




## DETERMINANTS OF THE SIZE OF PRIVATE SECTOR CREDIT DISBURSEMENT IN GHANA



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### ABSTRACT

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The paper examines the antecedence of the size of private sector credit disbursement in Ghana using symmetric and asymmetric ARDL processes. We find that the treasury bill rates have both a direct and an indirect impact on the amount of credit channelled to the private sector with positive shocks dominating the stimulating effect of the treasury bill rate. Similarly, negative shocks in the average lending rates have a detrimental effect on the credit to the private sector which supports the view that banks use interest rates to ration credit. Also, the saving rates have a direct and indirect effect on private sector credit but positive shocks in the savings rate have a detrimental effect on the amount of credit to the private sector. Moreover, we found a dominance positive effect of the shocks in foreign currency deposits on private sector credit disbursement. Finally, a rise in crude oil prices induces private sector allocation in Ghana even though the effect of oil prices on credit appears mixed.

#### JEL Classification:

C32; C58; E40; E60; E63.

**Contribution/ Originality:** This study contributes to the existing literature by examining the impact of positive and negative shocks in treasury bills rate, savings rates, lending rates, foreign currency deposits and oil prices on private sector credit in economies in transition.

### 1. INTRODUCTION

The literature contains strong and overwhelming evidence that credit to the private sector precipitates into economic growth and development. Private sector credits are used to finance innovations which boost economic activities to stimulate investment and growth in the private sector and the economy (Idun & Aboagye, 2014; Laeven, Levine, & Michalopoulos, 2015). The evidence also shows that the structure of the financial system influences the size and direction of private sector credit allocation. On this, multiple studies have concluded that more competitive banking systems allow for greater credit allocation to the private sector credits. For instance, Pagano (1993) postulates that competitive banking systems reduce financial intermediation leakages thereby ensuring that credit goes to credible enterprises that engage in positive net present value projects. It follows that financial repressions can exacerbate financial leakages which in turn can lead to financial constraints in imperfect markets. In the same token, a growing number of studies suggest that imperfect banking system can channel funds

into small firm cheaply if banks have the greater market power to leverage lending relationships to channel funds into innovative firms (Idun, Aboagye, & Bokpin, 2020; Petersen & Rajan, 1995). Stiglitz and Weiss (1981) suggest that banks may prefer to ration credit at the equilibrium loan rate in the wake of information asymmetry but not necessarily because of lack of availability of loanable funds or movement of interest rates. In effect, information asymmetry can stifle credit allocation to the private sector in the wake of excess supply of loanable fund. In most economies, banks rely on the information richness in macroeconomic variables in their credit transmission process. Competition in the banking sector can also lead banks to carelessly allocate credit to bad borrowers in their bid to garner more market share. On this assertion, Dell’Ariccia (2001) postulate that banks may not employ rigorous screening processes in credit allocation in their quest not to lose customers to their competitor. In this case, information asymmetry does not impede credit flow to borrowers but the rate of interest does. However, the nature of credit market imperfections can be fueled by macroeconomic variables which are directly related to financial liberalization/repression. In this study, we examine the symmetric and asymmetric determinants of the size of private sector credit disbursement in Ghana.

Figure 1 shows the trend of the private sector credit disbursement in Ghana in million Ghana cedis from the first quarter of 2000 to the first quarter of 2019. The evidence shows that credit disbursement to the private sector has generally increased over the period. This trend is against the backdrop of the intermittent global and domestic financial crises the banking industry has experienced over the recent period. Besides the global financial crisis which occurred between 2007 and 2009 and slowed down economic activities in most countries, between 2017 and 2019, the Bank of Ghana started a clean-up exercise that saw the crashing-out of two universal banks and an amalgamation of five other banks into the new Consolidated Bank Ghana Limited. The bank cited infringement on proper governance procedure and widespread loan impairments as well as disregard to sound micro-prudential banking practices as some of the factors that triggered the clean-up exercise in the Banks and Special Depository institution sub-sector of the financial system. Besides the clean-up exercise, the bank also raised the capitalization threshold from GHS120,000,000 to GHS400,000,000 to strengthen the soundness of the industry and also prepare the banks to meet the capital adequacy requirement in Basel III. Expectedly, the increase in the capitalization has soured-up liquidity in the banking system which has partly contributed to the recent spikes in the amount of credit disbursed to the private sector. However, the clean-up exercise alone might not be the only factor responsible for the rising trend in the total credit disbursed to the private sector.

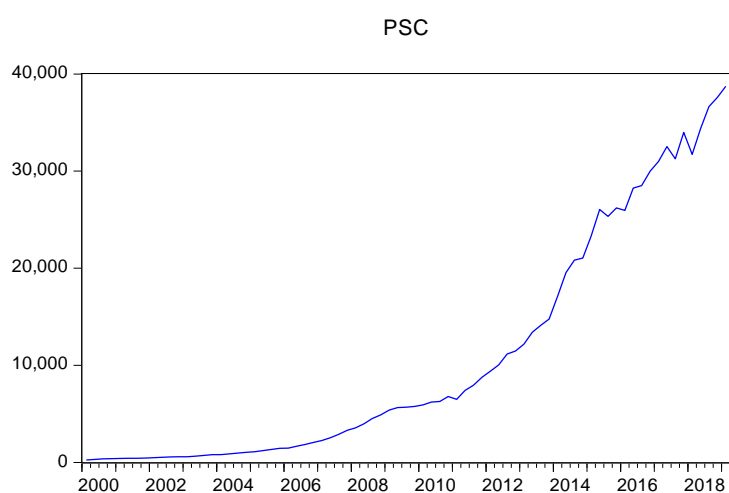


Figure-1. The trend of the private sector credit in Ghana (2000Q1-2019Q1).

This paper aims at examining the factors that determine the size of private sector credit disbursement from the banking system in Ghana. We analyze how the rise and fall of government short-term bond rates, lending rates, savings rates, foreign currency deposits and crude oil prices induce the volume of private sector credit in Ghana.

Closely related to this paper within the Ghanaian environment is a study by Baoko, Acheampong, and Ibrahim (2017). The authors examined how the real exchange rate, real gross domestic product, real lending rate, broad money supply, bank assets and bank deposit affect private sector credit in Ghana using the ARDL model popularized by Pesaran, Shin, and Smith (2001). Even though we did not include most of their variables in our investigation, we also went ahead to examine how both positive and negative volatilities in our exogenous variables impact on the size of the private sector credit disbursement using the non-linear ARDL method proposed by Shin, Yu, and Greenwood-Nimmo (2014). Decomposing the effect of both positive and negative effects is in order since, in reality, time-series variables tend to rise and fall intermittently in response to policy direction or external shocks. The information richness in the nonlinear estimates would assist in determining whether positive or negative shocks in the treasury bill rates, lending rates, savings rates, foreign currency deposits and oil prices are responsible for the rising trend of the size of credit distribution to the private sector.

