

UNIVERSITY OF GHANA

MACROECONOMIC DETERMINANTS OF NONPERFORMING LOANS IN GHANA

BY

STEPHEN KOFI ENTSIE ANDOH

(10044331)

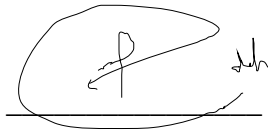
**THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA LEGON, IN
PARTIAL FULFILMENT OF THE REQUIREMENT FOR THE AWARD OF MPhil IN
ECONOMIC DEGREE**

DEPARTMENT OF ECONOMICS

JULY, 2020

DECLARATION

I, **STEPHEN K. E. ANDOH**, hereby declare that this Thesis was put together by me and that apart from past and present literature duly acknowledged, this work has never been submitted in whole or in part for any other degree in this University or elsewhere.

A handwritten signature in black ink, consisting of a large, stylized 'S' followed by 'K. E. Andoh'.

STEPHEN K. E. ANDOH

10044331

STUDENT

SUPERVISORS:

A handwritten signature in black ink, appearing to read 'Augustin Fosu'.

PROFESSOR AUGUSTIN FOSU

A handwritten signature in blue ink, appearing to read 'William Bekoe'.

DR. WILLIAM BEKOE

DEDICATION

Dedicated to my dear spouse Akosua Asantewaa Andoh, my kids Nhyira Aba Amosuah Andoh,

Paa Kwesi Sekyi Andoh and Ewurabena Andoh.

ACKNOWLEDGEMENT

I am highly thankful to God Almighty for abundant grace and divine directions throughout this research work. Profound appreciation also goes to Professor Augustin Fosu for his excellent supervision, support, pieces of advice and encouragement. I also thank my other advisor, Dr. William Bekoe, for his support. The lecturers of the Economics Department of the University of Ghana also deserve appreciation for their support in countless ways.

My gratitude goes to my family for their words of encouragement and motivation and to my boss, Dr. Ernest Obuobisa-Darko for the valuable ideas he gave me.

Once again my appreciation to all, and I pray the blessing of the Almighty will be with you all the days of your lives.

ABSTRACT

The core activities of banks are essential for the development of a country. They support the economy through their depository and lending activities. However, there are risks associated with performing these functions, which should be managed effectively to avoid jeopardizing the advancement of the financial sector. Major economies of the world have suffered various degrees of financial sector deterioration due to the failure of banks to maintain healthy loan portfolios.

The present research was undertaken to measure the impact of changes in Ghana's macroeconomic conditions on loan books of Ghanaian commercial banks. Quarterly time series data covering June 2004 to December 2016 were used for the study, and the Autoregressive Distributed Lag (*ARDL*) was carried out to establish the existence of cointegration among the variables. The results reflected the existence of long-run relationships among the variables employed in the study. Gross Domestic Product, Inflation, and Exchange Rate were found to have negative coefficients in the Nonperforming Loans equation, -0.44, -1.05 and -4.19 respectively, whilst Money Supply, Monetary Policy Rate had positive coefficients, 0.12 and 1.94 respectively. However, the estimated impact was insignificant for Gross Domestic Product as evidenced by probability value of 0.785, though significant for Money Supply, Monetary Policy Rate, Inflation and Exchange Rate evidenced by probability values of 0.000. It is recommended that the Central Bank include in their monetary policy decisions strict measures to be complied by banks to limit the extent to which lending rates are adjusted upwards in response to upward adjustments in the policy rates. Additionally, banks are to ensure proper risk underwriting procedures to minimize nonperforming loans in the short run and long run.

TABLE OF CONTENTS

Declaration	i
Dedication	ii
Acknowledgement	iii
Abstract	iv
List of Figures	ix
List of Tables	x
List of Abbreviations	xi

CHAPTER ONE

INTRODUCTION	1
1.1 Background to the Study	1
1.2 Problem Statement	5
1.3 Research Questions	7
1.4 Objectives of the Study	8
1.5 Hypothesis of the study	8
1.6 Significance and Relevance of the project	8
1.7 Scope of the Study	10
1.8 Organization of the Study	11

CHAPTER TWO

LITERATURE REVIEW	13
2.1 Introduction	13
2.2 Theoretical Literature Review	13
2.2.1 The Concept of Nonperforming Loans	13

2.2.2 Theories of nonperforming loans	14
Agency Theory	14
Moral Hazard Theory	16
Debt-Deflation Theory	16
Financial Theory	17
2.3 Empirical Literature Review	19
2.4 Ghana's banking sector and Nonperforming loans	23
2.5 Conclusion	26
<u>CHAPTER THREE</u>	
METHODOLOGY	28
3.1 Introduction	28
3.2 Theoretical Framwork	28
3.3 Model Specification	31
3.4 Description of variables	33
3.4.1 Monetray Policy Rate	33
3.4.2 Growth in Gross Domestic Product	33
3.4.3 Inflation	34
3.4.4 Money supply	35
3.4.5 Exchange rate	36
3.5 Estimation Techniques	37
3.6 Data types and Sources	42

CHAPTER FOUR

DATA PRESENTATION AND DISCUSSION OF RESULTS	44
4.1 Introduction	44
4.2 Results of Unit Root Test	44
4.3 Results of the Bound Test for Cointegration	46
4.4 Diagnostic Test of the model	47
4.5 Stability Test of the model	48
4.6 Results and discussion of the long run model	48
4.7 Results of the Error Correction Model	52
4.8 Diagnostic Test of the Error Correction Model	53
4.9 Stability Test of the Error Correction Model	54
4.10 Results of the WALD Causality Tests	54
4.11 Conclusion	56

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS	58
5.1 Introduction	58
5.2 Summary of the study	58
5.3 Conclusion	61
5.4 Policy Implications and Recommendations	62
5.5 Limitations of the study	63

References	65
APPENDICES	77
APPENDIX 1	77
APPENDIX 2	78
APPENDIX 3	79
APPENDIX 4	80
APPENDIX 5	81
APPENDIX 6	82
APPENDIX 7	83
APPENDIX 8	84
APPENDIX 9	85
APPENDIX 10	86

LIST OF FIGURES

FIGURE	PAGE
Figure 2.1: Trend of nonperforming loans in Ghana from 2004 to 2016	25

LIST OF TABLES

TABLE	PAGE
Table 2.1 : Concentration of banks in Ghana from 2007 to 2017	24
Table 4.1: Results of Unit Root Test	44
Table 4.2: Results of Bound Test for Cointegration	45
Table 4.3: Extract of the Pesaran Table	46
Table 4.4: Extract of results of the Diagnostic Tests	46
Table 4.5: Estimated Long Run Coefficients using the ARDL Approach	48
Table 4.6: Extract of the results of the Diagnostic Tests	53
Table 4.7: Extract of the results of the Causality Test for GDP	53
Table 4.8: Extract of the results of the Causality Test for MPR	54
Table 4.9: Extract of the results of the Causality Test for M2	54
Table 4.10: Extract of the results of the Causality Test for INF	54
Table 4.11: Extract of the results of the Causality Test for EXR	55

ABBREVIATIONS

NPLs - Nonperforming loans

GDP - Gross Domestic Product

PwC – PriceWaterHouseCoopers

BOG- Bank of Ghana

GSS – Ghana Statistical Service

M2 – Money Supply

Md - Money Demand

USD - United States Dollar

ADB – Agricultural Development Bank

U.A.E – United Arab Emirates

ECM – Error Correction Model

MPR – Monetary Policy Rate

INF – Inflation

EXR – Exchange Rate

LIR – Loan Interest Rate

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

The activities of the financial sector in every nation are essential for the development and sustainability of that nation's wealth. The financial agents or institutions, especially the commercial banks, are intended to drive the money supply (M2) of every economy. According to many researchers, an efficient commercial banking system accelerates economic growth, which is fundamental for poverty alleviation (Hou, 2007; Adekunle, Salami & Adedipe Oluseyi, 2013; Rajaraman & Visishtha, 2002). For example, Khan and Senhadji, (2001) explain that a country's economic progress is dependent on, among other factors, a very stable and well performing banking sub-sector. They explained further that, the growth of an economy is not only hindered when the banking sub-sector is poorly performing, but the prosperity of global economy is also affected. Richard (2011) also postulated that every banking sector functions to enhance productivity by revitalizing investment. Rajaraman and Visishtha, (2002) also propounded that the advancement an economy is hampered without a sound financial system.

The commercial banks intermediate between surplus economic units and the deficit economic units, which is an important part of the savings-investment mechanism in every economy. The banks perform the key role of transfer of money from economic units with excess liquidity to investors through lending, which is crucial for the prosperity of an economy.

According to Greuning and Bratanovic (2003), the lending activities of commercial banks are deemed essential in economies where the majority of borrowers have inadequate or no access to capital markets. The borrowers or investors may be individuals or businesses who need funds in the form of loans for consumption or investment purposes and are expected to repay according to terms, conditions and covenants agreed by the commercial banks and borrowers.

However, the expectations of the commercial banks may not be met as certain borrowers default or are unable to repay the loans granted them. The unpaid loans become problematic and are classified as non-performing loans (NPLs). As defined on page 46 of IMF's financial soundness indicators report, 2006, and also defined by Freeman (2004) "a loan is non-performing when payments of interest and principal are past due by 90 days or more, or at least 90 days of interest payments have been capitalized, refinanced or delayed by agreement, or payments are less than 90 days overdue, but there are other good reasons to doubt that payments will be made in full".

Incidences of NPLs are a common phenomenon found in every financial sector, globally. Empirically, no lending institution globally has been able to keep problem-free loan portfolios and the commercial banks of these financial sectors are the largest provider and custodian of loans in every economy. Uncontrolled levels of NPLs therefore impacts negatively on the economy, by primarily creating liquidity problems for the commercial banks which hinders the supply of funding to businesses for investments (Alam, Haq & Kader, 2015).

The high NPLs further compel commercial banks to restrict lending by tightening their lending procedures with the ultimate purpose of reducing the levels of NPLs on their balance sheet. These actions prevent creditworthy industries from securing loans to invest and expand their profitable operations (Aziz et al., 2009 as in Alam et al, 2015).

Several factors have been identified as causes of NPLs globally, including rapid credit growth strategies adopted by banks. For example, Bercoff, Giovanni and Grimard (2002) identified credit growth as a causal factor of NPLs in Argentina. Keeton and Morris (1987) also found excessive granting of credit facilities by financiers as a key cause of unhealthy credit portfolios. The rapid credit growth agenda embarked on by commercial banks can be attributed to several factors; notable amongst them is the drive of management to increase assets in order to increase revenue which in turn increases returns on equity to shareholders. Jimenez and Saurina (2006), as cited in Messai et al. (2013), also attributed the rapid credit growth agenda by commercial banks to the agency problems that potentially influence executives of lending companies to advance credit facilities excessively in times of difficulties. Other bank specific causes of NPLs identified include negligence on the part of banks, poor loan underwriting techniques and inadequate monitoring.

Besides the bank-specific factors, NPLs can also be triggered by factors outside the control of banks. For example, studies have shown that loan repayment problems could emanate from borrowers' specific issues, such as a borrower's character or unwillingness to repay the loan.

Other external factors include increasing borrowing charges, inflation, depreciation of the cedi and delays in the payment of contract proceeds by the government to contractors and other service providers (PricewaterhouseCoopers, 2010).

The foregoing implies that NPLs cannot be completely eliminated. Rather, what is prudent is to control the levels of NPLs to ensure that it is kept at minimum ranges acceptable for profit maximization and continuity of credit flow in the banking sector. Studies have suggested that failure to do so retard the monetary transmission mechanism to the real economy, leading to subdued credit flows, thus weakening investment levels and growth.

Over the last few decades, empirical work conducted on banking sectors globally has revealed many banking failures due to rising levels of NPLs. For instance, Hou (2007) postulated that the root causes of most bank failures are NPLs which in the long-run damage the economy. These failures hinder credit flow in the economy which retards the advancement of business units (Chijoriga, 1997; Brownbridge & Harvey, 1998), hence negatively affecting their economies. A practical example is the global financial crisis which started in 2007 and emanated from the increased non-performing mortgage loans.

In Ghana, statistics show that loans constitute a large chunk of the operating assets of commercial banks. Non-payment of these loans is a recipe for banking crises which in turn lead to economic deterioration.

According to PricewaterhouseCoopers (2013), total operating assets for 2012 were GHS25.8 billion and loans and advances alone constituted about 47%, which represents the most significant component of total operating assets of banks in Ghana. The report also revealed high NPLs, impacting adversely on commercial banks performance in Ghana. Reasons for the high non-performing loans highlighted in these reports included high borrowing costs largely driven by the policy rate, which is the largest component of lending rates in Ghana. However, these reports do not adequately demonstrate how the policy rate creates the NPLs.

The present study examines how the monetary policy rates have contributed to the increasing NPLs in Ghana. The study therefore seeks to primarily examine the linkage between the monetary policy rates and NPLs in Ghana. The study also considers the linkage between the NPLs levels in Ghana and key macroeconomic indicators including: inflation, GDP, rate of currency exchange and M2. Additionally, the study aims at providing recommendations to policy makers and other stakeholders, on controlling the levels of NPLs in the wake of rising borrowing cost, and shocks from the macroeconomic variables under consideration, using Ghana as a case study.

1.2 Problem Statement

An efficient and well performing banking sub-sector is crucial for the stability and survival of banks and the economy as a whole (Brownbridge & Harvey, 1998). Increasing and uncontrolled levels of nonperforming loans (NPLs) have remained a key factor negatively affecting the profitability and efficiency of banks, creating banking crises and resulting in the collapse of banks which serve as the intermediaries for savers and investors (Brownbridge, 1998).

