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IS THERE A LINK BETWEEN THE GHANA REFERENCE RATE AND LENDING RATES OF BANKS IN GHANA?

BY

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DECLARATION

I, Edith Adjoa Semwaa Amponsah, do hereby declare that this thesis has not been documented for presentation in this or any other University. I, therefore, declare that this thesis is my own work, and all references have been recognized accordingly. I bear full responsibility to any shortcomings.

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DATE

CERTIFICATION

I hereby certify that this thesis was supervised in accordance with the laid down procedures of the University.

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28/07/2021

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DATE

DEDICATION

I dedicate this thesis to the Almighty God for His love and protection throughout this period of research and to and all and sundry who have a love for the subject matter investigated by this thesis.

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First, I am grateful to God Almighty for good health and wellbeing that was necessary to complete this work. I am also thankful to Him for His abundant grace and mercy over my life.

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ABSTRACT

This thesis examined the macrodynamic hyperlink between the Ghana Reference Rate (GRR) model and interest rates in Ghana. Although other studies abound, both in Ghana and abroad, that explored interest rates and its impacts on commercial bank lending rates, none of these studies specifically studied addressed the question of whether the GRR has any link with commercial bank lending rates. This study employs the non-experimental, quantitative-correlational, ex-post-facto design within a time series framework. Besides, it utilises secondary, quantitative data lending rates, the GRR, and the control variables collected from the website of the Bank of Ghana (BoG), representing monthly time series data spanning the period April 2018 to January 2020, capturing only the post-GRR introduction period in Ghana. The data was analyzed using descriptive statistics and inferential statistics. After performing individual unit root tests and the Engle-Granger single equation cointegration tests coupled with graphical representations, a multivariate linear regression model was employed to examine the effects of the Ghana reference rate (GRR), bank-specific variables of profitability, liquidity, interest expenses, and the macroeconomic factors of the exchange rate, money supply, and inflation rates on commercial bank lending rates in Ghana. The parameters of the multivariate regression model were estimated using the Fully Modified Ordinary Least Squares (FMOLS). Moreover, a pairwise Granger causality test was performed to test the causal link between the GRR and lending rates in Ghana. The robustness of the FMOLS multivariate regression findings, in terms of the consistency of the statistical significance and effects of the parameter estimates, were checked using three estimators, namely, *1) Dynamic OLS (DOLS) Estimator; 2) Two-Stage Least Squares (TSLS)*; and *3) Generalized Methods of Moments (GMM)*. The predictive ability of the FMOLS model was further ascertained using the bias proportion, variance proportion, andcovariance proportions. The FMOLS model is further tested for serial correlation and asymptotic normality. The study pursued five main research

questions and below is a summary of the findings. Concerning the first research question, *what is the causal effect of the GRR on commercial bank lending rates in Ghana*, the analysis revealed that the Ghana Reference Rate has a positive and statistically significant causal effect on commercial bank lending rates in Ghana based on the FMOLS and Granger causality results. The finding implies that the introduction of the GRR has caused commercial bank lending rates to increase substantially, hence the two variables are temporally related. Concerning the second research question was, *what are the effects of the bank profitability or financial performance indicators of ROA and ROE on lending rates of commercial banks in Ghana,* the results revealed that the bank profitability variable of ROA exerts a statistically significant positive effect on lending rates, whiles the effect of ROE on lending rates is negatively significant. In relation to the third research question, *to what extent does the bank liquidity variable of Core Liquid Assets to Total Assets (CLATTA) ratio influence lending rates of commercial banks in Ghana,* the analysis indicated that banks liquidity (CLATTA) has an insignificant positive relationship with lending rates. When it comes to the fourth research question, *what are the effects of bank interest expense variables of savings deposit interest (SDR) rates and 3 months' Time Deposits Rates (TDR) on commercial bank lending rates in Ghana,* the results reveal that positively significant effect of the Savings Deposit rate (SDR) on lending rates, whereas the 3-Month-Time Deposit rates (TDR) have a significant negative effect on lending rates in Ghana. Regarding the fifth and final research question, *do the macroeconomic factors of the exchange rate, money supply, and inflation rates significantly impact commercial bank lending rates in Ghana,* the findings reveal that all the macroeconomic variables of inflation, and exchange rates and money supply. influence commercial bank lending rates negatively and significantly. The study recommends, amongst other things, that future studies focus on the determinants of credit risk premium of commercial banks as the findings from that study could help banks properly determine interest rates in Ghana.

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FAVAR	-	Factor-augmented Vector Autoregressive Model
ADF	-	Augmented Dickey-Fuller
AIC	-	Akaike Information Criterion
ARDL	-	Autoregressive Distributed Lag
BoG	-	Bank of Ghana
BR	-	Base Rate
CD	-	Certificate of Deposit
CIV	-	Cash-in-Vault
CLATTA	-	Core Liquid Assets to Total Assets
CRR	-	Cash Reserve Requirement
DL	-	Demand for Loanable Funds
DOLS	-	Dynamic Ordinary Least Squares
DSGE	-	Dynamic Stochastic General Equilibrium
EU	-	European Union
FMOLS	-	Fully Modified Ordinary Least Squares
FX	-	Foreign Exchange
GDP	-	Gross Domestic Product
GFC	-	Global Financial Crisis
GMM	-	Generalized Methods of Moments
GoG	-	Government of Ghana
GRR	-	Ghana Reference Rate
IBR	-	Inter-Bank Lending Rates
IEA	-	Institute of Economic Affairs
KBRR	-	Kenya Bank Reference Rate

LR	-	Lending Rates
MPC	-	Monetary Policy Committee
MPR	-	Monetary Policy Rate
MS	-	Broad Money Supply
OLS	-	Ordinary Least Squares
PP	-	Phillips-Perron
ROA	-	Return on Asset
ROE	-	Return on Equity
SDR	-	Savings deposit rate
SIC	-	Schwarz Information Criterion
SL	-	Supply of Loanable Funds
SOLS	-	Static Ordinary Least Squares
TDR	-	Time deposit rate
TSLS	-	Two-Stage Least Squares
VAR	-	Vector Autoregressive Model
ZLB	-	Zero Lower Bound
ANN	-	Artificial Neural Network
MA	-	Moving Average Model
AR	-	Auto-Regressive Model
ARMA	-	Auto-Regressive Moving Average
ARIMA	-	Auto-Regressive Integrated Moving Averages
VAR	-	Vector Autoregression Model
VEC	-	Vector Error Correction Model
PSO	-	Particle Swarm Optimization
VARMA	-	Vector Autoregressive Moving Average

DFM	-	Dynamic Factor Model
DSGE	-	Dynamic Stochastic General Equilibrium Model
FAVAR	-	Factor Vector Autoregressive
MLP	-	Multilayer Neural Network or Multilayer Perceptron
MLR	-	Multi-Layer Perceptron
SA	-	Sentiment Analysis
BoG	-	Bank of Ghana
EMH	-	Efficient Market Hypothesis
IPO	-	Initial Public Offering
MM	-	Miller and Modigliani Theorem
OPEC	-	Organization of Petroleum Exporting Countries
NNS	-	New Neoclassical Synthesis Theory of Inflation
NNs	-	Neural Networks
MAE	-	Mean Absolute Error
RMSE	-	Root Mean Square Error
MSE	-	Mean Square Error
R	-	Correlation Coefficient
FFT	-	Fourier transform
GDP	-	Gross Domestic Product
CPI	-	Consumer Price Index
DT	-	Decision Tree
MoF	-	Finance Ministry
GSS	-	Ghana Statistical Services
AfDB	-	African Development Bank
WDI	-	World Bank Development Indicators

RNN	-	Recurrent Neural Network
NAR	-	Nonlinear Autoregressive Neural Network
NARX	-	Nonlinear Autoregressive Exogenous Neural Network
RBF	-	Radial Basis Function
CBD	-	Central Business District
CBK	-	Central Bank of Kenya
CI	-	Confidence Interval
CL	-	Confidence level
CPI	-	Consumer Price Index
CVs	-	Control Varaibles
DV	-	Dependent Variable
ECM	-	Error Correction Model
ER	-	Exchange Rate
EVIEWS	-	Econometrics Views
FDI	-	Foreign Direct Investment
G2P	-	Governments-To- Person Payments
GDP	-	Gross Domestic Product
GFCF	-	Gross Fixed Capital Formation
GNI	-	Gross National Income
GoG	-	Government of Ghana
GSE	-	Ghana Stock Exchange
GSMA	-	Global System for Mobile Communications
GSS	-	Ghana Statistical Service
HTML	-	Hyper-Text Markup Language
ICT	-	Information Communications Technology

INV	-	Gross Domestic Investment
IVs	-	Independent Variables
KNBS	-	Kenya Bureau of Statistic
LDCs	-	Less Developed Countries
M2	-	Broad Money
MENA	-	Middle East and North Africa
MFIs	-	Microfinance Institutions
MM	-	Mobile Money
MMOs	-	Mobile Money Operators
MMSPs	-	Management of the Mobile Money Service Providers
MMTS	-	Mobile Money Transfer Services
MNCs	-	Multinational Corporations
MNOs	-	Multinational Organizations
MoF	-	Ministry of Finance
MPR	-	Monetary Policy Rate
MPSP	-	Mobile Payment Service Provider
NER	-	Nominal Exchange Rate
NFC	-	Near Field Communications
ODA	-	Official Development Aid
ODA	-	Official Development Aid
OLS	-	Ordinary Least Squares
OTA	-	Over-The-Air
P2P	-	Peer-To -Peer
PDA‘s	-	Personal Digital Assistants
PMPs	-	Proximity Mobile Payments

POS	-	Point of Sale
PSP	-	Payment Service Provider
RER	-	Real Exchange Rates
RMPs	-	Remote Mobile Payments
SEM	-	Structural Equation Modeling
SIM	-	Subscriber Identification Module
SIM	-	Subscriber Identification Module
SMEs	-	Small and Medium Enterprises
SMS	-	Short Message Service
TTP	-	Total Transactions Payments
VAR	-	Vector Auto Regression
VECM	-	Vector Error Correction Model
VIF	-	Variance Inflation Factor
WAP	-	Wireless Application Protocol

CHAPTER ONE

INTRODUCTION

1.1 Introduction

This chapter provides a general background to the research. It provides the review of relevant literature that focused on the main themes in this study and examines the research problem that called for the investigation into this study. The chapter also provides the general and specific objectives of the study with significance as well. The outline of the study is also introduced in this chapter.

1.2 Background of the study

The financial sector of every economy plays a significant role in the development of the country. Aside the provision of capital to businesses, firms and government, the financial sector also employs people in the sector for income generation and poverty reduction (Nguyen & Su, 2021). Financial institutions and financial markets as well as sub-indices (financial depth, financial access, and financial efficiency) have significant positive impacts on the economies around the world. The banks in every economy either as commercial banks, development banks and other microfinance institutions play a critical role in the development of the country. Aside serving as the financial intermediaries between lenders and borrowers, the banks serve as advisory institutions to investors to a large extent to help investment in viable and sustainable businesses (Yensu, Yusif, Tetteh, Asumadu, & Atuilik, 2021).

Despite the economic significance of banks to the economy of countries especially among emerging economies, the interest rate charges by banks have limited the ability of commercial banks in Ghana to extend credits to individuals and firms in the country (Owusu-Ankamah & Sakyi, 2021). The decision for individuals and businesses to decide on which bank to engage in their business activities with such as deposits and seeking for capital depends to a large

extent on the customer policy, brand, interest rates on the loans dispersed and the transaction time spent by the customers at the banking hall (Dao et al., 2021). Among these listed items that affects the individuals to access financial capital from commercial banks around the world and especially in developing countries such as Ghana, the lending rate which is the price at which commercial banks gives loans to customers has been recognized as a major factor that affect the demand for financial capital (Maiti, Esson, & Vuković, 2020).

Modern capital financing depends heavily on access to loans and the use of debts in creating wealth for businesses and individuals. According to Maiti et al., (2020) the ability of businesses and individuals to create wealth depends heavily on the ability of investors to borrow from the commercial banks operating in the country since this has been recognized to provide extra value to investors. Notwithstanding the important contribution of credit to businesses, many investors in Ghana who depends heavily on loans from the banks in the country are being crowded out on daily basis due to the high rates of interest on loans in the country (Jefferis, Kasekende, Rubatsimbira, & Ntungire, 2020). The lending rates of banks in most emerging economies are dependent on the overhead costs, exchange rate, inflation rate and the economic growth rate of the country. Jefferis et al., (2020) stated that other important elements that determines the lending rates of banks in emerging economies include the return on assets, market structure of the financial sector, and the real Treasury bill rates.

According to Aboyadana (2021) the monetary policy decisions of countries affects the risk-taking behaviors of the commercial banks in developing countries. The risk associated with loans disbursement in many sub-Saharan African countries depends to a large extent on the bank size and the profitability concern of the banks. The ability of individuals and business especially small and medium enterprises (SMEs) to have access to credit depend to a large extent on the firms' characteristics, good book-keeping record and the lending rates of the commercial banks that disburse the loans to the beneficiaries (Thuku, 2017).

The ability of banks to set the lending rates at which capital is given to individuals and business to a large extent do not only on internal factors such as firm profitability, banks size and overhead cost, but also depends to a large extent on external factors such as the reference rate set by the central bank of the country. Schrimpf and Sushko (2019) revealed that various benchmark rates exist to determine the lending rates at which commercial banks give loans. A reference rate is a benchmark rate set by the central bank of a country used to set interest rate by universal banks in a specific country (Tan, 2019). A reference rate is also defined as the rate that determines the pay-off in a financial contract between two parties that is considered an exogenous factor which is not under the control of the parties to the contract. According to Musah (2017) the reference rates are the exchange rates fixed by central banks for all currencies, usually daily. They are based on a regular daily concertation procedure involving all the banks governed by that central bank. This means that the ability of commercial banks to set the lending rates which is the measure of the rate at which commercial banks give loans to customers depends to a large extent on the referencing rate (Illes, Lombardi, & Mizen, 2015).

The reliability of reference rates – the extent to which their governance and administration adequately safeguard against manipulation or error – has recently come into question (Adusei, 2016). It is of critical importance that any reference rate has proper oversight to prevent abuses and errors in the financial sector. According to Gennaioli et al., (2014) the robustness of a reference rate – understood as its availability even under stressful market conditions – is another important criterion for users. If the reference rate is not robust to difficult market conditions, there may be a risk of unwanted cash flow mismatches for commercial banks as well as other market participants in periods when they already face difficulties such as high level of non-performing loans. According to Disyatat (2011) the tightening or loosening of the lending rates of banks depends to a large extent on the monetary policy rates which include the reference rate set by the Central Bank of the country. This means that even though banks have

other internal factors that determine the lending rate, there also exist a benchmark known as the reference rate which occupies a greater percentage in the determination of the lending rates of the banks in emerging economies such as Ghana.

1.3 Statement of Research Problem

The survival of most households, businesses and government projects depend to a large extent on the level of credit availability for these economic agents in the country. One of the major determinants of the access to credit by the economic agents depends on the lending rate which is the rate at which the commercial banks give loans to customers (Diriba, 2020). The lending rate by commercial banks in Ghana was rated as one of the highest rates in the world leading to the increased level of non-performing loans in the country. The average rate of lending rate between 2010 and 2018 stood at 35.5% according to the Bank of Ghana report (BOG, 2019). According to the Bank of Ghana report, the total ratio of non-performing loans in the country stood at 15.3% as at the end of February 2021 and this showed an increased from 14.7%.

According to Khan et al., (2020) the size of the non-performing loans (NPLs) in a country determines the stability of the financial sector and the performance of the economy. Whiles a major component of the non-performing loans is determined by the lending rates of the banks, the income diversification and the capital adequacy also affect the level of non-performing loans in many developing countries. The average lending rates for commercial banks in Ghana operating for the financial period 2020 was estimated to be 22% (Bank of Ghana report, 2021). According to Mukolu and Adeleke (2020) an estimated 45% of the profits of commercial banks operating in many developing countries comes from the lending rates of these banks to the economic agents. The lending rate of commercial banks in Ghana depends on several factors.

Scores of empirical studies have been conducted to establish the determinants of lending rates in many parts of the world. Haritone Shikumo and Mirie (2020) revealed that the bank size and

the bank's liquidity significantly influence the level of bank lending rate in Kenya. However, the study did not recognize the benchmark for setting the lending rates which is the reference rate of the country set by the Central Bank. Mbowe et al., (2020) in a similar study on the determinants of lending rates in Tanzania found that operating costs, non-performing loans, and the costs of funds positively determines the lending rates of Banks in the country. This study however failed to establish the causal link between the reference rate and the lending rates of the banks in the country. Altavilla et al., (2020) in a study on European banks sought to establish the missing link between the lending rates and the monetary policy pass-through. It was discovered that the lending rates of the countries had a causal link with capital ratio, exposure to domestic sovereign debt and the percentage of non-performing loans in these countries.

All the empirical reviews above seeks to mention the traditional determinants of lending rates without making mentioning of the reference rate which is the major benchmark in the determination of lending rates by commercial banks. Studies on the causal link between the reference rate of countries and the lending rates of the banks remains missing. For case of Ghana, there is no study on the causality between the reference rate and the lending rates of the commercial banks operating in the country. This study therefore seeks to establish if there exist any causality between the reference rates of Ghana and the lending rate existing in the country.

1.4 Research Purpose

The major purpose of the study is to establish the relationship between the Ghana reference rate and the lending rates of operating commercial banks in the country.

1.5 Objectives of the Study

The main objectives of the study are:

a. to analyze the causal relationship between the Ghana reference rate and the lending rate of commercial banks in Ghana.
b. to examine the bank specific factors that influence the lending rates of commercial banks in Ghana.
c. to assess the macro-economic factors that influence the lending rates of commercial banks in Ghana.

1.6 Research Questions

The study seeks to answer the following research questions;

a. is there a causal relationship between the Ghana reference rate and the lending rate of commercial banks in Ghana?
b. do bank specific characters influence the lending rates of commercial banks in Ghana?
c. what are the macro-economic factors that influence the lending rates of commercial banks in Ghana?

1.7 Significance of the study

The findings of this study add to current and ongoing literature that explores the determinants of lending rates of commercial banks in Ghana and the efficacy of certain policies introduced by the Bank of Ghana such as the Ghana Referencing Rate. Future scholars may make use of the results of this report for further studies on other lending rate strategies in the banking sector. Management of Ghanaian banking and financial institutions within the country can also benefit from the results of this study as it may enable them to understand the impact of the GRR on lending rate. Regulatory bodies and policymakers, such as the Bank of Ghana, should be able to evaluate the effectiveness of these policies to fulfill their intended function. Finally, this analysis indicates the efficacy or otherwise of the Ghana Reference Rate in reducing the loan rates of commercial banks in Ghana.

