THE ROLE OF TRANSPORT INFRASTRUCTURE ON FOREIGN DIRECT INVESTMENT IN MALAYSIA

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Abstract - Foreign Direct Investment (FDI) is an important contributor to the development and the transformation of the Malaysian economy, particularly in establishing new industries, enhancing production capacity, employment, trade and technological capability. This study investigates the impact of tansport infrastructure on FDI in Malaysia from 1980 to 2013. Time series Malaysian data is used to capture the role of infrastructure on FDI through ARDL method. There were four hypothesized indicators in this study; air transport and road transport along with the common variables to measure FDI. The results revealed that it was evident that both infrastructure variables had positive impact on FDI in Malaysia. The findings suggest that the improvement of infrastructure though lowered transportation costs helped to increase competitiveness in attracting FDI.

Keywords: Foreign Direct Investment, infrastructure, ARDL method,and Malaysia

1. Introduction

FDI is an important contributor to the development and transformation of the Malaysian economy, particularly in; establishing new industries, enhancing production capacity, creating employment, increasing trade and improving technological capability. Malaysia’s impressive development since the 1960’s can be traced back to its friendly foreign investment policies. With the introduction of the Investment Incentive Act 1968, Malaysia began luring foreign investors to Malaysian soil through the establishment of the Free Trade Zones (FTZs) during the Second Malaysia Plan (1971-75). The shift towards an FDI-led growth and export-oriented industrialization from 1985 onwards has led to a surge of FDI in the late 1990s. To attract a larger inflow of FDI, the government advocated more liberal policy by allowing a larger percentage of foreign equity ownership in business entities under the Promotion of Investment Act, 1986.

However, in the last 10 years, FDI has been modestly contributing towards Malaysia’s GDP. Improvement in the standard of living, level of education and per capita income require the country to inevitably shift its economy towards higher added-value in the services sector; particularly, the financial services and shared services operation. As described by the Dunning’s Investment Development Path (1993), Malaysia is possibly in the third stage of this path, where the need for outward FDIs increases just as much as inward FDIs. The waning advantage in labour intensive production forces local firms to relocate their businesses to countries like China or India. The fierce competition from the emerging markets such as China, India and Vietnam, and their ability to provide unbeatable cheap and abundant labour, has helped them win more FDIs than any other developing countries including Malaysia.

High transaction costs from inefficient infrastructure can hinder the economy from tapping into its full potential regardless of the progress on other fronts, if any. Moving a business to a labour intensive country with poor transportation infrastructure offsets any advantage that the cheap labour country has got to offer (Khadaroo and Seetanah, 2010). If a country can offer incentive by lowering the cost of doing business, particularly the transportation cost, this can increase the level of FDI inflows. Increases in FDI, in turn can further increase trade through trade-FDI nexus, in which FDI contributes to export growth of the FDI-recipient.

Therefore, using Malaysian time series data, this study seeks to examine the role of infrastructure in bringing FDI to Malaysia from 1980 to 2013. The continuous investments made to upgrade the quantity and quality of the nation's infrastructure are expected to enhance access and connectivity and, therefore, improve productivity. Physical infrastructure development which are attractive features sought by investors are important for the existing industries to transform into high value-added activities. Furthermore, this physical infrastructure need to be developed in tandem in order to synergise their potentials in pushing an economy to its level best. This paper is organized as follows; in section 2 the literature is reviewed while, the methodology and data is presented in Section 3. A discussion of the results is given in Section 4, followed by the conclusion in Section 5.

2. Literature Review

The primary benefits of transport infrastructure development are increased accessibility and reduced transport costs. Firms can benefit from these without contributing directly to the project. Ample supply of transport infrastructure at no or low costs to users is conjectured to have a positive impact on costs and productivity of firms. In one of the studies by Yol and Teng (2009), they found that one percentage point improvement in infrastructure would induce FDI flows to rise by approximately 2.6 percent annually. Similar studies by Root and Ahmed (1978), Loree and Guisinger (1995), Kinoshita (1998) and Goodspeed et al. (2006) have reported similar findings on the importance of infrastructure in drawing FDI flows.

