Determinants of Non-Performing Loans in Uganda's Commercial Banking Sector.

Sunday Nathan[*], Mukisa Ibrahim[**] and Mwebaze Tom[***]

Abstract

Over the past decade, Non-Performing Loans (NPLs) in Uganda's commercial banking industry have exhibited a positive trend, in spite of the reforms undertaken in the industry. The continued increase in NPLs has not only affected credit growth, but also resulted in the collapse and closure of some commercial banks. Against this backdrop, it was necessary to understand the determinants of NPLs in Uganda's commercial banking sector. To execute the study, quarterly data for the period 2002q1 to 2017q2 was analyzed using ARDL and bounds test techniques while controlling for both bank-specific and macroeconomic factors. The findings of the study indicate that NPLs increase with increase in lending rates, real effective exchange rate and unemployment rate while increase in returns on assets and GDP growth rate lower NPLs. Based on the findings, commercial banks are advised to diversify their asset portfolio by holding other income earning assets such as governments bonds, equity so as to reduce on credit risk exposure. In addition, commercial banks need to focus more on internationally competitive sectors. Measure that reduce lending rates, promote GDP growth, reduce unemployment would also serve to reduce NPLs.

Key words: Commercial Banking sector, Non-performing loans, ARDL, Uganda**.**

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[*]Economic Policy Research Center,Email: nsunday@eprcug.org,Tel: +256785085697

[**]Makerere University, Email: mukisaibrahim@yahoo.com,Tel: +256772632147

[***]Email: Makerere University,Email: tm2001ug@gmail.com,Tel: +256772467561

1. Introduction

The banking sector is very instrumental in economic growth process of any country. It plays a key role of administering the payment system and intermediating between savers and borrowers. In Uganda, the Banking sector has remained important for provision of financial intermediary services such as mobilization of savings, risk management, and diversification of risks. Through provision of short term, medium term and long term loans, the banking sector has also been crucial in promoting investments in areas of construction, agriculture and manufacturing. The sector has also been important in facilitating trade through provision of services such as bank drafts, cheque, bills of exchange and credit cards. Implementation of government monetary policy has also be aided by the banking sector.

The banking sector in Uganda is dominated by commercial banks, whose major activity is receiving deposits and providing loans. Lending being the major source of income for these commercial banks, various types of loans (such as; business loans, mortgages, auto loans, personal loans, agricultural loans, salary loans) have been introduced. While conducting the lending activities, commercial banks in Uganda are faced with the risk of default where by some individuals and companies are unable to meet their debt payment obligations on time. Some individuals are unable to pay completely while others are only able to pay a fraction of the loan which has resulted into accumulation of NPLs. According to data from Bank of Uganda, non-performing loans as a percentage of total gross loans in Uganda's commercial banking sector increased from 2.8% in 2006 to 4.2% in 2012 and later increased to 10.5% by the end of 2016.

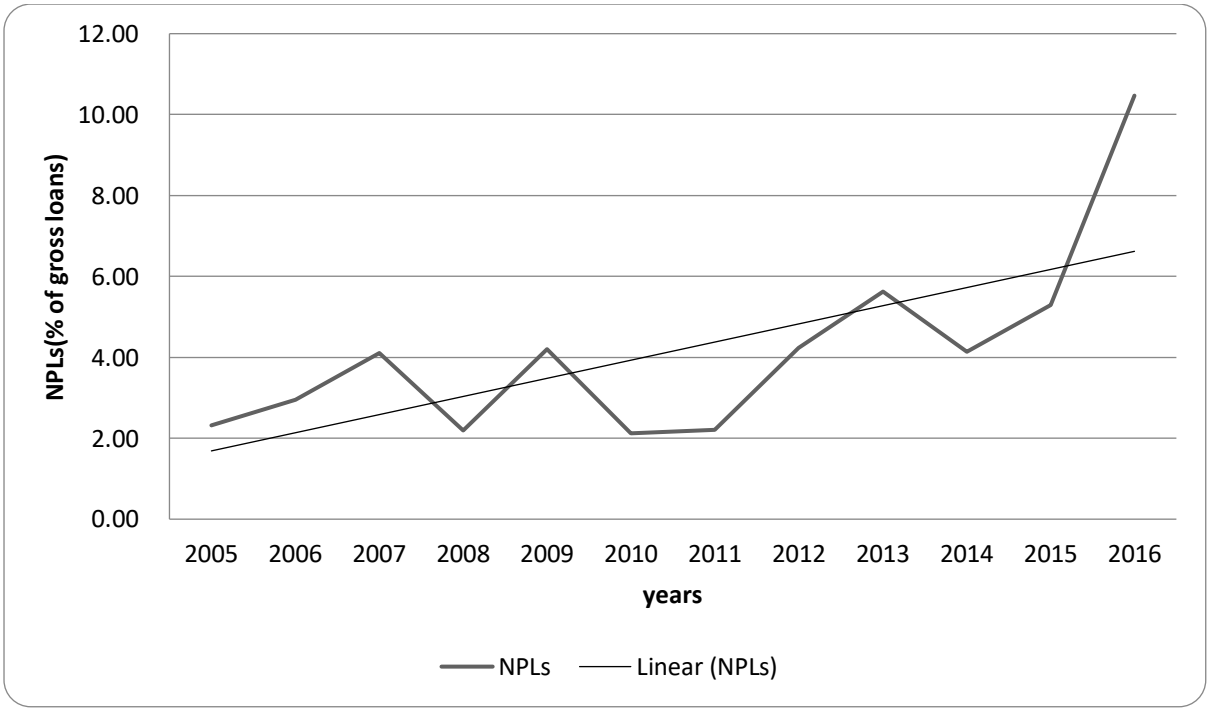

Figure 1: The trend of NPLs in Uganda's Commercial Banks

Source: Author's own construction based on data from Bank of Uganda

As shown in figure1 above, NPLs in Uganda have experienced a positive trend over the years under review. The problem of NPLs in Uganda has been exacerbated by the fact that banks find it difficult to realize the value of the loan collateral in the property market (Bank of Uganda, Annual Supervision Report, 2016).