We find that the treasury bill rate has both a direct and indirect impact on the amount of credit channelled to the private sector with positive shocks dominating the stimulating effect of the treasury bill rate. Similarly, negative shocks in the average lending rates have a detrimental effect on the credit to the private sector which supports that view that banks use interest rates to ration credit (Stiglitz & Weiss, 1981). Also, the saving rate has a direct and indirect effect on private sector credit but positive shocks in the savings rate have a detrimental effect on the amount of credit to the private sector. Moreover, we found a dominance positive effect of the shocks in foreign currency deposits on private sector credit disbursement. Finally, a rise in crude oil prices induces private sector allocation in Ghana even though the effect oil prices on credit appears mixed.

These are the subsequent sections of the paper. The next section discusses some stylized facts and the existing literature on the issues. Section three contains discussions on the method employed for the study. Section four presents the empirical findings and discussions on the findings. The final section concludes the study and provides recommendations.

### *1.1. Some Stylized Facts*

It has been well-documented that the largest private subsector of most economies which comprises the small and medium enterprises, is often bedevilled by a myriad of constraints paramount among which is access to finance. This condition has been attributed to the participation of the state in the domestic credit market, the so-called crowding-out effect. However, the empirical evidence for Ghana shows that state participation in the credit market may not be the ultimate or sole reason why the private sector has limited access to the loanable fund. Figure 1 shows the annual growth in the banks' investment in the government bond markets as well as the growth in private sector credit allocation over the last decade to 2019. It shows that growth in private sector credit disbursement has had an increasing trend between 2010 and 2013, the growth situation shows a decreasing trend in recent years.

The trend in recent years can be attributed to the clean-up exercise embarked on by the Bank of Ghana in recent times. Between 2017 to 2019, the Bank of Ghana forced some banks to go on liquidation for failing to meet the regulatory requirement on liquidity management and asset quality management. The bank also enforced the new capitalization requirement of GHS400,000,000 (about \$72,859,744.99). The enforcement of the new capital threshold encouraged some banks to merge which has the potential to improve their market share and efficiency (Kumar, 2018). As at the end of September 2019, only 23 banks out of 30 survived the industry cleansing. The development has improved liquidity in the banking system but can also hurt savings mobilization if customers lose confidence in the banking system. Between 2007 and 2017, the average growth in investment in government bonds (IGB) was 39 per cent. Within the same period, the average growth in private sector credit (PSC) was only about 27 per cent. This development is irrespective of the fact that in recent times, the state has developed an appetite Euro bonds. Similarly, the standard deviation of the percentage change in IGB is 42 per cent whilst that of the percentage change in PSC is about only 12. This means the amount that goes to support public expenditure has grown more

rapidly than the amount allocated to the private sector by the banks in Ghana. Despite this development, large proportions of the private sector still mention access to finance as a hindrance to their growth and performance.

A growing body of knowledge suggests that countries which provide enabling environment for private sector development are more inclined to develop faster than countries which extract resources from the private sector into the public sector (Acemoglu & Robinson, 2012; La Porta, Lopez-de-Silanes, Shleifer, & Vishny, 1998). The financial systems across the world are also embracing private credit information systems aimed at reducing information asymmetry and fostering credit flows into the productive sectors (Djankov, McLiesh, & Shleifer, 2007). In Eastern Europe, Brown, Jappelli, and Pagano (2009) document that information sharing systems on debtors have reduced cost of credit and facilitated induced credit allocation to the private sector. Their results also suggest that countries with weak legal systems and inefficient financial systems are more likely to leverage information-sharing systems to improve credit accessibility by the private sector. In Ghana, private credit information sharing systems started in 2010 to collect and store information about borrowers and their lenders. The system is meant to provide protection to the banks and facilitate the advancement of loanable funds to credit-worthy private enterprises. Despite the existence of information sharing systems in Ghana, the cost of credit is still relatively high (hovering between 20 to 26 per cent). Inadequate credit flow to the private sector can inhibit investment in tangible and intangible assets in the private sector (Gómez, 2019).

## 2. LITERATURE REVIEW

The information asymmetry theory serves as the foundation for this investigation. In the process of intermediation, borrowers and lenders interaction determine the interest rates which is a cost of borrowing and a return to banks. Banks will lend more when the interest rate is high and borrowers will naturally borrow more when the interest rate is low. So, the prevailing interest rate is as a result of the jockeying between the supply-side of credit and the demand-side of credits. Demand-side of credit include, the level of economic activities, firm's capacity to borrow, household borrowings and government borrowings whilst the supply factors include, savings, foreign currency deposits, accumulated deposit and bank capitalization. Stiglitz and Weiss (1981) opine that banks and other financial institutions use the interest rate to ration credit even when there is enough liquidity at the equilibrium due to information asymmetry. Their proposition suggests that banks would advance more credit to the private sector when interest rates are high in opaque credit markets.

There has been a resurgence on discourses patterning to the determinants of credits or the cost of it in recent times owing to the global financial crises and isolated country-specific crises which are partly fueled by loan impairment or nonperforming loans. Ahmed (2016) reported that a boost in the level of economic activities drives the allocation of private sector credit in Pakistan whilst government borrowings hurt private sector credit transmission. In the same study, the author found that bank lending capacity has a positive effect on banks' credit flow while inflation and government borrowings were detrimental to private sector credit disbursement. In a comparative study involving banks in the United States and Europe, Naceur, Marton, and Caroline (2018) reported that found that higher capital ratios are associated with the growth in banks' lending in the U.S, whilst bank's liquidity improves growth in lending in Europe after the global financial crisis. Delis, Hasan, and Ongena (2020) emphasized the role of the institution in the intermediation process by emphasizing that democratization has a dampening effect on costs of credit using firm-level and country-level data from multiple countries.

Due to the rise and fall of the treasury bills rate, central banks can induce systemic liquidity or mop-up excess liquidity. Inferring from the Laffer's curve, a rise in the treasury bill rate can generate domestic debt of the government. However, funds mobilized for the government's fiscal expansion programs can boost economic activities to attract private sector credits since industries need more funds to expand capacity to accommodate the boost on economic activities. However, as the debt level increases, the system encounters debt over-hang which reduces economic activities and economic growth. This implies that the relationship between the treasury bill rate

(which induces domestic debts) and the size of private sector credit disbursement can be nonlinear. Similarly, governments use expansionary monetary policy to boost economic activities and growth when there is a recession. During a recession period, the Bank of Ghana's Monetary Policy Committee can reduce the policy rate to discourage government borrowings and this can induce a greater amount of credit to the private sector to boost economic activities.