The ability of infrastructure to promote FDI is attributed to the fact that it creates conducive investment climate for foreign investors to entrust their funds in the host country. Multinationals are in fact profit-seeking entities which seek to minimize the costs of doing business and in the presence of poor infrastructure or unavailability of public inputs will tend to increase costs. As such, infrastructure should thus improve the investment climate for FDI by subsidizing the cost of total investment by foreign investors and thus raising the rate of return (Khadaroo and Seetanah, 2008). The study further notes that if a business entity is moving its operation to a developing economy to take advantage of the host country's low labour cost but it has an inadequate and unreliable transportation system and high transportation cost, then the business will not set up its operation there. The start-up cost of doing business is less if the host country is able to provide an efficient transportation system and other public infrastructure (Erenberg, 1993). This is supported by Erden and Holcombe (2005) where a 10 percent increase in public investment is associated with a 2 percent increase in private investment.

Cheng and Kwan (2000) found that good infrastructure which is measured by the density of all roads, had a positive effect on FDI in 29 Chinese regions from 1985 to 1995. The proxies of infrastructure which includes the quality of transport, communications and energy infrastructure, according to Wheeler and Mody (1992) also show positive impact to investment. Their study covered a panel of 42 countries from 1982 until 1988. Based on another study by Khadaroo and Seetanah (2010), they claimed that transportation-based infrastructure has been acknowledged as an important factor in making these countries attractive to foreign investors in short and long run. Their analysis consists of 30 Sub Saharan African countries (SSA) where figures such as the number of telephones per 1,000 populations and the length of paved roads per square kilometer of area are used to capture the effect of infrastructure.

Khadaroo and Seetanah (2008) also found that transport infrastructure has been contributing positively to the amount of FDI flows in Mauritius. The study used a constructed transport capital stock as a proxy for infrastructure using ARDL model. Meanwhile, Asiedu (2002) focused on 34 African countries and used the same method to examine the effects of infrastructure development to FDI. The number of telephones per 1,000 populations is used to measure infrastructure development and the data have been split over two-time periods; the years 1980 to 1989 and 1990 to 2000. The result showed that in the 1980s, one unit increase in infrastructure led to 1.12 percent increase in FDI/GDP. However, in the 1990s, more than one unit increase in infrastructure is required to obtain 1.12 percent increase in FDI/GDP, thus, indicating that the effect of infrastructure on FDI had changed over time and the pre-requisite of attracting FDI is higher than previous year.

On the other hand,according to Ang (2008), trade openness and infrastructure development, also confirmed as a determinant to promote FDI in Malaysia. He obtained the result by using time series data spanning from the period beginning 1960 until 2005. Total government spending on transport and communication is used as the proxy for infrastructure development. From the literature review, it is noticeable that countries with better infrastructure development are more attractive to foreign investment. Thus, this study attempts to expand further by using infrastructure proxies as the augmented variables. In the attempt to make valuable contribution to FDI literature, other determinants such as market size and exchange rate are selected as the proxies of Malaysian infrastructure.

3. Empirical Methodology

In order to capture the impact of infrastructure on FDI in Malaysia, this study employed the Autoregressive Distributed Lag (ARDL) bounds testing approach as proposed by Pesaran, et al. (2001). The procedure was adopted because it is more appropriate for estimation in small sample studies. The bounds test was also a simple procedure and the ARDL techniques did not require the variables in the model to be integrated to the same order, as opposed to other multivariate cointegration techniques such as Johansen and Juselius (1990). The existence of long-run relationship between FDI and selected explanatory variables was modeled as follows:

$$FDI = f\ (Y, EX, IFRS), \qquad (1)$$

Where;

FDI = FDI stock,
Y = GDP,
EX = exchange rate,
IFRS = infrastructure variables

The FDI stock was chosen as the dependant variable because stocks measure was more stable than FDI flows. The size of the host market is an important element for foreign investors to invest in a country because it determines the host country's economic conditions and the potential demand for their product. Y is the proxy for market size and is expected to be positive because this variable is used as an indicator of the market potential for the products of foreign investors. Wheeler and Mody (1992), Loree and Guisinger (1995) and Yol and Teng (2009) are among the studies which have supported the importance of market size. Exchange rate (EX) is expected to have a positive relationship with FDI. In general, when a currency of one country depreciates, it increases FDI flows into that country. A real depreciation encourages foreign purchasers of domestic assets and increases inward FDI (Sadewa, 2000).

