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DETERMINANTS OF NON-PERFORMING LOANS IN THE BANKING SECTOR OF GHANA BETWEEN 1998 AND 2013

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ABSTRACT

This paper studied determinants of non-performing loans in Ghana, using historical time series annual data covering the period of 1998-2013. Using Seemingly Unrelated Regression model and Principal Component Analysis, the study found money supply, financial development and macroeconomics variables to be significant determinants of non-performing loans, except real income. The study recommends policies targeted at influencing non-performing loans.

Contribution/ Originality: This study is one of very few studies which have investigated the determinants of non-performing loans in Ghana using Seemingly Unrelated Regression model and Principal Component Analysis.

1. INTRODUCTION

The banking sector plays an important role in the development of an economy. The stability of the sector is therefore very vital since it determines the step for development of an economy. Basically, extension of credit facilities is one of the major activities of all banking institutions. This is usually confirmed by the greater proportion of loans representation in the overall operating assets of banking institutions. An efficient financial intermediation requires a stable banking system to channel surplus funds into savings for investments to promote rapid economic growth. High and rising levels of non-performing loans (NPL's) in many countries continue to a large extent exert strong pressure on bank's balance sheet with possible adverse effect on bank's lending operations.

According to Nkusu (2011) a non-performing loan is any loan in which interest and principal payments are more than 90 days overdue; or more than 90 days' worth of interest has been re-financed. The sustainability of banks is largely threatens by loan default. These bad loans become cost to banks in terms of their implications on the quality of their assets portfolio and profitability. This is in line with the banking regulation which requires the banks to make provisions for non-performing loans and charge for bad loans that reduce their income as well as the loan portfolio. According to World Bank Group (2014) non-performing loans as proportion of total loans is 24.6 % for Ireland, 31.3 % for Greece, 9.5 % for Egypt, 6% for Russia, 3.6% for South Africa, 3.2% for USA, 2.9 % for Brazil

and 1% for China. Non-performing loans have been huge concern for all the nations across the globe. Seven years later, the Central Bank of Ghana revealed that the NPL ratio, which measures the ratio of loan losses to gross loan advances, worsened from 14.7% in December 2015 to 17.3% as at December 2016 (Bank of Ghana, 2017). The Bank of Ghana has expressed concern of an NPL ratio of 17.3% in the Ghana banking industry.

Dash and Kabra (2010) conducted a study on non-performing loans in Indian banking sector during the period of 1998 to 2009. The study employed both bank-level and macroeconomic-level data and substantiated the importance of loans growth, loans to assets ratio, economic growth, and exchange rate for loan losses. Also Espinoza and Prasad (2010) investigated non-performing loans in the Gulf Cooperation Council (GCC) region with a sample of 80 banks during the period of 1995-2008. The study results indicated that at macroeconomic level, economic growth and interest rate appear to be important while credit growth, capital and efficiency are significant factors of bad loans at the bank level. Greenidge and Grosvenor (2010) argued that the magnitude of NPLs was a key element in the initiation and progression of financial and banking crises while (Reinhart and Rogoff, 2010) pointed out that NPLs can be used to mark the onset of a banking crisis.

Thiagarajan *et al.* (2011) found out that there was a significant inverse relationship between GDP and the credit risk of both public and private sector banks. It came out that there were lagged non-performing assets which had a strong and statistically significant with positive influence on the non-performing assets. The output was the outcome from a study on determinants of the credit risk in the Indian commercial banking sector by using an econometric model on a panel data level with 22 public sector banks and 15 private banks. Guy (2011) affirmed that NPLs have been widely used as a measure of asset quality among lending institutions and are often associated with failures and financial crises in both the developed and developing world. An empirical study on macroeconomic determinants of nonperforming loan in the banking system in Malaysia was carried out by Adebola and Dahalan (2011). The study used macroeconomic variables such as the lending rate; producer price index and industrial production index affect bad loans. The study utilized ARDL approach and the result revealed that the lending rate had a significantly positive effect on NPL. The study indicated that during the period of high lending rates, it was expected that bad loans will increase causing a rise in rate of default by customers. Nkusu (2011) conducted a study on the analysis of bad loans in 26 advanced economics in the period of 1998 to 2009 using macroeconomic approach. The findings show that economic growth, unemployment and asset prices were determinants of non-performing loans. Louzis *et al.* (2012) studied macroeconomic and bank-specific determinants of non-performing mortgage, business and consumer loans in 9 largest banks in Greek between 2003 and 2009. The study found out that GDP growth, unemployment, interest rate and public debt affected losses in all categories of loans, while among internal factors; performance and efficiency appeared to be important. Furthermore, quantitative impact of the determinants varied among the type of loans. Higher NPA ratio shakes the confidence of investors, depositors and lenders. It also causes poor recycling of funds, which in turned had deleterious effect on the deployment of credit.