Several Bank of Ghana (BOG) financial stability reports and PriceWaterHouseCoopers (PwC) banking survey reports on the banking sector of Ghana for the past twelve (12) years, revealed significant growth in the level of NPLs. For instance, NPLs increased from GHS61.3 million in December 2000 to GHS1,719 million in December 2012 (*BOG 2013*), implying an increase in locked-up capital which could be loaned to businesses for investment. Going by the various studies conducted on the subject in Ghana and other jurisdictions, the consistent growth in NPLs in Ghana over the past few years is a threat to the soundness and health of the economy of Ghana if appropriate measures are not taken. Currently, the impact of increasing levels of NPLs in Ghana is manifested in banks' high loan to deposit ratios, leading to their inability to provide loans to businesses all year round.

A major contributing factor of the rising levels of non-performing loans is the high borrowing cost. According to PwC banking survey report, 2015, the monetary policy rates increased from 16% to 21% in 2014 alone. The monetary policy rates have a direct positive impact on lending rates in Ghana and borrowers (i.e. businesses and individuals) have difficulty repaying their loans when lending rates increase.

Over the years, banks in Ghana amend their loan interest rates (LIR) in response to Monetary Policy Rate (MPR) adjustments by the regulator. Banking surveys conducted over the years have shown a significant positive link between the MPR and the lending rates of banks (Cobbinah, 2011). This implies an unstable lending rate which has the propensity to create high NPLs.

Various empirical studies have been conducted for other parts of the globe to examine the macroeconomic causes of NPLs (Nkusu, 2011; Fofack, 2005; Bofondi & Ropele, 2011; Dash & Kabra, 2010; Adebola, Sulaiman, Yusoff & Dahalan 2011). The studies found interest rates, amongst other macroeconomic factors, as one of the causes NPLs. In Ghana, LIR are positively impacted by MPR adjustments and LIR have been cited in several reports including the PwC banking survey reports as a key contributing factor of NPLs in Ghana. However, existing literature on the subject in Ghana have excluded the contribution of MPR adjustments in nonperforming loans levels in Ghana. Therefore, it is essential to examine the extent to which adjustments in the MPR affect non-performing loans in Ghana through its influence on the lending rates.

Other macroeconomic variables considered include the rate of currency exchange, gross domestic product, money supply and inflation. The study identified policy reviews that commercial banks in Ghana should undertake to ensure a healthy portfolio, especially during periods of interest rate hikes.

1.3 Research questions

This paper aims at answering the following questions:

- How do changes in the monetary policy rates, affect nonperforming loans in Ghana?
- How do changes in gross domestic product levels, inflation levels, the level of money supply and exchange rates impact nonperforming loans in Ghana?
- What strategies could be adopted by commercial banks and their regulator to control the negative effects of changes in the selected economic indicators on credit portfolios of financiers?

1.4 Objectives of the study

Generally, this thesis aims at examining the linkage between changes in certain macroeconomic indicators and the levels of nonperforming loans in Ghana.

The research has the following specific goals:

- To establish the linkage between changes in the policy rate and nonperforming loans.
- To examine the linkage between nonperforming loans and other economic indicators comprising inflation rate gross domestic product, money supply and exchange rate
- To determine appropriate strategies that could be used by financial institutions to minimize NPLs in response to changes in the selected economic variables.

1.5 Hypothesis of the study

The study seeks to test and validate the following hypothesis;

H₀: Changes in macroeconomic variables have no significant impact on nonperforming loans in Ghana

H₁: Changes in macroeconomic variables have significant impact on nonperforming loans in Ghana

1.6 Significance and relevance of the study

The financial sector of Ghana contributes about 6.5% of gross domestic product, (GSS, 2014) and the activities of banks dominate the financial sub-sector. These banks have lending and deposit mobilization as their core business which indeed is evidenced by their art of being the intermediaries between surplus units and deficit units.

Loans are given to economic units including individuals and firms, by the banks in order to fund their capital expenditures and to support their businesses which in turn increase productivity necessary for economic stability and growth. By implication, maintaining good loan portfolios by banks in Ghana directly impacts the stability and advancement of the banking sub-sector and Ghana's economy as a whole. In view of the invaluable role of the financial sector through the banks to economic stability and growth, it is important to identify issues that hinder the performance and stability of banks.

The significance of this work, therefore, comprises the following:

- The outcomes of the study will add to previous findings of similar research in other countries, using Ghana as the case study.
- The study will provide players in the financial sector, especially the Central Bank, some guidance to developing strategic policies and practices needed to minimize the deterioration of bank loans during periods of significant fluctuations in the macroeconomic indicators included in this research.
- This paper will provide a basis for further work on nonperforming loans and also add to existing literature on the subject matter.

1.7 Scope of the Study

This research focuses on Ghana, a developing economy with considerable growth prospects and opportunities. According to the World Bank (2015) Ghana is the second-largest economy, after Nigeria, in West Africa with a gross domestic product (GDP) of \$37.86 billion in 2015, and a GDP growth of 3.9% in 2015.

The Ghanaian banking sub-sector has remained profitable and well capitalized. The sub-sector dominates the financial sector which is the second largest contributor to GDP under services sector. The banking sector is highly competitive and open, albeit somewhat crowded. The country, as at December 2015, had about 32 commercial banks, 24 non-bank financial establishments, 140 rural banks, and microfinance companies making Ghana an economy to consider, though relatively small, for the study (BOG, 2015).

The banks have recorded considerable nonperforming loans (NPLs) levels, which have been primarily associated with high and rising cost of borrowing, specifically interest rates, by private sector and salaried workers in the country (PwC, 2009). It is for this reason that the study seeks to investigate the link between adjustments in the monetary policy rate (MPR) and other macroeconomic shocks and the level of NPLs in Ghana. The choice of Ghana is premised on:

- i. The need to establish for Ghana, an economic justification for the rising NPLs in Ghana which will serve as a basis for making valuable lending and borrowing decisions by key stakeholders operating within Ghana.

- ii. The Central Bank of Ghana as well as other world accredited financial and audit firms and institutions have monitored Ghana's financial sector performance for a considerable number of years, making the required data to complete the research relatively easy to obtain.

- iii. Again, being Africa's eleventh largest economy in terms of Nominal Gross Domestic Product, presents an opportunity for a regional outlook of the issues under the study (IMF World Economic Outlook, 2018).

- iv. The availability of reliable quarterly data on the variables employed in the study between 2004 and 2016 where Ghana experienced significant financial sector reforms and increasing levels of NPLs.

The study seeks to measure the link between all categories of NPLs and their macroeconomic causes in Ghana, specifically, the monetary policy rates, inflation, exchange rates fluctuation, GDP levels, and M2 levels.

1.8 Organization of the Study

The sections of the thesis are organized as follows: Chapter Two, deals with a review of relevant literature on similar works undertaken locally and internationally. The literature covers both theoretical and empirical studies. Chapter Three covers the methodology.

The methodology covers theoretical frame work, model specification, estimation techniques and data types and sources. . Chapter Four presents and discusses the results of the work. Chapter Five details the summary, conclusions, limitations of the thesis, contribution to knowledge, and provides recommendations based upon the research findings.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews related literature on the macroeconomic causes of nonperforming loans. The chapter is divided into two sections; the first section reviews the theoretical studies in the subject area and the second section deals with the review of empirical studies. The chapter also provides an overview of the Ghanaian Banking sector and closes with the provision of a summary of the main issues discussed.

2.2 Theoretical Literature Review

2.2.1 The Concept of Nonperforming Loans

In accordance with policy requirements and global standards, banks review their asset portfolios on regular basis, at least every quarter. This is to enable banks group their loans and advances into various categories, to determine the health of their loan portfolios. According to the IMF Financial Soundness Indicators, 2006, bank loans should be categorized as follows.

- **Current:** This category is for assets whose installment repayment is not in arrears and the next repayment is less than 30 days;
- **OLEM (Other Loans Exceptionally Mentioned):** This class of assets represents credit facilities whose repayment is overdue for over 30-days but below 90-days from the last repayment date.

- **Substandard:** This classification of assets refers to loans and advances whose repayment is overdue for over 90-days but below 180-days from the last repayment date.
- **Doubtful:** This refers to loans and advances whose repayment is overdue for more than 180-days but below 360-days from the last repayment date.
- **Loss:** This represents loans with repayments outstanding for over 360-days.

Facilities classified CURRENT and OLEM can be referred to as performing loans whilst facilities classified SUBSTANDARD and beyond can be referred to as a non-performing loans (IMF financial soundness indicators, 2006).

2.2.2 Theories of Nonperforming Loans

Several theories have been propounded to explain nonperforming loans and this section considers a review of the key theories. These include: The agency theory, moral hazard theory, debt-deflation theory and the financial theory,

Agency Theory

The incidence of nonperforming loans (NPLs) can be explained by the Agency Theory which postulates that firms (in this case commercial banks) go through various forms of problems due to nonaligned interest of agents' (managers, sales representatives) and the interest of principals (shareholders, board, executive management).

Whereas shareholders, board or executive management, seek optimum returns on equity, managers' or sales representatives seek better earnings (Eisenhardt, 1989; Jensen & Meckling, 1976). For example, executive management contracts sales representatives to sell and increase the asset portfolio of the banks, a common practice in many banking sectors. In Ghana, it is practiced by Fidelity Bank Ghana Limited, Barclays Bank Limited, for instance. Generally, these sales representatives are paid commissions based on the volumes of loans sold and disbursed. As a result, the sales representatives and managers have different risk tolerance levels. Sales representatives, in their bid to increase their commissions earned, tend to manipulate information so as to go through the loan underwriting procedures to earn a commission (Barry, 1981). Some sales representatives in connivance with managers tend to relax risk and underwriting procedures when granting loans in order to rake in more commissions or some forms of monetary gains. This tends to influence the risk tolerance levels of executives which leads to banks financing high risk transactions (Smith & Stulz, 1987).

This principal-agent problem in financial institutions can be reduced when shareholders or executive management set reasonable revenue targets to be achieved by managers and sales representatives. Furthermore, through better monitoring (Kirby & Davis, 1998) such as pre-approval audits and establishing more appropriate incentives for managers and sales representatives, the agency conflict could be eliminated. For example, banks could implement inducements to sales representatives in order to shift competing interests into equilibrium. Good compensation packages can be strong mechanisms for minimizing agency problems (Tosi, Werner, Katz, & Gomez-Mejia, 2000).

Moral Hazard Theory

This theory demonstrates that the existence of penalties for loan default provides borrowers the disincentive to default. Moral hazard is encouraged in two (2) ways:

- (a) when borrowers on one hand know that banks or financial institutions are unable to access their historical credit profiles and,
- (b) when banks on the other hand apply high risk premiums in addition to the policy rates which have the tendency to breakdown the credit market (Alary & Goller, 2001).

Klein (1992) postulates that sharing of credit data amongst financiers compels debtors to honor their loan repayment commitments. Debtors are likely to honor their repayment agreements since they are aware that they will be 'blacklisted' when they default which minimizes their chances of undertaking formal borrowing in the future.

According to Padilla and Pagano (2000), moral hazard challenges could be minimized when banks demonstrate that loan default, attracts extra interest cost as penal charges or leads to bans on accessing credit facilities, since credit data on borrowers is available. In Ghana, these penalties exist but are not properly enforced by the commercial banks to punish loan defaulters, due to increased competition amongst the banks for customers.

The Debt-Deflation Theory

This theory relates to the effect of debt on the price of properties, goods and services. According to the theory, price decreases in an economy are facilitated by total outstanding debts.

The concept, which was developed by Irving Fisher in 1933, advocates that borrowers tend to default on their loan obligations during economic downturns and depressions due to increasing total debt levels in real value, caused by deflation. According to Fisher, falling commodity prices increased the debt burden of borrowers. Debt is an essential component of consumer and business finance and it typically goes through cycles, thereby affecting the amount issued. At its peak, the debt can deflate the value of real currency and as debt issuance increases, risk of non-payment of the debts is also higher. Debt- deflation causes the values of debtors' properties to fall which can result in many negative repercussions. The defaults coupled with the falling values of debtors' collaterals, results in an increase in bank insolvencies, a reduction in lending and by extension a reduction in spending (Fisher 1933).

Financial Instability Theory

This theory was propounded by Hyman Philip Minsky, an economist. Minsky argued that financial crises are prevalent in capitalism because debtors and financiers tend to progressively make reckless decisions during periods of economic prosperity. This high level of confidence in the economy creates financial bubbles, which later burst. Capitalism, therefore, is prone to move periods of financial stability to instability.

Conventionally, credit facilities are secured with assets to hedge against default. Using the mortgage market as an example, financiers grant mortgage loans if borrowers can adequately demonstrate their ability and willingness to generate cash flows to make the initial deposit and repay both the principal and interest in addition to ensuring that borrowers satisfy their risk acceptance criteria.

However, during economic boom, financiers and debtors become excessively optimistic and prepared to take on greater risks, if house prices rise. Banks tend to reduce the amount of deposit required in a bid to increase the portfolio. Credit terms and conditions tend to be relaxed leading to increased lending which causes asset prices to rise, thereby increasing confidence even further. Rather than hedge borrowing (safe secured lending) banks engage in speculative loaning and even 'Ponzi borrowing' (financiers lending money hoping that asset prices keep rising to facilitate repayment) which is unsustainable in the long-term. These assets bubble and speculative loaning cannot be sustained forever. When asset values stop rising, financiers and debtors realize that their cash may not be adequate to meet their loan obligations. Heavily indebted borrowers begin liquidating their properties for purposes of settling their loan commitments (Minsky, 1974). Asset prices falls consequently, creating low confidence which may adversely affect banks' liquidity and eventually cause people to seek to withdraw their money. This is a market failure requiring government regulation such as:

- Strict enforcement of minimum reserve requirement. In Ghana, this regulation is enforced as a reserve requirement where banks are mandated to keep a minimum of 11% of their deposits with the Bank of Ghana.
- Establishing and implementing a stability fund where banks will be mandated to make periodic contributions during boom years for purposes of ensuring smooth banking operations during times of crisis.
- Strict loan underwriting benchmarks and requirements for mortgage lending which will inhibit self-certification mortgages.
- Willingness to regulate asset price inflation, e.g. raising interest rates if there is excess house price inflation.

