Re-examination of the Impact of Credit on Economic Growth in Malaysia: Further Evidence from the Asymmetric ARDL Cointegration Technique

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A B S T R A C T

Earlier studies on the relationship between credit and economic growth hardly unveil the asymmetric effects of domestic credit on economic growth. This paper attempt to cover the limitation of the earlier studies by re-investigating the asymmetric effect of domestic credit on economic growth in Malaysia over the period 1980-2019. Using a recently developed asymmetric ARDL methodology, the study found an evidence of a significant asymmetric effect of domestic credit on economic growth. A long run asymmetric cointegration between domestic credit and economic growth was established. The data also reveals that domestic credit tends to have a greater impact on economic growth. The policy implication of this study is that Malaysian policy makers need to enhance and further develop its credit policies to make them more efficient and flexible so as to realize a sustainable economic growth.

Keywords: Asymmetric ARDL, Credit, Economic Growth, Financial development, nonlinearity
JEL Codes: E51, F43, C18

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1. Introduction

The financial development and economic growth relationships have been a subject of interest to researchers at both theoretical and empirical levels for quite sometimes. This concern has been linked to the important implications the relationship has in designing a sustainable development policy (Lele, 1991). Schumpeter (1911) first designed the theoretical underpinnings of the finance-growth nexus. He identified the essential role of domestic credit in boosting economic growth through the financing of manufacturing and investment. Later McKinnon (1973), Shaw (1973) postulated that imposing certain constraints on the banking system like fixing the short term interest rates, jerking up the banks reserves ratio, credit rationing all do negatively affect the financial progress of an economy thereby lowering economic growth. Domestic credit is a vital factor in stimulating the banking sector as well as the entire financial system.

The Domestic private credit indicator for financial development measures both the depth and breadth of the finance in a country (Durusu-Ciftci, D., Ispir, M. S., & Yetkiner, H. (2017). Financial depth measures the financial system in terms of the size of the economy (GDP) while financial breadth measures the comparative significance of banks as it relates to the nation`s capital market. Domestic private credit is an essential ingredient for business

growth, as its prolonged growth spurs industrialization, formation of new firms and growth in employment generation through increase in entrepreneurial activity triggered from greater accessibility of finance.

Malaysia has over the years evolved as a leading economy among the emerging nations recording a remarkable achievement in financial development (Ang, 2009). The government of Malaysia engaged in several economic reforms including lifting of government restrictions on the banking system concerning ceiling of interest rate, launching of credit programs and high reserve requirements which improves the financial sector performance and stimulates economic growth (Anwar & Sun, 2011). Added to that, a reduction in the lending rate from 12.95 percent to 13.3 percent in 2011 and 2012 respectively, by the commercial banking sector increased the domestic credit to the private sector (Bui, 2020).

Recently, the main goal of macroeconomic policy in Malaysia focuses on achieving macroeconomic stability and economic growth. Economic growth enables stability in the macroeconomic environment through employment generation, increase investment, rise in income and social safety. Credit in form of loans and advances plays a vital role in providing firms with the required capital, thereby ensuring a smooth and enhanced productivity thus promoting economic growth. Evidence has shown that consumer credits and financial inclusion stimulates consumption and overall aggregate demand, hence economic growth (Ibrahim & Alagidede, 2018).

The Malaysian economy considered as one of the fastest growing emerging economies, is faced with series of developmental challenges. On the wake of the current Covid 19 pandemic, the economy is faced with domestic and external shocks of recent evidenced by the sluggish growth in the GDP. A negative impact of credit expansion on economic growth, implying a still not sufficiently developed financial sector. A rising inflation rate that creates uncertainty which negatively affect economic growth (Anwar & Sun, 2011).

More so, the fall in the global oil price resulting from the covid19 pandemic made the economy faced with dwindling revenue from the oil market. Being a net oil exporter the pandemic has impacted negatively on the country`s crude oil export. This has affected the domestic economy by lowering the growth rate and reducing the domestic credit expansion. An unsustainable credit growth would lead to severe effects on the financial market and the economy.

