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Estimating the Domestic Determinants of Foreign Direct Investment Flows in Malaysia: Evidence from Cointegration and Error-Correction Model

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ABSTRACT

This study investigates the domestic short-run and long-run factors that influence FDI flows into Malaysia using annual data over period 1975-2006. After ascertaining that the series are I(0), the cointegration test statistics identify three cointegrating relations among the series, which implies an existence of long-run relationship among the variables in the study. The results of the long-run FDI equation indicate that FDI flows in Malaysia are positively influenced by real exchange rate, GDP growth and infrastructure while negatively by exports. In the short run, FDI flows are negatively influenced by its own lags, GDP growth, infrastructure and exports, while positively affected by economy's openness and real exchange rate variables. The error-correction term suggests that approximately 12 percent of total disequilibrium in FDI flows was being corrected in each year in Malaysia across the study period.

ABSTRAK

Kajian ini menyelidik faktor-faktor jangka masa pendek dan jangka masa panjang domestik yang mempengaruhi aliran Pelaburan Langsung Asing (FDI) di Malaysia menggunakan data tahunan untuk tempoh masa 1975-2006. Selepas memastikan siri adalah I(0), statistik ujian kointegrasi mengenalpasti tiga hubungan kointegrasi antara siri, yang menggambarkan kewujudan hubungan jangka masa panjang antara pembolehubah dalam kajian ini. Keputusan persamaan FDI jangka masa panjang memberi gambaran aliran FDI di Malaysia dipengaruhi secara positif oleh kadar pertukaran benar, pertumbuhan GDP dan infrastruktur dan secara negatif oleh eksport. Dalam jangka masa pendek, aliran FDI dipengaruhi secara negatif oleh pembolehubah latnya sendiri, pertumbuhan GDP, infrastruktur dan eksport, dan secara positif olek keterbukaan ekonomi dan kadar pertukaran benar. Terma pembetulan ralat (ECT) mencadangkan bahawa lebih kurang 12 peratus ketidakseimbangan dalam aliran FDI diperbetulkan setiap tahun di Malaysia sepanjang tempoh kajian.

INTRODUCTION

During and after the 1990s, the dramatic surge in private capital flows to developing countries represented an additional resource for supplementing local domestic resources in financing economic growth and development. In many of these countries, domestic resources hardly provide the necessary resources required for financing economic development. In addition, FDI is regarded as an important vehicle and indicator of the country's degree of economic globalisation and integration into world economy. FDI, to both the home and host countries, is considered to be very important for a number of reasons. Firstly, FDI flows provide an important window through which firms can avoid soaring production costs at home and find attractive markets abroad. Secondly, since FDI flows are non-debt creating financial commitments, they are preferred instruments of financing external current account deficits particularly in developing countries (Demekas et al. 2005). Thirdly, FDI flows affect growth positively by decreasing the costs of research and development (R&D) through stimulating innovation in the host country (Lensinky and Morrissey 2001; Graham and Wada 2001; Sanchez-Robles and Calvo 2003). Borensztein et al. (1998) considered FDI to be an important vehicle for transfer of technology, contributing to growth more than domestic investment. Fourthly, in presence of adequate absorptive capacities, FDI can have positive effects on domestic employment (Lall 2002) in addition to leading to higher rates of human capital accumulation, hence, a potential for future growth processes and accelerated technological transfer over time. FDI can be an important channel for bringing knowledge and integration into global production chains which are badly needed for successful exports strategy by developing countries. Yussof and Ismail (2002) found that inward FDI has been an important source of knowledge transfer in technology, management skills and international linkages for Indonesia, Malaysia, the Philippines and Thailand. Furthermore, Aron (1999) argued that, through training of workers and hands-on learning, FDI raises the skills of local manpower, thereby increasing their productivity level. Furthermore, FDI flows can accelerate technology diffusion and transfer to domestic firms and the labor force, productivity spillovers and enhanced competition (Borensztein et al. 1998). Slaughter (2002) reported a strong positive correlation between skill upgrading and the presence of local affiliates of U.S. MNCs.

Foreign direct investment, among the three components of private capital flows (the others being portfolio investment and bank loans), has assumed paramount importance since the mid-1990s as its share to emerging markets has significantly increased compared to the other two. According to the World Investment Report (2007), the world's inward FDI flows rose by approximately 29% between 2004 and 2005, that is, from $711 billion in 2004 to $916 billion in 2005. In 2007, the FDI inflows amounted to $1.3 trillion, an increase of 38% from the previous year although these flows were slightly below the 2000 peak of $1.4 trillion. The report attributes this huge surge in FDI to the rise of corporate profits worldwide and resulting to higher stock prices that raised the value of cross-border mergers and acquisitions which account for a high share of FDI. This rise has made an positive

impact especially among developed countries as well as higher growth rates in some developed and transition economies in addition to China. The report noted that due to higher corporate profits, reinvested profits constitute about 30% of the total inward FDI flows worldwide and nearly 50% in developing countries alone in 2006.

While the share of developed countries in world FDI inflows stood at around 66% in 2006, that of developing countries constituted around 29%. In terms of regions, Europe received 43.4% with EU taking 40.7% of that share. Asia, Latin America and the Caribbean and the United States received approximately 20%, 6.4% and 13.4% respectively while Africa trailed the recipient list with mere 2.7% in 2006. Among developing countries, China emerged as the major FDI recipient with a lion's share of about 28.8% of the region's share, which represents 5.3% of total world's share of total FDI inflows in 2006, followed by Hong Kong, Singapore, Mexico and Brazil. The share of the developing world has been continuously declining from 1997-2000 although it rebounded in 2001, reaching its peak of 38% in 2004 before falling to 33% and 29% in 2005 and 2006 respectively. In terms of growth rates, while the share of developed world increased by approximately 45% from $590.3 billion in 2005 to $ 857.5 billions in 2006, that of developing countries rose by about 21 percent from $314.3 billions in 2005 to $379.1 billions in 2006.