A study by Farhan *et al.* (2012) assessed the perception of 201 Pakistani Bankers who were involved in lending decisions of their various banks. It revealed that interest rate, energy crisis, unemployment, inflation and exchange rate had a significant positive relationship whereas GDP growth had insignificant negative relationship with the non-performing loans. Saba *et al.* (2012) studied the determinants of non-performing loans in the United States banking sector where the study investigated into the bank specific and macroeconomic variables of nonperforming loans between 1985 and 2010 using OLS regression model. The result revealed that real total loans had a positive significant effect whereas interest rate and GDP per capital had a negative significant with NPL. Djiogap and Ngomsi (2012) investigated the determinants of bank long-term loan in the Central African Economic and Monetary Community (CEMAC). The study made used of panel data of 35 commercial banks from six African countries between 2001and 2010. Fixed effect model was applied to examined the impact of bank size, GDP growth and capital adequacy ratio on NPLs. The result indicated negative significant impact of capital adequacy ratio on the level of NPLs. The study affirmed that a more diversified banks and well capitalized banks were better able to

withstand potential credit challenges. However, inflation variable was statistically insignificant in explaining the total business loans ratios of banks.

Badar and Javid (2013) researched into the impact of macroeconomic forces on nonperforming loans on commercial banks in Pakistan during the period of 2002 and 2011 where the study assessed 36 commercial banks considered the long and short run dynamics between nonperforming loans and macroeconomic variables. Macroeconomic variable such as inflation, exchange rate, interest rate, gross domestic product and money supply were used. The study applied vector error correction model where it found that there was a strong negative long run relationships existed of inflation, exchange rate, interest rate, gross domestic product and money supply with NPLs. Curak *et al.* (2013) empirically investigated the determinants of non-performing loans in Southeastern European banking systems. The study sampled 69 banks in 10 countries between 2003 and 2010 and made use of generalized method of moments estimator for dynamic panel models in the analysis. The results show that lower economic growth, higher inflation and higher interest rate were associated with higher non-performing loans. Moreover the credit risk was affected by bank specific variables such as bank size, performance (ROA) and solvency. Messai and Jouini (2013) conducted a study on micro and macro determinants of non-performing loans sampled 85 banks in three countries (Greek, Italy and Spain) between 2004 and 2008. The study found that the problem loans varied negatively with the growth rate of GDP, profitability of the banks' assets and positively with the unemployment rate, the loan loss reserves to total loans and the real interest rate.

Asantey and Tengey (2014) noted in their study with reference to bad loans on banks' lending potential and its effects on financial performance. The study made use of Pearson Correlation matrix and ordinary least square regression to analysed the data. The study found negative correlation between bad loans and lending potential as well as return on investment or net profit. It concluded that banks must hedge against bad loans realization to maximize their financial performance and to improve access to borrowers. A study on the determinants of non-performing loans in Central and Eastern European countries, Skarica (2014) observed that the primary cause of high levels of NPLs was the economic slowdown, which was evident statistically significant and economically large coefficients on GDP, unemployed and the inflation rate. The study made use of fixed effects estimator model of a panel dataset within the period of Q3:2007 and Q3:2012.

Addai and Chengyi (2015) investigated the impact of delinquent loans on financial performance of banks in Ghana. The study made used of multiple regression and found that statistically there was a significant impact of delinquent loans on interest income and net profit. The study recommended that banks must embark on effective and regular monitoring of the lending process. Reddy (2015) observed that the public sector and to some extent the private banks accounted for the bulk of Non-Performing Assets where it studied non-performing loans in India. Amuakwa-Mensah and Boakye-Adjei (2015) studied the detrimental effect of non-performing loans had on banks' income and the economy in the banking industry of Ghana. The study made use of panel regression model, it found that both bank specific variables (previous year NPL, bank size, net interest margin and current year's loan growth) and macroeconomic variables (inflation, real gross domestic product, per capita growth and real effective exchange rate) significantly affected NPL's in the banking industry.

The high level of Non-Performing Assets (NPAs) taints the overall portfolio but puts a burden on the income statement of banks in the form of higher provisions which will lead to liquidity problems for many banks. A continuous increase in the NPL ratio can lead to credit crunch as witnessed in other countries in recent times and this could ultimately slow down the developmental agenda of Ghana.

As at 2016, the banking sector of Ghana comprised of twenty-nine (29) banks, of which fourteen (14) have domestically controlled. The banks managed 1,173 branches and 912 Automated Teller Machines (ATM) distributed across the ten (10) regions of the country. Ghana situation is worrying considering the problems with non-performing loans as indicated in Table 1.

Table-1. Non-performing loans to total gross loans (%)

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016
%	7.68	16.20	18.08	14.15	13.20	12.00	11.27	14.67	17.2

Source: The WBG (2016)

It is evident from Table 1 that the Bank non-performing loans to total gross loans (%) in Ghana was 17.29 as of 2016. Its highest value over the past 8years was 18.08 in 2010 while its lowest value was 7.68 in 2008. This placed Ghana in the 9th position out of 114 countries in terms of worst non-performing loans with 17.29 and 7th in Africa with the lowest of 0.20 with Macao globally. This concern must be addressed in the Banking Industry of Ghana as a high ratio may signal deterioration of the credit portfolio. This can have negative impact on the overall performance on liquidity, investment capacity, earnings and profitability. The paper adds to the scare empirical studies on non-performing loans in Ghana. The study is significant as it explains and examines non-performing loans which are vital when managing the banking sector and the economy as a whole. The methodology was innovative as the paper used Seemingly Unrelated Regression model and Principal Component Analysis for the analysis. There is therefore the need to research into the determinant of non-performing loan within the Banking sector of Ghana. The rest of the paper is organised as follows. The next section describes the methodology of the study, while the third section considers the results and discussion of the study and the final section concludes with policy implications and recommendation.

