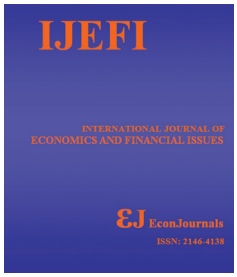

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Monetary Policy Effects on Private Sector Investment: Evidence from Sierra Leone

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ABSTRACT

Private sector investment has become an increasingly significant objective for the government of Sierra Leone in promoting economic growth and enhancing job creation, and monetary policy has always been one of the main economic management tools that governments use to shape economic performance. The study therefore examines the rate at which changes in monetary policy in Sierra Leone has affected the behavior of private sector investments, theories and empirical studies are reviewed in a way to identify a suitable model for private sector investment for the period 1980-2014. Using recent econometric techniques, the results suggest that money supply and gross domestic saving exert positive and statistically significant effect on private sector investments whereas treasury bill rate, inflation and gross domestic debt exert a negative effect. An important policy implication emerging from this study is to facilitate the establishment of financial institutions to increase credit delivery to the private sector so as to enhance private investment.

Keywords: Monetary Policy, Private Sector Investment, Sierra Leone
JEL Classifications: E52, E58, E220

1. INTRODUCTION

Investment is a key macroeconomic variable essential for economic growth and development of every country. Investment comprises both private and public components, however in recent years; developing countries have placed greater emphasis on the improvement of the private sector since it has remained among the main engines of growth of modern economies across the globe. In Sierra Leone, government over the years has introduced several measures to revitalize the private sector and thus economic growth.

The government recognizes that the private sector constitutes the main engine for economic growth and development. It seeks-noting than merely about 20% of the national businesses to be in the hands of the state, and the rest, although operated mostly informally, should be in the hands of the private sector (IMF County Report, 2011). Thus, within the framework of the national poverty reduction strategies, key reforms and programmes like the structural adjustment program (SAP), agenda for prosperity, and other financial sector reform measures have been sought to place the private sector in the driver's seat for promoting economic growth and enhancing job creation.

Monetary policy is one of the key economic policy instruments that governments use to shape economic performance. In contrary to fiscal policy, monetary policy can resolve the issue of economic shocks very fast. Discussing the impact of monetary policy on private sector investment Khan (2010), argues that monetary policy objectives are concerned with the management of numerous monetary targets which include; boosting growth, attaining full employment, stabilizing price, averting economic crisis, stabilizing real exchange rate and interest rates. It is obvious that these objectives are all not consistent with each other, as the tendency of monetary policy objectives are anchored upon the credence assigned by monetary authorities or country priorities. It has been experienced that prominence is usually placed on ensuring low inflation rates or maintaining price stability.

Nevertheless, understanding about the effectiveness of monetary policy in Sierra Leone is very vital for a better understanding of the existing concept. Has monetary policy played a role in private sector development in Sierra Leone in the past decades? What are the major monetary policy instruments of Sierra Leone? How can the private sector development/investment be enhanced? These are some of the questions which are to be explored in this study. A comprehensive understanding of these questions is essential for policy making and hence the transformation of the private sector development model towards a sustainable pattern. In the existing literature, there are many studies which investigated the contribution of monetary and fiscal policy on economic growth, Isaac and Samwel (2012), Korsu and Daboh (2010) and Abbas and Christensen (2007); however the outcomes on empirical substantiation are different depending on the selection of country, time-frames, and the applied methodology. This study expands the existing literature by focusing on the relationship between monetary policy and private sector investment alone and by evaluating monetary policy in a different approach. The latter is based on Sierra Leone's official data and perhaps endeavored for the first time in this paper. To the knowledge of the authors, there is also a need of logical study on identifying the major monetary policy instruments that influence private sector investment in Sierra Leone vis-à-vis that of other African economies. The rest of the paper commences with the main issues associated with monetary policy and private sector investment/development in Sierra Leone and a brief review of literatures. This is followed by the description of the methodology. The estimation techniques and empirical results and discussions are then presented. Subsequently diagnostics and stability tests analysis are conducted in order to examine the robustness of the model adopted. The paper finally ends with policy implications and some concluding remarks.

2. MONETARY POLICY FRAMEWORK OF SIERRA LEONE AND PRIVATE SECTOR INVESTMENT

The conduct of monetary policy has been primarily geared towards achieving price stability. At present, the Bank of Sierra Leone (BSL) Act 2000 gives the objective of the central bank as "to achieve and maintain monetary stability" and includes in the functions to be performed by the bank" to formulate, adopt and execute a monetary policy in Sierra Leone." This function has been assigned to the monetary policy technical committee at the BSL, under the chairmanship of the Governor. This committee has set its main objective as the maintenance of low inflation content with achieving high sustainable economic growth and financial stability. Prior to 1992, the pursuance of the objective of monetary policy was carried out mainly through the use of direct instruments such as special deposit requirements, reserve requirements, moral suasion and selective/qualitative credit control. It sought to limit the growth of money and credit through direct constraint on the growth of commercial banks balance sheets. Interest rates on government securities were administratively determined. With regards reserve requirement commercial banks were required to hold a minimum of 40% of their total deposits liabilities as reserve asset with the central bank. This was in addition to cash/deposits ratio of 10%. As part of liquid assets, treasury bills holdings by the banks not exceeding 20% of total reserve requirements were generally the norm while the remainder was held in deposit form.

Within the context of the SAP, monetary reforms were implemented with the aim of reducing inflation and strengthening the reserve position by maintaining tight monetary controls and replacing the administrative system of controls on interest rates and exchange rate with a system of indirect controls based on market related instruments.

In January 1992, a tender system was introduced for the sale of ordinary treasury bills to commercial banks. This involved replacing a system of setting rates for these treasury bills with a more effective market-determined treasury bill auction. Following the establishment of this auction mechanism, the hitherto segmented markets in treasury bills (bank and non-bank) were unified in August 1992 and open market operations (OMO) in the primary market were begun (Source: Bank of Sierra Leone).

On the 28th of February 1994, the BSL introduced a clearing house mechanism for trading treasury bills by commercial banks in a secondary market. This was introduced to include all the sale and purchase of treasury bills before maturity. These reform measures laid the foundation for the active use of OMO as the main instrument of monetary policy in the Bank since 1992.

At present, the main instrument of monetary policy is OMO. Operations are however concentrated in the primary market for government securities. Reserve requirement is also employed as a monetary policy instrument. Reserve and liquidity ratios are used as prudential measures, and because of the small size of the financial market and the high liquidity of commercial banks there has been very little activity in the secondary market.

