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THE DETERMINANTS OF FOREIGN DIRECT INVESTMENT IN THE MANUFACTURING INDUSTRY OF MALAYSIA

Wong Hock Tsen*

Malaysia received, over the past decades, substantial amounts of foreign direct investment (FDI) in its manufacturing industry which is an important engine of its economic growth. The main aim of this study is to investigate the long-run relationship between FDI and its location-related determinants in the manufacturing industry of Malaysia over the period 1980-2002. The results of the Johansen (1988) co-integration method show that there is one co-integrating vector in each of the estimated models. Moreover, the results of the Phillips and Hansen (1990) fully-modified least squares (FMLS) estimator show that an increase in education, infrastructure, market size or current account balance leads to an increase in FDI whereas an increase in inflation or exchange rate leads to a decrease. The experience of Malaysia in attracting FDI could be an example for other developing countries.

1. INTRODUCTION

Research on foreign direct investment (FDI) has been one of the most intensive areas of international economics in the last decade (Pan, 2002). Although there is sizeable research on the determinants of FDI, empirical studies on FDI in the developing countries, such as Malaysia, are relatively scarce. Malaysia received substantial amounts of FDI in its manufacturing industry over the past decades. In 1978-1979, the average of FDI in approved projects was 151.6 million US dollars. That average increased remarkably to 648.9 million US dollars in 1980-1989 and 4,752.7 million US dollars in 1990-1999. In 2002, the amount was 3,046.8 million US dollars. It was not much affected during the Asian financial crisis in 1997-1998. In 1996, it was 12,353.6 million US dollars and increased to 12,829.9 million US dollars in 1997. In 1998, FDI was 8,274.1 million US dollars (Ministry of Finance of Malaysia, various issues). In short, FDI in Malaysia was rather stable during the

* School of Business and Economics, University of Malaysia, Sabah, Malaysia.

crisis in comparison to other forms of foreign investment such as portfolio investment and foreign loans which decreased significantly during the crisis (Bank Negara Malaysia, 2002). Thus, the crisis reminded of the importance of FDI for the economy.

FDI is different from other major forms of foreign investment in that it is motivated largely by the long-term profit prospects in production activities that investors directly control. Generally, FDI has played an important role in the development of the manufacturing industry in Malaysia.

Manufacturing industry is an important engine of economic growth for the Malaysian economy. In 1987, it contributed 19.8 per cent of the gross domestic product (GDP). That contribution increased to 24.6 per cent in 1990 and 44.8 per cent in 2001. It also contributed significantly to Malaysian exports. In 1987, manufactured exports, namely exports of manufactured goods, machinery and transport equipment and miscellaneous manufactured articles, contributed 39.9 per cent of the total exports. The contribution of manufactured exports to total exports increased to 53.6 per cent in 1990. In 2002, 73.5 per cent of total exports were manufactured (Ministry of Finance of Malaysia, various issues). Today, Malaysia is one of the world's largest exporters of semiconductor devices, namely electrical goods and appliances. Furthermore, the Malaysian manufacturing industry generated a significant number of employment opportunities. That contribution was 15.5 per cent of total employment (928.9 thousand) in 1987 and increased to 19.9 per cent (1,332.8 thousand) in 1990. In 2002, 27.2 per cent of total employment (2,679.8 thousand) was generated by the manufacturing industry (Ministry of Finance of Malaysia, various issues). In fact, manufacturing industry is also an important source of technology transfer and foreign exchange earnings for Malaysia and is expected to play a significant role in driving the Malaysian economy from an agriculture-based economy to an industry-based one to achieve a fully developed country by 2020 or what is known as Vision 2020. The main aim of Vision 2020 is to fully develop Malaysia in terms of national unity and social cohesion, economy, social justice, political stability, system of government, quality of life, social and spiritual values, national pride and confidence (http://www.wawasan 2020.com/vision/p4.htm1). In short, manufacturing industry plays a pivotal role in the transformation and development of the Malaysian economy.

The role of FDI in the host country, which includes the development of manufacturing industry, is becoming increasingly important (Wong, 2003). Despite the importance of FDI for the manufacturing industry of Malaysia, there is little published work on the determinants of FDI in that industry. Moreover, most of the previous studies on the subject were based on cross-section or panel data. The use of time series data for a single country offers an alternative approach to capture the relationship between FDI and its determinants (Erdal and Tatoğlu, 2002). Those determinants may change over time (Dunning, 1993, p.144). Identifying a set of factors that enhance the attractiveness of a country as a location for FDI is important for policy makers. Thus, the latter are able to manipulate the factors that affect FDI to attract more of it. More specifically, the study focuses on the location-related determinants of FDI.