The objective of this study is to investigate the domestic short-run and long-run determinants of foreign direct investment (FDI) in Malaysia using annual data over the period of 1975-2006. To achieve this objective, the study employs the Johansen cointegration and error-correction model (Johansen, 1988; Johansen and Juselius 1990; Johansen 1991). The study hopes to identify the important macroeconomic factors that can affect foreign direct investment in both the short-and-long run that policymakers can influence in Malaysia. Johansen cointegration and error-correction model does exactly that. The technique distinguishes the relationships among the variables into short-run and long-run relationships. While short-run causal dynamics effects are implied by the differenced explanatory variables, long-run relationships are indicated by the lagged error-correction term (ECT). However, the estimation process is based on a number of crucial steps. Firstly and prior to testing for cointegration, the properties of individual time series are investigated by applying the Augmented Dickey-Fuller (ADF) and the Phillip-Perron (PP) tests. Secondly, assuming that the series are stationary, Johansen maximum likelihood method will be applied to examine the question of cointegration among the variables in a multivariate setting. Thirdly, if the variables are found to be integrated, the error-correction model will be estimated by including the error-correction term (ECT) lagged by one year, derived from long-run relationships, as independent explanatory variables in the estimation process of equation (2). This step is very crucial in that if the variables are cointegrated, then tests involving differenced variables are mis-specified and some important information lost unless a lagged error-correction term is included.

This is why this study is unique compared to many recent studies (Hasan, 2007; Ang 2008) that dealt with determinants of FDI flows in Malaysia. Hasan (2007) and Ang (2008) have, in passing, mentioned the use of error-correction and cointegration

model, neither unit root nor cointegration test results are reported in any of these papers. For a study of such important subject like foreign direct investment, it is crucial for both empirical and policy purposes to understand and identify which macroeconomic factors significantly affect foreign direct investment in the short run and which of these factors would influence it in the long run. For this reason, the study focuses on domestic determinants that policymakers can possibly influence rather than the overall determinants of foreign direct investment some of which are beyond the influence of national government.

OVERVIEW OF FDI INFLOWS INTO MALAYSIA

Prior to the economic transformation in the 1980s, Malaysia was once one of the world's biggest producer of primary products such as tin, rubber and palm oil. With help from countries such as Japan, heavy industries preponderated and within a short period of time, exports boomed, constituting the country's primary engine of growth. Malaysia consistently achieved more than 7% GDP growth along with low inflation in the 1980s and the 1990s. In the period 1988-1997, the economy underwent a period of broad diversification and sustained rapid growth averaging 9% annually. During the period 1996-97, the economy grew, on average, at annual rate of 8.7% while inflation averaged 3.8% in the same period. At the same time, unemployment was low, averaging about 2.5% per annum. Manufacturing sector grew from 13.9% of GDP in 1970 to approximately 30% in 1999, while agricultural and mining sectors, which together had accounted for 42.7% of GDP in 1970, dropped to 9.3% and 7.3%, respectively in 1999.

The success of this rapid economic growth is thought to have been partly due to the privatisation of inefficient state-owned enterprises, thus subjecting them to commercial pressures and forcing them to better utilise their resources and partly to massive FDI flows that played a significant role in pushing the Malaysian economy forward. Three factors that make Malaysia attractive to FDI have been identified see (Oti-Prempeh, 2003). These include (1) its undervalued currency; (2) low cost of labour; and (3) fairly low inflation rate. The strength of the country's appeal to foreign investment is rooted in its Promotions of Investment Act No. 327 (1986), which have been strongly observed in successive national economic plans.

To resuscitate the economy from severe repercussions that arose from 1997 crisis, the National Economic Action Council (NEAC) was urgently established in January 1998 with objective of tackling the economic woes. The NEAC's road map was the National Economic Recovery Plan (NERP) National Economic Action Council (NEAC), National Economic Recovery Plan (NERP) (August 1998) available at http://www.neac.gov.my), tasked with the following goals: Firstly, restoring public and investor's confidence with regards to the economy suffering from image problem despite strong fundamentals. Secondly, ensuring that the shocks from the currency depreciation and falling share values were not passed through to the real sector of the economy. Thirdly, reviving and making the national economy

more attractive globally by enhancing its international competitiveness. Fourthly, strengthening the country's economic fundamentals so that the economy is back on track to achieve developed country status by the year 2020, better known as "Vision 2020." The presence of such plans must have underpinned the foreign investors' confidence in the Malaysian economy.

