International Journal of Business and Technopreneurship
In Press, Accepted Manuscript – Note to users

The Foreign Direct Investments-Economic Growth Nexus in Malaysia: New Evidence from NARDL

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ABSTRACT

This study employs the autoregressive distributed lags model and the non-linear autoregressive distributed lags model to determine the linear and non-linear relationship between foreign direct investments (FDIs) and economic growth in Malaysia from 1982 to 2017. The main results indicate that an increase (decrease) in FDIs increases (lowers) economic growth. Besides, the Wald test output suggests that the magnitude of reactions in economic growth after a change in FDIs is considered equal in the short run. In the long run, however, the decline of gross domestic products after a reduction in FDIs is higher than the increase in gross domestic products after an increase in FDIs. Therefore, the authorities should implement policies that attract new FDI and retain the existing FDI. Correspondingly, more policy interventions are needed when net FDI decreases.

Keywords: autoregressive distributed lags model, economic growth, foreign direct investments, Malaysia, non-linear autoregressive distributed lags model.

1. INTRODUCTION

Although the impact of inward FDI on economic growth has been frequently debated in recent years, the empirical results have been inconsistent. As a result, a proper understanding of the impact of inward FDI on economic growth is desirable. The linkages between FDI and economic growth are commonly examined by linear models and standard techniques of cointegration. Nonetheless, Anoruo (2011) suggests that the economic variables could be nonlinearly connected. If this assertion is true, then a linear model is unable to capture this potential asymmetric relationship. Moreover, the literature has also suggested that the feedback to positive and negative economic shocks could be asymmetric in terms of magnitude. This asymmetrical impact is in line with the prospect theory proposed by Kahneman and Tversky (1979).

FDI has played an important role in the development of emerging countries including Malaysia. In fact, FDI drives successful industrialisation in Malaysia. Currently, FDIs, particularly in the manufacturing industry, have contributed towards the expansion of markets through the development of supply chain ecosystems and related services. Considering the significance of FDI in Malaysia, plenty of efforts have been done to uncover the linkage between FDI and economic growth. However, the inflows of FDI are not consistent and subject to the external and internal economic conditions. The competition to attract new FDI are also intensified with the uprising of new emerging countries such as Vietnam, causing the possibility that FDI inflow into Malaysia to be lowered than the previous decades. Hence, it becomes crucial for Malaysia authorities to determine the implications of a reduction in FDI inflows into Malaysia.

In the previous studies, the reduction effect is assumed to be symmetrical. However, as suggested by Kahneman and Tversky (1979), the reaction of economic growth to a rise or a drop in FDI inflows could be varying. Based on such concern, this paper employ the linear and nonlinear autoregressive distributed lag (ARDL) model to compare the linear and nonlinear impact of FDIs towards the economic growth in Malaysia. Although numerous studies has been conducted to examine the nexus between FDI and economic growth in Malaysia, this paper is significant as the

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non-linear effect of FDIs on economic growth in Malaysia, which, to the best of our knowledge, has not been explored in the previous literature. In addition to the significance of examining the nonlinear reactions, this study, which focus on non-linearity, could contribute by giving more insights to relevant authorities to implement policies that can help simulate Malaysian economic growth through FDIs.

2. LITERATURE REVIEW

According to the FDI-led-growth hypothesis, FDI is widely known as a pusher of national economic growth. FDIs are expected to drive economic growth through capital formation and accumulation (Chowdhury and Mavrotas 2006; Kohpaiboon 2006; Hansen and Rand 2006; Lean and Tan 2011; Nistor 2014; Volos, Kyprianidis and Stouboulos 2015). Capital formation and accumulation are equivalent to an increase in the stock of physical capital in a country. FDI, as a non-debt source for development finance, also contributes to the funding of investment projects in an economy and narrows the gaps in capital requirements (Abbes *et al*. 2015).

Besides, FDI is a fundamental source of transferring modern technology and developing human capital in host countries (Abbes *et al*. 2015; Ahmed 2012; Buckley *et al*. 2002; Bwalya 2006; Kohpaiboon 2006; Lean and Tan 2011; Nistor 2014; Volos, Kyprianidis and Stouboulos 2015). Also, FDIs could introduce modern technology that can improve the technological capability of firms in the host country, thereby stimulates long-term and sustainable economic growth (Lean and Tan 2011). In addition to the positive impacts on human capital and technological improvement, FDIs transfer technological know-how and managerial knowledge which accelerate innovations and enhance productivity in the host countries through various forms such as observation, demonstration, spillovers, and competitive effects (Falk 2015; Javorcik 2004; Tuan, Ng and Zhao 2009).

On top of that, the inflows of FDIs create possible spillover effects through the backward linkages, horizontal linkages and their interaction with other factors to improve economic growth. Notably, backward spillovers increase the productivity of domestic firms and the possibility of introducing improved and new products (Falk 2015; Javorcik 2004). The horizontal spillovers, on the other hand, allow local firms to learn through imitations and introducing radical innovations simultaneously when the productivity gap between local and foreign companies is small (Falk 2015). Hong (2014) confirms that FDIs have interactions with human capital, wage levels, infrastructure level, economic scale, and regional difference. As a result, economic growth is promoted in the lagged adjustment process. However, Mengistu and Adams (2007) illustrate that the positive contribution of FDIs on economic growth is contemporary rather than with delays in effect.