The main aim of the study is to investigate the long-run relationship between FDI and its location-related determinants in the manufacturing industry of Malaysia over the period 1980-2002. The empirical estimation begins with the Dickey and Fuller (1979) and Phillips and Perron (1988) unit root test statistics and then the long-run relationship between FDI and its location-related determinants is examined using the Johansen (1988) co-integration method. Finally, the Phillips and Hansen (1990) fully-modified least squares (FMLS) estimator is used to estimate the FDI models since, in the study, the long-run relationship rather than the short-run dynamic interactions is of interest. The estimator is consistent and asymptotically efficient, even in the presence of endogeneity (Lynde and Richmond, 1993, pp. 884-885). Moreover, the estimator works well in finite samples (Phillips and Hansen, 1990).

The study is organised as follows: Section 2 presents FDI in Malaysia. Section 3 discusses the location-related determinants of FDI. Section 4 presents the methodology used in the study. Section 5 describes the data. Section 6 presents the empirical results and discussions. The last section lists concluding remarks.

2. FOREIGN DIRECT INVESTMENT IN MALAYSIA

Malaysia received substantial amounts of FDI over the past decades. The average over the period 1985-1995 was 2.9 billion US dollars, which was higher than other ASEAN-4 countries, namely Thailand,

Indonesia and the Philippines. FDI in those countries in the same period remained at 1.4, 1.4 and 0.7 billion US dollars, respectively. In 1988, FDI in Malaysia was 2.7 billion US dollars. In 2002, it reached 3.2 billion US dollars. Generally, FDI over the period 1997-2000 was higher in Malaysia than in other ASEAN-4 countries, except in 1998 and 1999. In those years, it was lower than its counterpart in Thailand (UNCTAD, 2001 & 2003) (Table 1). In short, Malaysia is one of the success stories in attracting FDI among the ASEAN-4 countries, and its experience could be an example for other developing countries.

Table 1
FDI in Malaysia

	1985-95	1997	1998	1999	2000	2002
FDI Flows (Billions of US Dollars)	2.9	6.5	2.7	3.5	5.5	3.2
FDI as a Percentage of Gross Fixed Capital Formation	14.5	15.1	13.9	20.1	16.4	14.5

Source: United Nations Conference on Trade and Development (UNCTAD).

FDI has highly contributed to gross fixed capital formation in Malaysia. This contribution amounted to 14.5 per cent per annum over the period 1985-1995. In 1999, it reached 22.1 per cent. Nonetheless, in 2002, that share slid to only 14.5 per cent. The stock of FDI in Malaysia also increased over time. In 1980, it was 5.2 billion US dollars. It increased from 10.3 billion US dollars in 1990 to 56.5 billion US dollars in 2002. Moreover, FDI contributed a high portion of GDP in Malaysia. The stock of FDI as a percentage of GDP in 1980 was 20.7 per cent. It rose from 23.4 per cent in 1990 to 59.5 per cent in 2002 (UNCTAD, 2003) (Table 2). Generally, FDI plays an important role in the Malaysian economy.

Table 2
FDI in Malaysia

	1980	1990	1995	2000	2002
FDI Stock (Billions of US Dollars)	5.2	10.3	28.7	52.7	56.5
FDI as a Percentage of Gross Domestic Product	20.7	23.4	-	58.5	59.5

Source: United Nations Conference on Trade and Development (UNCTAD).

The main sources of FDI in the manufacturing industry of Malaysia have changed over time. In 1978-1979, Japan, the United Kingdom (UK) and the United States (US) were the main sources, accounting for 51.4 per cent of total FDI in the manufacturing industry. In the 1980s, Japan was the most important source of FDI while Singapore was the second and the UK and the US were the third and fourth respectively. In the early 1990s, Taiwan became the most important source of FDI in Malaysia. Nevertheless, FDI from the US and Japan was also important. From the mid 1990s to 1999, the US became the most important source, followed by Japan and Singapore. However, in 2002, Germany was the most important source of FDI in Malaysia. It was followed by the US and Singapore. These countries contributed 75.5 per cent of the total of FDI in the manufacturing industry of Malaysia. Generally, the US, Japan and Singapore are the important sources of FDI in Malaysia. In 1978-1999, the three countries contributed, on average, 48.9 per cent of the total FDI in the manufacturing industry of Malaysia (Table 3).