1.8 Scope of the Study

The study focuses on Ghana in relation to the lending rates of commercial banks in the country. The study covers the period of April 2018 to January 2020. The data used for the study will be a secondary data for the study period using the Fully Modified Ordinary Least Square (FMOL).

1.9 Outline of the Study

The study consists of five (5) chapters. The Chapter one (1) focuses on the introduction, problem study, research objectives and the research questions that called for the study. The chapter two (2) will focus on the review of theoretical and empirical literature. The chapter three will focus on the research methodology for the study. The chapter four (4) will pay attention to the discussion and analysis of the results and the final chapter five (5) will give a summary, conclusion and policy recommendation to the work based on the results from the analysis.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This section addresses all relevant concepts, theories, and empirical works like and relevant to the subject under investigation.

2.2 Conceptual Literature

2.2.1 Lending Rates

Lending charges are payments imposed on borrowers when they receive credit from banks. Banks and debtors are very often highly impacted extraordinarily by lending charges. The archetypical response of financial institutions like banks, since the previous three or so decades, to the frequently escalating lending rates has been to make significant adjustments in the coverage charges, commissions, base rates, and transaction fees (Santomero, 1984). A constellation of arguments has emerged since that time, that lending costs are excessive and scare away borrowers and different investors. The argument offered by banks, on the other side, has been that operational fees and transaction costs are high because, without them, banks would be unable to finance their operational expenses and remain in business.

The whole income will additionally be higher than the standard price (Van de Heuvel, 2000; 2002). Borrowing and output by banks and established firms also decrease alternatively than borrowing and funding by means of businesses with publicity to the public debt market (Gertler, 1994).

Because of how crucial and sensitive the issues of lending rates are: Ghana's Banking Act 2004 (Act 673) emphasizes why banks need to structure their transactions and operations to maximize the apprehension of customers pertaining to the amount of fees paid; whether in

percentages or actual amounts, as well as interest due 14 days in advance on the borrower's account. The act also mandates banks to furnish their customers with a full list of charges and credit rates at bank branch offices or make them available to the customer upon request. Bank interest rates are typically influenced by the loan amounts given out, high money market rate volatility (Hogson & Saunders, 1981; Zarfar et al., 2008), and demand on deposits (Kashyap et al., 1993; Friedman & Kuttner, 1993; Hoggson & Sanders, 1981).

2.2.2 Interest Rates, Policy Rates, and Inflation

Interest rates square measure the value for borrowing cash and might move up or down; reflect several factors including the availability of funds, availableness of loans from lenders, and borrower's credit demand (Hoggson & Sanders, 1981). The rate of interest may be a mechanism that transmits financial institution policy actions to the important sector and permits the financial institution to catapult the economy along the required trajectory (Medina et al., 2011). Channels of transmission, its strength, and speed confirm the effectiveness of the financial policy. These depend upon several things including the economic science conditions, development within the monetary market structure, and the regulative framework (Kwakye 2010a). Financial policy changes expressly influence bank interest rates because the financial institution regulates some kinds of short-run interest rates, that influence the stock and bond markets, still as mortgages and different interest rates (Hoggson & Sanders, 1981; Lummer & McConnell, 1989). A truncated-interest amount denotes that corporations will sponge cash to conjecture in their capital stock and reimburse less interest for it because the business gallops on credit, and banks scrounge on a day- after- day basis from their monetary establishment or one another. Accordingly, slashing interest rates on loans animates economic progress (Towbin & Weber, 2011). Bank stocks are wounded lately by industrialist fears that superior interest amounts would mutilate earnings (Hansell, 1993).

When lending rates are distressed by oscillations in general economic crescendos or monetary policy undulations, commercial banks predictably undertake analogous modifications in the rate of their return on assets. This is because banks preserve a lot of moderately short-term assets, and the prices for short-term loans oscillate nippily as interest rates vacillate (Rasiah, 2010). The interest rate elements are opportunity costs, inflation premiums, default risk premiums, and actual risk-free prices.

The Base Rate Policy's institution is incongruous, albeit the projected escalation in battle in the short-haul sector for lending, to entertain a chief upshot on bank interest spreads, as banks retain the savoir-faire to scrutinize certain loan pricing factors, credit risk premiums, term structure or loan tenure, and product-related operating costs, which endow banks with some leverage to safeguard the variance in their interest charges (Bihari, 2011).

The actual rate that borrowers and lenders get paid on the market is contingent upon the loan interest rates disbursed by the central banks, the maturity, (perceived) credit risk, and advances to scrutinize the economy’s money supply and banking sector, which is made every quarter to govern inflation which will protract the country's exchange rates (Bank of Zambia, 2010). The vacillation of bank rates has an undulation upshot; it induces every vicinity of the economy of a country.

Borrowing is the predominant behavior of Governments. This is frequently the quintessential consequence of government expenditure exceeding their tax-generated revenues, causing them (governments) to finance their programs through what is commonly alluded to as ―deficit financing. An astronomical echelon of government borrowing, spending, and disbursement make it arduous for individuals and corporations to borrow, and consequently, the ―crowding out outcome occurs.

Inflation disturbs investors; they want to conserve the ―purchasing power of their money. If inflation is elevated and risks keep escalating, investors will crave a grander interest rate to

consider offering their money for more than the shortest haul (Scot, 2009). As inflation plummets, investors necessitate subordinate rates as their opportunities become squatter (Huybens & Smith, 1999). The policy rate transmutes to consider the amendments in inflation. Vicissitudes in the monetary policy make interest rates inferior or superior, and if the money supply is depressed, this tautens monetary policy and instigates interest rates to levitate (Zarfar et al., 2008).

Governments unswervingly manipulate the supply of money as a component of the so-called ―economic management regime‖. However, undulations in an economy's money supply can trigger and elicit unnecessary uncertainty, especially, when inflation continues to remain beyond the target. As rightly observed by De Gregario and Sturzenegger (1997), the Bank of Ghana's Monetary Policy Committee's (MPC's) aim, and indeed in several other countries, is to drive interest rates so that inflation can be maintained within a certain target range within a reasonable

time without creating unwarranted economic instability. The central bank’s acts and policies have a substantial influence on the rate of interest and the funds available to borrowers. Although the central bank does not have the supremacy to set interest rates in general, it has control over the lending rate and modifications in the interest rates may have a quintessential impact on other market rates.

The Central bank also possesses another monetary policy tool; the prerogative to modify the reserve requirements. When the reserve prerequisites are augmented, banks are compelled to preserve more investments and consequently, have less money accessible to lend out; by altering the accessibility of credit, interest rates might be touched. The Central Bank will also have a substantial bearing on market interest rates through its open market operations. Open market interest activities have an unambiguous impression on the market rate of government

securities, which in turn influences other rates. Such open market pacts transform the echelon of reserves accessible to the banking system, and this drastically impacts the amount of funds that banks have not sponged and the rate of loans. Open market trading of securities by the Central Bank continues to augment the cost of government securities. This depresses the number of reserves in the financial system; as with a reduced number of reserves, banks have a lesser amount of liquidity obtainable and there is a susceptibility to proliferate the loan rate. The disposable effect of such government accomplishment is thus an attenuation in the allocation of liquidity and credit accessibility and a skyward strain on market interest rates (Leisenring, 1980).

2.2.3 Mathematical Modelling of Interest Rates

A basic markup equation for commercial banks was developed by Rousseas (1985) to explain the pass-through interest rate process:

$$lr = k(u) \dots\dots\dots\dots\dots\dots\dots (2.1)$$

where, lr is the bank lending rate and k is the mark-up function representing the level of monopoly or market control exerted by individual banks or, in total, by the banking industry as a whole. u is the unit prime or variable costs borne by the banks, basically interest earned on deposits and borrowed funds. Growing market dominance or expanding prime rates for banks has led to rising rates for bank loans. Since the banking business system is not completely competitive, a permanent discount can be required on the bank cost of the loans

Supposing an unremitting mark-up, we could re-formulate (2.1) in linear form as follows:

$$lr = \alpha + \beta u \dots\dots\dots\dots (2.2)$$

where α is a mark-up on the fund's loan cost and β is a degree of pass-through from the funds' loan cost to the lending rate. According to Mota and Grigoli (2017), the fundamental crux of

Rousseas' (1985) model was to draw a quintessential analogy between the contribution of the assets to the accelerated rate of monetary policy.

Consequently, revisions to the central monetary policy rate would predict the prices of bank loans. In addition, the α distribution should be noted to include both time-varying and constant components. The following aspect considers the likelihood of the bank conditions, banking market structure, and other macro-financial factors which determine whether the markup will exhibit tight fluctuations over time:

$$lr_t = (\alpha_1 + \alpha_{2,t}) + \beta mpr_t \dots\dots\dots\dots (2.3)$$

$\alpha_{2,t}$ may have a prejudice in the calculation if we flunk to consider the potential time-varying aspect of the spread. Amalgamating subsisting narratives, $\alpha_{2,t}$ is governed by X_t vector incorporating macro-financial elements such as credit risk premium (Gambacorta et al., 2015; Bondt, 2005); Mihaylov, 2016; Grigoli & Mota, 2017; Chileshe & Akanbi, 2016), bank competition (van Leuvensteijn et al., 2013; Leroy & Luccote, 2015; Chileshe & Akanbi, 2016), and the unorthodox returns from investing in government bonds (Holton & d'Acri, 2015; Cifarelli & Paladino, 2016):

$$\alpha_{2,t} = \gamma X_t + \varepsilon_t \dots\dots\dots\dots (2.4)$$

As a fragment of the Rousseas (1985) template, the clouts of bank competitiveness on the pass-through have before this time been surveyed. We then endure collaring the credit risk impacts. Credit risk survives on both borrowers and bank sides. Chileshe & Akanbi (2016) calculate credit risk, on the bank side, as bank leverage or capital-to-assets ratio. On the borrower side, credit risk is primarily tied to asymmetric data issues (Chileshe & Akanbi, 2016). Because commercial banks cannot unfailingly extricate between creditworthy debtors and precarious borrowers, some credit evasions ought to be projected. As the lending rate treks, the likelihood of loan nonpayment can accelerate. (Chileshe & Akanbi, 2016).

Stiglitz and Weiss (1981) discern between two effects owing to misplaced knowledge and information. First is the adverse selection effect, interconnected with the injurious impact of picking. The second is the corollary of a stimulus (moral hazard). The adverse selection effect designates the status quo where loftier interest rates heighten better but less profitable loans and, on the other hand, higher-projected returns incite riskier proposals. Hence, with escalating interest rates, commercial banks are confronting a strenuous state of play when they try to figure out which borrower is more expected to reimburse their loan or not. The motivation (moral hazard) effect harnesses to the borrower's investment conviction. Higher interest rates plunge the creditor into riskier schemas to bring about a superior return.

Less cost-effective but precarious devices are habitually also necessitated to evolve with prudent projects. The commingled bearing of the adverse selection and reward (moral hazard) upshots of Stiglitz and Weiss (1981) is to make banks diffident to further proliferate the lending rate after accomplishing their optimal level due to the escalating risk of default (credit rationing). The circumstance results in an escalation in the loan rate's stickiness. However, as Bondt (2005) has pointed out, banks don't need to ration credit. In comparison, they will augment the risk premium for loans. This banking stratagem could be a trailblazer to a pass-through retail rate overestimation, so that ($\beta > 1$) in (2.2) and (2.3) above.

To disparage this perceived chauvinism, the borrower's default risk may be compensated for by inculcating into the equation, the non-performing loan ratio, X_t. Furthermore, credit risk will take on a dissimilar designation when interest rates are at zero lower bound (ZLB). In the post-crisis environment, banks customarily tauten their lending settings, and although monetary policy is slackened, credit supply is restricted (Plašil et al., 2012; Bijsterbosch & Falagiarda, 2014; Altavilla et al., 2015). Yet banks archetypally look at up-to-the-minute loans with an elevated risk premium indecorously after the crisis. That leads to a sticky plummet in lending prices.

Luxuriating government bonds as a substitute asset to lending, particularly in the post-Global Financial Crisis (GFC) epoch, will transmute bank determinations from commercial lending to government lending. The unorthodox return from investing in government bonds is enunciated in the disparity between the government bond yield and the repo rate. This gauge the clout of fiscal policy and time changing sovereign risk, as well as acuities of the potential course of short-term rates and term premiums, which further manipulate the setting of long-haul lending rates (Hofmann & Mizen, 2004).1 The monetary policy under such a scenario can undergo less successful conduction mechanisms, remarkably during economic recovery (Borio & Hofmann, 2017).

2.2.4 Reference Rates

Reference rates are typically putative interest rates which intersect payments under a finance contract with methodical interest rates on the money market. In domestic and international capital markets a large range of yardstick interest rates is used, with capacious regalia of unsecured and delimited money markets in many currencies. Consequently, how reference rates are constructed and exploited is quintessential to financial market activity. They (reference rates) are customarily contingent upon indiscreet interbank term loans and borrowing have become domineering, not only because they disseminate bank finance risk management, but also because they were the foremost configurations of rates to be espoused and have been the industry norm over time. These prices are now overpoweringly entrenched in financial markets, principally in loan and interest rate derivatives transactions.

2.2.5 The Benefits of Using Reference Rates

Using the reference rates connects the payoffs in the financial contract to the stock market's regular interest rates. Contrary to the situation where each actual contract corresponds to its custom interest rate, applying reference rates reduces financial contract volatility and promotes its standardization. This decreases transaction costs substantially, and improves market

liquidity, particularly if reference rates are commonly used. Thus, by encouraging constructive trading and controlling individual contracts, reference rates minimize the cost of financial sector risk reallocation. In principle, any market interest rate may act as a reference rate. Generally, the widely used reference rates represent the overall conditions in a well-defined market. Conceptually, various reference rates can be differentiated by the price (or risk) elements they contain, which can aid to assess their suitability for different applications.

Any market interest rate will in theory function as a reference rate. The commonly employed reference rates typically reflect the general conditions in a well-defined marketplace. In quantitative terms, different comparison values can be defined by the price (or risk) elements they include, which can aid in the determination of their aptness for different purposes.

2.2.6 Components and Uses of Reference Interest Rates

A typical approach to contra-composing market interest rates is to separate them into a risk-free rate and various risk premiums, including a credit risk premium, term premium, and liquidity risk premium. The weight of these risk premiums fluctuates across instruments; the term premium tends to escalate with the mellowness of the underlying instrument; the liquidity risk premium relies on the easiness at which the money market contrivance may be swapped, and the credit risk premium is contingent upon the borrower's antedated credit rating and clout in unwavering lending markets. In fact, it is not easy to putrefy the reference values into their apparatuses.

The observational works that have been done up until now, however, have certain stuff to say about the matter. Second, liquidity risk premia appear to be comparatively more important for shorter bonds and this claim was proposed by Nobili (2012) and Gefang et al. (2011). Second, the collateral risk premium will usually get higher the longer the loan is held. There is also

evidence that the standard bank credit risk premium during the financial crisis became more significant (Angelini et al., 2009; Gefang et al., 2011).

The deployment of a solo interest rate as a reference rate thus indicates a preference for risk elements in which one party to the deal moves to the other. It also circumscribes to what notch the reference rate is an effectual hedge or, more broadly, is an efficient gizmo for handling various configurations of financial risk.

Reference rates that are contingent upon leaky interbank markets include a risk-free rate and a credit risk premium reverberating the ostensible common credit risk of the mockup of banks supporting the reference rate (common bank risk). Some consumers may like the common bank risk dynamic to be integrated into the reference rate. Correspondingly, banks often covet a reference rate that cogitates the financing costs of the banking sector. Harnessing such rates in loan contracts proffers a surrogate shrubbery against financing cost risks by transmitting the common bank financing cost risk onto the borrower (leaving the bank only with its bank-specific financing cost risk, which is more controllable by the bank).

Many customers might adore the inclusion of the emblematic bank risk factor in the reference rate. Moreover, banks also pursue a reference rate expressive of the banking sector's funding costs. The discharge of such rates in loan contracts postulates a surrogate bulwark against funding cost risks by swinging the archetypal bank financing cost risk to the borrower (leaving the bank with its market-specific cost risk of borrowing, which is more governable by the creditor). For other purposes, clients might like a reference rate that is free from common bank risk. For example, handling cash flows from an interest rate swap may involve a reference rate of little to no credit risk.

However, some customers may elect reference rates with exclusive risk components (for example, a non-financial corporate bond issuer would cherry-pick a communal corporate risk premium rather than a conventional bank premium at the reference rate).

2.2.7 Properties of a Good Reference Rate

A variety of official sector businesses are looking at reference rate schemes to make them both perpetual and more effective. The dependability of the performance ratings – the gradation to which their execution and administration properly protect against abuse or misconduct – has been questioned recently. It is of the utmost importance that every reference rate is closely monitored to prevent breaches and miscalculations. Another critical criterion for customers is the robustness of the reference rate accepted as being possible even in tough market circumstances. If the reference rate is not resilient to challenging macroeconomic environments, banks and other market players can run the risk of unexpected cash flow anomalies at times when they are already facing problems.

There are several other properties which are fascinating from the user's point of view. Reference rates should be computed based on clear guidelines, including straightforward fallback procedures for times of market stress; have a sufficiently high publication frequency to enable continuous contract pricing; be readily available to encourage contract verification, and be representative of a well-defined market segment applicable (**Table 2.1**).

Reference prices focused on unencrypted interbank loans have not only been comprehended for many years as timely and precise preferences for bank financing costs but also as a fair representation for contraptions with very constrained credit risk, given the slant of a truncated and relentless exclusive bank risk premium. Only since the financial crisis of 2007 - 2009 have the representativeness and heftiness of those rates been questioned.

Table 2.1: Desirable Features of Good Reference Rate

General Feature	Definition	Important for
Reliability	Proper governance and administration to safeguard against manipulation or error	Market integrity and functioning
Robustness	Clear rules for reference rate production, including transparent and well-known fallbacks in periods of market stress	Availability and usability in times of market stress
Frequency	Rates calculated on a daily basis to facilitate market functioning	Pricing of new contracts, mark-to-market valuation
Ready availability	Published on dedicated sites	Verification of contracts
Representativeness	Rate drawn from a representative sample of the market in question	Correct pricing basis

Source: *Bank for International Settlements [BIS] (2013), p.7.*

2.2.8 Reference Interest Rates, Financial Stability, and Monetary Policy

a. General Economic Effects of the Use of Reference Interest Rates

The features of the reference rates used in the lending market have a direct effect on the risk-sharing between lenders and borrowers. The use of reference rates focused on unsecured interbank loans exposes the borrower to interest rate fluctuations arising from adjustments in the risk-free rate and the common banking risk variable. Around the same time, the lender acquires a (partial) buffer against adjustments in its own funding rates.