Evidence also implies that the relationship between FDIs and economic growth is negative. Hong (2014) discusses that, to a certain extent, FDIs could create a crowding-out effect on domestic investment and capital. This effect will hurt the economic growth of countries that are more dependent on domestic investments. One of the countries where domestic investment dominates the FDIs is Pakistan (Saqib, Masnoon and Rafique 2013). Hansen and Rand (2006) suggest that FDIs might have potential distortions, such as causing a decline in the balance of payments since the repatriated profits will negatively affect competition in the host country's domestic market.

However, FDIs could be neutral to the host countries' economic growth. Herzer, Klasen and Nowak-Lehmann (2008) suggest that factors like distinctions between countries, sectors, industries, types of firms and types of FDI in the estimation may lead to the neutral effect. Additionally, in the 1970s and 1980s, FDIs accounted for a small share of GDP, and this caused FDIs to have a limited impact on economic growth. Athukorala (2003) adds that despite the absence of a relationship between FDIs and economic growth, it does not insinuate that FDIs are unimportant. Instead, it could be the positive effect has probably been offset by the weak political status in the host country.

On the other hand, Belloumi (2014) explains that in the 1990s and 2000s, FDIs failed to affect economic growth in Tunisia because foreign firms acquired existing companies rather than financing new activities. Apart from that, he proves that a host country without a minimum level of achievement in education, technology, infrastructure, and financial development would not be able to capture the benefit from FDIs. This idea is in line with the arguments of Borensztein, De Gregorio and Lee (1998), Nguyen (2011), Iyidogan (2013), Elya Nabila *et al*. (2018), Elya Nabila *et al*. (2019) and Sohag *et al*. (2019).

Interestingly, while the existing literatures have studied the nonlinearity between FDI and several economic variables such as industrial output (Bilgili *et al*. 2016), export productivity (Aurangzeb and Stengos 2014), inequality (Lin, Kim and Lee 2015; Wu and Hsu 2012), and health (Nagel, Herzer and Nunnenkamp 2015), only a few papers have examined the non-linear relationship between FDIs and economic growth. For instance, Brahim and Rachdi (2014) employ non-linear least squares approach to identify the potential non-linear impact of FDIs. Their study focuses on 19 Middle Eastern and North African countries from 1984 to 2011. In addition to that, Makris and Stavroyiannis (2019) examine the direction of causality for possible nonlinearity between FDI and GDP in the USA.

In the Malaysian context, most of the studies found inwards FDIs have contributed positively to Malaysian economic growth (e.g., Ahmed 2012; Alzaidy, Ahmad and Lacheheb 2017; Har, Teo and Yee 2008; Lean and Tan 2011). However, Karimi and Yusop (2009) argue that FDIs might not have a direct effect on growth. Instead, FDIs might affect growth indirectly when they interact with other factors. For instance, the interaction of FDIs and human capital creates positive spillover effects and therefore improves Malaysian economic growth (Ahmed 2012). Furthermore, a well-developed domestic financial sector will promote FDI spillover effect in the short run and long run (Alzaidy, Ahmad and Lacheheb. 2017).

Besides, Sidek (2012) suggests that the impact of FDI on Malaysian economic growth is nonlinear whereby positive economic growth is not achievable unless a minimum inflow of FDI reached. Duasa (2007) employed the generalized autoregressive conditional heteroskedasticity for a non-linear model to analyse the non-linear relationship between FDIs and Malaysian economic growth from 1990 to 2002. She reports that there is no significant causal relationship between FDIs and economic growth. However, FDIs are conducive to less volatile economic growth, while economic growth is conducive to stable FDIs.

In summary, the literature above suggests that the impact of FDIs on economic growth in Malaysia has been inconclusive. Moreover, the linear models commonly employed in the literature are unable to examine the asymmetric (or non-linear) relationship between FDIs and economic growth. Hence, there is a need to apply the non-linear ARDL approach to study the none-monotonic effect of an increase and decrease in FDI towards the short-run and long-run economic growth in the context of Malaysia.

3. METHODS

This research examines time-series data consists of annual data ranging from 1982 to 2017. Table 1 shows the sources of the variables. The linear relationship between FDIs and economic growth in this paper is estimated by employing the linear ARDL approach. The ARDL approach capture long-run relationships in a small sample size. Further, it is applicable regardless of whether the underlying regressors are purely I(0), purely I(1) or a composition of both (Pesaran, Shin and Smith 2001), Consequently, despite having no prior knowledge regarding the integration order of the underlying variables, it can test the presence of long-run relationship among the estimated variables. Another advantage of this method is that it can introduce both lagged independent and lagged dependent variables in the estimated model (Pesaran and Shin 1998) and the bounds test provides robust empirical results although the sample sizes are small.

Table 1 Source of Variables

Variable	Data sources
1. Gross Domestic Product (GDP)	World Bank database
2. Foreign Direct Investment (FDI)	World Bank database
3. Government expenditure (G)	World Bank database
4. Number of pupils enrolled in secondary education as a proxy of human capital (SC)	UNESCO Institute for Statistics

Source: Author compilation

The following equation illustrates the linear relationship between the variables in this paper:

$$LGDP_t = \alpha_0 + \alpha_1 LFDI_t + \alpha_2 LG_t + \alpha_3 LSC_t + \varepsilon_t \quad (1)$$

where $LGDP_t$ is the natural log of Malaysian GDP (current United States dollar (USD)), LFDI is the natural log of net FDI inflows into Malaysia (current USD), LG is the natural log of government expenditure (current USD), LSC is the natural log of number of pupils enrolled in secondary education as a proxy of human capital. Additionally, t implies period, α_0 represents the intercept term, α_i (i = 1, 2, 3) denote the slope parameters, and ε_t indicates the disturbance term. LG and LSC are included to reduce the bias introduced by the omitted variable. The literature suggests that an increase in government expenditure will encourage more economic activity and therefore increase the national output and accelerate the economic growth. On the other hand, the education attainment raises the productivity of labours, and hence contribute to the economic growth.

