supported by several empirical studies. For instance, by using panel data analysis, Sun (1998) found evidence that suggested positive correlation between FDI and DI. The arguments are also in line with Shan (2002a) who applied the Vector Autoregressive (VAR) model on Chinese data to investigate the empirical link between FDI, growth in industrial output and other variables. His results suggest a significant positive impact of FDI on the Chinese economy when FDI ratio to industrial output increases.

On the other hand, the opponents of a positive role of FDI argue that FDI has adverse impact on growth because it crowds out DI (for example, Huang 2003; Braunstein and

Epstein 2002). According to this view which is also supported by the industrial organisation theory, multinational enterprises (MNEs) employ a strategy to develop monopoly power over domestic firms in the host country (Hymer 1960; Caves 1996). The ownership-specific advantages of the MNEs (such as advanced technology, low transaction costs, managerial skills, etc.) can lead to monopoly power that could lead to the control of input supplies in the host economy (Dunning 1981). The tax holidays and subsidies provided by most host governments to MNEs gives them extra advantage in creating monopoly power. This will strengthen the competitive edge of the foreign firms over domestic firms that eventually will force domestic firms to exit the market. From this view, it is argued that FDI may substitute DI in the long-run. FDI may also substitute DI when MNEs compete with DI for limited investment opportunities and when it disturbs the backward linkages via the substitution of imports for local commodities (Noorzoy 1979). This view is further supported by empirical evidence found by several researchers. For example, Braunstein and Epstein (2002) applied the panel regression model on Chinese provincial data to investigate the crowding-out/ crowding-in effect of FDI on DI. Their results indicate that FDI crowds-out DI in China. From these results, they concluded that due to strong competition created by MNEs to indigenous firms, the social benefits of FDI are dissipated at least at provincial level. This forced the provinces to provide tax incentives, reduce wages and working conditions, and relax some regulations on environmental protection. Moreover, there is a tendency for investment policies to favour foreign investors over domestic private investors which in turn provide more privileges to foreigners to exploit scarce local resources (Huang 1998; 2003). Against this background, FDI is perceived to crowd-out DI.

For the case of Malaysia, many studies have been done on the broad impact of FDI on economic growth. These studies have produced mixed results. For example, the studies of Duasa (2007) and Pradhan (2009) found evidence for weak empirical linkage between FDI and economic growth while the findings of Chowdhury and Mavrotas (2005) indicate bi-directional causality between FDI and economic growth. In her study, Duasa (2007) found no evidence for causal relationship between FDI and economic growth. However, the results suggest that FDI is an important stablising factor for the economic growth of Malaysia. Similarly, economic growth plays the role of stabilising the inflow of FDI. Karimi and Yusop (2009) and Pradhan (2009) confirm the absence of a long-run relationship between FDI and GDP in Malaysia. They also found weak evidence of a bi-directional causality between GDP and FDI for both short-run and long-run which was contrary to the findings of Chowdhury and Mavrotas (2005) which indicated the existence of bi-directional causality between FDI and economic growth. Moreover, Merican (2009) found evidence that suggests that FDI is significant in explaining Malaysia's economic growth. Lean and Tan (2010) identified a significant positive impact of FDI on economic growth. They also attested to an increase in FDI having a positive impact on DI.

With regard to DI, limited work has been done to evaluate the complimentary/substitution role of FDI on DI and their impact on growth. Investment in infrastructure such as communication, transportation, freight services, distribution channels and financial industries is important to encourage foreign capital inflows. Using a simple two-factor (domestic investment and export) growth model, Tan and Lean (2010) suggest the presence of bi-directional causality between DI and economic growth in both the short-run and long-run. The results suggest a direct and positive impact of DI and export on economic growth.

However, in another study, Lean and Tan (2010) replaced the export by FDI as the other factor in the two-factor growth model. They found that FDI positively affects economic growth while DI has a negative long-run effect on growth. Furthermore, they attest that FDI has crowding-in effect on DI. The distinction between these two studies is the inconsistent impact of DI on economic growth. This inconsistency could be a result of model specifications in these two studies. Excluding either FDI or export from the empirical model possibly results in a misspecification problem due to omission of important variables. Hence, further studies that take into consideration both FDI and export into the empirical model are needed to determine the exact impact of DI.

