The Impact of Infrastructure on Foreign Direct Investment in Malaysia

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Abstract-_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 aims to investigate the role of infrastructure on FDI in Malaysia from 1980 to 2013. Time series Malaysian data is used to capture the impact of infrastructure on FDI through ARDL method. The results revealed that besides GDP and exchange rate, infrastructure also had positive impact on FDI in Malaysia. The findings suggest that the reduction of business cost through improvement of infrastructure helped to increase competitiveness in attracting FDI._

General Terms- _H54; FOO_

Keywords- _Malaysia; infrastructure; FDI_

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 requires 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. However, 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) [12]. 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. Furthermore, The Tenth Malaysia Plan recognised the need for world-class infrastructure to support its economic activity towards advanced high-income economy. 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. Therefore, using Malaysian time series data, this study seeks to examine the impact of infrastructure it may bring to FDI in Malaysia from 1980 to 2013. The results would be able to advise the government in terms of allocating more of the development expenditure towards infrastructures. The continuous investments made to upgrade the quality of the nation's infrastructure are expected to enhance access and connectivity and, therefore, improve productivity. 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

There are numerous literatures on the determinants of FDI in developing countries and many of them have included variables such as; market size, economic openness, labor cost, return on capital as factors that stimulate the inflow of FDI. Among these variables, infrastructure is identified as a driving force in the flow of FDI into a country. In one of the studies by Yol and Teng (2009),[27] 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),[23] Loree and Guisinger (1995)[16], Kinoshita (1998)[13] and Goodspeed et al. (2006)[8] 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)[11]. 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)[7]. This is supported by Erden and Holcombe (2005) [6]where a 10 percent increase in public investment is associated with a 2 percent increase in private investment.

The proxies of infrastructure which include the quality of transport, telecommunications and energy infrastructure, according to Wheeler and Mody (1992)[26] 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)[12], 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.Meanwhile, Asiedu (2002)[2] focuses on 34 African countries and uses the same method to examine the effect 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 was 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 was higher than previous year. Ang (2008) found that besides trade openness, infrastructure development is 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. On one hand, total government spending on transport and communication is used as the proxy for infrastructure development while ratio of private credit to GDP is used as the proxy for financial development. From the literature review, it is noticeable that countries with better infrastructure development are more attractive to foreign investment.

3. 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 was more appropriate for estimation in small sample studies. The existence of long-run relationship between FDI and selected explanatory variables was modeled as follows*where FDI is FDI stock, GDP is a proxy for market size, EX is exchange rate and IFRS is infrastructure variable.*

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

The FDI stock was chosen as the dependent 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. GDP 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)[26], Loree and Guisinger (1995)[16] and Yol and Teng (2009)[27] are among the studies 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)[24]. The theoretical underpinning summarized that well-developed regions with better infrastructures were more attractive for FDI (e.g., Kirkpatrick et al., 2006; Ch. Abdul Rehman, 2011)[14]. For the purpose of this analysis, Telecommunication (mobile and fixed-line telephone subscribers per 100 people) were 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:

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

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:

$$\Delta LFDI_t = \beta_0 + \delta_1 LFDI_{t-1} + \delta_2 LY_{t-1} + \delta_3 LEX_{t-1} + \delta_4$$

$$LIFRS_{t-1} + \sum_{i=1}^{n} b_i \Delta lnFDI_{t-i} + \sum_{i=1}^{n} c_i \Delta LY_{t-i} + \sum_{i=1}^{n} d_i \Delta LEX_{t-1} +$$

$$\sum_{i=1}^{n} f_i \Delta LIFRS_{t-i} + \varepsilon_t \qquad (3)$$

The first step in the ARDL bounds testing approach was to evaluate equation (3) 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, H0: $\delta_1 = \delta_2 = \delta_3 = \delta_4 = 0$ against the alternative hypothesis of H1: $\delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq 0$. 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 FDIt is computed after establishing the cointegration:

$$LFDI_t = \beta_0 + \sum_{i=1}^{n} \delta_1 LFDI_{t-1} + \sum_{i=1}^{o} \delta_2 LY_{t-1} + \sum_{i=1}^{p} \delta_3 LEX_{t-1} +$$

$$\sum_{i=1}^{q} \delta_4 LIFRS_{t-1} + \varepsilon_t \qquad (4)$$

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 a 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 33 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)[4]. Finally, the short-run dynamic parameters were acquired by employing an error correction model associated with long-run estimates:

$$\Delta LFDI_t = \mu + \sum_{i=1}^{n-1} b_i \Delta LFDI_{t-i} + \sum_{i=1}^{o-1} c_i \Delta LY_{t-i} + \sum_{i=1}^{p-1} d_i \Delta LEX_{t-i} +$$

$$\sum_{i=1}^{q-1} e_i \Delta LIFRS_{t-i} + vecm_{t-1} + \varepsilon_t \qquad (5)$$

4. RESULTS

Before estimating the long-run relationship of infrastructure and FDI, a unit root test was conducted using the ADF test. This was 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)[20]. 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 are calculated for the Wald test and compared against the critical values provided by Narayan (2005)[17]. The reported F-statistics for all the models were 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. The model tested was significant at one percent level of significance.