The entrance of foreign banks is can boost credit availability to the private sector. This happens because foreign banks pump more money into their subsidiaries which increases the liquidity of the domestic banking system (De Hass & Van Lelyveld, 2004). Foreign bank penetration can also induce more foreign deposits since the foreign business develops trust in a banking system upon the entrance of holding banks from their countries or developed nations. Foreign currency deposits reflect deposits made by banks' customers in their foreign accounts dominated in currencies other than the Ghana cedi. Foreign currency deposit can serve as a hedge against depreciating of the Ghana cedi. Banks can rely on their foreign currency liquidity position to support services to businesses that engage in international trade. Banks can also grant loan dominated in foreign currencies. Foreign currencies can also come from international investors to engage in foreign direct investment in Ghana. This can increase the capital inflows of Ghana and the number of loanable funds. In general, we expect increases in foreign currency deposits to boost loanable funds to the private sector. The effect of foreign participation in a domestic economy can be seen through the impact of capital inflow. Capital inflows improve liquidity but can also be associated with excessively expansionary monetary and credit flow into an economy (Magud, Reinhart, & Vesperoni, 2014) which can hurt economic outcomes.

Information sharing systems are reducing information asymmetry that in turn is enhancing the volume of credit to the private sector. Information sharing reduces adverse selection and ensures that credit goes to borrowers who can repay loans and other commitments associated with loans. Information sharing systems reduce the banks' susceptibility and vulnerable to bad borrowers when they churn out adequate information about borrowers. More recently, researchers have tended to study the impact of information systems on credit transmission to the private sector. Brown et al. (2009) studied whether the proliferation of information sharing systems in the financial markets of Eastern European and the Soviet Union countries enable banks to channel more credits to firms in those countries. In both cross-sectional and panel data structuring, they found a high correlation between information sharing systems and allocation of private sector credit. Besides, they reported that information sharing systems reduce the cost of borrowing in those countries. Their results were more robust for firms that operate in opaque industries which indicates that information sharing among banks can serve as a substitute for market imperfections that are fueled by weak institutional arrangement. Laeven et al. (2015) also showed that credit scoring systems assist banks to conduct proper screening and pinpoint innovating firms for credit allocation. However, between public and private information systems, private information systems tend to be more associated with large volumes of credit to the private sector (Djankov et al., 2007; Grajzl & Laptieva, 2016). Financial intermediaries rely on information to transmit credit to credible borrowers (Choudhary & Jain, 2020; Ferri, Murro, Peruzzi, & Rotondi, 2019; Gurara, Presbitero, & Sarmiento, 2020; Kusi, Agbloyor, Gyeke-Dako, & Asongu, 2020). The studies show that information sharing systems can aid in the pinpointing viable avenues for credit transmission in the intermediation process. However, there is no evidence that information systems have alleviated information asymmetry especially in emerging economies which are still assimilating credit information sharing technologies.

In opaque environments, financial intermediaries can use interest rates to ration credit notwithstanding the availability of loanable funds (Stiglitz & Weiss, 1981). Research on the supply side of credit points out interest rates as a determinant of credit to the private sector. Banks and other financial institutions would supply more credit when the lending rate is high. However, higher lending rates increase the cost of doing businesses thereby whittling down the gains from business operations. In the wake of rising interest rates, businesses and individuals may not demand more credits from the financial institutions. This, however, depends on whether firms have

positive net present value projects which can produce a return greater than the lending rates. In such instances, managers may demand more credit despite the higher lending rates. Businesses may be indifferent regarding high-interest rates in regimes characterized by market imperfections to the extent that the behaviour of economic agents normalizes the high-interest rates situation. In that case, economic agents demand funds by disregarding the lending rate. In terms of fueling bank crisis, credit boom has consequences on bank crises but the crises-inducing effect of household credit expansion for consumption is more pronounced than that of business credit expansion (Büyükkarabacak & Valev, 2010). Ghosh (2010) shows that growth in credit is associated with bank instability in India.

Also, the literature shows that collateral availability influences the size of credit to the private sector. The conclusion is that more collateral leads to more credit. This also implies that the prices of assets can have a direct impact on the amount of bank credit allocation (Ghosh, 2010). If assets prices are increasing, the banks will grant more credit based on the market value of assets. Therefore, bank officials need to take into consideration the level of inflation in determining the real value of assets used as collateral. In other words, credit allocations must be based on the real value of the assets used as collateral. Because of the availability of collaterals, banks prefer to finance less innovative firms than startups and high-tech firms which normally innovative. This may come about because startups and high-tech firms may lack the track records for project acceptability during the loan screening process. They also lack the necessary assets based required for loan collaterals which increases their financial constraints. In effect, banks prefer to support fewer innovating firms with large asset base than financing high-tech firms' investment in risky but viable projects (Guiso, 1998). On whether the location of the firm affects the valuation of collateral, firms operating in the hinterlands are more likely to experience lower valuation of their assets than firms in the cities. In Ghana, for instance, the cost of land in the cities is about five times the cost of land in rural areas. Therefore, the banks are more prone to value land belonging to firms operating in rural areas less than the land and premises of firms operating in the cities. this affects the value of the collateral provided by firms in the hinterlands thereby intensifying their financial constraint level (Becicova & Blazek, 2015).

The performance of banks is affected by the movement in oil prices. Oil price volatility influences the level of economic activities by increasing the cost of doing business for firms that depend on energy in their operations. Saif-Alyousfi, Saha, Md-Rus, and Taufil-Mohd (2020) found that rising oil prices induce deposits mobilisation which in turns improves the performance of a bank's lending activities in GCC. Similarly, Kassouri, Altıntaş, and Bilgili (2020) show using threshold panel method that oil prices can lead to greater financial development except that higher level of democratization can reduce the impact of the oil price hike on the level financial development in oil-exporting countries. Aravind and Nayar (2020) show the long-run relationship between oil prices and credit availability in Oman using ARDL cointegration model. On the other hand, Agbanike, Nwani, Uwazie, Anochiwa, and Enyoghasim (2019) used the ARDL model and reported that it is rather the level of financial development that cause energy consumption in Nigeria. Ghana became an oil-producing country in December 2010. Since then the country started exporting oil in commercial quantities. However, Ghana still imports oil in greater quantities. Crude oil prices have a direct impact on the cost of the firm's operation. In Ghana, the Petroleum Regulatory Authority has a formula that automatically adjusts the prices of oil depending on the movement of the world crude oil prices. However, domestic oil prices in Ghana tend to be influenced by exchange rates differentials and taxes in recent times. In this study, the effect of crude oil prices on loanable funds can be seen in terms of the inflows from the proceeds of oil to the producer of the oil. Portions of oil proceeds can be deposited in the domestic banks for which the banks can do business with them at least in the short run. This can increase the amount of loanable fund to the private sector.

The above discussion shows that the determinants of private sector credit disbursement have attracted the attention of researchers across the globe. Different variables and methods have been examined. However, none the studies have examined the asymmetric effect of the antecedent of private sector credit even though macroeconomic



variables experience both positive and negative shocks (Shin et al., 2014). This paper bridges that gap in the discourse by exploring the effect of rising and falling treasury bill rate, average lending rates, savings rate, foreign currency deposits and crude oil prices. Information on the effect of positive and negative shocks of these variables can better inform policies on how to tam or stimulate the dynamics to induce private sector development.