This continued increase in NPLs is has had a number of adverse effects on the sector. For example, the fall in the profits of the industry. Bank of Uganda reported that for the year June 2013 to June 2014, when NPLs increased from 4.0% to 5.8%, annual after tax profits for the banking sector reduced from Ush.498.1 billion shillings to Ush.358.8 billion (representing 28% reduction in profits). From June 2015 to June 2016 when the highest increase in NPLs was reported (from 4.0% to 8.3%), annual after tax profits reduced from Ush.556.3 billion to Ush.485.6 billion (44.2 % reduction) in the same period.

According to Bank of Uganda, the continued increase in NPLs has also been responsible for the closure of some commercial banks such as;Teefe Bank (1993), International Credit Bank Ltd (1998), Greenland Bank (1999), Co-operative Bank (1999), Global Trust bank (2014) National Bank of Commerce which was solid to Crane bank in 2012 and Crane Bank[1] itself, which was taken over by the central bank in October 2016 and later sold to Development Finance Company of Uganda (DFCU) bank in February 2017. The increase in non-performing loans has also had adverse effects on bank's lending behaviors leading to decline in credit growth. For instance, thereduction in loan growth in the year 2011 to 2012 from 13.7% to 3.2% and the year 2015 to 2016 from 19.7% to 3.7% (BoU; ASR, 2016). The decrease in credit growth is due to the fear of making losses arising from accumulation of NPLs which can easily lead to insolvency of the bank.

Furthermore, literature has it that NPLs negatively affects economic growth. According to Zeng (2012), accumulation of NPLs traps resources in unproductive ventures, making it difficult for commercial banks to fund new and economically viable ventures. The setting aside of funds to cover potential losses expected from granted loans leads to financial disintermediation, hence limiting financial deepening which in turn hinders economic growth (Caprio and Klingebiel, 2002). In addition, defensive actions undertaken by commercial banks (inform of credit rationing) hinder access to credit by even viable projects which limits the ability of the overall economy to grow. There is also the cost implication of outsourcing recovery or setting up enhanced units to track problem loans which increases the operating costs of the banks (Zeng, 2012).

In the bid to minimize NPLs and improve the performance of commercial banking sector in Uganda, a number of reforms have been undertaken. Key among these was the significant restructuring of the sector that took place in the late 1990s and early 2000s. As result of restructuring, a number of banks that were considered insolvent were taken over by the central bank and eventually sold off (Mukokoma, 2012). All the banks that were closed were believed to be having tremendous levels of NPLs (Odeke&Odongo, 2014).Another important reform was the introduction of credit reference bureau (CRB) in 2005. The role of Credit Reference Bureauwas to reduce information gap between lenders and borrowers by; providing timely and accurate information on the debt profiles of the borrowers,and repayment history. It was believed that the

[1]Crane bank's non- performing loans increased by 122.9% from shs19.36 billion to shs142.3billions in only one year, 2014 to 2015.

CBRs would reduce default rates since borrowers would want to protect their reputation by meeting obligations in timely manner (Mutebile, 2008).

Besides credit reference bureaus, there has also been an introduction of prudential guidelines, making banking industry one of the most highly regulated. For instance in 2005, Bank of Uganda introduced minimum core capital requirement of 8% of risk weighted assets and a total capital of not less than 12% of the total risk adjusted assets. In line with the agreements signed by the central banks of the East African Community, the minimum core capital requirement was further raised to 10% by December 2016 (BoU, 2016).

Despite all the reforms undertaken in banking sector, non-performing loans have remained high and continued to increase. As a ratio of total gross loans, NPLs increased from 2.3% in 2005 to 4.2% in 2009, which then increased to 5.6% by the end of 2013, before shooting to a record figure of 10.5% in 2016 (Bank of Uganda data). The trend exhibited by these NPLs puts the banking sector at a risk of systemic instability which in turn can harm the whole economy and thus retard economic growth. Given the above, it's therefore necessary to prevent the rise in NPLs. However, in order to achieve this, it's important to understand its root causes.

Available studies have mixed findings, for example, while Khemraj and Pasha (2009) find NPLsto increase with appreciation of the local currency, Jakubik and Reninger (2013)find appreciation of thecurrency to have a reducing effect on NPLs, in commercial banks. In case of Uganda, Nanteza (2015) only considered economic factors, moreover using a small sample (14 years). To the best of our knowledge, no study has considered both macroeconomic and bank-specific factors in the context of Uganda.

The contribution of the study is therefore twofold. First, it provides evidence of the determinants of NPLs in Uganda taking into account both macroeconomic and bank-specific factors while using the most recent data set spanning from2002q1 to 2017q2. Secondly, the study applies ARDL technique which allows us to isolate short run and long run impacts of the different factors.

The remainder of this study is organized as follows. Section 2 presents literature on the concept of NPLs, section 3 presents the theoretical framework adopted for the study, section 4 presents empirical model that was estimated, section 5 presents estimation procedure, section 6 presents empirical findings and discussion of the results, while section 7 provides the conclusion and policy recommendations.

2. Literature Review

From the theoretical perspective, NPLs can be explained by increase in lending rates, as discussed by the asymmetric information theory. According to this theory, high interest rate induces moral hazard and adverse selection problems in the credit markets. High interest rate scares way good borrowers, leaving the bank with a pool of highly risky borrowers thus leading to adverse selection. Regarding moral hazardbehaviour, high interest rate makes borrowers to choose projects that have high expected returns so as to raise the funds for repaying the loan. However such projects are associated with high risk of defaulting(Stiglitz and Weiss, 1981). Non-performing loans can also arise from a fall in prices (deflation). This argument is based on the debt deflationary theory advanced by Fisher (1933), which positsthat a deflation increases the real debt burden of the borrower, thus reducing their debt repayment capacity. The business cycle theory postulates that NPLs are counter cyclical, decreasing during a boom and increasing

during a recession. The explanation for such behavior for NPLs is that a recession is associated with lower real GDP growth rates and lower incomesthus reducing the borrowers'ability to pay the loans contracted. Moreover, lower GDP growth is associated with high unemployment rates which adversely affects people's incomes and demand for the firms' products.

Regarding empirical literature, different studies suggest different factors to be responsible for the increase in NPLs in various countries. For instanceKhemraj and Pasha (2009), found that increase in NPLs in Guyana are driven byincrease in the real effective exchange rate and lending rate.Whileon the other hand, improvement in the economic conditions tends to decrease non-performing loans.Using VECM, Fainstein and Novikov (2011)also argue that higher real GDP growth rate results into low levels of NPLs in the Baltic countriesstudied. The authors argue that increase in GDP growth increases people's incomes, thus increasing their debt repayment capacity.