The physiognomies of the reference rates exploited on the lending market diametrically disturb the risk-sharing between lenders and borrowers. Using reference rates inaugurated on indiscreet interbank loans imperils the borrower to interest rate oscillations resulting from risk-free vicissitudes and the common risk vector for the banking industry. At around the same time, the lender procures an (inequitable) fortification at its funding rates against variations. This risk

transmission and the stipulations in which it transpires will disturb credit dissemination and distribution. For example, if banks can move the cost burden of lending onto borrowers, this will increase bank credit access. At around the same time, borrowing could dwindle if borrowers must pay rates that cogitate the leeway of losing bank funds. The scope and size of these impacts depend on several factors, including end-users' willingness to protect themselves against loan-rate volatility and banks' capacity to cope with the possibility of borrowing costs. Besides, the employment of reference rates compounds the value of these rates for economic finance milieus. Based on the essentials of the financial contracts, the reference rate amendments are then more or less straightforwardly directed to other zones of the financial system and the economy. Sudo (2012), Kawata et al. (2012), and Muto (2012) establish that where reference values are raucous and capricious, oscillations in financial and economic activity can levitate spectacularly.

In addition, reference rates may also instigate precariousness because the markets are subjected to assorted manners of hazards and devastations (thus, stress on bank financing markets that affect the financing costs of company lenders selling interbank-based bonds at an interest-rate conditional upon lax interbank dealings, regardless of the circumstances in corporate bond marketplaces).

b. Implications for Monetary Policy Transmission

In the wider financial system and economy, adjustment of the reference interest rates hardwires the borrowing conditions with those in the market where reference rates are set. In the dissemination of monetary policy, reference rates often form an important part of the interest rate structure.

The execution of monetary policy will rely on the relationship between the main reference rate(s) in the jurisdiction and the core policy rate and operational objective of the central bank.

This partnership could be best with overnight prices, which are then referred to by many central banks as operational targets.

For three factors, the use of reference rates could accentuate the snags of money policy transmission. First, reference rates will behave in unexpected ways during epochs of tautness on the economy. Reference rate credit and liquidity risks continued to escalate and become particularly surprising during recession periods that are concomitant with the escalation of risk echelons and market illiquidity. This means that policy adjustments should not alter the principal reference values immediately the same as they will do in regular times.

Second, if the reference rates are not implemented efficiently, the conditions for economic financing may shift in unforeseen and inadvertent ways. For example, a rise in the common bank risk portion of the reference rates might stem into a tautening of credit provisos far beyond interbank lending if these reference rates were exercised on a spacious tier to price, household mortgages, consumer loans, and corporate bonds.

Third, cross-border influences can disrupt the interaction between monetary policy and the primary reference rate(s) adopted in the domestic economy. One example, although a more transient one, is the variations in time zone. The setting of a widely applied reference rate, such as Libor, may indicate market conditions at a specific point in time in that market but does not signify market conditions in another market where trade takes place later in the day. For the central bank in this time zone, the reference rate for a given day could delay and restrict the effect of policy intervention.

The liaison between monetary policy and the primary reference rate(s) embraced in the home economy can, thirdly, be interposed by a cross-border stimulus. The time zone discrepancies are one example, but more spasmodic. The launch of a conjoint reference rate such as Libor which insinuate market settings at a given twinkling on that market, but this does not presage market rates on another market where swapping happens later that day. The reference rate for the

central bank in that time zone could procrastinate and hamper the sway of policy action on a certain day.

Cross-border effects are also caused by the use as reference rates of implicit foreign exchange (FX) interest rates in sundry markets of evolving economies. A central bank with a short-term interest rate on the domestic money market would only influence implicitly the reference rate indicated by the FX. In moments of extreme uncertainty in the FX market or where the reference rate for foreign exchange is used when calculating the FX-implied figure, the difficulties are theoretically compounded. Particularly in economies that have already implemented domestic (not FX-implied) reference rates, underdevelopment of their domestic capital markets (e.g. good liquidity even in a small set of tenures) may often present challenges to the application of monetary policy. This helps to understand current attempts in many developing markets to further expand domestic money markets.

c. Financial Stability Aspects

The use of reference rates will also have financial stability implications. Firstly, if the prices for the comparison are not properly regulated, the parties are at risk of avoiding trade of instruments associated with the reference rate generally employed. The ensuing stock market volatility may have far-reaching implications on financial stability. The second issue is the possible financial stability effect of the cost burden transfer in bank loans to borrowers. There are some strong motives for the banks to be adept to pass on the common bank allotment of their funding cost risk when making loans and thereby eliminate it from the (leveraged) banking sector. Transferring common bank funding risks to organizations that are better able to handle and maintain these risks would help to convalesce stability while accelerating the supply of floating rate-based financial instruments. However, an empiric problem surfaces as to how much such a switch effectively mushrooms the system-wide risk distribution. There is also a trade-off between

the aptitude of the banking system to terminate risk and its proficiency to conduct financial intermediation at the macro level.

Thirdly, there are financial stability problems where mispricing extends in one market to other areas of the financial system with reference rates. The vulnerability of the bank sector can be overlooked by interbank market respondents, for example. This undercutting of the typical bank risk will allow financial risks to build up, especially when the reference rate is used frequently. The possibility of the credit risk premium in major currencies being close to null until 2007, without doubt, stimulated a greater emphasis on unsecured wholesale financing of the wholesale industry. Owing to rising liquidity and/or credit risk premiums, high growth in the reference prices may cause exacerbated financial difficulties during the crisis.

Fourthly, there is a substantial rise in the fundamental danger of discrepancies between the actual risk levels and the reference values. The usage, based on an unsecured interbank market benchmark for discount swaps, will result in valuation problems if a bank uses a pricing mechanism that is oriented and thus covered entirely. In such cases, the gap between the demands of the contract and the reference cost is like an insufficient safeguard; thus, the inherent risk increases. Some investors invest in the management of costs in free credit risk or take a position on policy spreads on interest rate derivatives markets. For these factors, the risk base would be minimized by a reference rate using (near) credit-free rates.

Finally, these developments will undermine the central bank's capability to efficiently respond to financial fragility in addition to financial stability threats. For illustration, it can be more arduous to appraise the general crescendos and instigates of oscillations in the interbank market if reference rates are extraordinarily precarious because of idiosyncratic dynamics.

2.2.9 The Ghana Reference Rates Model

The Ghana Reference Rate (GRR) framework was designed by the BoG in 2018, in collaboration with the Ghana Association of Bankers, for the computation of bank lending

rates. The central aim of the implementation of the GRR model is to meet the BoG's pledge to push towards a more market-based model of the base rate setting and, in the long term, to increase the efficiency of credit lending and increase the transmission between the rate of the Central Bank and the lending rate of the banks.

In cooperation with the Ghana Bankers Association, the Ghana Reference Rate (GRR) system for calculating the bank lending rates was developed by the BoG in 2018. The key objective of introducing the GRR model would be to fulfill BoG's commitment to shift to a more market-based base rate model and to improve, in the long-term, stability of credit lending and movement from the central bank rate to Ghana's commercial banks ' loan rates. It additionally operates as a yardstick criterion for the bank sector since it is based on perceptible market variables such as the 91-day T-bill rate, Monetary Policy Rate, Interbank Lending Rate, along with the Cash-in-Vault and Cash Reserve Requirement (BoG, 2018).

Mathematically, the GRR model is defined:

$$GRR = 0.4 * MPR + 0.2 * IBR + 0.4 * \left[\frac{91 - Day\ T - Bill\ Rate}{1 - CRR - CIV}\right] \ldots\ldots\ldots (2.5)$$

where:

GRR = Ghana Reference Rate

MPR = Monetary Policy Rate

IBR = Inter-Bank Lending Rates

CRR = Cash Reserve Requirement

CIV = Cash-in-Vault

Using the above GRR model, commercial bank loan rates are now computed viz:

$$Lending\ Rate = GRR \pm Risk\ Premium \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2.6)$$

This means that banks must exploit the GRR to calculate the credit limits, adding or deducting the bank's personal risk premium. The GRR paradigm impacts banks in different ways. Firstly,

as the GRR operates, the banks no longer must divulge their base costs. Second, except for workers' loans, the GRR model shall be implemented for loans and advances. Thirdly, the characteristics of a market risk premium shall be disclosed to the BoG, and finally, the terms of credit shall be determined by adding or removing the consumer's risk premium (specific risk).

2.3 Theoretical Literature

2.3.1 Theories of Interest Rates

The rate of interest is summative of interest payable for every period, articulated as a share of the amount advanced, borrowed, or deposited (called the principal amount). It is known as the proportion of the amount of the loan that the lender owes as an interest to the borrower, usually calculated as an annual percentage. It alludes to the price at which a bank or other moneylender is paid to give out its money or the rate at which a bank charges its savers to retain their money in an account (Ardeshir & Saeed, 2004).

This section discusses the interest rate theories namely, *the Classical Theory of Interest, Neo-classical Theory of Interest or Loanable Funds Theory of Interest, Keynes Theory of Liquidity Preference, and Neo-Keynesian Theory of Interest Rates or Hicks-Hansen IS-LM Curve.*

a. The Classical Theory of Interest

The Classical interest rate hypotheses are associated with David Ricardo, Marshall, A.C. Pigou, Cassels, Walras. This is habitually acknowledged as the veritable theory of interest rates since it only considers actual variables such as competitiveness and thrift during the calculation of interest rates and gives monetary considerations little value. Across the limits of demand and expenditure (or capital) supply, the interest rate is ascertained, as per the classical principle. Investment price is interest when businesses borrow money to invest.

Investment thus relies on the interest rate. Low-interest rates promote increased investment and high-interest rates contribute to a decline in spending. So, investment is inversely correlated to interest rates. Households are saving their money to gain interests. High interest leads to high savings and low interest leads to low savings. Thus, savings are directly (or positively) linked to the interest rate.

Investment is, thus, contingent upon the rate of interest. Truncated interest rates invigorate elevated investment and soprano interest rates precipitate into inferior expenditure. This means that spending is inversely tied to interest rates. Households invest their capital for the sole purpose of income acquisition. Superior interest rates lead to prominent growth and dwindling rates result in stumpy savings. Therefore, investments divvy an up-front and a positive bond with interest rates.

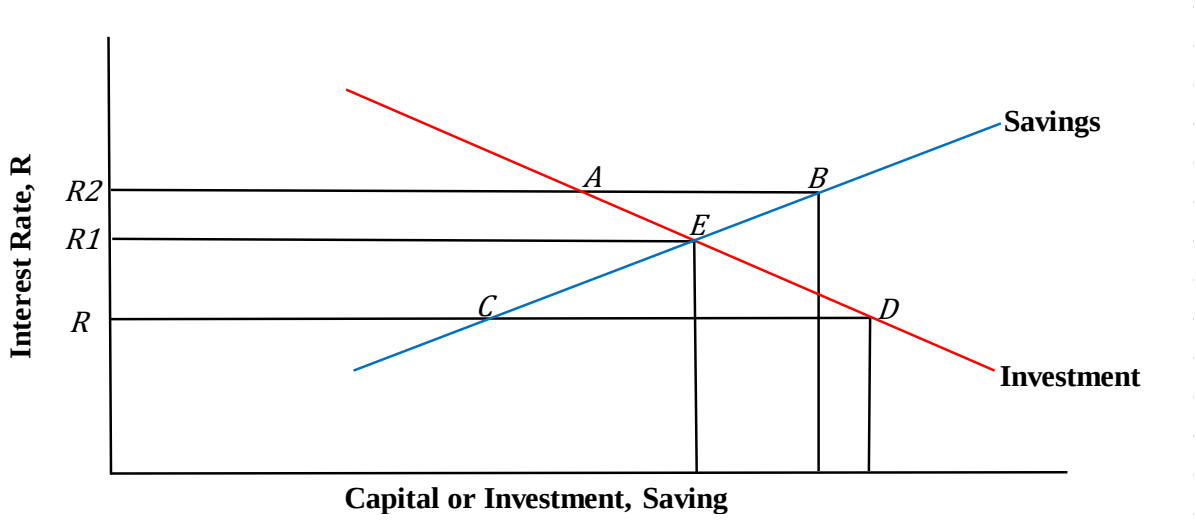
The investment demand for businesses is satisfied by saving households. Saving means supply, spending means demand for goods from customers. As such, at a time when savings and demand consumption overlap or break, the exchange rate is determined. The interest rate is estimated to balance the demand for goods by investing and borrowing (Woodford, 2003; Spahija, 2016).

It is seen in **Figure 2.1** below, in which the interest rate is shown on the vertical line and the investment and savings are shown on the horizontal line. $R1$ is the equilibrium of interest rate calculated at point E, where savings supply and demand for investment converge. This interest rate on the consumer market is considered the natural rate of the interest rate. This example can be seen under **Figure 2.1**, in which the abscissa (horizontal line) depicts the income and savings, and the ordinate (vertical axis) denotes the interest rate. $R1$ is the interest rate equilibrium measured at item E, as investment savings supply and investment demand converge. If the market interest rate is elevated above that of the natural interest rate (that is,

$R2 > R1 = 11$), savings will outstrip investment ($B > A$ in **Figure 2.1**). As a result, interest rates will decay until the equilibrium of interest rate ($R1$ at point E) is reached.

When the market interest rate is tinier than the natural interest rate (i.e., $R < R1$), the investment will be superior to the saving rate. Hence, interest rates will proliferate until the equilibrium of interest rate is attained.

Figure 2.1: The Classical Theory of Interest Determination



Source: Graph Developed by Author, 2020

In the classical theory, saving is a significant indicator of the interest rate that can be written down as $S(r)$ and investment is a decreasing indicator of the interest rate that can be written down as $I(r)$. Therefore, the rate of interest that determines the equilibrium is calculated as:

$$I\,(r) \;=\; S\,(r) \ldots\ldots\ldots\ldots\ldots\ldots \quad (2.7)$$

The saving curve increases as savings correspond closely to the interest rate. As interest rates, for example, augment from R to $R1$, savings from C to E are also sprouting (see **Figure 2.1**). This illuminates that as the interest rate attenuations augment investment and as the interest rate levitates, savings also plunge. The curve of investment demand declines as the investment rate rises, so as interest rates rise, investment demand falls, and vice versa. Here, it is worth

noting that saving insinuates to the procurement of capital in the classic principle of profit. In other words, saving in this philosophy refers not to capital, but instead to goods and services used for positive purposes. The classical theory is also sometimes referred to as the actual theory of importance.

b. Neo-classical Theory of Interest or Loanable Funds Theory of Interest

The theory of loanable funds is a rewording of the Classical Principle of Interest consistent with Wickells's and several other Swedish economists and UK economics such as D. H Roberson. It is an extension of the old classical importance theory (Wicksell, 1936).

The hypothesis of the interest rate of credit funds is based on the following assumptions:

i. It is based on a wage level associated with a stable job standard (i.e. maximum job).
ii. The reserves of the economy are fully utilized.
iii. To claim loanable funds, the maximum versatility of funds across the market is strongly optimized and distinctive.
iv. Market competitiveness is absolute, and so the rates of all lenders and creditors are price determiners, and there is only one real interest rate on the planet.
v. The theory follows the structure for a partial equilibrium in which all factors other than the rate of interest which could impact on the economy or creditable funding availability are assumed to be constant. That also means that the rate of interest is not compatible with other macro variables.
vi. The money supply (M) as defined by the monetary authorities shall be given.
vii. The money supply is independent of the interest rate.
viii. There is an exogenous advantage of the supply of resources.
ix. The theory is carried out in "flow" terminology, with due respect for the need for liquidity and the allocation by a unit of time of reliable funds.

x. Dishoarding is known to be an elastic interest. Saving depends on income rather than the interest rate.

As a part of this theory, the interest rate is contingent upon the order and supply of lending money. The Classical Interest Theory only considered borrowing on current savings receipts, while neoclassical economics did not only lend, but also saw bank credit, dishoard, and disinvestment. Classical companies need only saving for investments, while neo-classical economics' loanable fund theory of interest is another source of investment lenders' liquidity, not just savings but also stored money, bank loans, and dis-investment income. Since the principle of interest in the loanable funds has seen both savings from Classical Interest Theory and bank lending, dishoarding, and disinvestment, it is often referred to as either financial or nominal interest theory. It is also indeed such a legitimate currency attraction hypothesis (Mankiw, 2003).

The distribution of loanable funds (SL) in loanable funds theory of interest rates denoted as:

$$SL = S + H + \Delta M \dots\dots\dots\dots (2.8)$$

where S represents the overall savings of every household and business net of its dissipation; H represents the total dishoarding of capital or cash; ΔM is an ongoing supply of capital, regulated by monetary authorities.

The loanable fund (DL) demand is epitomized by:

$$DL = I + \Delta MD \dots\dots\dots\dots\dots\dots\dots (2.9)$$

where I is the aggregate investment expenditure: and ΔMD is incremental demand for hoarding money. The equilibrium rate of interest is determined by two equations namely:

$$DL = SL \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (2.10)$$

$$I + \Delta MD = S + H + \Delta M \dots\dots\dots\dots\dots (2.11)$$

The neo-classical loanable funds' theory of interest rate is seen in **Figure 2.2**, in which the interest rate is seen along the vertical axis and the Loanable Fund is shown along the horizontal

axis and/or as it is regulated by the monetary authorities. If the interest rate is zero, saving is $S0$ since, in this theory, saving is independent of the interest rate and depends on income. Therefore, saving (S) is a steep curve relative to a dishoarding (H) curve.

