Domestic Debt and Private Investment: The Case of a Small Open Economy

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Abstract

The study investigates the relationship between domestic debt and private investment in Nigeria for the period 2000:Q1 – 2019:Q2. Using the Autoregressive Distributed Lag (ARDL) methodology we found the existence of a long-run relationship among the variables. The study affirms that domestic debt has a significant negative effect on private investment in Nigeria, confirming the crowding-out hypothesis. On the basis on the empirical findings, the study recommends minimizing public borrowing (especially from domestic sources) in Nigeria. In addition, funds sourced through domestic borrowing should be judiciously utilized in order to improve the investment climate in the country.

Keywords: Domestic debt, private investment, ARDL

JEL Classification: E22, E62, H63

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I Introduction

Investment is critical to economic growth. Investment is the purchase of new capital, not for consumption, but for the future creation of wealth. It comprises of public and private investment. While public investments are undertaken by the government, private investments are undertaken by individuals and corporate organizations.

Concerns about the level of private investment in any economy is premised on the critical role that the private sector plays in enabling growth and development. According to a study by the Australian Department of Foreign Affairs and Trade (2014), the private sector is the engine of growth, generating 90.0 per cent of jobs, funding 60.0 per cent of all investments and providing more than 80.0 per cent of government revenues in developing countries[3]. This underscores the increasing concern on the stock of private investment as well as the factors that influence it. The liquidity constraints and low savings level faced by most governments in developing countries further necessitate the need to rely on private investment.

In Nigeria, private investment is influenced by several factors including access to bank credit, inflation, interest rate, and the quality of infrastructure, see Ajide (2013) and Ekpo (2016). The private sector has, however, played minimal role in driving economic activities in the country as private investment as a share of GDP has steadily declined from 86.0 per cent in 1981 to about 14.9 per cent in 2018, see Central Bank of Nigeria – CBN, (2018). This has made government borrowing to remain the key source of funding that the fiscal authorities rely upon to stimulate economic activities. Persistent government borrowing may, however, become distortionary particularly when it narrows the fiscal space and crowds out the private sector from accessing domestic credit, thereby amplifying the vulnerabilities of the economy, Hoeller (2012). For instance, the budgetary allocation for capital spending in the 2020 Federal Government budget was only ₦2.14 trillion representing about 20.7 per cent of the total budget[4]. However, ₦2.45 trillion was earmarked for debt service payments with 71.0 per cent of the total sum for the servicing of domestic debt which currently accounts for about 62.2 per cent of the total debt stock.

From a theoretical perspective, while the neo-classicals oppose public borrowing arguing that it potentially drives interest rates upward and crowds out private investment, the Keynesians believe that public borrowing stimulates private sector investment through the accelerator principle and the multiplier effect. Both perspectives, however, discountenance the Ricardian submission, that public borrowing could have a zero-net effect on private investment. Public borrowing is a characteristic of all economies. In Nigeria, the increasing expansion in public expenditures, coupled with dwindling revenues has often made the government to resort to borrowing. This resulted to the debt overhang that characterized the 1980s up until 2005 when about 60.0 per cent of the country's US$30.85 billion indebtedness to the Paris Club (a major source of macroeconomic distortion) was cancelled, reducing it to US$3.5 billion by 2007. Similarly, the

[3] The private sector provides an increasing share of public and essential services such as banking, telecommunications, health and education.

[4] This falls significantly short of the 30.0 per cent target in the Economic Recovery and Growth Plan (ERGP) 2017-2020.

stock of public debt declined from ₦4,220.98 billion in 2005 to ₦2,600.73 billion in 2007 (CBN, 2018).

In recent times, however, government borrowing has resumed its upward trend, owing in part to the sharp decline in government revenue, resulting from the fall in global crude oil prices from the peak of $112 per barrel in 2014 to a trough of US$28 per barrel in 2016, as well as disruption in domestic oil production. Despite expenditure rationalization and revenue improvement by the Federal Government, the financing gap has continued to deteriorate, necessitating recourse to increased borrowing (especially from domestic sources) with attendant implications for the economy. This heightened debt position has led to the resurgence of the debate about the net benefits of public borrowing in Nigeria. While some studies were in favour of the positive role domestic public borrowing plays on private investment, Nwaeze (2017), others opposed domestic public borrowing, see Anyanwu (2017; Akomolafe, (2015), and Ude and Ekesiobi (2014).

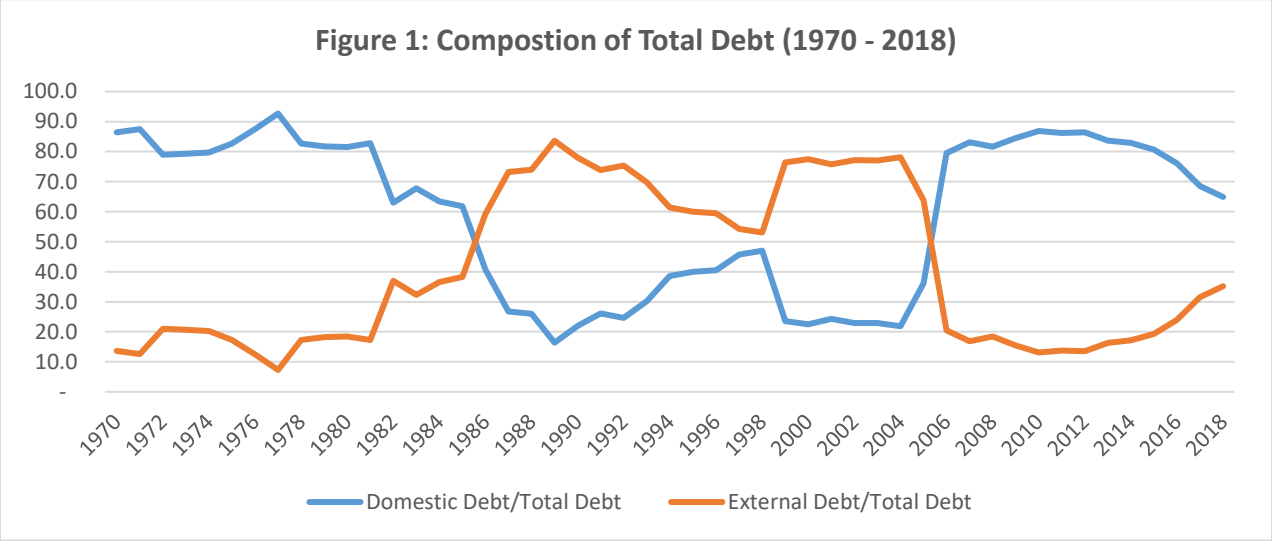
Against the backdrop of this unsettled debate, as well as the theoretical linkages, concerns about the exponential growth in domestic borrowing in recent times have been quite justified. This study adds to the literature on domestic debt and private investment in Nigeria by varying the period covered, methodology used and frequency of data. Specifically, this study estimates an Autoregressive Distributed Lag (ARDL) model using quarterly data spanning 2000:Q1 – 2019:Q2. An advantage of the ARDL approach is that it allows for inferences on long-run estimates which may not be possible under alternative co-integration procedures. To the best of my knowledge, although there are existing literature on the subject matter in Nigeria, this is the first study to use the ARDL approach and quarterly data, extending the analysis to the most recent available data. Thus, the main objective of this study is to investigate the impact of domestic public debt on private investment in Nigeria.