While studying the Romanian banking sector, Vogiazas and Nikolaidu (2011), expounded more on the economic factors that drive NPLs, by showing that not only GDP growth matters but also factors such as investment expenditure, inflation rate, unemployment rate, country's external debt to GDP and broad money (M2)significantly influence NPLs. The study however did not find support for the bank-specific variables. Financial markets and interest rates indicators were found not to possess explanatory power when added to the baseline model. Besides the economic factor listed byVogiazas and Nikolaidu (2011),Nkusu (2011) adds that high interest rates, a fall in house prices and a fall in equity prices are associated with a rise in non-performing loans.

Based on the argument that NPLs for the lagged period tends to have an impact on the current value of NPLs, Ćurak*et al* (2013), adopted dynamic panel data techniques (GMM) and showed that nonperforming loans in South-Eastern European banking sectorvary inversely with returns on assets and economic growth. In addition, the study found that increase in real interest rate, inflation, and solvency of the bank, tend to increase NPLs while increase in the size of the bank results in lower levels of NPLs, suggesting that large banks are more efficient in screening loan applicants and monitoring their loan portfolios compared to their smaller counterparts. Contrary toKhemraj and Pasha (2009),the study did not find support for the view that appreciation of exchange rate is associated with an increase in NPLs.

Building on the previous studies, Beck, Jakubik and Piloui (2013) found more support for the inverse relationship between real GDP growth and NPLs. The findings of the study indicated that share prices, nominal effective exchange rate, and bank lending rate are the otherfactors that influence NPL ratio in the countries studied. The study, however revealed that direction of the impact of exchange rates depends on the extent to which banks lend in foreign currency to unhedged borrowers.

Whereas all the previous studies didn't compare the strength of the effect of bank specific factors and macroeconomic factors, Warue (2013), indicated that bank specific factors contribute more to NPLs performance compared to macroeconomic factors. In his analysis, Warue (2013) grouped the banks according to size, and ownerships. As a result, the study was able to isolate the impact of different factors according to bank size and ownership. For example, returns on assets (one of the most prominent factor in the literature) was found to matter only in small and large banks but not small banks. At the same time returns on assets was only significant in local and government banks but not foreign.Similar to Khemraj and pasha (2009), the author did not find any evidence linking banks asset size to NPLs levels across all bank categories in Kenya.

Among the variables found to have significant impact across all bank types and size was Per capita income.

Considering the Eurozone's banking systems for the period 2000-2008,Makri*et al* (2014)found support for the real business cycle where unemployment rate and GDP growth rate were found to be the key determinants of NPLs. On the other hand, returns on assets was the main bank specific determinant of NPLs. Specifically, the study found that increase in GDP growth and returns on equity have a decreasing effect on non-perfoming loans while increase in unemployment rate is associated with an increase in NPLs. Contrary to the findings of Ćurak*et al* (2013), this study, found that inflation rate does not have an impact on NPLs.

Considering Uganda, Nanteza(2015), examined the effect of economic factors on NPLs in Uganda's commercial banks, using amultiple linear regression model. In contrast to the empirical studies such as Khemraj and Pasha (2009) and Abid*et al* (2014), the study did not find any significant relationship between NPLs and economic factors. Precisely, the study found that exchange rate, inflation rate, interest rate and GDP growth do not have any significant impact on NPLs in Uganda's commercial banks. The author however attributed these results to the small sample that was used in the study.

Having explored the different techniques used in the empirical analysis, Ofori*et al* (2016) set out to assess the effect of bank specific factors on the loan performance in HFC bank using ARDL and bounds test technique. The author also found support for the argument that increase in lending rate reduces the borrower's ability to pay the loan. Increase in the loan to asset ratiowas also linked to excessive credit risk exposure, thus increasing NPLswhile increase in bank's loan loss provision over reserve was found to reduce NPLs. However, Contrary to Warue (2013)the study did not find any significant impact of returns on equity and inefficiency on non-performing loans.

Among the most recent studies is Fajar and Umanto (2017) who analyzed the determinants of NPLs using banks listed in Indonesia stock exchange for the period 2005q1 to 2014q4. Similar to Ćurak*et al* (2013), Fajar and Umanto (2017) also adopted dynamic panel data techniques (systems GMM) in the analysis. The results of the analysis indicate that, past value of non-performing loans positively contributes to the current value, thus confirming the bad loans are not immediately written off. The results further show that GDP growth rateincreases individuals' incomes while inflation reduces the real debt burden, all of which increase borrowers' ability to pay the loan. On the other hand, increase in operating cost was linked to increased inefficiency thus increasing NPLs.Contrary to the findings ofOfori*et al* (2016), the authors found that that interest rate have on impact to NPLs, whichthe authors attributed to the fact that many of loans have a middle to long term period arguing that, bank interest rate would only be significant for more than four years.

2.1 Summary of the literature

On the basis of the reviewed literature, there are mixed results with regards to the impact of different variables. With exception of GDP growth, no variables shows consistent effect across countries. Such mixed findings could be attributed to the variation in the economic environment, the methodology and the data used. Another important thing to note is the fact that most of the studies apply panel data techniques. Such studies are either cross country or use bank level data.
For the case of Uganda, the findings of the study conducted by Nanteza (2015) implies that economic factors are not very important in explaining the problem. Moreover this study only

considered four factors ignoring other economic factors such as unemployment, debt to GDP ratio, which have been found to have a significant impact on loan performance in other countries. It therefore remains unclear as to which factors are important in explaining NPLs in Uganda's commercial banking industry.

3.0 Theoretical framework

In order to investigate the determinants of non-performing loans in Uganda's commercial banking industry, the study adapted the model of NPLs developed by Zeng (2012). The model is formulated using optimal control theory in whicha differential equation of the state variable (NPLs) is specified. Note that loan balance is a control variable. For purposes of derivations, loan balance is represented by$\boldsymbol{L}$ and non-performing loans represented by$\boldsymbol{N}$.