Monetary policy is conducted within the framework of a monetary targeting regime. The operational target is reserve money and is used for day-to-day (or week-to-week) policy to attain the ultimate between the central bank's ultimate policy goals and the operating target. Quarterly targets on reserve money are set within the framework of international monetary fund (IMF) supported and monitored programmes and these are consistent with programme targets on inflation and economic growth.

The operating framework of monetary policy is presented in Table 1.

Within this framework, broad money growth (ΔBM) is linked with price inflation (ΔP) and real output growth (ΔY) by an assumption for the growth in the velocity of circulation of money (V), that is, how quickly money circulates around the economy: BM=ΔP+ΔY–ΔV. In the instance of, say, an increase in the growth of broad (and reserve) money, the Monetary Policy Technical Committee of the central bank takes judgment on how much of this higher money growth is translated into higher price inflation (ΔP) or instead into higher growth in real output (ΔY) and/or into lower growth in the speed with which money circulates around the economy (ΔV). The framework is also based on the

Table 1: Schematic representation of the monetary policy framework in Sierra Leone

Monetary policy instruments	Operational target	Intermediate target	Ultimate policy objectives
Open market type operations (OMOs)	Reserve money	Broad money	Price stability
Reserve requirement	Total deposit liability	Liquid asset	Sustained economic growth

fact that, reserve money - the operational target is linked to broad money - the intermediate target - by making an assumption for the money multiplier, that is, the ratio of broad money to reserve money. The money multiplier is assumed to be relatively stable. The conduct of monetary policy in Sierra Leone is faced with varying constraints. Secondary market trading in government securities is limited and underdeveloped. Less than 5% of the total trading in government securities is undertaken in the secondary market (Source: Bank of Sierra Leone).

In the key monetary policy indicators - treasury bills rate and the rate of inflation - prior to the policy shift from direct to indirect monetary management, attainment of price stability, the primary objective of monetary policy, was far-fetched as the rate of inflation skyrocketed to an all-time high of about 185% in 1987. Following the shift, the monetary authorities have succeeded in drastically reducing the rate of inflation, although the treasury bills rate has not succeeded in appropriately signaling the central bank's monetary policy stance.

The growth rate of commercial banks' credit to the private sector was very low during the third and fourth quarters of the year. Broad money (M2) expanded by 31.3% in 2005 almost doubt its programme target of 16.5% and exceeding its target in 2004 (BSL Annual Report). This expansion was accounted for mainly by the growth in Quasi money imitated by the increase in commercial banks foreign currency deposits and savings deposits. Broad money M2 also grew by 23.1% in the same year. This growth was not unconnected to the increase in demand deposit and currency in circulation.

Monetary policy was challenging but remained focused on maintaining price stability. The control of liquidity was also difficult in the absence of new securities and as such, monetary operations had to be supplemented by the sales of foreign exchange by the bank. In the financial services sector, there was considerable evidence of response by commercial banks and other financial institutions to challenge in the economic drive brought by the year 2005. Thus, leads to the official opening of the second discount house the "capital discount house." The commercial banks opened 4 new branches and foreign exchange bureaus increased from 45 to 50 increasing credit to the private sector by the commercial banks by 15.5%.

Management of monetary policy which was aimed at achieving single digit inflation in 2006 was challenging. The BSL capacity for OMO was constrained by the non-availability of government securities and currency. Government's fiscal policy was also tight and complemented BSL effort in meeting its objectives. However, with a tight fiscal stance, monetary targets were met at the end of 2006 as the economy witnessed an impressive performance with an estimated real gross domestic product (GDP) of 7.8% following a 7.3% growth in 2005.

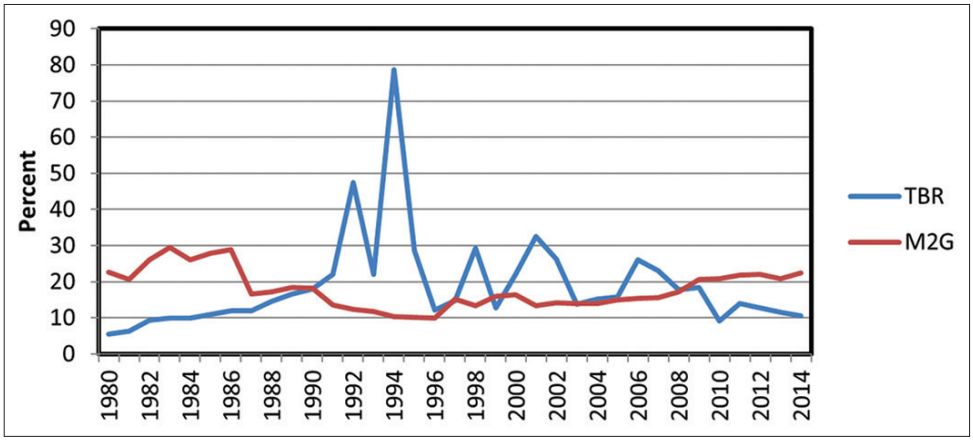
Following the successful completion of the poverty reduction growth facility arrangement with the IMF in June 2005, the executive board of the fund approved a successor three year programme for Sierra Leone. In September 2006, the IMF in collaboration with the government carried out a review of performance for the first half of 2006, in which government's financial performance was found to be satisfactory. Money supply (M2) grew slowly at a rate of 21.45% compared to 31.29% in 2005. The growth in M2 was not inconsistent with the expansion in M1 and commercial banks' deposits. The rise in M1 was due to the increase in currency in circulation and demand deposit. Moreover, credit to the private sector grew by 18.5% compared to 17.8% in 2005 (Tucker, 2004; 2005).

Conversely, inflation remained in the double digit; this was fuelled initially by the food and fuel prices, but reverted to the single digit in February 2009 in line with decline in international commodity prices. International reserves declined slightly but still represented over four months of import coverage at the end of December 2008. The financial sector was further deepened with the entry of more new banks, resulting in a surge in competition for government securities in an already oversubscribed market and thus bringing a downward movement in interest rate. The central bank introduced longer-term maturity treasury bills (6 months and 1 year) to develop its yield curve and enhance its capacity for monetary operations. The Bank also under the memorandum of understanding signed with Ministry of Finance in 2006, converted an additional Le 47.50 billion worth of nonnegotiable noninterest bearing securities into tradable securities for monetary operations. As a result of the above developments, monetary aggregates expanded with money supply (M2) and reserve money (RM2) growing by 22.5% and 10.2% respectively (BSL Annual Report). This expansion was driven mainly by the domestic credit to the private sector. Domestic credit to the private sector grew by 31.5% at end 2010.

Treasury bills rate were also high during the nineties hitting 47.5% in 1990, 50% in 1991 and 78% in 1992 respectively (Figure 1). These were the periods when inflation was high. Since then the treasury bills rates have been on the decrease as a result of a persistent decrease in inflation.