Figure 1 and 2 illustrates the growing trend in the GDP growth and domestic private credit respectively over the period 1980-2019, in Malaysia. The GDP growth rate as depicted in figure 1 shows a symmetric linear trend over the period showing a continuous positive growth. Figure 2 shows that the growth in the domestic private credit as percentage of GDP has been fluctuating over the period in Malaysia over the period 1980-2019. In 1996, the increasing trend in the growth in domestic private credit reached its peak, and subsequently assumed a decline trend. For the domestic private credit, the trend is nonlinear implying the possible presence of asymmetries in the trend over the period. Thus, the actual relationship between domestic credit and economic growth might certainly be asymmetric in the case of Malaysia. This further necessitates an empirical investigation to uncover the true relationship between domestic private credit and economic growth.
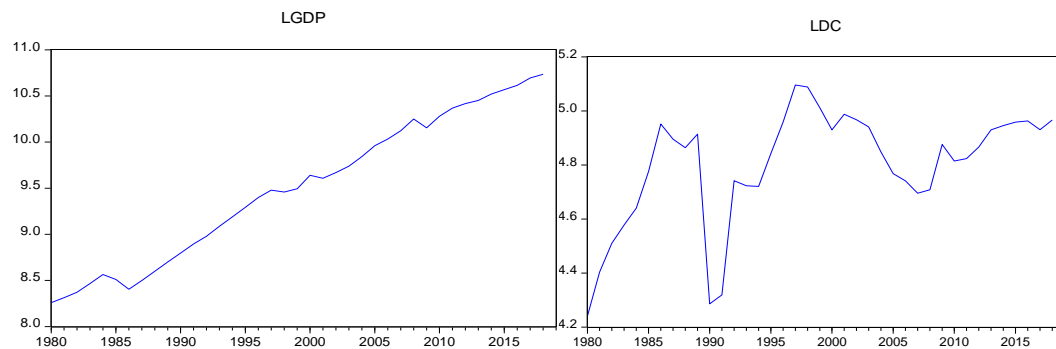
Figure 1 Plot of GDP 1980-2019   **Figure 2 Plot of Domestic Credit (DC) 1980-2019**

Malaysia recorded an above average GDP growth of 5.897 percent with a corresponding domestic credit growth of 118.806 percent in 2017 (Bui, 2020). Nonetheless, the nonlinear effect of domestic credit on economic growth could not be established yet (Bui, 2020).

Despite the plausible role of domestic credit on economic growth, the overall results of the credit-growth nexus cannot be generalized across all nations considering country-specific economic structures (Law & Sighn, 2014).Relying on single country data will avoid the problem of various sources of unobserved heterogeneity (Barra & Ruggiero, 2020). Most empirical studies have hardly examined the nonlinear relationship between domestic credit and economic growth more especially in an emerging economy like Malaysia.

Our aim in this study is to fill this literature gap by extensively examining the possible nonlinearities in the domestic private credit and economic growth relationship. We do this by employing a recently developed nonlinear ARDL propounded by Shin et al., (2014). An annual time series data covering 1980-2019 is used.

Our study contributes to the existing literature in several ways. First, for the first time and following Ibrahim and Alagidede, (2018) we study the domestic private credit and economic growth in Malaysia using the endogenous growth model. To that effect new variables; Government expenditure and domestic investments are added to the model. Secondly, we use a more sophisticated and recently developed econometric methodology. The nonlinear ARDL unlike other econometric techniques allows the study of nonlinearities or asymmetric relationships among two or more variables. It also allows the estimation of I(1) variables or a combination of I(1) and I(0) variables. The methodology takes care of potential estimation problems like estimation biasedness and serial correlation. Of greater interest is that this technique has not been used before in analyzing the domestic credit and economic growth.

The remaining part of the paper is organized as follows. The next section reviews extensively the literature on domestic credit-growth nexus. Section 3 presents the data and methodology of the study. Section 4 discusses the results and findings. Section 5 presents the summary and conclusion of the paper.

2. Literature Review

The effect of credit on economic growth has generated a heated debate among various researchers and policy makers more especially with the recent development and innovation in the financial structure. The policy implication of the McKinnon/ Shaw school of thought lies in the assertion that restrictions of the banking operations like putting ceilings on interest rate, high reserve requirement for banks and credit rationing hinders financial development, thus leading to a lower economic growth. In a similar vein, endogenous growth proponents argued that financial intermediation speed up economic growth (Greenwood & Jovanic, 1990). They further argued that government intervention in the financial system has a negative effect on the economic growth. Consequently, a good number of studies have attempted to study the relationship between domestic credit and economic growth.

Nonetheless, these studies keep producing conflicting results thereby making the area still in need for more research (Botev & Jawadi ,2019). Some empirical literatures established a nonlinear relationship between finance and economic growth includes; Checchetti and Kharroubi (2012), Arcand et al. (2012), Samargandi et al (2015).