Following introduction, section two provides stylized facts on Nigeria's public debt and private investment. Section three examines the theoretical and empirical literature. Section four is on the research methodology. Section five estimates the model and discusses the results. The last section contains the conclusion and policy implications.

II Stylized facts on Public Debt and Private Investment

Prior to the mid 1980's, Nigeria's public debt was predominantly domestic accounting for an average of 78.7 per cent between 1970-1985, while external debt accounted for only 21.3 per cent. This trend was, however, reversed during 1986 - 2004 when external debt overshot domestic debt, accounting for an average of 70.4 per cent. The increased borrowings with the attendant rising debt service raised concerns about the need for proper debt management in the country. Thus, the government initiated some policy measures which included the creation of the Debt Management Office (DMO) in 2000, as well as starting negotiations for debt relief in the mid-2000s. In 2005, the country secured a breakthrough in her debt relief with the Paris Club agreement granting an International Development Assistance (IDA) only status which was supportive of the debt relief struggle. A final agreement was reached to cancel 60.0 per cent (US$18.0 billion) of Nigeria's debt with the Paris Club.

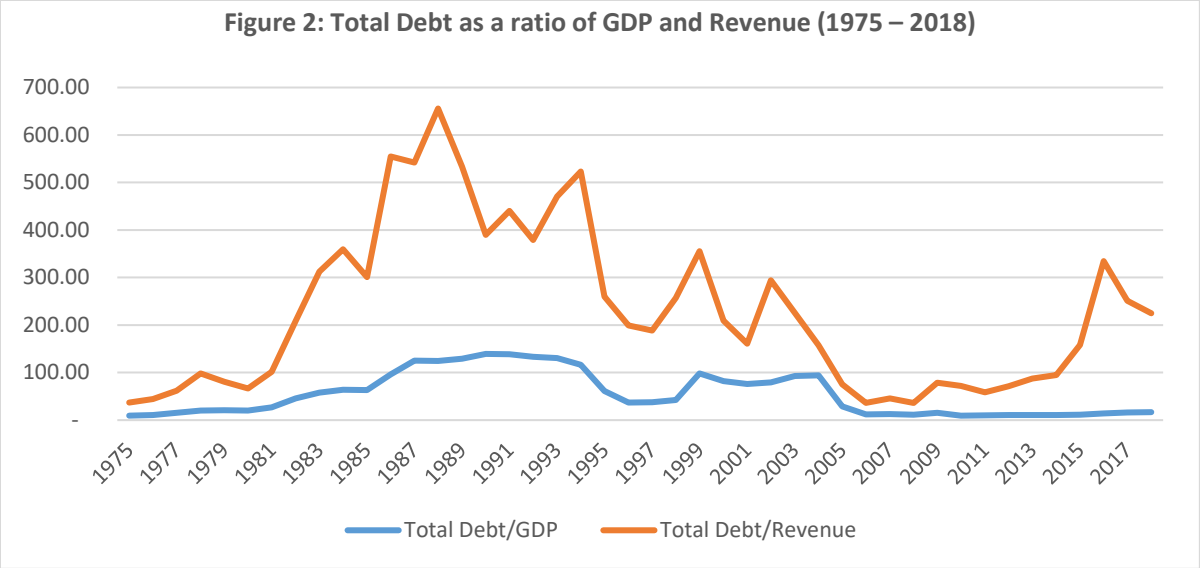
With the Paris Club debt relief of 2005, the stock of domestic debt became the major contributor to total debt, accounting for an average of 73.0 and 79.6 per cent in the periods 2005-2009 and 2010-2018, respectively (Figure 1).



Source: Central Bank of Nigeria (CBN, 2018)

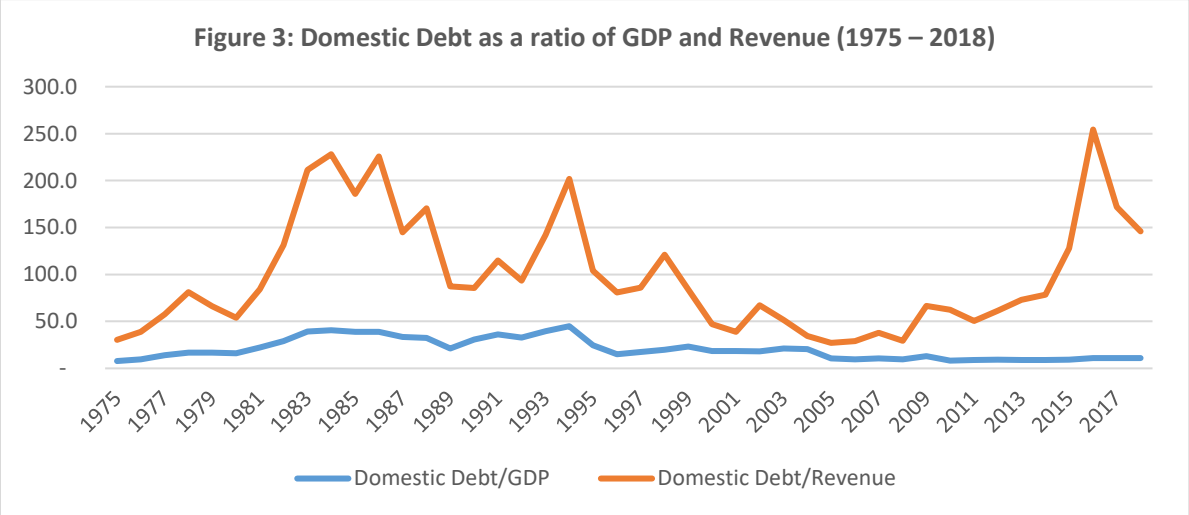
The Debt to GDP ratio which had been above the sustainability threshold of 30.0 per cent, peaked at 129.7 per cent during the period 1987-1994 and fell to 84.9 per cent in the period 2000-2004. The private investment growth during the same periods averaged 20.8 and 14.7 per cent, respectively (Figure 4). However, owing to the fiscal consolidation of the government, the debt relief, as well as the rebasing of the GDP in 2010 the debt stock to GDP ratio fell to 16.1 per cent in 2005-2009 and further to 12.3 per cent in the period 2010-2018 (Figure 2).