- Policies to inhibit speculative and Ponzi lending.
- Categorizing banks into traditional saving segment and high risk investment banking.
- A solid regulator ready to act as lender of last resort.

2.3 Empirical Literature Review

Literature on nonperforming loans (NPLs) can be categorized into two broad areas: literature on causes of NPLs and literature relating to the effect of NPLs on a nation. Literature relating to effects of NPLs on an economy is very scanty. However, previous work done on the causes of NPLs in banks invariably have concluded that individual factors relating to a loan applicant, banks' own loan underwriting and monitoring problems (bank-specific factors) and some macroeconomic conditions determines the risk of a credit facility. Most of the researchers adopted a cross sectional study which involved both qualitative and quantitative methods of data collection.

The qualitative methods focused on the use of primary data gathered from direct interviews and administration of self-developed questionnaires distributed to respondents in the risk and credit departments of banks, from which their responses were analyzed and discussed. The quantitative methods however focused on the use of secondary data for their analysis. For instance, Keeton and Morris (1987) studied the losses of 2,470 United States banks between 1979 and 1985. They found macroeconomic changes, among other factors, as causes for the variation in loan defaults. Their work also revealed that financiers with relatively high risk tolerance end up recording higher loan defaults.

Sinkevicius and Greenwald (1991) adopted a simple log-linear regression model to analyze credit defaults of big United States banks which revealed both internal (high interest rates and excessive lending) and external factors (depressed regional economic conditions) accounting for bank credit losses.

Fofack (2005) conducted a study using a pseudo panel-based model on selected African nations which affirmed that inter-bank loans, real exchange rate appreciation, economic growth and real interest rate changes are critical causes of loan losses in these countries.

Similarly, Mileris (2014) analyzed the impact of changes in macroeconomic indicators on loan losses in banks of some European Union nations including Lithuania. The analysis revealed a strong linkage between NPLs and macro changes in Lithuania. Deterioration in Lithuania's gross domestic product (GDP), exports, employees' compensation, household's consumption expenditures, unemployment rate, and government expenditures greatly deteriorated loan portfolios in Lithuanian banks.

İSLAMOĞLU (2015) also studied the impact of interest rate changes and public debt stock /GDP ratios, on NPLs of banks listed on Borsa Istanbul, Turkey, using quarterly data from 2002 to 2013. The study identified the macroeconomic indicators causing NPLs levels in Turkey.

Another study conducted in Austria by Kalirai and Scheicher (2001), investigated the link between the country's macroeconomic data and the changes in the impairments (loan loss provision) of Austrian banks. The study revealed that worsening industrial production and capital markets,

increased interest rates, and low confidence in businesses were key contributors to the loan loss provisions of banks.

Several other research methodologies have been used in assessing the relationship between changes in monetary policy rate (MPR), gross domestic product (GDP), Inflation (INF), money supply (M2) and exchange rate (EXR) levels and NPLs. For instance, Saba et al. (2012) used Pearson's correlation analysis and Ordinary Least Squares to study the impact of changes in Real GDP per Capita, Inflation, as well as growth in total loans on NPLs in the United States of America.

Similar studies were conducted in Spain (Salas & Saurina, 2002), using Panel data; Greece (Louzis et al., 2011) using panel data analysis; Romania (Vogiazas & Nikolaidou, 2011) using time series analysis; Pakistan (Badar & Javid, 2013) using Johansen and Juselius Multivariate Cointegration; Central, Eastern and Southeast Europe (Jakubik & Reininger, 2013) using Panel data analysis; Turkey (Sahbaz & Inkaya, 2014) using the VAR method and the Granger causality test; The Gulf Cooperation Council (Espinoza & Prasad, 2010) using dynamic Panel analysis.

These studies empirically confirm a significant negative correlation between GDP and NPLs (Louzis, Vouldis & Metaxas, 2011; Fofack, 2005; and Salas & Saurina, 2002), a significant direct linkage between high lending rates and NPLs (Nkusu 2011; Adebola, Yusoff, & Dahalan, 2011; Louzis, Vouldis & Metaxas, 2011), a significant direct linkage between inflation levels and NPLs (Vogiazas & Nikolaidou, 2011; Badar & Javid, 2013; Saba et al., 2012); a significant direct linkage between Exchange rates and NPLs (Badar & Javid, 2013; Jakubik & Reininger, 2013) and a

significant positive correlation between Money supply and NPLs (Vogiazas & Nikolaidou, 2011; Badar & Javid, 2013).

Nevertheless, some studies have revealed insignificant linkages between changes in certain macroeconomic variables and NPLs. For instance, Haniifah (2015) adopted a multiple linear regression model to study the macroeconomic causes of NPLs in 25 Ugandan banks using secondary data obtained from Bank of Uganda and World Bank databases over the period 2000-2013. The outcome was inflation rate and GDP growth having statistically insignificant negative effect on NPLs whilst interest rate impacted positively, but insignificant, on NPLs.

However, in Ghana, very few studies have used econometric models to analyze the impact that macroeconomic adjustments have on the levels of NPLs in Ghana. For instance, Amuakwa-Mensah & Boakye-Adjei (2015) used panel data to analyze the impacts of both bank-specific variables and changes in macroeconomic variables on credit losses in Ghana using data on twelve (12) banks between 1998 and 2008. Bank-specific variables used include bank size, prior year's NPLs, banks' net interest margin and loan growth; macroeconomic variables used were real GDP per capita growth, real effective exchange rate (REER) and annual inflation rate. In another study, Ofori-Abebrese et al. (2016) used the ARDL bounds test techniques to analyze how changes in real effective exchange rate, M2, annual inflation rate, growth in real GDP and the Treasury bill rate affect NPLs of one (1) bank, namely HFC bank, between 2008 and 2015.

This study similarly employed the ARDL approach, by using the WALD's test to assess the effect of macroeconomic adjustments on credit losses. However, the study used longer time series spanning from 2004 to 2016, thus expanding the coverage for a more suitable time series analysis. More importantly, the study analyzed NPL data for the entire Ghanaian banking sector and also introduced the monetary policy rate (MPR) in the model as a key macroeconomic variable for the analysis to econometrically explain the contribution of changes in MPR to nonperforming loan levels in Ghana for more policy guidelines.

The foregoing review of empirical studies shows the importance of macroeconomic conditions in determining the health of a nation's NPLs. However, the studies have left out equally critical variables, including the MPR, as key determinants of NPLs aside interest rates, growth in GDP and inflation, which have been found to have strong relationships in the creation of NPLs.

2.4 Ghana's banking Sector and NPLs

Ghana's banking sector has experienced dramatic changes and rapid proliferation of licensed banks. As at end of 2017, there were 34 banks registered under the Banking Act 2004 (Act 673) as presented in Table 2.1.

Table 2.1 Number of Banks in Ghana from 2007 to 2017

Period	Number of Banks
2007	23
2008	23
2009	25
2010	25
2011	26
2012	27
2013	27
2014	29
2015	30
2016	32
2017	34

Source: 2017 Ghana banking survey report by PwC

The rapid proliferation of banks in Ghana coupled with the global banking trends or changes in banking service delivery through digital channels has led to an improved, vibrant and very competitive banking environment in Ghana. Banks in Ghana now originate their loans via mobile banking and telephone services to ensure quick and easy access to loan facilities. A banking survey conducted by PwC in 2015 on the Ghanaian banking sector regarding customers' expectations of the banking sector by 2020 revealed among other findings, the availability of credit facilities, convenience, simplicity and speed in service delivery.

In spite of these positive developments in the sector, minimizing NPLs levels have been the sector's major challenge. Bank NPLs to total gross loans ratio have been above 5% over the past two decades, signifying an unhealthy loan portfolio, which has the potential of retarding the growth of the sector.

The country recorded its very high bank NPLs to total gross loans ratio of 17.2%, 19.6% 22.7% 18.3% and 17.6% in 1998, 2001, 2002, 2003, and 2010, respectively (World Development Indicators, 2017). Though non-performing loans level declined from 14.67% in 2015 to approximately 10% in 2015, the figure continues to be above the desired or acceptable level of 3%. Figure 2.1 shows a graphical presentation of the trend of NPLs in Ghana.

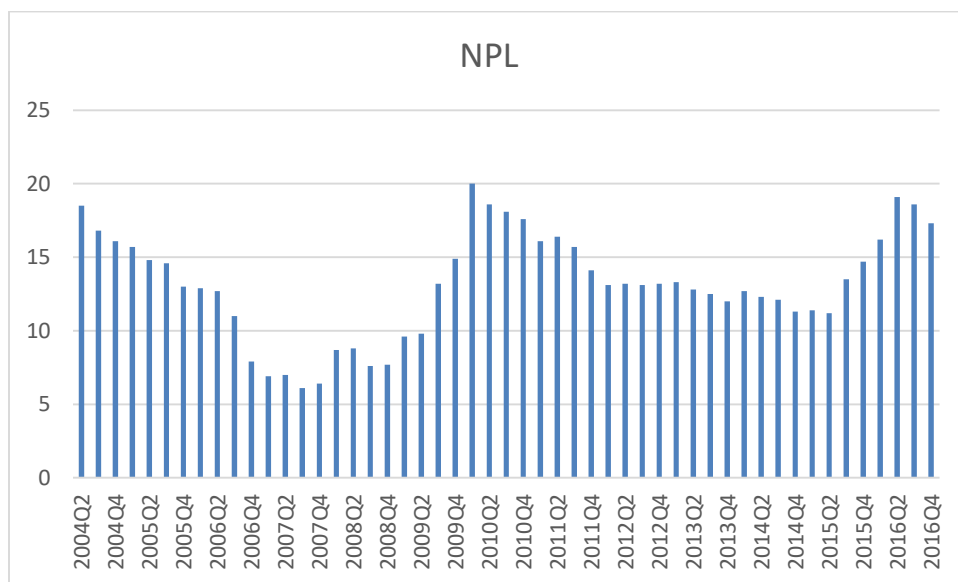


Figure 2.1: Trend of NPLs levels in Ghana from June 2004 to December 2016

Several bank specific factors have been identified, in several PwC surveys or reports on the Ghanaian banking industry as well as several studies conducted on the subject in the Ghanaian Universities, as causes of bank loan losses in Ghana. Prominent amongst them included poor loan underwriting skills, inadequate monitoring and diversion of funds.

Competition amongst the banks, as the number of banks increased, has also been identified as an underlying factor influencing the aforementioned causes of NPLs in Ghanaian banks.

Though, the proliferation of banks has improved competition amongst the banks which in turn has led to some improvement in service delivery, Andoh (2014) identified competition, amongst other factors, as one of the key contributors driving non-performing loans levels in Ghana. Similarly, PwC in their 2012 annual banking survey report also outlined competition as one of the key factors fueling loan losses in Ghana.

The sector experienced some banks collapsing due to several reasons including NPLs. For example, the Ghana Co-operative Bank and the Bank for Housing and Construction collapsed because of non-performing loans in the year 2000 (PwC, 2006; Ayagre et. al., 2014). In recent times, some banks including the Legacy Merchant Bank, now the Universal Merchant Bank was taken over and recapitalized by Fortiz Equity Fund Limited in 2013 to save the bank from collapsing, due to high levels of NPLs.

Furthermore, BOG in its press statement captioned “GCB bank limited takes over UT bank limited and Capital bank limited”, dated August 14, 2017 cited severe impairment to the capital of UT bank and Capital bank, which emanates from high NPLs, as one of the reasons, amongst other reasons, leading to the take-over of UT Bank and the Capital Bank by Ghana Commercial Bank in 2017.

2.5 Conclusion

The foregoing review of literature relating to nonperforming loans (NPLs) provides ample support for the fact that incidences of NPLs are dangerous to the stability and sustainability of the financial sector of every economy which tends to create devastating consequences for the economy as a

whole. The literature review also provided adequate insight on the micro and macro factors that create NPLs which seemed to be similar globally and needs to be tackled effectively by each economy to avoid potential global financial crises.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

The study primarily examines the role changes in certain macroeconomic variables play in affecting the level of nonperforming loans (NPLs) in Ghana. This chapter covers the following: the theoretical framework, model specification, estimation techniques and data types and sources.

3.2 Theoretical Framework

The theoretical framework of the study is based on a modified version of the theory of moral hazard by Niinimäki (2007). In the model we consider a borrower that secures a loan from a bank. This borrower is assumed to operate in a risk-neutral economy and can borrow to invest in a bad investment, expected to generate relatively high returns compared to returns on a good investment. This relationship can be expressed as expressed as:

$$\mu_g (Y_g - r) < \mu_b (Y_b - r) \quad (1)$$

where: μ_g represents the expected probability of success of a good investment being financed with a loan, Y_g represents the output of a good investment financed with the loan, Y_b represents the output of a bad investment financed with the loan, r represents the interest rate of the economy, in this case the monetary policy rate, μ_b represents the expected probability of success of a bad investment being financed with a loan. Equation (1), implies that expected net returns from a good and low risk investment is less than expected net returns from a bad and high risk investment.

The model assumes a simple economy with banks, borrowers (entrepreneurs only) and a bank regulator. For brevity, the model assumes that banks sources for non-interest bearing deposits and lend the deposits out to entrepreneurs at the rate, r , to invest in their businesses and generate profits adequate to repay the loans. The regulator on the other hand is expected to have the credit data of all borrowers and makes it available to banks to guide their lending. The entrepreneur secures the loan and can undertake a good investment or a bad investment depending on the level of monitoring by the banks and also the incentive to divert the loan into an investment he perceives to be highly profitable. The entrepreneur takes his decision in a bid to generate high returns in order to cover the interest cost, r , and his profits. However, investments perceived to generate relatively high returns tend to be risky and their expected probability of success is low, as shown in equation 2:

$$\mu_b < \mu_g \quad (2)$$

where; μ_g represents the expected probability of success of an investment with expected low returns μ_b represents the expected probability of success of an investment with expected high returns.