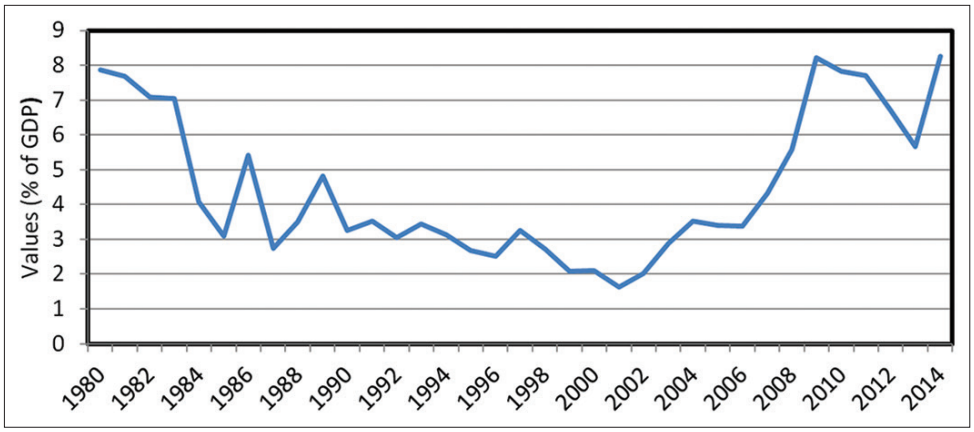
In view to determine the behavior of investment in the private sector of Sierra Leone, trend analysis is done (Figure 2), the general trend is downward in the eighties, till the 2000s where it finally starts to rise at a rate faster than the way it was declining. Interestingly, while the private investment as a share of GDP fall by 3% annually between 1980 and 2000, during the period 2002-2014 the trend shows an exponential rise with a complete reversal of it pattern, by growing yearly at a 4% rate which can largely be attributed to the privatizations and the stable macroeconomic environment the "Agenda for prosperity" plan attracted foreign capitals, the main constituent of this increase, and this was reflected

Figure 1: Trends in monetary indicators



Source: BSL and world development indicators

Figure 2: Trend in private investment in Sierra Leone (1980-2014)



Source: World development indicators

by an increment in foreign direct investment as a share of GDP of 7.3% annually between 2002 and 2014.

3. LITERATURE REVIEW

3.1. Theoretical Framework, the IS-LM Model

The IS-LM model presents a suitable model to explore the effects of monetary policy, while capturing the interplay of variables where private sector investment is determined by five key variables, which are money supply, interest rate, gross domestic saving, inflation and gross domestic debt. The IS curve shows combinations of interest rates and levels of output where planned spending equals income. Similarly the LM curve or money market equilibrium represents combinations of interest rates and levels of income where demand for real balances is equal to the supply. Along the LM curve, the money market is in equilibrium, Dornbusch et al. (2004). The IS curve is downwards sloping implying that a decrease in the interest rate increases the amount of investment spending resulting in increased aggregate demand and the level of output. At equilibrium, an increase in government expenditure will increase the level of aggregate demand, which raises output to meet the increased demand. The new equilibrium raises output from a rise in interest rates since the demand for investment funds increases; as a result interest rates rise in response. At this point the increase in government spending has resulted to a rise in interest rates which decreases the amount of investment spending by the private sector; hence the increase in government spending has crowded out private sector investment (Furceri, and Sousa, 2009). If interest rates remain unchanged subsequently government expenditure will lead to increased output and a new equilibrium level. When the goods market is at equilibrium, the money market is not because income has increased and the quantity of money demanded is higher resulting in surplus demand. Interest rates will be forced to rise unless there is corresponding increase in money supply. Monetary policy is accommodative of fiscal policy in the sense that money supply increases in order to stop interest rate from rising.

Moreover, in introducing an element of policy uncertainty as a factor that drives private investment, Alesina and Rodrik (1994) stated that when a policy reform is initiated, it is very unlikely that the private sector will see it as 100% sustainable. A number of reasons may be inferred, among them is the expectation that the political-economic configuration that sustained the previous policies may re-emerge. There is also the fear that unanticipated outcomes may lead to a reversal. Investors have to respond to the signals made by the reform for it to be successful.

Again, private investment is delayed by restrictions on investment financing. Ghosal and Loungani (1995) submitted that small and

medium enterprises are generally unable to finance their activities directly through open market debt. Hence, they resort heavily to the bank credit markets, which are also characterized by imperfections due to information asymmetry between lenders and borrowers. Developing countries are normally faced with the challenge of accessing credit due to the absence of futures market and poor access to long term financing.

3.2. Hypothetical Frameworks

The hypothetical framework entails a collection of the explanatory variables in explaining their interplay with the dependent variable. The framework does not however account for the external sector but rather specifies the internal (domestic) features of the variables.

3.2.1. H_1 money supply and private sector investment

Government borrowing supposedly reduces the amount of available domestic savings bringing upward pressure on the level of interest rates as the sale of treasury bills and bonds reduces money supply in circulation while government spending places the money back in circulation (Friedman, 1968). If Government spending equates borrowing it in effect reverts to the situation prior to the sale of treasury bills and bonds though with a higher domestic debt. Due in part to bureaucratic processes, government spending does not match the removal of money supply through the purchase of securities, prompting the growth of money supply from the central bank to cater for money demand from the public. In The framework, it is assumed that a positive relationship exists between the growth of money supply and private sector investment (Keynes, 1936), since the excess liquidity ensures that the supply of loanable funds is restored through money supply growth. The Keynesians involve a narrow transmission mechanism between money supply and changes in aggregate demand. When the money supply increases it will be spent on bonds, thereby lowering interest rates and ultimately leading to an increase in investment.

It is hypothesized that the change in money supply will cause a change in private sector investment.

$$H_1: \Delta PSI_{t+i}=\lambda_1 \Delta MS_t+\varepsilon_1 \quad (1)$$

ε_1 denotes an error correction factor. All other factors that can influence private sector investment are assumed to be included in this error correction factor. λ_1 denotes the slope and i denotes the time for the private sector of the economy to react to the changes. Therefore it can be hypothesized that this is a positive relationship i.e., λ is positive.