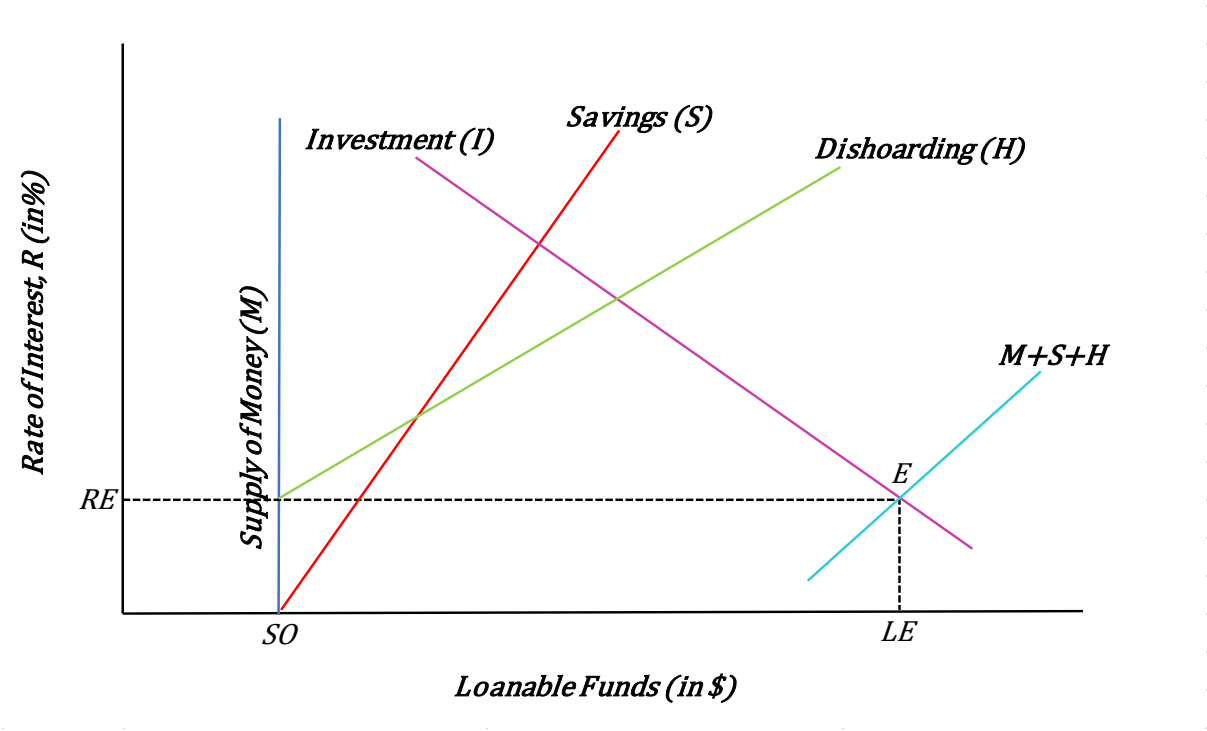
The dishoarding curve is flat because of interest. Higher interest rates result in more hoarded funds and reduced interest rates lead to fewer hoarded funds

$M + S + H$ is the supply of creditable funds. $M + S + H$ is the horizontal amount of money supply (M), savings (S), and dishoarding (H). The investment curve (I) is moving downwards as the investment is a declining function of the interest rate. When interest rate rises, demand for investment declines and vice versa.

The interest rate (its equilibrium value), as per to the neo-classical theory of loanable funds, is gauged at point E, where the supply of loanable funds $(M + S + H)$ crisscrosses investment demand as seen in **Figure 2.2**. The interest rate at point E is RE percent and it connects to the quantity of the loanable funds (LE). The Loanable Funds Theory is a flow theory as it includes connecting the interest rate to investment and the hoarding of funds on the demand side with savings, dishoarding, and bank capital on the supply side. They are all flow factors. As such, the principle implies that it is the 'flow equilibrium' (or the equilibrium between the two flows) of the loanable funds that decides the interest rate. The Loanable Funds Theory is a flow theory as it encapsulates relating the interest rate to the so-called flow factors of expenditure, the demand-side hoarding of funds, supply-side deposits, dishoarding, and banking money. As such, the theory means that the interest rate is determined by the 'flow equilibrium' (or the balance of the two flows) of the loanable funds.

c. Keynes Theory of Liquidity Preference

Figure 2.2: Neo-classical Theory of Interest or Loanable Funds Theory of Interest



Source: Graph Developed by Author, 2020

It is critically quintessential to note the theorem of classical interest and the doctrine of loanable interest before we cram Keynes' liquidity preference theory. The classical interest-rate hypothesis is a legitimate theory gauged by the cross-section between household deposits and investments. Keynes averred that the rate of interest is purely a monetary singularity, a liquidity partition fee, and the interest rate is governed by the T-junction between the demand and the supply of money on the monetary market. The interest rate is determined by a roundabout of supply and investment demand for deposits, according to the Loanable Funds dogma of interest.

insight into how interest rates are, in the short-term, measured in his classic piece, *The General Theory of Employment, Income and Capital* (1936). This principle is distinguished as the

liquidity choice principle because the interest rate swaps to balance the supply of, and demand for the economic-money commodity with the most capricious commodity.

The concept of liquidity preferences advocates that the interest cost is one element pivotal in establishing how much money people opt to hold. The lucidity is that the rate of interest is the expense of retaining currency; it's something you care about by seizing money or currency, which does not possess interest rates. As interest rates levitate, people begin to avow lesser money/ liquid/ cash/capital (Keynes, 1936; Mankiw, 2003). The theory of interest of loan funds is distinct from the Classical Interest theory since, in addition to investments in loanable funds, it includes bank lending, dishoarding, and decommissioning.

The rate of interest, in concord with Keynes, is ascertained at the crux where the demand for money (M^d) approximates the supply of money (M^s). This can be transcribed as:

$$M^d = M^s \dots\dots\dots\dots\dots\dots (2.12)$$

It was clinched by Keynes that money was obligatory for three reasons: *a purchase motive, a precautionary motive* and *a speculative motive.* Since this triple taxonomy of motives has become the orthodox stock demand for capital, it is summarized in the following equation:

$$M^d = L_1(Y) + L_2(r) \dots\dots\dots\dots (2.13)$$

where, M^d is money demand. The foremost fragment of money's demand is $L_1(Y)$ which mirrors the procurements and the precautionary demand, and both (that is, transaction and precautionary motives) augment the income function such that the original part of money's demand is $L_1(Y)$. The subsequent aspect of money's demand is $L_2(r)$ which exposes the speculative exigency for income, which is a dwindling function of the rate of interest, to the echelon that as the interest rate (r) proliferates, money's speculative demand shrinks. Therefore, money's speculative demand hinges on the interest rate, such that the succeeding element of money's demand is $L_2(r)$. Keynes, following other economists, also presupposed that the money supply had been bestowed exogenously by the monetary authority, so that:

$$M^s = m \ldots\ldots\ldots\ldots\ldots\ldots\ldots (2.14)$$

where is M^s money's supply and m is bequeathed by the nation's monetary authority.

An equilibrium echelon is reached in the money market when: $M^d = M^s$, i.e.,

$$L_1(Y) + L_2(r) = M^s \ldots\ldots\ldots\ldots (2.15)$$

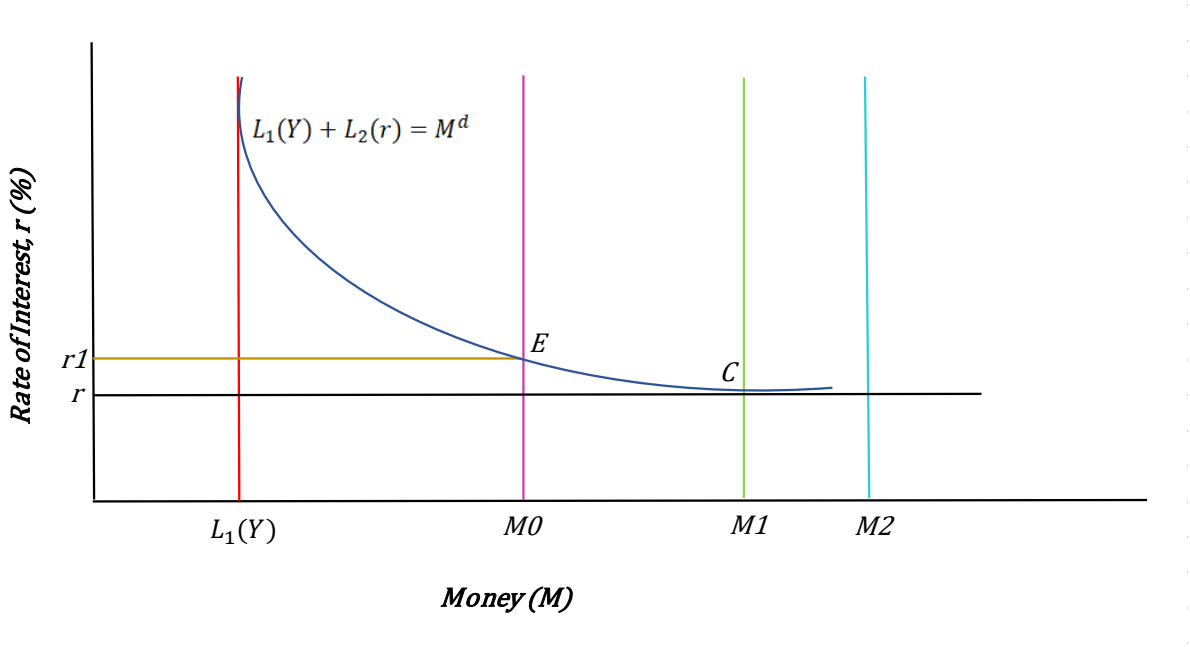
In synchronization with Keynes' liquidity interest preference principle, the interest rate computation is grasped in **Figure 2.3** below, which displays interest rates on the ordinate (vertical axis) and money's demand and supply on the abscissa (horizontal axis). Money's demand is delineated by the plunging sloping curve labelled: $L_1(Y) + L_2(r) = M^d$.

The foremost component of money's demand: $(L_1(Y))$, signifying Keynes' transaction and precautionary money demands is presupposed to be autonomous of the rate of interest, r. Thus, it is exposed by the vertical line $(L_1(Y))$. The succeeding component of money's demand $(L_2(r))$, embodying money's speculative demand is not shown separately in the figure because the, M^d, curve itself becomes the, $(L_2(r))$, curve when it is read with, $(L_1(Y))$, as the origin in place of 0, which aggregates to subtracting, $(L_1(Y))$, horizontally from the, M^d curve, $M0, M1, M2$ are supplies of money, which are given exogenously by the monetary authority.

A money market equilibrium echelon is realized at point E, where money's demand (M^d) approximates, money supply, to the extent that equals M^s at point E. The interest rate, r1 is decided at point E, were, $L_1(Y) + L_2(r)$ corresponds to $M0$.

There will be money market disequilibrium at any other rate of interest except $r1$, and the market dynamics will coerce the rate of interest towards $r1$. For a case in point, at an inferior rate, there will be superfluous money demand. Thus, the rate of interest will escalate towards $r1$. When the rate of interest is elevated, money demand will be depressed demand, and, consequently, the interest rate will plummet.

Figure 2.3: Liquidity Preference Theory



Source: Author's computation, 2020

d. Neo-Keynesian Theory of Interest Rates or Hicks-Hansen IS-LM Curve

The rate of interest has been computed by classical economics to elucidate savings and consumer economic activity. Neoclassical economics, by integrating both real and monetary industries, measured the interest rate (r) using demand and the distribution of creditworthy funds. Keynes entirely ignored the actual factors of real savings and spending (so much emphasized in the measurement of interest rates by both traditional and neo-classical economists).

Keynes attempted to guesstimate interest rate as $L_1(Y) + L_2(r) = M^s$ by the currency supply and demand market, plus, r, another unknown revenue Y, by its monetary argument, M^d functions. However, since the value of Y is known, it is impossible to be used to ascertain r by the balance equation {(i.e., $L_1(Y) + L_2(r) = M^s$}.

Keynes' solution approach included the circularity of Keynes' statement that interest rate, r determines investment, and investment determines income by a multiplier process. Thus, r

influences income, Y, and is influenced by Y. That is the case of a joint determination of the interest rate. Hicks (1937) and later Hansen (1953) removed this theoretical flaw from Keynes' model via the IS-LM curve. The Hicks-Hansen IS-LM model is also known as the neo-Keynesian model or the Modern Theory of Interest Rate.

Today, it is widely agreed that both the real or the goods market and the money market factors determine the interest rate and the actual profits. The widely recognized method for the joint determination of interest rate and real income is the Hicks-Hansen IS-LM method. The key feature of the model is the joint determination of interest rates and actual profits. This Hicks-Hansen IS-LM hypothesis (after the Classical Theory of Interest; the Theory of Interest and Keynes's Preference for Liquidity) was only a conclusive interest theory as certain theory did not associate the interest rate with earnings. Their theory was only one indeterminate theory of interest. This theory has considered four main elements: *savings and classical interest investment theory, liquidity or capital* and *asset demand preference and asset allocation* from the Keynes theory of liquidity preference, with the assistance of IS and LM curves, to measure the price and real income jointly in commodities and currency markets.

The IS curve was developed by a combination of commodity savings and investment. Thus, the IS curve shows the income that holds the product market steady at any given interest rate. So, the IS curve reflects a commercial balance between goods and services. The IS curve demonstrates the variance in the interest rate and the volume of sales associated with the business balance in goods and services. The LM curve has been created by a mixture of liquidity and stock-market capital. Therefore, the LM curve tells us the interest rate that equilibrates the money supply at the point of income. Consequently, the LM curve represents the amount of real money movements in the stock market. The LM curve indicates the shifts in the interest rate and the rate of income that are associated with the market equilibrium for the real money balances. Note that the IS curve does not describe either income, Y, or interest

rate, r. Instead, the IS curve is the connection between Y and r that occurs on the market for merchandises and services or, equivalently, on the market for loanable funds.

The LM curve thus articulates that the interest rate which balances the supply of money at the income point. Concomitantly, the LM curve mirrors the current cash flows of the stock exchange. The LM curve parades the interest rate changes and the rate of income correlated with the business balance of actual cash holdings. Notice that either income, Y, or interest rate, r, are not defined in the IS curve. The IS curve is the relation between Y and r on the market for goods and services, or similarly, on the loanable capital market.

We crave an elite liaison between these two variables to resolve the equanimity of the economy, and this is the LM curve. The IS and LM curves together decide, when price echelons are set, the short-haul interest rate, and national revenues. Now let's look at the building-up of these two curves, IS and LM. The IS curve demarcations are shown in **Figure 2.4 (A)**, which exhibits the interest rate along the vertical axis, and the horizontal axis indicates assets and deposits.

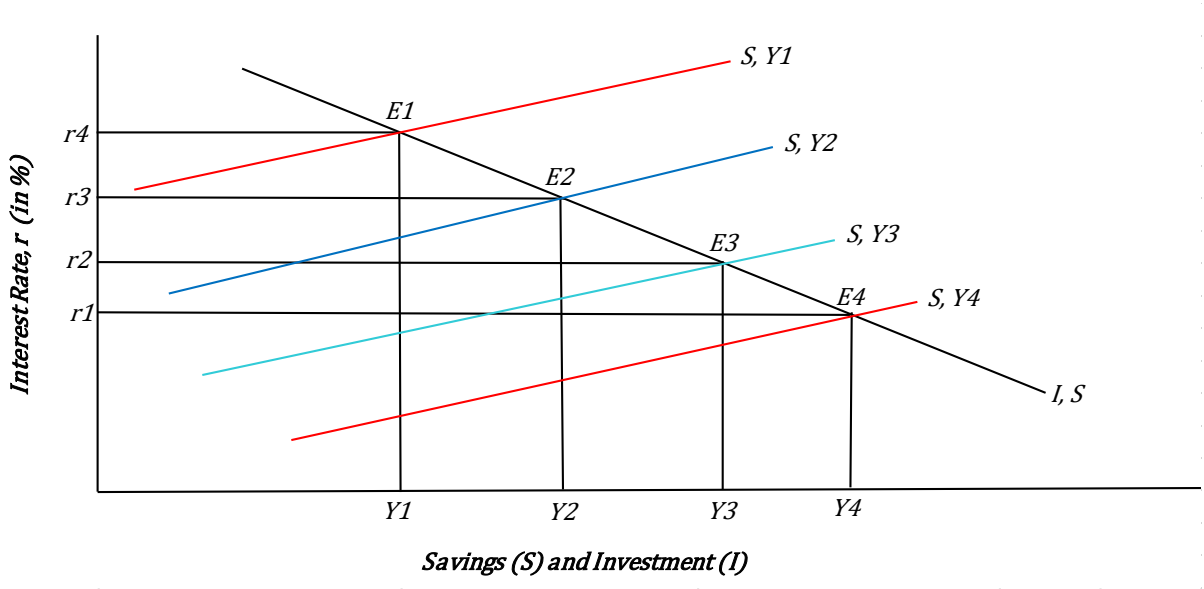
The downhill curvature is an investment curve, and the upward arch is a saving curve, the S curve. Both savings and investment are properties of the interest rate. But here, in **Figure 2.4 (A)**, besides saving and investment curve, one more imperative variable is added, namely income (Y). Yet the third variable (Y in the present case) cannot have its independent axis in a two-dimensional model.

It is then seen as a parameter of the S and I curve, such as $S;\ Y1$ and I. After announcing the income curve (Y), both S and I are also a function of income, Y. S lines are drawn upwards, as savings are anticipated to improve the function of the interest rate, r. Yet because savings are often influenced by Y, there is a whole family of such rising curves, one for each value of Y. For instance, when $Y1$ is rising to $Y2, Y3$, and $Y4$, savings are also levitating along with Y from $S, Y1$ to $S, Y2;\ S, Y3$; and $S, Y4$. If the income level is $Y1$, the equilibrium between savings and investment is at point $E2$ and so on income $Y4$. As shown in **Figure 2.4 (B)** below, it is very

clear that as income increases from $Y1$ to $Y2$ to $Y3$ and $Y4$, the interest rate tends to plummet from $r4$ to $r3$, to $r2$ and $r1$.

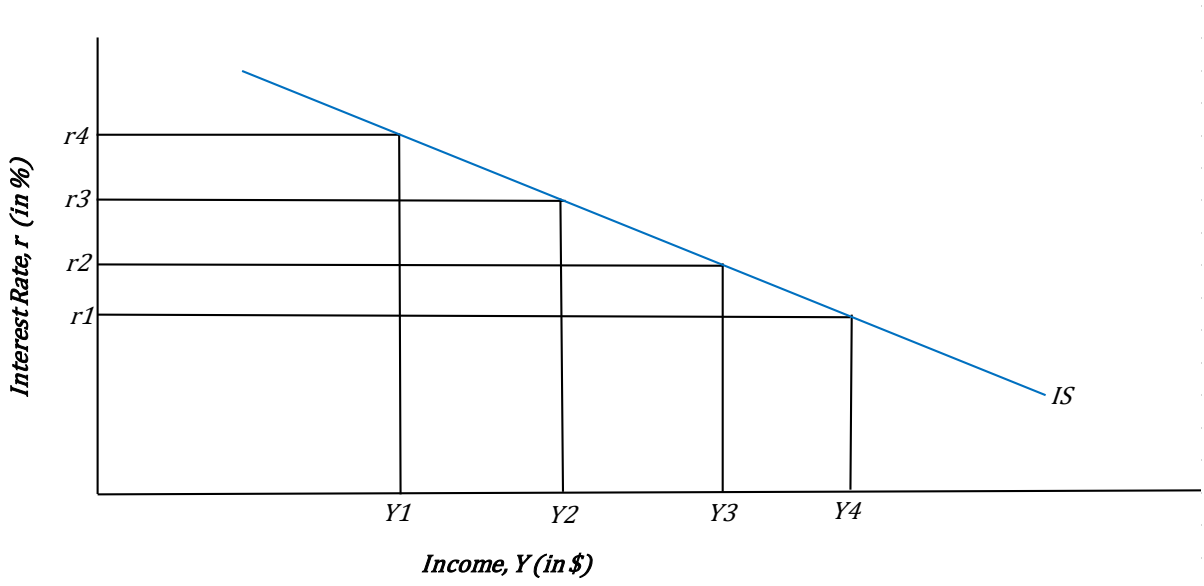
When we map the equilibrium affiliation between Y and r as seen in **Figure 2.4 (B)**, we get a sinking sloping curve called the IS curve. This curve is the spot of alternate variations of Y and r, where the commodity market will be in equilibrium. At all other points, except the points on the IS curve indicate disequilibrium in the commodity market. It can also be discovered that, as Y augments, the equilibrium between investment and savings is established at truncated-interest rates **(see Figure 2.4 (A)).** Thus, as income amplifies, the investment-saving (IS) curve tumbles downhill with the deteriorating interest rate as shown in **Figure 2.4 (B)**. Thus, the IS curve exposes the permutation of the interest rate and the echelon of income that is lucid with the equilibrium in the market for merchandises and services.