Additionally, this study explores the asymmetric impacts of FDIs on Malaysian economic in the short-run and long-run by employing the nonlinear ARDL (NARDL) cointegration approach developed by Shin, Yu and Greenwood-Nimmo (2014). Since the estimation concept adopted in the NARDL model is similar to that of the linear ARDL model, it is better to begin by discussing the linear ARDL model. We can transform the ARDL model into the unrestricted error correction model (ECM) as shown in equation (2).

$$\Delta\ LGDPt = \beta_0 + \beta_1\ LGDPt-1 + \beta_2\ LFDIt-1 + \beta_3\ LGt-1 + \beta_4\ LSCt-1 + \sum_{j=1}^{q} \lambda 1\, \Delta LGDPt-q + \sum_{j=0}^{q} \lambda 2\, \Delta LGDIt-q + \sum_{j=0}^{q} \lambda 3\, \Delta LGt-q + \sum_{j=0}^{q} \lambda 4\, \Delta LSCt-q + \varepsilon_t \quad (2)$$

which β_0 represents the intercept term; β_i (i = 1, 2, 3, 4) denotes the coefficients of the lagged dependent and independent variables. On the other hand, λ_i (i = 1, 2, 3, 4) represent the short-run coefficients of variables at lag orders. Similarly, q implies the maximum lags which are determined by choosing the lag combination that provides the minimum Akaike information criterion (AIC). Lastly, ε_t represents the error term.

Otherwise, the NARDL approach allows the use of the positive and negative partial sum to model the asymmetric relationship and detect both short-run and long-run asymmetric effects. It also allows the joint analysis of non-stationary and nonlinear issues in the context of an unrestricted error correction model (Raza *et al*. 2016). According to Shin, Yu and Greenwood-Nimmo (2014), the asymmetrical long-run equation in the form of NARDL for identifying the asymmetric impacts of FDI on economic growth can be specified in Equation (3).

$$LGDP_t = \delta_0 + \delta_1 LFDI\_P_t + \delta_2 LFDI\_N_t + \delta_3 LG_t + \delta_4 LSC_t + \varepsilon_t \quad (3)$$

where δ_i= (i = 1, 2, 3, 4) is a vector of long-run parameters for estimation, and $LFDI_t$ is decomposed as $LFDI_t = LFDI\_P_t + LFDI\_N_t$ in which $LFDI\_P_t$ and $LFDI\_N_t$ are the partial sum of positive as well as negative shifts in $LFDI_t$ respectively:

$$LFDI\_Pt = \sum_{j=1}^{t} \Delta LFDI\_Pj = \sum_{j=1}^{t} \max(\Delta LFDIj, 0), \quad (4)$$

and

$$LFDI\_Nt = \sum_{j=1}^{t} \Delta LFDI\_Nj = \sum_{j=1}^{t} \min(\Delta LFDIj, 0) \quad (5)$$

The long-run regression presented in Equation (3) allows us to examine to what extent LGDP responds asymmetrically to the increases and decrease in the net inflows of FDIs because the long-run relationship between economic growth and LFDI increase (decrease) is captured by δ_1 (δ_2). Since the economic growth and LFDI are expected to shift in the same direction, both δ_1 and δ_2 will have positive signs (Ibrahim, 2015). Furthermore, this research assumes that the reduction in LFDI will create greater long-run impacts in economic growth as compared to an increase in LFDI with the same magnitude. Therefore, $\delta_2 > \delta_1$. More discussions about the rationale of asymmetric reactions are included later.

The unrestricted ECM model for NARDL for the examination of the asymmetric impacts of FDIs on GDP growth in the long run and short run can be presented as equation (6).

$$\Delta LGDPt = \rho_0 + \rho_1 LGDPt-1 + \rho_2 LFDI\_Pt-1 + \rho_3 LFDI\_Nt-1 + \rho_4 LGt-1 + \rho_5 LSCt-1 + \sum_{j=1}^{r} \phi 1\, \Delta LGDPt - r + \sum_{j=0}^{r} \phi 2\, \Delta LFDI\_Pt - r + \sum_{j=0}^{r} \phi 3\, \Delta LFDI\_Nt - r + \sum_{j=0}^{r} \phi 4\, \Delta LGt - r + \sum_{j=0}^{r} \phi 5\, \Delta LSCt - r + \varepsilon_t \quad (6)$$

which ρ_0 represents the intercept term; ρ_i (i = 1, 2, 3, 4) denotes the coefficients of the lagged dependent and independent variables. On the other hand, ϕ_i (i = 1, 2, 3, 4) represent the short-run coefficients of variables at lag orders. Similarly, r implies the maximum lags which are determined by using the Akaike information criterion (AIC). ε_t represents the error term.