3.2.2. H_2 interest rate and private sector investment

Interest rate has a direct effect and negative relationship on private sector investment. When interest rates increase, private sector investment decreases because the loans will cost much more to repay therefore demand for credit by private sector falls and when interest rates fall then demand for credit rises as the cost of financing investments reduces (Friedman, 1978). While interest rates are set by the market in the case of the 91-day treasury bill rate as the benchmark rate, the central bank influences the direction of the benchmark rate through the availability of liquidity in the economy. It is therefore hypothesized that the change in interest rate will cause a change in private sector investment.

$$H_2: \Delta PSI_{t+i}=-\lambda_1 \Delta IR_t+\varepsilon_1 \quad (2)$$

ε_1 denotes an error correction factor. All other factors that can influence private sector investment are assumed to be included in this error correction factor. λ_1 denotes the slope and i denotes the time for the private sector of the economy to react to the changes. Therefore it can be hypothesized that this is a negative relationship i.e., λ is negative.

3.2.3. H_3 government gross domestic debt and private sector investment

In the framework, private sector investment is influenced by the amount of domestic debt borrowed by the government from the financial sector (Wray, 1989). Huge government borrowing of domestic savings reduces the availability of funds for private sector investment, which implies that a negative relationship exists between private sector investment and government borrowing.

It is therefore hypothesized that the change in gross domestic debt will cause a change in private sector investment.

$$H_3: \Delta PSI_{t+i}=-\lambda_1 \Delta GDD_t+\varepsilon_1 \quad (3)$$

ε_1 denotes an error correction factor. All other factors that can influence private sector investment are assumed to be included in this error correction factor. λ_1 denotes the slope and i denotes the time for the private sector of the economy to react to the changes. Therefore it can be hypothesized that this is a negative relationship i.e., λ is negative.

However in the long run, Lagged private sector investment is assumed to benefit from gross domestic debt that can be used to finance public investment such as road constructions, railways, telecommunications, electricity and other industrialized industries can as well raise private sector investment. In addition government spending transfers funds from public into some private sector increasing output and hence incomes.

3.2.4. H_4 inflation and private sector investment

Monetary policy should be tightened to achieve single digit inflation since investors both private and foreign may not be willing to invest in an environment with high inflation rate (Dobrinsky, 2005). The framework envisages an inverse relationship between inflation and private sector investment as increase in the rate of inflation may discourage private sector investment. It is therefore hypothesized that the change in interest rate will cause a change in private sector investment.

$$H_4: \Delta PSI_{t+i}=-\lambda_1 \Delta INF_t+\varepsilon_1 \quad (4)$$

ε_1 denotes an error correction factor. All other factors that can influence private sector investment are assumed to be included in this error correction factor. λ_1 denotes the slope and i denotes the time for the private sector of the economy to react to the changes. Therefore it can be hypothesized that this is a negative relationship i.e., λ is negative.

3.2.5. H_5 gross domestic savings and private sector investment

Gross domestic savings provide the basis for sustained long-term private sector investment. Assuming no foreign inflows means that government savings and private sector savings determine the investment–savings nexus. The growth of gross domestic savings is assumed to be responsible for capital accumulation and indirectly the productivity of labour, the real savings interest rate is further considered to be positively related to changes in gross domestic savings (Aghion et al., 2006). It is hypothesized that the change in gross domestic savings will cause a change in private sector investment.

$$H_5: \Delta PSI_{t+i}=\lambda_1 \Delta GDS_t+\varepsilon_1 \quad (5)$$

ε_1 denotes an error correction factor. All other factors that can influence private sector investment are assumed to be included in this error correction factor. λ_1 denotes the slope and i denotes the time for the private sector of the economy to react to the changes. Therefore it can be hypothesized that this is a positive relationship i.e., λ is positive.

4. METHODOLOGY

4.1. Empirical Framework

The model uses ordinary least squares (OLS)-estimates as this is a very regular estimation technique used in econometric analysis and its estimates, according to the Gauss-Markov theorem, are the "Best Linear Unbiased Estimates" (BLUE) once certain criteria are satisfied. The time series properties of the variables are examined in the process. The methodology therefore involves estimating an econometric model where the impact of monetary policy on private sector investment in Sierra Leone is investigated.

In this study, we have regressed private sector investment on its explanatory variables through the following procedures: Testing for stationarity properties of the variables using the augmented Dickey Fuller (ADF) and Phillip-Perron (PP) unit root tests, followed by Johansen's co-integration test to verify for the existence of co-integrating and long run relationships. Consequently the vector error correction model (VECM) is employed to estimate the error correction term. Finally, diagnostic and stability test were also carried out to determine the robustness of the model adopted and the stability of the parameters respectively.

4.2. Empirical Model Specification

Following the IS-LM model such as the Keynesian IS-LM function, it is clearly vision that money supply is an important determinant of private sector investment. Our empirical model specification for estimating the impact of monetary policy on private sector investment specifies money supply and other key determinants of private sector investment as commonly suggested in the IS-LM literature. Thus, in deriving our empirical model for estimating this relationship for Sierra Leone, we posit that:

$$Y=F(QR) \quad (6)$$

Where Y denotes private sector investment and Q and R are vectors of monetary policy instruments and other private sector investment determining variables respectively as established in the empirical literature. The Keynesian IS-LM model in particular emphasizes in general the importance of policy (both monetary and fiscal) for promoting private sector investment. On this basis, the above theoretical model motivates the general empirical IS-LM model for the time series regression, which is specified as follows:

$$PSI_t=\alpha+\beta Q_t+\gamma R_t+\varepsilon_t \quad (7)$$

Where PSI is private sector investment, and Q and R are as previously defined. ε_t is the error term where the independent variables are uncorrelated with the error term, cov (ε_t QR) = 0, while subscript t denotes time. Critical component of monetary policy for private sector investment of developing countries comprise money supply and interest rate.

$$\text{Thus } Q=F(MS, IR) \quad (8)$$

Where MS denotes money supply and IR denotes interest rate which is a proxy of bank lending rate. This assumes that IR, which constitutes treasury bills rate (i.e., the benchmark rate on which interest on other government securities are determined through auction as a measure of interest rate) is crucial for the conduct of an effective monetary policy that can enhance private sector investment.