This paper seeks to contribute to the existing literature by applying the VECM and the time series techniques of impulse response function (IRF) and variance decomposition (VD) to investigate the empirical link between FDI, DI and economic growth in Malaysia. The study also applies the Granger Causality approach to test the causal relationship between the mentioned variables.

3. Data and Econometric Framework

As mentioned in the previous sections, the focus of this paper is to investigate whether inflows of FDI and DI enhance economic growth and whether the FDI crowds out or crowds in DI. The econometric methodology applied in this study is the Vector Autoregressive (VAR) technique. The basic model employed in this study can be expressed as:

$$GDP_t = \alpha_0 + \alpha_1 FDI_t + \alpha_2 GDI_t + \alpha_1 EXP_t + \alpha_4 HCD_t + \varepsilon_t \quad (1)$$

The variable *GDP* is the annual growth rate of real per capita GDP. The expression *FDI* is real FDI inflows, and *GDI* is real gross fixed capital formation, *EXP* refers to value of exports, and *HCD* is the measure of human capital development. Measures of these variables, namely FDI inflow, gross fixed capital formation and gross domestic product (GDP) were taken from International Financial Statistics (IFS) published by International Monetary Fund (IMF). The study employed annual data from 1970 to 2008.

Exports, to some extent, improve the efficiency of the domestic economy by providing competition which reduces the price of domestic goods and improves their quality. Malaysia's economic growth is fueled by export demand. Thoburn (1986) stated that export is a principal channel of generating sustainable economic growth. Ghirmay *et al.* (2001) in their study, found that exports are cointegrated with economic growth in Malaysia. They also noticed a unidirectional causality between economic growth and export in Malaysia. Lonik (2006) who employed the autoregressive distributed lag (ARDL) and cointegration procedure to investigate the export-led growth hypothesis in Malaysia concluded that the hypothesis is valid for Malaysia for the time frame of 1978 to 2002.

HCD is measured by government expenditure on education and training. Human capital is an important factor for FDI impact on growth. Using a cross-country analysis, Borensztein *et al.* (1998) found that the effect of FDI on growth is dependent on the level of human capital of the host country, where FDI has positive growth effects only if the level of education is higher than a given threshold. This idea is also supported by Hermes and Lensink (2003) and Farhad *et al.* (2001).

Hence, excluding both *EXP* and *HCD* may cause a problem of omitting relevant variable(s) which may result in imprecise estimation of the model.

The stationarity of each series was tested using Augmented Dickey-Fuller and Phillips-Perron methods to test their order of integration. If the series are integrated of the same order, then, there is a possibility for cointegration of the variables, with a test for co-integration being meaningful.

3.1 Johansen-Juselius Multivariate Cointegration Test

Johansen (1988) and Johansen and Juselius (1990) proposed two likelihood tests for data involving two distinct series. The variables are cointegrated if and only if a single cointegrating equation exists.[1] The purpose of the maximum likelihood estimation is to test the independent number of cointegrating vectors in the VAR model.

In our 5-variable model of *GDP*, *FDI*, *GDI*, *EXP* and *HCD*, we consider Z_t as a 5x1 vector which consists of the 5 variables; a more general way to present the multivariate model can be shown as:

$$Z_t = \theta + \sum_{i=1}^{T-1} \omega_i Z_{t-i} + \pi Z_{t-T} + \varepsilon_t \qquad (2)$$

where $\omega_i = -\mathrm{I} + \mathrm{A}_1 + ... + \mathrm{A}_i$ (I is a unit matrix) and $\pi = -(\mathrm{I} - \mathrm{A}_1 - ... - \mathrm{A}_k)$ are coefficient matrices, k denotes the lag length, and θ is a constant. The rank of the matrix π is equal to the number of independent co-integrating vectors which are defined as:

$$\pi = \alpha\beta' \qquad (3)$$

where α denotes the matrix of the speed of the cointegrating vector adjustment to the long-run equilibrium, and β represent the 5xr matrices of parameters of the long-run cointegrating vector.