The long-run relationship can be examined by employing a Wald test with the null hypothesis of no cointegration ($\rho_1 = \rho_2 = \rho_3 = \rho_4 = \rho_5 = 0$). The long-run impact of positive and negative changes in LFDI can be computed as ($\delta_1 = -\rho_2/\rho_1$) and ($\delta_2 = -\rho_3/\rho_1$), respectively. Furthermore, the long-run coefficient of LG ($\delta 3$) and LSC ($\delta 4$) can be computed as $-\rho_4/\rho_1$ and $-\rho_5/\rho_1$, respectively. The short-run adjustment caused by a positive and a negative change in LFDI is captured by the coefficients $\phi 2$ and $\phi 3$ respectively. Similarly, the short-run parameter of LG and LSC is captured by $\phi 4$ and $\phi 5$, respectively. The long-run asymmetry between LGDP and LFDI can be tested by adopting the Wald test to investigate the validity of the null hypothesis of equality, i.e $-\rho_2/\rho_1 = -\rho_3/\rho_1$. In the same vein, the short-run symmetry between LGDP and LFDI can be tested by adopting the same test on the null hypothesis of equality ($\phi 4 = \phi 5$). The rejection of the null hypothesis suggests the long-run effects are asymmetric in the long-run and short-run, respectively. The EViews statistical software package is utilized to generate the outputs in this paper. The built-in ARDL estimation option is used for the linear ARDL estimation while the stepwise regression is applied to estimate the unrestricted ECM model of NARDL.

The implications of FDI on economic growth, however, could be asymmetric as suggested by the prospect theory. The main objective of this paper is to examine the application of this theory in the FDI – economic growth nexus in Malaysia. On the other hand, the Keynesian theory assumes an increase in government spending will increase money supply into the economy. That will contribute to the expansion in aggregate demand and economic growth through the multiplier effect. Therefore, government spending is expected to have a positive sign in its relationship with economic growth.

In a similar fashion, human capital is expected to have a positive effect on economic growth. Human capital promotes economic growth through the economic value generated by people's knowledge, skills, and know-how. Human capital strengthens the capacity of technological change and innovation of new products. Subsequently, productivity, national output, and economic growth are enhanced.

Finally, to testify the robustness of the results, two dummy variables, namely D1 and D2, are included in the ARDL and NARDL. D1 represents the 1997-1998 Asian Financial Crisis, while D2 denotes the 2007-2008 Global Financial Crisis. The D1 and D2 take the value of one during 1997 – 1998 and 2006 – 2009 respectively, and zero otherwise. Since these crises posed an adverse impact on economic growth, these crisis dummies are expected to have negative signs. Incorporating dummy variables to capture the impact of crises in the estimated models has been adopted by various researchers such as Cerra and Saxena (2008), Dell'Ariccia, Detragiache and Rajan (2008) and Raz *et al*. (2012). The 1997-1998 Asian Financial Crisis started from a speculative attack towards Thai baht in 1997, and the crisis spread to the neighbouring Asian countries, including Malaysia. Meanwhile, the Global Financial Crisis in 2007-2008 was initiated from the burst of the US housing bubble in 2006. The bubble bust led to a sharp fall in the value of securities that tied to US real estate prices, harming global financial institutions and global equity markets during 2008 and early 2009.

The unrestricted ECM models for ARDL and NARDL approaches with the crisis dummies can be respectively presented as equation (7) and (8) below.

$$\Delta LGDPt = \beta_0 + \beta_1 LGDPt-1 + \beta_2 LFDIt-1 + \beta_3 LGt-1 + \beta_4 LSCt-1 + \beta_5 D1t-1 + \beta_6 D2t-1 + \sum_{j=1}^{q} \lambda 1\, \Delta LGDPt-q + \sum_{j=0}^{q} \lambda 2\, \Delta LGDIt-q + \sum_{j=0}^{q} \lambda 3\, \Delta LGt-q + \sum_{j=0}^{q} \lambda 4\, \Delta LSCt-q + \varepsilon_t \quad (7)$$

$$\Delta LGDPt = \rho_0 + \rho_1 LGDPt-1 + \rho_2 LFDI\_Pt-1 + \rho_3 LFDI\_Nt-1 + \rho_4 LGt-1 + \rho_5 LSCt-1 + \rho_6 D1t-1 + \rho_7 D2t-1 + \sum_{j=1}^{r} \phi 1\, \Delta LGDPt-r + \sum_{j=0}^{r} \phi 2\, \Delta LFDI\_Pt-r + \sum_{j=0}^{r} \phi 3\, \Delta LFDI\_Nt-r + \sum_{j=0}^{r} \phi 4\, \Delta LGt-r + \sum_{j=0}^{r} \phi 5\, \Delta LSCt-r + \varepsilon_t \quad (8)$$

4. RESULTS AND DISCUSSION

To begin the discussion, the augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test were conducted to detect if a variable is stationary in level or first difference; the results are displayed in Table 2. To recap, the dependent variable in the ARDL and NARDL should integrate at order one (I(1)) and independent variables can integrate at order zero (I(0)) or I(1). In both ADF and PP tests, LGDP, LG, and LSC are non-stationary in level, but become stationary in first-differenced when the time series are assumed to have intercept only and contain both intercept and trend. Hence, these variables are I(1) variables. On the other hand, LFDI is a I(0) variable since it is stationary in level in both ADF test and PP test for both model specifications. This means that the application of ARDL and NARDL model is an acceptable approach for this paper.