As found in the literatures, other determining factors for private sector investment considered as control variables include:

$$R=F(GDS, INF, GDD) \quad (9)$$

Where GDS denotes gross domestic saving, INF denotes inflation and GDD denotes government gross domestic debt. Hence, substituting Equation (8) and (9) in (7), provides our detailed empirical private sector investment model as:

$$PSI_t=\alpha+\beta (MS, TBR)_t+\gamma (GDS, INF, GDD)_t+\varepsilon_t \quad (10)$$

Simplifying yields:

$$PSI_t=\beta_0+\beta_1 MS_t+\beta_2 TBR_t+\beta_3 GDS_t+\beta_4 INF_t+\beta_5 GDD_t+\varepsilon_t \quad (11)$$

Since our interest is to examine the changes in monetary policy and private sector investment, natural logarithm of the first difference has been taken for each variable to estimate the elasticity (degree of responsiveness) of private sector investment with respect to money supply, Treasury bill rate, gross domestic saving, inflation and government gross domestic debt. In other words, the parameters will show the percentage change in the dependent variable given a percentage change in the independent variables:

$$\Delta \ln PSI_t=\beta_0+\beta_1 \Delta \ln MS_t+\beta_2 \Delta \ln TBR_t+\beta_3 \Delta \ln GDS_t+\beta_4 \Delta \ln INF_t+\beta_5 \Delta \ln GDD_t+\varepsilon_t \quad (12)$$

Where β_0 is a constant, β_1-β_5 are parameters to be estimated and ε_t is the error term which is a white noise process described as: $E(\varepsilon_t)=0$; $E(\varepsilon^2_t)=\delta^2$; $E(\varepsilon_t \varepsilon_\tau)=0$ for which $t\neq\tau$. The A priori expected signs of the coefficients in Equation (12) are: $\beta_1>0$; $\beta_2<0$; $\beta_3>0$; $\beta_4<0$; $\beta_5<0$.

The model is estimated with the aid of E-views 7.2 software. Data were sourced from the international financial statistics (2015) data base and World Development Indicators (WDI).

5. ESTIMATION TECHNIQUES AND EMPIRICAL RESULTS

At this point, the time series properties of the variables are examined. Given that the study involves the use of co-integration and ECM, a few words regarding these are in place. It is a standard practice for every valuable research that requires the use of econometric technique to underscore the importance of exploring the data generating process that is fundamental to the variables before estimating the parameters and carrying out various hypothesis testing. This procedure is meant to avoid the problem of spurious regression results.

5.1. Unit Root Tests

In compliance with recent development in macroeconomic time series modeling, unit root tests of the variables in the model were executed to determine their time series properties. The order of integration of each series was established using the ADF and PP tests. The ADF test equation is given as:

$$\Delta x_t=\alpha+\delta x_{t-1}+\sum\delta_i\Delta x_{t-1}+\delta_m\Delta x_{t-m}+\varepsilon_t \quad (13)$$

$$\Delta x_t=\alpha+\beta_t+\delta x_{t-1}+\sum\delta_i\Delta x_{t-1}+\delta_m\Delta x_{t-m}+\varepsilon_t \quad (14)$$

Equation (13) includes an intercept and no trend, while Equation (14) includes intercept and time trend. α_0 is a constant, δ is a coefficient of autoregressive process, Δ is the difference operator, t is a time trend, x_t is the variable under consideration, m is the number of lags and ε_t is the stochastic error term. The lagged differences of the variables are augmented to the test model in order to mitigate autocorrelation problems in the disturbance term. The Akaike information criterion and Schwarz Bayesian Criterion are used to determine the optimal lag length m in the above equations.

The PP test equation is similar to the ADF test but the lag m, is omitted to adjust for the standard error in view to correct for heteroskedasticity and autocorrelation. Consequently The PP test equation is specified as:

$$\Delta x_t=\alpha+\beta_t+\delta x_{t-1}+\sum\delta_i\Delta x_{t-1}+\varepsilon_t \quad (15)$$

The tests rely on rejecting the null hypothesis of a unit root (the series are non-stationary) in favor of the alternative hypothesis of no unit root (the series are stationary). If the absolute values of the ADF and PP test statistics are greater than the critical values, we reject the null hypothesis of non-stationary and conclude that the series is stationary. On the other hand, if the absolute values of the ADF and PP statistics are less than the critical values, we fail to reject the null hypothesis and conclude that the series is non-stationary. These tests results are presented in Table 2.

The unit root test result for both the ADF and PP tests reveal that all the variables in the private sector investment equation were non-stationary at their level but became stationary at first differencing. Thus the variables are integrated of order one, denoted as I(1). This suggests the use of co-integration analysis since the concept of co-integration requires variables must be integrated of same order. The graphs of the series shown in Appendix A and B also confirm that the series are non stationary in levels but stationary at first difference.

5.2. Cointegration Tests

After validating that the series are integrated of order one denoted as I(1), it is now feasible to check for cointegration between private sector investment and monetary policy via the Johansen's multivariate framework. The Johansen cointegration test is carried out in view of a vector autoregressive model (VAR) of the form:

$$\Phi(Z)X_t=\Psi_t \quad (16)$$

Where $X_t=[Q_t, R_t]'$, $\Phi(Z)$ denotes the long run multiplier matrix, Φ denotes coefficients of the short run dynamics and Z denotes a lag operator. When two or more series are non-stationary, it is imperative to examine whether their linear combination is stationary. This observable fact is known as cointegration test. The presence of cointegration implies that there exists a long run relationship among the variables in the model. The idea behind the presence of cointegration is that even though monetary policy instruments and private sector investment may develop over time, a stable cointegration equilibrium relationship must exist between them. Particularly a monetary policy is sustainable if the variables do not drift too far apart over the long run. In other words, the variables can deviate from each other over the short run but monetary policy and/or market forces restore them back over the long run.

In determining the number of co integrating vectors in the regression model, we utilized the Johansen likelihood ratio test procedure. This technique enables us to test for the presence of non-unique cointegration relationships. The use of two statistical tests i.e., the trace test and the maximum Eigen value test statistics were suggested. The trace test (λ_{trace}) is defined as:

$$\lambda_{trace}(r)=-T\sum_{j=i+1}^{n}\ln(1-\hat{\lambda}_i) \quad (17)$$

Whereas the maximum Eigen value tests (λ_{max}) is defined as:

$$\lambda_{max}(r,r+1)=-T\ln\left(1-\hat{\lambda}_{r+1}\right) \quad (18)$$

Where T=Number of usable observations
λ_i=Eigen values or estimated characteristics root
λ_{trace} test the null hypothesis
r=0 against the alternative of r>0
λ_{max} test the null hypothesis
r=0 against the alternative of r=1.

If the null hypothesis of no co-integrating vector is rejected, it indicates that there is a long-run relationship among the variables in the model. These tests results are presented in Tables 3 and 4.