Table 1. Bound Test

Critical Value	Lower Bound Value	Upper Bound Value	Computed F-statistics
1%	4.823	6.412	
5%	3.912	4.124	16.771
10%	2.776	3.371	

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. This finding converged with economic theories and many past studies such as by Yol and Teng (2009)[27], Shahrudin et al. (2010)[19] and Quazi (2010)[21] who found that income was a significant determinant of FDI. Exchange Rate also performs well in all models suggesting that exchange rate is significant in influencing FDI in Malaysia in the long run.

For infrastructure, a higher level of Telecommunication increased FDI in Malaysia. In the model above, one percent increase in Telecommunication would induce an increase of FDI by 0.66 percent in the long run. The reduction of business cost though lowered communication cost helped to increase competitiveness in attracting FDI. Obviously, the finding of this study showed that infrastructure had a long run impact on FDI and this was consistent with Loree and Guisinger (1995)[16], Asiedu (2002)[2] Kirkpatrick et al. (2006)[14], Khadaroo and Seetanah (2008) [10]and Ismail (2009)[18].

Table 2. Estimated Long-run Coefficients

Variables	Model
Intercept	-2.391(-0.713)*
GDP	0.951(4.402)***
Exchange Rate	0.311(0.146)*
Infrastructure	0.557(2.413)**

The robustness of the model was 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. Estimated Long-run Coefficients

Diagnostic Tests	Model
Serial Correlation LM Test	2.147 (0.132)
Ramsey RESET Test	1.631 (0.136)
ARCH Test	1.259 (0.231)

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 causes the FDI to diverge (Rehman, et.al., 2011). ECM is negative and statistically significant implying that long-run equilibrium can be attained as shown in Table 4. This means that the error correction process converges monotonically to the equilibrium path. The coefficients

ranged from -0.28 to -0.55, suggesting that a deviation from the equilibrium level of FDI during the current period will be corrected by 28% to 55% 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 is significant in attracting FDI in the short run. For infrastructure variables, Telecommunication showed significant and positive impacts on FDI in the short run. A one percent increase in Air Transport and Telecommunication induced investment into Malaysia by 0.55 percent and 0.37 percent, respectively.

Table 4. Error Correction Model

Variables	Model
Error Correction Term (-1)	-0.547(-3.809)***
ΔGDP	0.430(3.472)***
ΔExchange Rate	0.051(0.163)**
ΔInfrastructure	0.372(1.897)**

5. CONCLUSION

Aspects of infrastructure have begun to capture greater attention as it plays an increasingly important role in investment due to the fact that the developing countries will face difficulties to tie-up with the global economy without sufficient and good quality of infrastructure. For FDI, it affects a country's domestic capital, productivity and employment. Inward FDI direct investment boost employment directly while indirectly improves a host economy's competitiveness, productivity and efficiency among local firms. This study provides empirical evidence of the important of infrastructure in attracting foreign investor. Major findings of this study suggest that Government will be on the right track by investing heavily in the telecommunication sector according to the expenditure allocation in the Malaysian Plan. The results show that the telecommunication infrastructure is significant and give a positive impact on FDI in the country. In order to ensure high quality of communication services is supplied at competitive prices, the Government together with private sector should invest in research and development of infrastructure. The country's social-economic development will significantly improve by the availability of the efficient telecommunication services. Water supply and electricity were important factors in the past to attract foreign investment but today, telecommunication connectivity has become a basic necessity. Also, this non-physical infrastructure is important to facilitate the services sector in which Government is moving rapidly. This is in line with the Government plan to shift the funding from physical infrastructure to soft infrastructure in the tenth Malaysia Plan.

Reflecting on the results of this study, variables that have low impact on FDI should be investigated further, possibly

using a more advanced method. The results only highlighted telecommunication as a proxy for infrastructure, thus it is suggested that in the future other relevant infrastructure variables maybe applied to the models to improve the result obtained here.

REFERENCES

[1] Ang, JB (2008). Determinants of foreign direct investment in Malaysia. Journal of Policy Modeling, 30, 185–189.