### 3. METHODS

We obtained quarterly data on the treasury bill rates, average lending rate, savings rate, foreign currency deposits and crude oil prices from the Bank of Ghana for the period: quarter one of 2000 to quarter one of 2019. We employed the symmetric and asymmetric Bound Testing ARDL Cointegration techniques introduced by Pesaran et al. (2001) and Shin et al. (2014) respectively.

We implement the study based on a simple model of credits which assumes both the demand and supply factors of credits:

$$Y_t = f(T_t, L_t, S_t, F_t, O_t) \quad (1)$$

The log-linear representation of Equation 1 is

$$\ln Y_t = (\beta_0 + \beta_1 l T_t + \beta_2 l L_t + \beta_3 l S_t + \beta_4 l F_t + \beta_5 l O_t) \quad (2)$$

Where

$Y_t$  is the amount of bank credit disbursed to the private sector at t.

$T_t$  is 91day treasury bills rate at time t.

$L_t$  is the average banking sector lending rate at time t.

$S_t$  is the average savings rate at time t.

$F_t$  is the amount of foreign currency deposits at time t.

$O_t$  is the world crude oil prices at time t.

$\beta_0, \dots, \beta_5$  are the parameters to be estimated.

$l$  is the natural log of the series.

To examine the symmetric relationships in Equation 2 we used the autoregressive distributive lags popularized by Pesaran et al. (2001). Pesaran et al. (2001) ARDL methodology can provide consistent results in a single equation estimation. In a single equation, the linear ARDL procedure provides results for both the long run and short run explanation about the determinants of private sector credit allocation in an even for small observations. The model does not require the examination of the stationarity properties of the variables, however, to exclude higher-order integrated variables beyond I(1), we examined the stationarity properties to ensure that only I(0) and I(1) are included in the estimation of the ARDL model.

We transformed the Equation 2 into a linear ARDL model as:

$$\begin{aligned}
D(\ln Y)_t = & \sum_{i=1}^p \beta D(\ln Y)_{t-i} + \sum_{i=1}^k \Psi D(\ln T)_{t-i} + \sum_{i=1}^q \mu D(\ln L)_{t-i} + \sum_{i=1}^r \Omega D(\ln S)_{t-i} + \sum_{i=1}^s \pi D(\ln F)_{t-i} \\
& + \sum_{i=1}^v \delta D(\ln O)_{t-i} + \alpha_1 \ln Y_{t-1} + \alpha_2 \ln T_{t-1} + \alpha_3 \ln L_{t-1} + \alpha_4 \ln S_{t-1} + \alpha_5 \ln F_{t-1} \\
& + \alpha_6 \ln O_{t-1} + @TREND_t \\
& + CointEq_{t-1}
\end{aligned} \tag{3}$$

We define the additional dynamics as,

- D represents the first difference of the respective variables.
- $\varepsilon$ =Error term.
- i=the lag length of the variables defined as 1, 2, ..., p or k or q or r or s for the respective variables in the ARDL(p,k,q,r,s).
- TREND represents the time trend.
- CointEq is error correction term which defines the speed of adjustment from short-run relationship into the long-run relationships.
- $\beta, \Psi, \mu, \Omega, \pi$  and  $\delta$  are the short-run parameters of the respective first-differenced variables to be estimated.

The null hypothesis of the long-run relationships:  $H_0: \alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0$ , against the

alternative hypothesis:  $H_A: \alpha_1 \neq \alpha_2 \neq \alpha_3 \neq \alpha_4 \neq \alpha_5 = 0$ .

However, the estimation of Equation 3 is based on the assumption that there exists a symmetric relationship between private sector credit and the exogenous variables. In reality, economic variables response to positive and negative shocks. If we can deduce the responsiveness of the private sector credits to positive or negative shocks in the exogenous variables, it will provide us with richer information on how to trigger policies to address those specific shocks to stimulate optimal private sector credit. To address issues of asymmetry, we employed the nonlinear ARDL framework introduced by Shin et al. (2014) which decomposes the time series into their positive and negative shocks before establishing how those shocks induce the dependent variable. The nonlinear ARDL can also provide information about which of the shocks is dominant in inducing the movement of private sector credit in Ghana. The Shin et al. (2014)'s nonlinear ARDL model accepts mixed stationary variable which must be stationary only at order 1 I(1) or order 0 I(0). The nonlinear ARDL model has all the properties of the Pesaran et al. (2001) ARDL model and also allows for the examinations of the impact of both positive and negative shocks of the exogenous variables on the private sector credit in Ghana. Several studies have used the nonlinear ARDL model to produce results which show that appreciation of time series variables affects the dependent variable differently from the depreciation of the series, in terms of magnitude and direction. Bahmani-Oskooee and Fariditavana (2015) used both the linear and nonlinear ARDL model to examine the J-curve effect in trade balance due to currency depreciation in the U.S and found the nonlinear model to have performed more efficiently. Similarly, Shahbaz (2018) used the nonlinear ARDL framework to ascertain the effect of positive and negative shocks of energy prices on economic growth in Pakistan. Finally, Mahmood, Alkhateeb, and Furqan (2020) used the nonlinear model to examine the effect of industrialization and urbanization on CO<sub>2</sub> emission in Saudi Arabia.

We modified Equation 3 and specified the nonlinear model as:



$$\begin{aligned}
 D(IY)_t = & \sum_{i=1}^p \beta D(IY)_{t-i} + \sum_{i=1}^k \Psi D(LT)_{t-i} + \sum_{i=1}^k \Psi D(LT^+)_{t-i} + \sum_{i=1}^k \Psi D(LnT^-)_{t-i} \\
 & + \sum_{i=1}^q \mu D(LL)_{t-i} + \sum_{i=1}^q \mu D(LL^+)_{t-i} + \sum_{i=1}^q \mu D(LL^-)_{t-i} + \sum_{i=1}^r \Omega D(LS)_{t-i} \\
 & + \sum_{i=1}^r \Omega D(LS^+)_{t-i} + \sum_{i=1}^r \Omega D(LS^-)_{t-i} + \sum_{i=1}^s \pi D(LF^+)_{t-i} + \sum_{i=1}^s \pi D(LF^-)_{t-i} \\
 & + \sum_{i=1}^v \delta D(lnO^+)_{t-i} + \sum_{i=1}^v \delta D(LO^-)_{t-i} + \alpha_1 IY_{t-1} + \alpha_2 LT^+_{t-1} + \alpha_2 LT^-_{t-1} \\
 & + \alpha_3 LL^+_{t-1} + \alpha_3 LL^-_{t-1} + \alpha_4 LS^+_{t-1} + \alpha_4 LS^-_{t-1} + \alpha_5 LF^+_{t-1} \\
 & + \alpha_5 LF^-_{t-1} + \alpha_6 LO^+_{t-1} + \alpha_6 LO^-_{t-1} + @TREND_t \\
 & + CointEq_{t-1}
 \end{aligned} \tag{4}$$

Where the positive shocks are represented by the  $IND^+$  with  $IND^-$  denoting the negative exogenous variables:

$$POS = IND_t^+ = \sum_{j=1}^t DIND_j^+ = \sum_{j=1}^t \max(DIND_j, 0)$$

And the negative shocks are represented by:

$$POS = IND_t^- = \sum_{j=1}^t DIND_j^- = \sum_{j=1}^t \min(DIND_j, 0)$$

We can use Equation 4 to delineate both the symmetric and asymmetry effects of our determinants on the size of private sector credit disbursement in the banking system of Ghana. According to Shin et al. (2014) we can perform the ARDL techniques by Pesaran et al. (2001) to examine nonlinear relationships.