However, an analysis of the debt-to-revenue ratio (which is the global standard, and considered a more appropriate measure of debt sustainability) shows that overtime the ratio of debt to revenue exceeded the debt sustainability threshold of 250.0 per cent of revenue on several occasions such as in the period 1985-1989 which peaked at 517.4 per cent. It however began to drop gradually to 440.7 and 209.5 per cent during the periods 1990-1994 and 2000-2004, respectively. This drop was however short-lived as it rose to 270.0 per cent in the 2016-2018 period.



Source: Central Bank of Nigeria (CBN, 2018)

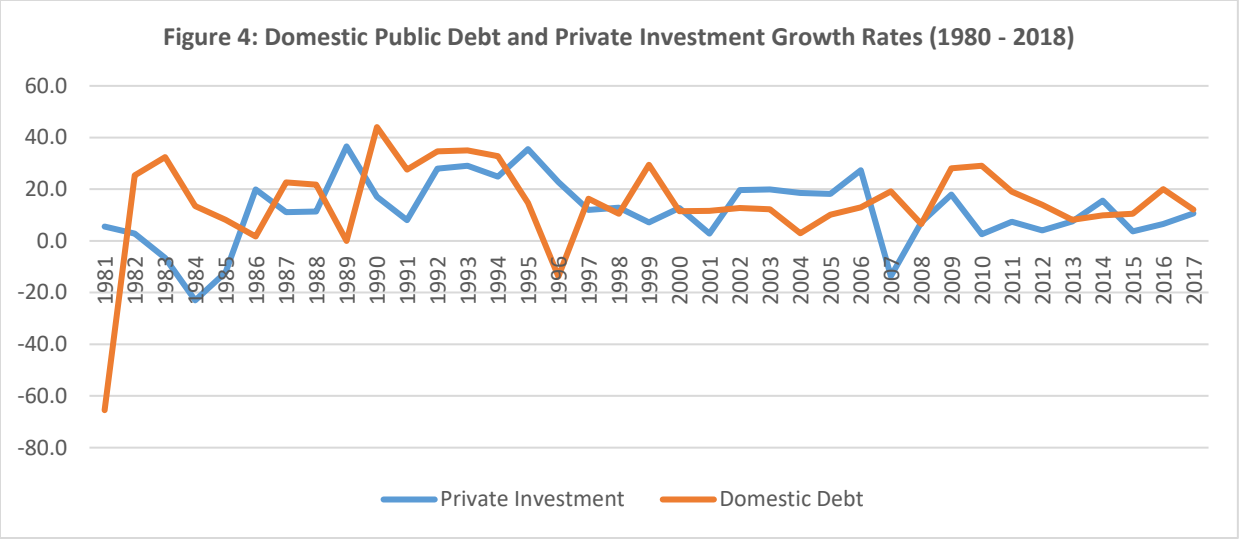
As a ratio of GDP, domestic debt has remained well below the debt GDP threshold of 40-60 per cent, maintaining a downward trend, from 36.8 per cent in 1990-1994 to 10.6 per cent and 9.6 per cent in 2005-2009 and 2010-2018, respectively[5]. As a ratio to revenue, however, domestic debt remained high for most of the period. From a high level of 127.7 per cent in the period 1990-1994, it declined to 38.0 per cent during 2005-2009. It has, however, been on the increase, rising to 114.0 per cent in during 2010-2018.



Source: Central Bank of Nigeria (CBN, 2018)

Figure 4 shows the behavior (growth rates) of public domestic debt and private investment in Nigeria the last few decades. Private investment, at least visually, has been, for most periods, moving in opposite direction with domestic public debt.

[5] Largely due to the rebasing of GDP in 2010.



Source: Central Bank of Nigeria (CBN, 2018)

III Theoretical and Empirical Literature Review

The theoretical literature surveys debt and investment theories. Three distinct schools of thoughts regarding the impact of debt on the economy are exploed; the Neo-classical, Keynesian, and Ricardian equivalence.

The Neo-classical Theory

The Neoclassicals oppose public debt because they believe it has a negative effect on private investment. Proponents of this school of thought opine that borrowing to finance government expenditure will inevitably raise interest rates and subsequently reduce private investments. Perry (2014) stated that the theory assumes that individuals have finite lifespans with that of successive generations overlapping. This implies that budget deficits increase current consumption which reduces savings, and interest rates must rise to ensure equilibrium in the capital markets, which in turn results in declining private investment. In effect thus, persistent deficits, "crowd out" private capital accumulation.

The Keynesian Theory

The Keynesians support government borrowing, particularly during periods of recession, basing their argument that during such periods, the beneficial multiplier effects of increased spending far outweigh the fears of crowding out. During periods of expansions, however, there would not be any need for deficit spending. The Keynesians argued that an economy would experience a partial crowding out if there were slack in the economy, with practically no crowding out in periods of recession. This is because savings and investment decisions do not depend only on the rate of interest, but largely on expectations of future profit. Businesses usually calculate the expectations of future profit based on a number of factors, including the state of mind or emotional psychology of investors, see Perry (2014). Thus, government borrowing increases aggregate demand, which eventually stimulates savings and private investment.

The Ricardian Equivalence

The 'Ricardian Equivalence'' posits a neutral relationship between public debt and economic activities. The theory proposes that deficits today must be compensated by future tax increases, thereby leaving interest rates and private consumption unaffected. Ricardo (1821) found that when governments tried to stimulate the economy by increasing debt-financed spending, aggregate demand remained unchanged. He concluded that debt-financed fiscal policy would not raise aggregate demand and is ineffective in raising employment and output in an economy. Ricardo's view was popularized and extended by Barro (1974) when he opined that financing a deficit with taxes or public debt has equivalent impact. He argued that debt payment and taxing horizons merge with intergenerational altruism, thereby, having no net wealth effect. Not oblivious of the future tax burden of current public debt, parents save more and leave higher bequest to their children to help pay higher taxes in the future.