2. METHODOLOGY

2.1. Model Specification

The main objective of this study is to examine determinants of NPL in Ghana. The relationship between NPL and its covariates is expressed as a linear function as shown in equation (1).

$$NPL = \beta_0 + \alpha\, MV + \lambda\, MS + \gamma\, FD + \varepsilon_t \qquad (1)$$

where NPL represents nonperforming loans; MV denotes measures of money supply (M1, M2 and M2+); MS represents a vector of macroeconomic variables; FD represents a vector of financial development measurements and ε_t is the error or disturbance term which is assumed to be normally distributed and not serially correlated.

The parameter α is the coefficient of the macroeconomic variables which measures the extent to which the MV affects the NPL. The parameter λ is the coefficient of the vector of measures of money supply. It represents the degree or extent to which money supply affects NPL. It is a priori expected that changes in the MS will have significant impact on the NPL and the coefficient λ is expected to be positive. The parameter γ is the coefficient of the vector of financial development. It represents the degree or extent to which financial development affects the NPL. It is expected that changes in financial development will have a positive or negative effect on the NPL depending on the choice of proxy for financial development.

2.2. Data Source and Variable Description

The historical time series data sets used for the study was NPL of commercial banks which were sourced from Bank of Ghana's Monetary Time Series, World Bank World Development Indicators and International Monetary Fund's International Financial Statistics (IFS). Sample data is between 1998 and 2013. The choice of variables, the number of banks and the choice of time frame for the study were based on availability of data and the focus of the study where there was a clear indication on the rise of NPL's in Ghana due to slowdown in the economy.

2.2.1. Macroeconomic Variables

The economic conditions are one of the important factors that affect operations and financial conditions of bank customers, and ultimately banking business and performance. Macroeconomic variables and an economy's overall

regulatory environment also influence NPL. The model captures the effect, if any, of macro-economic variables on the NPL. MV is a vector of macro-economic variables including inflation rate (INF) denoting GDP deflator; real total output of the economy (Y) proxy by GDP; lending rate; exchange rate (EX).

GDP growth reflects positive economic environment which is beneficial to both households and businesses, incomes of households and businesses grow which make it possible for borrowers to have sufficient funds to service their debts. Inflation can have a positive or negative impact on non-performing loans in case of price stability or price instability contributing to the debtor's capacity to repay the loan or otherwise. The lending rate can be defined as the weighted average rate that typically meets the short- and medium-term financing needs of the private sector. The rate is normally differentiated according to creditworthiness of borrowers and objectives of financing. Increase of interest rate produces additional burden and the level of non-performing loans. High lending interest reflects high risk premium that banks charge for low credit quality debtors indicating poor credit portfolio. Exchange rate may affect loan losses for those loans nominated in foreign currency; this is so in emerging markets as there is no matching currency between the incomes of the households and what the businesses receives and their loans debts. The implication is that changes in exchange rate may affect debt burden. Depreciation of domestic currency increases debt and debtor's inability to repay the loans leading to loan losses for the banks.

2.2.2. Financial Development

The financial structure of an economy, in particular, the extent to which an economy is developed financially is critical in the effectiveness of loan performance. Proxies for financial sector development are captured in the FD variable. They include private sector credit/GDP (CPS/Y); private sector credit/total domestic credit (CPS/DC); broad money/GDP (M2+/Y); narrow money/broad money (M1/M2+); and total domestic credit/GDP (DC/Y).

2.3. Estimation Strategy

The model is estimated in five stages using Seemingly Unrelated Regression. Each stage captures three measures of money supply in a simultaneous equation format and a measure of financial development.

$$\mathbf{NPL = \beta_o + \alpha\ MV + \lambda\ MS + \gamma\ FD + \varepsilon_t} \qquad (2)$$

In order to accurately estimate the parameters in the above specified econometric models using time series data, four steps are followed. First, a Principal Component Analysis is done to test the robustness of the results and include only the relevant variables in the estimation. The PCA will also account for correlation among the measures of financial development and the sufficiency at which the proxies adequately measures financial development. The second step examines the stationarity status of the individual series in the regression model to ensure that the estimated relationships are not spurious. Then the existing long-run equilibrium relationship among the variables in the models specified above is tested using SUR model.