Table 3
FDI in Approved Projects by Country (Percentage)

	1978-79	1980-84	1985-89	1990-94	1995-99	2002
US	11.47	7.56	7.49	14.27	29.50	23.04
Japan	22.49	18.16	24.63	20.54	18.26	5.07
Singapore	6.27	11.62	13.78	6.36	12.98	8.80
Germany	4.41	3.90	1.68	1.82	4.19	43.66
Taiwan	-	-	-	21.02	8.38	2.18
UK	17.45	11.09	4.61	3.40	2.25	1.45
Korea	8.88	0.76	1.36	4.06	3.43	3.19
Hong Kong	5.03	5.95	4.96	3.06	0.58	0.57
Australia	2.11	5.81	2.04	3.41	0.89	0.94
Others	21.89	35.15	39.45	22.06	19.54	11.10
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Ministry of Finance of Malaysia, various issues.

In 1978-1979, FDI in the manufacturing industry of Malaysia was mainly in the sectors of electrical and electronic products, petroleum and food, which accounted for 55.4 per cent of the total. In the 1980s, FDI was mainly in the electrical and electronic, chemical and non-metallic sectors. In the 1990s, electrical and electronic, petroleum and chemical sectors were the most important destinations for FDI. In 2002, petroleum, and electrical and electronic sectors were the main destinations. Generally, FDI in the manufacturing industry of Malaysia was mainly in

the electrical and electronic, petroleum and chemical sectors. In 1978-1999, the three sectors contributed an average of 48.3 per cent of the total FDI in the manufacturing industry of Malaysia (Table 4). One of the reasons that Malaysia became a hub of electrical and electronic manufacturing is its well-trained and disciplined labour force with relatively low wages. Furthermore, Malaysia has provided incentives (fiscal and monetary) and established the necessary infrastructures for the needs of investment. The appreciation of the Japanese Yen, the trade friction between Japan and the newly industrialised Asian economies (NIEs) with the US and European Union countries, and the increasing wage rates in Japan and Asian NIEs in the mid-1980s, amongst others, have contributed to a massive relocation of labour-intensive industries, particularly electrical and electronic industry from Japan and Asian NIEs to Malaysia (Chung-Sok and Jung-Soo, 1998, pp. 128-129). FDI in Malaysia has increased its exports and assisted in the transformation of the economy from an agriculture-based economy to an industrial one and contributed to economic growth and development.

Table 4
FDI in Approved Projects by Industry (Percentage)

	1978-79	1980-84	1985-89	1990-94	1995-99	2002
Electrical	22.17	14.04	21.76	22.88	33.65	34.59
Petroleum	21.64	4.14	7.26	19.69	17.34	41.38
Non-metallic	11.44	11.81	5.66	4.75	4.85	0.85
Textiles	2.82	3.59	4.45	6.43	2.74	0.29
Rubber	3.56	4.73	6.70	0.63	0.52	1.90
Chemical	2.76	16.61	9.91	13.35	14.51	4.28
Food	11.61	8.11	12.10	1.83	1.72	3.72
Basic	1.61	8.17	7.14	13.16	4.88	1.37
Transport	0.71	6.84	5.11	2.11	3.04	1.22
Paper	0.17	3.16	2.89	1.21	5.07	1.53
Fabricated	11.47	3.68	3.07	3.16	3.45	1.84
Others	10.04	15.12	13.95	10.8	8.23	7.03
Total	100.0	100.0	100.0	100.0	100.0	100.0

Notes: “Electrical” refers to electrical and electronic products. “Petroleum” refers to petroleum and coal. “Non-metallic” refers to non-metallic products. “Textiles” refers to textiles and textile products. “Rubber” refers to rubber and rubber products. “Chemical” refers to chemicals and chemical products. “Food” refers to food manufacturing. “Basic” refers to basic metallic products. “Transport” refers to transport equipment. “Paper” refers to paper, printing and publishing material. “Fabricated” refers to fabricated metal products.
Source: Ministry of Finance of Malaysia, various issues.

3. LOCATION-RELATED DETERMINANTS OF FOREIGN DIRECT INVESTMENT

Dunning (1993) argues that location is one of the important factors of attracting FDI. Shatz and Venables (2000) classify FDI into two main categories, namely vertical FDI and horizontal FDI. Vertical FDI occurs when a multinational corporation (MNC) fragments the production process internationally, locating each stage of production in a country. The main motive is to minimise production costs which could be labour of different skill levels, primary commodities, intermediate goods, or even access to externalities such as knowledge spillovers. Vertical FDI is usually trade creating since products at different stages of production are shipped among different locations. Horizontal FDI occurs when an MNC carries out the same production activities in different countries. The motive could be to reduce costs, such as transportation costs and tariffs, or to improve the competitive position of firms in the market. This type of FDI is mainly to serve local markets and therefore substitutes for trade, since parent firms replace exports with local production (Shatz and Venables, 2000).