Investment Theories

Neo-classical Theory

The Neo-classical theory of investment explains investment behaviour regarding fixed business investment[6]. It is based on the neoclassical theory of optimal capital accumulation, which is determined by the relative prices of the factors of production. The theory explains the causes of fluctuations in investment which are responsible for occurrence of business cycles in a free market economy. According to the theory, investment is determined by the marginal product of capital and user cost of capital (real rental cost of capital). If the former exceeds the latter, it will be lucrative for the firm to add to its stock of capital, that is increase investment, Mukher (2018).

Accelerator Theory

The Accelerator theory of investment is a Keynesian idea which stipulates that capital investment outlay is a function of output. Increases in national output or income results to proportional increases in capital investment spending. According to the theory, when the income of people increase, consumption will also increase, leading to a higher amount of the commodities that will need to be produced, which in turn will require more capital. Thus, at any given period, investment will depend on the growth of output (equation 1). However small the change in national income, it leads to an accelerated change in investment.

$$I = \alpha Y \tag{1}$$

The accelerator is the numerical value of the relation between the increases in investment resulting from an increase in income. The net induced investment will be positive if national income increases and induced investment may fall to zero if the national income or output remains constant, Mukher (2018).

Empirical Literature

The empirical studies on the impact of public debt on private investment vary in line with the theoretical views. The nexus, though extensively studied, has remained inconclusive, see Table 1.

[6] Fixed business investment includes the purchase of machines, construction of new factories, etc. by businessmen.

Table 1: Summary of some empirical literature

S/N	AUTHOR	METHODOLOGY	ANALYSIS	CONCLUSION
1	Mabula & Mutasa (2019)	ARDL	Annual data (1970 - 2016) – Tanzania	No significant evidence of long- and short-run relationship between domestic debt and private investment
2	Kimani & Olweny (2018)	ARDL	Quarterly data (2001:Q1 - 2017:Q4) – Kenya	Negative relationship between domestic borrowing and private investment, confirming the crowding-out effect
3	Lidiema (2018)	ARDL	Annual data (1975 - 2014) – Kenya	Public domestic debt had a negative relationship with private investment, but the relationship diminishes in the long run
4	Thilanka & Ranjith (2018)	VECM	Annual data (1978 - 2015) – Sri Lanka	Both domestic and external debt positively affect private investment, evidencing the crowding-in effect.
5	Mwakima (2017)	Regression	Annual data (2008 - 2016) – Kenya	Domestic public borrowing was negatively related to private sector credit.
6	Anyanwu, et. al. (2017)	Panel Data	Annual data (1990 - 2012) – Nigeria	Domestic public debt significantly decreases private sector credit
7	Nwaeze (2017)	VAR	Annual data (1970 - 2016) – Nigeria	Positive relationship between private investment and domestic borrowing
8	Philip et. al. (2017)	SVAR	Annual data (1970 - 2015) – Nigeria	Domestic debt induces prolonged crowding out effect
9	Yossef, M. S. (2016)	ECM	Quarterly data (1991:Q1 - 2013:Q4) – Egypt	In the short run, there was a negative relationship between treasury bills and private investment. In the long run, however, there was a positive relationship
10	Akomolafe, et. al. (2015)	VECM	Annual data (1980 - 2010) – Nigeria	Domestic debt crowds out domestic investment in both short- and long-run.

11	Apere, T. O. (2014)	Instrumental Variable	Annual data (1981 - 2012) – Nigeria	Domestic debt crowded in private investment
12	King'wara (2014)	ECM	Annual Data (1967 - 2007) – Kenya	High levels of domestic borrowing crowds-out private investment
13	Ude & Ekesiobi (2014)	Regression	Annual Data (1970 - 2012) – Nigeria	Inverse relationship between domestic debt and domestic private investment
14	Bista (2013)	ARDL & ECM	Annual Data (1975 - 2011) – Nepal	Domestic borrowing had positive impact on private investment, confirming the crowding-in effect
15	Onyeiwu	OLS & ECM	Annual data (1980 - 2010) – Nigeria	Results presented evidence of crowding out of private investments
16	Maana, et. al. (2008)	GMM	Annual data (1996 - 2007) – Kenya	Despite the increase in the domestic debt level, private sector investment increased.

From the summary of empirical literature above, this study is a departure from earlier studies on the subject matter in Nigeria.

First, from Table 1 above, different data span and frequency have been used to analyze the empirical relationship between domestic debt and private investment, globally. Except for Kimani and Olweny (2018) and Yossef (2016) that used quarterly data in their analysis, all other studies (Nigeria inclusive) used annual data.

Unlike prior studies on Nigeria that used annual data, this study utilizes high frequency data (quarterly data), extending the analysis to the most recent available data (2000Q1 – 2019:Q2). The choice of the study period was due to the unavailability of quarterly data for some of the relevant series during earlier periods. Furthermore, the trend analysis of public debt and private investment in Nigeria showed the astronomical rise in the domestic component starting from the mid-2000s, with those periods also witnessing very low private investment growth rates. The study also provides a graphical analysis of all the variables employed (section 4.2.1.2) in order to visualize their trend and behaviour over the study period, thereby enriching the study.

Second, in terms of the theoretical framework, it was observed that apart from Mabula and Mutasa (2019), no study relied on both debt and investment theories. Some studies relied on only debt theories, Nwaeze, (2017) and Akomolafe, (2015), while a few basically had no theoretical framework. Unlike earlier studies, this study relies on both debt and investment theories.

Second, it is evident from Table 1 that various methods (OLS, ECM, VECM, ARDL, Panel Data, VAR, Instrumental Variable, etc.) have been also used globally to examine the relationship

between our variables of interest. For instance, the ARDL methodology which this study employs[7] was used for Tanzania by Mubala and Mutasa (2019); for Kenya by Kimani and Olweny (2018) and Lidiema (2018); and for Nepal (Bisal (2013). Thilanka and Ranjith (2018) and Akomolafe, et. al. (2015) used the VECM for Sri Lanka and Nigeria, respectively, while the ECM was used by Yossef (2016) for Egypt, King'wara (2014) for Kenya and Onyeiwu (2012) for Nigeria. The regression analysis was used for Kenya by Mwakima (2017) and Nigeria by Ude and Ekesiobi (2014). Maana, et. al. (2008) used the GMM for Kenya. Other methodologies used for Nigeria include panel data by Anyanwu (2017), VAR by Nwaeze (2017), SVAR by Philip et. al (2017).

The empirical findings showed mixed results (Table 1) and therefore, the conclusion cannot be generalized. It is, however, important to allude to the persistence of empirical findings on Nigeria. Apart from Nwaeze (2017), all other studies found negative relationship between domestic debt and private investment in Nigeria. The results might have been influenced by the characteristics of the data used (annual data).