Loan balance ($\boldsymbol{L}$)can increase production and total consumption($\boldsymbol{C}$), and thus social utility. However, since non-performing loans ($\boldsymbol{N}$) is "financial pollution"($\boldsymbol{P}$), and is detrimental to social welfare, it decreases social utility. Accordingly, Zeng (2012) specifies the social utility function as shown below.

$$U = \varphi L^{\theta} - \upsilon N^{m}; \quad 0 < \theta < 1, \varphi > 0, \upsilon > 0, \text{and } m > 1, N > 0, L > 0 \qquad (1)$$

From equation (1), the marginal utility with respect to loan balance is positive but declining; $\frac{\partial U}{\partial L} = \varphi\theta L^{\theta-1} > 0$ and $\frac{\partial^2 U}{\partial L^2} = \varphi\theta(\theta-1)L^{\theta-2} < 0$, while that for non-performing loans is negative but also diminishing; $\frac{\partial U}{\partial N} = -\upsilon m N^{m-1} < 0$ and $\frac{\partial^2 U}{\partial L^2} = -\upsilon m(m-1)N^{m-2} < 0$

Following Zeng (2012), the growth rate of NPLs is given as;

$$\dot{N} = -\alpha L - \beta A^2 - \delta N + h|\Delta G| + \gamma(i-r) + aS + b\Delta E \ (2)$$

Where, $\boldsymbol{A}$ is the internal bank management, $\boldsymbol{G}$is economic growth rate; $\boldsymbol{i}$ is the nominal interest rate, $\boldsymbol{r}$ is the profit margin of an enterprise, $\boldsymbol{S}$ capturesenterpriser's irrational behavior, $\boldsymbol{E}$ is exchange rate. $\alpha, \beta, \delta, h, \gamma, a, b$ are coefficients, where by α is assumed to be negative and the rest positive. From equation (1), the social objective function is given by;

$$Max \int_0^T U dt = Max \int_0^T \left(\varphi L^{\theta} - \upsilon N^{m}\right) dt \qquad (3)$$

The objective function in equation (3) is subject to the constraint conditions in equations (2) and the restrictions on the parameters in equation (1). The current value Hamiltonian function for the above problem is thus given as;

$$H = U(N, L) + \lambda(-\alpha L - \beta A^2 - \delta N + h|\Delta G| + \gamma(i-r) + aS + b\Delta E) \ (4)$$

The first order conditions are given by;

$$\frac{\partial U}{\partial L} = \varphi\theta L^{\theta-1} - \alpha\lambda = 0; \frac{\partial U}{\partial N} = -\upsilon m N^{m-1} - \delta\lambda \text{and } \dot{\lambda} = \frac{\varphi\theta(\theta-1)L^{\theta-2}\dot{L}}{\alpha} (5)$$

Setting $\dot{\lambda} = -\frac{\partial U}{\partial N}$ and simplifying gives;

$$\dot{L} = \frac{\alpha\left[\upsilon m N^{m-1} + \delta\left(\frac{\varphi\theta L^{\theta-1}}{\alpha}\right)\right]}{\varphi\theta(\theta-1)L^{\theta-2}} (6)$$

In the steady state, $\dot{L}$ and $\dot{N}$ are equal to zero, therefore, from equations (6), we obtain;

$$N = \left(\frac{-\delta\varphi\theta L^{\theta-1}}{\acute{a}\upsilon m}\right)^{\frac{1}{m-1}} = nL^{\frac{\theta-1}{m-1}} > 0, \text{ where;} n = \left(\frac{-\delta\varphi\theta}{\alpha\upsilon m}\right)^{\frac{1}{m-1}} > 0 \quad (7)$$

And from equation (2) we get;

$$N = \frac{1}{\delta}(-\alpha L - \beta A^2 + h|\Delta G| + \gamma(i-r) + aS + b\Delta E) (8)$$

Combining (7) and (8) yields the following equation;

$$N = \frac{1}{2\delta}\left(\delta n L^{\frac{\theta-1}{m-1}} - \alpha L - \beta A^2 + h|\Delta G| + \gamma(i-r) + aS + b\Delta E\right) (9)$$

According to equation (9), non-performing loans are determined by loan balances (L), effort of internal bank management (A), economic growth rate (G), nominal interest rate (i), profit margins (r), enterpriser's irrational behavior (S), and exchange rate (E).

4.0 Model specification

Empirical model for the study is developed by modifying the model in equation (9), to include unemployment rate and the amount of large exposure to total growth loans (measure of loan concentration) as suggested by empirical literature and Bank of Uganda, respectively. Regarding unemployment, it's argued that high unemployment rate negatively affects income of individuals thereby reducing their ability to service the loans (Akinlo and Emmanuel, 2014). In addition, higher unemployment rate reduces the demand for products produced by firms which ultimately leads to decline in revenues of the firms (Kjosevski and Petkovski, 2017), thus constraining their ability to pay the loans. Large exposure is used as a measure of the extent of commercial bank's loan concentration (concentrated exposures to individual counterparties). Accordingly increase in large exposure to gross loans implies increased concentration of the loan portfolio which increases concentration risk.

To avoid collinearity that may arise between interest rates and loan balances, the empirical model excludes loan balances. The exclusion of loan balances and enterpriser's irrational behavior is further based on absence of data. Internal bank management can be seen from the profitability of the bank, which in this study, is captured using returns on assets. Therefore the empirical model is specified as shown below;

$$LnNPLs_t = \beta_0 + \beta_1 LnLR_t + \beta_2 ROA_t + \beta_3 LnLEL_t + \beta_4 RER_t + \beta_5 UE_t + \beta_6 GDPG_t + e_t (10)$$

Where; $\boldsymbol{LNPLs}$ is the logarithm of non-performing loans, $\boldsymbol{LLR}$is the logarithm of lending rate, $\boldsymbol{ROA}$is returns on assets, $\boldsymbol{LLEL}$ is logarithm of large exposure to total gross loans, $\boldsymbol{RER}$ is real effective exchange rate, $\boldsymbol{UE}$ is unemployment, $\boldsymbol{GDPG}$ is GDP growth rate, $\boldsymbol{e}$ is the error term

By letting $\beta^{'} = (\beta_1\beta_2\beta_3\beta_4\beta_5\beta_6)$and $x_t^{'} = (LnLR_tROA_tLnLEL_tRER_tUE_tGDPG_t)$, equation (10) can be reduce to the form of;

$$y_t = \beta_0 + \beta' x_t + e_t (11)$$

Where;β is a vector of parameters to be estimated.$y_t$represents NPLs. $x_t$is a vector of regressors. Note that all the manipulations in the subsequent sections are based on the model in equation (11).