The literature presented different perspectives and limitations on the relationship between domestic credit and economic growth. The vast literatures often times presented a contradictory result. The conflicting findings suggest that the relationship between domestic credit and economic growth might differ on the basis of a country, methodology, period of study and other factors. The existence of an asymmetric information and uncertainty that may lead to misallocation of savings has been buttressed in the study of credit-growth nexus (Barra & Ruggiero, 2020). The role of banks in financial development has been highlighted. For instance, Dow, & Rodriguez-Fuentes (1997) identified the role of banks in disbursing loans based on higher local knowledge and information.

Several studies have established a positive effect of domestic credit on the economic growth. For example, Amable, et al. (2004) found that the imperfection in the credit market raises the impact of temporary shocks in the domestic economy. Rajan and Zingales, 1998 established that domestic credit has a positive effect on economic growth. Aghion et al.(1999) found that the demand and supply of credit tend to be cyclical when the financial sector is not developed. Thus, focus should be on long term economic policies that will effectively develop the banking system.

Beck et al (2000) using a data from 63 countries over the period 1960-1995 applied GMM method of estimation investigated the effect of banking credit on economic growth. They found that the banking system credit has a positive effect on real GDP. In a similar manner and in line with the Beck et al. (2000), Rioja and Valev (2004) using data from 74 countries and adopted GMM method examined the effect of credit on the economy. They conclude that credit has a heterogenous impact on economic growth across all the countries studied.

A study by Wolde-Rufael (2009) on Kenya over a time series data covering 1966-2005 established that domestic credit exerts a positive influence on economic growth. In a similar study, Jedidia et al. (2014) found that domestic credit is vital in stimulating the economic growth of Tunusia over the period 1973-2008. Timisina (2014) employed a data from Nepal covering 1975 to 2013 found that a 1% increase in the private sector credit will stimulate GDP growth by 0.4% increase in the long run. Menyah et al. (2014) investigated the effect of

domestic credit and trade liberalization on economic growth amongst the African countries. They found that both domestic credit and trade liberalization have a positive impact on economic growth. Abubakar et al. (2015) also established that domestic credit plays a key role in the economic growth of the ECOWAS countries. Samargandi and Kutan (2016) studied the BRICS countries using a quarterly data of 1989-2012. They conclude that domestic credit had a positive impact on economic growth in all the BRICS countries. Belinga et al(2016) using an annual time series data of Cameroun covering the period 1969-2013 established that domestic credit has been a major driver of the country`s economic growth and that the influence of credit over economic growth is of linear type. Ibrahim and Alagidede (2018) employed annual time series data of the 29 sub Saharan African countries covering 1980-2014 period. They found that while finance potentially spurs economic growth, the overall effect of finance crucially depends on the relative speed of growth in finance and that of the real sector. They conclude that domestic credit exerts a positive and significant influence on the countries economic growth and that the relationship is monotonic. Wang and Jiang (2019) in their study also established a positive impact of domestic credit on the economic growth of China over the period 2007-2016. Of recent,, Botev and Jawadi (2019), employed a data of 100 countries over the period 1990-2012 concluded that domestic credit has a positive effect on economic growth in all the countries.

Despite these empirical findings, on the positive impact of credit on economic growth, a section of empirical studies on the contrary found that credit has no influence on economic growth. Some went further to argue that credit has a negative effect on economic growth. Studies such as De Gregoio and Guidotti (1995) using a panel data on Latin American countries found that domestic credit negatively impacts economic growth. Levine (2005) affirms that an excessive growth and unproductive use of domestic credit could lead to the credit boom in the short run and the negative effect on economic growth in the long run. Hunag & Lin 2009, Beck, 2012, found a similar effect of credit on economic growth. Narayan (2013) using a data from 65 countries covering the period 1995-2011 applied GMM method and established that bank credit might cast a shadow on the economic upswing. He argued that the relationship between finance and economic growth is nonlinear when a threshold levels are introduced. Arcand et al. (2015) has established that when private sector credit reaches a credit reaches a certain threshold of 80-100% of GDP, it stagnates economic growth. The relationship between credit and economic growth is nonlinear. Arcand et al., 2015 found that excessive increase in domestic credit would not have a positive effect on economic growth of the OECD countries over the period 1970-2003. In a similar study, Cournede and Denk (2015) established a negative relationship between domestic credit and the economic growth of the OECD and G20 countries.

In the case of Malaysia, Ansari (2002) examined the impact of financial development, money supply and government expenditure on GDP for Malaysia. He found that both monetary and fiscal policies have no visible impact on the GDP. But the impact of financial liberalization on GDP appears to be highly significant and that the relationship is linear. He further found that the financial liberalization has positively impacted on the economic growth. Ang and McKibbin (2007) found that financial sector reforms have contributed to the financial deepening in Malaysia but that the financial development has no significant impact on economic growth. Ibrahim (2007) investigated the role of financial sector in accelerating economic growth in Malaysia. He found that the process of financial sector development has

led to instability in the financial system in Malaysia. Ang (2008) found that financial development has contributed to economic growth in Malaysia through improved efficiency in investment. Anwar and Sun (2011), using an annual time series data covering 1970-2007, established that financial development has positively contributed to the growth in domestic capital stock but has no significant impact on economic growth.