Although there are existing literature on the subject matter in Nigeria, to the best of our knowledge, this is the first study to use the ARDL approach for Nigeria. The choice of the methodology was informed by the fact that the series were found to exhibit a mixed order of integration - I(0) and I(1). Furthermore, the ARDL allows for inferences on long-run estimates which may not be possible under alternative co-integration procedures.

IV Research Methodology

The study uses quarterly time series data from 2000:Q1 to 2019:Q2. The data was sourced from various editions of the Central Bank of Nigeria (CBN)'s Annual Report. The variables used include private investment (PI) - proxied by Gross Fixed Capital Formation, domestic debt (DD), domestic credit (DC), real GDP (RGDP), the prime lending rate (PLR) and the consumer price index (CPI).

Model Specification

Since the variables employed in this study were integrated of mixed order [(1) and I(0)], and not I(2) or higher, an ARDL type model was specified and estimated. ARDL models have long been used to examine relationships between time series variables and have gained renewed interest in recent years as a method for examining co-integrating relationships between I(0) and I(1) variables courtesy of the study by Pesaran and Shin (1998) and Pesaran et al. (2001). An ARDL can also be specified if all variables are of order I(1). An ARDL model is a dynamic specification that combines the lags of both the dependent and independent variables in a model unlike a VAR model which includes only endogenous variables. For this study, the ARDL model is specified in equation 2 below:

$$\Delta PI_t = \beta_0 + \sum_{i=1}^{n} \beta_1 \Delta PI_{t-i} + \sum_{i=0}^{n} \beta_2 \Delta DC_{t-i} + \sum_{i=0}^{n} \beta_3 \Delta DD_{t-i} + \sum_{i=0}^{n} \beta_4 \Delta RGDP_{t-i} + \sum_{i=0}^{n} \beta_5 \Delta PLR_{t-i} + \sum_{i=0}^{n} \beta_6 \Delta CPI_{t-i} + \varphi_1 PI_{t-i}$$
$$+ \varphi_2 DC_{t-i} + \varphi_2 DD_{t-i} + \varphi_3 RGDP_{t-i} + \varphi_4 PLR_{t-i} + \varphi_5 CPI_{t-i} + \mu_t \ldots\ldots\ldots 1$$

[7] Though the ARDL methodology is usually defined by the data characteristics.

The dependent variable, private investment, is proxied by the Gross Fixed Capital Formation. Other variables include domestic credit, that is credit made available to borrowers by the financial sector - it is expected to have a positive sign; domestic debt which is the component of total debt borrowed by government from within the country - the sign may be positive or negative (if it is negative, it implies a crowding out effect, and if positive, a crowding in effect); the real GDP which is the value of all goods and services produced domestically – it is expected to have a positive sign; the prime lending rate which is the user cost of capital (an increase in interest rate would raise the cost of capital and therefore dampen domestic investment)- it is, thus, expected to have a negative sign; and the consumer price index which measures the average change in prices – it is expected to have a negative sign.

The component of equation 3 stated below is the short-run component of the ARDL model with β_1, β_2, β_3, β_4, β_5 and β_6 as short-run coefficients.

$$\sum_{i=1}^{n}\beta_1\Delta PI_{t-i}+\sum_{i=0}^{n}\beta_2\Delta DC_{t-i}+\sum_{i=0}^{n}\beta_3\Delta DD_{t-i}+\sum_{i=0}^{n}\beta_4\Delta RGDP_{t-i}+\sum_{i=0}^{n}\beta_5\Delta PLR_{t-i}+\sum_{i=0}^{n}\beta_6\Delta CPI_{t-i}.....2$$

Another component of equation 2 stated in 4, is the long-run component of the ARDL model, with the error correction long-run coefficients; φ_1, φ_2, φ_3, φ_4, φ_5 respectively.

$$\varphi_1 PI_{t-i}+\varphi_2 DC_{t-i}+\varphi_3 DD_{t-i}+\varphi_4 RGDP_{t-i}+\varphi_5 PLR_{t-i}+\varphi_6 CPI_{t-i}.....3$$

The μ_t, is the traditional disturbance term which should be white noise. If we replace the long-run component in 4 with, Z_{t-i}, the model reverts to the Error Correction Model (ECM) and the ARDL model can then be re-specified as equation 5;

$$\Delta PI_t=\beta_0+\sum_{i=1}^{n}\beta_1\Delta PI_{t-i}+\sum_{i=0}^{n}\beta_2\Delta DC_{t-i}+\sum_{i=0}^{n}\beta_3\Delta DD_{t-i}+\sum_{i=0}^{n}\beta_4\Delta RGDP_{t-i}+\sum_{i=0}^{n}\beta_5\Delta PLR_{t-i}$$

$$+\sum_{i=0}^{n}\beta_6\Delta CPI_{t-i}+Z_{t-i}+\mu_t.....4$$

The ARDL model may be viewed as a form of unrestricted ECM because all the long-run relationship variables are specified and not restricted. In other words, when the long-run components are replaced with the lagged residual extracted from running the long-run model, then it reverts to ECM. Equation 4 is, therefore, the final ARDL model estimated. The ECM examines the long-run dynamics while the ARDL short-run specification examines the short-run causality.

V Empirical Findings

Some preliminary analyses were rendered to highlight the statistical properties of the data of interest. Starting with the summary statistics (Table 2) it can be observed that the variables contained 78 observations. In terms of skewness, all variables except RGDP (real GDP) are positively skewed. Similarly, the behaviour of their kurtosis is mixed. While PI (private

investment) and PLR (prime lending rate) are leptokurtic, the remaining variables are platykurtic. The probability value of the Jarque-Bera shows that apart from RGDP, all the variables are not normally distributed at 5% significance level (Prob. less than 0.05), which is typical of time series data. This necessitated the need for transformation of the data.