Two likelihood ratio (LR) test statistics used to determine the number of unique co-integrating vector in Y_t are constructed using residuals vectors v_{0t} and v_{it}, known as the trace test and maximal eigenvalue test.

The critical values for both λ_{trace} and λ_{max} statistics are calculated by Johansen and Juselius (1990) and later refined by Osterwald-Lenum (1992) in a Monte Carlo analysis, which had given the most comprehensive set of critical values for VARs with up to 11 variables. If r is found to equal n, it means none of the series is actually integrated. The vector Y_t is said to be stationary. The VAR can be formulated at levels of all series. If $r = 0$, it means there are no co-integrating vectors or a long-run equilibrium relationship that causes the variables to move together in the long-run. If $0 < r < n$, there exists r co-integrating vectors, or $n - r$ common stochastic trend driving the series. Therefore, r error correction terms involving levels of the series need to be included to apply VAR.

3.2 Error Correction Model (ECM), Granger Causality and Innovation Accounting

With referance to Kim and Seo (2003), given the assumption that FDI is determined to be independent of contemporaneous movements in macro-variables in the host country, this

[1] According to Granger (1988), if the variables in a system are co-integrated, then the causal analysis needs to incorporate the error correction term for the adjustments of deviation from its long run equilibrium and avoid misspecification of the model.

is not as restrictive as it may seem for it allows full dynamics. Therefore, the unrestricted vector autoregressive (VAR) system can be written as follows:

$$\Delta GDP_t = \alpha_{10} + \sum_{i=1}^{p} \gamma_{1,i} \Delta GDP_{t-i} + \sum_{i=1}^{p} \theta_{1,i} \Delta FDI_{t-i} + \sum_{i=1}^{p} \delta_{1,i} \Delta GDI_{t-i} + \sum_{i=1}^{p} \varpi_{1,i} \Delta EXP_{t-i} + \sum_{i=1}^{p} \phi_{1,i} \Delta HCD_{t-i} + \varepsilon_{1t} \tag{4}$$

$$\Delta FDI_t = \alpha_{20} + \sum_{i=1}^{p} \gamma_{2,i} \Delta GDP_{t-i} + \sum_{i=1}^{p} \theta_{2,i} \Delta FDI_{t-i} + \sum_{i=1}^{p} \delta_{2,i} \Delta GDI_{t-i} + \sum_{i=1}^{p} \varpi_{2,i} \Delta EXP_{t-i} + \sum_{i=1}^{p} \phi_{2,i} \Delta HCD_{t-i} + \varepsilon_{2t} \tag{5}$$

$$\Delta GDI_t = \alpha_{30} + \sum_{i=1}^{p} \gamma_{3,i} \Delta GDP_{t-i} + \sum_{i=1}^{p} \theta_{3,i} \Delta FDI_{t-i} + \sum_{i=1}^{p} \delta_{3,i} \Delta GDI_{t-i} + \sum_{i=1}^{p} \varpi_{3,i} \Delta EXP_{t-i} + \sum_{i=1}^{p} \phi_{3,i} \Delta HCD_{t-i} + \varepsilon_{3t} \tag{6}$$

$$\Delta EXP_t = \alpha_{40} + \sum_{i=1}^{p} \gamma_{4,i} \Delta GDP_{t-i} + \sum_{i=1}^{p} \theta_{4,i} \Delta FDI_{t-i} + \sum_{i=1}^{p} \delta_{4,i} \Delta GDI_{t-i} + \sum_{i=1}^{p} \varpi_{4,i} \Delta EXP_{t-i} + \sum_{i=1}^{p} \phi_{4,i} \Delta HCD_{t-i} + \varepsilon_{4t} \tag{7}$$

$$\Delta HCD_t = \alpha_{50} + \sum_{i=1}^{p} \gamma_{5,i} \Delta GDP_{t-i} + \sum_{i=1}^{p} \theta_{5,i} \Delta FDI_{t-i} + \sum_{i=1}^{p} \delta_{5,i} \Delta GDI_{t-i} + \sum_{i=1}^{p} \varpi_{5,i} \Delta EXP_{t-i} + \sum_{i=1}^{p} \phi_{5,i} \Delta HCD_{t-i} + \varepsilon_{5t} \tag{8}$$

Contemporaneous restriction, for which no exact identification is guaranteed, often leads to invalid estimates while the long-run identifying assumption restrains the loner-run dynamics in the absence of any economic theory describing an equilibrium relationship (Kim and Seo 2003).