When analysing FDI flows in Malaysia, two events that are of phenomenal significance in the development of Malaysian economy must be considered. The first event is the 1996-97 crisis, commonly referred to as currency or financial crisis that erupted in July 1997. As a result of this crisis, the Malaysian economy suffered a great hit that caused a dramatic shrink of FDI flows. Although relatively a small economy, Malaysia is an open economy in which trade and foreign investments have driven economic growth rapidly. Particularly, FDI has played a crucial role in the country's economic development process. Although the FDI flows were erratically volatile in the 1980s, they stabilised in the period 1988-96. With exception of 1994 when the FDI flows recorded a negative growth rate, growth rates have been generally favorable over the period. For example, while FDI flows grew by a positive rate of about 70% in 1988 for the first time since 1983, the flows increased by more than 130% in the following year. Between 1997 and 1998, FDI inflows experienced negative growth rates, from a negative rate of 13% in 1997 and 57% in 1998 respectively, reflecting the peak of the crisis. Although the flows witnessed alternating ups and downs in the period 1999-2005, substantial surges were reported in year 1999, 2002, 2004 and 2006. In these four years, FDI flows experienced remarkable growth rates of approximately 44%, 478%, 87%, and 58% respectively (Figure 1).

One of the events that have coused these alternating ups and downs are the economic crisis that arose from the floating of the Thai *baht* in July 1997 unfolded in this region, every country took whatever measures it deemed appropriate in

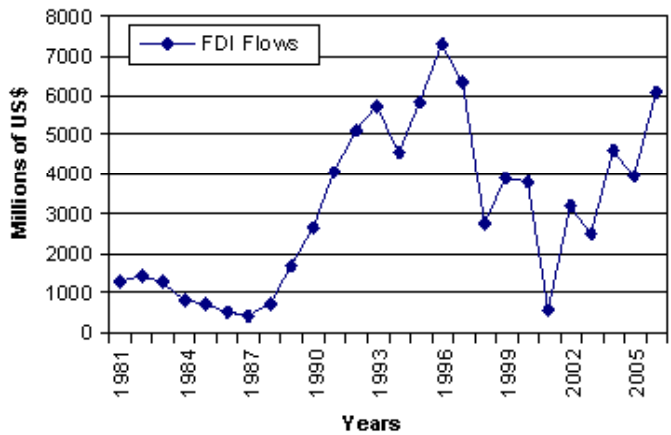

FIGURE 1. Foreign direct investment flows into Malaysia (1981- 2006) (US$ Million)
Source: Major FDI Indicators (WIR 2007)

response to the crisis. Indonesia, Korea and Thailand for example, approached the International Monetary Fund (IMF) for help. In contrast, Malaysia declined the IMF package, which called on the affected countries to cut down government spending, allow insolvent banks and financial institutions to collapse, and raise interest rates. The package was considered to be contrary to the traditional Keynesian orthodox, which calls for increase in government spending, propping up failing major companies and cutting interest rates. Malaysian government opted to impose capital control measures in the third quarter of 1998. Among these measures were travelers were to seek the central bank approval if they were to take more than RM10,000 out of the country. In addition, the ringgit itself was pegged at RM3.80 to the US dollar. No one could certainly tell whether the measures were responsible for this strong FDI turnaround in that year. Another dramatic fall of FDI came in 2001 when the FDI recorded a fall of about 85.4% before bouncing by approximately 478% in the following year. This last disastrous episode of FDI flight was blamed on the September 11, 2001 incident in which the New York World Trade Center was attacked. The crisis created uncertain economic situation and weaken the stock market performance and contributed to discourage business confidence, resulting in a sharp impact on cross-border mergers and acquisitions (M&As) and corporate investment expansion plans. Although the flows fell by more than 22% in 2003, FDI flows rose by more than 85% in 2004.

The second event is the continuous rise of China and India as major open economies that aggressively compete with Malaysia, among others, over FDI inflows into developing countries in general and East Asian region in particular. In recent years, the two countries have become more attractive to efficiency-seeking FDI as they have significantly improved their infrastructure. For example, in 1998, the two giants pulled in more than $46 billion of inward FDI, that is, approximately 7% of the global inward FDI inflows. Although the combined share of these two countries, known as the Asian drivers, declined to around 3% of the world's total FDI in the period 1999-2000, perhaps due to the financial crisis of 1996-97, they were able to recapture 9% and 10% of the global FDI in the years 2002 and 2003 respectively. China alone increased its share of the global FDI inflows by 28.9% from 2003 to 2006 while India increased its share by about 290% in the same period.

LITERATURE REVIEW

There is increasing understanding that trade and FDI are the vehicle that moves globalisation. The nature and quantity of determinants and factors that determine FDI flows into a country depends, largely on the barriers to trade. Each country must pull down and opportunities must open up for attracting FDI into a country. As the race for FDI among the nations intensifies, the conditions for attracting FDI continue to increase and multiply as well. Among the important factors that attract the FDI flow are particularly the characteristics of a host country.

These determinants and factors are broadly grouped into three major categories:

economic conditions, host country policies and MNE strategies. Under economic conditions, the important factors include the size of markets, natural resource availability, location and competitiveness. Under the host country policies, the main components are macroeconomic policies, private sector activities, policies related to trade and industry and FDI policies. Finally, under MNE strategies, the important factors are the level of the country's risk and location, sourcing, integration transfer.

Dunning et al. (1977) and Dunning (1988) combined the microeconomic and macroeconomic perspectives to produce the so-called OLI paradigm in which three conditions must be satisfied simultaneously for the FDI to take place. The firm must have an ownership (O) advantage e.g., tangible assets such as products or technologies and intangible assets such as patents or brands, existing together with country-specific locational (L) advantage in both home and host countries such as low factor costs, and potential benefits from internalization (I) advantage of production process abroad. However, in a subsequent eclectic paradigm, Dunning (1993) admitted that it is the location advantages of the host country (e.g., market size and income levels, labor availability, cost and skills, infrastructure and political and macroeconomic stability) that determines the cross-country pattern of FDI.