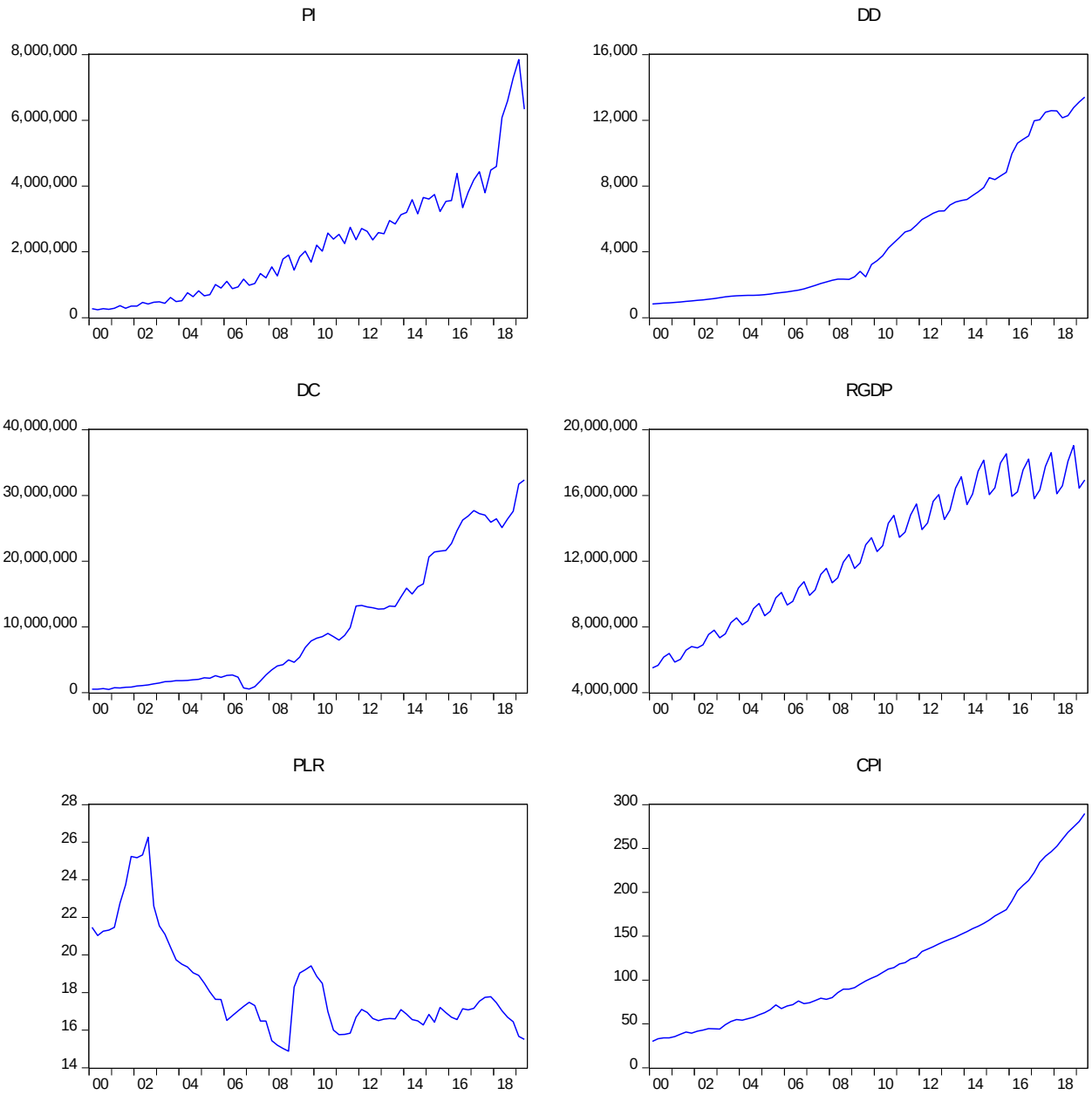
Table 2: Summary Statistics

	PI	DD	DC	RGDP	PLR	CPI
Mean	2224192	4935.662	10190963	12460792	18.19838	118.9292
Median	1962833	3020.41	7358446	12759004	17.14692	100.5181
Maximum	7849182	13412.8	32341481	19041438	26.26333	289.6928
Minimum	238879.8	833.3825	472011.7	5495323	14.88137	30.0578
Std. Dev.	1771637	4082.276	9813457	4040269	2.581277	71.50156
Skewness	1.078673	0.738628	0.751566	-0.125543	1.408008	0.771869
Kurtosis	3.919786	2.150213	2.171771	1.69341	4.397097	2.581448
Jarque-Bera	17.87549	9.439369	9.572458	5.753222	32.11594	8.314513
Probability	0.000131	0.008918	0.008344	0.056325	0.00000	0.01565
Sum	1.73E+08	384981.6	7.95E+08	9.72E+08	1419.473	9276.48
Sum Sq. Dev.	2.42E+14	1.28E+09	7.42E+15	1.26E+15	513.0503	393660.4
Observations	78	78	78	78	78	78

Source: Author's Computation using e-views 11

In order to visualize the trend and behaviour of the variables over the study period, a graphical analysis is undertaken. Figure 1 plots all the variables. A visual inspection shows the existence of trends in all the variables except the prime lending rate.

Figure 5: Trend Analysis



Source: Author's Computation using e-views 11

Unit Root Test

In a bid to bring the data to a common measure and for ease of interpretation, the natural log of private investment, domestic debt, domestic credit, real GDP and consumer price index were taken.[8] Unit root tests were conducted for the variables and the results are presented in Table 3.

The results indicate that the variables are of mixed order of integration, I(0) and I(1). Using the Augmented Dickey Fuller (ADF) test, all the variables were stationary at first difference except domestic credit and the consumer price index which were stationary at level. While using the

[8] The prime lending rate (PLR) was not logged because it is a rate.

Phillips-Perron test, all the variables were stationary at first difference, except private investment, real GDP and consumer price index which were stationary at level.

Table 3: Unit Root Test

	Augmented Dickey Fuller (ADF)		Philip-Perron (PP)	
Variable	**Test Stats**	**I(d)**	**Test Stats**	**I(d)**
LPI	-3.520307[a Λ]	I(1)	-4.081666[a #]	I(0)
LDD	-3.519050[a Λ]	I(1)	-3.519050[a Λ]	I(1)
LDC	-3.470032[b #]	I(0)	-3.519050[a Λ]	I(1)
LRGDP	-3.163450[c #]	I(1)	-4.081666[a Λ]	I(0)
PLR	-3.519050[a Λ]	I(1)	-3.519050[a Λ]	I(1)
LCPI	-3.469235[b #]	I(0)	-3.469235[b #]	I(0)

Note: a, b and c denote 1%, 5% and 10% levels of significance respectively; Λ and # denote test equations with constant only, and constant and trend, respectively.

Having specified and defined the ARDL model, the process of estimation commenced with running equation 5, the ARDL model (unrestricted ECM). A maximum lag order of 8 was abruptly chosen as the maximum lag order of both the regressors and the dependent variable in the quest for selecting the optimal lag for the ARDL. However, the model lag selection criteria using the AIC information criteria chose different lags across variables, thus, ARDL (4,1,0,4,2,0). The study ensured that the error of the model are not serially correlated by undertaking some diagnostic tests, specifically, the autocorrelation using the LM Test and stability test to ensure the model is dynamically stable. Furthermore, the study utilized the ARDL Bounds test to investigate if short-run and long-run relationship exists. The Bounds test is to detect any evidence of long-run relationship (if there is co-integration). Having established a long-run relationship, the study proceeded to estimate the long-run level and the ECM. The result of the models estimated was used to measure the short-run dynamic effects and the long-run equilibrium relations between the variables.