Greene (2003) viewed seemingly unrelated regression (SUR) as a special case of the generalized regression model $E(y) = X\beta$, $V(y) = \sigma^2\Omega$; however, it does not share all of the features or problems of other leading special cases (e.g., models of heteroskedasticity or serial correlation). While, like those models, the matrix Ω generally involves unknown parameters which must be estimated, the usual estimators for the covariance matrix of the least squares estimator $\hat{\beta}_{LS}$ are valid, so that the usual inference procedures based on normal theory are valid if the dependent variable y is multinormal or if the sample size N is large and suitable limit theorems are applicable. Also, unlike those other models, there is little reason to test the null hypothesis H_0: $\Omega = I$; the form of Ω is straightforward and its parameters are easy to estimate consistently.

2.4. Principal Component Analysis

Principal Component Analysis is a dimension reduction tool used to test the robustness of the results. In a model with many variables, the probability of over-fitting the model and producing conclusions that cannot be used to generalise the other data sets is very high. When there are strong correlations between the various variables in the model, they can be reduced to a few principal components through an orthogonal transformation. These few principal components will contain much of the information in the original larger set of variables. A PCA converts a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables.

2.5. Tests for Stationarity

After the PCA is done and the principal components have been obtained, a unit root test is done on the selected variables to test for the stationarity. Stationarity means that the relationship has no trend and is thus constant over time. In estimating the parameters of a model using time series data, a test for the stationarity of the variables is required to determine the order of integration of each variable used. This is very crucial in cointegration process for specifying an econometric model. This study thus tests for stationarity of the endogenous and exogenous variables within the framework of Augmented Dickey-Fuller-and Phillips-Perron test procedure. This is to prevent spurious regression which is a common problem associated with time series data.

3. RESULTS AND DISCUSSION

3.1. Descriptive Statistics of Variables

The descriptive statistics of the variables are shown in Table 2, which shows the mean, standard deviation, minimum value and maximum value.

Table-2. Descriptive Statistics of Variables

Variable	Mean	Standard Deviation	Min	Max
lnINF	3.015	0.459	2.633	4.391
lnY	1.775	0.376	1.237	2.642
lnM1	7.511	1.330	5.332	9.642
lnM2	7.964	1.361	5.778	9.937
lnM2 +	8.210	1.365	5.967	10.201
lnLR	3.232	0.232	2.862	3.738
lnEX	- 0.127	0.602	- 1.465	0.668
lnRISK	1.409	0.991	- 0.693	2.590
lnCPS/Y	- 21.068	0.220	- 21.436	- 20.719
lnCPS/DC	- 0.789	0.193	- 1.096	-0.461
lnM2 +/Y	- 20.309	0.300	- 20.837	- 19.898
lnM1 /M2 +	4.158	1.302	2.203	6.105
lnDC /Y	- 20.278	0.356	- 20.723	- 19.673

Source: Author's Construct, 2016

The study used mean to describe the central tendency of the data set and standard deviation to describe the dispersion within the data. From the data set, the proxies for financial development had the highest mean range. Ratio of private sector credit to real income, ratio of broad money to real income and ratio of credit deposit to real income had the highest mean values respectively and comparatively low level of dispersion as shown in their respective standard deviations of 0.220, 0.3 and 0.356. Measures of money supply (M1, M2 and M2+) had similar range of mean values between 7.5 to 8.2 and standard deviations ranging from 1.3 to 1.4. In all, ratio of private sector credit to domestic credit had the least dispersion with standard deviation of 0.193.

3.2. Results of the Correlation Matrix and Principal Component Analysis on Financial Development

3.2.1. Correlation Matrix on Financial Development

Table 3 displays the Correlation Matrices employed to measure the relationship between the variables. The table records high correlations of 0.93 while the minimum value of 0.47. *InCPS/DC* has a weak negative and significant relationship with *InCPS/Y* of (r = - 0.47. p < 0.001) at 0.05 significance level. Moreover, *InM2+/Y* had a strong positive and significant relationship with *InCPS/Y* of (r = 0.87, p < 0.001) at 0.05 significance level. *InM2+/Y* had a strong negative and significant relationship with *InCPS/DC* of (r = - 0.70, p < 0.001) at 0.05 significance level. InM1/M2+ had a strong negative and significant relationship with *InCPS/Y* of (r = - 0.85, p < 0.001) at 0.05 significance level. InM1/M2+ had a strong positive and significant relationship with *InCPS/DC* of (r = 0.74, p < 0.001) at 0.05 significance level. InM1/M2+ had a strong negative and significant relationship with *InM2+/Y* of (r = - 0.90, p < 0.001) at 0.05 significance level. *InDC/Y* had a strong positive and significant relationship with *InCPS/Y* of (r = 0.88, p < 0.001) at 0.05 significance level. *InDC/Y* had a strong negative and significant relationship with *InCPS/DC* of (r = - 0.84, p < 0.001) at 0.05 significance level. *InDC/Y* had a strong positive and significant relationship with *InM2+/Y* of (r = - 0.92, p < 0.001) at 0.05 significance level. *InDC/Y* had a strong negative and significant relationship with *InM1/M 2+* of (r = - 0.93, p < 0.001) at 0.05 significance level. Variables with negative signage means that the variables are inversely correlated with NPL's which implies that as these variables increases NPL's decreases. On the other hand, variables with positive signage means that it is positively correlated with NPL's which implies that as these variables increases so does NPL's. The result sums up the need and call by many authors such as Addai and Chengyi (2015); Reddy (2015) and Amuakwa-Mensah and Boakye-Adjei (2015) where they indicated that both bank specific variables and macroeconomic variables significantly affect NPL's in the banking industry.