However, when the entrepreneur succeeds with the risky investment, the output is large as shown in equation 3;

$$Y_b > Y_g. \quad (3)$$

where; Y_g represents the output of an investment with expected low returns, Y_b represents the output of an investment with expected high returns.

In the absence of adequate credit data on borrowers as well as the presence of high interest rates r , the moral hazard problem is assumed to surface. The entrepreneur primarily chooses the bad project since it is expected to yield higher profits to him to pay the loan and also since the banks have inadequate information on the credit history of borrower. With a low probability of success, the entrepreneur fails leading to an increase in loan default as expressed in equation 4.

$$NPL \geq \mu_b (Y_b - r); \text{ but } r = MPR \quad (4)$$

By substituting MPR for r , the equation becomes

$$NPL \geq \mu_b (Y_b - MPR) \quad (5)$$

where; NPL represents nonperforming loan, Y_b represents the output of a bad investment financed with the loan, MPR represents the monetary policy rate, μ_b represents the expected probability of success of a bad investment being financed with a loan. From equation 5, the incidence of nonperforming loans is greater than the expected net returns of a bad investment.

The moral hazard problem can be eliminated by strict monitoring of the entrepreneur and applying relatively lower interest rates leading to the entrepreneur choosing the good investment with a high probability of success which in turn minimizes the incidence of NPLs which is expressed in equation 6.

$$NPL < \mu_g (Y_g - MPR) \quad (6)$$

where; NPL represents nonperforming loan, Y_g represents the output of a good investment financed with the loan, MPR represents the monetary policy rate, μ_g represents the expected probability of success of a good investment being financed with a loan. From equation 6, the incidence of nonperforming loans is expected to be less than the expected net returns of a good investment though, the net returns is relatively lower compared to the expected net returns of a bad investment.

Unfortunately, since credit history of borrower is readily unavailable, monitoring becomes difficult. Moreover, banks tend to adjust their rates when the regulator adjusts the policy rate upwards which encourage borrowers to choose high risk investments which tend to be unsuccessful.

3.3 Model Specification

From the theoretical framework explained above, the researcher derived a model to achieve the research goals. The choice of using the moral hazard theory is based on the discussion that applying high interest rates could lead to the creation of NPLs. In Ghana, risk premiums incorporated in interest rates, in practice, are usually fixed rates which are added to the monetary policy rate (MPR) and charged on loans over the repayment period. Changes only occur in the MPR which has the tendency of increasing or decreasing the aggregate lending rate, which is in line with the researcher's goal of determining the linkage between MPRs and NPLs. Rising from the theoretical framework, the empirical model in a functional form is stated as:

$$NPL=f(MPR) \tag{7}$$

Where,

- NPL is ratio of bank nonperforming loans to total gross loans (%).
- MPR is monetary policy rate (%).

But empirically, GDP (Khemraj &Pasha, 2009); INF (Nkusu, 2011); M2 (Ahmad, 2003); EXR (Fofack, 2005) have also been found to account for high NPLs globally, thus the model to be estimated can be represented as:

$$NPL=f(GDP, INF, MPR, M2, EXR) \quad (8)$$

Expressing equation 7 in a linear form becomes:

$$NPL_t=\beta_0+ \beta_1GDP_t + \beta_2M2_t + \beta_3MPR_t + \beta_4INF_t + \beta_5EXR_t+u \quad (9)$$

where; NPL_t is ratio of bank nonperforming loans to total gross loans (%) at time t , GDP_t is Gross Domestic Product growth rate at constant prices (%) at time t , $M2_t$ is M2+ growth rate in % (Money supply) at time t , MPR_t is monetary policy rate (%) at time t , INF_t is Inflation, measured by the Consumer Price Index at time t , EXR_t is exchange rate (%) at time t , β_0 is intercept, β_1 , β_2 , β_3 , β_4 , β_5 are the coefficient of estimation, u is the error term

where: $\beta_1 < 0$; $\beta_2 < 0$; $\beta_3 > 0$; $\beta_4 > 0$; $\beta_5 > 0$

3.4 Description of variables

3.4.1 Monetary Policy Rate

Evidence from literature has shown that higher or increasing interest (lending) rates impact negatively on disposable income of borrowers when lending rates are variable. An upward movement in interest rates increases the interest burden of credit facilities which could increase the repayment (installment) amount of loans if loan expiry remains unchanged, which further reduces the disposable income of borrowers, or it extends the expiry of loans which also affects borrowers' income negatively.

Lending rates in Ghana are fundamentally determined by the monetary policy rate, the cost of lending funds and the risk associated with the loans. However, to a large extent, banks in Ghana use the policy rate as a benchmark for determining their lending rates (PwC, 2010; Uzeru, 2012).

3.4.2 Growth in Gross Domestic Product (GDP)

Several financial sector research papers have explained that a rise in GDP impacts positively on the income of economic units. That is, upward movements in GDP may stimulate an upward adjustment in income of borrowers, increasing their cash flows available for debt servicing, lowering the incidence of loan defaults (Khemraj & Pasha, 2009). Furthermore, with the increase in the disposable income of individual borrowers, consumption of goods and services tend to increase, *ceteris paribus*, increasing borrowing firms' ability to generate adequate cash flows for effective debt servicing. GDP therefore is inversely related to non-performing loans.

Previous research papers have shown adequate empirical evidence of an inverse linkage between growth in real GDP and NPLs (Salas and Suarina, 2002; Rajan and Dhal, 2003; Fofack, 2005). According to literature, significant positive growth in real GDP, all things being equal, may translate into upward income adjustment thereby improving the credit settlement capabilities of debtors leading to low incidences of overdue credit settlement, and vice versa.

3.4.3 Inflation

According to Fisher (1930), the real interest rate is equal to the nominal interest rate minus the expected inflation rate, as shown below:

$$\text{Real rate of interest} = \text{the nominal rate of interest} - \text{the expected rate of inflation} \text{--- (1)}$$

Therefore

$$\text{The expected rate of inflation} = \text{the nominal rate of interest} - \text{real rate of interest} \text{--- (2)}$$

From equation (1) above, if inflation increases, nominal interest rates must increase to the level adequate to ensure equilibrium. Change in inflation is therefore positively correlated with nominal interest rates. In other words, a change in inflation positively affects the nominal rates which are applied to loans. That is, when the rate of inflation increases, central banks respond by adjusting the policy rates to ensure equilibrium, which in turn increases lending (nominal) interest rates of banks.

Nkusu (2011) therefore explained that, when nominal interest rates are variable, inflation reduces the debt servicing capabilities of the debtors since the banks will respond by increasing their lending rates. Furthermore, increased inflation reduces the disposable (real) income of individuals (debtors) vice versa.

$$\text{Real Income } (y) = \text{Nominal Income} - \text{inflation} \text{---- (3)}$$

The foregoing implies that increased inflation may have an adverse effect on real income which in turn will negatively affect borrowers' ability to service their debt. However, some studies have explained that increased inflation can positively affect loan repayments.

Other studies have also posited a direct or inverse linkage between inflation and NPLs (Klein, 2013; Beck et al, 2015; Nkusu, 2011). For example, Nkusu, (2011) found that increased inflation reduces the real value of borrowers' outstanding debt, ceteris paribus, which in turn enhances their loan repayment capacity, hence lowering the incidence of NPLs. This describes an inverse linkage between NPLs and inflation. Nonetheless, he found a direct relationship as well in that, increased inflation, as per the formula (3) above, reduces real income when salaries/wages are sticky which in turn could also weaken the loan payment capabilities of debtors, which creates NPLs. Thus, the linkage between inflation and NPLs is inconclusive in the literature.

3.4.4 Money Supply

Changes in the level of M2 have been identified as another important macroeconomic determinant of NPLs. According to theory, an increase in M2, with money demand (Md) remaining constant, results in excess funds available for lending by banks. This in turn results in a decrease in interest rates, ceteris paribus; implying that borrowers interest cost will decrease.

A decrease in borrowers' interest cost in turn decreases the loan repayment instalment, thus increasing borrowers' capacity to service their debts, hence lower NPLs. This reflects a negative linkage between M2 and NPLs.

The relationship between M2 and NPLs, have been studied in many parts of the world including Malaysia where M2 impacts negatively on NPLs (Ahmad, 2003). Vogiazas and Nikolaidou (2011) found a similar outcome in the financial sector of Romania. However, Bofondi et al. (2011) found an opposite relationship between M2 and NPLs in the Italian financial sub-sector, whereas Fofack (2005) found no relationship for sub Saharan Africa.

3.4.5 Exchange Rates

Literature provides mixed opinions on the linkage between real exchange rate fluctuations and NPLs. For instance, the appreciation of a nation's currency against a major trading currency such as the United State Dollar (USD) has a two-way effect.

On the one hand, an appreciation can adversely affect the loan repayment capacity of exporters in that country (Fofack, 2005), since the exporters foreign earnings in USD may fall short of the required amounts needed to service the exporter's debt granted in their home currency. Alternatively, this currency appreciation against the USD can positively affect the loan settlement capabilities of exporters whose facilities are disbursed in USD, since the borrower will need to convert fewer amounts to cater for the foreign currency denominated facility (Khemraj & Pasha 2009).

Nevertheless, a decrease in the home currency's price will increase the cost of goods imported which in turn creates difficulties in financing letters of credit established on behalf of traders by banks, thereby increasing the incidence of non-payment, and vice versa (Badar & Javid, 2013).

Macroeconomic risk, therefore, is critical for analyzing and making credit risk conclusions. For instance, a sound macroeconomic policy is key in stabilizing an economy and the advancement of financiers operating in that economy (Bucher, Dietrich & Hauck 2013). According to Mileris (2014), the advancement of financiers during economic slump can be enhanced by stabilizing the real economy through the implementation of sound macro policy. Mileris explained further that during an economic downturn, internal funding sources over time become exhausted as existing loans generate very little cash flows, which results in highly restricted lending. Timely collection of existing loans and the related accrued interest becomes an important source of banks' liquidity, thus minimizing the default loan rate. External funding on the other hand is also hindered which negatively affects banks' capacity to fund new loans.

3.5 Estimation Techniques

To achieve the goals of the study, the parameters in the model specified in equation (2) were tested in three basic steps. The first step was aimed at determining whether each time series variable is stationary or non-stationary using the Augmented Dickey-Fuller (ADF) unit root test propounded by Dickey and Fuller (1979).

Stationarity is critical to our study since statistical results of non-stationary time series variables for a defined time period are inappropriate for generalization; hence, forecasting becomes deceptive (Gujarati, 2013). To ensure a reliable analysis, the variables used for the study (non-performing loans ratio, money supply growth rate, inflation rates, monetary policy rates and exchange rates) are tested for stationarity.

The hypothesis for the unit root test is given below:

H₀: The series is non-stationary

H₁: The series is stationary

The null hypothesis is either accepted or rejected. It is accepted (that is, the series is non-stationary) if the analysis produces a t-ratio below the critical value. This would suggest the existence of unit root which further suggest that working with the variables in their levels might lead to spurious regressions results. The ideal results will be to reject the null hypothesis at levels or at first difference in order to proceed to the next stage of the analysis. This is when each variable produces a t-ratio greater than the critical value. Rejecting the null hypothesis implies that the variable are stationary and good to proceed with the co-integration test.

The second step involved an analysis to establish the existence of a long-run equilibrium relationship, using the 'Autoregressive Distributed Lag (*ARDL*)' test (Pesaran & Shin, 1996; Pesaran & Pesaran, 1997; Pesaran & Smith, 1998; Pesaran *et al.*, 2001).

The researcher's choice for the ARDL technique, amidst other very good techniques like the Johansen Cointegration Test developed by Johansen (1990) is due to the small number of observations used for the study. The total number of observations used for the study is 51, which is relatively small but could be efficiently analyzed using the ARDL. Furthermore, the ARDL technique allows the researcher to use the ordinary least square (OLS) method to facilitate the estimation once the lag of the model is identified. The *ARDL* technique is performed in two steps (Pesaran & Pesaran, 1997). The first step involves carrying out the F-test to determine the existence of any long-run relationship among the variables.

The hypothesis for the F-test is;

H₀: No cointegration exist among the variables

H₁: There is cointegration

OR

H₀: C(14)=C(15)=C(16)=C(17)=C(18)=C(19)=0

H₁: C(14)≠C(15)≠C(16)≠C(17)≠C(18)≠C(19)≠0

Where

C (14) represents the coefficient of the lagged levels of NPLs

C (15) represents the coefficient of the lagged levels of GDP

C (16) represents the coefficient of the lagged levels of M2

C (17) represents the coefficient of the lagged levels of MPR

C (18) represents the coefficient of the lagged levels of INF

C (19) represents the coefficient of the lagged levels of EXR

The F statistic computed from the F-test is compared with lower and upper critical bound values on the Pesaran table. If the computed F-statistic is below the lower critical bound value, the null hypothesis of no cointegration cannot be rejected. On the other hand, if the computed F-statistic exceeds the upper critical bound value, the null hypothesis is rejected and implying the existence of Cointegration among the variables. However, if the F statistic lies between the lower and upper critical bound values, the result is inconclusive.