Table 2 Result of ADF and PP Test

Unit root test	Variable	Intercept		Intercept and Trend	
		Level	First-differenced	Level	First-differenced
ADF	LGDP	-0.7345(0)	-5.0092(0)***	-2.0677(0)	-4.9366(0)***
	LFDI	-3.4376(0)**	-6.5606(1)***	-4.9100(0)***	-6.4458(1)***
	LG	-0.1792(0)	-4.7875(0)***	-2.1875(0)	-4.7015(0)***
	LSC	-2.0392(0)	-5.3037(0)***	-0.9142(0)	-5.6189(0)***
PP	LGDP	-0.7345(0)	-5.0092(0)***	-2.2930(1)	-4.9455(1)***
	LFDI	-3.4150(3)**	-18.725(14)***	-4.9100(0)***	-18.165(14)***
	LG	-0.1792(0)	-4.7760(3)***	-2.1875(0)	-4.6889(3)***
	LSC	-2.0159(2)	-5.2993(1)***	-0.9710(1)	-5.6156(3)***

Source: EView Analysis

Note: *** and *** indicates 1% and 5% level of significance, respectively. The values inside the parentheses indicate the lag order and bandwidth for the ADF and PP test, respectively.

The next step is to determine the existence of a cointegration relationship in the estimated model. The ARDL bounds test developed by Pesaran and Shin (1998) and the NARDL Wald test developed by Shin *et al*. (2014) were conducted to examine the null hypothesis of the non-existence of cointegration between the dependent and independent variables. Here, the optimal lag order is one in both ARDL and NARDL models based on the lowest AIC. The results are demonstrated in Table 3. Since the value of F-statistic exceeds the upper bounds critical value of all significance level and the p-value of F-statistic is 0.0134, this confirms the existence of a long-run relationship in the ARDL and NARDL model, respectively.

After confirming the existence of long-run cointegration in both ARDL and NARDL framework, the analyses of the long-run equation and the potential short-run relationship are carried out. The results for ARDL and NARDL approaches are presented in Table 4.

In the long run, the ARDL model suggests that all explanatory variables are statistically significant at least at the 5 percent significance level and are positively associated with GDP in the long run, except for the number of pupils enrolled in secondary education (LSC). Notably, a percent increase in FDIs leads to an increase of about 0.15 percent in Malaysian GDP. The same conclusion can be found in the papers such as those of Ahmed (2012) and Lean and Tan (2011). On the other hand, a 1 percent increase in government expenditures leads to an increase of about 0.76 percent in Malaysian GDP.

Table 3 Result of ARDL and NARDL cointegration tests – Baseline model

Optimal lag length	**ARDL - Bounds cointegration test**	**NARDL - Wald test for cointegration**
	F-statistic	**Prob (F-statistic)**
f(LGDP, LFDI,LG,LSC)	6.8742	0.0134
(1,0,1,0)	(Cointegration found)	
Critical values of the bound test (for the ARDL model)	Lower bounds I(0)	Upper bounds I(1)

10% significance level	2.72	3.77
5% significance level	3.23	4.35
1% significance level	4.29	5.61

Source: EView Analysis

Table 4 The Impacts of Independent Variables (Short-run and Long-run) – Baseline model

Dependent Variable: LGDP	**Independent Variables**	**ARDL**	**NARDL**
Long-run coefficients	LFDI	0.1484**	
		-0.0583	
	LG	0.7616***	1.0281***
		-0.108	-0.1219
	LSC	0.3184	0.5029**
		-0.2995	-0.1289
	LFDI_P		0.0986*
			-0.0387
	LFDI_N		0.1663***
			-0.0322
	C	-0.0507***	-5.6867**
		-0.6784	-2.5492
Short-run coefficients	ΔLG	0.7179***	0.6978***
		-0.0788	-0.0811
	ECM term	-0.2764***	
		-0.0502	
	ΔLFDI_N		0.0450***
			-0.0117
	ΔLFDI_P		0.0720**
			-0.0281
Diagnostic outputs		**P-value**	**P-value**
P-value of Wald (LR)			0.0027
P-value of Wald (SR)			0.4289
R-squared		0.9967	0.8879
Adjusted R-squared		0.9961	0.852
P-value of F-statistic		0	0
P-value of JB		0.7372	0.5799
P-value of LM(1)		0.6191	0.8312
P-value of LM(2)		0.3977	0.1071
P-value of BPG		0.4353	0.245

Source: EView Analysis

Note: ***, **, and * indicates the statistical significance at the significance level of 1%, 5%, and 10% significance level. LFDI_P and LFDI_N denote the partial sum of positive and the partial sum of negative, respectively. Wald (LR) represents the Wald test to long-run symmetry, Wald (SR) represents the Wald test to short-run symmetry. JB represents the Jarque-Bera test, LM(q) represents the Breusch-Godfrey Serial Correlation LM test to q lag order, BPG represents the Breusch-Pagan-Godfrey Test. Δ indicates the first-differenced of the respective variable. The values in the parentheses indicate the standard errors of the estimates.