Table 2: Results of unit root tests

Variable	ADF test statistics				
	Level/Δlevel	Lag length	With intercept	With intercept & trend	Inference
lnPSI	Level	1	−1.728266	−1.754340	I(1)
	Δlevel	1	−6.628547**	−7.177042**	
lnMS	Level	1	−1.593142	−1.363449	I(1)
	Δlevel	1	−6.137639**	−6.210215**	
lnTBR	Level	1	−2.432694	−2.840828	I(1)
	Δlevel	1	−6.011744**	−6.154412**	
lnGDS	Level	1	−3.556986	−3.605498	I(1)
	Δlevel	1	−8.644862*	−8.504350*	
lnINF	Level	1	−2.229181	−3.383709	I(1)
	Δlevel	1	−6.788202**	−6.711879**	
lnGDD	Level	1	−0.719389	−2.634844	I(1)
	Δlevel	1	−7.841317**	−7.745813**	
			PP test statistics		
lnPSI	Level		−1.686584	−1.488825	I(1)
	Δlevel		−6.633925**	−7.472036**	
lnMS	Level		−1.630652	−1.279410	I(1)
	Δlevel		−6.138814**	−6.210599**	
lnTBR	Level		−2.463795	−2.296392	I(1)
	Δlevel		−5.155124**	−5.254505**	
lnGDS	Level		−3.563928	−3.593918	I(1)
	Δlevel		−8.694861*	−8.550712*	
lnINF	Level		−2.195523	−3.383709	I(1)
	Δlevel		−7.566738**	−7.385315**	
lnGDD	Level		−0.480602	−2.624093	I(1)
	Δlevel		−8.076083**	−8.029597**	

**and *indicate that the variable is stationary at the 1% and 5% level of significance respectively

Table 3: Results of the Johansen's test of cointegration (trace)

Hypothesized number of CE(s)	Eigen value	Trace statistic	0.05 critical value	P**
None*	0.786381	121.8092	95.75366	0.0003
At most 1*	0.556367	70.87174	69.81889	0.0411
At most 2	0.487350	44.05071	47.85613	0.1089
At most 3	0.365376	22.00135	29.79707	0.2984
At most 4	0.190923	6.995515	15.49471	0.5782
At most 5	0.000124	0.004098	3.841466	0.9477

Trace test indicates 2 cointegrating equationn (s) at the 0.05 level. *Denotes rejection of the hypothesis at the 0.05 level, **MacKinnon-Haug-Michelis (1999) P values

Table 4: Results of the Johansen's test of cointegration (maximum Eigen value)

Hypothesized number of CE(s)	Eigen value	Max-Eigen statistic	0.05 critical value	P**
None*	0.786381	50.93746	40.07757	0.0021
At most 1	0.556367	26.82103	33.87687	0.2730
At most 2	0.487350	22.04936	27.58434	0.2178
At most 3	0.365376	15.00584	21.13162	0.2885
At most 4	0.190923	6.991417	14.26460	0.4902
At most 5	0.000124	0.004098	3.841466	0.9477

Max-Eigen value test indicates 1 cointegrating equation (s) at the 0.05 level. *Denotes rejection of the hypothesis at the 0.05 level, **MacKinnon-Haug-Michelis (1999) P values

The co-integration test result for the trace test shows two co-integrating equations at the 5% significance level while the maximum Eigen test shows one co-integrating equation. Consequently, there exists long-run equilibrium relationship between private sector investment and the explanatory variables. We therefore fail to reject the null hypothesis of no long run equilibrium relationship between monetary policy variables and private sector investment. The result of the normalized cointegration equation is presented in Table 5.

The result of the normalized private sector Investment equation shows that money supply has a positive effects on private sector investment in Sierra Leone whereas treasury bill rate gross domestic savings, inflation and gross domestic debt, have negative effects on private sector investment. The elasticity shows that private sector investment is more positively responsive to money supply than the rest, and is more negatively responsive to inflation than gross domestic savings and gross domestic debts. The private sector investment elasticity for money supply, treasury bill rate, gross domestic savings, inflation, and gross domestic debts are 0.48, −0.13, −0.19, −0.22, and −0.10 respectively (Table 5).

5.3. ECM

The VECM is a restrictive VAR that can be used to estimate non-stationary time series that were identified to be co-integrated. It is designed in such a way that, it restricts the long-run behavior of the independent variables to meet to their co-integrating relationship and at the same time allow for short-run correction.

Granger (1986) have shown that any co integrated series has an error correction representation that covers both long run equilibrium and short run adjustment process. This underscores an important correspondence existing between co-integration

Table 5: Normalized long run cointegrating equation

lnPSI	lnMS	lnTBR	lnGDS	lnINF	lnGDD
1.000000	0.480393 (0.15216)	−0.130064 (0.06451)	−0.186996 (0.11803)	−0.215969 (0.03222)	−0.104382 (0.01390)

Source: Computed by authors using E-views 7.2 software. Values in parenthesis are standard errors

and error correction mechanism. Error correction mechanism represents a systematic disequilibrium adjustment process through which X and Y are prevented from "drifting too far apart." The ECM can be presented thus:

$$\Delta y_t=\delta_1(L)\Delta y_{t-1}+\text{Ơ}_1(L)\Delta X_t+\gamma_1 Z_{t-1}+\varepsilon_{1t} \quad (19)$$

Where Z_t is the ECM variable in equation 19 and it is tested for the significance of Z_{t-1}: i.e., $\gamma_1<0$.

Substituting Equation (12) into Equation (19) in incorporating the error correction term to reflect the short run dynamics yields:

$$\begin{aligned}\Delta \ln PSI_t &= \beta_0+\sum_{i=1}^{q}\beta_1\Delta\ln PSI_{t-1}+\sum_{i=1}^{q}\beta_2\Delta\ln MS_{t-1}\\ &+\sum_{i=1}^{q}\beta_3\Delta\ln TBR_{t-1}+\sum_{i=1}^{q}\beta_4\Delta\ln GDS_{t-1}+\\ &\sum_{i=1}^{q}\beta_5\Delta\ln INF_{t-1}+\sum_{i=1}^{q}\beta_6\Delta\ln GDI_{t-1}+\lambda ECM_{t-1}+\varepsilon_t\end{aligned} \quad (20)$$

Where Δ is the first difference operator, q is the lag length, λ is the speed of adjustment and ECM_{t-1} is the lagged error term and all other variables are as previously defined.

The results of the short run dynamic model are reported in Table 6. The coefficient of the error correction term indicates the speed of adjustment in eliminating deviation from the long run equilibrium. The coefficient has the expected negative sign (−0.19) and it is statistically significant at the 5% level. The significance of the coefficient further confirms the existence of the long run relationship between private sector investment and the I(1) variables under consideration. The magnitude of the coefficient implies that nearly 19% of the disequilibrium in the previous year's shock adjusts back to long run equilibrium in the current year.

The specific objective related to money supply and private sector investment was to evaluate the effect money supply had on private sector investment. The result in Table 6 above shows that the coefficient representing money supply has a statistically significant positive effect on private sector investment, which implies that an increase in money supply will induce private sector investment. Since both variables are moving in the same direction, this validates the hypothesis that money supply positively affects private sector investment. This finding is in line with the IS-LM theory that expansionary monetary policy (increase in money supply) promotes private sector investment via interest rate reduction. Using different technique, Tarawalie (2010) found similar result for Sierra Leone.