Numerous research works have examined the effects of economic conditions, host country policies and MNE strategies on FDI flows into countries. For example, Clegg and Scott-Green (1999) and Neubaus (2006) have shown that market size and growth variables have significant positive effect on FDI. Neubaus (2006) found that market size affects a large part of horizontal FDI but does not matter for vertical FDI. Moreover, Jaumotte (2004) reported that market size of a regional trade agreement (RTA) has a significantly positive effect on FDI although Kristtjansdottir (2005), on the contrary, found that FDI appears to be more driven by wealth effects rather than market size effects. Similarly, recent studies by Hasan (2007) and Ang (2008) on the determinants of foreign direct investment in Malaysia confirmed that increased size of the market results in more FDI flows into a country due to the benefits of the economies of scale. In corroboration of these findings, Dunning (1980), Kravis and Lipsey, (1982), Wheeler and Mody (1992), Sader (1993), Tsai (1994), Shamsuddin (1994), Billington (1999), Pistoresi (2000) reported similar evidence on the effect of market size on FDI inflows.

The economy's openness is another determinant widely claimed to be critical in influencing the FDI flows into a country. For example, Nonnemberg et al. (2004), Sahoo (2006), and Botric et al. (2006) found that openness variable is parallel with the inflows of FDI and exerted positive influence on the FDI. The degree of openness, which reflects the willingness of a country to accept foreign investment, has proved to be important in attracting capital (Nonnemberg et al. 2004). For traditional determinant, infrastructure has been suggested as playing a significant role in effort to attract FDI inflow. Kravis and Lipsey, (1982), Culem (1988), Edwards (1990), Pistoresi (2000) and Ang (2008), *inter alia,* reported similar evidence.

On the other hand, the evidence on the effect of real exchange rate, whether

in the short run or long run has been consistently mixed. Based on the currency area hypothesis, the assumption is that firms would not invest in countries with weaker currencies. Aliber (1970) has observed that capital market bias arises because income streams from countries with weaker currencies are associated with an exchange rate risk, and therefore, an income stream is *capitalized* at a higher rate by the market when it is owned by a weaker currency firm. An evidence to this, Caves (1988), Froot and Stein (1991), Blonigen (1995), Blonigen and Feenstra (1996) and Ang (2008) observed a negative correlation between a country's exchange rate and FDI while Edwards (1990) and Hasan (2007) reported a positive relationship. Similarly Ricci (2006) demonstrated that for small countries or currency areas, exchange rate volatility has a long-run negative effect on net inward FDI flows. Similar evidence was reported by Kozo and Shujiro, (2004) who claimed that a depreciation of the currency of the host country attracted FDI while high volatility of the exchange rate discouraged FDI. However, Barrell et al. (2003) found that increased exchange rate correlation would divert the FDI of United State from a larger market to a smaller market. This is because as exchange rate correlation converges towards one; exchange rate risk diversification becomes a weaker determinant of location at the same time as other factors like rate of return become more relevant. Although Lui et al. (2006) found that weaker domestic currency will attract more inward FDI because it reduces the funding costs in source country, they do not accept the conjecture that sharp depreciation can bring benefits from FDI if this also leads to higher exchange rate volatility. They concluded that exchange rate volatility in general has strong negative effects on FDI. Nevertheless, Sader (1991) and Tuman and Emmert (1999) observed that exchange rate has an insignificant effect on FDI in a share regression.

In the sphere of trade, export and FDI have a causality relationship. Singh and Jun (1995) found that Singapore is a country different from other five countries in which trade policy had no significant effect on the inward FDI flows. Furthermore, Zhang and Ow (1996) concluded that ASEAN's direct investments in China shows complementarily to trade, which corresponds with its comparative advantage. Moreover, by examining the relationship between exports and FDI using a two-country model, Jorge (1985) found FDI to be a substitute for exports. However, this finding depends on the relative cost of different sectors. Foreign country sectors with higher production costs would increase imports while lower production costs would increase exports.

RESEARCH METHODOLOGY

MODEL SPECIFICATION

Based on the literature review, there is no unanimous conclusion as to which

variable has the most significant and positive impact on FDI flows. As our specific objective is to determine the most important domestic factors that attract foreign direct investment (FDI) into Malaysia, the following model is employed:

$$\text{FDI} = f(\text{OPN, RER, EXP, GDP, INFR}) \tag{1}$$

where FDI is foreign direct investment, GDP is gross domestic production, RER is exchange rate and OPEN is openness of the economy, INFR gross fixed capital formation used as a proxy for infrastructure, EXP are exports. The above model, based on the new growth theory derived from the international trade and economic development, can be estimated in log-linear form as follows:

$$\begin{aligned}\text{In FDI}_t = {} & \beta_0 + \beta_1 \text{ In OPN}_t + \beta_2 \text{ In RER}_t + \beta_3 \text{ In EXP}_t + \beta_4 \text{ In GDP}_t \\ & + \beta_5 \text{ Ln INFR} + \xi_t\end{aligned} \tag{2}$$

where β is $K \times 1$ vector of unknown parameters, ξ is random error, FDI is the flows of foreign direct investment in Malaysia in U.S dollars. The rest of the variables remained as defined before. The expected signs are: $\beta_1 > 0$, that is, OPN has positive impact on FDI ; $\beta_2 < 0$; $\beta_2 > 0$; i.e., the effect of RER on FDI cannot be determined *a priori* because it can have affect FDI negatively or positively; $\beta_3 < 0$, that is, exports negatively impact on FDI; $\beta_4 < 0$, that is, real GDP growth positively affects FDI and finally, $\beta_5 > 0$ i.e., INFR affects FDI positively.