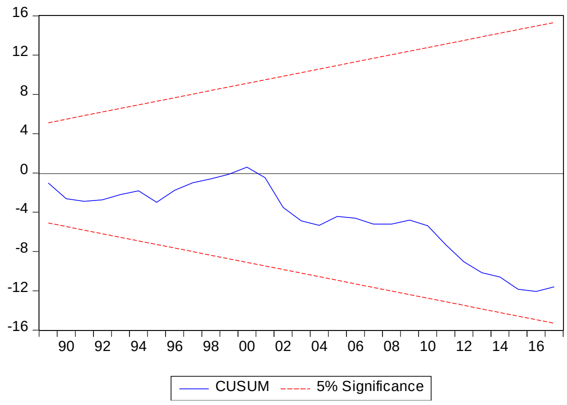
While the linear ARDL model shows that FDIs and economic growth is positively related, it does not show whether the impacts are monotonic when the net FDI decreases. Examining the NARDL estimation shows that all explanatory variables are statistically significant at least at the10 percent significance level and positively correlated with GDP in the long run. Interestingly, a 1 percent increase in FDI (LFDI_P) elevates Malaysian GDP by 0.10 percent, while a 1 percent decrease in FDI (LFDI_N) results in reducing Malaysian GDP by roughly 0.17 percent. The larger coefficient size of LFDI_N compared to LFDI_P suggests that GDP reacts more to negative changes, supporting the prospect theory. Besides, a 1 percent increase in government expenditures increases Malaysian GDP by about 1.03 percent, while a 1 percent increase in the number of pupils enrolled in secondary education increases the Malaysian GDP by around 0.50 percent.

As for the short-run analysis, the ARDL model does not support the importance of FDI in determining the GDP. However, the NARDL model indicates the opposite where a 1 percent increase in FDI will contribute to economic growth by 0.07 percent, while a 1 percent decline in FDI will reduce economic growth by 0.05 percent. Additionally, both ARDL and NARDL models showed that government expenditures have a statistically significant positive impact on GDP. In the ARDL model, a 1 percent increase in government expenditures facilitates Malaysian GDP by 0.72 percent.

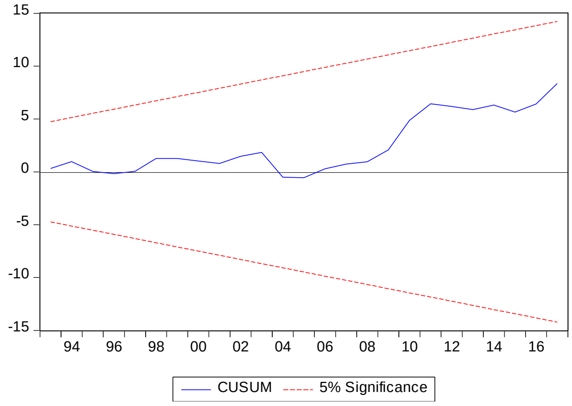
In the NARDL model, on the other hand, a 1 percent increase in government expenditures will significantly stimulate Malaysian GDP by nearly 0.70 percent. The ECM term demonstrates a negative value and is statistically significant at 1 percent significance level, providing additional evidence to support the claim that the ARDL model poses a long-run relationship. The ECM term also indicates that 27.64 percent of disequilibrium will disappear in next year.

Although the coefficients of LFDI_P and LFDI_N indicate the asymmetric responses of LGDP, the statistical evidence the asymmetric impacts in the NARDL needs to be examined as well. Table 4 also reports the statistical evidence and the diagnostic tests of the ARDL and NARDL models. The p-value of the Wald test of the long-run symmetry (0.027) that is below the threshold value of 0.05 confirms that FDI has an asymmetrical impact on Malaysian GDP in the long run at the 5 percent significance level. Although the FDI has a positive relation with Malaysian GDP in the short run, the null hypothesis of symmetric effect is not rejected at the 5 percent significance level by using the Wald test. This conclusion reveals that FDIs have a short-run symmetric impact on Malaysian GDP. Therefore, the decrease in FDIs appeared to have a greater significant impact on economic growth in the long run only. The intuitive explanation of the absence of an asymmetric short-run effect is that FDIs usually have long investment horizons and commitment. Therefore, the economic implication of any net FDI changes in the short run is not expected to different shapely. However, the asymmetric effect will be amplified in the long run as the effect of the prospect theory accumulates.

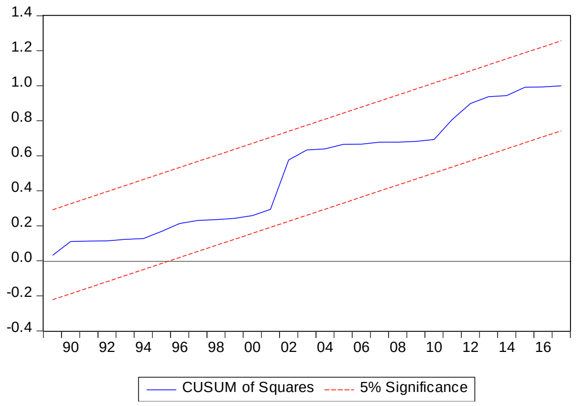
Table 4 also shows that both ARDL and NARDL models provide good fits of the data since the values for R2 and adjusted R2 are ranged from 0.85 to 0.99 for both ARDL and NARDL models. Besides, the F-statistic also suggests the null hypothesis that all independent variables in the ARDL and NARDL models are zero is rejected at the 5 percent significance level. The Jarque-Bera statistics showed that all models have typically distributed errors. Furthermore, the nonrejection of the null hypothesis of the Breusch-Godfrey Serial Correlation LM Test (order one and order two) and Breusch-Pagan-Godfrey Test at 5 percent level indicated that there is no serial correlation and heteroskedasticity in the estimated models, respectively. Furthermore, all models are reported stable, as indicated by the CUSUM and CUSUM squared (See Figure 1).