Table-1. Results from the philip-peron unitroot tests.

		At Level					
		LP	LT	LL	LS	LF	LO
With Constant	t-Statistic	-2.420	-2.185	-1.800	-1.892	-1.879	-1.838
	Prob.	0.140	0.213	0.378	0.335	0.340	0.360
		n0	n0	n0	n0	n0	n0
With Constant & Trend	t-Statistic	-0.419	-2.218	-1.849	-1.746	-2.805	-1.773
	Prob.	0.985	0.473	0.671	0.721	0.200	0.708
		n0	n0	n0	n0	n0	n0
Without Constant & Trend	t-Statistic	6.576	-0.811	-0.653	-0.847	5.739	0.452
	Prob.	1.000	0.361	0.431	0.346	1.000	0.810
		n0	n0	n0	n0	n0	n0
		At First Difference					
		d(LP)	d(LT)	d(LL)	d(LS)	d(LF)	d(LO)
With Constant	t-Statistic	-7.841	-5.825	-8.033	-8.011	-8.287	-8.116
	Prob.	0.000	0.000	0.000	0.000	0.000	0.000
		***	***	***	***	***	***
With Constant & Trend	t-Statistic	-8.196	-5.810	-8.012	-8.052	-8.376	-8.104
	Prob.	0.000	0.000	0.000	0.000	0.000	0.000
		***	***	***	***	***	***
Without Constant & Trend	t-Statistic	-3.911	-5.835	-8.062	-8.035	-5.844	-8.135
	Prob.	0.000	0.000	0.000	0.000	0.000	0.000
		***	***	***	***	***	***

Notes: (\*)Significant at the 10%; (\*\*)Significant at the 5%; (\*\*\*) Significant at the 1%. and (no) Not Significant. Treasury bill rate (LT) foreign currency deposits (LF), crude oil prices (LO), lending rates (LL) and savings rate (SL).

To analyse the stationarity properties in the dynamics, we first perform a unit root test to determine the order of stationarity of the variables. Following prior literature, we used the Philip-Peron (PP) since it caters for higher autoregression of the individual series. The null hypothesis for the PP test is that the series contain unit roots against the alternative hypothesis that the series is stationary. The results, in Table 1, show that both the dependent and independent variables are stationary after first difference. This means that long-run relationships exist among the variables.

This essentially implies that all the variables qualify for inclusion in the examination of the cointegrating and long-run relationships using the ARDL bound testing approach.

To verify nonlinearity, we performed the BDS test under the hypothesis that the series is normally distributed. However, the very low p-values associated with the results for all variables in Table 2 rejected the null hypotheses which imply the presence of nonlinearity in the dynamics.

Table-2. Results from the BDS tests.

LP					LF				
Dimension	BDS Statistic	Std. Error	z-Statistic	Prob.	Dimension	BDS Statistic	Std. Error	z-Statistic	Prob.
2	0.206	0.005	41.805	0.000***	2	0.202	0.005	42.645	0.000***
3	0.349	0.008	44.486	0.000***	3	0.341	0.008	45.280	0.000***
4	0.450	0.009	48.008	0.000***	4	0.438	0.009	48.776	0.000***
5	0.521	0.010	53.284	0.000***	5	0.506	0.009	54.033	0.000***
6	0.573	0.009	60.614	0.000***	6	0.554	0.009	61.309	0.000***
LO					LT				
Dimension	BDS Statistic	Std. Error	z-Statistic	Prob.	Dimension	BDS Statistic	Std. Error	z-Statistic	Prob.
2	0.154	0.006	27.950	0.000***	2	0.151	0.005	28.685	0.000***
3	0.263	0.009	29.807	0.000***	3	0.246	0.008	29.179	0.000***
4	0.331	0.011	31.213	0.000***	4	0.296	0.010	29.424	0.000***
5	0.369	0.011	33.182	0.000***	5	0.317	0.011	30.084	0.000***
6	0.386	0.011	35.749	0.000***	6	0.317	0.010	31.097	0.000***
LS					LL				
Dimension	BDS Statistic	Std. Error	z-Statistic	Prob.	Dimension	BDS Statistic	Std. Error	z-Statistic	Prob.
2	0.162	0.008	21.637	0.000***	2	0.162	0.010	15.673	0.000***
3	0.274	0.012	22.841	0.000***	3	0.277	0.017	16.703	0.000***
4	0.350	0.014	24.263	0.000***	4	0.359	0.020	17.946	0.000***
5	0.393	0.015	26.005	0.000***	5	0.410	0.021	19.426	0.000***
6	0.417	0.015	28.386	0.000***	6	0.438	0.021	21.266	0.000***

Notes: (\*)Significant at the 10%; (\*\*)Significant at the 5%; (\*\*\*) Significant at the 1%. and (no) Not Significant. Treasury bill rate (LT) foreign currency deposits (LF), crude oil prices (LO), lending rates (LL) and savings rate (SL).

## 4. EMPIRICAL RESULTS

### 4.1. Short Run Determinants of the Private Sector Credit Allocation

Table 3 compares the results and performance of the nonlinear and linear ARDL models. The table shows that the speed of adjustment from the short run dynamics towards the long run (CointEq(-1)) is negative and significant at the 0.05 level. This error correction term meets the requirement that it should be less than zero and significant at the 0.05 level. The speed of adjustment to the long run from the short run is about 0.131 and 0.091 per cent for the nonlinear ARDL model and linear ARDL model respectively. This implies that the cointegrating relationship represents the short-run activities. The joint F-statistics of the nonlinear model is 10.798 whilst that of the linear ARDL is 5.511 which implies that the nonlinear model has superior explanatory power. Similarly, the nonlinear ARDL reported adjusted R-square that shows that about 81.5 per cent of the changes in the private sector credit is explained by the positive and negative shocks in the treasury bill rate, lending rates, savings rate, foreign currency deposits and crude oil prices. Only 18.5 per cent is accounted for by the residuals. On the other hand, the linear

ARDL model reported an R-square of 54.3 per cent which shows that the residuals in that model accounted for about 45.7 per cent of the joint explanatory power. The results from the bound tests show a cointegration relationship by rejecting the null hypothesis that there are no cointegration relationships at the 1% significant level. However, the nonlinear model performed better than the linear ARDL model. On the bound tests, the F-statistics for the nonlinear model is 8.13 and that of the linear model is 7.49.