The distinction between vertical FDI and horizontal FDI is not clear as one plant may serve both functions (Shatz and Venables, 2000). Moreover, the motives of foreign production may change over time (Dunning, 1993, p. 57). The boundaries between different types of FDI become less evident as all FDI is seen as part of an overall strategy of enhancing competitiveness. This strategy therefore makes it increasingly difficult to point to a single locational determinant (Noorbakhsh et al., 2001, p. 1595).

The literature of the location-related determinants of FDI proposes few important factors that affect FDI, such as production costs, infrastructure, human capital, exchange rate and market size. Some of the factors are likely to affect all types of FDI. Nevertheless, the different strategic objectives implicit in vertical FDI and horizontal FDI suggest that some of the factors may affect one type of FDI more than the other (Ewe-Ghee, 2001, p. 12).

The lower the costs of production, the more attractive to FDI it becomes. Therefore, the higher the wage costs, the more it is likely to defer FDI and the relationship between FDI and wage costs is expected

to be negative. Nevertheless, empirical findings about the significance of the relationship are mixed (Billington, 1999), (Ewe-Ghee, 2001). Cheng and Kwan (2000) find that real wage costs have a significant negative impact on FDI in China. Interest rate is a measure of the cost of capital. A higher interest rate implies more costly investment and, therefore, the higher the interest rate, the more it is likely to defer FDI and the relationship between FDI and the interest rate is expected to be negative. Love and Lage-Hidalgo (2000) and Erdal and Tatoğlu (2002), amongst others, find that an increase in the interest rate leads to a decrease in FDI.

The better the infrastructure of the host country, the more attractive it is to FDI. A good infrastructure will facilitate production activities as well as the distribution of output. Therefore, the relationship between FDI and infrastructure is expected to be positive. Nevertheless, there is no catch-all variable for the infrastructure. Instead, proxies are frequently employed for the quality of the transport and communication system. Most empirical studies conclude that their infrastructure proxy (or proxies) has a significant positive impact on FDI (Billington, 1999), (Cheng and Kwan, 2000).

The better the human capital, the more attractive it is to FDI. The hypothesis that the human capital in the host country is a determinant of FDI in developing countries has been embodied in the theoretical literature. For example, Lucas (1990) conjectures that lack of human capital discourages foreign investment in developing countries. Zhang and Markusen (1999) present a model where the availability of skilled labour in the host country is a direct requirement of the MNC and affects the volume of FDI. Dunning (1993) argues that the skill and education level of labour can influence both the volumes of FDI and the activities that the MNC undertakes in a country (Noorbakhsh et al., 2001, p. 1595). Therefore, the relationship between FDI and human capital is expected to be positive. Noorbakhsh et al. (2001) find that human capital has a significant positive impact on FDI and the importance of that capital for FDI has increased over time. Cheng and Kwan (2000) find that human capital has a positive impact on FDI in China, but is statistically insignificant.

Exchange rate movements can influence FDI by affecting the home currency cost of acquiring an asset abroad (Froot and Stein, 1991). For

example, an appreciation of exchange rate has a negative impact on FDI because it affects the cost of acquiring assets in that country (Love and Lage-Hidalgo, 2000), (Erdal and Tatoğlu, 2002). Erdal and Tatoğlu (2002), amongst others, find that exchange rate has a significant negative impact on FDI.

Generally, the larger the market size of the host country, the more attractive it is to FDI. A large market size is conducive to an increase in demand for products and services, allows the achievement of economies of scale (Caves, 1971), (Erdal and Tatoğlu, 2002) and encourages horizontal FDI. Nevertheless, vertical FDI is indifferent to the market size of the host country. The net impact of market size on FDI is likely to be positive. Therefore, the relationship between FDI and the market size is expected to be positive (Ewe-Ghee, 2001). Alternatively, the MNC perception of the market size might be more closely related to the growth rate of the host country. Most of the studies in the literature suggest that the market size, proxied by real GDP or real GDP per capita, is found mostly to have a significant positive impact on FDI (Billington, 1999), (Cheng and Kwan, 2000), (Shatz and Venables, 2000). This partly reflects the fact that most of the world's FDI is horizontal in nature (Ewe-Ghee, 2001).