Engle and Granger (1987) indicated that if two series are cointegrated, there must be an error correction representation and conversely, if there is an error correction representation, two series must be cointegrated. A finding of cointegration with the Johansen test indicates that there is a stable long run relationship among the variables in the system. However, the co-integration tests do not indicate the causal effect direction.

In the cointegrated case, the error correction model (ECM) is appropriate for examining long run relationships and takes the following form:

$$\Delta GDP_t = \eta_1 + \sum_{i=1}^{k-1} \omega_{1,i} \Delta GDP_{t-i} + \sum_{i=1}^{k-1} \varphi_{1,i} \Delta FDI_{t-i} + \sum_{i=1}^{k-1} \psi_{1,i} \Delta GDI_{t-i} + \sum_{i=1}^{k-1} \kappa_{1,i} \Delta EXP_{t-i} + \sum_{i=1}^{k-1} \rho_{1,i} \Delta HCD_{t-i} + \mu_1 ECT_{t-1} + \varepsilon_t \tag{9}$$

$$\Delta FDI_t = \eta_2 + \sum_{i=1}^{k-1} \omega_{2,i} \Delta GDP_{t-i} + \sum_{i=1}^{k-1} \varphi_{2,i} \Delta FDI_{t-i} + \sum_{i=1}^{k-1} \psi_{2,i} \Delta GDI_{t-i} + \sum_{i=1}^{k-1} \kappa_{2,i} \Delta EXP_{t-i} + \sum_{i=1}^{k-1} \rho_{2,i} \Delta HCD_{t-i} + \mu_2 ECT_{t-1} + \varepsilon_t \tag{10}$$

$$\Delta GDI_t = \eta_3 + \sum_{i=1}^{k-1} \omega_{3,i} \Delta GDP_{t-i} + \sum_{i=1}^{k-1} \varphi_{3,i} \Delta FDI_{t-i} + \sum_{i=1}^{k-1} \psi_{3,i} \Delta GDI_{t-i} + \sum_{i=1}^{k-1} \kappa_{3,i} \Delta EXP_{t-i} + \sum_{i=1}^{k-1} \rho_{3,i} \Delta HCD_{t-i} + \mu_3 ECT_{t-1} + \varepsilon_t \tag{11}$$

$$\Delta EXP_t = \eta_4 + \sum_{i=1}^{k-1} \omega_{4,i} \Delta GDP_{t-i} + \sum_{i=1}^{k-1} \varphi_{4,i} \Delta FDI_{t-i} + \sum_{i=1}^{k-1} \psi_{4,i} \Delta GDI_{t-i} + \sum_{i=1}^{k-1} \kappa_{4,i} \Delta EXP_{t-i} + \sum_{i=1}^{k-1} \rho_{4,i} \Delta HCD_{t-i} + \mu_4 ECT_{t-1} + \varepsilon_t \tag{12}$$

$$\Delta HCD_t = \eta_5 + \sum_{i=1}^{k-1} \omega_{5,i} \Delta GDP_{t-i} + \sum_{i=1}^{k-1} \varphi_{5,i} \Delta FDI_{t-i} + \sum_{i=1}^{k-1} \psi_{5,i} \Delta GDI_{t-i} + \sum_{i=1}^{k-1} \kappa_{5,i} \Delta EXP_{t-i} + \sum_{i=1}^{k-1} \rho_{5,i} \Delta HCD_{t-i} + \mu_5 ECT_{t-1} + \varepsilon_t \tag{13}$$

The coefficient of the ECT_{t-1} term infers long run causality, while the joint F-test of the coefficients of the first differenced independent variables indicates short run causality. The causality can be derived through the Wald test of the joint significance of the lags of the independent variables.

To examine the relationship among economic variables, innovation accounting (variance decomposition and impulse response function) technique can be applied in the analysis. Kim and Seo (2003) applied this technique in their study on South Korea to identify the complementary or substitution relationship between FDI and DI, and its impact on economic growth.