The result indicates the maximum lag selection automatically chosen by the model using the AIC information criteria ARDL (4,1,0,4,2,0). It should be noted that the probability values do not account for the model lag selection[9].

The ARDL F-statistic which is 12.02233 (see appendix A) lies outside the upper bound of the asymptotic bounds at 10%, 5%, and 1% significance level, respectively, as provided by Pesaran and Chin. Similarly, using the T-test, the absolute of 7.682034 lies outside the upper bound of the asymptotic bounds at all levels of conventional significance, 10%, 5%, and 1% respectively. This indicates the existence of a long-run relationship between the variables.

This necessitated the inclusion of ECM term to capture the rate at which a drift from the equilibrium can be corrected in case of a shock. The result of the ARDL-ECM version is presented

[9] Available upon request

in appendix B. The ECM at -2.998717 meets the mandatory criteria of being negative, and significant. The constant is also statistically significant. The value of the ECM shows the speed of adjustment towards the long-run equilibrium. The negative sign implies that if the system is moving out of equilibrium it will be returned to equilibrium. This indicates that about 299% departure from long-run equilibrium are corrected each period and are statistically significant.

Table 4: Long-run Equation

Levels Equation
Case 5: Unrestricted Constant and Unrestricted Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LDC)	0.017333	0.027774	0.624082	0.5352
D(LDD)	-0.272863	0.094940	-2.874055	0.0058
D(LCPI)	0.780556	0.587527	1.328544	0.1895
D(LRGDP)	0.449643	0.217183	2.070346	0.0431
D(PLR)	-0.021009	0.006724	-3.124757	0.0028

EC = D(LPI) - (0.0173*D(LDC) -0.2729*D(LDD) +
0.7806*D(LCPI) + 0.4496
*D(LRGDP) -0.0210*D(PLR))

From the long-run equation, domestic debt, real GDP, and prime lending rate are statistically significant implying that they are good predictors of private investment in Nigeria. Furthermore, they all maintained the theoretical aprori expectations. The domestic credit also maintained theoretical aprori expectations, though was not significant. The consumer price index was not significant and did not maintain theoretical aprori expectations. From the result of the study, domestic debt, real GDP, and prime lending rate, all have long-run relationship with private investment in Nigeria. The result indicates that the higher the domestic debt, the lower will be the private investment. Similarly, the higher the real growth of GDP, the higher will be the level of private investment. Finally, the higher the prime lending rate, the lower will be the level of private investment in Nigeria.

Post Estimation Analysis

The diagnostic tests carried out include the Serial Correlation Test, the Heteroscedasticity test and the Stability Test. The serial correlation test on Table 5 shows that the probability value associated with the Chi-Square is more than the 5 % level, indicating no evidence of serial correlation.

Table 5: Serial Correlation Test

Breusch-Godfrey Serial Correlation LM Test:

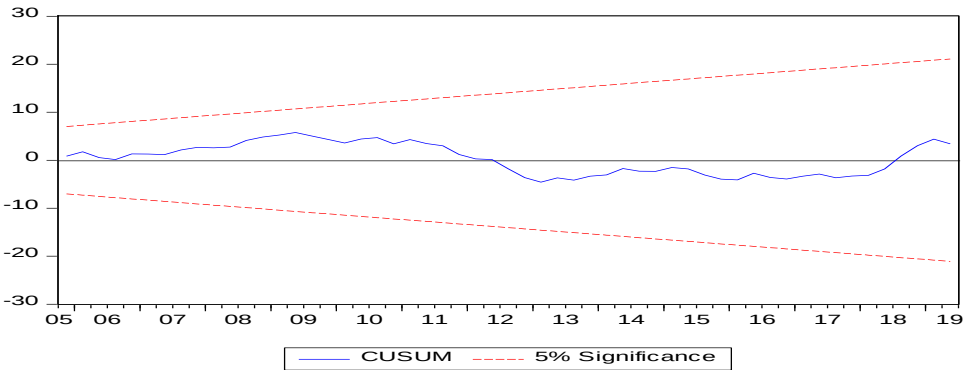
F-statistic	0.740797	Prob. F(4,51)	0.5686
Obs*R-squared	4.008524	Prob. Chi-Square(4)	0.4049

The Heteroscedasticity test on Table 6 shows that the probability value associated with the Chi-Square is more than the 5% level indicating no evidence of Heteroscedasticity.

Table 6: Heteroscedasticity Test
Heteroscedasticity Test: Breusch-Pagan-Godfrey

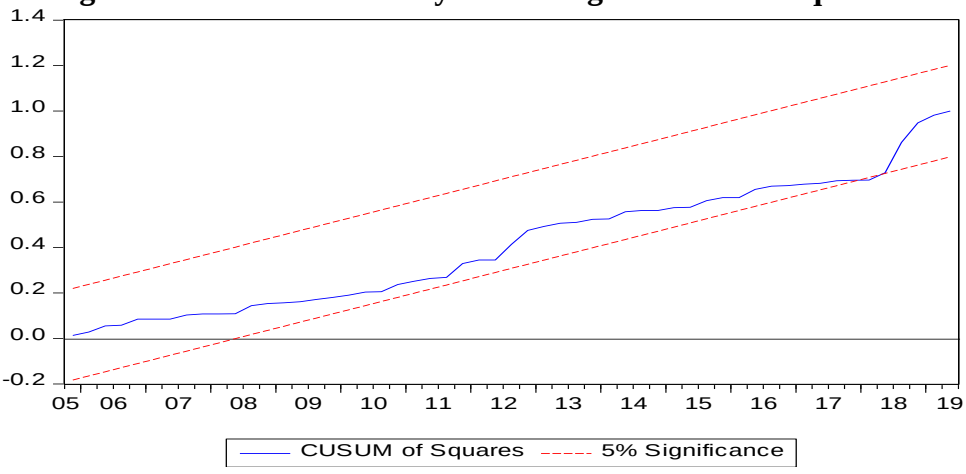
F-statistic	1.505442	Prob. F(17,55)	0.1274
Obs*R-squared	23.18147	Prob. Chi-Square(17)	0.1434
Scaled explained SS	7.531118	Prob. Chi-Square(17)	0.9756

Fig 6: Stability Test



The blue line lying in-between the red line in figure 6 using the CUSUM test indicates that the model is stable. Similarly, using the CUSUM Squares, in figure 7, also indicates that the model is structurally stable and devoid of structural breaks. This is evident in the blue line lying in-between the red lines.