Unlike money supply, the coefficient representing interest rate that has been proxied by treasury bill rate is negative and statistically significant at the 5% level implying that an increase in interest rate will impede private sector investment. The negative relationship between interest rate and private sector investment is not surprising because when interest rates increases, the loans will cost much more to repay therefore demand for credit by the private sector falls. It can also be the case that, the higher the interest rate the higher the cost of capital, which in turn reduces returns on investment.

Another objective that has been specified by the study is to establish the effect of gross domestic savings on private sector investment with the assumption that, gross domestic savings increases private sector investment. From the result in Table 6 above, the coefficient representing gross domestic savings is positive and statistically significant at the 5% level, which by implication, an increase in gross domestic savings will enhance private sector investment. Since both variables are moving in the same direction, it validates the assumption that gross domestic savings positively affects private sector investment.

Inflation is however found to be insignificant in the ECM depicted by its probability value (15.1%) but has got a negative relationship with private sector investment. As for government gross domestic debt, its coefficient is negative and highly statistically significant at the 1% level. This implies that an increase in government gross domestic debt will hinder private sector investment. As both variables are moving in an opposite direction, this validates the hypothesis that government gross domestic debt negatively affects private sector investment. This result reveals that increase in government gross domestic debt may in consequence crowd out private sector investment. The existence of a negative relationship or a crowding out effect is in line with findings by Mitra (2006), and Adelenga and Radzewicz-Bak (2009).

Overall, the regression results fail to reject the hypothesis of the study. The adjusted R^2 is 0.502483, implying that 50.2% of the variation in private sector investment is explained by the independent variables, which is an indication of a very good fit. In comparison to the R^2, the adjusted R^2 is better and more precise good fit measure because it allows degree of freedom to sum of squares therefore even after addition of new independent variable(s) the residual variance does not change. The Durbin Watson statistic (2.035) indicates the absence of autocorrelation among the variables. The overall equation is highly statistically significant as shown by the probability value of the F-statistic (0.002068).

5.4. Diagnostic and Stability Tests

For any research work to be meaningful, its analytical tool must be exemplified and its model free from been a spurious one. The diagnostic test result reported in Table 7 helps to give a clearer picture on how this is justified. In ensuring that the OLS-estimates

Table 6: Parsimonious ECM of private sector investment

Variable	Coefficient	Standard error	t-statistic	P
Constant	0.037590	0.047893	0.784872	0.4399
ΔlnMS	0.282595	0.117111	2.413056	0.0229
ΔlnTBR	−0.026977	0.011213	−2.405762	0.0317
ΔlnGDS	0.115408	0.047722	2.418324	0.0310
ΔlnINF	−0.352284	0.237835	−1.481214	0.1510
ΔlnGDD	−0.048412	0.010996	−4.402537	0.0001
ECM(−1)	−0.192488	0.060092	−3.203218	0.0069
Diagnostics tests				
R^2	0.705337	Mean dependent variable		0.038429
Adjusted R^2	0.502483	S.D. dependent variable		0.048945
S.E. of regression	0.048305	Akaike info criterion		−3.160207
Sum squared residual	0.067669	Schwarz criterion		−3.067692
Log likelihood	50.98321	Hannan-Quinn criteria		−3.130049
F-statistic	3.102137	Durbin-Watson stat		2.035390
P (F-statistic)	0.002068			

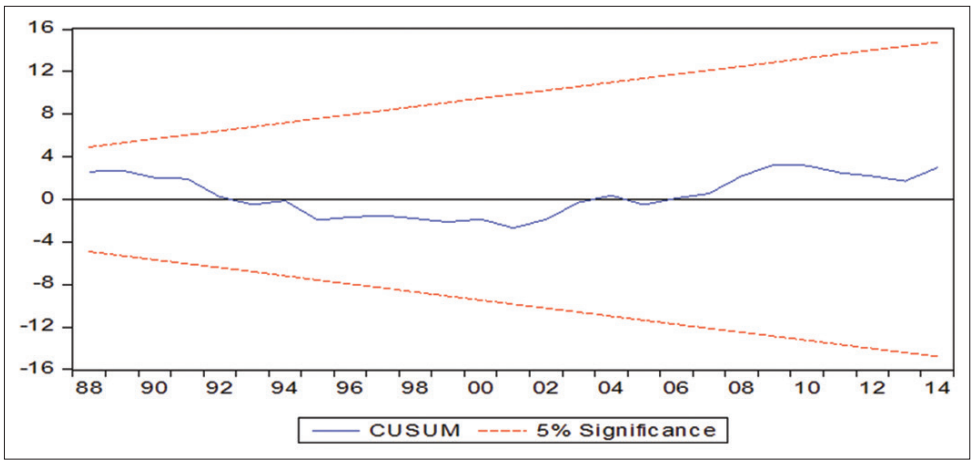
Source: Computed by authors using E-views 7.2 software. ECM: Error correction model

Table 7: Diagnostic test results

Test type	Statistic	P
Normality test (Jarque-Bera statistics)	Jarque-Bera statistics=0.372354	P=0.830127
Serial correlation (Breush-Godfrey serial correlation LM test)	F-statistics=0.394169	Prob. chi-square=0.4717
ARCH test (autoregressive heteroskedasticity test)	F-statistics=1.799933	Prob. chi-square=0.1783
Heteroskedasticity test (Breush-Pagan-Godfrey)	F-statistics=0.462417	Prob. chi-square=0.7838
Model specification test (Ramsey RESET test)	F-statistics=0.766814	P=0.3899

Source: Computed by authors using E-views 7.2 software

Figure 3: Plot of cumulative sum



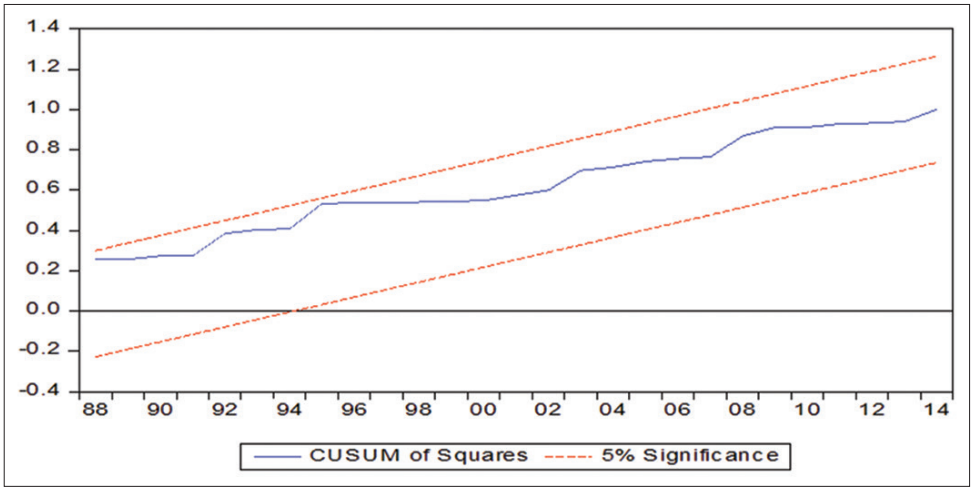
of the model via the diagnostics tests are BLUE, we verify from the various test conducted that the error term is normally distributed, no autocorrelation in the error term, no heteroscedasticity in the variance of the error term and no misspecification of the model. The test for parameter stability is also executed at this point by plotting the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ) to verify whether the coefficients of the estimated model are stable over the period of study.