The literature suggests that in addition to the variables selected above, there are other factors which could have an important impact on FDI such as incentives (fiscal and monetary), special economic zone (such as free trade or exports processing zone), business or investment climate, economic distance or transportation costs and political stability (Noorbakhsh et al., 2001). Nevertheless, those factors are empirically difficult to investigate.

Most of the studies in the literature on the determinants of FDI are carried out using cross-section or panel data. Nevertheless, there are some studies that are prepared using time-series data such as Yang et al. (2000), Love and Lage-Hidalgo (2000) and Erdal and Tatoğlu (2002). Yang et al. (2000) examine the determinants of FDI in Australia using quarterly data over the period 1985-1994. FDI is estimated as a function of the interest rate, real GDP, exchange rate, openness of the economy, measure of labour disputes and wage costs. They find that the interest rate, wage costs, openness of the economy and measure of labour disputes are important determinants of FDI in Australia. The estimated

model successfully explains within-sample variability but this success is greater at the beginning of the sample than at the end.

Erdal and Tatoğlu (2002) and Love and Lage-Hidalgo (2000) use co-integration analysis in their studies. Erdal and Tatoğlu (2002) examine the determinants of FDI in Turkey using annual data over the period 1980-1998. The result shows that the market size, the infrastructure and openness of the economy have attracted FDI in Turkey. On the other hand, exchange rate and economic instability are found to have hindered FDI. Love and Lage-Hidalgo (2000) developed a simple model of the location-related determinants of FDI and tested it on FDI from the US to Mexico using annual data over the period 1967-1994. The result shows that domestic demand and relative factor costs are important in influencing the inflow of FDI, suggesting support for both cheap labour and market size hypotheses. The short-run dynamics of the model indicate that exchange rate movements have an effect on the timing of the investment decision.

4. METHODOLOGY

The discussion of the location-related determinants of FDI in the previous section suggests that the latter could be estimated as a function of production costs, infrastructure, education, exchange rate and market size in the host country. More specifically, there are two models to be estimated:

$$\ln FDI_t = \beta_{10} + \beta_{11} \ln INF_t + \beta_{12} \ln INFRA_t + \beta_{13} \ln EDU_t + \beta_{14} \ln ER_t + \beta_{15} \ln GNI_t + u_{1,t} \quad (1a)$$

$$\ln FDI_t = \beta_{20} + \beta_{21} \ln INF_t + \beta_{22} \ln INFRA_t + \beta_{23} \ln EDU_t + \beta_{24} CA_t + \beta_{25} \ln GNI_t + u_{2,t} \quad (1b)$$

where *ln* is logarithm; FDI_t is foreign direct investment; INF_t is inflation, a proxy for production costs; $INFRA_t$ is the infrastructure; EDU_t is education, a proxy for human capital; ER_t the exchange rate; GNI_t the market size; CA_t the current account balance; and $u_{i,t}$ ($i = 1, 2$) a disturbance term. The above models are named Model 1 and Model 2, respectively. Model 2 is the same as Model 1 except that CA_t is used as an alternative to ER_t. The discussion of the location-related determinants of FDI suggests that $INFRA_t$, EDU_t and GNI_t are expected to have a

positive impact on FDI_t. On the other hand, INF_t and ER_t are expected to have a negative impact. CA_t is expected to have a positive impact on FDI_t since an increase in the current account balance is usually viewed as an implication of a healthy economy. Therefore it encourages more FDI.

The empirical estimation in the study begins with the unit root tests to avoid spurious regression or nonsense correlation. In the study, the Dickey and Fuller (1979) and Phillips and Perron (1988) unit root test statistics are employed. According to Engle and Granger (1987), the series that are integrated in the same order may co-integrate together. The cointegrated series may drift apart from each other in the short run but the distance between them tends to be constant or in a stationary process in the long run. More formally, a vector yt of series ($n \times 1$) is said to be cointegrated if each of the series is integrated in the same order. The linear combination of the said vector and a non-zero co-integrating vector α' of series ($n \times 1$), i.e. α'yt, is stationary or said to be integrated of order zero, I(0).