**Table-3.** Short-run symmetric and asymmetric estimates of the determinants of private sector credits.

Nonlinear ARDL			ARDL			
Variable	Coefficient	Std. Error	Variable	Coefficient	Std. Error	
			@TREND	0.012***	0.002	
C	0.750***	0.062	C	1.559***	0.215	
D(LP)(-1))	-0.514***	0.081	D(LP(-1))	-0.301***	0.103	
D(LP)(-2))	-0.415***	0.077	D(LP(-2))	-0.186*	0.100	
D(LP)(-3))	-0.275***	0.069	D(LP(-3))	-0.255***	0.092	
D(LT <sup>+</sup> )	-0.155***	0.040	D(LT)	-0.023	0.032	
D(LT <sup>+</sup> (-1))	0.151***	0.040	D(LT(-1))	0.033	0.036	
D(LT <sup>-</sup> )	0.099***	0.035	D(LT(-2))	-0.110***	0.036	
D(LT <sup>-</sup> (-1))	-0.176***	0.040	D(LS)	-0.077**	0.038	
D(LT <sup>-</sup> (-2))	-0.247***	0.038	D(LS(-1))	0.113**	0.043	
D(LT <sup>-</sup> (-3))	-0.064	0.038	D(LS(-2))	0.124***	0.038	
D(LL <sup>+</sup> )	0.135	0.129	D(LS(-3))	0.075**	0.034	
D(LL <sup>-</sup> )	-0.268**	0.104	D(LF)	0.090	0.054	
D(LL <sup>-</sup> (-1))	-0.703***	0.106	D(LF(-1))	0.144**	0.057	
D(LL <sup>-</sup> (-2))	-0.523***	0.120	D(LF(-2))	0.243***	0.058	
D(LL <sup>-</sup> (-3))	-0.435***	0.107	D(LO)	0.020	0.024	
D(LS <sup>+</sup> )	0.049	0.051	D(LO(-1))	-0.008	0.025	
D(LS <sup>+</sup> (-1))	-0.232***	0.055	D(LO(-2))	-0.041	0.025	
D(LS <sup>-</sup> )	-0.129***	0.045	D(LO(-3))	0.052**	0.025	
D(LS <sup>-</sup> (-1))	0.507***	0.052				
D(LS <sup>-</sup> (-2))	0.373***	0.062				
D(LS <sup>-</sup> (-3))	0.130**	0.051				
D(LF <sup>+</sup> )	-0.019	0.050				
D(LF <sup>+</sup> (-1))	0.195***	0.053				
D(LF <sup>+</sup> (-2))	0.225***	0.058				
D(LO <sup>+</sup> )	-0.053	0.042				
D(LO <sup>+</sup> (-1))	-0.134***	0.045				
D(LO <sup>+</sup> (-2))	0.049	0.042				
D(LO <sup>+</sup> (-3))	0.210***	0.043				
D(LO <sup>-</sup> )	0.051*	0.029				
D(LO <sup>-</sup> (-1))	-0.211***	0.034				
D(LO <sup>-</sup> (-2))	-0.198***	0.031				
D(LO <sup>-</sup> (-3))	-0.105***	0.032				
R-squared	0.899			0.664		
Adjusted R-squared	0.815			0.543		
CoIntEq(-1)*	-0.131***			-0.094***		
Durbin-Watson	2.364			2.007		
Akaike	-4.641			-3.963		
F-statistic	10.798			5.511		
Prob(F-statistic)	0.000			0.000		
Cointegration Test						
Bound Test	F-stat=8.13			F-Stat.=7.49		
	Signif.	I(0)	I(1)	Signif.	I(0)	I(1)
	10%	1.98	2.97	10%	2.75	3.79
	5%	2.21	3.25	5%	3.12	4.25
	2.5%	2.42	3.52	2.5%	3.49	4.67
	1%	2.68	3.84	1%	3.93	5.23

Notes: (\*)Significant at the 10%; (\*\*)Significant at the 5%; (\*\*\*) Significant at the 1%. and (no) Not Significant. Treasury bill rate (LT) foreign currency deposits (LF), crude oil prices (LO), lending rates (LL) and savings rate (SL).

The F-statistics confirm the long-run relationships among the variables. In nutshells, these summary statistics show that the estimates from the nonlinear ARDL model are superior to and efficient than estimates from the linear

ARDL model. The Durbin-Watson values also show that autocorrelation is not a problem in the models since they reject the null hypothesis of autocorrelation in the residuals. The CUSUM results in Figure 3 also show that both models are stable. Since the nonlinear ARDL model is relatively superior to the linear ARDL model, we would discuss the influence of the determinants based on the estimates from the nonlinear model.

Figure 2 shows the multiple dynamic adjustments from the nonlinear model. The essence of these graphs is to determine the best-fitted nonlinear ARDL that meets the Akaike Information Criterion (AIC). It would also help us ascertain the multiplying effects of positive and negatives shocks in the asymmetric estimation, helping to pinpoint the dominant shocks in the empirical estimations. The continuous black line shows the impact of positive shocks. The dashed black lines show the impact of the negative shocks on the forecasting horizon. The deep dashed red lines in the middle show the difference between the impact of positive and negative shocks. Finally, the dotted red lines (upper and lower bounds) show statistical significance at the 5% significant level. Figure 2 shows that treasury bill rate (LT) foreign currency deposits (LF) and crude oil prices (LO) have positive dominance effect on private sector credits. Similarly, the negative shocks in lending rates (LL) and savings rate (SL) have a dominance effect on private sector credit.