Figure 2.4 (A): Commodity Market: Saving and Investment



Source: Graph developed by Author, 2020

Figure 2.4 (B): Commodity Market: IS Curve



Source: Developed by Author, 2020

2.4 Empirical Literature

Economic analysis that measures interest rate changes uses either a cost-for-money approach or a monetary policy choice (Becker et al, 2012; Espinosa-Vega & Rebucci, 2004; Mojon, 2000, Holton & d'Acri, 2015; Blot & Labondance, 2013). The discrepancy between the two schemes in the reference rate varies. The solution to the fund's costs follows the term rate structure which assigns to every lending rate a market rate with a comparable maturity.

On the other side, the monetary policy approach employs the main monetary policy rate (sometimes approximated by the short-term money market rate) as the reference point for the pass-through of all lending rates. In this report, we follow the monetary policy viewpoint as we reflect on how both short-and long-term loan rates respond to monetary policy level changes.

Rousseas (1985) suggested an unpretentious mathematical replica for interest rate transfers constructed on the impression of marginal cost. The rate of bank loans will swap individually with the vogue of monetary policy (the cost of financing), supposing optimal dynamic markets, and we should envisage a plump transformation. This theory, however, is still exploited since

the systems of banks and capital markets are monopoly or oligopoly. There is also a probability of an unsuccessful pass-through.

Many documents evaluate interest rate changes using the simulation method only as an informative vector (Jobst & Kwapil 2008; Holmes et al., 2015; Bernhofer & van Treeck 2013). On the other hand, some other papers agree that the price and interest rate transition focus not only on monetary policy but on a copious exhibit of market conditions. More control variables are available (Sander & Kleimeier, 2006; Gambacorta et al., 2015; Eller & Reininger, 2016).

Hypothetically, bank contest is the most universally used interest-rate flow through. Van Leuvensteijn et al. (2013), and Mojon (2000) intimate, for illustration, that the pass-through is more precipitate and peremptory and fuller at a grander level of banking antagonism by exploiting various banking rivalry approaches. Also, the other market factors such as the prevalence of asymmetric details, nonelastic demand for loans, and the cost of a menu that disturbs the cross-over, and exchange rates, are covered by Cottarelli and Kourelis (1994), Mester and Saunders (1995), Bondt (2005), and Mujon (2000).

Other pass-through co-determinants encompass bank physiognomies such as bank assets, leverage ratio, capital buffer, and liquidity ratio, among others (Holton & d'Acri, 2015; Horváth & Podpiera, 2012; Kapuściński & Stanislawska, 2018; Havránek et al., 2016).

The position of bank credit risk because of the 2007/08 global financial crisis was underlined by previous interest rates pass-through reports. Paries et al. (2014) investigate, for example, how household and corporate price impact contradictions on the supply and demand side. The borrower's credit risk is increasing in terms of corporate lending, especially in Spain, Italy, and Ireland. Similarly, with the emphasis on eurozone banks, Holton and d'Acri (2015) have identified a big influence of credit risk on the rate transition. Few studies also deal with the impact of monetary policy on the mechanism of change.

Commercial banks use public bonds as an alternative investment loan commodity. The shift in the bond market would also impact the transition of monetary policy prices to the prices of bank lending. Eller and Reininger (2016) have found, in their emphasis on EU countries, that long-term bond yields in most of the countries of the euro region, but not in Eastern Europe and Central Europe have a significant effect on long-term lending rates. Besides, Zoli (2013) explores the role of spreads of sovereign bonds in the Italian transaction and notices a major impact on company loan prices. Paries et al. (2014) agree with Zoli's conclusion that sovereign spread in Italy, Portugal, and Spain and has a major impact on customer and market standards. Generally, there are variations on the empirical proof on the pass-through of interest rates. Several researchers are seeing a complete, some partial pass-through in diverse country contexts (Haughton & Iglesias, 2012; Wang & Lee, 2009;). Evidence also differs for European Union (EU) countries and their various kinds of loans (van Leuvensteijn et al., 2013; Holton & d'Acri, 2015; Hofmann, 2006; Égert et al., 2007; Sorensen &Werner, 2006; Belke et al., 2013). For instance, while Rocha (2012) sees a clear pass-through from monetary market levels to general lending levels in Portugal, Hofmann (2006) reports that such a pass-through is weak in Germany.

Sorensen and Werner (2006) advocate a higher interest rate on mortgage deals and a lower rate on personal credit for the various modes of credit in the euro area. On the other hand, Belke et al. (2013) and Mojon (2000) found that a stronger flow through mortgage rates could lead to the short-term loan expense of the euro area countries. The commencement of the global financial crisis in 2007/08 and concomitant stratagems and market movements is normal in the world.

Gambacorta et al. (2015) have used a model of co-integration to analyze the long-term relationship between money market values and bank lending rates in Spain, Italy, the United States, and the United Kingdom. They note a weakening pass-through in the post-Global

Financial Crisis (GFC) period that may be associated with greater volatility and risk perception. Hristov et al. (2014) analyze interest rate pass-through in euro-zone countries using the panel VAR and DSGE model. They observe that the poorer pass-through in the sense of the GFC is caused by the heightened pressure of the financial industry.

In order to examine long-term relationships between monetary market valuation and bank loan prices, Gambacorta et al. (2015) used a co-integration model in the United States, Spain, United Kingdom, and Italy. They note a decrease that can be correlated with increased volatility and risk perception in the post-Global Financial Crisis (GFC) context. Hristov et al. (2014) examine, using the VAR and DSGE model row, the interest rate change in Eurozone countries. They remember that the weaker GFC pass-through is triggered by the increased demand from the financial sector.

Consequently, several countries have deployed FX as an unorthodox monetary policy. FX-strategies in the SMEs, such as in the Czech Republic, where the use of conventional operating instruments, such as a repo rate is no longer feasible, are found by Lízal and Schwarz (2013). It shows that the exchange-rate adjustment to inflation can be much stronger in the same direction as the import market mechanism and the current interest-rate mechanism. For the Czech Republic, though, it is a fair decision to introduce FX initiatives in terms of the "unrestricted" CNB 's potential to acquire foreign assets. FX interference in the Czech Republic is discussed in Franta et al. (2014) as the quantitative easing process.

Switzerland has also taken FX steps to enforce the monetary policy with a zero-lower bound (ZLB), albeit less efficient. For example, Amador et al. (2017) indicate that FX transfers are expensive for the Swiss Central Bank, owing to their adverse effects on the balance sheet and the economy. The ZLB's complexities of monetary policy execution concerning FX initiatives provide the common condition of Japan from the 1990s. The use of FX techniques is successful in Japan, as in Switzerland, although to a small degree (Iwata & Wu, 2012).

Although minimal empirical work is also available on the effect of FX policies on the change of low-interest rates to retail loans. In the Czech Republic, Horváth and Podpiera (2012), use the pooled average community estimate method to identify a simple, almost absolute move for mortgage and company loan rates. They assert that the transmission of credit rates is influenced by factors such as bank asset size, resources, deposit volume, and credit risks. On the other hand, the interest rate upswing in the Czech Republic in 2004-2013 was scrutinized by Havránek et al. (2016). They had a squatter rate of industrial loan interest and a higher rate of mortgage lending at the beginning of the GFC.

Andries and Billon (2016) have also identified the literature's interest rate advancement and the obstacles it faces in a useful manner. To calculate future interest rate passes in asymmetric asymmetry, Wang and Lee (2009), Haughton and Iglesias (2012) use threshold and self-regressive models and model (TAR). The asymmetric amendments are a form of non-linearity that is subject to the rate transfer and will need to be accounted for by policymakers.

Equally interesting and useful are all forms of non-linearity that rely on the state of the economy, such as the demand or loan period, levying banks, bank competitiveness (Aristei & Gallo, 2014; Haughton & Iglesias, 2012; Wang & Lee, 2009).

Precise research on interest rate enhancements in Africa has also been executed. For illustration, in Nigeria, besides other contraptions such as bank loan rate, bank deposit rate, and maximum lending rate, Tsenkwo and Longdu'ut (2003) endeavored to augment the government's monetary policy rates. The outcome denotes that almost all variables, except the savings rate of the bank, display a good sign of long-term convergence. The study showed that the pace of monetary policy and bank lending, bank loan rates, and the bank deposit pace were causally unidirectoral. Moreover, the rate of monetary policy and the rate of bank deposits were found to be bidirectionally causal. In some Ghanaian research, the causes of Ghana's lending rate and its collaboration with other corporate, industry, and macroeconomic variables were

scrutinized. For example, the Bank of Ghana policy rate on commercial bank lending using the Barclay Bank of Ghana as a case study was examined by Cobbinah (2011). The results indicate a very good relationship between the Bank of Ghana Base Rate and the loan rate. instance, while Rocha (2012) sees a clear pass-through from monetary market levels to general lending levels in Portugal, Hofmann (2006) reports that such a pass-through is weak in Germany.

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The determinants of the spread of interest rates in the banking sector in Ghana have been scrutinized by Quarmyne et al. (2014). The paper converged on the distribution of some banking sector and macroeconomic determinants, based on the availability of data. The study elucidated that the variables heart-rending interest-rate spread estimates in Ghana include GDP, premium, exchange-rate, liquidity, loan deficit, T-bill rate, overhead costs, and profit margin.

Amidu (2006) delved into how monetary policy upsets lending in Ghana. For the period 1998 to 2004, the study exploited the Bank of Ghana database for panel cross-section data. The study uncovers that Ghanaian banks' lending exercises are dazzlingly disturbed by their economic operations and money supply changes. The outcomes of this study further reinforce preceding explorations into a negative but statistically marginal effect in the central bank's prime rate and inflation rate on bank loans. The report exhibits that banks 'size and liquidity have a whopping upshot on banks' enthusiasm to lend credit where feasible.

Under Uzeru (2012), factors that impel the loan rate in Ghana were pinpointed. Secondary data on inflation, GDP, and various banking variables between 2005 and 2010 were procured from the Price Water House Coopers and Ghana Statistical Service. The study exposes that the loan rate in Ghana has levitated with interest rates for bank-specific motivations. While the analysis considered economic conditions, the lending rate plummeted by rising the T-bill rate.

Again, macroeconomic pointers have demonstrated major positive impacts on lending rates in Ghana for inflation and the gross domestic product. All the variables that were found were favorable with respect to the credit rates, except for GDP and T-Bill prices, which were linked to the loan rate. It is important to echo in the review of empirical literature that prior analyses of interest rate dynamics have used the cost of money method or monetary policy option (Bondt, 2005; Hofman, 2006; Havránek et al., 2016; Bernhofer & van Treeck, 2013;) (Mojon 2000; Becker et al., 2012; Blot & Libondance, 2013; Espinosa-Vega & Rebucci, 2004; Holton & d'Acri, 2015). The difference between the two schemes is variable on a reference scale. The

fund costs follow the term interest rate arrangement, which applies the market rate of each loan amount at comparable maturity.

In the other hand, the methodology of monetary policy is grounded on the prime monetary policy rate (sometimes associated with the short-haul money market rate). This thesis, however, deploys a view of monetary policy to ascertain the synchronicity between the GRR and lending rates in Ghana.

Many interest rates studies, including mathematical models (Rousseas, 1985) as well as simulations have also been carried out (Jobst & Kwapil 2008; Holmes et al., 2015; Bernhofer & van Treeck 2013). A broad variety of studies were not only done for monetary policy but also with more limited control variables (Sander & Kleimeier, 2006; Eller & Reininger, 2016; Gambacorta et al., 2015).

The prominence of the responsibility of the credit risk related to the 2007-2008 global financial crisis (e.g., Paries et al., 2014; Holton & d'Acri, 2015; Eller & Reininger (2016); Zoli, 2013; Paries et al., 2014; Hofmann, 2006) is illustrated in Europe (e.g., Portugal, Spain, and Italy). Additional experiments were performed in Italy, Spain, UK, and the USA for the study of long-haul liaisons between money market prices and bank lending rates by co-integration (e.g., Gambacorta et al., 2015).

Furthermore, Ghana studies scanned real interest rates and their collision on commercial bank credit rates (Wang & Lee 2009; Hofmann, 2006; Hofmann and Werner 2006; Égert and others 2007; van Leuvensteijn et al., 2013; Belke et al., 2012, 2013; Holton & d'Acri 2015; Tsenkwo and al. 2013). Moreover, several Ghanaian inquiries have centered mainly on the MPR effect on loans (Cobbinah, 2011), bank interest rate spread determinants in Ghana (Churchill, Kwaning, & Ababio, 2014), and macroeconomic determinants of the rate spread across Ghana (Sheriff et al., 2014).

The supreme aspiration of this thesis is, thus, the question of whether the GRR is allied to the lending rates of banks because, at the time of this study, the synchronicity was not researched between the GRR and the lending rates of the commercial banks in Ghana.

2.5 Summary

The chapter focused on the theoretical and empirical reviews of Ghana Reference Rate and its linkage with the lending rates by Commercial Banks in Ghana. The theoretical review focused on the classical and the neo-classical theories of interest rates. The theories also explained the Keynesian theory of money demand and money supply in the economy used to established equilibrium interest and lending rates. Whiles most of the empirical studies on developed countries showed no linkage between reference rate and the lending rates in these countries, the case for emerging economies showed a linkage between the reference rates and the lending rates of the commercial banks operating in these countries. This therefore establishes the gap that needs to be investigated using data for the study analysis.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter discusses the data gathering and analysis methods used. It begins by discussing the research design. Also, data collection methods are discussed. Lastly, the statistical/econometric methods employed in analyzing the data are discussed.

3.2 Research Design

This study uses the non-experimental, quantitative-correlational, ex-post-facto design within a time series framework. The non-experimental approach is used because of the impossibility of variables manipulation by the researcher and the random distribution of variables/subjects. A quantitative-correlational approach is employed because it requires mathematical methods and statistical/econometric techniques to quantify and scrutinize the collaboration amongst remote variables (Yilmazkuday, 2011). This is harmonious with the purpose of this analysis to examine whether there is a correspondence between the Ghana reference rate and the commercial bank lending rate in Ghana. Also, the research design is ex-post-facto (after-fact) implying that the relation between the GRR and the lending rate is being investigated in this analysis after-the-fact, that is, after the implementation of the GRR model in April 2018, and commercial bank lending rates have already been decided by the banks, leaving the researcher with no influence whatsoever over these variables. Moreover, the research work uses time-series data. This indicates that the chosen sample was analyzed over many years and allows us to detect any causal blueprints and parallels in the set of data using time-series data (Jalil & Ma, 2008). It varies from cross-sectional analysis, where for a single year, multiple variables are analyzed.

3.3 Data Sources and Collection

Data are characteristics or knowledge obtained through observation (Schutt, 2006). Data when contextually viewed through the lenses of O'Sullivan and Rassel (1999) and Schutt (2006) alludes to a compendium of quantitative and qualitative variable values for one or more units or objects, whereas a datum (the singular of data) is a solo value of a distinct variable. This research applied secondary information that is mixed in nature (quantitative and qualitative). Secondary data applies to information gathered on established government or institutional websites or databases by anyone other than the user and usually readily available. This varies from the primary data that the investigator typically obtains during the study period by questionnaire administrations or interviews (O'Sullivan & Rassel, 1999; Schutt, 2006). Quantitative data contains data that comes in number and figure forms and is usually calibrated, collected, documented, evaluated, visualized using graphs, charts, or other analytical methods. In conjunction, qualitative data corresponds to information that often comes in the configurations of texts, photographs, or other non-numeric formats (O'Sullivan & Rassel, 1999; Schutt, 2006).

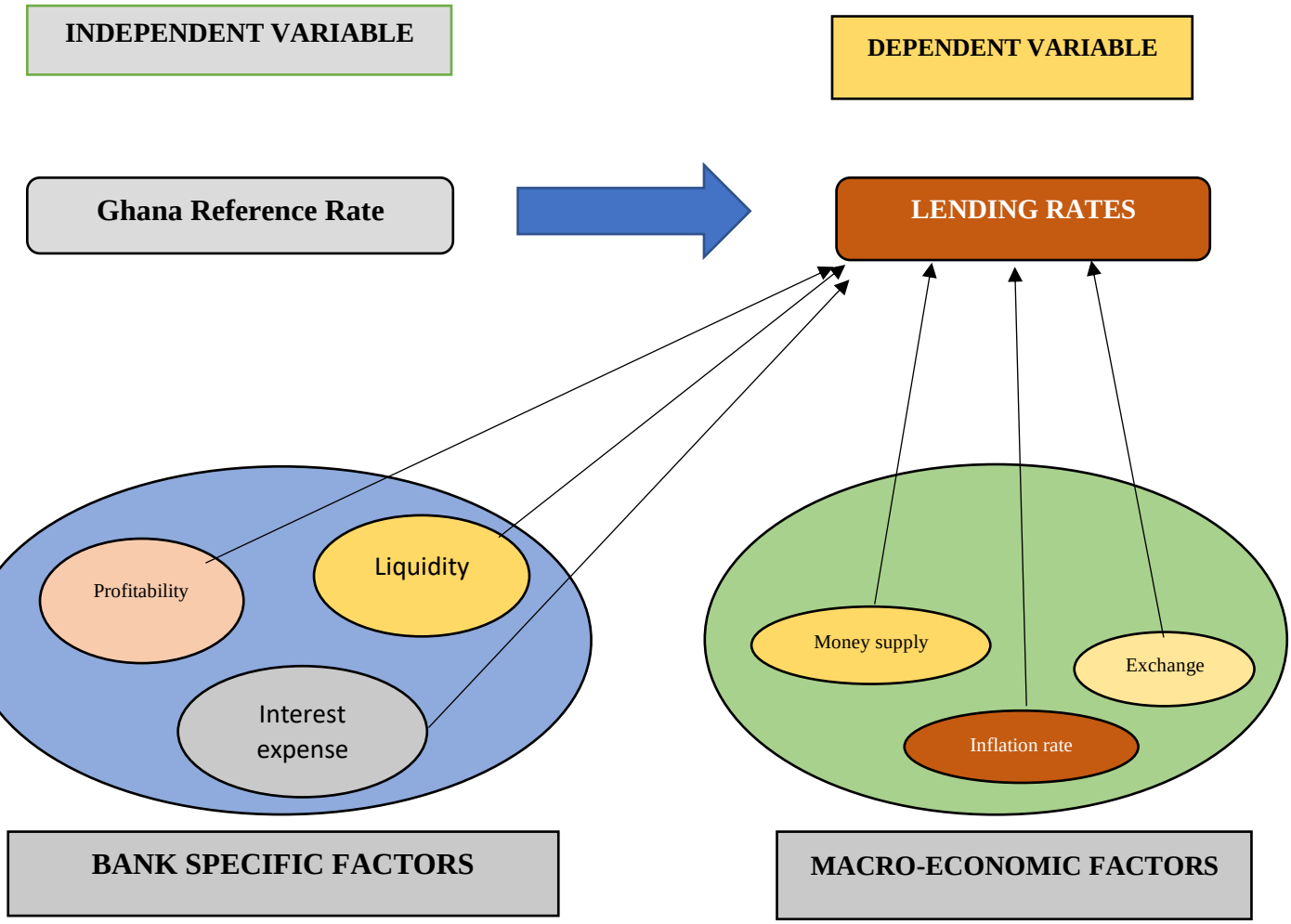
All the secondary, qualitative data applied in this research were gathered from journal articles, books, theses, and other online publications, and mostly came in text formats. Secondary, quantitative data lending rates, the GRR, and the control variables were all collected from the website of Ghana's Central Bank (BoG). The data epitomize monthly time series traversing the period April 2018 to January 2020, incarcerating only the post-GRR introduction period for Ghana.