4. Empirical Results

We started with testing for stationarity of the individual variables.[2] The results of Augmented Dickey-Fuller (ADF) test and Phillips Perron (PP) test are presented in Table 1. The results of ADF test and PP test show that all variables are non-stationary at their respective levels. After first differencing all variables, both ADF test and PP test led to the rejection of null hypothesis (H_0) for the existence of unit root in the variables. The results indicate that all variables are significant at first difference. Hence, we can conclude that all variables under study are integrated at order one, I(1).

Once the series are made stationary (by appropriately differencing them), they can further be used for regression analysis. However, the drawback of this method is the possibility of losing long-run information that may exist in the variables. This problem can be overcome by applying the cointegration technique which shows the long-run equilibrium relationship between the non-stationary series (Mallik 2008).

Table 2 presents the results of cointegration test. The lag length of the cointegration test is selected by non-autocorrelation of error term. Thus the optimal lag length that was selected is 1 (i.e. lag = 1). According to the results based on Johansen's test, the null hypothesis of no cointegration (*r* = 0) can be rejected using the maximum eigenvalue or trace test statistics. This implies the existence of long-term causality. However, the direction

Table 1. Unit root tests

	Augmented Dickey-Fuller test [a]		Phillips-Perron test [a]	
Variables	H_0: I(0)	H_1: I(1)	H_0: I(0)	H_1: I(1)
GDP	-2.5725	-4.8435*	-2.7568	-5.8077*
FDI	-3.1955	-8.1758*	-3.2095	-8.1758*
GDI	-2.2153	-4.5252*	-2.4280	-4.4854*
EXP	-2.4655	-6.4213*	-2.6122	-6.6223*
HCD	-2.9828	-3.6672*	-2.9895	-7.2211*

Notes:
* Denotes significance at 5% level. The 5% critical value for augmented Dickey-Fuller test is -3.45 and the 5% critical value for Phillips-Perron test is -3.45.
[a] Test equation specification: Both the intercept and trend are included.

[2] We transformed all data to natural logarithm before we started with our analysis. In this section, LNRPCGDP measures natural logarithm of real per capital GDP, LNRFDI is natural logarithm of real FDI, LNRGDI the natural logarithm of real gross fixed capital formation, LNREXP is the natural logarithm of real export, and LNRHCD is the natural logarithm of real human capital development.

Table 2. Cointegration test[3]

H_0	H_1	Trace	95% critical values	Max Eigenvalue	95% critical values
$r = 0$	$r = 1$	77.9307*	69.8189	37.2410*	33.8769
$r \leq 0$	$r = 1$	40.6897	47.8561	19.6124	27.5843
$r \leq 0$	$r = 1$	21.0773	29.7971	13.5147	21.1316
$r \leq 0$	$r = 1$	7.5627	15.4947	7.0030	14.2646
$r \leq 0$	$r = 1$	0.5597	3.8415	0.5597	3.8415

Notes:
* Denotes significance at 5% level.
Lag length selection: Non-autocorrelation of error terms, lag = 1

Table 3. Granger causality and error correction model

Variables	Chi-squared statistics					ECT_{t-1} [t-statistics]
	ΔGDP_t	ΔFDI_t	ΔGDI_t	ΔEXP_t	ΔHCD_t	
ΔGDP_t	-	0.8621	5.6372*	11.9415*	3.2312	-0.8946* [-5.0182]
ΔFDI_t	0.1608	-	0.1895	0.4489	0.0018	-1.0491 [-0.4965]
ΔGDI_t	1.8410	0.1525	-	0.0756	0.0126	-1.3680* [-2.6791]
ΔEXP_t	8.2475*	1.4816	3.9974*	-	6.9570*	-1.4892* [-4.4401]
ΔHCD_t	0.2424	0.1565	0.6813	0.0969	-	-0.1153 [-0.3615]

Note: * Denotes significance at 5% level.

is not yet clear. Thus, we can conclude that the model of five variables is a fair representation of Malaysia and a stable long run relationship between the variables does exist.