In the study, the Johansen (1988) co-integration method is used to test the number of co-integrating vectors in equations (1a) and (1b). The Johansen (1988) co-integration method can be used to compute two likelihood ratio tests for testing the number of co-integrating vectors in the system, namely the maximum eigenvalue (λ_{Max}) and trace (λ_{Trace}) statistics, which are respectively computed as

$$\lambda_{Max} = -T \ln (1 - \lambda_{r+1}), \quad r = 0,1,2, \ldots , p-1 \tag{2}$$

$$\lambda_{Trace} = -T \sum^{p}_{i=r+1} \ln (1 - \lambda_i), \quad r = 0,1,2, \ldots , p-1 \tag{3}$$

where T is the sample size and λ_i ($i = 1, 2, ..., p$; $\lambda_1 > \lambda_2 > ... > \lambda_p$) is the eigenvalue. The λ_{Max} test statistic tests the null hypothesis (H_0) of r co-integrating against the alternative hypothesis (H_a) that there are ($r + 1$) co-integrating vectors. For the λ_{Max} test statistic, the null hypotheses to be tested are in a sequence of the following: H_0: $r = 0$ against H_a: $r = 1$; H_0: $r \leq 1$ against H_a: $r = 2$; ... ; H_0: $r \leq p - 1$ against H_a: $r = p$. For example, if H_0: $r = 0$ is rejected at 95 per cent critical value and H_0: $r \leq 1$, ... and H_0: $r \leq p - 1$ are all not rejected at the same value, then the λ_{Max} test statistic indicates the existence of one co-integrating vector. The λ_{Trace} test statistic

tests the H_0 that has at most r co-integrating vectors in the system. That is, the number of co-integrating vectors is less than or equal to r. For the λ_{Trace} test statistic, the null hypotheses to be tested are in a sequence of the following: H_0: r = 0 against H_a: r ≥ 1; H_0: r ≤ 1 against H_a: r ≥ 2; ... ; H_0: r ≤ p - 1 against H_a: r = p. For instance, if H_0: r = 0 is rejected at 95 per cent critical value and H_0: r ≤ 1, ... and H_0: r ≤ p - 1 are all not rejected at the same value, the λ_{Trace} test statistic implies the existence of at least one co-integrating vector. Critical values of the λ_{Max} and λ_{Trace} test statistics can be obtained from Osterwald-Lenum (1992).

Phillips and Loretan (1991) review various approaches to the asymptotically efficient estimation of a long-run relationship. They point out that in the presence of unit roots, conventional methods such as ordinal least squares estimator suffer from problems of asymptotic bias, inefficiency and non-standard asymptotic distributions that make them unsuitable for inference. In the study, the long-run relationship rather than the short-run dynamic interactions is of interest. Thus, the study employs the Phillips and Hansen (1990) FMLS estimator. The estimator is consistent and asymptotically efficient, even in the presence of endogeneity (Lynde and Richmond, 1993, pp. 884-885). The estimator is working well in finite samples (Phillips and Hansen, 1990).

5. DATA

The sample period in the study is 1980-2002, which is largely dictated by the availability of data. All the data were obtained from the Ministry of Finance of Malaysia, except otherwise noted. Foreign direct investment (FDI_t) is expressed as the value of foreign investment in approved projects in the manufacturing industry divided by the consumer price index (CPI, 1995 = 100). The CPI was obtained from the International Monetary Fund (IMF). Inflation (INF_t) is measured by the CPI. Infrastructure ($INFRA_t$) is expressed as total roads in Malaysia; education (EDU_t) as the ratio of total Malaysian federal government education development expenditure to its GDP, which is a proxy for human capital; exchange rate (ER_t) as the real effective exchange rate (1995 = 100) (IMF); current account balance (CA_t) as current account balance divided by the CPI; and market size (GNI_t) as nominal gross national income divided by the GDP deflator (1995=100) (IMF). All variables, except the current account balance, are expressed in logarithm.

The FDI data are obtained from the Malaysian Industrial Development Authority (MIDA), based on the value of foreign investment in approved projects in the manufacturing industry. Currently, MIDA is the only government agency in Malaysia that compiles the FDI data in the manufacturing industry. The data are also published by the Ministry of Finance of Malaysia through its Economic Report. Since the FDI data represent the value of foreign investment in approved projects in the manufacturing industry and not the actual value of foreign investment in that industry, the interpretation of the results of the study shall be according to the data used. Therefore, more specifically, the study examines factors that determine the value of foreign investment in approved projects in the manufacturing industry of Malaysia.