Figure 7: Structural Stability Test Using the CUSUM Squares Test



VI Conclusion and Policy Implications

This study investigated the relationship between domestic debt and private investment in Nigeria. The variables used include private investment, domestic debt, domestic credit, real GDP, prime lending rate and the consumer price index.

The unit root test results indicated that the variables are of mixed order of integration [i.e. both I(0) and I(1)], necessitating the choice of the ARDL methodology. The model was tested for cointegration and the results of the Bounds test showed the existence of a long-run relationship among the variables. From the long-run equation, domestic debt, real GDP and prime lending rate were statistically significant and maintained apriori expectation. Domestic credit though appropriately signed was insignificant. Furthermore, the consumer price index was not appropriately signed and was insignificant. The study, thus, affirms that domestic debt has a significant negative effect on private investment in Nigeria, confirming the crowding-out hypothesis.

In line with the foregoing, this study recommends minimizing public borrowing (especially from domestic sources) in Nigeria. In addition, funds sourced through domestic borrowing should be judiciously utilized in order to improve the investment climate in the country.

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Appendix

Appendix A

ARDL Long Run Form and Bounds Test

ARDL Long Run Form and Bounds Test
Dependent Variable: D(LPI, 2)
Selected Model: ARDL(4, 1, 0, 4, 2, 0)
Case 5: Unrestricted Constant and Unrestricted Trend
Date: 12/20/19 Time: 17:13
Sample: 2000Q1 2019Q2
Included observations: 73

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.075529	0.075535	0.999924	0.3217
@TREND	-0.000236	0.000741	-0.317857	0.7518
D(LPI(-1))*	-2.998717	0.390355	-7.682034	0.0000
D(LDC(-1))	0.051978	0.088474	0.587495	0.5593
D(LDD)**	-0.818239	0.347975	-2.351429	0.0223
D(LCPI(-1))	2.340667	1.700560	1.376410	0.1743
D(LRGDP(-1))	1.348354	0.857514	1.572398	0.1216
D(PLR)**	-0.063001	0.018320	-3.439003	0.0011
D(LPI(-1), 2)	1.229758	0.335185	3.668889	0.0006
D(LPI(-2), 2)	0.781983	0.238238	3.282363	0.0018
D(LPI(-3), 2)	0.409099	0.115019	3.556802	0.0008

D(LDC, 2)	-0.098207	0.082648	-1.188252	0.2398
D(LCPI, 2)	0.161371	0.698992	0.230863	0.8183
D(LCPI(-1), 2)	-1.761564	1.215134	-1.449686	0.1528
D(LCPI(-2), 2)	-1.771855	0.929772	-1.905688	0.0619
D(LCPI(-3), 2)	-1.976305	0.647590	-3.051784	0.0035
D(LRGDP, 2)	0.360305	0.376292	0.957516	0.3425
D(LRGDP(-1), 2)	-0.653770	0.399463	-1.636622	0.1074

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 5: Unrestricted Constant and Unrestricted Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LDC)	0.017333	0.027774	0.624082	0.5352
D(LDD)	-0.272863	0.094940	-2.874055	0.0058
D(LCPI)	0.780556	0.587527	1.328544	0.1895
D(LRGDP)	0.449643	0.217183	2.070346	0.0431
D(PLR)	-0.021009	0.006724	-3.124757	0.0028

EC = D(LPI) - (0.0173*D(LDC) -0.2729*D(LDD) + 0.7806*D(LCPI) + 0.4496
*D(LRGDP) -0.0210*D(PLR))

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	12.02233	10%	2.75	3.79
K	5	5%	3.12	4.25
		2.5%	3.49	4.67
		1%	3.93	5.23
			Finite Sample: n=75	
Actual Sample Size	73			
		10%	2.89	3.993
		5%	3.382	4.567
		1%	4.393	5.788

		Finite Sample: n=70	
	10%	2.893	4.008
	5%	3.368	4.59
	1%	4.428	5.898

t-Bounds Test			Null Hypothesis: No levels relationship	
Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	-7.682034	10%	-3.13	-4.21
		5%	-3.41	-4.52
		2.5%	-3.65	-4.79
		1%	-3.96	-5.13

Appendix B

ARDL Error Correction Model Regression

ARDL Error Correction Regression
Dependent Variable: D(LPI, 2)
Selected Model: ARDL(4, 1, 0, 4, 2, 0)
Case 5: Unrestricted Constant and Unrestricted Trend
Date: 12/20/19 Time: 16:15
Sample: 2000Q1 2019Q2
Included observations: 73

ECM Regression
Case 5: Unrestricted Constant and Unrestricted Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.075529	0.029966	2.520458	0.0147
@TREND	-0.000236	0.000624	-0.377873	0.7070
D(LPI(-1), 2)	1.229758	0.299353	4.108054	0.0001
D(LPI(-2), 2)	0.781983	0.220710	3.543037	0.0008
D(LPI(-3), 2)	0.409099	0.108483	3.771089	0.0004
D(LDC, 2)	-0.098207	0.064334	-1.526522	0.1326
D(LCPI, 2)	0.161371	0.574259	0.281008	0.7798
D(LCPI(-1), 2)	-1.761564	0.649243	-2.713256	0.0089
D(LCPI(-2), 2)	-1.771855	0.627415	-2.824056	0.0066
D(LCPI(-3), 2)	-1.976305	0.545123	-3.625430	0.0006

D(LRGDP, 2)	0.360305	0.160899	2.239329	0.0292
D(LRGDP(-1), 2)	-0.653770	0.173271	-3.773111	0.0004
CointEq(-1)*	-2.998717	0.338042	-8.870830	0.0000

R-squared	0.887575	Mean dependent var	-0.004817
Adjusted R-squared	0.865090	S.D. dependent var	0.304640
S.E. of regression	0.111895	Akaike info criterion	-1.382469
Sum squared resid	0.751225	Schwarz criterion	-0.974579
Log likelihood	63.46011	Hannan-Quinn criter.	-1.219917
F-statistic	39.47396	Durbin-Watson stat	1.776135
Prob(F-statistic)	0.000000		

* p-value incompatible with t-Bounds distribution.

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	12.02233	10%	2.75	3.79
K	5	5%	3.12	4.25
		2.5%	3.49	4.67
		1%	3.93	5.23

t-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
t-statistic	-8.870830	10%	-3.13	-4.21
		5%	-3.41	-4.52
		2.5%	-3.65	-4.79
		1%	-3.96	-5.13