3.4 Conceptual Framework

Camp (2001) when employing his research methodology lens defined conceptual framework as a contrivance that the researcher alleges can help illuminate the plodding development of

the phenomena being reconnoitered. It is related to principles, empiric research, and essential theories used to encourage and systemize the expertise of the researcher (Peshkin, 1993). It is the researcher's interpretation of how the study problem should be solved. The conceptual configuration /framework postulates an all-inclusive resolution to the issue under study (Liehr & Smith, 1999). From a mathematical angle, the empirical structure explains the relationship between the core principles of the analysis. The study conceptual framework postulates that loan interest rates of commercial banks in Ghana are influenced by the GRR, bank-specific variables of profitability, liquidity and interest expenses, and macroeconomic factors of inflation rates, money supply, and exchange rates.

Figure 3.1: Conceptual Framework of the Study



Source: Author's Development, 2020

The conceptual framework above shows the independent variables and the dependent variables. The chart shows that the dependent variable as the lending rates which is determined by several factors which include the bank specific factors and the macro-economic factors. The bank specific factors for the study are profitability, liquidity, and interest expense. The macro-economic factors used for the study are money supply, exchange rate and the inflation rate. The Ghana reference rate impacts on the lending rates of the commercial banks though the control variables which are the bank specific factors and the macroeconomic factors. There is therefore pass-through factor between the Ghana reference rate and the lending rates of the universal banks in Ghana.

3.5 Data Analysis Procedure

The data analysis procedure are described below.

3.5.1 Descriptive Statistics

Descriptive Statistics mainly the Mean, Median, Maximum and Minimum values, Standard Deviation, Skewness, Kurtosis, Jarque-Bera statistic (and its probability value), the Sum of data observations, the Sum Squared Deviations, and the total number of Observations are exploited to illustrate the data set for all the variables.

3.5.2 Descriptive Charts: Trend Lines

Before conducting the unit root tests, it is necessary to observe the line graphs of all the variables to ascertain whether they have a constant, linear, quadratic, or polynomial trend specified by the generalized equation:

$$X_t = k + \varphi T^n \dots\dots\dots\dots (3.1)$$

where;

Constant trend occurs at $T = 0$

Linear Trend ($T \neq 0, n = 1$)

Quadratic Trend ($T \neq 0, n = 2$)

Cubic Trend ($T \neq, n = 3$)

Polynomial Trend ($T \neq 0, n > 3$)

Therefore, the trend lines of all parameters are plotted and visually scrutinized to aid in the performance of unit root tests based on the correct assumption of the empirical distribution of the trend lines.

3.5.3 Individual Unit Root Tests

After recognizing the fundamental trend behind each variable sequence, Group Unit Root Checks are conducted on the data series by selecting any one of the three ADF test models that are compatible with the trend lines found on each variable. There are three models of the ADF test specified as follows:

$$\Delta Y_t = \beta_1 + \varphi Y_{t-1} + \alpha_i + \varepsilon_{1t} \dots\dots\dots\dots (3.2) \text{ Intercept only}$$

$$\Delta Y_t = \beta_1 + \beta_2 t + \varphi Y_{t-1} + \alpha_i + \varepsilon_{2t} \dots\dots\dots\dots\dots (3.3) \text{ Trend and Intercept only}$$

$$\Delta Y_t = \varphi Y_{t-1} + \alpha_i + \varepsilon_{3t} \dots\dots\dots\dots\dots (3.4) \text{ No trend, no intercept}$$

The assessment of how or not the unit root can be based on the intercept only, trend and intercept only or no trend, no intercept assumptions is achieved through a visual analysis of the multiple trend lines of the data series. The individual Unit Root Analysis was conducted on all the variables using the Augmented Dickey-Fuller and Philip Perron Tests.

The ADF test involves estimating Hamilton's (1994) equation:

$$\Delta y_t = \alpha + \beta_t + \rho Y_{t-1} + \sum_{j=1}^{k} \Upsilon_j \Delta y_{t-j} + \varepsilon_t; t = 1, \dots\dots, T \dots\dots\dots\dots (3.5)$$

where, T is the length of the sample, t is a time trend, and k is the length of the lag in the dependent variable. The selection of this parameter is rendered using the Akaike Information Criterion (AIC) modified by Ng and Perron (2001).

The standard Augmented Dickey-Fuller (ADF) test is conducted to gauge the degree of integration of the variables and to ascertain whether the data series are stationary.

The Phillips-Perron (PP) tests are like the Dickey-Fuller test and enable us to understand that the ADF test for autocorrelation between error terms using non-parametric (i.e., outside the regression framework) approaches. However, the vital values for the PP tests have the same distribution as the Augmented Dickey-Fuller statistic. The lag lengths of the ADF tests are chosen automatically based on the Schwarz Information Criterion (SIC). The spectral estimation procedure for the PP tests is based on the Bartlett kernel to allow for the possible residual correlation, the bandwidth of which is automatically chosen depending on the Newey-West bandwidth.

3.5.4 Cointegration Tests

A cointegration test is employed to appraise if there is a long-term association between different time series. Formed by Engle and Granger (1987), the cointegration experiments describe situations in which two or more non-stationary time series are coupled together in such a manner that they cannot deviate from long-term equilibrium. Tests are used to assess the degree of sensitivity of two factors at the same average price for a given period.

Cointegration can be detected in data employing three approaches; *Graphical Methods*, *Single Equation Methods (Engle-Granger, Phillips-Ouliaris, Hansen & Park Tests)* and *Johansen System Cointegration Tests*.

It is essential to confirm for single equation cointegration between variables in each equation to prevent a well-known spurious regression problem (Maddala & Kim, 1998). The single equation cointegration test is valid when dealing with single equation cointegrating problems

as opposed to a vector of equations that would usually need the Johansen Cointegration Test. Since this study analyzes the causal correlation and interaction between the lending rate and the Ghana Reference Rate (a single equation), the use of Johansen System Cointegration tests will be impractical. Rather, we select the Engle-Granger Single Equation Cointegration Test and the Graphical Method.

3.5.5 Engle-Granger Single Equation Cointegration Test

The Engle-Granger tests for single equation cointegration are unassumingly unit root tests operated on the residuals obtained from a Static Ordinary Least Squares (SOLS) estimation of (3.6).

$$y_t = X_t'\beta + D_{1t}'\gamma_1 + u_{1t} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (3.6)$$

where;

$D_t = (D_{1t}', D_{2t}')$ are deterministic trend regressors and the n stochastic regressors, X_t' are governed by the system of equations:

$$X_t = \Gamma_{21}'D_{1t} + \Gamma_{22}'D_{2t} + \varepsilon_{2t} \dots\dots\dots\dots\dots (3.7)$$

$$\Delta\varepsilon_{2t} = u_{2t} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (3.8)$$

Assuming that the series are not cointegrated, all linear variations of (y_t, X_t'), including the residuals from SOLS, are non-stationary root unit-roots. The test of the null hypothesis of no co-integration against the alternate of co-integration, thus, leads to the unit root test of the null of non-stationarity against the stationarity alternative.

3.5.6 Graphical Method

Trend lines are also plotted to visually identify cointegrating relationships between lending rates and the GRR and the other control variables in the equation.

3.5.7 Empirical Model Specifications

The multivariate linear regression (3.9) and (3.10) below are employed to examine the effects of the Ghana Reference Rate (GRR), bank-specific variables of profitability, liquidity, interest expenses, and the macroeconomic factors of the exchange rate, money supply, and inflation rates on commercial bank loan rates in Ghana.

$$LR_t = \beta_0 + \beta_1 GRR_t + \gamma_i \sum_{i=1}^{j} Profit_t + \psi_i \sum_{i=1}^{k} Liquid_t + \phi_i \sum_{i=1}^{l} InterestEXP_t + \lambda_i \sum_{i=1}^{m} MacroECON_t + \varepsilon_t \ldots\ldots (3.9)$$

An expanded version of (3.9) is specified to aid in the achievement of the specific research objectives:

$$LR_t = \beta_0 + \beta_1 GRR_t + \gamma_1 ROA_t + \gamma_2 ROE_t + \psi_1 CLATTA_t + \phi_1 SDR_t + \phi_2 TDR_t + \lambda_1 ER_t + \lambda_2 INF_t + \lambda_3 MS_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.10)$$

but;

$$GRR_t = 0.4MPR_t + 0.2IBR_t + 0.4\left[\frac{91 - Day\ T'Bill\ Rate}{1 - CRR - CIV}\right]_t \ldots\ldots\ldots (3.11)$$

where;

$\beta_0 =$ constant or autonomous term

$\beta_1, \gamma_1, \gamma_2, \psi_1, \phi_1, \phi_2, \lambda_1, \lambda_2, \lambda_3 =$ slope parameter coefficients

$\varepsilon_t =$ stochastic error term,

and the variables used in (3.9) and (3.10) are defined as follows:

LR_t = lending rate measured as the average, monthly commercial bank lending rate.

GRR_t = the Ghana reference rate measured as the monthly figures provided by the Bank of Ghana.

$Profit_t$ in (3.9) refers to average monthly bank profitability or financial performance measured using return on assets (before tax) and return on equity (after tax), represented in (3.10) as;

ROA_t = return on assets is a measure of how profitable the bank is relative to its total assets measured on annual basis.

ROE_t = return on equity is the measure of the financial performance of the bank measured on annual basis.

$Liquid_t$ in (3.9) represents average monthly bank liquidity captured in (3.9) using core liquid assets to total assets, represented in (3.10) as;

$CLATTA_t$ = a measure of the proportion of the bank's assets that are easily convertible to cash and hence highly liquid.

$InterestEXP_t$ in (3.9) stands for banks' average monthly interest expenditures represented in (3.10) as;

SDR_t = banks' average monthly savings deposit interest rates

TDR_t = banks' 3 months' average time deposits rates

$MacroECON_t$ as used in (3.9) denotes macroeconomic factors proxied in (3.9) by;

ER_t = average monthly US dollar to Ghana cedi exchange rate

MS_t = average monthly broad money (M2) supply;

INF_t = monthly inflation rate date given by the Bank of Ghana composite index

3.5.8 Estimating Model Parameters

The parameters indicated in (3.9) and (3.10) above are estimated using the Fully Modified Ordinary Least Squares (FMOLS). A brief theoretical description of the FMOLS is presented below;

a. The Fully Modified Ordinary Least Squares (FMOLS)

Cogitate the dimensional time series vector process, (y_t, X_t'), with cointegrating equation:

$$y_t = X_t'\beta + D_{1t}'\gamma_1 + u_{1t} \dots\dots\dots (3.12)$$

where;

$D_t = (D_{1t}', D_{2t}')$ are deterministic trend regressors and the n stochastic regressors are governed by the systems of equations:

$$X_t = \Gamma'_{21} D_{1t} + \Gamma'_{22} D_{2t} + \varepsilon_{2t} \dots\dots\dots (3.13)$$

$$\Delta\varepsilon_{2t} = u_{2t} \dots\dots\dots\dots (3.14)$$

Phillips and Hansen (1990) propose a semi-parametric solution that uses the problem of cointegrating equations and stochastic regressors to remove the problem induced by the longer-term interaction. The resulting Fully Modified OLS (FMOLS) is asymptotically impartial and has fully successful combinations of regular asymptotic, which make standard forest tests with asymptotic statistical inference from Chi-square. In the FMOLS estimator, the symmetric and single-siding residual covariance matrices are approximate estimates.

Let u_{1t} be the residuals derived after conjecturing (3.12). The u_{2t} may be obtained indirectly as $u_{2t} = \Delta\varepsilon_{2t}$ from the level regressions.

$$X_t = \widehat{\Gamma}'_{21} D_{1t} + \widehat{\Gamma}'_{22} D_{2t} + \Delta\hat{\varepsilon}_{2t} \dots\dots\dots\dots\dots\dots\dots\dots\dots (3.15)$$

or directly from the difference regressions

$$\Delta X_t = \widehat{\Gamma}'_{21} \Delta D_{1t} + \widehat{\Gamma}'_{22} \Delta D_{2t} + \hat{u}_{2t} \dots\dots\dots\dots\dots\dots\dots\dots (3.16)$$

Let $\widehat{\Omega}$ and $\widehat{\Lambda}$ be the long-haul covariance matrices processed using the residuals $\hat{u}_t = (\hat{u}_{1t}, \hat{u}_{2t})'$.

Then we may delineate the modified data:

$$y_t^+ = y_t - \widehat{\Lambda}_{12}\widehat{\Omega}_{22}^{-1}\hat{u}_2 \dots\dots\dots\dots (3.17)$$

$$\hat{\lambda}_{12}^+ = \hat{\lambda}_{12} - \widehat{\Lambda}_{12}\widehat{\Omega}_{22}^{-1}\hat{u}_2 \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (3.18)$$

The FMOLS estimator is given by

$$\hat{\theta} = \begin{bmatrix} \beta \\ \widehat{\gamma_1} \end{bmatrix} = \left(\sum_{t=2}^{T} Z_t \, Z_{\acute{t}} \right)^{-1} \left(\sum_{t=2}^{T} Z_t \, y_t^{+} - T \begin{bmatrix} \hat{\lambda}_{1\acute{2}}^{+} \\ 0 \end{bmatrix} \right) \ldots\ldots\ldots (3.19)$$

where; $Z_t = (X_t', D_t')'$.

The methodology to the computation of the FMOLS is the development of long-haul covariance matrix estimators $\widehat{\Omega}$ and $\widehat{\Lambda}$. Before discussing the possible options for measuring $\widehat{\Omega}$ and $\widehat{\Lambda}$, the scalar estimator would be helpful.

b. The Justification for Using the FMOLS

To examine the long-lasting rapport between financial and economic time series parameters that unveil co-integration (Adusei, 2013), the Fully Modified Ordinary Least Squares (FMOLS) estimator is engaged. Borrowed from Phillips and Hansen (1990), FMOLS exploits kernel estimators of the nuisance variables that manipulate the OLS estimator's asymptotic distribution (Shahbaz, 2009). When through the lenses Phillip and Hansen (1990) and Shahbaz (2009), the FMOLS achieves asymptotic efficiency by tweaking least squares to account for serial correlation effects and endogeneity tests in regressors arising from the presence of cointegrating relationships. The proficiency of the FMOLS estimator lies in its capacity to employ several kernel functions, examples of which are depicted below (Andrews, 1991):

Quadratic spectral	$k(x) = \frac{25}{12\pi^2 x^2}\left\{\frac{\sin(1.2\pi x)}{1.2\pi x} - \cos(1.2\pi x)\right\}$	1.3221	2	2/25
Tukey–Hamming	$k(x) = \begin{cases} 0.54 + 0.46\cos(\pi x) & \text{if } \ x \le 1.0 \\ 0 & \text{otherwise} \end{cases}$	1.6694	2	4/25
Tukey–Hanning	$k(x) = \begin{cases} 0.50 + 0.50\cos(\pi x) & \text{if } \ x \le 1.0 \\ 0 & \text{otherwise} \end{cases}$	1.7462	2	4/25
Tukey–Parzen	$k(x) = \begin{cases} 0.436 + 0.564\cos(\pi x) & \text{if } \ x \le 1.0 \\ 0 & \text{otherwise} \end{cases}$	1.8576	2	4/25
Truncated uniform	$k(x) = \begin{cases} 1 & \text{if } \ \lvert x \rvert \le 1.0 \\ 0 & \text{otherwise} \end{cases}$	0.6611	1/5	–

The estimates of the FMOLS parameters as well as their corresponding p-values and t-statistics permit the researcher to resolve the impacts on Ghana's lending rates of commercial banks and all of the other control variables. The R-squared statistical data were used to assess the general suitability for the data distribution of the FMOLS model.

c. Testing the Causal Effect of the GRR on Lending Rates using Pairwise Granger Tests

This study's main goal is to ascertain if there is or not any causal link between the GRR and lending rates. But it should be noted that the FMOLS calculation is based on a statistical correlation. However, the pairwise Granger Causality Test is employed to validate whether there is a directional/causal impact of the GRR on lending prices. The Granger Causality Test is a statistical experiment to corroborate whether a time series variable is efficacious in foretelling a related variable. It first came into being in 1969. Regressions archetypally present "simple" correlations but Clive Granger advocated that the economic causality could be confirmed by gauging the knack to estimate time series values for the future using previous time series values. As 'real causality' is a fundamentally metaphysical topic, and thus a misunderstanding of the post hoc ergo propter hoc that one prior case should be taken as proof for the cause, econometricians argue that the Granger test only demonstrates "predictive causality."

Utilizing the word "causality" on its own is a misunderstanding since the word "precedence" for Granger-causality is best represented or, as Granger himself believed later in 1977, "temporally connected." Rather than testing whether *Y* causes *X*, the Granger causality tests whether *Y* forecasts *X*.

The time series *X* is presupposed to Granger-cause *Y* if it can be seen, usually by a sequence of t-tests and F-tests on the lagged values of *X* (with the lagged values of *Y* included), that these *X* values supply statistically germane information on the prospective values of *Y*.