The next step involves the estimation of the coefficients of the long-run relationship. Thereafter, the short-run coefficients of the variables are estimated and the speed of adjustment to equilibrium is determined using the *ECM* version of the *ARDL*. The third step involved conducting the WALD causality test to determine the causal relationship between the variables under study. The main idea behind the causality test is to examine whether the past values of one variable contains information relevant to predicting another variable. Therefore, the researcher conducts the WALD test on the lagged values of each and every independent variable in the Error Correction Model to ascertain whether the lagged values of each independent variable jointly cause the dependent variable or not. The hypothesis adopted for the test is:

H_0 : No short-run causality exists among the variables

H_1 : Short-run causality exists among the variables

OR

i. *Hypothesis for $D(GDP(-1))$ and $D(GDP(-2))$*

$$H_0: C(4) = C(5) = 0$$

$$H_1: C(4) \neq C(5) \neq 0$$

Where

C (4) and C (5) represent lagged levels 1 and 2 of GDP, respectively.

ii. *Hypothesis for $D(MPR(-1))$ and $D(MPR(-2))$*

$$H_0: C(6) = C(7) = 0$$

$$H_1: C(6) \neq C(7) \neq 0$$

Where

C (6) and C (7) represent lagged levels 1 and 2 of MPR, respectively.

iii. *Hypothesis for $D(M2(-1))$ and $D(M2(-2))$*

$$H_0: C(8) = C(9) = 0$$

$$H_1: C(8) \neq C(9) \neq 0$$

Where

C (8) and C (9) represent lagged levels 1 and 2 of M2, respectively.

iv. *Hypothesis for $D(INF(-1))$ and $D(INF(-2))$*

$$H_0: C(10) = C(11) = 0$$

$$H_1: C(10) \neq C(11) \neq 0$$

Where

C (10) and C (11) represent lagged levels 1 and 2 of INF respectively.

v. *Hypothesis for $D(EXR(-1))$ and $D(EXR(-2))$*

$H_0: C(12) = C(13) = 0$

$H_1: C(12) \neq C(13) \neq 0$

Where

C (12) and C (13) represent lagged levels 1 and 2 of EXR respectively

3.6 Data types and sources

The secondary data used comprised quarterly time series from June 2004 to December 2016. The secondary data were compiled from several sources. The quarterly data on money supply, inflation measured by the consumer price index, monetary policy rates and exchange rates were sourced from BOG's financial stability reports and quarterly bulletins published by the BOG. Data on GDP growth were however picked from two sources: Published quarterly GDP bulletin by the GSS and published BOG's quarterly bulletins.

Quarterly data on non-performing loans were selected from published BOG's quarterly financial stability reports. The choice of the sample period and variables used in the analysis was primarily due to the accessibility of information on the selected variables and the significance of each variable.

Additional data were sourced from IMF working reports and working papers on Ghana's economy available online as well as data from World Development Indicators (WDI) available online at The World Bank's database, for purposes of determining the suitability, reliability, adequacy and accuracy of the data.

The researcher therefore decided to exclude information on the variables from 1960 to 2004 and limited the analysis to cover data from second quarter of 2004 to the last quarter of 2016 in order to proceed with the analysis. The quarterly data used for the study were available in quarterly monetary bulletins, quarterly GDP bulletins and financial stability reports at the Bank of Ghana website and the Statistical Service website.

CHAPTER FOUR

DATA PRESENTATION AND DISCUSSION OF RESULTS

4.1 Introduction

This chapter, which consists of four sections, analyses and discusses the results of the study. Section one covers a presentation and discussion of the time series properties of the data used for the study; the unit root test and the bound test for cointegration. Section two presents and discusses the outcome of the estimated long-run model using the ARDL approach. This section further presents and discusses the findings of the Error Correction Model for the selected ARDL model. The third section seeks to analyze the results of the estimated correlation coefficients between the dependent and independent variables. The results of the estimated correlation coefficients among the explanatory variables were also analyzed in this section. The final section discusses the direction of causality.

4.2 Results of Unit Root Test

The researcher determined the stationarity status of the macro indicators in the model and NPLs. The outcome of the test based on the Augmented Dickey Fuller (ADF) approach, are indicated in Table 4.1.

Table 4.1: Results of Unit Root Test

AUGUMENTED DICKEY-FULLER UNIT ROOT TEST (INTERCEPT & NO TREND) FOR ARDL							
	AT LEVELS			AFTER FIRST DIFFERENCE			ORDER OF INTEGRATION
VARIABLE	T- STATISTIC	5% CRITICAL VALUE	P- VALUE	T- STATISTIC	5% CRITICAL VALUE	P- VALUE	
NPL	-1.969093	-2.922449	0.2991	-5.018593	-2.922449	0.0001	I(1)
GDP	-5.968923	-2.921175	0.00000				I(0)
M2	-1.772543	-2.921175	0.3896	-6.889925	-2.922449	0.0000	I(1)
MPR	-3.033632	-2.925169	0.039				I(0)
INF	-3.162120	-2.921175	0.1806	-4.708656	-2.922449	0.0004	I(1)
EXR	-1.350089	-2.598551	0.9986	-5.891043	-2.922449	0.0000	I(1)

From Table 4.1, Nonperforming Loans (NPLs), Money Supply (M2), Inflation (INF) and Exchange rate (EXR) were non-stationery at log levels, as we fail to reject the null hypothesis of the existence of unit root. However, after first differencing, these variables achieved stationarity, and the null hypothesis that there is unit root is rejected at 5 percent. This implies Non performing loans, Money supply, Inflation and Exchange rate are integrated of order one ($I(1)$).

Gross Domestic Product (GDP) and the Monetary Policy rate (MPR) on the other hand were stationary at their log levels, with intercept and no trend. This established that GDP and MPR are integrated of order zero ($I(0)$). None of the variables used for the study were found to be $I(2)$.

However, the results of the Unit Root Test revealed a mixed order of integration which allows the researcher to employ the *ARDL* methodology to test for the existence of long-run equilibrium relationship between NPLs and the explanatory variables.

4.3 Results of the Bound Test for Cointegration

Following from the results of Unit Root Test, the researcher employed the WALD Test to perform the bound testing for purposes of establishing the existence of a long-run cointegration relationship among the variables. The outcome of the test is presented in Table 4.2.

Table 4.2 Results of bound test for cointegration

Test Statistic	Value	Df	Probability
F-statistic	5.237175	(6, 29)	0.0016
Chi-square	31.42305	6	0.0000
Null Hypothesis: C (14)=C (15)=C (16)=C (17)=C (18)=C (19)=0			
Normalized Restriction (= 0)			
Coefficients		Value	Std. Err.
C (14)		-0.580515	0.124991
C (15)		3.847492	1.746053
C (16)		1.476704	0.428081
C (17)		0.133627	0.027796
C (18)		-0.417744	0.253718
C (19)		-3.316884	1.135497

The decisive statistic here is the F-statistic which is to be compared with the Pesaran critical values at 5% significance level. However, the absolute values of the coefficients also provide an indication of the existence of cointegration since they are all not equal to zero. Furthermore, the probability value in the table also gives an indication of significance of the relationship when compared with the 5% significance level. Table 4.2 below is an extract of the Pesaran table employed for analyzing the WALD test.

Table 4.3 Extract of the Pesaran table

Pesaran Critical values		
Unrestricted	Lower bound	Upper bound
5%	3.79	4.85

From the results of the Wald test, the null hypothesis of no cointegration is rejected at 5% significance level since the F-statistic of 5.31 is above the upper bound critical value of 4.85. This suggests the existence of a long-run relationship among the variables in the model, when the equation is normalized on NPLs as the dependent variable.

4.4 Diagnostic Test of the Model

Following from the results of the WALD test in determining the long-run relationship among the variables in the model, it is expedient and appropriate to further determine whether the results meet the standard classical linear regression assumptions by conducting a diagnostic test.

The diagnostic tests, first and foremost, help in detecting any defects in the model, and then correct such defects if any, to avoid the possibility of spurious results and conclusions. This was done by employing the Breusch-Godfrey Serial Correlation LM test in Eviews 11 to determine whether the model has serial correlation. The result of the test is attached as Appendix 1 and an extract of the result presented in Table 4.4.

Table 4. 4: Extract of the results of Breusch-Godfrey Serial Correlation LM Test

F-statistic	0.272071	Prob. F(2,27)	0.7838
Obs*R-squared	0.89822	Prob. Chi-Square(2)	0.6184

Given the observed R-squared value of 89.9% and a probability value of 61.84%, the null hypotheses of no serial correlation cannot be rejected at the 5% significance level. In other words, we accept the null hypothesis that the model has no serial correlation and the results presented in the study are reliable and are suitable for policy analysis.

4.5 Stability Test of the model

The researcher further conducted a stability test of the model following the confirmation of no serial correlation among the variables. This is to determine whether the coefficients in the model are stable or not. As explained in Abdul 2013, in standard cointegration analysis, the stability of coefficients in the regression is crucial.

The study employed the CUSUM (Cumulative sum) test of the recursive estimates (OLS only) to test for the stability of the coefficients. Appendix 2 depicts the results, graphically, of the test which confirms that the model is stable at the 5% significance level.

4.6 Results and Discussion of the Long-Run Model

Following the determination of the existence of cointegration, and conducting the diagnostic and stability tests, the researcher proceeded with the estimation of the long-run relationship between the variables in the model (i.e. equation 2) using Eviews 11. Table 4.5 shows the results generated.

Table 4.5 Estimated Long-Run Coefficients using the ARDL Approach

Variable	Coefficient	Std. Error	T-statistic	Prob
C	0.490113	2.269798	0.193942	0.8334
GDP	-0.441106	1.538408	-0.284599	0.7851
M2	0.121267	0.026023	4.520131	0.0000
MPR	1.937775	0.293842	6.829973	0.0000
INF	-1.048240	0.184995	-5.666307	0.0000
EXR	-4.193713	0.769861	-5.421727	0.0000

From the Table 4.5, the coefficient of Gross Domestic Product (GDP) is negative (-0.441106) which confirms results of previous studies conducted on the subject including the work of Khemraj and Pasha 2009; Badar and Javid 2013; Farhan et al. 2012. In Ghana, the result is in line of results found by Ofori-Abebrese et. al. (2016) and Amuakwa-Mensah & Boakye-Adjei (2015).

However, the degree of GDP's impact on NPLs was insignificant at 5% significance level in the case of Ghana, as shown by the probability value of 0.7851. This compares with the work of Ofori-Abebrese et. al. (2016) but contrary to results of Amuakwa-Mensah and Boakye-Adjei, 2015; Khemraj and Pasha, 2009; and Salas and Saurina, 2002. This result reveals that in Ghana, an improvement in GDP has the propensity to reduce NPL portfolios of banks in the long-run but the impact is not strong enough to cause significant changes in NPLs.

The coefficient of Money Supply (M2) was also found to be positive (0.121267) signifying a direct relationship between NPLs and M2. The result is similar to the results obtained by Ofori-Abebrese et. al. (2016) in a similar study conducted in Ghana and the results found by Bofondi et al (2011) in Italy.

However, the result is contrary to findings of several studies including work done by Vogiazas et al. (2011) in Romania and Ahmad (2003) in Malaysia postulating an inverse linkage between NPLs and M2. The probability value of 0.0000 found, however, indicates that M2 significantly determines the NPLs levels in Ghana at 5% significance level contrary to the finding of Ofori-Abebrese et. al. (2016) who found an insignificant relationship.

Theoretically, an increase in money supply, with money demand remaining constant, is expected to stimulate the investment and consumption levels leading to an increase in income which in turn lower the interest rates hence minimizing the incidences of NPLs. However, in Ghana the reduction in interest rates do not stimulate a reduction in NPLs. The researcher concluded from discussions held with some members of the Ghana Bankers Association, that the reduction in the interest rates creates two conditions. Firstly, the reduction in the interest rates makes borrowing attractive to consumers and businesses and secondly it lowers the interest income of banks, which constitutes about 60% of banks revenue.

As a result, as banks have more cash to lend as money supply increases, coupled with the falling revenues as interest rates fall, banks in Ghana tend to increase their lending in order to maintain or increase their revenue to cover their cost of operations. As a result, the banks resort to various means, including relaxing their credit risk management policies and lending to borrowers operating in high risk activities. These loans eventually become non recoverable creating NPLs in the banks.

As confirmed by previous studies, such as the work of Ombaba (2013), Monetary Policy Rate positively correlates to NPLs in Ghana as evidenced by the positive coefficient of 1.937775. The degree of impact was also significant at 5% significance level as evidenced by a probability value of 0.0000. This is explained by the quick increases in the lending rates of banks as the Bank of Ghana increases the MPR which in turn increases the cost of borrowing. As the disposable incomes of individuals remain unchanged or as the immediate cash flows of businesses remain unchanged loan repayment becomes problematic, leading to defaults and increased nonperforming assets¹.

The coefficient of inflation was negative and significant at 5% significance level in Ghana. As found by Nkusu (2011), increased inflation reduces the real value of borrowers' outstanding debt, *ceteris paribus*, which in turn enhances their loan repayment capacity hence lowering the incidence of NPLs. The result also confirms the findings of Ofori-Abebrese et. al. (2016); Amuakwa-Mensah & Boakye-Adjei (2015); Adebola et al. (2011).

Finally, non-performing loans was found to respond negatively and significantly to changes in exchange rates in Ghana as shown by the negative coefficient of -4.193713 and a probability value of 0.0000. Evidence of a negative impact of exchange rate on NPL is found in the works of Ofori-Abebrese et. al. (2016); Amuakwa-Mensah & Boakye-Adjei (2015); Jimenez et al. (2006); Quagliariello (2007); and Louzis et al. (2010). The result is contrary to the outcome of studies conducted in the CESSEE region by Klein (2013), but is explained by the fact that the loan portfolios of banks in Ghana are predominantly cedi denominated.

¹ It is worthwhile to note that the Policy Rate impact or effect could also be that of reduced NPLs since an increase in the MPR forces banks to lend less and creates a liquidity squeeze. However, this is not the case in Ghana per the results of this study.

As a result, as exchange rate increases (depreciation in the Cedi), borrowers who earn foreign currency or have their invoices quoted in foreign currency tend to receive more cedi, increasing their capacity to prepay their loans or service their loans which minimizes the incidence of NPLs.

4.7 Results of the Error Correction Model

The researcher generated an Error Correction Model (ECM) using the residual of the long-run model for purposes of conducting an Error Correction Test to reconcile the short-run behaviour of the economic variables with their long-run behaviour.

As cited by Asiedu (2010), the ECM captures the short-run dynamics of the system and the resultant coefficient measures the speed of adjustment to obtain equilibrium in the event of shocks to the system. Theoretically, the coefficient of the error correction term should be negative and its impact, whether significant or not significant, is depicted by probability value which is expected to be below 0.05 or 5%. Appendix 3 shows the results of the Error Correction Test performed using Eviews 11.