5.0 Estimation procedure

5.1 Unit root tests

Estimation of the model using time series data techniques without testing for stationarity may result into spurious regression leading to false conclusion. It is therefore against this background that we carry out the unit root tests before estimating the model. Augmented dickey fuller (ADF) and the Phillips-Perron (PP) tests were used in the study. The results are presented in table 1 and table 2.

Table 1: Unit root tests at level

	ADF(LEVEL)		**PHILLIPS PERRON**	
Variables	Intercept	Intercept and trend	Intercept	Intercept and trend
LnNPLs	-1.956	-3.199*	-1.883	-3.047
LnLR	-2.054	-2.491	-2.250	-3.282*
ROA	-2.963**	-4.960***	-2.332	-2.814
LnLEL	-3.05**	-2.837	-2.893	-2.711
RER	-3.257**	-3.539**	-3.168**	-3.408**
UE	-3.703***	-4.231***	-2.544	-2.766
GDPG	-3.507***	-3.539**	-4.678***	-4.663***

***, ** and *** represent significance at 10%, 5% and 1% respectively.**

The results of ADF and Phillips-Perron unit root tests show that LnNPLs, LnLR and LnLEL are non-stationary at level since the p-values for both tests are greater 0.05. GDP growth and real effective exchange rate (RER) are stationary with both tests since the p-values for both tests are less than 0.05. However the two tests contradict on ROA and UE. The ADF show that these variables are stationary while the Phillips-Perron shows that they are non-stationary at level. Since there are nonstationary series in our data, we shift the analysis of unit roots to first difference to find whether these variables are difference stationary.

Table 2: Unit root tests at first difference

	ADF		**PHILLIPS PERRON**	
Variables	Intercept	Intercept and trend	Intercept	Intercept and trend
LnNPLs	-5.622 ***	-5.614 ***	-7.045 ***	-7.024 ***
LnLR	-8.485***	-8.423***	-8.453***	-8.394***
ROA	-4.542***	-4.612***	-5.595***	-5.570***
LnLEL	-7.563***	-7.613***	-9.292***	-9.566***
UE	-3.832***	-3.834**	-4.820***	-4.800***
*, ** and *** represent significance at 5% and 1% respectively				

Source; author's computations

The results of the unit root test at first difference show that all variable that were not stationary at level are difference stationary. This therefore implies that the data is made up of a mixture of I (0) and I (1) variables

5.2 Estimation technique

Given that the data set contains both I (0) and I (1) variables, ARDL and bounds test is the most suitable technique for examining the long run and short run determinants of non-performing loans in Uganda's commercial banking industry.The technique is superior to other approaches ofcointegration(such as the Johansen and Angel Granger) due to the following: (i) it does not require all variables to be integrated of order one, as is the case in Johansen; (ii) It can be applied for small sample size such as the one in this particular study; (iii) it also produces unbiased estimates even in the presence of endogenous covariates (Harris &Sollis, 2003); (iv) the method can be applied even when the variables have different optimal number of lags; (v) the approach can further estimate the short run and long run relationships between the dependent variable and its predictors.The basic ARDL model in the literature is given as;

$$y_t = \beta_0 + \sum_{i=1}^{p} \phi_i y_{t-i} + \sum_{i=0}^{q} \psi_i^{'} x_{t-i} + e_t \quad (12)$$

Where ϕ_i and ψ_i are the coefficients of the lags of the dependent variable and the independent variables respectively. Note that ψ_0 is exactly equal to vector β defined earlier. The lags in equation (12) imply a set of dynamic responses in nonperforming loans(y) to any given change in explanatory variables(x). There is an immediate response followed by short run and long run responses.

Reparameterization of the model in equation (12) results into a reduced form of the ARDL model shown in equation (13)[2].

$$\Delta y_t = \beta_0 - \alpha[y_{t-1} - \theta' x_{t-1}] + \sum_{i=1}^{p-1} \gamma_i \Delta y_{t-i} + \sum_{i=0}^{q-1} \lambda_i' \Delta x_{t-i} + e_t \quad (13)$$

In the above model, x and y are as defined earlier,$\alpha = 1 - \sum_{i=1}^{p} \phi_i$ is the speed of adjustment coefficient/parameter, whichmust be between 0 and -1, and statistically significant for

[2]See appendix B for reparameterization process

equilibrium is to be restored. $\theta = \frac{\sum_{i=0}^{q} \psi_i}{\alpha}$is a vector of long run coefficients. γandλ are the short run coefficients and the term in the brackets is the error correction term. The optimal lag orders p and q (possibly different across regressors) are obtained by using lag selection criterion such as Akaike information criterion (AIC) or the Bayesian information criterion (BIC).

To test for existence of long run relationship among the variables, model in equation (13) is estimated using OLS and then Wald test (F-statistic) is conducted under the null hypothesis of "no level relationship(cointegration) among the variables" against the alternative that "there exits level relationship". This procedure is termed as bounds test. From the reduced form equation (13), the null hypothesis for the test is therefore expressed as:

$$H_0^F: (\alpha = 0) \cap \left(\sum_{i=0}^{q} \psi_i = 0 \right)$$

According to Pesaran, Shin and Smith (2001), the null hypothesis is rejected if the computed F-statistic exceeds the upper critical. If the computed F-statistic is lower than the lower bound critical value, we fail to reject the null hypothesis. However, if the computed F-statistic falls within the bounds, the test is inconclusive. In this case, prior knowledge about the order of integration is important in order to make a decision on the long run relationship.

5.3 Types and sources of data

The study uses aggregated, quarterly data for the period from 1st quarter of 2002 to 2nd quarter of 2017. Data on bank specific factors and real effective exchange rate was obtained from Bank of Uganda while data on macroeconomic variables was obtained from World Development Indicators (WDI) data base.

6.0 Empirical findings

6.1 Descriptive statistics

Before estimating the model, it's important to know the properties and the behavior of the different variables. This is done using descriptive statistics presented intable 3. These results suggest absence of outliers in the data since for most of the variables, the mean and median values lie midway between the minimum and the maximum values.