However, empirical literatures have indicated that studies on non linearity of credit and economic growth are inconclusive (Shen and Lee, 2006; Law and Singh, 2014; Adeniyi et al., 2015). Majority of the existing studies on the nonlinearity in the credit-growth nexus suffers from a serious weakness of relying on simple threshold estimation methods to determine the presence of nonlinearity in the credit-growth relationships. This is done by incorporating a square term of finance in the growth model. Secondly, most of these studies failed to consider the asymmetric relationship between the credit and economic growth. A greater number of the studies applied causality test and error correction mechanism (Shittu, 2012). The conventional linear Granger causality test which most studies employed, may fail to identify the nonlinear causality between financial development and economic growth. Hiemstra, & Jones, 1994, argued that in the real world situation, relationships are almost certainly nonlinear. Under such circumstances, a nonlinear model may properly capture the real world situation.

This lack of consensus regarding the nature and direction of the relationship between credit and economic growth made this study relevant. In our current study, we avoid these problems by using the recently developed asymmetric ARDL technique.

We aim to broader the body of knowledge from these threads by looking at the asymmetric relationship between domestic private credit and economic growth. This will help in the economic policy decisions. Policy makers need to have knowledge of the factors influencing domestic credit so as to have a meaningful contribution to economic growth.

3. Data and Methodology

Shin et al.; (2014) introduced the asymmetric ARDL cointegration technique that utilizes positive and negative partial sum decompositions, thereby allowing for the identification of asymmetric effects in both the long run and short run periods (Ibrahim, 2015). Essentially, the specification of the asymmetric ARDL allows the combine analysis of the problems of non-stationarity and nonlinearity within the context of an unrestricted error correction model. It further has the advantage that it can be employed irrespective of the order of integration of the variables, being I(0), or I(1) or a combination of both, hence permitting for statistical inferences on long run estimates. These are not possible with other forms of cointegration techniques. Nonetheless, just like the conventional ARDL, the asymmetric ARDL cointegration approach is not valid in the presence of I(2) series. The asymmetric ARDL model is a new technique for detecting nonlinearities focusing on the long run and short run asymmetries among economic series. It is an expansion of the conventional ARDL model. The asymmetric ARDL performs better for determining cointegration in small sample sizes like our own (Romilly et al., 2001).

Following the standard procedure in the literature and in line with Ibrahim and Alagidede, 2018, annual data spanning the period 1980-2019, were extracted from the World Development Indicators (WDI) of the World Bank. The study used real GDP per capita as a

proxy for economic growth. Domestic private credit is the ratio of domestic private credit provided by deposit money banks and other financial institutions to the GDP (Andersen & Tarp., 2003; De Gregorio & Gindotti, 1995). These are credits extended to the domestic economy including private sector credits driving the allocation and utilization of funds to a more efficient and productive ventures. This measure presents a better indicator of the quality and size of services provided by the financial system because they focus on credit granted to the private sector (Ibrahim & Alagidede, 2018). We consider a broad set of control variables usually adopted in the growth literature (Law & Sighn 2014). Inflation is the annual percentage change in consumer price index used to proxy macroeconomic and business environment stability. A priori expectation, inflation affects economic growth negatively. The final government expenditure measures the size of the government. Gross fixed capital formation as a percentage of GDP is used as a proxy for investment rate. It is expected to have a positive influence on economic growth.

To investigate the asymmetric effect of domestic credit on economic growth, following Katrakilidis and Trachanas (2012); Ibrahim (2015), we propose an asymmetric ARDL specification which is derived from the conventional ARDL as follows;

$$\ln GDP_t = \beta + \delta_1 \ln DC_t + \delta_2 \ln CPI_t + \delta_3 \ln GE_t + \delta_4 \ln INV_t + \mu_t \tag{1}$$

where $LGDP_t$, is the economic growth, LDC_t is domestic private credit, CPI_t is the inflation rate, LGE_t government expenditure, $LINV_t$. Subscript t stands for time period, while μ_t is a stochastic error term. All variables are expressed in their natural logarithm form.
From equation (1), we can derive the empirical model for the ARDL to explore the relationship amongst domestic credit with economic growth in the context of Malaysia. Hence,