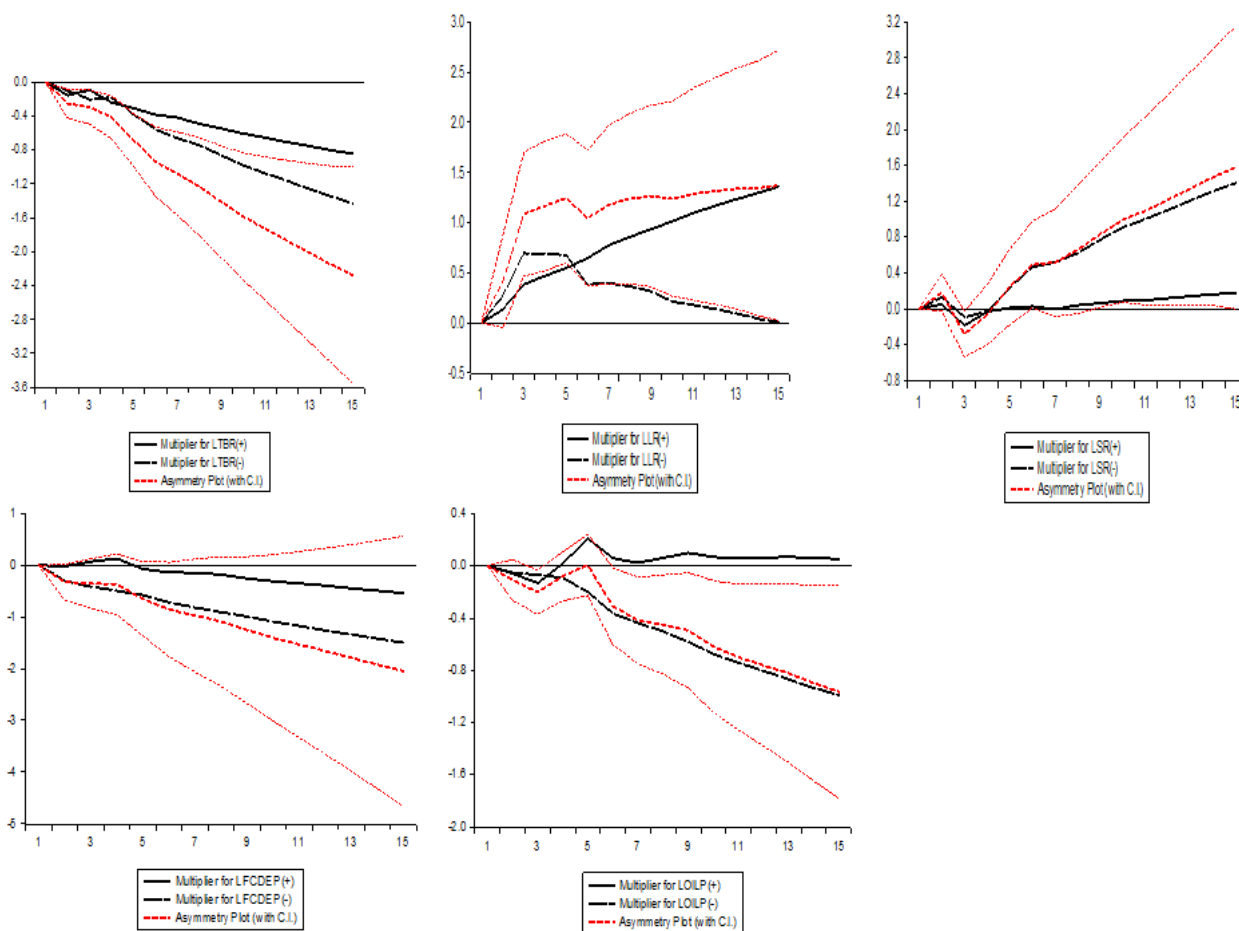


Figure-2. Positive and negative multipliers of the asymmetric estimates.

The first section of Table 3 shows that the past period sizes of credit allocation reduce the size of short-run credit to the private sector by 0.514 per cent, 0.415 per cent and 0.275 per cent respectively for the first period, second and third period. Similarly, the treasury bill rate (DLT) has both a direct and indirect impact on private sector credit in the short run. This result is reflected in both the positive and negative shocks in the treasury bill rates over the period. Figure 2 (the first graph) shows that the positive shocks have a dominance effect on private sector credit. As the treasury bill rate increases, people prefer to invest in the government’s short-term bonds at the

expense of putting their money in the banks. The limited amount of deposits can reduce loans to the private sector. This result is similar to the one in Baoko et al. (2017) which suggest that reduction in the state's cost of borrowing can stimulate demand for the private sector credit.

Besides, we did not find meaningful evidence that the positive shocks in the lending rate (DL) in the short run has a strong positive effect on private sector allocation credit. Rather, we find that negative shocks in the lending rates have a negative relationship with the size of private sector credit. The second graph in Figure 2 confirms that a reduction in private sector credit is detrimental to the amount of credit to the private sector. This means that banks use the lending rate as a credit ration tool so the reduction in the lending rates serves as the disincentive for lending to the private sector at the equilibrium lending rate (Stiglitz & Weiss, 1981). On the other hand, increases in lending rate would reduce the demand for loanable funds by the private sector. However, if the private sector expects lending rates to increase into the future, they will demand more credit now thereby increasing the size of private sector credit allocation. Similarly, the shocks in the savings rates have direct and indirect impacts on the amount of credit distributed to the private sector. Positive shocks in the savings rate are detrimental to private sector credit and it takes time for the negative shocks in the saving rates to reflect in private sector credits. This can be attributed to information asymmetry that the information content of savings is not evenly dispersed among participants or that people do not save enough to boost the number of credits that go to the private sector. This assertion is in line with the concerns that the rate of savings in Ghana is low. Furthermore, positive shocks in the number of foreign currency deposits have a positive effect on private sector credit disbursement in Ghana. This result is particularly revealing because it illustrates the effect of foreign inflows into the banking sector on the private sector development in Ghana. To the best of researcher's knowledge, this is the first instance of documentation of the effect of foreign currency deposit on the private sector allocation in Ghana using time series analysis. Foreign currency inflows can increase the liquidity position of the banks thereby increasing the supply of loans to the private sector. Foreign inflows can also boost the level of economic activities thereby inducing the private sector to seek more credits to increase their capacity.

Finally, the shocks in the world's crude oil prices have both direct and indirect effect on the amount of private sector allocation. The rise in crude oil prices is detrimental to private sector credit disbursement whilst the fall in crude oil prices boost the amount of credit that goes to the private sector. This means that the translation of oil prices into lending to the private sector occurs after nine months of changes in oil prices.

#### 4.2. Long-Run Relationships

Table 4 provides results on the long-run level estimates for both the Nonlinear ARDL and linear ARDL estimates.

**Table-4.** Long-run symmetric and asymmetric estimates of the determinants of private sector credits.

Nonlinear ARDL			Linear ARDL		
Variable	Coefficient	Std. Error	Variable	Coefficient	Std. Error
LT <sup>+</sup>	-1.456	1.162	LT	0.745	0.521
LT <sup>-</sup>	2.607	1.840	LL	-0.665	1.075
LL <sup>+</sup>	2.655	1.679	LS	-1.815*	0.948
LL <sup>-</sup>	0.821	1.068	LF	-1.260	1.034
LS <sup>+</sup>	0.218	1.022	LO	0.283	0.190
LS <sup>-</sup>	-2.718	2.127			
LF <sup>+</sup>	-0.833	1.538			
LF <sup>-</sup>	2.291	2.231			
LO <sup>+</sup>	0.182	0.362			
LO <sup>-</sup>	1.997	1.219			
@TREND	0.291	0.207			

Notes: (\*)Significant at the 10%; (\*\*)Significant at the 5%; (\*\*\*) Significant at the 1%. and (no) Not Significant.

For the nonlinear estimates, we did not find statistically meaningful evidence that the appreciation and depreciation of each of the exogenous variables have any impact on private sector credit disbursement in the long-run. At 5 per cent significance level, we also did not find meaningful evidence that any of the variables induce private sector credit when we employed the symmetric ARDL model. Therefore, the implications of the results in this paper are limited to the short-run estimates in [Table 3](#).