Table 3: Descriptive statistics

stats	NPLs	LR	ROA	LEL	RER	UE	GDPG
Mean	3.910	21.15	3.217	40.10	104.1	2.534	5.208
Median	3.565	20.46	3.388	39.79	103.6	2.425	5.281
Variance	2.592	5.123	0.621	52.63	31.13	0.429	4.321
sd	1.610	2.263	0.788	7.254	5.580	0.655	2.079
cv	0.412	0.107	0.245	0.181	0.054	0.258	0.399
Sum	242.4	1312	199.4	2486	6453	157.1	322.9
Min	1.812	17.73	1.330	28.23	92.95	1.255	1.123
Max	10.47	27.22	4.785	61.00	114.5	3.641	11.50
Skewness	1.729	0.796	-0.237	1.079	-0.124	0.0488	0.531
Kurtosis	6.755	2.945	2.532	4.243	2.294	1.822	3.863
JB	67.33	6.56	1.145	16.01	1.447	3.611	4.838
P-value	2.4e-15	0.0376	0.5642	3.3e-04	0.4851	0.1644	0.089

Source; Authors computations

From the results, NPLs displays the highest dispersion shown by coefficient of variation of 0.412 while real effective exchange rate (RER) displays the lowest level of dispersion with coefficient of variation of 0.054.The skewness, kurtosis and the Jarque-bera values suggest that ROA, RER, UE and GDPG are symmetric and normally distributed. The skewness values for these variables are close to zero, the kurtosis values close to 3 and the Jarque-bera values for these variables are less than 6, and p-values are greater than 0.05. Lending rate, LEL and NPLs in their original states are not normally distributed. This explains why these two variables appear in natural form in the analysis.

6.2 Correlation of variables

Correlation analysis is carried out to determine the extent of linear association between any two variables in our study. This can also help to reveal the possibility of multicollinearity problem in the regression. The results are shown by the correlation matrix in table 4below.

Table 4. Pairwise correlation matrix.

	LnLR	ROA	LnLEL	RER	UE	GDPG
LnLR	1					
ROA	0.00980	1				
LnLEL	-0.4062*	0.0148	1			
RER	0.2581*	-0.0710	-0.3972*	1		
UE	-0.5921*	-0.0434	0.5029*	-0.4772*	1	
GDPG	-0.3663*	-0.0621	-0.120	-0.2683*	0.3309*	1

Source; Authors computations

From the correlation matrix, it can be predicted that there is no problem of collinearity among the explanatory variables since all the correlation coefficients are less than 0.8 in absolute terms (Kennedy, 2008). However, the pair wise correlation matrix can be spurious hence the need to investigate these relationships in a multivariate regression analysis.

Table 5: Bounds test

F-statistic	Critical Values					
5.236	1%U-bound	1%L-bound	5%U-bound	5%L-bound	10%U-bound	10%L-bound
	4.43	3.15	3.61	2.45	3.23	2.12

Source; Authors computations

The results of the bounds test confirm the existence of a level relationship among the variables since the F-statistic is above the upper bound at all levels of significance suggesting the rejection of the null hypothesis of no level relationship.

Table 1: Short run and Long run coefficients, and diagnostic tests

DEPENDENT VARIABLE D.LnNPLs				
	Variables	Coefficients	t-ratio	P-value
LONG RUN	LnLR	1.173**	2.440	0.020
	ROA	-0.262***	-3.280	0.002
	LnLEL	0.695	1.590	0.121
	RER	0.034**	2.520	0.017
	UE	0.166*	1.790	0.083
	GDPG	-0.095***	-4.030	0.000
SHORT RUN	D.LnNPLs(-1)	0.400**	2.640	0.012
	D.ROA	-0.158*	-1.980	0.056
	D.ROA(-1)	0.112	1.390	0.173
	D.ROA(-2)	-0.055	-0.670	0.508
	D.ROA(-3)	0.253***	2.890	0.007
	D.LnLEL	-0.661**	-2.060	0.047
	D.LnLEL(-1)	-0.739**	-2.150	0.039
	D.LnLEL(-2)	-0.399	-1.390	0.174
	D.LnLEL(-3)	-0.510**	-2.010	0.052
	D.RER	-0.012	-1.400	0.170
	D.RER(-1)	-0.018**	-2.550	0.015
	D.RER(-2)	-0.009	-1.320	0.196
	D.GDPG	0.056**	2.500	0.017
	D.GDPG (-1)	0.042**	2.290	0.028
	D.GDPG (-2)	0.034**	2.500	0.017
	Constant	-5.437**	-1.950	0.060
	ECT	**-0.776*** **	**-4.57**	**0.000**
ANOVA	R-squared	0.671		
	Adj R-squared	0.464		
	F-stat (p-value)	3.25 (0.0009)		
DIAGNOSTIC TESTS	Test	Test statistic	P-value	
	Serial correlation	Chi2(1) = 0.203	0.6526	
	ARCH effect	Chi2(1) = 0.872	0.3503	
	Heteroscedasticity	Chi2(1) = 0.800	0.3723	
	Ramsey RESET	F(3, 37) = 1.300	0.2905	
	Normality	Chi2(2) = 1.707	0.4260	
	Multicollinearity	Mean VIF = 4.82		

Source; author's computations

Before discussing the results, it's important to assess whether the estimated model satisfies the assumptions of classical linear regression and passes the diagnostic tests. These results are presented in the bottom panel of table 6. The resultsshow that; there is no autocorrelation and

conditionalheteroscedasticity;the functional form is acceptable; and the errors are normally distributed. VIF also suggest that there is no multicollinearity. The model parameter stability tests confirmed that the parameters of the estimated model are stable since the CUSUM and CUSUMsq curves are contained within the 5 percent critical bounds (see Appendix).

In the estimated model, error correction term is found with the correct sign and magnitude and significant at 1%. Coefficient of-0.776 implies that around that 77.6% of the adjustment towards long run equilibrium takes place in the first quarter.