$$\Delta \ln GDP_t = \alpha_0 + \sum_{i=1}^{p} \sigma_1 \Delta \ln GDP_{t-i} + \sum_{i=0}^{q} \sigma_2 \Delta \ln DC_{t-i} + \sum_{i=0}^{r} \sigma_3 \Delta \ln CPI_{t-i} + \sum_{i=0}^{s} \sigma_4 \Delta \ln GE_{t-i} + \sum_{i=0}^{h} \sigma_5 \Delta \ln INV_{t-i}$$

$$+ \vartheta_1 \ln GDP_{t-1} + \vartheta_2 \ln DC_{t-1} + \vartheta_3 \ln CPI_{t-1} + \vartheta_4 \ln GE_{t-1} + \vartheta_5 \ln INV_{t-1} + \mu_t \tag{2}$$

Equation (2) expresses the error correction model which clearly shows the short run and the long run coefficients. The Δ symbolizes a first-difference operator and is generically defined as; $\Delta x_t = x_t - x_{t-i}$, α_0 is a constant, $\sigma_1, \sigma_2,$ $\sigma_3, \sigma_4,$ and σ_5 are the coefficients for short run estimates. While, $\vartheta_1, \vartheta_2,$ ϑ_3, ϑ_4 and ϑ_5 represents long run association, and μ_t is the stochastic error term. p, q, r, s, and h represents the lag lengths for the series in the model for distributed lag. To capture an asymmetric impact of credit on economic growth, Shin et al., 2014 suggested a transformation of the linear equation (2) into an asymmetric form by replacing DC_t by its positive and negative components thus;

$$\Delta \ln GDP_t = \alpha_0 + \sum_{i=1}^{p} \sigma_1 \Delta \ln GDP_{t-i} + \sum_{i=0}^{q} \sigma_2 \Delta \ln DC_{t-i}^{+} + \sum_{i=0}^{r} \sigma_3 \Delta \ln DC_{t-i}^{-} + \sum_{i=0}^{s} \sigma_4 \Delta \ln CPI_{t-i} + \sum_{i=0}^{h} \sigma_5 \Delta \ln GE_{t-i} + \sum_{i=0}^{m} \sigma_6 \Delta \ln INV_{t-i}$$

$$+ \vartheta_1 \ln GDP_{t-1} + \vartheta_2 \ln DC_{t-1}^{+} + \vartheta_3 \ln DC_{t-1}^{-} + \vartheta_4 \ln CPI_{t-1} + \vartheta_5 \ln GE_{t-1} + \vartheta_6 \ln INV_{t-1} + \mu_t \tag{3}$$

In accordance with Shin et al.(2014), domestic private credit variable, DC_t is decomposed into its increasing and decreasing partial sums as;

$$DC_t = DC_0 + DC_t^+ + DC_t^-$$

Where DC_t^+ and DC_t^- symbolizes the partial sum of a positive (an increase in domestic credit) and the negative changes (a decrease in Domestic credit). Nonetheless, the partial sum for positive as well as negative changes in DC_t are generated through following formulas;

$$DC_t^+ = \Sigma_{i=0}^t \Delta DC_i^+ = \Sigma_{i=0}^t \max\left(\Delta DC_i, 0\right)$$

$$DC_t^- = \Sigma_{i=0}^t \Delta DC_i^- = \Sigma_{i=0}^t \min\left(\Delta DC_i, 0\right)$$

In a similar way as equation (2), the first part of equation (3) is used to estimate the short run asymmetric relationship between domestic private credit and economic growth, while the second part of the equation estimates the long run asymmetric relationship.

The long run asymmetric impact can be tested with the use of Wald test by evaluating the Null hypothesis for an asymmetry $H_0 : \vartheta^+ = \vartheta^-$ against an alternative for an asymmetry $H_1 : \vartheta^+ \neq \vartheta^-$. Rejection of Null hypothesis indicates a presence of asymmetrical impact of domestic credit on economic growth. Long run impacts of an increase or decrease in domestic credits are provided by $\beta_2 = \dfrac{-\vartheta^+}{\alpha_0}$ and $\beta_3 = \dfrac{-\vartheta^-}{\alpha_0}$ respectively. The Wald test used in testing for cointegration amongst the dependent and independent variables in the asymmetric model is expressed as; $H_0 : \alpha = \vartheta_0 = \vartheta_1 = \vartheta^+ = \vartheta^- = 0$.

Equally, $\sum_{i=0}^s DC_i^+$ and $\sum_{i=0}^s DC_i^-$ can be used to capture the asymmetric influence in short run of an increase and decrease in domestic credits.