From the results, the estimated coefficient of the ECM is appropriately negative and significant at 5% level of significance as reflected by a probability value of 0.0030. Again the estimated coefficient of 0.459450, implies that approximately about 45.94% of disequilibria from the previous year's shock converge back to the long-run equilibrium in the current year.

As found in the long run equation, Gross Domestic Product (GDP) was also found in the ECM equation to be statistically insignificant at 5% significance level. This implies that the long run and short run effect of GDP on nonperforming loans (NPLs) is the same. However, the ECM equation depicted an opposite impact of money supply (M2), monetary policy rate (MPR), inflation (INF) and exchange rate (EXR) on NPLs in the short run. Whereas M2, MPR, INF, and EXR were found to impact significantly on NPLs in the long run, their short run results depicted an insignificant impact on NPLs as evidenced by probability values statistically different from zero at 5% significance level.

The short-run results obtained imply that other factors other than the macroeconomic variables used for the research, such as the bank specific variables, may be responsible for NPLs in the short-run. These bank specific variables include poor loan underwriting procedures, poor risk management and monitoring, poor corporate governance, etc.

4.8 Diagnostic Test of the Error Correction Model

The next step, following the estimation of the ECM, is to determine whether the results of the Error Correction Test meet the standard classical linear regression assumptions by conducting a diagnostic test on the Error Correction Model. As explained earlier, the diagnostic test helps in detecting any defects in the model, and then corrects such defects if any, in order to avoid the possibility of spurious results and conclusions. This was done by employing the Breusch-Godfrey Serial Correlation LM test in Eviews 11 to determine whether the model has serial correlation. The result of the test is attached as Appendix 4 and an extract of the result presented in table 4.6.

Table 4.6 Extract of results from the Breusch Godfrey Serial Correlation LM test

F-statistic	0.091065	Prob. F(2,32)	0.9056
Obs*R-squared	0.294155	Prob. Chi-Square(2)	0.8373

Given the observed R-squared value of 29.4% and a probability value of 83.7%, the null hypotheses of no serial correlation cannot be rejected at the 5% significance level. In other words, we accept the null hypothesis that the model has no serial correlation and the results presented in the study are reliable.

4.9 Stability Test of the Error Correction Model

The ECM was further tested to determine whether the coefficients in the model are stable or not using the CUSUM (Cumulative sum) test of the recursive estimates (OLS only). Appendix 5 depicts the results, graphically, of the test which confirms that the model is stable at 5% significance level.

4.10 Results of the WALD Causality Test

The results of the WALD Causality tests on GDP, MPR, M2, INF and EXR are attached as Appendices 6 to 10, respectively, and summarized below in Tables 4.7 to 4.11.

Table 4.7 Extract of the results of the WALD's Causality Test for GDP

Test Statistic	Value	Df	Probability
F-statistic	0.234773	2, 34	0.9152
Chi-square	0.449545	2	0.9017

Given the probability value of 0.93, the null hypotheses of no causality cannot be rejected at the 5% significance level. In other words, we accept the null hypothesis of no causality which implies that the lagged values of GDP jointly cannot cause NPLs in Ghana.

Table 4.8 Extract of the results of the WALD’s Causality Test for MPR

Test Statistic	Value	Df	Probability
F-statistic	0.467196	2, 34	0.7292
Chi-square	0.784392	2	0.6401

With a probability value of 0.72, the null hypotheses of no causality cannot be rejected at the 5% significance level. In other words, we accept the null hypothesis of no causality which implies that the lagged values of MPR jointly cannot also cause NPLs in Ghana.

Table 4.9 Extract of the results of the WALD’s Causality Test for M2

Test Statistic	Value	Df	Probability
F-statistic	0.252708	2, 34	0.7440
Chi-square	0.475415	2	0.7284

The probability value of 0.74 indicates that the null hypotheses of no causality cannot be rejected at the 5% significance level. In other words, we accept the null hypothesis of no causality which implies that the lagged values of M2 jointly cannot also cause NPLs in Ghana.

Table 4.10 Extract of the results of the WALD’s Causality Test for INF

Test Statistic	Value	Df	Probability
F-statistic	0.060632	2, 34	0.9230
Chi-square	0.132126	2	0.9165

The probability value of 0.92 indicates that the null hypotheses of no causality cannot be rejected at the 5% significance level. In other words, we accept the null hypothesis of no causality which implies that the lagged values of INF jointly cannot also cause NPLs in Ghana.

Table 4.11 Extract of the results of the WALD’s Causality Test for EXR

Test Statistic	Value	Df	Probability
F-statistic	1.907359	2, 34	0.1615
Chi-square	3.814718	2	0.1990

The probability value of 0.16 also indicates that the null hypotheses of no causality cannot be rejected at the 5% significance level. In other words, we accept the null hypothesis of no causality which implies that the lagged values of EXR jointly cannot cause NPLs in Ghana.

4.11 Conclusion

The results discussed above are all within the acceptable criteria or decision rules required for making conclusions and recommendations. This implies that the econometric model used for the study is deemed acceptable for the analysis. Furthermore, results confirm outcomes of previous studies conducted in other regions.

However, the few exceptions identified from the study such as the insignificance of GDP in explaining NPLs in Ghana and the lack of short-run causality could be further tested to reaffirm these outcomes or otherwise. The lack of short-run causality running from the independent variables to the dependent variables found could be as a result of several factors including:

- a. The period over which the data was collected and analyzed could not produce short-run causality among the variables.
- b. The sample size used was not large enough to produce results different from the results obtained in this study.
- c. The frequency of the data collected (quarterly intervals) and analyzed were too close to produce short-run causality among the variables

Furthermore, the no short-run causality results obtained imply that other factors other than the macroeconomic variables used for the research, such as the bank specific variables, may be responsible for NPLs in the short-run. These bank specific variables include poor loan underwriting procedures, poor risk management and monitoring, poor corporate governance, etc.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter provides a summary of the study in accordance with the goals of the research. The chapter also highlights the limitations of the study and the lessons drawn from the study. The chapter finally provides recommendations intended to minimize the incidence of NPLs in the Ghana as well as further research interest that could be explored by other researchers in the area of NPLs.

5.2 Summary of the study

This research sought to examine the impact changes in selected macroeconomic variables have on the loan portfolios of commercial banks in Ghana. Theories and empirical literature on the subject were reviewed from various sources covering the banking sectors of many major economies in the world. The study analyzed quarterly data on nonperforming loans (NPLs) as the dependent variable and gross domestic product (GDP), monetary policy rate (MPR), money supply (M2), inflation (INF) and exchange rate (EXR) as independent variables using the ARDL bounds test of Cointegration (WALD's test) in Eviews 11 from June 2004 to December 2016. The secondary data used were sourced from various publications by the Bank of Ghana (BOG) and the Ghana Statistical Service (GSS) as well as the International Monetary Fund (IMF) and the World Bank publications and website.

A summary of the outcomes obtained from the study is presented below.

- The first goal of this study was to examine the impact of changes in the monetary policy rate on the level of nonperforming loans (NPLs) in Ghana. Similar to evidence from previous studies conducted on the subject, the study revealed a significant positive impact of the MPR on NPLs through its positive effect on lending rates. This direct relationship is supported by similar studies: for example, Clementina and Isu (2014) and Swamy (2012) who studied macroeconomic determinants of NPLs and found a positive relationship between NPLs and IR in Kenya and India, respectively.

- The second goal of the study was to investigate the impact of changes in other macroeconomic variables on the level of NPLs.

Gross domestic product (GDP), money supply (M2), inflation (INF) and exchange rate (EXR) were the other macroeconomic variables selected for the study. The regression results established an insignificant relationship between GDP and NPLs in Ghana. This result is contrary to the findings of Khemraj and Pasha (2009) in Guyana and Clementina and Isu (2014) in Nigeria, but supported by the findings of Alexandria and Santoso (2015) in Indonesia. Whereas Khemraj and Pasha (2009) and Clementina and Isu (2014) established a significant inverse relationship between NPLs and GDP, Alexandria & Santoso (2015) found an insignificant negative relationship between GDP and NPLs.

Money supply was found to have a positive and significant impact on non-performing loans. This is in line with the results from a similar study by Bofondi et al. (2011) on the Italian banking system, but contrary to the evidence of an inverse and significant relationship between M2 and NPLs found by many researchers including Ahmad, (2003) in Malaysia and Vogiazas et al. (2011) in Romania.

In Ghana, the inflation rate was found to have a significant negative impact on NPLs levels, consistent with the findings of Nkusu (2011) involving 26 advanced economies, which suggested that increased inflation reduces the real value of borrowers' outstanding debt, *ceteris paribus*, which in turn enhances their loan repayment capacity, hence lowering the incidence of NPLs.

The exchange rate was found to impact negatively and significantly on the levels of NPLs in Ghana. An increase in the exchange rate (depreciation in the Cedi) tends to minimize the incidence of NPLs. The finding is contrary to the conclusions drawn by Zeman and Jurca (2008), in a study conducted on the Slovak banking sector using a vector error correction model involving quarterly data from 1995 to 2006. The finding is also contrary to the findings of Klein (2013) who used the panel VAR methodology to study the determinants of NPLs in the CESEE region for the period 1998 to 2011.

The study also found no short-run causality running from the independent variables to the dependent variables which implies that other factors, such as poor loan underwriting procedures, poor risk management and monitoring, poor corporate governance, may be responsible for NPLs in the short-run whilst changes in macroeconomic conditions may be responsible for NPLs in the long-run. The no short-run causality running from GDP, M2 and EXR compares with the results of Ofori-Abebrese et. al. (2016) who used the ARDL approach to test the impact of selected macroeconomic variables on the performance of loans in Ghana between 2008 and 2015, with HFC bank as the case study. They however found causality from INF to NPLs which is contrary to the results obtained in this study.

5.3 Conclusions

From the foregoing findings, it can be concluded that the monetary policy rate in Ghana plays an important role in determining NPLs levels in the banking industry, hence the importance of its inclusion in the study. Keeping the policy rate high may be a recipe for higher non-performing loans, which could endanger the financial sector and the economy². It can also be concluded that exchange rate management is important for maintaining healthy loan portfolios of banks in Ghana, as depreciation has the tendency to improve exports, and hence improve the debt servicing capacity of borrowing exporters. The study should, therefore, provide a valuable addition to the existing literature on the determinants of NPLs in Ghana.

²The impact of MPR on NPLs could be tested further by analyzing the pass-through effect of the increase in policy rate on the cost of loans [policy rate (i) + financing premium (x)] under two (2) scenarios: 1. Where the cost of loans increases by only by margin (i) when policy rate increases and 2. Where cost of loans increases by a margin $i+x$ when the policy rate increases. This will require micro data including banks' lending rates, which could be considered in another study.

As a weakness, however, the study analyzes the aggregate the NPL portfolio. Future studies should break down the portfolio into segments such as consumer loans, SME loans and corporate loans, in order to determine which segments are more sensitive to changes in the macroeconomic variables.

5.4 Policy implications and recommendations

The results of the study could be valuable to the central bank, financiers and businesses operating in Ghana. This is because, the results could provide a guide to the central bank when setting its monetary policy rates, or formulating and implementing policies to control inflation and regulate the exchange rates. Furthermore, commercial banks will be guided on when to expand lending or contract lending, whether to grant facilities with short repayment tenors, medium repayment tenors or long repayment tenors and whether they should apply fixed rates or variable rates when granting loans.

For instance, the insignificant relationship between GDP and NPLs implies that financiers in Ghana may expand lending to the private sector during periods of economic boom, which in turn will increase investments to propel the economy for sustainable growth. Nevertheless, financiers should exercise great caution when granting the facilities because the progressive increases in loans also has the propensity to create liquidity crises in the banking sector, which can lead to an increase in interest rates, thus increasing NPLs.

Bank managers should therefore critically consider the macroeconomic conditions of the country when offering loans in order to maintain healthy loan portfolios. They should also closely monitor the monetary expansionary policies as well as the inflation targeting policies implemented by the central bank to guide their lending activities for profit maximization while at the same time minimizing NPLs. Additionally, managers should take keen interest in improving the credit underwriting skills, credit risk management and monitoring skills to minimize their credit losses created by the bank specific causes in the short run.

Perhaps more importantly, in setting the policy rate in particular, the monetary authorities should keep in view the implications for NPLs. Monetary and fiscal policy changes that improve the economy, but have the potential of increasing NPLs in the long-run, may be implemented, provided that there is strict adherence to regulatory standards and procedures by lenders for purposes of enhancing efficiency in the financial sector. Finally, the central bank could incorporate in its periodic publications, policy directions and timelines as well as the policy implications on the lending and borrowing activity for purposes of guiding lenders and borrowers to optimize the credit process during the implementation of the economic policies.

5.5 Limitation of the study

The researcher encountered a number of limitations during the course of the study. The study originally considered quarterly data spanning from 1960 to 2016. However, obtaining the quarterly data for all the variables under study over period, from 1960 to 2004, presented some challenges. Whereas quarterly data for some of the variables were available others were not. A formal request made by the researcher through the Department of Economics, University of Ghana, to BOG for

data spanning from 1960 to 2004 was also not successful as officials of the Bank of Ghana could not provide the needed information. This resulted in undue delays during the analysis stage.