Table 5
Results of the Dickey and Fuller (1979)
and Phillips and Perron (1988) Unit Root Test Statistics

	t_γ - no trend	t_γ - trend	$Z(t_\gamma)$ – no trend	$Z(t_\gamma)$ - trend
ln FDI_t	-1.2612(0)	-2.0394(2)	-1.5114(3)	-1.0783(3)
Δ ln FDI_t	-3.7202*(0)	-3.7349*(0)	-4.9812**(3)	-3.7131*(3)
ln CPI_t	-2.4837(0)	-1.8085(0)	-2.9855(3)	-1.7143(3)
Δ ln CPI_t	-2.3109(0)	-2.5256(0)	-5.7749**(3)	-3.4850(3)
Ln $INFRA_t$	-1.0062(0)	-2.2166(0)	-1.8515(3)	-2.7929(3)
Δ ln $INFRA_t$	-5.3705**(0)	-5.2624**(0)	-5.9621**(3)	-5.9621**(3)
ln EDU_t	-1.4898(2)	-0.1428(0)	-0.6667(3)	-0.9393(3)
Δ ln EDU_t	-2.8221(2)	-4.7392**(0)	-4.3640**(3)	-4.3681**(3)
ln ER_t	-1.2974(0)	-2.3394(1)	-1.0783(3)	-2.1170(3)
Δ ln ER_t	-3.5895*(0)	-3.6206*(0)	-3.7131*(3)	-3.6099*(3)
CA_t	-1.6651(0)	-2.0367(0)	-1.9530(3)	-2.1992(3)
Δ CA_t	-4.7164**(0)	-4.7001**(0)	-5.0358**(3)	-4.9845**(3)
ln GNI_t	-1.0359(1)	-2.3544(3)	-1.7143(3)	-1.7237(3)
Δ ln GNI_t	-3.4182*(0)	-3.4964(0)	-3.4850*(3)	-3.7117*(3)

Notes: In is logarithm. Δ is the first difference operator, t_γ is the Dickey-Fuller (DF) or Augmented Dickey-Fuller (ADF) t-statistic, $Z(t_\gamma)$ is the Phillips and Perron (1988) t-statistic. Values in parentheses are the lag lengths used in the estimation of the Dickey and Fuller (1979) or Phillips and Perron (1988) unit root test statistics. Critical values for t_γ ($Z(t_\gamma)$) with a drift (no-trend) at 1% and 5% for sample size 25 are -3.72 and -2.99, respectively. Critical values for t_γ ($Z(t_\gamma)$) with a drift and a time trend (trend) at 1% and 5% for sample size 25 are -4.37 and -3.60, respectively (MacKinnon, 1996).
** denote significance at 1 per cent level.
* denotes significance at 5 per cent level.

6. RESULTS AND DISCUSSIONS

The results of the Dickey and Fuller (1979) and Phillips and Perron (1988) unit root test statistics are reported in Table 5. The lag length used to compute the Dickey and Fuller (1979) test statistics is based on the Akaike (1973) information criterion. For the Phillips and Perron (1988) unit root test statistics, the results reported are based on three truncation lags which are used to compute the test statistics after considering truncation lags one to three in computing the test statistics. On the whole, the results of the Dickey and Fuller (1979) and Phillips and Perron (1988) unit root test statistics show that all the series are non-stationary in level but become stationary after taking the first differences. In other words, all the series, namely FDI, inflation, infrastructure, education, exchange rate and market size are said to be integrated of order one. The series that are integrated in the same order may cointegrate together. Thus, the study proceeds to the co-integration test.

Table 6
Results of the Johansen (1988) Likelihood Ratio Test Statistics

H_0:	r=0	r<= 1	r<= 2	r<= 3	r<= 4	r<= 5
λ_{Max} Test Statistic						
Model 1	66.4	23.8	20.8	13.4	4.7	2.1
c.v.	39.8	33.6	27.4	21.1	14.9	8.1
λ_{Trace} Test Statistic						
Model 1	131.1	64.7	40.9	20.2	6.8	2.1
c.v.	95.9	70.5	48.9	31.5	17.9	8.1
λ_{Max} Test Statistic						
Model 2	55.3	24.1	18.7	12.4	8.9	2.8
c.v.	39.8	33.6	27.4	21.1	14.9	8.1
λ_{Trace} Test Statistic						
Model 2	122.2	66.9	42.8	24.1	11.7	2.8
c.v.	95.9	70.5	48.9	31.5	17.9	8.1

Notes: All the models are estimated using order of VAR = 1.
c.v. denotes 95 per cent critical value.