## 5. CONCLUSION

The paper examines the effect of treasury bill rate, lending rate, savings rate, foreign currency deposit and crude oil prices on the amount of money that flow to the private sector in Ghana. We found evidence in favour of the view that information asymmetry influences the size of credit allocation irrespective of the equilibrium rate of interest. The study employed both the symmetric ARDL and Asymmetric and found the performance of the nonlinear model superior to the linear model. The bound testing cointegration approach shows cointegrating relationships among the variables. The evidence suggests that the appreciation in the treasury bill rates have dominant-negative multiplier effects on the size of private sector credit disbursement. The Central Bank based on the borrowing requirement of the government can increase the treasury bill rates. This paper has shown that rising treasury bill rates are detrimental to private sector development in the short-run. Similarly, depreciation in the lending rates predominantly induces the fall in the size of private sector credits which shows that banks in Ghana lend more to the private sector when interest rates are high. This confirms the view that at the equilibrium credit market, lending would use interest rates to ration credit notwithstanding the availability of loanable funds (see [Stiglitz and Weiss \(1981\)](#)). In the same token, the depreciation in the savings rates has a dominant positive effect on the amount of credit distributed to the private sector. This confirms the view that savings boost the liquidity and economic activities which in turns triggers greater lending to the private sector. Also, positive shocks in the size of foreign currency deposits improve the amount of credit to the private sector. This means that foreign inflows are good for private sector development. Positive shocks in the crude oil prices have both direct and indirect effect on the size of private sector credit, signifying a J-curve induced by the shocks in the crude oil prices. This phenomenon shows that the rising crude oil prices hurt private sector development initially as it plummets economic activities and raises the cost of a firm's operation. However, after the second quarter, prices of crude oil induce private sector development. This phenomenon is possible because it takes time for Ghana to receive the inflows from rising crude oil prices to boost systemic liquidity and economic activities.

The following implications can be deduced from the paper. The banks should refrain from the use of lending rates in their risk management. The gap between the average lending rate 23% and the average deposit rate 7.5% is high due to information asymmetry. In the advent of technology, the banks can resort to the use of credit scoring technologies to screen borrowers to induce private sector development. Foreign inflows and government's external borrowings, if necessary, are important for private sector development as it may reduce the government's domestic borrowing rates. Also, strategies to boost savings, including financial education, is desirable for private sector development. Finally, Ghana should intensify ongoing exploration activities in the energy sector. Ghana can use more of her crude oil productions domestically when oil prices increase to help preserve foreign exchange. Savings rates increase must be hinted to the general public in advance since it takes time for the increases to translate into private sector credit allocation. Further investigations should apply the nonlinear model to examine the asymmetric effect of bank diversification and information sharing system on the size of private sector credit in Ghana.



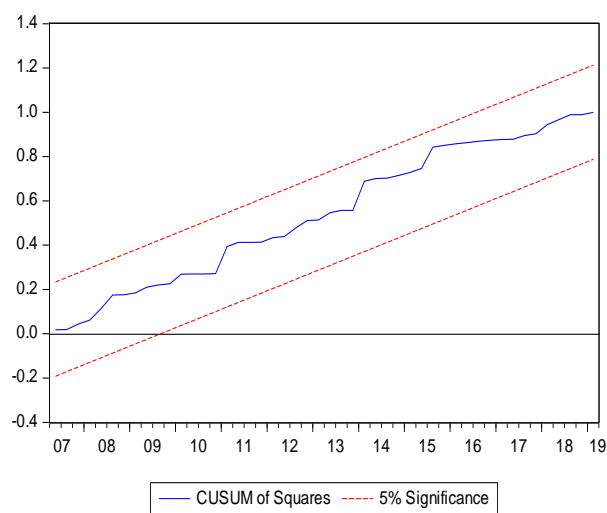
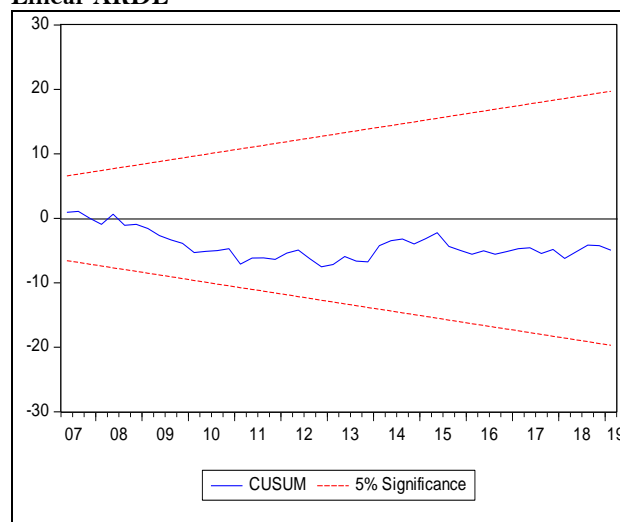
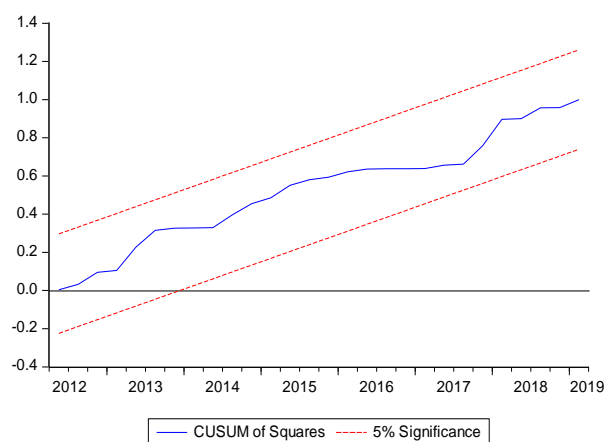
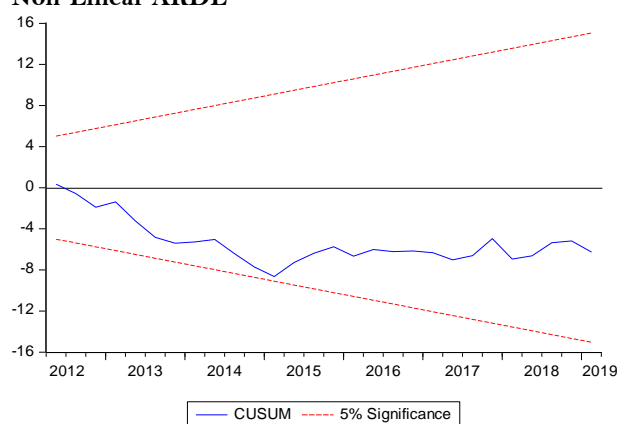
**Linear ARDL****Non-Linear ARDL**

Figure-3. Models stability test results.

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