The Granger causality results are presented in Table 3. For the long-run Granger causality, the results suggest that one period lagged error-correction term, ECT_{t-1} has a negative sign and is statistically significant at the 5 per cent level when per capital GDP, GDI, and export stand as dependent variables. This shows that per capita GDP has bilateral causal relationship with GDI and export. These findings are in line with Duasa (2007) and Karimi and Yusop (2009), but they contradict the findings of Chowdhury and Mavrotas (2005). We could not establish any empirical linkage between FDI and economic growth. Given the fact that the Malaysian government has introduced FDI friendly policies and environment to attract more foreign investors, our findings seem to be surprising as the results do not support the idea that FDI brings positive impact on economic growth in long-run. Instead, GDI has been the

[3] Johansen's procedure is sensitive to the lag length. In our study, we applied Correlogram on the residuals to test the non-autocorrelation of error terms to determine lag length.

main capital contributor to the economic growth. In the view of the increasing trend of FDI outflows from Malaysia, the Government is advised to improve the investment incentives and benefits to encourage local investors to invest more in the home country. The negative sign of ECT_{t-1} suggests that the economic determinant is endogenous and has long-run equilibrium (Tan and Lean 2010). The ECT_{t-1} in the per capita GDP equation implies that the estimated system is corrected from the previous period's disequilibrium by 89.5 per cent in a year.

For the case of short-run causality, the results also show that per capita GDP and export have a bilateral causal relationship. This implies the existence of a short-term to long-term relationship between economic growth and export. These findings are consistent with Ghirmay *et al.* (2001) and Lonik (2006). The results further explain the importance of the interaction between growth and export in Malaysia in both the short and long terms. As the export sector is a major contributor to the national income in Malaysia, policy makers can focus on FDI and GDI policies to enhance export to generate better results in economic growth.

There is unilateral causality running from GDI to per capital GDP, GDI to export, and from human capital development to export. This implies that both GDI and export play an important role in stimulating economic growth in Malaysia. These results are in line with Tan and Lian (2010). However, the results suggest the absence of any causal relationship between FDI and all other variables included in the model. We also found that GDI and human capital development leads to enhancement of capital and skills in productivity to boost the exports which in turn generate economic growth. The causality running from per capita GDP to exports suggest that economic growth helps to build the foundation of human capital development and increases the dynamics of the investment sector to produce more goods and services for the growth of the export sector.

Figure 1 shows the results of the impulse responses of variables to one standard deviation of shock to each of the variables in the system. In this study, we focus on the responses of per capita GDP and GDI to one standard deviation of shock to FDI. From the impulse responses shown in Figure 1, we found that FDI has temporary positive impact on both per capita GDP and GDI. A positive shock on FDI has a temporary impact on economic growth. This impact is statistically significant at least for about one period (year). On the other hand, there is no significant impact of a shock on per capita GDP to FDI. Results on GDI indicate that the positive shock in FDI also increases the GDI temporarily. The impact is also significant for about three to four periods. Similar to per capita GDP, the shock to GDI has also no significant impact on FDI. This implies that the inflow of FDI crowds-in GDI but GDI does not impact other variables. The temporary crowding-in effect of FDI on GDI should not come as a surprise because when foreign investors invest in the country, local suppliers are needed to invest in raw materials and parts for manufacturing. This activity requires local businesses to invest in business expansion. However, this will not happen in the initial stage until the local suppliers reach a scale that supports their orders. It is therefore no surprise that FDI leads to temporary economic growth. This is aligned with our discussion earlier on the non-existence of a long-run relationship between these two variables.

Apart from FDI, the per capita GDP also responds positively to a positive shock on GDI, exports and human capital development. Similar to FDI, growth response to a shock on GDI and export is also significant for about one to two periods. Meanwhile the shock on