The results of the Johansen (1988) co-integration method are reported in Table 6. The results of the λ_{Max} and λ_{Trace} test statistics are computed with unrestricted intercepts and no trends. For all the models,

namely Model 1 and Model 2, the results of the λ_{Max} and λ_{Trace} test statistics show that the null hypothesis, i.e. H_0: r = 0, is rejected at 95 per cent critical value and the rest of the null hypotheses, i.e. H_0: $r \leq 1$, $r \leq 2$, $r \leq 3$, $r \leq 4$ and $r \leq 5$, are not rejected at that value. This indicates that there is one co-integrating vector in each of the estimated models. In other words, there is a long-run relationship between FDI and its determinants. The study continues to estimate the long-run relationship between FDI and its determinants using the Phillips and Hansen (1990) FMLS estimator.

Table 7
Results of the Phillips and Hansen (1990) FMLS Method

Model	1	2
Constant	-4.7895	-25.2438
	(-.91980)	(-4.7588)**
ln CPI_t	-14.3382	-28.6787
	(-11.1059)**	(-11.9610)**
ln $INFRA_t$	5.4948	7.3156
	(12.5429)**	(14.8617)**
ln EDU_t	0.2463	0.2855
	(2.2958)*	(2.1801)*
ln ER_t	-4.1164	-
	(-9.8139)**	
CA_t	-	0.0036
		(8.1256)**
ln GNI_t	4.6068	10.8749
	(7.1108)**	(9.9532)**
Adj. R^2	0.9418	0.9423

Notes: Adj. R^2 is the adjusted R^2. Values in parentheses are the t-statistic.
** denotes significance at 1 per cent level. * denotes significance at 5 per cent level.

The results of the Phillips and Hansen (1990) FMLS estimator are reported in Table 7. All explanatory variables in each of the models are found to have the expected signs and statistical significance at 1 or 5 per cent level. An increase in education, infrastructure, market size or current account balance leads to an increase in FDI. On the other hand, an increase in inflation or exchange rate leads to a decrease in FDI. The finding that education positively affects FDI is consistent with the finding of Noorbakhsh et al. (2001), amongst others. Erdal and Tatoğlu

(2002) report that the better the infrastructure of the host country, the more attractive it is to FDI. The study also finds a similar result for Malaysia. Billington (1999), Cheng and Kwan (2002) and Erdal and Tatoğlu (2002) report the positive impact of the market size on FDI, and the present study also reports the same finding. It finds the negative impact of inflation, a proxy for the costs of production and exchange rate on FDI, which is consistent with the findings of Cheng and Kwan (2002) and Love and Lage-Hidalgo (2000) for the former, and the finding of Erdal and Tatoğlu (2002) for the latter. Generally, the results show that education, infrastructure, market size and current account balance have a positive impact on FDI in Malaysia. On the other hand, inflation and exchange rate are found to have a negative impact. The goodness of fit of Model 2 is marginally better than the one of Model 1.

7. CONCLUDING REMARKS

The main aim of the study is to investigate the location-related determinants of FDI in the manufacturing industry of Malaysia using time series data. The co-integration analysis is used to examine the long-run relationship between FDI and its determinants. Generally, the results show that good education or infrastructure attracts FDI. The larger the market size or the healthier the current account balance, the more it is expected to attract FDI. On the other hand, an increase in inflation or exchange rate leads to a decrease in FDI.

In the 1980s and 1990s, Malaysia actively pursued an export-oriented policy with the main aim of increasing exports and promoting economic growth and development. It improved, amongst others, its basic infrastructures with the aim of attracting FDI. Furthermore, the availability of a pool of relatively cheap and well-trained labour was an important factor that attracted FDI, particularly in labour-intensive sectors such as electrical and electronic products. The tightness of the labour market in the 1990s and the rise of countries relatively well-endowed with labour, such as China and Vietnam, together with the globalisation of the world economy made FDI in Malaysia shift to high value-added and capital intensive activities, including high technology, research and development (R&D) and knowledge-intensive industries. Moreover, high value-added and capital-intensive industries are expected to be the engines of growth and development for the economy in the future.

It is no longer sufficient for the host country to have a single location-related determinant to attract FDI in high value-added and capital-intensive activities.The availability of a pool of relatively cheap labour may not also be sufficient. FDI in high value-added and capital-intensive activities seeks not only cost reduction and bigger market shares but also access to technology and innovative capacity. These resources, as distinct from natural resources, are human-made. Thus, human capital is a critical factor in attracting FDI in a liberalised and globalised world economy. Countries that have a pool of human capital become more attractive to FDI. The success story of Malaysia in attracting FDI could be an example for other developing countries.

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