The desirable advantage of this technique over other estimation techniques is that both the long run and short run asymmetric influences can be simultaneously estimated. There is no restrictive assumption regarding the order of integration of the series and make it possible for the series to have different optimal lags which is not possible with the conventional cointegration techniques (Ozturk and Acaravci, 2011). Whether the series are integrated at level; I(0), at first difference; I(1), or are mutually cointegrated, their combinations can possibly determine the existence of a stable asymmetric long run and short run relationships.

4. Results and Discussion

This section discusses the results and findings of the study. Table 1 describes the sample data together with the descriptive statistics employed in the analysis. It shows a statistical summary of each variable in the sample. From the table, the standard deviation of the variables ranges from 0.2 to 0.8 with the highest value of 0.8 and 0.7 for LGE and LGDP respectively. It is clear that investment has a low variation among the variables in the model, followed by domestic credit. Government expenditure and gross domestic product has the highest variations. Evidently, this clear fact has been shown from the variations between their minimum and maximum values which are in accordance with the standard deviation values. All the variables in the sample have a positive mean values. Except for LGE and LINV, all other variables have negative values for skewness. The Kutosis statistics value indicate that only LDC have excess kurtosis of 3.4 reflecting the impact of significant structural changes in

the variable, thus further need for asymmetric investigation. The results of the skewness and kutosis indicate that the distributions are to a larger extent leptokurtic. The presence of a thick (fat) tails and leptokurtosis. From the skewness and Kutosis test results, some possible basic deductions can be made regarding the distribution of the data sets and its asymmetric nature. The domestic credit variable has a non-normal distribution as indicated by the significant Jarque-Berra (JB) statistics.

Table 1: *Descriptive Statistics*

Variable	LGDP	LDC	LCPI	LGE	LINV
Mean	9.4978	4.6389	4.3171	23.2441	3.3341
Median	9.4934	4.6870	4.3732	23.1189	3.2575
Maximum	10.7341	5.0658	4.7930	24.5312	3.7759
Minimum	8.2593	3.9102	3.7235	22.1214	2.8812
Std Dev.	0.7921	0.2671	0.3073	0.8174	0.2286
Skewness	-0.0475	-0.8611	-0.1587	0.2956	0.4947
Kurtosis	1.6724	3.4033	1.8142	1.6821	2.1961
Jarque-Bera	2.8785	5.0843	2.4486	3.3907	2.6409
Probability	0.2371	0.0786	0.2939	0.1835	0.2670

Note: LGDP, LDC,LCPI, LGE and LINV represents, Gross Domestic Product, Domestic Credits, Consumer Price Index, Government Expenditure and Domestic Investment. All in their natural logarithms.

Next we conduct a unit root test. The main reason for conducting a unit root test is to facilitate the determination of the order of integration of the variables. The ARDL bound testing procedure requires that no any I(2) variable is included in the model (Ibrahim, 2015).Thus, we adopt the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests to unveil the stationary status of each variable in the model. The ADF and PP tests are among the widely used methods of testing the existence of unit roots in a serie. A constant term and a trend are added into the specifications of the tests and an optimal lag length is selected based on the Schwartz criteria, which sets 4 as the optimal lag length.

Table 2: *Unit Root Tests*

A: **Augmented Dickey Fuller (ADF)**				
Variable	Level		First Difference	
	Intercept	**With Trend**	**Intercept**	**With Trend**
LGDP	-0.2339	-2.4171	-5.8872***	-5.8005***
LDC	-2.2897	-1.9022	-5.0727***	-5.1242***
LCPI	-2.3281	-3.1959	-5.4929***	-5.3754***
LGE	-0.1828	-1.9772	-5.0076***	-4.9564**
LINV	-1.6948	-2.2301	-5.6999***	-5.6179***
B: **Phillip-Peron(PP)**				
LGDP	-0.2219	-2.5252	-5.8850***	-5.7931***
LDC	-2.3137	-2.0384	-5.0678***	-5.1135***
LCPI	-1.8912	-3.4108*	-5.5863***	-5.4267***
LGE	-0.2377	-1.9772	-5.0019***	-4.9474**
LINV	-1.7852	-2.4392	-5.6977***	-5.6148***

Note: ***, **,and * imply significance at 1%, 5% and 10% levels respectively. The figures show the t-statistic value for testing the null hypothesis that the variable possesses a unit root.