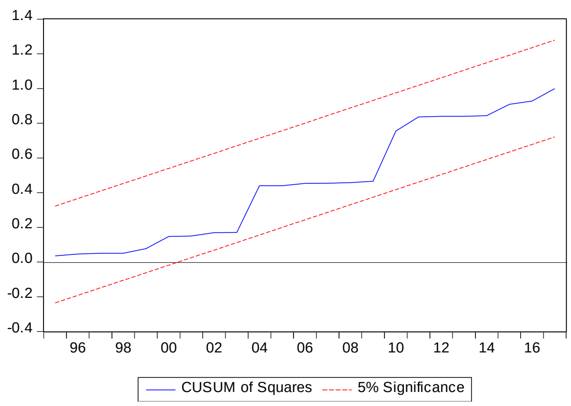
CUSUM for ARDL model



CUSUM for NARDL model



CUSUM Squared for ARDL model



CUSUM Squared for NARDL model

Figure 1. The CUSUM and CUSUM Squared result for ARDL and NARDL – Baseline estimation

Source: EView Analysis

Next, the robustness estimations where two crisis variables, D1 and D2 are included in the ARDL and the NARDL models are presented to cross-examine the results in the baseline models above. The cointegration results are presented in Table 5. The Bounds test and the Wald test suggest that the cointegration relationship remained in the models.

Table 5 Result of ARDL and NARDL cointegration tests – Robustness model

Optimal lag length	ARDL - Bounds cointegration test	NARDL - Wald test for cointegration
	F-statistic	Prob (F-statistic)

f(LGDP/LFDI,LG,LSC, D1, D2)	4.8932	0.0263
(1,0,1,0,0,0)	(Cointegration found)	
Critical values of the bound test (for the ARDL model)	Lower bounds I(0)	Upper bounds I(1)
10% significance level	2.26	3.35
5% significance level	2.62	3.79
1% significance level	3.41	4.68

Source: EView Analysis

Next, Table 6 presents the results of the long-run and short-run dynamics of the robustness estimations, together with the several diagnostic tests and statistical evidence of the asymmetric effects of LFDI. The sign and statistically significance of the independent variables in ARDL and NARDL from the robustness estimations are found to be in line with the baseline models. Although both D1 and D2 are statistically insignificant in the long-run, D1, which represents the 1997-1998 Asian Financial crisis, is statistically significant in the short run in the NARDL model at the 10 percent significance level. That crisis reduced GDP by roughly 0.09 percent. The ECM term in the ARDL model was also found to have negative value and is statistically significant at 1 percent significance level, thus supporting the conclusion that the ARDL model poses a long-run relationship.

Table 6 The Impacts of Independent Variables (Short-run and Long-run) – Robustness model

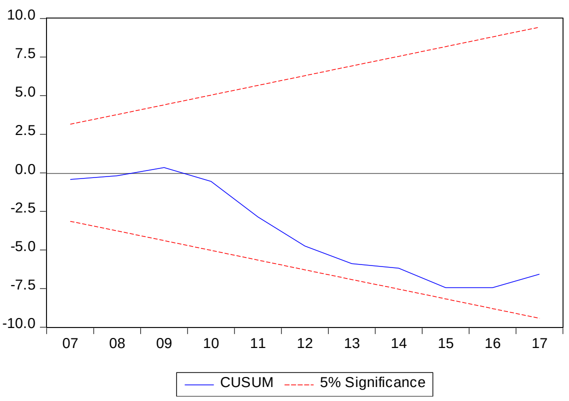
Dependent Variable: LGDP	Independent Variables	ARDL	NARDL
Long-run coefficients	LFDI	0.1299**	
		-0.0538	
	LG	0.7771***	1.0836***
		-0.0966	-0.1361
	LSC	0.3184	0.4104**
		-0.2418	-0.1351
	LFDI_P		0.0900**
			-0.0406
	LFDI_N		0.1605***
			-0.0331
	D1	0.0903	0.0838
		-0.1621	-0.0849
	D2	0.1207	-0.0031
		-0.0909	-0.0592
	C	-0.0614	-5.6281*
		-0.6887	-2.5338
Short-run coefficients	ΔLG	0.7328***	0.6590***
		-0.1176	-0.1102
	D1		-0.0882*
			-0.0465
	ECM term	-0.3428***	
		-0.0581	
	ΔLFDI_N		0.0429***

			-0.0125
	ΔLFDI_P		0.0807***
			-0.0283
Diagnostic outputs		**P-Value**	**P-Value**
P-value of Wald (LR)			0.0022
P-value of Wald (SR)			0.2838
R-squared		0.9969	0.9038
Adjusted R-squared		0.9961	0.8557
P-value of F-statistic		0	0
P-value of JB		0.6188	0.5722
P-value of LM(1)		0.8884	0.7731
P-value of LM(2)		0.1484	0.1673
P-value of BPG		0.5043	0.1908