ECONOMETRIC METHODOLOGY

To gain insight into the relationship between FDI and its short-run and long-run determinants, this study employs the Johansen multivariate cointegration analysis (Johansen, 1988; Johansen and Juselius, 1990), specified as a VAR of order ρ model:

$$y_t = A_1 y_{t-1} + \ldots A_\rho y_{t-\rho} + Bx_t + \xi_t \tag{3}$$

where y_t is k-vector of non-stationary $I(1)$ variables, x_t is a d-vector deterministic variables and ε_t is a vector of innovations. Johansen and Juselius (1990) reparameterised VAR in equation (3) to yield the following vector error-correction model (VECM):

$$\Delta y_t = \Pi y_{t-1} + \sum_{i=1}^{\rho-1} \Gamma_i \Delta y_{t-i} + Bx_t + \varepsilon_t$$

where $\Pi = \sum_{i=1}^{\rho} A_i - I, \quad \Gamma_i = -\sum_{j=i+1}^{\rho} A_j$. (4)

This Granger's representation theorem emphasizes that if the coefficient matrix Π, which gives the number of independent cointegrating vectors, has a reduced rank

$r < k$ then there exists $k \times r$ matrices $\alpha \times \beta$ each with rank r such that $\Pi = \alpha\beta'$ and $\chi\beta' y_t$ is I(0). r is the number of cointegrating relations (the *cointegrating rank*) and each column of β is the cointegrating vector whereas the elements of a are known as the adjustment parameters in the VEC model. Johansen method strives to estimate Π from unrestricted VAR and to test whether the restrictions implied by the reduced rank of Π can be rejected. In addition, Johansen (1990, 1995) constructed two associated likelihood ratio test statistics. The first statistic is the trace which tests the null hypothesis of r cointegrating relations against the alternative of k cointegrating relations, where k is the number of endogenous variables, for $r = 0$, 1, …, k–1. The trace statistic for the null hypothesis of r cointegrating relations is computed as

$$LR_{tr}(r/k) = -T \sum_{i=r+1}^{k} \log(1-\lambda_i) \tag{5}$$

where λ_i is the i-th largest eigenvalue of the Π matrix in equation (4). The second statistic is the maximum eigenvalue, which tests the null hypothesis of r cointegrating relations against the alternative of $r + 1$ cointegrating relations. The statistic is

$$\begin{aligned} LR_{\max}(r \mid r+1) &= -T \log(1-\lambda_{i+1}) \\ &= LR_{tr}(r \mid k) - LR_{tr}(r+1 \mid k) \quad \text{for } r = 0, 1, \ldots, k-1. \end{aligned} \tag{6}$$

DISCUSSION

DATA SOURCE AND DEFINITION

The objective of this study is to examine the domestic short-run and long-run determinants of FDI in Malaysia. The study employs annual data on foreign direct investment (FDI) flows, gross domestic product (GDP), degree of openness (OPN), defined as the ratio of sum of exports and imports of goods and services to GDP, real exchange rate (RER), exports of goods and services (EXP) and infrastructure defined as the number of main telephone lines per 1000 persons in Malaysia over period 1975-2006. For FDI data, we use flows collected from World Investment Report (2007). The series was converted into Ringgit using the relevant exchange rates. All the variables are in terms of Malaysian Ringgit (RM). The data are obtained from various publications databases. Sample size was determined by the data availability which, in turn, dictated the number of variables to include in the study.

UNIT ROOT TEST RESULTS

Prior to cointegration test, the series were subjected to augmented Dickey and Fuller Phillips and Perron unit root tests in order to establish whether the series are stationary or not. This is because estimation processes that employ non-stationary data

can lead to spurious results. All analyses were conducted using Eviews 6 software. Description of variables used in the analysis (1975-2000) are shown in Table 1.

Table 2 presents the result of ADF and PP tests for the level and first difference. By taking into consideration the constant and trend in the series, it is clear that both tests fail to reject the null hypothesis at levels. However, the tests reject the null at the first difference, suggesting that the series are stationary at first difference. Therefore, the series could be feasibly employed in the cointegration tests.

MULTIVARIATE COINTEGRATION ANALYSIS

After ascertaining that the series are stationary, the study employs the cointegration test procedure (Johansen 1988; Johansen & Juselius 1990). The results of JJ multivariate cointegration test shown in Table 3 indicate that both trace and maximum-eigenvalue test statistics simultaneously identify three cointegrating relations between FDI on the one hand and the specified determinants of FDI on the other hand. In other words, there is long-run relationship between FDI and its

TABLE 1. Description of Variables used in the Analysis (1975-2006)

Variable Name	Description	Source
Log FDI	Log of foreign direct investment	World Investment Report (2007)
Log OPN	Log of economy's openness defined as the ratio of sum of exports and imports of goods and services to GDP	IMF Financial Statistics database (2008)
Log RER	Log or real exchange rate	IMF Financial Statistics database (2008)
Log GDP	Log of real gross domestic product (GDP) obtained by deflating nominal GDP by domestic consumer price index	IMF Financial Statistics database (2008)
Log EXP	Log of exports of goods and services scaled by real GDP	IMF Financial Statistics database (2008)

TABLE 2. Unit root test results (ADF and Phillips-Perron)