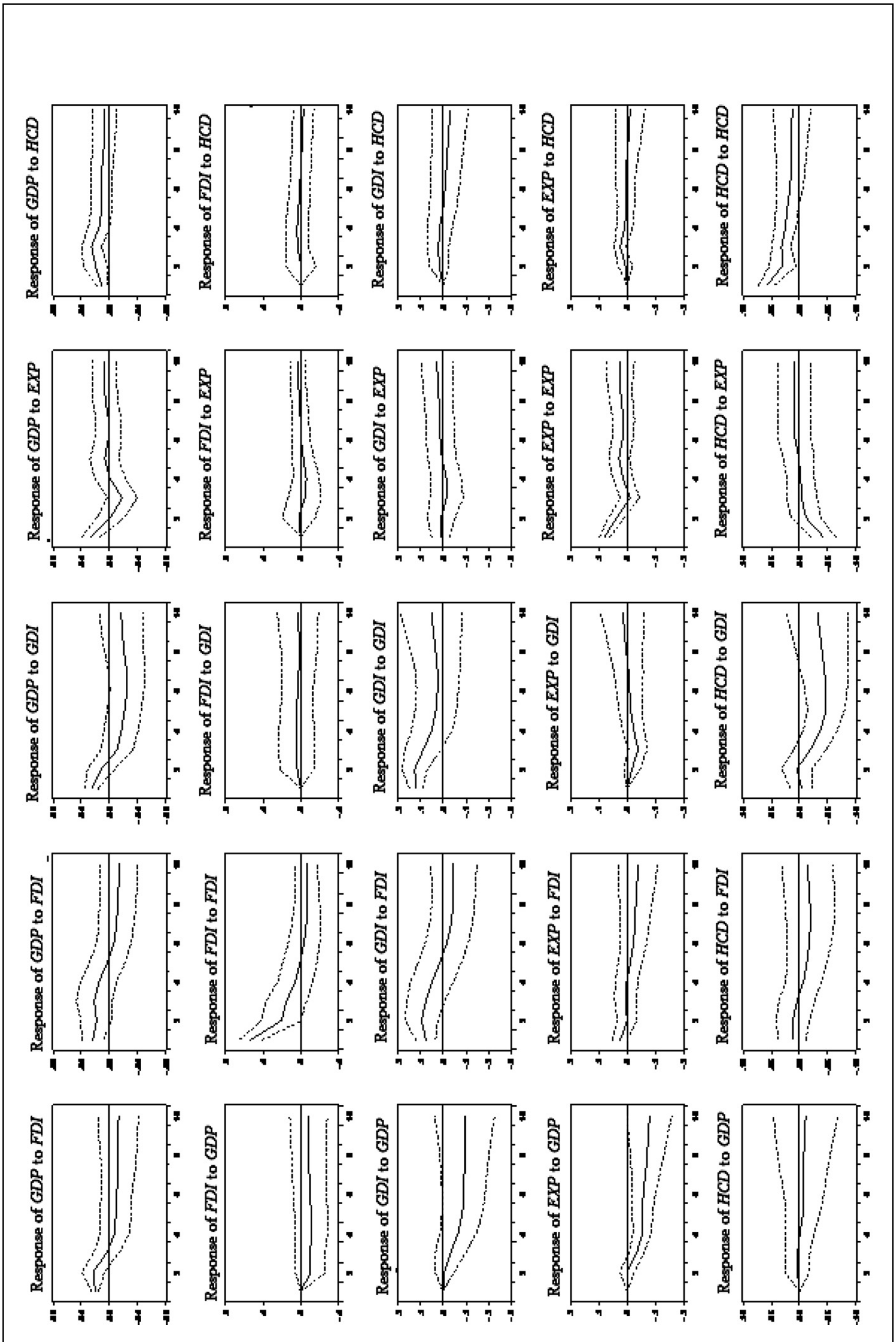

Figure 1. Impulse responses function

Table 4. Variance decomposition of GDP

Period	Std. Error	GDP	FDI	GDI	EXP	HCD
1	0.0496	16.9599	23.3240	26.2099	28.4276	5.0786
2	0.0619	24.3977	23.6889	20.2769	18.2951	13.3414
3	0.0736	17.5262	25.3368	16.6277	19.1665	21.3429
4	0.0787	16.3627	25.7365	19.1835	16.7717	21.9458
5	0.0830	15.8622	23.1936	23.7453	15.7771	21.4219
6	0.0884	15.3308	21.0898	28.9028	13.9674	20.7092
7	0.0937	15.4488	19.9262	32.4324	12.4422	19.7505
8	0.0980	15.8238	19.6601	34.0813	11.7195	18.7154
9	0.1018	16.1262	19.8864	34.7785	11.3778	17.8311
10	0.1051	16.6718	20.1643	35.0193	11.0478	17.0969