[2] Asiedu, E (2002). On The Determinants of Foreign Direct Investment to Developing Countries: Is Africa Different? World Development,30(1), 107 118.

[3] Cheng, LK and YK Kwan (2000). What Are The Determinants of the Location of Foreign Direct Investment? The Chinese Experience. *Journal of International Economics*, 51(2), 379– 400.

[4] Disbudak, C and S Purkis (2010). *Imbalances in Labour Markets: The Turkish Case*. Paper presented at the International Conference of the Middle East Economic Association (MEEA).

[5] Dunning, J (1993). *Multinational enterprises and the global economy*, New York: Addison Wesley.

[6] Erden, L and RG Holcombe (2005). The Effects of Public Investment on Private Investment in Developing Economies.*Public Finance Review*, 33(5), 575-602.

[7] Erenberg, SJ (1993). The Real Effects of Public Investment on Private Investment. *Applied Economics,* 23, 831-837.

[8] Goodspeed, T, J Martinez-Vazquez and L Zhang (2006). *Are Government Policies More Important Than Taxation In Attracting FDI*. ISP Working Paper Number 06-14,International Studies Program working paper series.

[9] Johansen, S and K Juselius (1990). Maximum Likelihood Estimation and Inference on Cointegration: With Applications to the Demand for Money. *Oxford Bulletin of Economicsand Statistics,* 52, 169-210.

[10] Khadaroo, J and B Seetanah (2008). Transport Infrastructure and Economic Growth. *Journal of Transport Economics and Policy*, 42(2), 1-13.

[11] Khadaroo, AJ and B Seetanah (2008). Transport and Economic Performance: The Case of Mauritius. *Journal of Transport Economics and Policy,* 42(2), 1-13.

[12] Khadaroo AJ and B Seetanah(2010). Transport infrastructure and foreign direct investment. *Journal of International development*, 22, 103-123.

[13] Kinoshita, Y (1998). *Micro-Determinants of Japanese Foreign Direct Investment in Asia.* Paper presented at *Eastern Economic Association and Japan Economic Seminar,* Columbia University.

[14] Kirkpatrick, C, D Parker and YF Zhang (2006). Foreign Direct Investment in Infrastructure in Developing Countries: Does Regulation Make A Difference? *Transnational Corporations*, 15(1).

[15] Kumar, N (2001). *Infrastructure Availability, Foreign Direct Investment Inflows and Their Export-Orientation: A Cross-Country Exploration*. Paper presented at conference on Research and Information System for Developing Countries, New Delhi, November 2001.

[16] Loree, D and S Guisinger (1995). Policy and Non-Policy Determinants of US Equity Foreign Direct Investment. *Journal of Business Studies*, vol. 26(2), p. 281-299.

[17] Narayan, PK (2005). The Saving and Investment Nexus for China: Evidence from Cointegration Tests. *Applied Economics*, 37(17), 1979-1990.

[18] Ismail, N.W.(2009). The Determinant of Foreign Direct Investment in ASEAN: A Semi-Gravity Approach, *Transition Studies Review* 16:710–722.

[19] Shahrudin N., Yusof, Z. and Mohd Satar, N.H., (2010). Determinants of Foreign Direct Investment in Malaysia: What Matters Most? Retrieved August 10, 2010 (from http://www.wbiconpro.com/6.Nur.pdf.)

[20] Pesaran, H, Y Shin and R Smith(2001). Bounds Testing Approaches to the Analysis of Level Relationships. *Journal of Applied Econometrics,* 16, 289-326.

[21] Quazi, R (2005). *Economic Freedom and Foreign Direct Investment in East Asia*. Paper presented at USA International Academy of Business and Public Administration Disciplines *(IABPAD) Meetings*, Prairie View A&M University, Prairie View, Texas.

[22] Rehman, A.C., Ilyas, M. and Alam, M.H. (2010). The Impact of Infrastructure on Foreign Direct Investment: The Case of Pakistan. *International Journal of Business and Management,* 6(5).

[23] Root, FR and A Ahmed (1978). The Influence of Policy Instruments on Manufacturing Direct Foreign Investment in Developing Countries. *Journal of International Business Studies,* 9(3), 81-93.

[24] Sadewa, PY(2000). The Effect of Exchange Rate on Foreign Direct Investment. Published doctoral dissertation, Purdue University, US.

[25] Tham, SY, E Devadason and LW Heng (Forthcoming 2009). Infrastructure and Trade Costs in Malaysia: The Importance of FDI and Exports. In D.H. Brooks and D. Hummels *(Eds), Infrastructure's Role in Lowering Asia's Trade Costs: Building for Trade.* Cheltenham, UK: Edward Elgar Publishing.