Table-3. Correlation Matrix for Financial Development

Variable	*lnCPS/Y*	*lnCPS/DC*	*lnm2 +/Y*	*lnM1/M2 +*	*lnDC/Y*
lnCPS/Y	1.00				
lnCPS/DC	- 0.47	1.00			
lnM2 +/Y	0.87	- 0.70	1.00		
lnM1/M2 +	- 0.85	0.74	- 0.90	1.00	
lnDC/Y	0.88	- 0.84	0.92	- 0.93	1.00

Source: Author's Construct, 2016

The correlation matrices were estimated to examine the level of correlation between the proxies of financial development in order to avoid the problem of multi-collinearity. As shown in Table 3, the correlation value between most of the measures of financial development in absolute terms exceeds 0.5. It is therefore necessary to use each measure of financial development exclusively in the estimation model. This calls for the use of Principal Component Analysis (PCA) to examine the sufficiency of each proxy in explaining variations in financial development in Ghana. Hence the next section presents the analysis on Principal Component Analysis.

3.2.2. Principal Component Analysis on Financial Development

The PCA helps to estimate by how much each of the individual proxies for financial development explains variations in Non-Performing Loans in Ghana. In Table 3, the first four proxies for financial development explains 100% variations in Non-Performing Loans. 85% of the variation is explained by the first eigenvalue.

Table-4. Principal Component Analysis

Component	Eigenvalue	Difference	Proportion	Cumulative
1	4.26	3.71	0.85	0.85
2	0.55	0.45	0.11	0.96
3	0.09	0.004	0.020	0.98
4	0.09	0.095	0.019	1.00
5	0.00	-	0.00	1.00

Source: Author's Construct, 2016

Furthermore, 96% of the variation is explained by the first two eigenvalues together. This is an acceptable large percentage. It should be noted that all the proxies for financial development were not put into a single equation, but rather each of the proxies in one separate equation to prevent multicollinearity. As explained in Table 3, there exists high correlation between the measures of financial development. All the five indicators were exclusively used to examine the effect of each proxy of financial development on Non-Performing Loans.

Table-5. PCA Scoring Coefficients

Variable	Comp 1	Comp 2	Comp 3	Comp 4
$lnCPS/Y$	0.43	**0.58**	0.32	- 0.37
$lnCPS/DC$	- 0.39	**0.79**	-0.18	0.09
$lnM2+/Y$	**0.46**	0.15	0.11	**0.87**
$lnM1/M2+$	**- 0.47**	- 0.05	**0.87**	0.14
$lnDC/Y$	**- 0.48**	- 0.07	0.30	0.28

Source: Author's Construct, 2016

The first principal component is a measure of *InDC/Y*, *InM1/M2+* and *InM2+/Y* with corresponding scores of -0.48, -0.47 and 0.46. *InM2+/Y* and *InCPS/Y* are positively related as they have positive signs which means *InM2+/Y* increases with increasing value of *InCPS/Y*. Same can be said on *InDC/Y* and *InM1/M2+* but in the opposite direction. Banks with high *InDC/Y* and *InM1/M2+* tend to have high NPL's. The second principal component is strongly correlated with two of the original variables that is, *InCPS/DC* and *InCPS/Y*. This suggests that these two variables vary together.

Table-6. Unit Root Test (Test for Stationary)

	ADF Unit Root Test		PP Unit Root Test	
Variable Name	**Level**	**1st Difference**	**Level**	**1st Difference**
$lnNPL$	-1.849	-2.651*	-2.042	-2.663*
$lnINF$	-3.926***		-3.940***	
lnY	-2.171	-4.607***	-2.082	-5.383***
$lnM1$	-1.074	-3.385**	-1.208	-3.363**
$lnM2$	-1.287	-2.659	-1.403	-2.632*
$lnM2+$	-1.720	-2.622	-1.740	-2.725*
$lnLR$	-2.549	-2.677*	-2.416	-2.722*
$lnEX$	-2.517	-2.675*	-2.613	-2.658*
$lnRISK$	-3.217**		-3.219**	
$lnCPS/Y$	-0.882	-5.255***	-0.691	-6.439***
$lnCPS/DC$	-1.375	-4.171***	-1.391	-4.145***
$lnM2+/Y$	0.261	-3.151***	0.227	-3.119***
$lnM1/M2+$	-0.230	-4.309***	-0.178	-4.680***
$lnDC/Y$	-0.694	-3.816***	-0.622	-4.141***

Source: Author's Construct, 2016, Note: *, ** and *** represents 1%, 5% and 10% significant levels respectively.