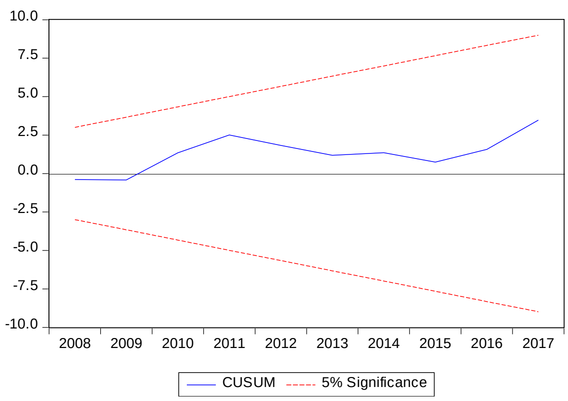
Source: EView Analysis

Note: ***, **, and * indicates the statistical significance at the significance level of 1%, 5%, and 10% significance level. LFDI_P and LFDI_N denote the partial sum of positive and the partial sum of negative, respectively. Wald (LR) represents the Wald test to long-run symmetry, Wald (SR) represents the Wald test to short-run symmetry. JB represents the Jarque-Bera test, LM(q) represents the Breusch-Godfrey Serial Correlation LM test to q lag order, BPG represents the Breusch-Pagan-Godfrey Test. Δ indicates the first-differenced of the respective variable. The values in the parentheses indicate the standard errors of the estimates.

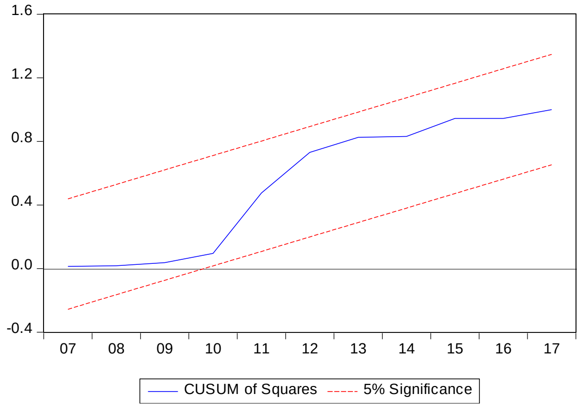
Moreover, the rejection of the null hypothesis of the Wald test of the long-run symmetry at the 5 percent significance level confirms that FDIs have an asymmetric impact on Malaysian GDP in the long run. Besides, the failure to reject the null hypothesis of the Wald test of the short-run symmetry again supports the previous result that FDIs had no asymmetric impact towards Malaysian GDP in the short run. Besides, the diagnostic test output also indicated that the robustness estimations passed those tests. CUSUM and CUSUM square shows that these models are stable (see Figure 2). In short, the findings are robust and valid as the inclusion of additional variables does not substantially affect the expected sign of and the statistical significance of the variables.



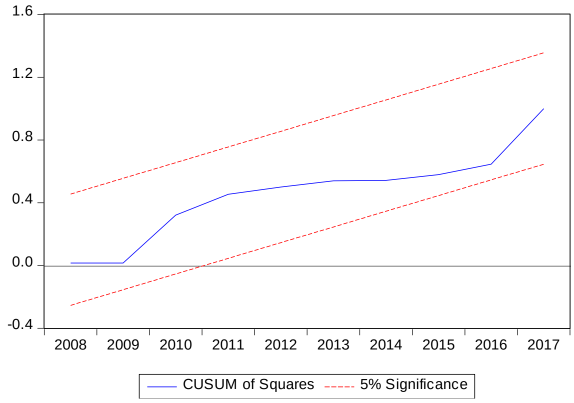
CUSUM for ARDL model



CUSUM test for NARDL model



CUSUM Squared for ARDL model



CUSUM Squared for NARDL model

Figure 2. The CUSUM and CUSUM Squared result for ARDL and NARDL – Robustness estimate

Source: EView Analysis

5. CONCLUSION

This paper compares the linear and nonlinear effects of FDI inflows on economic growth in Malaysia by employing a linear ARDL and NARDL model. The finding from the NARDL is crucial as this is the first attempt to measure the non-monotonic implication of FDI changes on economic growth in Malaysia. Annual data from 1982 to 2017 are collected and analysed. The main empirical result of this paper is that the impacts of increase and decrease in FDI on economic growth are asymmetry in the long run only, but symmetry in the short run. In the long run, the size of the reduction of GDP after a drop in the net FDIs is greater than the growth effect of GDP following an increase in the net FDIs. Befittingly, government expenditures are found to have a statistically significant positive effect on Malaysian GDP in the short-run and long run. The number of pupils enrolled in secondary education, moreover, is statistically significant to promote economic growth in the long run in the NARDL model only.

In terms of policy implications, the asymmetric impacts of FDI on economic growth suggest that those FDI-dependence countries, including Malaysia should examine the asymmetric impacts in order to maximise (minimise) the return (risk) of FDI. To preserve FDI inflows, the authorities can offer various tax incentives and reduce the red tape to facilitate more FDI inflows. Additional steps, such as a more investor-friendly regulation system and the signing of more multilateral free trade agreements, are helpful. Likewise, they should ensure that the domestic market to grow continuously to provide high returns on investment to foreign investors (Hornberger, Battat and Kusek 2011). A sufficient number of skilled workers and political stability will promote FDI inflows as well. Equally important, the more substantial impact of a drop in net FDI on economic growth suggests that the policymaker should be more proactive in interventions during the when the net FDI drops. Active fiscal policy implementation is warranted during that period to mitigate the more substantial negative effects of FDI outflows. As for the limitation, this paper is constrained by a relatively small sample size. A large sample size improves the accuracy of the estimations. Besides, this paper does not consider the implication of FDI on GDP growth in different economic segments. Hence, future work could investigate the sectoral data of GDP in order to assist in formulating better policies to help the most affected economic sectors.

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