Infrastructure variables were the highlights in this study and only selected variables were considered. This was also due to the limited availability of time series data. The theoretical underpinning summarized that well-developed regions with better infrastructures were more attractive for FDI (e.g., Kirkpatrick et al., 2006; Yol and Teng, 2009). For the purpose of this analysis, the hypothesized variables; Road (total route-km of rail lines), and Air (freight of air transport in million tons per km) are the added variables as proxies for infrastructure. From the equation (1) above, the econometric model of the FDI and its key determinants is derived as follows:

$$LFDI_t = \alpha + \beta_1 LY_t + \beta_2 LEX_t + \beta_3 LIFRS_t + \varepsilon_t \qquad (2)$$

Where;

LFDI = log of FDI stock,
LY = log of GDP,
LEX = log of exchange rate,
LIFRS = log of infrastructure variables.
ε = error term.

3.1 ARDL Bounds Test

The stationary status of all variables is first tested before proceeding with the ARDL bounds test in order to determine their order of integration. This is to ensure that the variables are not I(2) stationary to avoid spurious results. In the existence of I(2) variables, the computed F statistics would not be valid because the bounds test assumes that the time series must be I(0) (stationary) or I(1) (unit root) variables. Thus, denoting that the assumption of bounds testing would be invalid in the existence of I(2) variable, unit root tests in the ARDL procedure had to be carried out in order to ensure that all variables are not integrated of order 2 or beyond. In order to do the bound testing procedure, it is essential to model equation (2) as a conditional ARDL as follows:

$$\Delta LFDI_t = \beta_0 + \delta_1 \; LFDI_{t-1} + \delta_2 \; LY_{t-1} + \delta_3 \; LEX_{t-1} + \delta_4 \; LIFRS_{t-1} + \sum_{i=1}^{n} b_i \Delta lnFDI_{t-i} + \sum_{i=1}^{n} c_i \Delta LY_{t-i} + \sum_{i=1}^{n} d_i \Delta \; LEX_{t-I} + \sum_{i=1}^{n} f_i \Delta \; LIFRS_{t-i} + \varepsilon_t \qquad (3)$$

The first step in the ARDL bounds testing approach was to evaluate equation (4.23) using OLS to test for the existence of a long-run relationship among the variables. The hypothesis was tested by conducting an F-test for the joint significance of the coefficients of the lagged levels of the variables. The tested null hypothesis is of no-cointegration, H_0: $\delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$ against the alternative hypothesis of H_1: $\delta_1 \neq \delta_2 \neq \delta 3 \neq \delta_4 \neq 0$. The approximate critical values for the F-test were obtained from Narayan (2005) and the F-test had a non-standard distribution.

The null hypothesis can be rejected if the computed F-statistic lies above the upper bound critical value, implying that there is a long-run cointegration relationship between the variables in the model. Conversely, the null hypothesis of no-cointegration cannot be rejected if the computed F-statistic falls below the lower bound critical value. Nevertheless, inference would be inconclusive if the calculated value falls within the bounds. Next, the conditional ARDL long run model for FDI_t is computed after establishing the cointegration:

$$LFDI_t = \beta_0 + \sum_{i=1}^{n} \delta_1 LFDI_{t-1} + \sum_{i=1}^{o} \delta_2 LY_{t-1} + \sum_{i=1}^{p} \delta_3 LEX_{t-1} + \sum_{i=1}^{q} \delta_4 LIFRS_{t-1} + \varepsilon_t \quad (4)$$

In order to determine the optimal lag-length incorporated into the model and select the ARDL model to be estimated, the model can be selected on the basis of Schwarz Bayesian criterion (SBC) and Akaike information criteria (AIC). The SBC is generally known as parsimonious model in selecting the smallest possible lag length, while AIC is commonly used for selecting maximum relevant lag length. Since the study utilizes time series data with 28 years of observation, the SBC based model was chosen as it has a lower prediction error compared to AIC in all cases (Disbudak and Purkis, 2010). Finally, the short-run dynamic parameters were acquired by employing an error correction model associated with long-run estimates:

$$\Delta LFDI_t = \mu + \sum_{i=1}^{n-1} b_i \Delta LFDI_{t-i} + \sum_{i=1}^{o-1} c_i \Delta LY_{t-i} + \sum_{i=1}^{p-1} d_i \Delta \; LEX_{t-i} + \sum_{i=1}^{q-1} e_i \Delta \; LIFRS_{t-i} + vecm_{t-1} + \varepsilon_t (5)$$

4. The Results

Before estimating the long-run relationship of infrastructure and *FDI*, a unit root test was conducted using the ADF test. This is to satisfy the pre-requisite condition of the dependent variable being non-stationary or containing a unit root in I(1) and stationary at I(0) as described by Pesaran et al. (2001). The unit root test results are as reported in the Appendix.