Variables	ADF		Phillips-Perron	
	Constant	Constant + Intercept	Constant	Constant + Intercept
Level				
Log FDI	–1.6554	–2.8839	–1.4999	–2.9123
Log OPN	–0.4504	–3.4895	–0.4018	–1.9083
Log RER	–0.7179	–3.3212	–0.2546	–3.2378

TABLE 2 (*continued*)

Variables	ADF		Phillips-Perron	
	Constant	Constant + Intercept	Constant	Constant + Intercept
LevelLog GDP	–1.2347	–1.5625	–1.1658	–1.8236
Log EXP	–0.4274	–3.7776*	–0.4274	–1.5451
Log INFR	–0.3782	–2.6169	–0.4241	–1.2550
First Difference				
Log FDI	–7.0345**	–6.9004**	–7.0346**	–6.8999**
Log OPN	–4.3119**	–4.2251**	–4.5187**	–4.4813**
Log RER	–6.1119**	–6.0056**	–8.2558**	–8.1237**
Log GDP	–4.2654**	–4.1894**	–4.2781**	–4.2078**
Log EXP	–4.4829**	–4.3593**	–4.4636**	–4.3361**
Log INFR	–4.2731**	–4.2287**	–2.6798*	–2.5928*

Note: The optimal lagged differences in the parentheses are determined based on Akaike Info Criterion (AIC). The asterisk (*) and (**) denoted as the significant level of 1% and 5%, respectively

major determinants for Malaysia.

After establishing a long-run relationship among the variables, we normalise on the FDI equation since this is the equation of interest. As the cointegration vector, β, is not identified, arbitrary normalisation is imposed so that $\beta' S_{11} \beta = 1$ where S_{11} is the residual from a least squares regression of y_{t-k} on Δy_{t-k+1}, defined in equations (3 and 4)[6]. The first estimated eigenvector would form the maximum likelihood estimate of the cointegrating vector, β.

The cointegrating equation shown in Table 4 describes the long-run equilibrium relationship between FDI on one hand and its determinants on the other for Malaysia. When this expression, which is also vector error-correction term (ECT), is statistically significant, it implies that FDI is weakly endogenous with respect to the long-run parameters. In general, all the estimated parameter coefficients carry the

TABLE 3. Johansen-Juselius multivariate cointegration test results

Null hypothesis	Eigenvalue	Trace statistic	95%	Maximum Eigenvalue	95%
None	0.9071	173.78*	95.75	68.88*	40.07
At most 1	0.81974	104.89*	69.82	49.69*	33.88
At most 2	0.6528	55.21*	47.86	30.68*	27.58
At most 3	0.4345	24.53	29.80	16.55	21.13
At most 4	0.2173	7.98	15.49	7.10	14.26
At most 5	0.0297	0.87	3.84	0.87	3.84

Note: * denote rejection of the null hypothesis at the and 0.05. These nonstandard critical values are taken from Mackinon-Haug-Michelis (1999)

expected signs. With exception of economy's openness, the estimated coefficients of all the specified determinants of FDI are statistically significant at least at the 10% (exports) level. The results of the long-run FDI equation can be summarised as follows: first, the estimated coefficient of openness is statistically significant at the one percent level, which is consistent with theory. In other words, a one-percentage point increase in economy's openness would induce approximately 7.6 percentage point of FDI. This figure is relatively large compared to that by Ang (2008) who found that a one percentage point increase in trade openness would generate about 1.094-1.323 percentage point increase in FDI flows into Malaysia. Kravis and Lipsey (1982), Culem (1988), Edwards (1990), Pisterosei (2000), Chakrabarti (2001), Asiedu (2002), among others reported similar results previously.

Secondly, the estimated coefficient of real exchange rate is positively signed and statistically significant at the 1% level, suggesting that real appreciation of exchange rate causes FDI flows to surge into Malaysia. The finding is consistent with those by Edwards (1990), Hasan (2008), among others, who found positive correlation between exchange rate and FDI flows. Hasan (2008) argued that a weak currency is likely to increase the FDI flows to a country over time. In contrast, in another recent study on Malaysia, Ang (2008) found negative correlation between exchange rate and FDI. These conflicting findings obviously reflect how elusive

TABLE 4. Normalized cointegrating coefficients

Variable	FDI	OPN	RER	EXP	GDPGR	INFR
Coefficient	1.0000	–7.5739	–10.3394	12.1797	–0.4945	–2.6404
		(–6.3269)	(–2.2392)	(6.8957)	(–0.0528)	(–0.3984)

Note: Figures in given in parentheses () are standard errors

the effect of exchange rate on FDI flows.

Thirdly, the estimated coefficient of real Malaysian GDP growth rates carry the expected positive sign and statistically significant. In other words, a one percentage point rise in GDP growth would cause FDI flows into Malaysia to rise by approximately 0.5 percentage point of FDI per annum. The finding is as expected as GDP has been widely acclaimed as the measure of the market size for the products of foreign enterprise. The finding of a positive correlation between GDP growth and FDI flows corroborates the studies on Malaysia (Hasan 2007; Ang 2008) that reported a positive relationship between the two. Similar evidence was reported by Culem (1988), Billington (1999), among others. Chakrabarti (2001) argued that better opportunities for making profit could be found in more growing economies rather than the ones that grow slowly. Furthermore, Lui (2006) found a positive coefficient for economic growth rates, suggesting that higher economic growth attracts more FDI. The finding is consistent with that by Valerija and Lorena (2006) who argued that the positive and significant effect of real GDP on FDI is consistent with the fact

that the horizontal FDI is attracted to countries in which real income increases the domestic purchasing power.