The diagnostic test recommends good fit of the model. The model does not suffer from the problems of non-normality of the errors, serially correlated errors, ARCH effect, heteroskedasticity and functional form misspecification which further affirm that the estimation is BLUE. With regards stability test, the results of both the CUSUM and CUSUMQ plots lie within the 5% critical band width which validate the stability of the coefficients of the variables over the study period (Figures 3 and 4).

6. CONCLUSIONS AND POLICY RECOMMENDATIONS

Private sector investment/development has become an increasingly significant engine for the government of Sierra Leone in promoting economic growth and enhancing job creation, and monetary policy is one of the main economic management tools that governments use to shape economic performance. The study has therefore presented an investigation on the effect of monetary policy on private sector investments in Sierra Leone for a period of 34-year (1980-2014). The study followed an econometric approach where

Figure 4: Plot of cumulative sum of squares



various tests were conducted in order to avoid spurious regression results. Private sector investment has been used as the dependent variable and money supply, interest rate, gross domestic savings, inflation and gross domestic debt as independent variables. All the variables were found to be stationary after first differencing. The Johansen co integration technique is adopted to estimate the long run relationship. The test suggest that there exists a unique cointegrating relationship between private sector investment and our measure of monetary policy, which is further confirmed by the negative and statistically significant coefficient of the lagged error correction term in the parsimonious ECM. The magnitude of the coefficient implies that 19% of the disequilibrium caused by previous year's shocks converges back to the long run equilibrium in the current year. The plots of both the CUSUM (Figure 3) and CUSUMSQ (Figure 4) tests suggest the existence of a stable relationship between monetary policy and private sector investment/development.

The ECM suggests that money supply and gross domestic saving exert a positive and significant effect on private sector investment whilst interest rate and gross domestic debt exert a negative one. The positive and significant relationship is an indication that the variables are moving in the same direction and the negative relationships show an inverse movement.

The study has unearthed the importance of private sector investment/development via a robust monetary policy in influencing inclusive growth in Sierra Leone. The findings indicate that private sector investment can be stimulated by the implementation of both long run and short run monetary policies to ensure development of the private sector. Therefore, the policy implications for enhancing private sector investment will be for policy makers to facilitate the establishment of financial institutions to increase credit delivery to the private sector especially in rural areas with limited access to financial services, create the enabling environment for efficient allocation of credit to the private sector through the adoption of reforms to strengthen the rights of creditors and enforce commercial contracts, and strengthen the operations of the Sierra Leone Stock Exchange, which serves as a source of short and long term finance for investment.

However this research has only examined the relationship between monetary policy and private sector investment in Sierra Leone. Further research direction is therefore to expand the area of analysis by exploring the causality between monetary policy and private sector investment.

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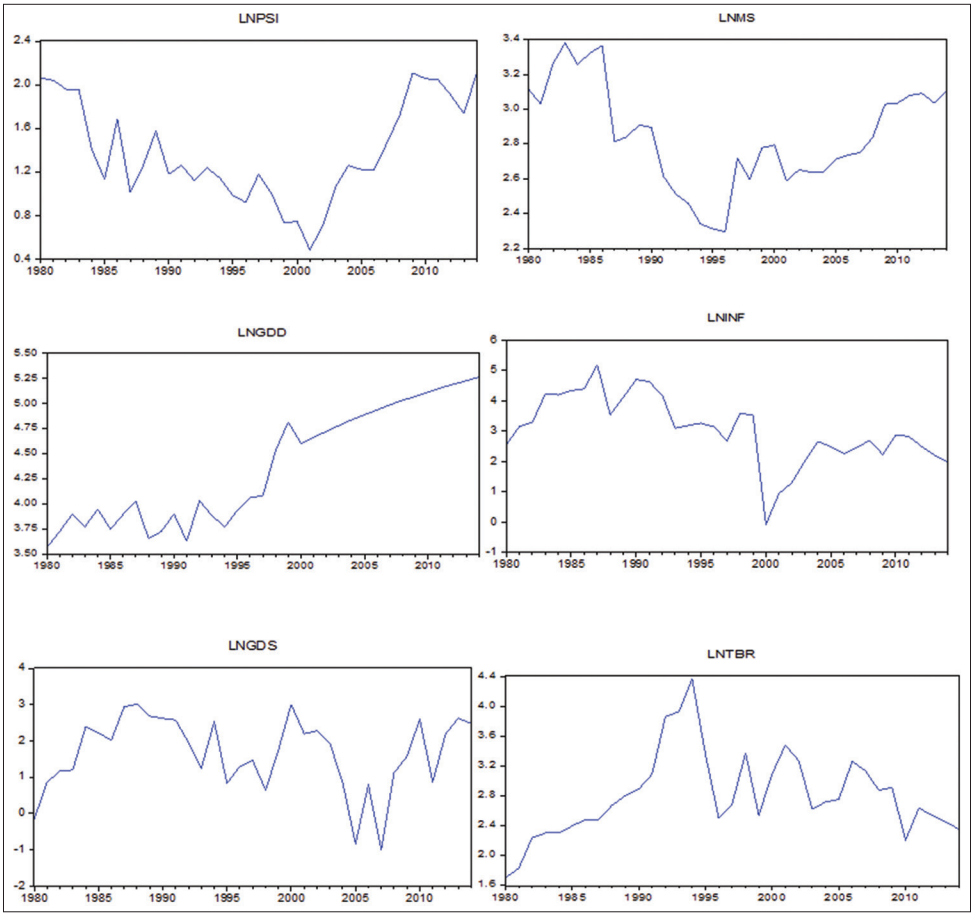
APPENDIX

Appendix Figures

Appendix A: Non-stationary in levels



Appendix B: Stationary at first difference