4.1 Cointegration

This study applied the bound testing approach proposed by Pesaran et al. (2001) to determine the existence of cointegration between FDI and the independent variables. The F-statistics is calculated for the Wald test and compared against the critical values provided by Narayan (2005). The reported F-statistics for all the models are greater than the upper bound critical value (Table 1). Hence, the results indicated that there existed a cointegration between independent and dependent variables in the models. Model 1 and Model 2 were significant at one percent level of significance.

Table 1: Bound Test for Cointegration Analysis Result

Critical Value	Lower Bound Value	Upper Bound Value	Model	Computed F-statistics
1%	4.614	5.966	1	7.715
5%	3.272	4.306	2	6.135
10%	2.676	3.586		

Note: Model 1; (FDI= GDP, Exchange Rate, Air Transport), Model 2; (FDI= GDP, Exchange Rate, Road transport)

4.2 Long-run Elasticity

The long run elasticities of *FDI* with respect to its independent variables were as reported in Table 2. The long-run ARDL model estimates were selected based on the SBC lag-length selection criteria. Based on the (1,0,0,0) ARDL order, all the independent variables are found to be positive and significant in promoting Malaysian FDI. The long run coefficients indicate that *GDP* is significant and have a positive relationship with *FDI* in all of the models. This finding converged with economic theories and many past studies such as by Yol and Teng (2009), Shahrudin et al. (2010) and Quazi (2010) who found that GDP and exchange rate were a significant determinant of FDI.

Table 2: Estimated Long-run Coefficients

Variables	Model 1	Model 2
Intercept	-16.211 (-2.073)**	-3.052 (-0.689)*
GDP	0.745 (3.502)***	1.344 (6.788)***
Exchange Rate	-0.034 (-0.055)*	-0.473 (-0.845)*
Infrastructure Air Transport	1.724 (2.596)**	
Road		0.810 (1.878)**

Both of the infrastructure coefficients are significant and have positive impacts on *FDI* in the long run.In Model 1, one percent increase in *Air Transport* would increase 1.724 percent of FDI in Malaysia. This result implied that air transport had a positive impact towards FDI in the long run, especially, since the importance of air transport had been increasing over time and the air transportation costs have been decreasing considerably in recent years. Micco and Serebrisky (2004) found that an improvement in airport reduced air transport costs by 15 percent. Lower air transport costs could attract more investment since it meant a lower cost of production in the country.

Meanwhile, in Model 2, the sign of Road Transport is consistent with initial expectation and statistically significant in affecting FDI in the long run. The estimated coefficients suggested that one percent increase in road transport would increase FDI by approximately 0.81 percent. In general, investors tend to look for a place with developed amenities prior to investing. For instance, good road designs, materials, and maintenance can reduce the wear and tear on vehicles, thus reducing transportation costs. The same goes to aircraft, which requires good airports (Khadaroo and Seetanah, 2010).

The robustness of the models were confirmed by several diagnostic tests, such as the Breush-Godfrey serial correlation LM test, the Ramsey RESET specification test and the ARCH test. The probability values for each diagnostic test had to be greater than 0.05 to prove that a model had the desired econometric properties, such as serially uncorrelated residual, correct functional form and homoscedastic. The results of diagnostic tests for the models were reported in Table 3. The models were well fitted as they passed all the diagnostic tests with probability values higher than 0.05. The results implied that the residuals of the four estimated models were serially uncorrelated with constant variance, and in a correct functional form. Hence the reported results are valid for reliable interpretation.

Table 3: Diagnostic Tests

Diagnostic Tests	Model 1	Model 2
Serial Correlation LM Test	1.624 (0.179)	2.772 (0.113)
Ramsey RESET Test	0.346 (0.667)	3.712 (0.068)
ARCH Test	1.728 (0.221)	0.846 (0.231)

To examine the stability of the long run coefficients and short run dynamics, cumulative (CUSUM) and cumulative sum of squares (CUSUMSQ) tests were conducted. The CUSUM and CUSUMSQ statistics were updated recursively and plotted against the break points. When the plots of CUSUM and CUSUMSQ statistics stayed within the critical bounds of five percent level of significance, which is shown by a pair of straight lines drawn at the five percent level of significant proposed by Brown, Durbin and Evans (1975), the null hypothesis that all coefficients were stable cannot be rejected. When either pair of straight lines was crossed, then the null hypothesis of stable coefficients was rejected at five percent level of significant. A similar procedure was used For CUSUMSQ test, which was based on the squared recursive residuals.