Fourthly, the estimated coefficient of exports is negative and marginally statistically significant at the 10 percent level although others (Hasan 2007) found the effect of exports significant and positive. The negative relationship between exports and FDI is widely claimed to exist since FDI becomes more of a substitute for trading in the face of trade barriers imposed by host country's governments. To avoid these trade barriers (e.g. tariff), foreign investors relocate plants in the local market rather than produce at home and export to foreign markets. Therefore, multinational corporations have to face tough choices between export and FDI, and thus the FDI is considered to result in a reduction of international trade conducted by MNCs and the host country in question (Remstetter 1987).

Finally, the estimated coefficient of infrastructure is positively signed as expected and statistically significant at the 1% level. In other words, a one-percentage point improvement in infrastructure would induce FDI flows to rise by approximately 2.6% annually. No doubt that infrastructure is critical in inducing FDI flows into a host country. Wheeler and Mody (1992), Kumar (19940 and Loree and Guisinger (1995) reported similar findings.

The final model was subjected to a battery of diagnostic tests that include the residual tests (serial correlation LM test, heteroskedasticity tests) and the stability test (Ramsey RESET test and the recursive estimates). The results (are not shown here but available with the authors) of the Breusch-Godfrey or LM test, the autoregressive conditional heteroskedasticity (ARCH) test, the White heteroskedasticity test and Ramsey regression equation specification test (RESET) indicate no serious problems with the model estimated in this study. The values of the Chi square and the F-statistic could not reject the null hypothesis of no serial correlation of any degree in the residuals. Similarly, the results of the ARCH test could not reject the null hypothesis of no ARCH of any order in the residuals as the White heteroskedasticity test could not reject the null hypothesis no heteroskedasticity problem in the specified among the residuals in this model. Finally, the Ramsey RESET test confirms that the model employed in this study does not suffer from any mis-specification error.

In addition, to check whether the estimation regression equations were stable throughout the sample period, we plot the CUSUM and CUSUM (cumulative sum) of squares tests (Brown et al. 1975) as shown in Figures 2-3. The importance of these tests is that a movement of the CUSUM and CUSUM squared residuals outside the critical lines is suggestive of the instability of the estimated coefficients and parameter variance over the sample period. In this study, the statistics fall inside 5% critical lines, implying that the tests could not reject the null hypothesis that the regression equations are correctly specified at 5% level of significance. This suggests that there have not been systematic changes in the regression coefficients.

ESTIMATES OF ERROR CORRECTION REPRESENTATION

Since all the variables are stationary and cointegrated in the system, the short-run

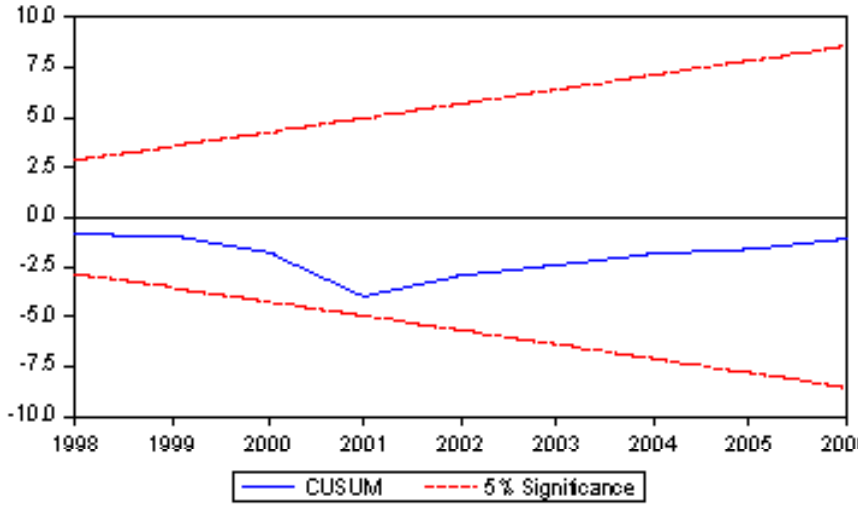

FIGURE 2. Plot of cumulative sum of recursive residuals (CUSUM)

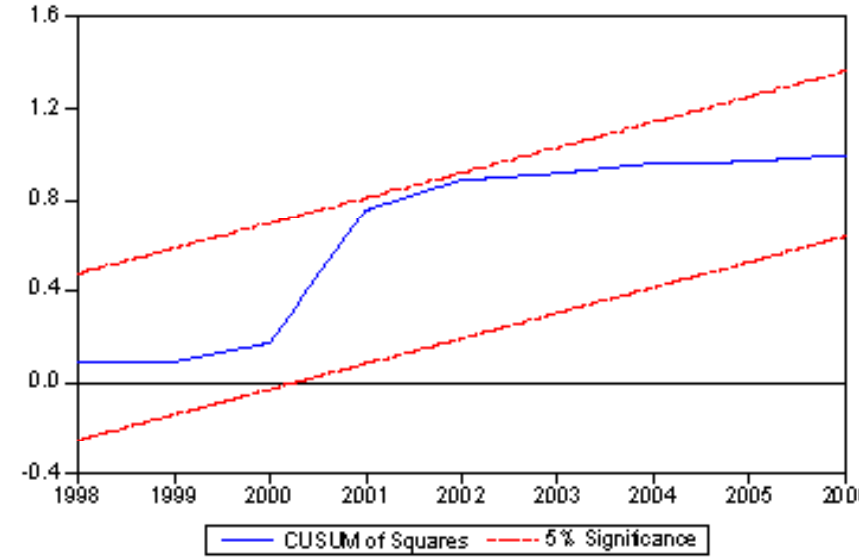

FIGURE 3. Plot of cumulative sum of squares of recursive residuals (CUSUMSQ)