6.3 Discussion of the results

ARDL results in table 6 show that lending rate has a statistically significantimpact on NPLs in the long run, with a coefficient of 1.17. This implies that a 1 percent increase in lending rate increases NPLs by 1.17 percent holding other factors constant. This result suggests that a rise in lending rate makes the loan expensive, thus imposing higher risk on borrower's ability to pay the interest. This finding is in line with expectations since lending rates in Uganda have persistently remained high even with continued reduction in the central bank rate (CBR). This result is in agreement with the findings of Ofori*et al*, 2016, Warue (2013),Louzis*et al*. (2012), Beck, Jakubik and Piloui (2013). The result however contrasts the findings of Nanteza (2015) who did a similar study in Uganda and found that lending rate doesn't have a significant impact on NPLs. The results for Nanteza (2015) are however attributed to the small sample size

Regarding returns on assets, the study finds a statistically significant inverse relationship with NPLs in Uganda's commercial banks, with a coefficient of -0.262. This implies that a unit increase in the ROA decreases NPLs by 26.2 percentin the long run, keeping other factors constant. The result is in line with our prior expectations and economic theory since higher returns on assets imply high profitability of the banks which makes bank managers less pressured in creating revenue from credit activities and thus, leading to less exposure to credit risk.This finding is well aligned withthe findings of Kjosevski and Petkovski (2017);Goldewski (2005) and Boudriga*et al*. (2009), and Louzis*et al*. (2012) and Ćurak*et al* (2013). In the short run, Returns on assets also have a negative impact on NPLs, significant at 5%. It can therefore be confirmed that increase in ROA is associated with a decrease in the level of NPLs.

Real effective exchange rate is found to have a positive impact on NPLs. The long run partial elasticity with respect to real effective exchange rate of 0.034 implies that a unit increase in RER increases NPLs by 3.4 percent keeping other factors constant. Such results support the argument that increase in real effective exchange rate reduces competitiveness of the country's exports, which reduces their debt repayment capacity. Similar results were obtained by Beck, Jakubik and Piloui (2013), Khemraj and Pasha (2009), Fofack (2005) and Akinlo and Emmanuel (2014) among others and in sharp contrast with the finding of Baboučak and Jančar (2005).

The study further finds unemployment rate to have a positive impact. The long run partial elasticity with respect to unemployment implies that a unit increase in unemployment rate increases NPLs by 16.6 percent and vice versa. Such results can be explained by two channels; the direct effect of unemployment on people's incomes and the indirect effect of unemployment which is transmitted through decline in aggregate demand leading to decline in the revenues of the firms. Both effects therefore may lead to rise in NPLs as both the individuals and firms are constrained. This finding is well in line with theory and our prior expectation and in agreement

with the findings of other previous scholars such as;Nkusu (2011), Kjosevski and Petkovski (2017), Vogiazas and Nikolaidu (2011), Bofondi and Ropele (2011) and Louzis*et al*. (2011) among others.

Finally, increase in GDP growth is found to have a decreasing effect on NPLs.This finding possibly confirms the argument that increase in GDP growth (increase in incomes) increases the loan repayment capacity of the borrowersthus reducing on the default rates (Khemraj and Pasha, 2009). The results agree with the findings of Farhan *et al* (2012); Jakubik and Reninger (2013); Skarica (2014) among others. The short run results, however show that increase in GDP growth increases NPLs. This can be explained the argument that short run increase in GDP growth may cause bank managers to become overconfident about the health of the economy. This wrong perception may tempt them to undertake excessive credit risk exposure. Such kind of temptation attracts bad borrowers thereby increasing the chances of loan default(Viswanadham and Nalib, 2015).

7.0 Conclusion

Based on the finding of this study, we argued that NPLs in Uganda's commercial banking industry are influencedby both bank-specific and macroeconomic factors. Among the bank specific factors considered in the study, lending rate was found to have a positive impact on NPLs while Returns on assets are found to have a negative impact on NPLs. Regarding the macroeconomic factors, real exchange rate and unemployment having positive impact, while GDP growth has a negative impact.

The study recommends that commercial banks should diversify their portfolio by holding other income earning assets such as governments bonds, equity so as to reduce on credit risk exposure. Efforts to promote the performance of the stock market (for example by promoting "market makers") so as to enable banks invests more in stocks and thus avoid giving out highly risky loans would go a long way in reducing NPLs in the commercial banks. Of great importance is efforts to reduce the lending rates both by individual banks (for example by adopting cost effective technology such as agency banking)and the Monetary Authority (through reduction of the Central Bank Rate).

Measures to promote GDP growth and reduce unemployment rate need to be adopted. For example, GDP growth can be increased by; improving the business environment and supporting high productivity industries. Regarding unemployment, there is need to support labour intensive industries, and strengthen apprenticeship programmes(toincrease employability of the youths through skills development and provision of some experience).

Given the positive significant impact of real effective exchange rate on nonperforming loans, commercial banks need to consider the international competitiveness of the different sectors and their be able to focus on sectors which are not highly affected by changes in the exchange rate. Besides, efforts by the monetary authority to ensure stability in the real effective exchange would be of immense importance.

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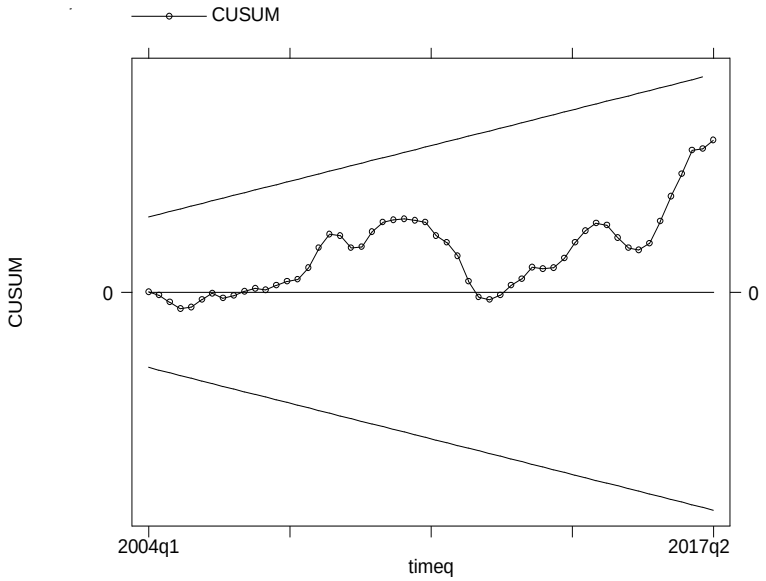
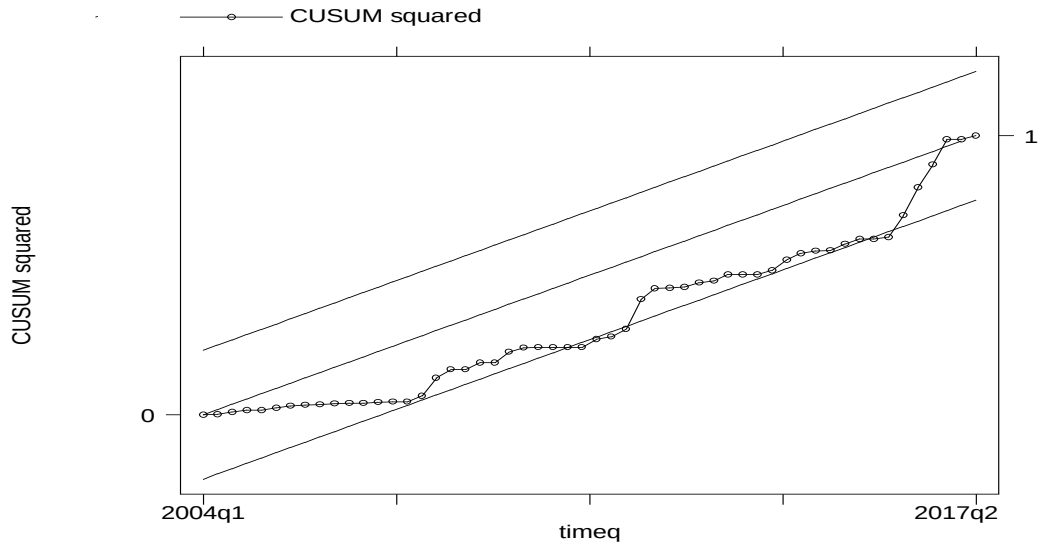
Appendix A: CUSUM and CUSUMQ