If one increases then the other one tend to as well, this component can be viewed as a measure of how well it affect NPL positively. In fact the study could state that based on the correlation of 0.79, this component is primarily a measure of *InCPS/DC*. It follows that bank/financial institutions with high values would tend to have low NPL whereas those with small values would have some serious challenges of NPL's.

The third principal component increases with *InM1/M2+*. In fact the study could state that based on the correlation of 0.87, this component is primarily a measure of *InM1/M2+*. This suggest that banks that places more attention to *InM1/M2+* tend to have better revenue from loans due to less NPL's. The fourth component increases with *InM2+/Y*. In fact the study could state that based on the correlation of 0.87, this component is primarily a measure of *InM2+/Y*.

Table 6 shows the results from unit root test of the data sets. The data was tested at level and first differenced. The result indicates that inflation and risk premium were stationary at the level. However, real income, money supply (*M1, M2 and M2+)*, lending rate, and all the measures of financial development (*CPS/Y, CPS/DC, M2+/Y, M1/M2+ and DC/Y*) were not stationary at the level. However, all the non-stationary variables became stationary after first differencing. The unit root test has two significance; statistical significance and economic implications. First, the presence of unit implies that Ordinary Least Squares (OLS) cannot be used in the estimation procedure. The use of OLS in the presence of unit root leads to spurious regression. Thus, if a series has unit root and OLS is used as econometric method used in estimation can lead to wrong sign of the parameter and overestimation or underestimation of the parameters of the variables. The economic implication is that the presence of unit root in data series results in permanent effect if there is a shock.

Table-7. Estimated Results

Variable	(1a)	(1b)	(1c)	(2a)	(2b)	(2c)	(3a)	(3b)	(3c)
Constant	-19.43	-16.694	-14.245	0.526	0.518	0.532	-11.192	-11.925	-6.646
	(-2.45)**	(-1.99)*	(-1.68)	(1.730)*	(0.30)	(0.31)	(-1.35)	(-1.49)	(-0.86)
lnINF	-0.34	-0.287	-0.249	-0.143	-0.142	-0.142	-0.284	-0.194	-0.194
	(-2.88)**	(-2.32)**	(-1.99)*	(-1.05)	(-1.04)	(-1.05)	(-2.10)*	(-2.12)*	(-1.55)
lnY	0.102	-0.017	-0.409	-0.091	-0.092	-0.091	0.470	0.346	0.234
	(0.46)	(-0.07)	(-0.17)	(0.40)	(-0.41)	(-0.41)	(1.65)	(1.40)	(0.92)
lnlR	0.608	0.755	0.888	0.621	0.622	0.625	1.142	1.166	1.244
	(1.86)*	(2.23)**	(2.65)**	(1.12)	(1.12)	(1.13)	(3.71)***	(3.88)***	(3.84)***
lnlRISK	-0.108	-0.099	-0.093	-0.043	-0.043	-0.043	-0.164	-0.170	-0.139
	(-1.92)*	(-1.63)	(-1.46)	(-0.60)	(-0.60)	(-0.61)	(-2.23)**	(-2.38)**	(-1.88)*
lnEX	1.212	0.985	0.971	0.390	0.387	0.391	1.599	1.426	1.224
	(5.28)***	(4.75)***	(4.41)***	(2.07)*	(2.09)*	(2.09)*	(3.60)***	(4.02)***	(3.50)***
lnM1	-0.736			-0.013			-0.980		
	(-3.92)***			(-0.21)			(-2.69)**		
lnM2		-0.544			-0.011			-0.857	
		(-3.33)***			(-0.20)			(-2.94)**	
lnM2 +			-0.490			-0.014			-0.637
			(-3.03)***			(-0.24)			(-2.40)**
lnCPS/Y	-1.271	-1.062	-0.907						
	(-2.76)**	(-2.23)**	(-1.90)*						
lnCPS/DC				-1.130	-1.128	-1.124			
				(-1.91)*	(-1.90)*	(-1.91)*			
lnDC/Y							-0.884	-0.897	-0.542
							(-1.70)	(-1.84)*	(-1.19)

Source: Author's Construct, 2016, Note: *, ** and *** represents 1%, 5% and 10% significant levels respectively.

The results above show the relationship between non-performing loans and its covariates. The results show that inflation is a significant determinant of non-performing loans. Thus, inflation has a negative significant effect on non-performing loans in models 1 and 3. Though inflation has a negative relationship with non-performing

loans in other models, it is insignificant in explaining variations in NPL. Explaining the relationship with NPL must be done with caution. As inflation increases, NPL decreases as shown in the negative sign of the parameter. This result is rather surprising as it is expected that an increase in inflation will lead to increase in NPL. The result does not align with Farhan *et al.* (2012) where it was indicated that inflation has a significant positive relationship with NPL's by 201 Pakistani Bankers in their study on NPL whereas (Badar and Javid, 2013) aligns with this result as a confirmation of their study which indicated that inflation has a strong negative long run relationship with NPL. Moreover, Curak *et al.* (2013) affirmed in their study of NPL that higher inflation has association with higher NPL's. Skarica (2014) observed that the primary cause of high levels of NPL's among others is inflation rate. Nkusu (2011) stressed that borrower's repayment ability could be affected by inflation from many aspects to affect NPL in either positive or negative direction. Djiogap and Ngomsi (2012) affirmed that inflation variable is statistically insignificant in explaining the total business loans ratios of banks in a study conducted within the CEMAC region on NPL's