References

- Adebola, S.S., Sulaiman, W., Yusoff, W., and Dahalan, J. (2011). An ARDL Approach to the determinants of non-performing loans in Islamic banking system in Malaysia. *Arabian Journal of Business and Management Review*, 1(2), 20-30.
- Afifi, A., Clark, V. and May, S. (2004). *Computer-Aided Multivariate Analysis*. 4th ed. Boca Raton, Fl: Chapman & Hall/CRC.
- Ahmad, N. H. (2003). *Formation of credit risk, regulatory price effect and the path linking credit to total risk*. Universiti Utara Malaysia.
- Alam, S., Haq, M.M. and Kader, A. (2015). Non-performing loan and banking sustainability: Bangladesh Perspective. *International Journal of Advance Research*, Vol. 8, 1197-1210.
- Alexandria, M.B. & Santoso, T. I. (2015). Non-performing loan: Impact of internal and external factor (evidence in Indonesia). *International Journal of Humanities and Social Science Invention*, 4(1), 87–91.
- Alhassan, A.L., Kyereboah-Coleman, A. and Andoh, C. (2014). Asset quality in a crisis period: an empirical examination of Ghanaian banks. *Review of Development Finance*, 4(1), 50–62.
- Andoh, S. (2014). *Causes and effects of non-performing loans on performance of Ecobank Ghana Limited*, University of Ghana Business School

- Ayagre, P., Appiah-Gyamerah, I., and Nartey, J. (2014). The effectiveness of internal control systems of banks: The case of Ghanaian banks. *International Journal of Accounting and Financial reporting*, ISSN 2162-3082, 2014, Vol. 4 No.2
- Badar, M. & Javid, A. Y. (2013). Impact of macroeconomic forces on non-performing loans: an empirical study of commercial banks in Pakistan. *WSEAS Transactions on Business and Economics*, 1(10), 40–8.
- Bank of Ghana. (2000). Bank of Ghana Quarterly Economic Bulletin: April – June 2000. Accra: Bank of Ghana.
- Bank of Ghana. (2001). Bank of Ghana Quarterly Economic Bulletin: October – December 2001. Accra: Bank of Ghana.
- Bank of Ghana. (2003). Bank of Ghana statistical release: Inflation outlook and monetary aggregates, Volume 3: No. 1. Bank of Ghana, Accra.
- Bank of Ghana. (2004). Bank of Ghana statistical release: Financial Stability Report, Volume 5: No. 2/2004. Bank of Ghana, Accra.
- Bank of Ghana. (2008). Bank of Ghana Financial Stability Report: volume 8: No. 1/2008. Bank of Ghana, Accra.
- Bank of Ghana. (2008). Bank of Ghana Financial Stability Report: volume 8: No. 3/2008. Bank of Ghana, Accra.

Bank of Ghana. (2008). Bank of Ghana Financial Stability Report: volume 8: No. 4/2008.

Bank of Ghana, Accra.

Bank of Ghana. (2013). Bank of Ghana Monetary Policy Report: Monetary and Financial

Developments, volume 3: No. 2/2013. Bank of Ghana, Accra.

Bank of Ghana. (2014). Bank of Ghana Monetary Policy Report: Monetary and Financial

Developments, volume 3: No. 1/2014. Bank of Ghana, Accra.

Bank of Ghana. (2016). Bank of Ghana Monetary Policy Report: Volume 1.1. Bank of

Ghana, Accra.

Beck, R., Jakubik, P. & PiloIU, A. (2013). Non-performing loans: What matters in

addition to the economic cycle? *European Central Bank Working Paper Series*,

1515, 1–32.

Bercoff, J.J., Giovanni, J.D., Grimard, F. (2002). Argentinean Banks, Credit Growth and

the Tequila Crisis: A Duration Analysis. Working Paper (Unpublished).

Berger, N. A. and De Young R. (1997). Problem Loans and Cost Efficiency in

Commercial Banks, Elsevier, *Journal of Banking and Finance*, Vol. 21(6) pages

849-870, June.

Bloem, M. A. and Gorter N. C. (2001). Treatment of Non-Performing Loans in

Macroeconomic Statistics, IMF Working Paper, WP/01/209.

- Bofondi, M., & Ropele, T. (2011). Macroeconomic determinants of bad loans: evidence from Italian banks. *Occasional Papers*, 89.
- Brownbridge, M. (1998). *The Causes of Financial Distress in Local Banks in Africa and Implications for Prudential Policy*, UNCTAD OSG/ DP/ 132
- Caprio, G., & Klingebiel D. (1996). *Bank Insolvency: Bad Luck, Bad Policy or Bad Banking*, Annual World Bank Conference on Development Economics
- Carlos, A., & Bonilla, O. (2012). *Macroeconomic Determinants of the Non-performing loans in Spain and Italy*. Department of Economics University of Leicester.
- Chen, C. (2009). *Bank Efficiency in Sub-Saharan African Middle-Income Countries*, IMF Working Paper No. WP/09/14
- Clementina, K. & Isu, H. O. (2014). The Rising Incidence of Non-performing Loans and The Nexus of Economic Performance in Nigeria: An investigation. *European Journal of Accounting Auditing and Finance Research*, 2(5), 87–96.
- Collins, N. J. & Wanjau, K. (2011). The Effects of Interest Rate Spread on the Level of Non-performing Assets: A Case of Commercial Banks in Kenya. *International Journal of Business and Public Management*, 1(1), 58–65.
- Colombo, E. & Driffill, J. (2003). *The role of financial markets in the transition process*: New York, United States of America Physica-Verlag Heidelberg Page 77

- Dash, M., & Kabra, G. (2010). The determinants of non-performing assets in Indian commercial bank: An econometric study. *Middle Eastern Finance and Economics*, 7, 94-106.
- Espinoza, R., & Prasad, A. (2010). Non-performing Loans in the GCC Banking Systems and Their Macroeconomic Effects, IMF Working Paper 10/224 (Washington: International Monetary Fund).
- Farhan, M., Sattar, A., Chaudhry, A. H. & Khalil, F. (2012). Economic determinants of non-performing loans: perception of Pakistani bankers. *European Journal of Business and Management*, 4(19), 87–99.148
- Faward, A. & Taqodus, B. (2013). Explanatory power of macroeconomic variables as determinants of non-performing loans: Evidence from Pakistan. *World Applied Sciences Journal*, 22(2), 243–55.
- IMF, (2006). Financial Soundness Indicators: compilation guide – Washington D.C.: International Monetary Fund, 2006. 256 - 257
- Fisher, I. (1933) “The Debt-Deflation Theory of Great Depressions,” *Econometrica* Vol. 1 (4) October 1933: p. 337-57
- Fofack, H. (2005). Non-performing loans in sub-Saharan Africa: Causal Analysis and Macroeconomic Implications. World Bank Policy Research Working Paper n° WP 3769.

- Freeman, R. (2004). The Treatment of Non-performing loans in Macroeconomic Statistics. IMF Issue Paper SNA/M2.04/07, page 8
- Ghana Banking Act (Act 673) (2004). Ghana Publishing Corporation, Accra
- Ghana Statistical Service, (2011). National Accounts Statistics: May 2011 edition
- Ghana Statistical Service, (2017). Quarterly GDP Bulletin: June 2017 edition
- Gopalakrishnan, T. V. (2004). Management of Non-Performing Advances: A study with reference to public sector banks in India, Northern Book Centre, Indian Institute of Banking and Finance.
- Gujarati, D. N. (2013). Basic econometrics. (5th ed). New York: McGraw-Hill Companies
- Hou, Y. (2007). The Non-performing Loans: Some Bank-level Evidences. The 4th Advances in Applied Financial Economics, the Quantitative and Qualitative Analysis in Social Sciences conferences.
- Istrate, E., Debasree D.G. & Weissburg, P. (2007). Toward developing a structured approach to the diagnosis and resolution of non-performing loans: The case of China and India. *Review of Policy Research*, 24(4), 345–65.
- Jameel, K. (2014). Crucial factors of non-performing loans: Evidence from Pakistani banking sector. *International Journal of Scientific and Engineering Research*, 5(7), 704–10.

- Janvisloo, M, A. & Muhammad, J. (2013). Non-performing loans sensitivity to macro variables: Panel evidence from Malaysian commercial banks. *American Journal of Economics*, 3(C), 16-21.
- Jimenez, G., Saurina J. (2006). Credit cycles, credit risk, and prudential regulation. *International Journal of Central Banking*, 2(2), 65-98.
- Keeton, W.R. (1999). Does Faster Loan Growth Lead to Higher Loan Losses? Federal Reserve Bank of Kansas City, *Economic Review*, 84(2), 57-75.
- Khemraj, T., Pasha, S. (2009). The determinants of non-performing loans: An econometric case study of Guyana. The Caribbean Centre for Banking and Finance Bi-annual Conference on Banking and Finance, St. Augustine, Trinidad.
- Klein, N. (2013). Non-Performing Loans in CESEE: Determinants and Impact on Macroeconomic performance, IMF Working Paper WP/13/72.
- Latif, A., Kyereboah-Coleman, A. & Andoh, C. (2014). Asset quality in a crisis period: An empirical examination of Ghanaian banks. *Journal of Advanced Research*, 4(1), 50–62.
- Lleshanaku, A. (2015). From the perspectives of macroeconomic factors: The past and future of problematic loans in Albania. *Academic Journal of Interdisciplinary Studies*, 4(1), 35–50

- Louzis, D.P., Vouldis, A.T., Metaxas, V.L. (2010). Macroeconomic and bank-specific determinants of non-performing loans in Greece: a comparative study of mortgage, business and consumer loan portfolios. Bank of Greece, Working Paper 118.
- Louzis, D. P., Vouldis, A.T. & Metaxas, V. L. (2012). Macroeconomic and bank-specific determinants of nonperforming loans in Greece: A comparative study of mortgage, business and consumer loan portfolios. *Journal of Banking and Finance*, 36(4),1012– 27
- Makri, V., Tsagkanos, A. & Bellas, A. (2014). Determinants of non-performing loans: the case of eurozone. *Panoeconomicus*, (2),193–206
- Mileris, R. (2014). Macroeconomic factors of non-performing loans in commercial banks. *Ekonomika*, 93(1), 22–39.
- Moinescu, B. G. (2012). Determinants of non-performing loans in central and eastern European countries: macroeconomic indicators and credit discipline. *Review of Economic and Business Studies*, 5(2), 47–58.
- Mugume, A. (2007). Competition and efficiency in the Ugandan banking sector. *African Economic Research Consortium (AERC) research paper*, 203. Nairobi: AERC.

- Nkusu, M. (2011). Nonperforming Loans and Macro financial Vulnerabilities in Advanced Economies, IMF Working Paper WP/11/161.
- Niinimäki, J-P. (2007). Does collateral fuel moral hazard in banking? Helsinki School of Economics and HECER Discussion Paper 181, ISSN 1795-0562
- Ofori-Abebrese, G. et al (2016). Macroeconomic factors and the performance of loans in commercial banks in Ghana: A case study of HFC Bank. *European Journal of Economics, Finance and Administrative Sciences*, ISSN 1450-2275.
- Ouhibi, S. & Hammami, S. (2015). Determinants of non-performing loans in the Southern Mediterranean countries. *International Journal of Accounting and Economics Studies*, 3(1), 50–3.
- Pesola, J. (2007). Financial fragility, macroeconomic shocks and banks' loan losses: evidence from Europe. Bank of Finland Research Discussion Paper 15.
- PricewaterhouseCoopers. (2006, November). Corporate failure and bankruptcies in Ghana: Investment Advocacy forum, Business house JCR, The University of Ghana
- PricewaterhouseCoopers. (2009). Ghana Banking Survey 2009, The Global Financial Meltdown: Will Ghana's Banking Industry survive the crunch?.
- PricewaterhouseCoopers. (2010). Ghana Banking Survey 2010, Risk Management in well Capitalized Banks.

- PricewaterhouseCoopers. (2011). Ghana Banking Survey 2011, Sustaining Growth: Challenges and opportunities.
- PricewaterhouseCoopers. (2012). Ghana Banking Survey 2012, Enhancing customer value to sustain profitable growth.
- PricewaterhouseCoopers.(2013). Ghana Banking Survey 2013, Harnessing the SME Potential.
- Pricewaterhousecoopers. (2014). Ghana Banking Survey 2014, The future of banking in Ghana...what's next?
- PricewaterhouseCoopers (2015). Ghana Banking Survey 2015, Bank of the future: What bank customers want to experience by 2020.
- Quagliariello, M. (2003). Macroeconomics indicators useful in predicting bank loan quality: evidence from Italy. Rome: Bank of Italy paper series, no. 1
- Rajan, R., & Dhal, S.C. (2003). Non-performing loans and terms of credit of public sector banks in India: An empirical assessment. Reserve Bank of India Occasional Papers, 24(3), 81-121.
- Richard, E. (2011). Factors that cause non-performing loans in commercial banks in Tanzania and strategies to resolve them. *Journal of Management Policy and Practice*, 12(7), 50-8.

- Rono, B.K., Wachilonga, L.W. & Simiyu, R.S. (2014). Assessment of the relationship between interest rate spread and performance of commercial banks listed in Nairobi securities exchange. *International Journal of Financial Economics*, 3(2), 98–112.
- Saba, I., Kouser, R., & Azeem, M. (2012). Determinants of non-performing loans: case of US banking sector. *The Romanian Economic Journal, Year XV no 44*, 141–52.
- Salas, V., & Saurina, J. (2002). Credit risk in two institutional regimes: Spanish commercial and savings banks. *Journal of Financial Services Research*, 22(3), 203-224.
- Shingjergji, A. (2013). The impact of macroeconomic variables on the non-performing loans in the Albanian banking system during 2005-2012. *Academic Journal of Interdisciplinary Studies*, 2(9), 335–39.
- Shingjergji, A. & Shingjergji, A. (2013). An analysis of the non-performing loans in the Albanian banking system. *International Journal of Business and Commerce*, 2(6), 1–11.
- Skarica, B. (2014). Determinant of non-performing loans in central and eastern European countries. *Journal of Financial Theory and Practice*, 38(1), 37–59.
- Sowa, N. K. & Kwakye J.K. (1993). Inflationary trends and control in Ghana, African Economic Research Consortium Research Paper 22, Nairobi.