CUSUM



CUSUMQ



APPENDIX B: Reparameterization of ARDL model

Considering the basic ARDL model

$$y_t = \beta_0 + \sum_{i=1}^{p} \phi_i y_{t-i} + \sum_{i=0}^{q} \psi_i^{'} x_{t-i} + u_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (1)$$

Equation (1) can written in the form of equation (2)

$$y_t = \beta_0 + \phi_1 y_{t-1} + \phi_1 y_{t-1} + \cdots + \phi_p y_{t-p} + \psi_0^{'} x_t + \psi_1^{'} x_{t-1} + \cdots + \psi_q^{'} x_{t-q} + e_t \dots\dots (2)$$

Note that $\psi_o = \beta$ (see the econometric model)

To transform the above model we make the following substitutions

$$y_t = y_{t-1} + \Delta y_t, y_{t-2} = y_{t-1} - \Delta y_{t-1}, \dots, y_{t-p} = y_{t-1} - \left(\Delta y_{t-1} + \Delta y_{t-2} + \cdots + \Delta y_{t-(p-1)}\right)$$

$$x_t = x_{t-1} + \Delta x_t, x_{t-2} = x_{t-1} - \Delta x_{t-1}, \dots, x_{t-q} = x_{t-1} - \left(\Delta x_{t-1} + \Delta x_{t-2} + \cdots + \Delta x_{t-(q-1)}\right)$$

Equation (2) becomes

$$\begin{aligned} y_{t-1} + \Delta y_t = {} & c + \phi_1 y_{t-1} + \phi_2 [y_{t-1} - \Delta y_{t-1}] + \cdots \\ & + \phi_p \left[y_{t-1} - \left(\Delta y_{t-1} + \Delta y_{t-2} + \cdots + \Delta y_{t-(p-1)}\right)\right] + \psi_0^{'}(x_{t-1} + \Delta x_t) + \psi_1^{'} x_{t-1} \\ & + \psi_2^{'}(x_{t-1} - \Delta x_{t-1}) + \cdots + \psi_q^{'}[x_{t-1} - \left(\Delta x_{t-1} + \Delta x_{t-2} + \cdots + \Delta x_{t-(q-1)}\right)] \\ & + u_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (3) \end{aligned}$$

Which simplifies to;

$$\begin{aligned} y_{t-1} + \Delta y_t = {} & \beta_0 + \phi_1 y_{t-1} + \phi_2 [y_{t-1} - \Delta y_{t-1}] + \cdots \\ & + \phi_p \left[y_{t-1} - \left(\Delta y_{t-1} + \Delta y_{t-2} + \cdots + \Delta y_{t-(p-1)}\right)\right] + \psi_0^{'}(\Delta x_{t-1} + \Delta x_t) + \psi_1^{'} x_{t-1} \\ & + \psi_2^{'}(x_{t-1} - \Delta x_{t-1}) + \cdots + \psi_q^{'}[x_{t-1} - \left(\Delta x_{t-1} + \Delta x_{t-2} + \cdots + \Delta x_{t-(q-1)}\right)] \\ & + u_t \dots\dots\dots\dots\dots (4) \end{aligned}$$

By letting

$$\gamma_1 = -\phi_2 - \phi_3 \dots - \phi_p, \gamma_2 = -\phi_3 - \phi_4 \dots - \phi_p, \dots, \gamma_{p-1} = -\phi_p$$

And

$\lambda_0 = \psi_o, \lambda_1 = -\psi_2 - \psi_3 \dots - \psi_{q,} \lambda_2 = -\psi_3 - \psi_4 \dots - \psi_{q,} \dots , \ \lambda_{q-1} = -\psi_q,$

The error correction model becomes;

$$\Delta y_t = \beta_0 - \left[1 - (\phi_1 + \phi_2 + \cdots + \phi_p)\right] \left[y_{t-1} - \frac{(\psi_0' + \psi_1' + \cdots + \psi_q')}{1 - (\phi_1 + \phi_2 + \cdots + \phi_p)} x_{t-1} \right] + \sum_{i=1}^{p-1} \gamma_i \Delta y_{t-i} + \sum_{i=0}^{q-1} \lambda_i^{'} \Delta x_{t-i} + e_t \dots\dots (5)$$

The above equation simplifies to

$$\Delta y_t = \beta_0 - \alpha[y_{t-1} - \theta' x_{t-1}] + \sum_{i=1}^{p-1} \gamma_i \Delta y_{t-i} + \sum_{i=0}^{q-1} \ddot{e}_i' \Delta x_{t-i} + e_t \dots\dots (6)$$

Where $\alpha = 1 - \sum_{i=1}^{p} \phi_i$ And $\theta^{'} = \frac{\sum_{i=0}^{q} \psi_i^{'}}{\alpha}$

$\alpha$is the speed of adjustment coefficient and θ is a vector of long run coefficients.