Table-7. Estimated Results (Continuation)

Variable	(4a)	(4b)	(4c)	(5a)	(5b)	(5c)
Constant	20.244	21.857	22.031	-11.366	-4.524	-0.138
	(2.66)**	(2.87)**	(2.71)**	(-1.91)*	(-1.14)	(-0.04)
lnINF	0.011	0.025	0.023	0.196	0.019	-0.083
	(0.09)	(0.21)	(0.20)	(1.12)	(0.14)	(-0.62)
lnY	0.171	0.164	0.169	-0.196	0.237	0.312
	(0.66)	(0.69)	(0.70)	(-0.56)	(0.83)	(1.00)
lnlR	1.223	1.244	1.228	1.029	0.994	0.996
	(3.80)***	(4.08)***	(4.02)***	(3.22)***	(2.88)**	(2.54)**
lnlRISK	-0.110	-0.104	-0.104	-0.070	-0.089	-0.117
	(-1.58)	(-1.57)	(-1.53)	(-0.97)	(-1.16)	(-1.39)
lnEX	0.213	0.157	0.132	-0.610	0.350	0.701
	(0.66)	(0.53)	(0.38)	(-0.88)	(0.94)	(2.02)*
lnM1	0.141			2.737		
	(0.62)			(2.14)		
lnM2		0.186			1.20	
		(0.90)			(1.50)	
lnM2 +			0.195			0.245
			(0.84)			(0.45)
lnM2 +/Y	1.123	1.229	1.241			
	(2.60)**	(2.81)**	(2.60)**			
lnM1 /M2				-2.434	-1.430	-0.609
				(-2.54)**	(-2.04)*	(-1.24)

Source: Author's Construct, 2016

Another variable of interest is real income. Real income has a negative relationship with NPL in models 1-3 and 5a. The statistical effect of changes in real income on NPL is insignificant. In other words, changes in real income have no significant effect on NPL. The result is in agreement of studies by several authors on NPL such as Farhan *et al.* (2012) in their study on NPL's in the Pakistani's Banking Sector discovered that GDP growth has insignificant negative relationship with the non-performing loans. Saba *et al.* (2012) studied into the determinants of non-performing loans in the United States banking sector, it was revealed that GDP per capital has a negative significant with NPL. Badar and Javid (2013) researched into the impact of macroeconomic forces on nonperforming loans on commercial banks in Pakistan. The study applied vector error correction model where it found strong negative long run relationships existed of gross domestic product with NPLs. Messai and Jouini (2013) conducted study on micro and macro determinants of non-performing loans sampled 85 banks in three countries (Greek, Italy and Spain) between 2004 and 2008. The study found that the problem loans varied negatively with the growth rate of GDP. Lending rate has a positive and significant relationship with NPL. Thus,

lending rate is a significant determinant of NPL. It must be noted that the magnitude of the parameter is huge in both models 1 and 3. A percentage change in lending rate leads to approximately (0.6 to 0.9) percentage change in NPL in the same direction in models (1a, 1b and1c). Also, a percentage change in lending rate leads to approximately 1.1 to 1.2 percentage change in lending rate in the same direction. Specifically, for instance, a percentage increase in lending rate leads to approximately 0.9 percent increase in NPL in model (1c) and 1.2 percent increase in model (3c). The result is in agreement with Adebola and Dahalan (2011) where their study revealed that lending rate had a significant positive effect on NPL using the banking sector of Malaysia. On the other hand, Louzis *et al.* (2012) in a study on NPL's using nine (9) largest banks in Greece indicated that interest rates affected losses in all categories of loans. Farhan *et al.* (2012) and Saba *et al.* (2012) in separate studies on NPL's using the United States banking sector confirmed that interest rate had a negative significant with NPL's. Badar and Javid (2013) stressed that there was a strong negative long run relationships existed between lending rate and NPL's. Curak *et al.* (2013) affirmed that higher interest was associated with higher NPL's in studying NPL's in the Southeastern European Banking Systems. Messai and Jouini (2013) suggested that problem loans had positively relationships with real interest rate in a study of eighty-five (85) banks in Greece, Italy and Spain on their micro and macro determinants of NPL's. In relation to the result of this study it is a fact that lending rate is significant to NPL's but can be in positive or negative as indicated by Farhan *et al.* (2012) and Saba *et al.* (2012).

Surprisingly, sign of the parameter of risk is negative. It was expected that risk premium will have a positive relationship with NPL. Thus, high risk premium will lead to a reduction in NPL and vice versa. From the result, a percentage change in risk premium will lead to approximately 0.16 increases in NPL in model 3b. Asantey and Tengey (2014) noted in their study with reference to bad loans on banks' lending potential and its effects on financial performance concluded that banks must hedge against bad loans realization to maximize their financial performance and to improve access to borrowers. Curak *et al.* (2013) empirically investigated the determinants of non-performing loans in Southeastern European banking systems and the result shows that credit risk was affected by bank specific variables such as bank size, performance (ROA) and solvency.