The Scwarz Information Criterion (Schwert, 1987) is used in the lag length selection. The critical values for constant without trend are -3.479, -2.883 and -2.578 while that of constant with trend are -4.028, -3.443 and -3.146 for 1%, 5% and 10% respectively. For PP the bandwidths are determined based on the Newey-West using Bartlett Kernel.. The critical values for constant without trend are -3.479, -2.883 and -2.578 while that of constant with trend are -4.028, -3.443 and -3.146 for 1%, 5% and 10% respectively. The figures are based on Mackinnon (1991).

The results in table 2 indicate that all the variables are integrated of order 1, i.e I(1). This justifies the application of the asymmetric ARDL. More so, the dependent variable is also I(1) fulfilling the Pesaran et.al. (2001) condition for ARDL bound cointegration.

Next we estimate equation (3) and test the asymmetric long run bound cointegration through a modified F bound testing approach as suggested by Barnarjee et al. (1998). The results are presented in table 3.The result shows that the value of F statistic (12.29), is greater than the upper critical value (3.38) of the bounds at 1 percent significance level. This suggests that the null hypothesis of no asymmetric cointegration between economic growth, domestic credit, inflation, government expenditure and investment is rejected. Rejection of the null hypothesis implies the existence of a long run asymmetric relationship amongst the variables. The evidence of a cointegrating relationship suggests that economic growth, domestic credit, inflation, government expenditure and domestic investment maintain a long term relationship. This further indicates that there is a common force that brings the series back to long run equilibrium (Fousekis et al.2015).

Table 3 *Bound Test for Nonlinear Cointegration*

Model	F-Statistics	95% lower bound	95% Upper Bound	Conclusion
GDP/DC	12.29	2.39	3.38	Cointegration

Note: Critical Values are from Narayan (2005) considering the small sample size.

Table 4 presents the short run and long run asymmetric estimates results. The table is categorized into three panels. Panel A is the short run estimates, panel B presents the long run asymmetric estimates, while panel C shows the diagnostic tests results which confirms the robustness of the result estimates.

The long run result indicates that the positive and negative changes in domestic credit, LDC^+ and LDC^- bears a positive and negative signs of coefficients with a result of 0.0054 and -0.0063 respectively, and are highly significant. This implied that a one percent increase in Malaysian domestic credit will increase the country`s output by about 54 percent. Nonetheless, a one percent decrease in the Malaysian domestic credit will lead to a 63 percent decrease in output. Looking at the size of the two coefficients, the results suggest that in the long run, output growth is more sensitive to the reduction in the domestic credit than in its expansion. This is an indication that the government need to enhance its domestic credit to the economy. This is in line with the findings of Samargandi and Kutan (2016); Ibrahim and Alagidede (2018) and Wang et al. (2019) that the size of the increase in output resulting from a fall in domestic credit is stronger than an equal size of a decrease in domestic credit. This implies that rising access to credit make finance available for domestic investment thereby raising the output in the economy. And it also indicates a U-shape asymmetric relationship between domestic credit and economic growth in Malaysia.

Table 4: *Asymmetric ARDL Estimates*

Panel A: Short-Run Coefficients

	Lag order			
	0	1	2	3
ΔLDC^{+}	0.0051(0.0002)	-0.0098(0.0001)	-0.0089(0.0001	-0.0055(0.0004)
ΔLDC^{-}	0.0009(0.1538)	-0.1676(0.0001)	0.0171(0.0001)	0.0093(0.0005)
$\Delta LGDP$	-	1.1890(0.0001)	0.3834(0.0031)	-
$\Delta LCPI$	0.0189(0.0015)	-0.0957(0.0002)	-0.0391(0.0012)	-0.0044(0.1995)
$\Delta LINV$	-0.0048(0.0067)	0.0095(0.0003)	0.0135(0.0003)	0.0145(0.0002)
ΔLGE	1.5801(0.0001)	-1.1134(0.0024)	-0.341(0.0002)	-0.4202(0.0007)
ECT_{t-1}	-	-0.6696(0.0000)	-	-

Panel B: Long-Run Coefficients

LDC^{+}	LDC^{-}	LCPI	LINV	LGE	Constant
	-0.0063(0.000)				
0.0054(0.000)	0.0545(0.006)		-0.0049(0.021)	-9.0311(0.000)	8.4041(0.000)

Panel C: Diagnostic Tests

NORMAL	LM-Test	BGP Test	RESET
0.1468(0.9293)	0.2678(0.1037)	0.0594(0.2510)	0.8532(0.8532)
Wald (Joint significance)			
0.0411(0.000)			

Note: a) Number in parenthesis are p-values
　　　b) NORMAL= Normality tests on the basis of skewness and Kutosis of residuals.
　　　c) LM= Langrange Multiplier test for serial correlation
　　　d) BGP= Breusch-Godfreay test for Heteroscedasticity
　　　e) RESET= Ramsey`s test for specification