Both CUSUM and CUSUMSQ showed that statistics were within the critical bounds, showing no evidence of any significant structural instability.

4.3 Short-run Elasticity

The short run dynamics of the model is examined from the error correction model, ECM. If the coefficient of ECM lies between 0 and -1, the correction to FDI in period *t* is a fraction of the error in period *t*-1. In this case, the ECM caused the FDI to converge monotonically to its long run equilibrium path in response to the changes in the exogenous variables. If the ECM is positive or less than -2, this will cause the FDI to diverge (Shahbaz and Islam, 2011). ECM is negative and statistically significant implying that long-run equilibrium can be attained as shown in Table 5.7. This means that the error correction process converges monotonically to the equilibrium path. The coefficients ranged from -0.362 to -0.426, suggesting that a deviation from the equilibrium level of FDI during the current period will be corrected by 36% to 43% in the next period.

As in the long run, the short run impact of *GDP* was positive and significant in attracting *FDI*. A similar result was also found for *Exchange Rate* where it was significant in attracting *FDI* in the short run.For infrastructure variables, *Air Transport* in Model 1 and *Road Transport* in Model 2 showed significant and positive impacts on *FDI* in the short run. A one percent increase in *Air Transport* and *Road Transport* induced investment into Malaysia by 0.679 percent and 0.380 percent, respectively.

Table 4: Error Correction Representation for the Selected ARDL Model

Variables	**Model 1**	**Model 2**
Error Correction Term (-1)	-0.362 (-4.028)***	-0.426 (-3.421)***
∆GDP	0.325 (2.512)**	0.615 (3.361)***
∆Exchange Rate	-0.020 (-0.044)*	-0.187 (-0.713)*
∆Infrastructure **∆Air Transport**	0.679 (2.787)**	
∆Road		0.380 (1.628)**

5. Conclusion

This paper investigates the role of transport infrastructure in enhancing the attractiveness of FDI in Malaysia. It is based on a time series data over the 1980-2013 period. The results from the analysis shows that transportation infrastructure has been an important ingredient in making the countries attractive to foreign direct investment in both the short and long run. The results are consistent with those obtained recently by scholars, particularly for developing country cases. The other classical variables included in the model yielded the expected results in general, GDP and exchange rate being among the main drivers of FDI. However, other relevant infrastructure variables maybe applied to the models to improve the result obtained here.

In addition, government in developing countries should also focus on the maintenance of road to increase the quality in future. If the country's infrastructure remains lack in quality, the share of world trade is most likely to decline (Nordas and Piermartini, 2004). In order to promote quality of road infrastructure, the Ministry of Transport can expand and upgrade the existing ones using new technologies and methods. For instance, concrete paving can reinforce road to sustain commercial and heavy vehicles and increase connectivity among rural areas and urban economic centres. The country's social-economic development will significantly improve by the availability of the efficient airports and roads.

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Appendix

1. Unit Root Tests

Table 5: ADF tests (level)

ADF (1)	**(no intercept and no trend)**	**(intercept but not a trend)**	**(intercept and a linear trend)**
LGDP	3.032***	-0.445*	-1.761
LEXCHANGE RATE	0.434*	-1.541*	-2.032*
LAIR TRANSPORT	1.770*	-2.162*	1.184
LROAD TRANSPORT	3.423***	0.374*	-3.183***

Note: i) *, ** and *** denotes statistical significance at the10%, 5% and 1% levels respectively.
ii) Critical values from *t*- table, 0.1= -1.714, 0.05 = -2.069, 0.01 = -2.807.

Table 6: ADF tests (first difference)

ADF (1)	***t-stat* (no intercept and no trend)**	***t-stat* (intercept but not a trend)**	***t-stat* (intercept and a linear trend)**
dLGDP	-1.126*	-3.415***	-3.593***
dLEXCHANGE RATE	-3.1882***	-3.2071***	-3.718***
dLAIR TRANSPORT	-2.429**	-4.271***	-6.333***
dLROAD TRANSPORT	-0.831*	-3.221***	-3.163***

Note: i) *, ** and *** denotes statistical significance at the10%, 5% and 1% levels respectively.
ii) Critical values from *t*- table, 0.1= -1.714, 0.05 = -2.069, 0.01 = -2.807.

2. CUSUM and CUSUMSQ

Figure 1: CUSUM for Model 1 (FDI/ GDP, Exchange Rate, Air Transport)