The general model of the Granger Causality equation can be written as follows:

$$Y_t = \sum_{i=1}^{n} \alpha_i Y_{t-1} + \sum_{i=1}^{n} \beta_i X_{t-1} + \varepsilon_{1t} \dots\dots\dots\dots (3.20)$$

$$X_t = \sum_{i=1}^{n} \gamma_i X_{t-1} + \sum_{i=1}^{n} \tau_i Y_{t-1} + \varepsilon_{2t} \dots\dots\dots\dots (3.21)$$

where;

Y_t, X_t = the current or forecast value of the dependent and independent variables, respectively,

Y_{t-1}, X_{t-1} = one year lagged (past) values of the dependent variable and independent variables, respectively,

$\alpha_i, \beta_i, \gamma_i, \tau_i$ = slope parameters

$\varepsilon_{1t}, \varepsilon_{2t}$ = white noise

$\sum_{i=1}^{n}$ = the summation operator

The decision regarding whether or not GRR Granger triggers commercial bank loan rates in Ghana is ascertained using the F test. The calculated F value is attained by the following recipe:

$$F = (n-k)\frac{RSS_R - RSS_{UR}}{m(RSS_{UR})} \dots\dots\dots\dots\dots\dots\dots\dots\dots (3.22)$$

where;

RSS_R and RSS_{UR} = consecutive values are the residual sum of squares in the restricted and unrestricted equation.

n = number of observations

m = number of lags

k = the number of variables estimated in the unrestricted equation

If the F- and the p-values are smaller than the crucial values of 0.05 or 0.10, the GRR Granger can contribute to loan rates, which insinuates a unidirectional causal influence of the GRR on loan rates in Ghana. The lag selection is done using Akaike and Schwarz Information Criteria.

3.5.9 Robustness Checks

a. Checking the Robustness of the FMOLS Estimates

The robustness of the findings, in terms of the consistency of the statistical significance and effects of the parameter estimates, are checked using three estimators, namely, *Dynamic OLS (DOLS) Estimator*, *Two-Stage Least Squares (TSLS)* and *Generalized Methods of Moments (GMM)*.

It is universally acknowledged that the ordinary least square (static OLS) approximation of the cointegrating vector (3.12) is unswerving and congregates at a speed faster than that of the norms when cointegrated (Hamilton 1994). A big shortcoming concerning static OLS (SOLS) is that estimates have an asymptotic distribution, which generally consists of non-Gaussian asymmetry, asymptotic bias, and which is indicative of non-scalar nuisances. Since orthodox methods of research are not right unless major amendments are made, SOLS is generally not endorsed if an inference is made on the cointegrating vector.

The panicking asymptotic distribution of SOLS is constructed on a long-term collaboration between regressors and equation errors, and the cross-relation between equations and regressors. The novel uncomplicated strategy for an asymptotically efficient estimator that jettisons feedback in the cointegrating process was introduced by Saikkonen (1992) and Stock and Watson (1993).

Known as Dynamic OLS (DOLS), the tactic necessitates augmenting the cointegrating regression with lags and leads of ΔX_t such that the resultant cointegrating equation error term is orthogonal to the overall history of the stochastic regressor innovations:

$$y_t = X_t'\beta + D_{1t}'\gamma_1 + \sum_{j=-q}^{r} \Delta X'_{t+j}\delta + u_{1t} \ldots\ldots\ldots (3.23)$$

The Two-Stage Least Squares (TSLS) Estimator is the succeeding estimator exercised to certify the potency of the FMOLS performance. It is an elite instrumental variables regression modus. As the word presents, in the two-stage least squares there are two detached stages. In the initial step, TSLS identifies sections that can be allocated to endogenous and exogenous parameters. In this stride, the OLS regression for each variable on the instrument set in the model is calculated.

The subsequent step is the regression of the preliminary equation with the values of the first-step regressions replacing all the variables.

The TSLS guesstimates are the coefficients of this regression. The TSLS estimator can settle the problem of cross-correlation between cointegrating equation errors and regressors (Davidson & MacKinnon, 1993; Hamilton, 1994; Hayashi, 2000; Stock & Watson, 2007; Johnston & DiNardo, 1997).

The third and last estimator employed in the analysis to verify the effectiveness of our FMOLS results is the Generalized Method of Moments (GMM). Established by Arellano and Bond (1991), GMM techniques management for unobserved country-specific effects, first-difference non-stationary variables, resolve the endogeneity of explanatory variables employing the relevant instruments, and checks for the existence of autocorrelation (Saci et al., 2009).

b. Testing the Predictive Ability of the FMOLS Model

After parameter estimations and robustness checks, the forecasting ability of the FMOLS model is tested. The forecasting ability is tested using three main statistics. Firstly, the bias factor shows us how far the mean of the prediction is from the mean of the actual series. The second depends on the variance proportion, which reveals how far the variation of the prediction is from the variation of the original series. Thirdly, the covariance proportion

estimates the remaining residual non-systematic prediction errors. The variance, bias, and covariance proportions add up to one.

The predictive competence of the FMOLS algorithm is confirmed after parameter estimates and robustness tests. Three key figures are exploited to appraise the forecasting capabilities. Next, the bias element denotes how far from the mean of the actual sequence the value of the forecast is.

The succeeding relies on the percentage of variances, which signposts how much the forecast differs from the original sequence. Thirdly, the covariance proportion guesstimates the remaining residual non-systematic prediction errors. The variance, bias, and covariance proportions add up to one.

Pindyck and Rubinfeld (1998, pp. 210-214) remark: "If your prediction is ―strong‖, the proportions of bias and variance should be minimal, so that most biases can be focused on the proportions of covariance."

c. Further Diagnostic Tests On The FMOLS Model

The FMOLS model is further tested for serial correlation and asymptotic normality.

CHAPTER FOUR

ANALYSIS AND DISCUSSION OF RESULTS

4.1 Introduction

This section covers the results and findings of the research and addresses them in the related empiric literature.

4.2 Descriptive Statistics

The mean value of LR in Ghana between 2018 and 2020 was 22.66714 with a maximum value of 25.02000 and a minimum value of 0.000000. A standard deviation of 5.216136 was noted. Also, the value of skewness and kurtosis was -4.187663 and 18.72759, respectively. This connotes that the data distribution is skewed negatively and leptokurtic. The average value of GRR recorded in Ghana from 2018 to 2020 was 13.18667. A maximum value of 16.14000 and a minimum value of 0.000000 was also recorded with a standard deviation of 6.558255. The value of skewness was -1.571982 and that of kurtosis was 3.478925. This indicates that the data distribution is skewed to the left and slightly leptokurtic with broader tails. Also, the average value of the ER between 2018 and 2020 in Ghana was 4.970395. The maximum value was 5.537700 and the minimum value was 4.405300. The standard deviation value was 5.216136. The value of skewness and kurtosis was -0.191624 and 1.924803 respectively. This reveals that the data distribution is skewed to the left and platykurtic with thinner tails. The mean value of INF in Ghana between 2018 and 2020 was 9.411905 with a maximum value of 9.970000 and a minimum value of 9.010000. The standard deviation in INF was 0.281663. The value of skewness was 0.387208 and the value of kurtosis was 2.203904. This parade a data distribution is positive, skewed to the right, and platykurtic. The average value of CLATTA documented in Ghana between the years 2018 and 2020 was 17.23714. The maximum value was 27.13000 and the minimum value was 0.00000. The standard deviation recorded was

11.21985. The value of skewness was -0.918823 and that of kurtosis was 1.890864. This point towards a data distribution that is skewed to the left and platykurtic with thinner tails in comparison to the normal distribution.

Table 4.1 (A): Descriptive Statistics

Descriptive Statistics for Lending rate (LR), Ghana reference rate (GRR), Exchange rate (ER), Inflation rate (INF), and Core liquid assets to total assets (CLATTA). The sample included 21 observations from 2018M04 to 2020M01.

	LR	GRR	ER	INF	CLATTA
Mean	22.66714	13.18667	4.970395	9.411905	17.23714
Median	23.73000	16.14000	5.016200	9.406634	23.46000
Maximum	25.02000	16.82000	5.537700	9.970000	27.13000
Minimum	0.000000	0.000000	4.405300	9.010000	0.000000
Std. Dev.	5.216136	6.558255	0.336605	0.281663	11.21985
Skewness	-4.187663	-1.571982	-0.191624	0.387208	-0.918823
Kurtosis	18.72759	3.478925	1.924803	2.203904	1.890864
Jarque-Bera	277.8151	8.849648	1.140062	1.079304	4.031233
Probability	0.000000	0.011976	0.565508	0.582951	0.133238
Sum	476.0100	276.9200	104.3783	197.6500	361.9800
Sum Sq. Dev.	544.1614	860.2143	2.266064	1.586676	2517.699
Observations	21	21	21	21	21

Key: *LR=Commercial Bank Lending Rate, GRR=Ghana Reference Rate, ER=US dollars to Ghana cedis exchange rates, INF=Inflation Rate, CLATTA=Core Liquid Assets to Total Assets ratio.*

Source: Author's estimation (2020).

From the table underneath, the mean value of MS from 2018 to 2020 in Ghana was 39079.81. The maximum and minimum values recorded was 63064.58 and 0.000000, respectively. The standard deviation was 28462.75. The value of skewness and kurtosis was -0.674734 and 1.499488, respectively. This exposes a data distribution that is skewed to the left and platykurtic compared to the normal distribution. Also, the average value of ROE in Ghana between 2018 and 2020 was 13.29524. The maximum value was 21.83000 whereas the minimum value was 0.000000. The value of the standard deviation recorded was 8.775418. The value of skewness was -0.826997and

that of kurtosis was 1.862122. This displays a data distribution that is negatively skewed and platykurtic. The mean value of ROA within the years 2018 to 2020 in Ghana was 5.789524. The maximum and minimum values recorded was 15.38000 and 0.000000, respectively. The value of the standard deviation was 6.255990. The value of skewness was 0.771103 and the value of kurtosis was 1.843946. This points that the data distribution is moderately skewed to the right and platykurtic with thinner tails and a broader apex compared to the normal distribution. The value of the mean of SDR was 5.392857 with a maximum value of 7.550000 and a minimum value of 0.000000. The value of the standard deviation was 3.494971. The value of skewness was -0.948683 and the value of kurtosis was 1.900000. This reveals a data distribution that is skewed to the left and platykurtic. The average value of TDR in Ghana from 2018 to 2020 was 8.333333. The maximum value was 12.75000 and the minimum value was 0.000000. The standard deviation value was 5.413140. The value of skewness and kurtosis was -0.932564 and 1.895712, respectively. This establishes that the data distribution is negatively skewed and platykurtic.

Table 4.1 (B): Descriptive Statistics [Continued]

Descriptive Statistics for Money supply (MS), Return on Equity (ROE), Return on Asset (ROA), Savings deposit rate (SDR), Time deposit rate (TDR). The sample included 21 observations from 2018M04 to 2020M01.

MS	ROE	ROA	SDR	TDR
39079.81	13.29524	5.789524	5.392857	8.333333
54992.04	17.15	3.39	7.55	11.5
63064.58	21.83	15.38	7.55	12.75
0.000	0.000	0.000	0.000	0.000
28462.75	8.775418	6.25599	3.494971	5.41314
-0.67473	-0.827	0.771103	-0.94868	-0.93256
1.499488	1.862122	1.843946	1.9	1.895712
3.563525	3.526654	3.250501	4.20875	4.110887
0.168341	0.171473	0.196862	0.121922	0.128036
820676	279.2	121.58	113.25	175
1.62E+10	1540.159	782.7481	244.2964	586.0417
21	21	21	21	21

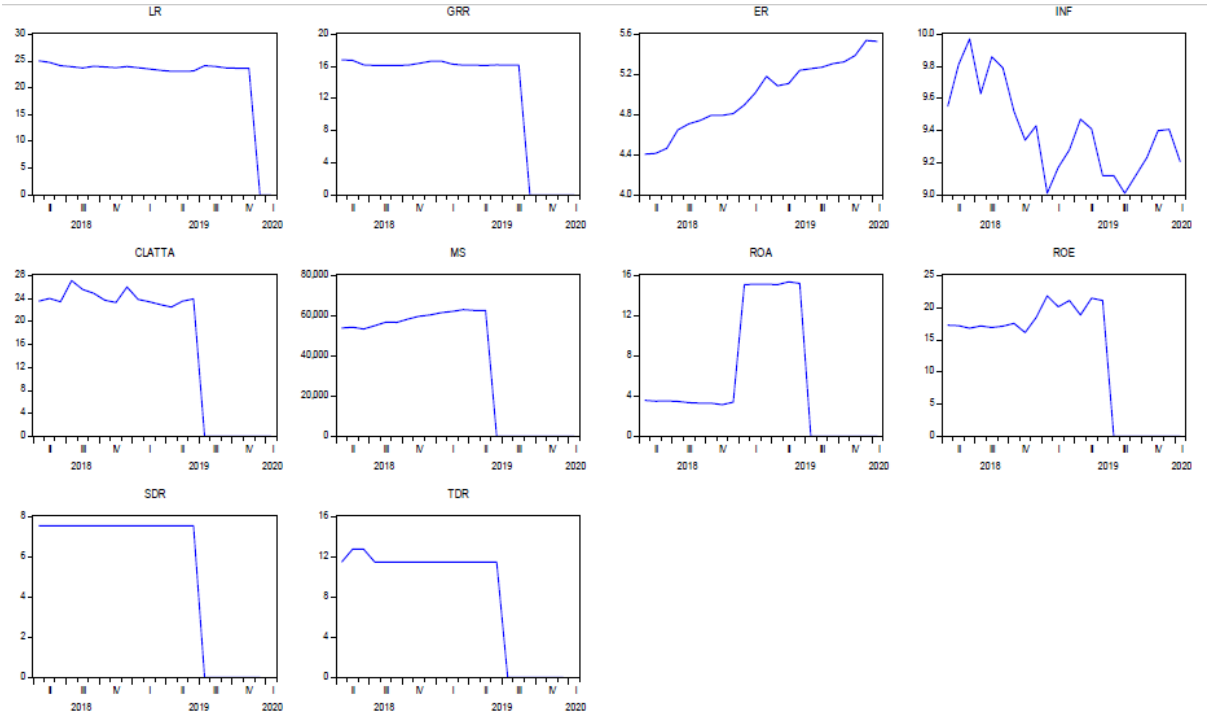
Key: *MS=Broad Money (M2) Supply, ROA=Returns on Assets, ROE=Returns on Equity, SDR=Savings Deposit (interest) rates, TDR=3 months' Time Deposit rates*

Source: Author's computation, 2020.

4.2.1 Descriptive Charts: Trend Lines

It can be observed from **Figure 4.1** below that the data series for most of the variables exhibit linear trends with intercepts. Hence, the unit root tests are performed with this underlying assumption.

Figure 4.1: Trend Lines for all Variables



Source: Author's computation, 2020.

4.2.2 Individual Unit Root Tests at Level

The results from the parametric Augmented Dickey-Fuller (ADF) and non-parametric Phillips-Perron (PP) tests reveal that all the parameters are non-stationary at level, meaning they are not integrated of zero-order (i.e., they are not I (0)).

Table 4.2 (A): Unit Root Tests for all Variables at Level

Variables	Augmented Dickey-Fuller (ADF)			Philips Perron Test			Stationarity & Order of Integration
	Trend and Intercept	p-value	Lags	Trend and intercept	p-value	Bandwidth	
LR	-3.625977	0.0578*	4	-0.91048	0.9357	0	Inconclusive
GRR	-1.637439	0.7424	0	-1.63744	0.7424	1	Non-stationary
ROA	-1.48952	0.8005	0	-1.55117	0.7775	1	Non-stationary
ROE	-1.847033	0.6453	0	-1.87694	0.6304	1	Non-stationary
CLATTA	-2.142818	0.4943	0	-2.14984	0.4908	0	Non-stationary
SDR	-1.857773	0.6382	0	-1.85777	0.6382	0	Non-stationary
TDR	-1.999869	0.5662	0	-1.99987	0.5662	1	Non-stationary
INF	-2.48146	0.3325	0	-2.56686	0.2967	1	Non-stationary
ER	-3.647969	0.0510*	1	-2.65187	0.2636	6	Inconclusive
MS	-1.945678	0.5957	0	-1.94568	0.5957	0	Non-stationary

Source: Author's estimation, 2020.

4.2.3 Individual Unit Root Tests at First Difference

The results from the parametric Augmented Dickey-Fuller (ADF) and non-parametric Phillips-Perron (PP) tests indicated that all the variables are stationary after first differencing, meaning they are integrated of first order (i.e., they are I (1)).