The effect of exchange rate on NPL was also of interest to the study. The result shows that exchange rate has a positive and significant effect on NPL in models 1, 2 and 3. A percentage change in exchange rate leads to change in NPL in the same direction. Interpretation of exchange rate on NPL is counter intuitive. An increase in exchange rate means a depreciation of a currency whilst a decrease in exchange rate means an appreciation of a currency. The result is in alignment with Amuakwa-Mensah and Boakye-Adjei (2015) study on NPL's in the banking industry of Ghana. The study confirmed among other things that real effective exchange rate significantly affected NPL's.

Money supply was found as a significant determinant of NPL as shown in models 1 and 3. The study used three measures of money supply (M1, M2 and M2+). All the measures of money supply were found to have a negative relationship with NPL in models 1and 3. The coefficient of the parameter of money supply was significant at 1% and 5% in models 1 and 3 respectively. Badar and Javid (2013) researched into the impact of macroeconomic forces on nonperforming loans on commercial banks in Pakistan during the period of 2002 and 2011 where the study assessed 36 commercial banks considered the long and short run dynamics between nonperforming loans and macroeconomic variables. The study applied vector error correction model where it found that there was a strong negative long run relationships existed between money supply and NPLs. All the proxies for financial development had a significant effect on NPL. However, the sign of the parameter of financial development depends on the type of proxy in question. For instance, the ratio of private sector credit to real income, ratio of domestic credit to real income, ratio of private sector credit to domestic credit and ratio of narrow money supply to broad money supply had a negative relationship with NPL. Meaning, an increase in any of these variables as a proxy for financial development leads to reduction in NPL. On the other hand, the ratio of broad money supply to real income had a positive relationship with NPL. This implies that an increase in ratio of broad money supply to real income will cause NPL to increase in the same direction. Greenidge and Grosvenor (2010) argued that the magnitude of NPLs

is a key element in the initiation and progression of financial and banking crises while Reinhart and Rogoff (2010) stressed that NPLs can be used to mark the onset of a banking crisis.

4. CONCLUSION, POLICY IMPLICATIONS AND RECOMMENDATION

The study ascertain the determinants of NPL's in Ghana banking sector using Bank of Ghana's Monetary Time Series, World Bank World Development Indicators and International Monetary Fund's International Financial Statistics Sample data between 1998 to 2013. The empirical results support the view that inflation is a significant determinant of non-performing loans. This implies that inflation could be a policy target to influence the level of non-performing loans in Ghana. However, the sign of the parameter of inflation was negative. Using inflation as policy instruments means that influencing the factors that reduces inflation will cause non-performing loans to increase due to their inverse relationship. The choice of inflation as a policy instrument should be done with caution due to the sign of the parameter of the coefficient of inflation. Real income on the other hand had a negative insignificant relationship with NPL. Policy instruments that influences real income has no effect on NPL.

With respect to lending rate, it has a positive and significant relationship with NPL. The magnitude of lending rate is approximately unitary elastic. Changes in lending rate affect NPL by same magnitude. Using lending rate as policy instruments to influence NPL would be effective in changing the level of NPL. Also, risk premium had a negative and significant effect on NPL. Thus, risk premium and NPL moves in opposite direction. Changes in lending rate by a unit percentage leads to less than proportionate change in NPL in the opposite direction due to inelastic coefficient of the parameter of risk premium. Exchange rate was found as a significant determinant of NPL. The sign of the coefficient of the parameter of exchange rate is positive. An increase in exchange rate means a depreciation of a currency whilst a decrease in exchange rate means an appreciation of a currency. Policies that cause depreciation of the Ghana Cedi would lead to increase in the level of NPL. On the other hand, factors that cause appreciation of the Ghana Cedi would cause the level of NPL to decrease. Exchange rate could therefore be targeted as policy instrument to influence the level of NPL. Similarly, money supply could be used to influence the level of NPL in Ghana. Financial development is a significant determinant of NPL in Ghana. The effect and the direction of financial development on NPL however depend on the choice of proxy as policy instruments. For instance, while the ratio of private sector credit to real income, ratio of domestic credit to real income, ratio of private sector credit to domestic credit and ratio of narrow money supply to broad money supply have a negative effect on NPL, the ratio of broad money supply to real income has a positive effect on NPL. This paper suggests that using lending rate as policy instrument and other policy instruments that lead to appreciation of the Ghana Cedi if given the adequate attention would be effective in changing the level of NPL's within the Banking Sector of Ghana. The paper further prescribed that banks must step up their loan recovery efforts and tightens credit risk management practices in order to minimize losses from non-performing loans. The findings of this study though within the context of the Ghana Banking Sector it is of essence to other countries within the Sub-Saharan West African countries whose banks are saddled with non-performing loans where lessons can be learnt.

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