Table 5. Variance decomposition of FDI

Period	Std. Error	GDP	FDI	GDI	EXP	HCD
1	0.5313	0.0000	100.0000	0.0000	0.0000	0.0000
2	0.5810	3.2078	96.2406	0.4292	0.1202	0.0022
3	0.6127	5.4976	92.6987	0.8688	0.6069	0.3281
4	0.6317	8.6053	87.9688	1.2870	1.4610	0.6778
5	0.6438	11.2617	84.6989	1.6791	1.5851	0.7751
6	0.6531	13.1651	82.6360	1.8893	1.5425	0.7671
7	0.6622	14.6126	81.2093	1.9280	1.5035	0.7466
8	0.6715	15.8705	79.9291	1.9323	1.5081	0.7560
9	0.6811	16.9576	78.5917	1.9781	1.6234	0.8492
10	0.6907	17.9418	77.1572	2.1183	1.7876	0.9951

human capital development results in a more persistent impact of more than 4 years. FDI does not respond significantly to shocks on all other variables in the system.

Table 4 shows the variance decomposition of per capital GDP. The evidence shows per capita GDP to be very much dependent on shocks to other variables in the system. Across the periods, all others variables are found to significantly contribute to the shocks on per capita GDP. This is in line with the Granger causality results where per capita GDP is endogenous. Table 5, shows the variance decomposition results for FDI. The results indicate that FDI shock is independent of all other variables in the system for five periods and then responds significantly to the shock in economic growth with the level, however, remaining low. Table 6 shows the results of variance decomposition for domestic investment. The results further prove that GDI is responsive to FDI shocks as discussed in the impulse responses analysis. However, in the later periods, the GDI is more responsive to per capita GDP than to FDI.

5. Conclusion

Foreign direct investment and domestic investment have for a long time been viewed as important determinants of economic growth. The relationship of economic growth to both,

Table 6. Variance decomposition of GDI

Period	Std. Error	GDP	FDI	GDI	EXP	HCD
1	0.1427	0.0000	28.3729	70.9603	0.6668	0.0000
2	0.2140	0.1015	32.6155	66.1861	0.4340	0.6630
3	0.2466	1.9902	33.8873	62.2155	0.6840	1.2231
4	0.2655	8.1783	32.4742	57.0776	0.9166	1.3533
5	0.2810	16.5484	29.1979	52.2048	0.8401	1.2089
6	0.2972	24.0848	26.4697	47.3415	0.9323	1.1717
7	0.3151	30.0787	24.9190	42.7366	1.0230	1.2427
8	0.3346	34.5615	23.9075	38.8424	1.2208	1.4678
9	0.3552	37.6913	22.9883	35.8987	1.5686	1.8532
10	0.3767	39.9538	21.9679	33.8399	1.9165	2.3219

FDI and DI, has become a subject of debate among academicians. On the one hand, causality is found between them (Chowdhury and Mavrotas, 2005) while on the other hand, Duasa (2007) and Karimi and Yusop (2009) could not establish causality between them. Nevertheless, it is important for policy makers to determine the exact relationship between economic growth and FDI on the one hand and DI on the other in order to design policies that will enhance economic growth.

This study aimed at examining the relationship between FDI, DI, and economic growth from 1970 to 2008. We employed the VAR/VECM model to investigate the dynamic relationship between these variables. The main findings of this study indicate the existence of a long-run bilateral causality between economic growth and DI. However, no causality was found to exist between FDI and DI on the one hand, and between FDI and economic growth on the other. The findings are consistent with the results reported by Duasa (2007) and Karimi and Yusop (2009) in their papers. But it is not similar to the findings of Chowdhury and Mavrotas (2005) who discovered bilateral causality between FDI and DI.

The Government of Malaysia offers FDI friendly policies in order so as to realise increased inflows of FDI. Export is an important growth factor in the Malaysian economy. Our findings confirm that there is a significant, positive relationship between export and economic growth. Policy makers need to draw up a master plan that draws greater FDI and GDI in export related sectors.

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