adjustment mechanism could be modeled as an ECM. The ECT derived from long-run relationship using Johansen procedure is used in the ECM, together with current and past differenced fundamentals that affect FDI in the short run. The system could be reduced gradually using the general-to-specific (top-down) modeling approach as proposed by (Hendry 1991; Hendry & Richard 1983) to a parsimonious form

using an optimal lag length the Akaike Information Criterion (AIC) identified 2 as the optimal lag length. The approach is employed to derive a simple VECM by eliminating sequentially the differenced variables whose coefficients were insignificant using t-ratios.

The results of the error-correction model reported in Table 5 indicate that the estimated coefficients of lagged FDI are statistically significant but negative. This implies that the short-run FDI flows are negatively influenced by the past FDI flows. With the exception of lagged economy's openness and real exchange rate, the coefficients of lagged real GDP growth, exports and infrastructure negatively affect the FDI flows in the short run. Masih and Masih (2004; p.597) have cautioned against attaching too much importance to such short-run relationships as they are derived from reduced-form model and not based on theory.

TABLE 5. Error correction representation of the model

Results of the selected error-correction model			
Regressor	Coefficient	t-Statistic	Prob.
Intercept	1.8764***	5.4511	0.0000
	(0.3277)		
ΔLog FDI(-1)	–0.5444***	–3.8801	0.0010
	(0.1403)		
ΔLog FDI(-2)	–0.3346**	–2.3258	0.0313
	(0.1438)		
ΔLog OPN(-2)	9.7207***	4.2421	0.0004
	(2.2915)		
ΔLog RER(-1)	3.4644**	2.7271	0.0134
	(1.2703)		
ΔLog XP(-1)	–6.4573***	–3.4657	0.0026
	(1.8632)		
ΔLog GDPGR(-1)	–0.0555***	–4.6148	0.0002
	(0.0120)		
ΔLog INFR(-1)	–11.6500***	–5.8126	0.0000
	(2.0042)		
Dummy variable	0.2392	1.5413	0.1397
	(0.1552)		
ECM(-1)	–0.1165***	–3.3468	0.0034
	(0.0348)		
R-squared	0.7553		
Adj. R-squared	0.6394		
F-statistic	6.5174		
Prob(F-statistic)	0.0004		
Durbin-Watson test	1.9154		

Note: (***), (**) and (*) refer to 1%, 5% and 10% level of significance respectively. Figures in parentheses denote standard errors

The coefficient of determination, R^2, is reasonably high, implying that approximately 76% of total variation in FDI flows into Malaysia is explained by the specified macroeconomic determinants of FDI flows. The financial crisis dummy variable, which was included to take value 1 after 1997 and zero otherwise, is not statistically significant, but carry positive sign. The Durbin-Watson statistic being close to 2 indicates that the residuals are uncorrelated with their lagged values, that is, there is no first-order serial correlation problem among the residuals.

The error-correction term that represents the proportion by which a long-run disequilibrium in the FDI can be corrected in each year is statistically significant at 1% level and correctly signed, suggesting that approximately 12% of total disequilibrium in FDI flows was being corrected in each year in Malaysia. Our calculation in this study indicates that the implied half-life is approximately 4 years and takes approximately 8 years to completely dissipate any disequilibrium in FDI flows in Malaysia during the study period. Therefore, the presence of statistically significant coefficients of differenced regressors and error-correction term is a clear indication of both the long-run and short-run relationships between the FDI flows and the specified array of independent in Malaysia across this study period.

CONCLUSION

The objective of this study is to investigate the domestic short-run and long-run determinants of foreign direct investment (FDI) in Malaysia using annual data over period 1975-2006. To achieve this objective, the study employs the Johansen cointegration and error-correction model. Both the trace and Maximum-eigenvalue cointegration tests simultaneously identify three cointegrating relations between FDI flows and the determinants.

In general, all the estimated parameter coefficients carry the expected signs. The results of the model indicate that, with exception of economy's openness, the estimated coefficients of all the specified determinants of FDI are statistically significant at the conventional level. The findings show that FDI flows in Malaysia are positively influenced by real exchange rate, GDP growth and infrastructure while negatively affected by exports in the long run. The negative relationship between exports and FDI is widely believed to be due to trade barriers that make FDI a substitute for trading in a host country (Remstetter 1987). In the short run, FDI flows are determined by all the specified lagged variables. Specifically, while FDI is negatively influenced by its own lags, GDP growth rates, infrastructure and exports, it is positively affected by economy's openness and real exchange rate variables.

The most important findings of this study is the existence of long-run and short-run relationship among the variables as implied by the statistical significance of the coefficients of differenced explanatory variables and the lagged error-correction term (ECT), respectively. This satisfies the fundamental objective of the study.

The important lesson to learn from this study is that policy makers should

pay close attention to those factors that negatively affect FDI flows. One important finding is the negative relationship between FDI flows and exports of goods and services in both the short run and long run. Policymakers need to review the tariff system and any other barriers that may act to inhabit a smooth FDI flows into the country. These measures can increase the confidence of foreign investors in the Malaysian economy making the country, in the long run, a favorable investment haven in the region.

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