[26] Wheeler, D and A Mody (1992). International Investment Location Decisions: The case of U.S. Firms. *Journal of International Economics,* 33, 57-76.

[27] Yol, MA and NT Teng (2009). Estimating the Domestic Determinants of Foreign Direct Investment Flows in Malaysia: Evidence from Cointegration and Error-Correction Model. *Jurnal Pengurusan,* 28, 3-22.
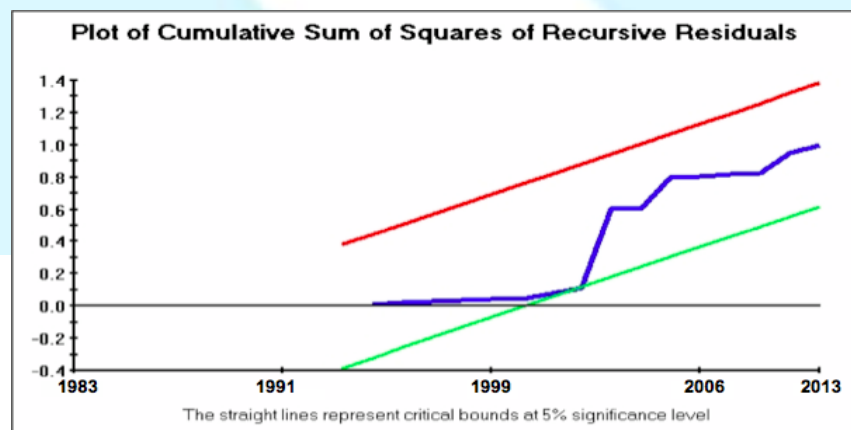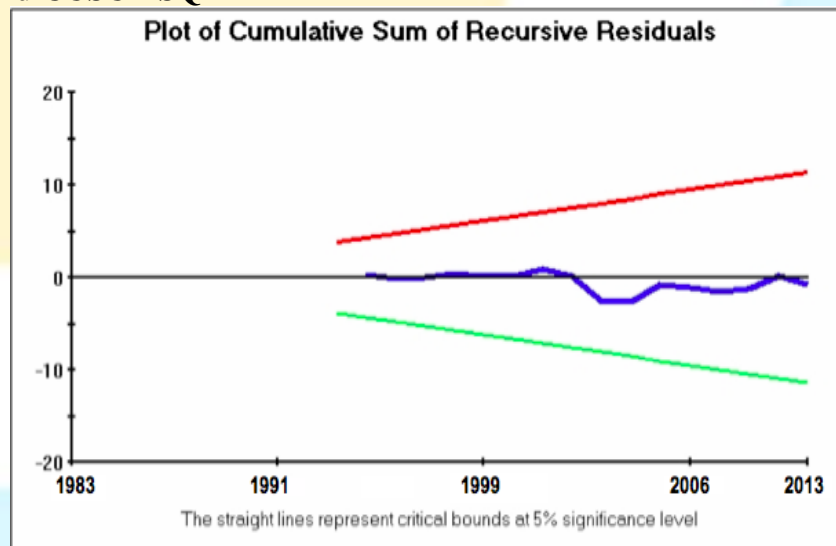
APPENDIX

1. Unit Root Tests

1.1 ADF tests (level)

ADF (1)	(no intercept and no trend)	(intercept but not a trend)	(intercept and a linear trend)
LGDP	3.128***	-0.219	-1.606
LEXCHANGE RATE	0.424*	-1.562	-2.112*
LINFRS	3.283***	0.875	-3.117***

1.2 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	-1.144	-3.238***	-3.402***
dLEXCHANGE RATE	-3.127***	-3.302***	-3.121***
dLINFRS	-0.719	-3.297***	-3.192***

2. CUSUM and CUSUMSQ

Plot of Cumulative Sum of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

Plot of Cumulative Sum of Squares of Recursive Residuals

The straight lines represent critical bounds at 5% significance level

3. Data Source

Variables	Descriptions
FDI	Is taken as a value of Malaysian FDI stock inward. Source: *World Investment Report(WIR)* website.
Real gross domestic product	GDP between Malaysia and the partner countries are sum together and taken at constant US$ 2000. Source: World Bank, World Development Indicators
Exchange Rate	Official exchange rate of Malaysia and its 36 partners taken in LCU per US$. Source: Source: World Bank, World Development Indicators
Telecommunication	Mobile & fixed-line telephone subscribers per 100 people (Line) Source: Source: World Bank, World Development Indicators.