- Swamy, V. (2012). Impact of macroeconomic and endogenous factors on non-performing bank assets. *International Journal of Banking and Finance*, 9(1), 27–47.
- Turan, G. & Koskija, A. (2014). Non-performing loan in Albania. *Academic Journal of Interdisciplinary Studies*, 3(3), 490–500.
- Valahzaghari, M.K., Kashefi, M., Alikhani, A. & Hosseini, S.E. (2012). The effect of macroeconomic factors on credit risk in the banking system of Iran. *Management Science Letters*, 2, 1747–54.
- Vatansever, M. & Hepşen, A. (2013). Determining impacts on non-performing loan ratio in Turkey. *Journal of Finance and Investment Analysis*, 2(4), 119–29.
- Zeman, J. & Jurea, P. (2008). Macro stress testing of the Slovak banking sector. *National Bank of Slovak Working Paper*, 1, 3–26.
- Zeng, S. (2012). Bank non-performing loans (NPLS): A dynamic model and analysis in China. *Modern Economy*, 3, 100–10.151

APPENDICES

APPENDIX 1

Breusch-Godfrey Serial Correlation LM Test:

Null hypothesis: No serial correlation at up to 2 lags

F-statistic	0.272071	Prob. F(2,27)	0.7838
Obs*R-squared	0.898224	Prob. Chi-Square(2)	0.6184

Test Equation:

Dependent Variable: RESID

Method: Least Squares

Date: 07/07/20 Time: 22:26

Sample: 2005Q1 2016Q4

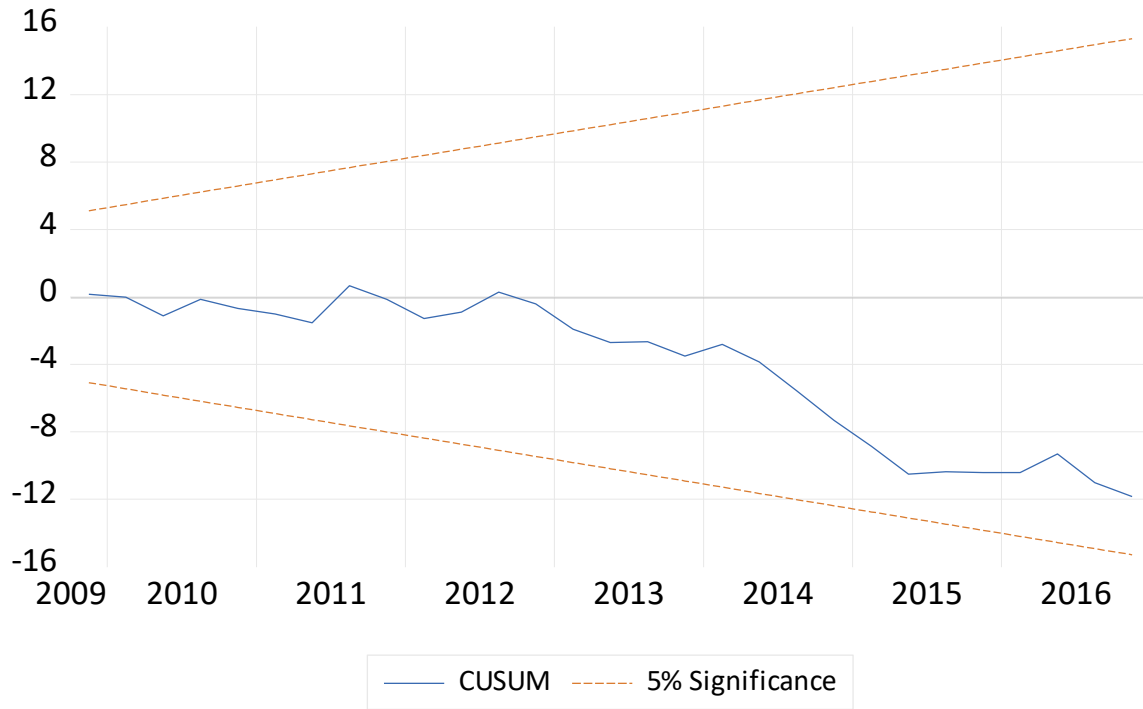
Included observations: 48

Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.650323	2.741424	0.218356	0.7855
D(NPL(-1))	-0.004673	0.359646	-0.013976	0.9196
D(NPL(-2))	0.098029	0.294951	0.375303	0.7867
D(GDP(-1))	0.035298	1.671261	0.495343	0.6244
D(GDP(-2))	0.015141	1.138262	0.395727	0.6954
D(MPR(-1))	0.143713	0.288050	0.498915	0.6219
D(MPR(-2))	0.175490	0.299650	0.585650	0.5630
D(M2(-1))	0.002609	0.048042	0.054308	0.9571
D(M2(-2))	0.014516	0.045508	0.318983	0.7522
D(INF(-1))	-0.007801	0.067249	-0.116000	0.9085
D(INF(-2))	-0.069191	0.088235	-0.784170	0.4398
D(EXR(-1))	-0.203452	1.842494	-0.610932	0.5464
D(EXR(-2))	-0.806876	1.607753	-0.501866	0.6198
NPL(-1)	0.145459	0.108217	0.344147	0.1901
GDP(-1)	-0.046919	1.980550	-0.478518	0.6361
MPR(-1)	-0.107242	0.156543	-0.685064	0.4991
M2(-1)	-0.018790	0.047614	-0.184612	0.8549
INF(-1)	0.046135	0.021799	0.281432	0.7805
EXR(-1)	0.290574	1.250952	0.232282	0.8181
RESID(-1)	-0.121299	0.428870	-0.281857	0.1041
RESID(-2)	-0.193554	0.350653	-0.493083	0.1470

R-squared	0.017257	Mean dependent var	2.62E-15
Adjusted R-squared	-0.723479	S.D. dependent var	0.865261
S.E. of regression	1.170959	Akaike info criterion	3.417056
Sum squared resid	33.61406	Schwarz criterion	4.235706
Log likelihood	-65.80934	Hannan-Quinn criter.	3.726425
F-statistic	0.020885	Durbin-Watson stat	2.157521
Prob(F-statistic)	0.996275		

APPENDIX 2



APPENDIX 3

Dependent Variable: D(NPL)
 Method: Least Squares
 Date: 07/09/20 Time: 12:11
 Sample (adjusted): 2005Q1 2016Q4
 Included observations: 48 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.340094	0.228914	-1.048840	0.2017
D(NPL(-1))	0.225099	0.157260	1.477025	0.1774
D(NPL(-2))	0.219246	0.151690	1.281968	0.2476
D(GDP(-1))	-0.502536	0.732146	-0.678883	0.5376
D(GDP(-2))	-0.291405	0.834170	-0.301373	0.7589
D(MPR(-1))	-0.227469	0.350063	-0.649650	0.5129
D(MPR(-2))	0.177193	0.278851	0.460526	0.6539
D(M2(-1))	-0.061153	0.040379	-0.594462	0.5392
D(M2(-2))	-0.008228	0.034911	-0.368838	0.7680
D(INF(-1))	0.004071	0.172013	0.031851	0.9883
D(INF(-2))	-0.052227	0.171938	-0.349415	0.7584
D(EXR(-1))	1.848677	1.361091	1.347306	0.1518
D(EXR(-2))	1.890193	1.402001	1.348211	0.1865
ECT(-1)	-0.459450	0.182969	-3.021807	0.0030
R-squared	0.469463	Mean dependent var		0.025000
Adjusted R-squared	0.198375	S.D. dependent var		1.451705
S.E. of regression	1.355324	Akaike info criterion		3.684451
Sum squared resid	62.45471	Schwarz criterion		4.230218
Log likelihood	-74.42683	Hannan-Quinn criter.		3.890697
F-statistic	1.532483	Durbin-Watson stat		2.033417
Prob(F-statistic)	0.071052			

APPENDIX 4

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

F-statistic	0.091065	Prob. F(2,32)	0.9056
Obs*R-squared	0.294155	Prob. Chi-Square(2)	0.8373

Test Equation:

Dependent Variable: RESID

Method: Least Squares

Date: 07/09/20 Time: 12:35

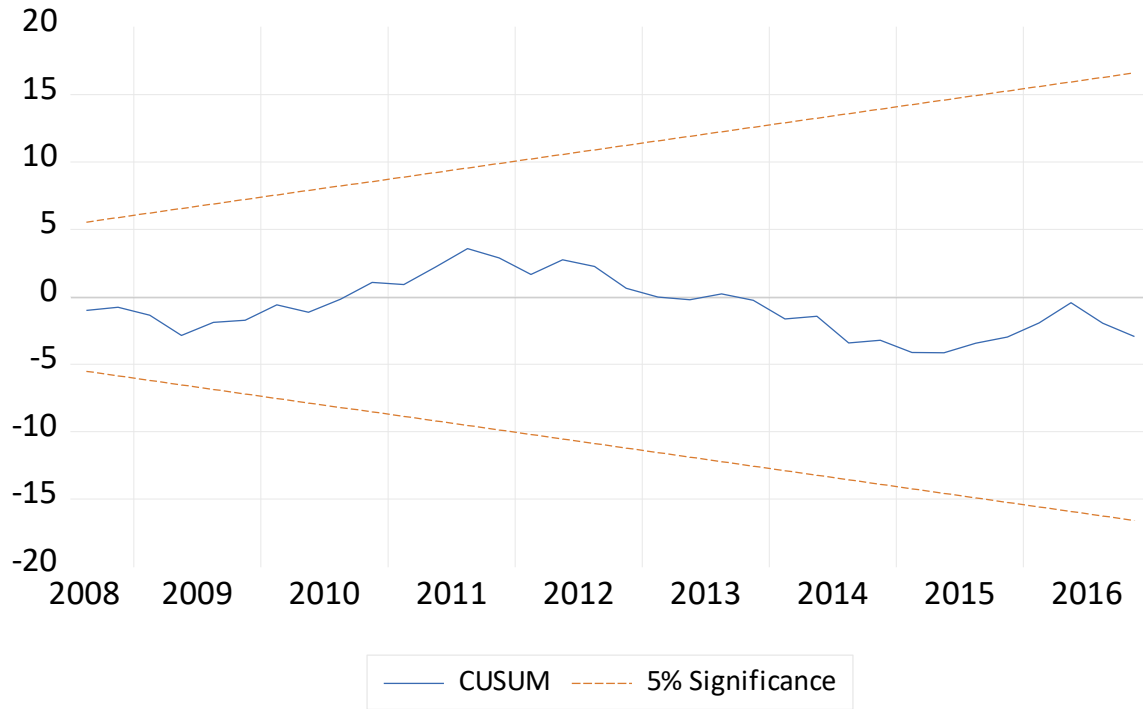
Sample: 2005Q1 2016Q4

Included observations: 48

Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.002461	0.242464	-0.008738	0.9905
D(NPL(-1))	-0.114494	0.479513	-0.363899	0.7983
D(NPL(-2))	0.120143	0.362005	0.328494	0.7216
D(GDP(-1))	-0.009650	0.833495	-0.019414	0.9846
D(GDP(-2))	-0.131420	0.924925	-0.140652	0.8678
D(MPR(-1))	0.024246	0.440139	0.046771	0.8999
D(MPR(-2))	0.070590	0.334776	0.259315	0.8744
D(M2(-1))	0.003586	0.042234	0.085942	0.9771
D(M2(-2))	0.007105	0.043972	0.202385	0.8981
D(INF(-1))	-0.222400	0.222441	-0.093869	0.9709
D(INF(-2))	-0.042015	0.202184	-0.206618	0.8454
D(EXR(-1))	-0.026513	1.496613	-0.016348	0.9666
D(EXR(-2))	-0.030028	1.714934	-0.022859	0.9783
ECT(-1)	0.018773	0.219805	0.083328	0.9598
RESID(-1)	0.094693	0.544416	0.167198	0.8917
RESID(-2)	-0.218240	0.467669	-0.479838	0.6345
R-squared	0.006462	Mean dependent var		1.48E-16
Adjusted R-squared	-0.448135	S.D. dependent var		1.112746
S.E. of regression	1.372753	Akaike info criterion		3.732715
Sum squared resid	60.30242	Schwarz criterion		4.356449
Log likelihood	-73.58516	Hannan-Quinn criter.		3.968425
F-statistic	0.016142	Durbin-Watson stat		1.984825
Prob(F-statistic)	0.999998			

APPENDIX 5



APPENDIX 6

CAUSALITY TEST FOR GROSS DOMESTIC PRODUCT (GDP)

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.234773	(2, 34)	0.9052
Chi-square	0.449545	2	0.9017

Null Hypothesis: $C(4)=C(5)=0$
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(4)	-0.542536	0.832146
C(5)	-0.256905	0.834170

Restrictions are linear in coefficients.

APPENDIX 7

CAUSALITY TEST FOR MONETARY POLICY RATE (MPR)

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.467196	(2, 34)	0.7292
Chi-square	0.784392	2	0.6401

Null Hypothesis: $C(6)=C(7)=0$
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(6)	-0.227469	0.350063
C(7)	0.177193	0.258851

Restrictions are linear in coefficients.

APPENDIX 8

CAUSALITY TEST FOR MONEY SUPPLY (M2)

Wald Test:

Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.252708	(2, 34)	0.7440
Chi-square	0.475415	2	0.7284

Null Hypothesis: $C(8)=C(9)=0$

Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(8)	-0.061153	0.040379
C(9)	-0.006228	0.039911

Restrictions are linear in coefficients.

APPENDIX 9

CAUSALITY TEST FOR INFLATION (INF)

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	0.060632	(2, 34)	0.9230
Chi-square	0.132126	2	0.9165

Null Hypothesis: $C(10)=C(11)=0$
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(10)	-0.005071	0.172013
C(11)	-0.055227	0.171938

Restrictions are linear in coefficients.

APPENDIX 10

CAUSALITY TEST FOR EXCHANGE RATE (EXR)

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	1.907359	(2, 34)	0.1615
Chi-square	3.814718	2	0.1990

Null Hypothesis: $C(12)=C(13)=0$
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(12)	1.886772	1.361091
C(13)	1.920193	1.422001

Restrictions are linear in coefficients.