The findings that domestic credit has a greater influence on economic growth is in line with the conclusions of Levine (2000), Beck and Levine (2004); and Law and Singh (2014). They pointed that private sector credit is the most important financial development indicator which reflects the efficiency of banking institutions in providing the credit sources to private sector (Law & Singh, 2014). More so, the existence of asymmetric effects of domestic credit on economic growth is confirmed by the significant of Wald test F-statistics as suggested by Shin et al. (2014). The highly significant Wald F-statistics of 0.0411 indicates the rejection of the null hypothesis of a symmetric impact of domestic credit on economic growth. Thus, our findings show that the relationship between private sector credit and GDP is not only asymmetric but further validates the U-shape hypothesis in the long run.

For the control variables, inflation has a positive and significant influence on the output growth. Government expenditure bears a negatively significant impact on economic growth in both long run and short run. This can happen because government consumption usually has a distortionary effects as it translate into present and or future tax burden on citizens, which in turn lowers private spending and investment (Monadjemi,& Huh, 1998)). Investment bears a negative and significant impact on economic growth in the long run. Nonetheless, the results in table 4 suggest that fixed capital formation has negative effect on economic growth in the long run. The neoclassical growth theory postulated that the long run growth cannot be sustained through capital deepening alone (King & Levine, 1994), because the diminishing returns to physical capital set in and what is required to overcome this is the complementary effect of human capital and/ or public capital in production (Aluko & Ibrahim, 2020).

The result of the short run dynamic estimates of the asymmetric domestic credit suggest that a positive change in domestic credit (increase) is associated with an increase in economic growth (GDP), while a negative change (decrease) in domestic credit is associated with a decrease in economic growth (GDP). The coefficient of the ECM is negative and significant with a high speed of adjustment (66 percent). Thus, these hold both in the long run and in the short run. Our findings reveal that private sector credit is a driving force in accelerating economic growth in Malaysia.

The findings suggest that the relationship between domestic credit and economic growth is not linear in both long and short run. Rather domestic credit appears to have an asymmetric effect on the GDP growth in Malaysia. This is different from the studies of Ang and McKibbin (2007; Ang, (2008), and Anwar and Sun (2011) that found a symmetric relationship between credit and economic growth.

The diagnostic tests at the bottom panel of table 4 indicate that our model is well specified since all the estimates pass through the conventional diagnostic tests of serial correlation, normality, heteroskedasticity and functional form. The CUSUM and CUSUMSQ suggest that the regression coefficients are generally stable over the period.

Our study does not examine the causes of the asymmetric relationship between domestic credit and economic growth. However, this might not be unconnected to the relative magnitude of the types of credit facilities extended by the financial system as highlighted by Ho and Hung (2009). More so, Ho and Hung (2009) argued that financial development facilitates investment loans that tend to promote growth whereas consumption loans which are non-productive tend to hinder growth. Notwithstanding it remains a wide gap that needs further research.

5. Conclusion

The paper applied asymmetric ARDL to test the asymmetric effect of domestic credit on economic growth and determine whether the relationship in Malaysia is consistent with the U-shape hypothesis. An annual time series data covering 1980- 2019 was employed. The ADF and PP unit root tests were conducted to ascertain the order of integration of the series. The results indicates that the series are integrated of order one. The study further carried out a nonlinear bound cointegration test. The result of the nonlinear bound cointegration test reveals an evidence of a strong asymmetric relationship between domestic credit and economic growth in the long run. Our finding indicates that domestic credit plays a vital role in the overall economic growth. The study supports the idea that development in the domestic credit influences growth through its ability in efficiently allocating resources to areas of need. It also reveals that although private credits spurs long term economic growth, the relationship is asymmetric.

The implication of this is that for the economy to realize the growth enhancing impact of the credit, it is important for the policy makers to consider the asymmetric effects of the domestic private credit on growth.

Our findings further stress the importance of using the right estimation technique in understanding the actual relationship amongst economic variables. Nonetheless, the study does not consider the asymmetric effect of other control variables on the economic growth as specified in the model. Although the result provides a detail picture for policy makers, it is

notable that our analysis focuses on only two variables; GDP and DC. Further research might explore more on the asymmetric effects of other variables on economic growth. Although the result can be applicable to other countries with similar, features, our analysis is based on the Malaysian economy

The findings of the study have relevant policy implications for the Malaysian economy. Government need to pursue relevant credit and finance polices to further grow the credit and financial sector to boost economic growth.

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