Table 4.2 (B): Unit Root Tests for all Variables at 1st Difference

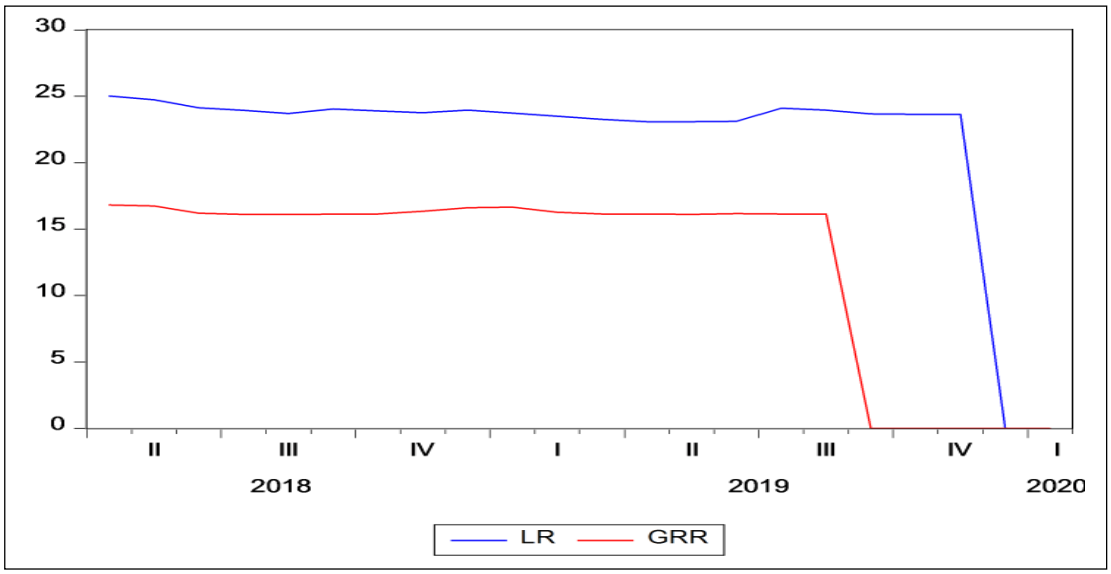
Variables	ADF at first Difference			Philips Perron Test			Stationarity & Order of Integration
	Trend and Intercept	p-value	Lags	Trend and intercept	p-value	Bandwidth	
LR	-0.918277	0.9278	4	-4.968445	0.0040**	0	Stationary I (1)
GRR	-4.578834	0.0085*	0	-4.654294	0.0074*	3	Stationary I (1)
ROA	-4.180423	0.0186**	0	-4.179835	0.0186**	1	Stationary I (1)
ROE	-4.406323	0.0120**	0	-4.426790	0.0115**	3	Stationary I (1)
CLATTA	-4.593492	0.0083**	0	-4.649171	0.0074**	3	Stationary I (1)
SDR	-4.370793	0.0136**	0	-4.376628	0.0135**	2	Stationary I (1)
TDR	-4.380552	0.0134**	0	-4.388105	0.0132**	2	Stationary I (1)
INF	-4.900462	0.0045**	0	-5.024179	0.0035**	2	Stationary I (1)
ER	-5.087120	0.0035**	1	-8.795793	0.0000**	19	Stationary I (1)
MS	-4.345147	0.0135**	0	-4.344904	0.0135**	1	Stationary I (1)

Source: Author's estimation, 2020

4.2.4 Cointegration Tests (Graphical Method)

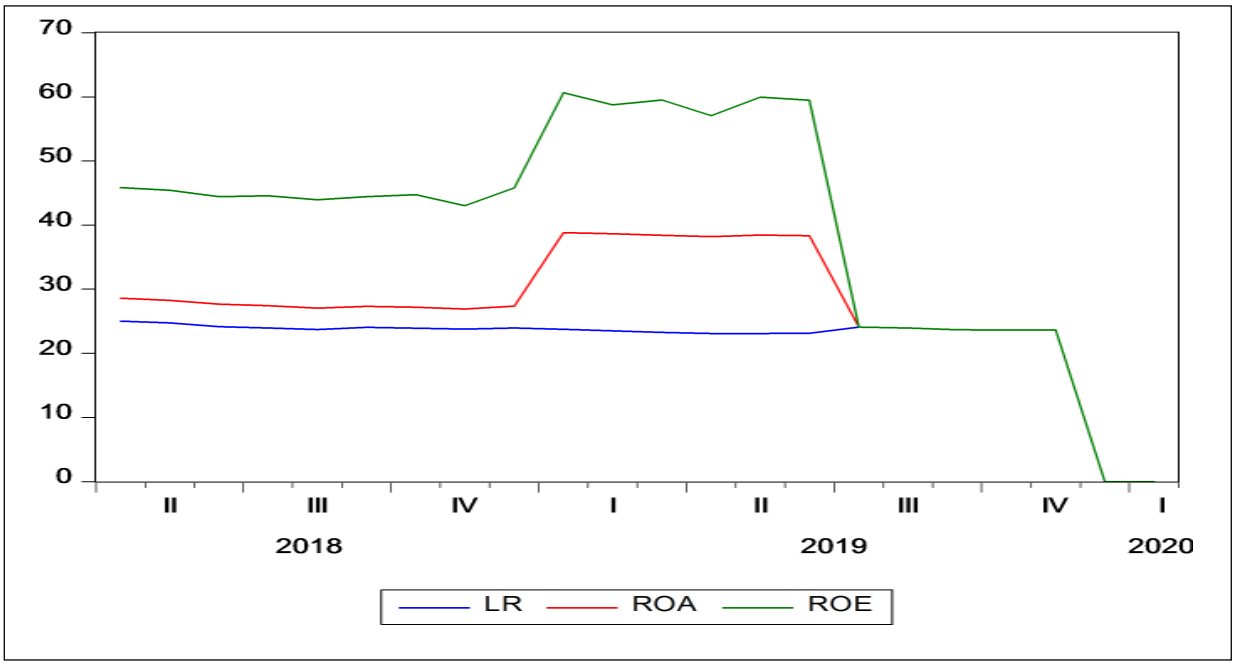
The graphs point to a high likelihood of cointegration between Lending Rates (LR) and most of the variables since it demonstrates very tight co-movements with most of them.

Figure 4.2 (A): Lending Rates vs GRR



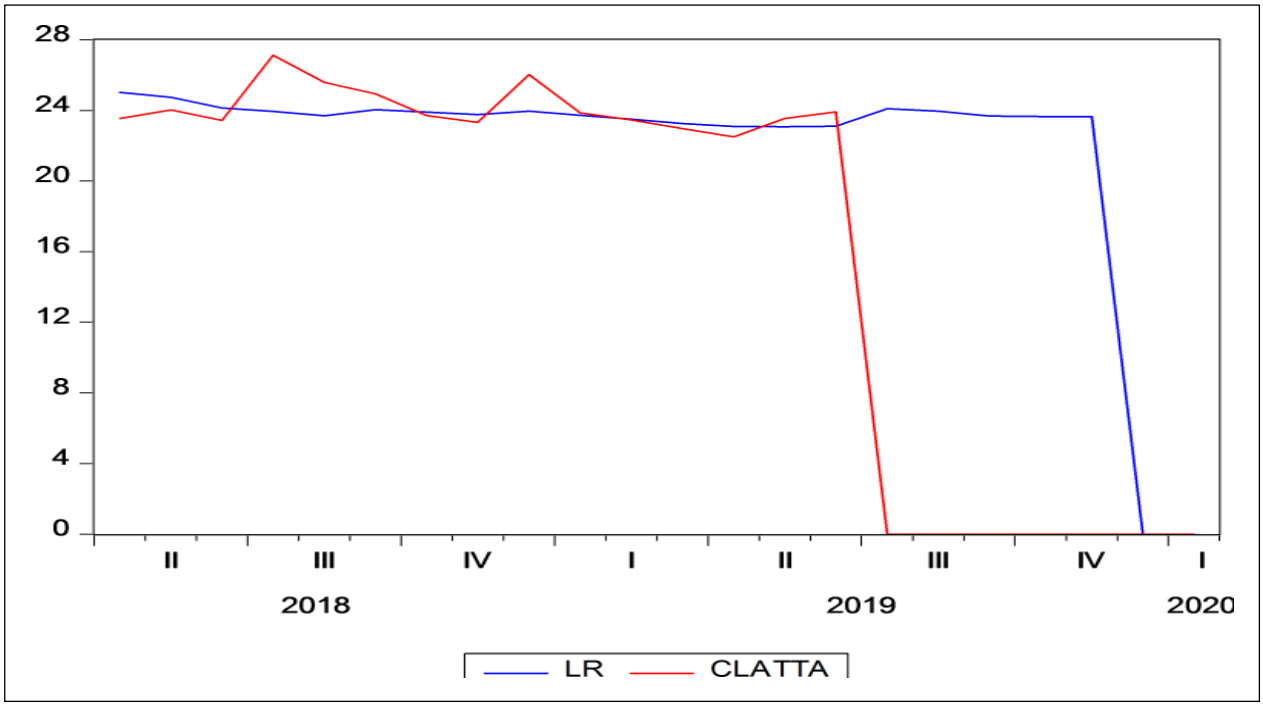
Source: Author's computation, 2020

Figure 4.2 (B): Lending Rates vs ROA & ROE (Profitability Variables)



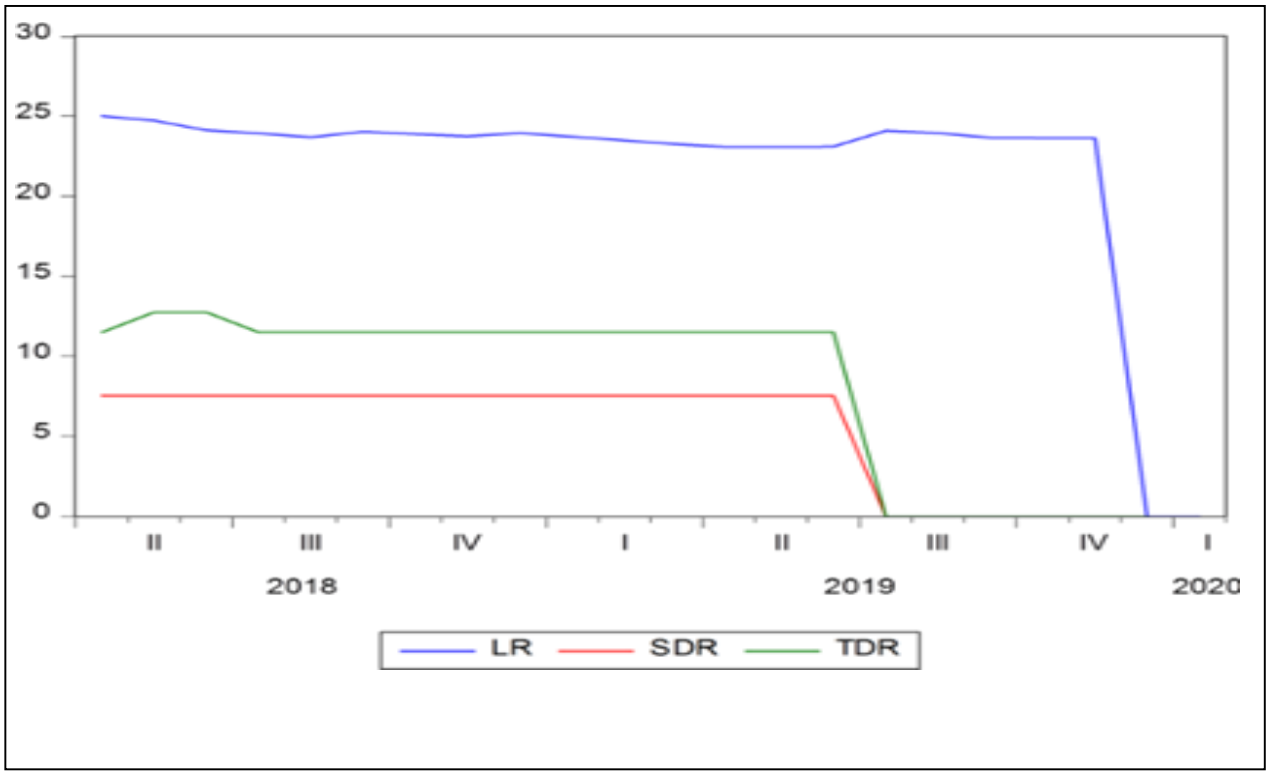
Source: Author's computation, 2020

Figure 4.2 (C): Lending Rates vs CLATTA (Liquidity Variable)



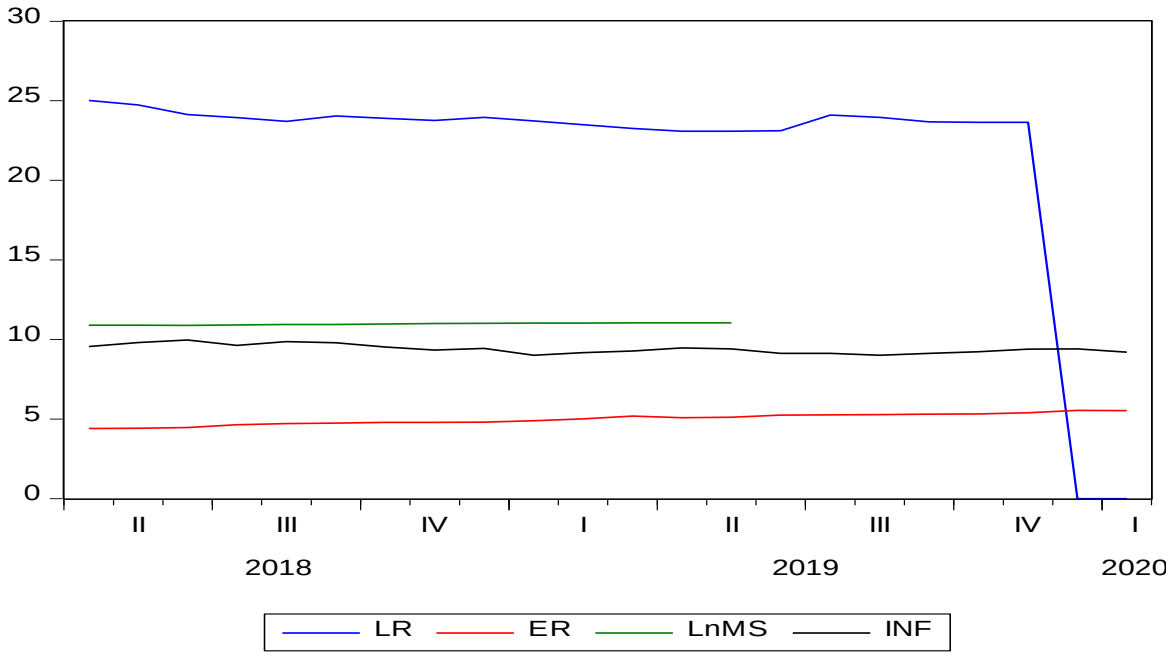
Source: Author's computation, 2020

Figure 4.2 (D): Lending Rates and SDR, TDR & T-bill 91 (Interest Expense Variables)



Source: Author's computation, 2020

Figure 4.2 (E): Lending Rates, ER, LnMS & INF (Macroeconomic Variables)



Source: Author's computation, 2020

4.2.5 Cointegration Tests (Engle-Granger)

The Engle-Granger tests show that Lending Rates (LR) are cointegrated with the Ghana Reference Rate (GRR) and three other variables, namely, CLATTA, ROE, and SDR (p-values <0.05).

The Engle-Granger test was performed on the lending rate (LR), Ghana reference rate (GRR), Exchange rate (ER), Inflation rate (INF), Core liquid assets to total assets (CLATTA), Money supply (MS), Return on Equity (ROE), Return on Asset (ROA), Savings deposit rate (SDR), Time deposit rate (TDR). The sample included 21 observations from 2018M04 to 2020M01. The Cointegrating equation and additional regressor deterministic assumed a constant and a linear trend respectively. A maximum lag length of 4 was automatically specified based on Schwarz information criterion.

Table 4.3: Engle-Granger Single Equation Cointegration Test

Dependent	t-statistic	Prob.*	z-statistic	Prob.*
LR	-3.829165	0.8599	-27.44718	0.0629
GRR	-3.646718	0.9009	-30.63304	0.0001*
ER	-5.799555	0.2399	-18.29676	0.8096
INF	-3.362139	0.9471	-14.64811	0.9593
CLATTA	-6.102753	0.2065	44.50151	0.0000*
MS	-4.366545	0.6976	-18.80569	0.7765
ROE	-7.949275	0.0212	-30.44019	0.0018*
ROA	-4.653183	0.5960	-21.25543	0.5698
SDR	-6.011978	0.2242	32.68158	0.0000*
TDR	-5.517922	0.3199	-24.47710	0.1918

Source: Author's computation, 2020

4.2.6 Multivariate Regression (FMOLS)

The proof of the existence of, at least, a single equation, I (1) cointegrating association, as verified by the ADF and PP unit root tests and the Engle-Granger test allows us to do the Fully Modified Ordinary Least Squares (FMOLS) multivariate regression analysis. The outcomes of the FMOLS regression are displayed in **Table 4.4** below.

According to the results, the Ghana Reference Rate (GRR) has a positive significant impact on the Lending Rate (LR) in Ghana (B=0.354; $p<0.05$).

As per the factors of bank profitability, the return on assets (ROA) has a substantial positive impact on the lending rate ($p>0.05$), but the impact of the return on equity (ROE) on the lending rate is strongly negative ($p>0.05$).

Bank liquidity, that is, core liquid assets to overall assets (CLATTA), has a positive insignificant association with the lending rate ($p>0.05$). But the bank interest rate expense indicator, i.e., the 3-month time deposit rates (TDR), has a major negative impact on the loan rate (B=-3.51; $p<0.10$). However, the impact of the savings deposit rate (SDR) on the lending rate is positively significant ($p<0.10$).

Concerning the macro-economic variables, the results indicate that the exchange rate has a substantial negative correlation with the lending rate (B=-37.30; $p<0.05$). Moreover, inflation affects lending rates negatively and significantly (B=13.77; $p<0.10$), whereas broad money supply influences lending rates negatively and non-significantly (B=-0.144E-05; $p > 0.05$).

The Fully Modified Least Squares (FMOLS) method was applied to an adjusted sample of (2018M05 2019M12). The dependent variable is Lending Rates (LR). The independent variable is the Ghana Reference Rate (GRR); the control variables are Exchange rate (ER), Inflation rate (INF), Core liquid assets to total assets (CLATTA), Money supply (MS), Return on Equity (ROE), Return on Asset (ROA), Savings deposit rate (SDR), and Time deposit rate (TDR). The sample included 21 observations from 2018M04 to 2020M01. The Cointegrating

equation deterministic assumed a constant and a trend component in the data series and the regressor equations were estimated using first differences. An Additional regressor deterministic was included based on the quadratic trend assumption and the Long-run covariance estimate was based on the Quadratic-Spectral kernel and the Newey-West fixed bandwidth = 3.0000.

Table 4.4: Multivariate Regression Results Based on Fully Modified Least Squares (FMOLS) Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GRR	0.354080	0.068073	5.201460	0.0006*
ROA	0.639490	0.159254	4.015525	0.0030*
ROE	-1.253063	0.444534	-2.818827	0.0201*
CLATTA	0.363455	0.420131	0.865100	0.4095
SDR	6.165362	3.142221	1.962103	0.0814**
TDR	-3.517448	1.706627	-2.061052	0.0694**
INF	-3.755096	1.929888	-1.945758	0.0835**
ER	-37.30233	5.953110	-6.266024	0.0001*
MS	-1.44E-05	2.31E-05	-0.623888	0.5482
C	229.3344	25.70612	8.921392	0.0000
@TREND	1.295127	0.304199	4.257502	0.0021
R-squared	0.425328	Mean dependent var		22.54950
Adjusted R-squared	-0.213197	S.D. dependent var		5.322982
S.E. of regression	5.863010	Sum squared residue		309.3740
Long-run variance	1.017180			

Source: Author's estimation, 2020

4.2.7 Pairwise Granger Causality Tests

The results from the pairwise Granger causality tests indicates that the Ghana Reference Rate (GRR) Granger causes lending rates (LR) ($p < 0.05$) but lending rates do not Granger cause the GRR ($p > 0.05$). This implies that the GRR has a significant unidirectional causal effect on LR in Ghana.

Table 4.5: Pairwise Granger Causality Test Results

The Pairwise Granger causality test was performed using sample data of 20 observations from 2018M04 2020M01. A maximum lag length of 2 was automatically selected and employed based on the Schwarz Information Criterion

	Obs	F-Statistics	Prob.
Null Hypothesis:		6.55775	0.0090
GRR does not Granger Cause LR			
LR does not Granger Cause GRR	20	0.19267	0.8268

Source: Author's estimation, 2020

a. Generalized Methods of Moments (GMM) Estimator

Thirdly, the system GMM estimator was applied to further check the effectiveness/robustness of the FMOLS regression results. The FMOLS R-square=0.4253 whiles the GMM R-square=0.5324. Hence, the GMM R square is much higher than that of the FMOLS. However, the GRR under GMM exerts an insignificant positive effect on LR whereas under FMOLS the effect was positively significant.

Excluding the ROE which is now positively significant under GMM and negatively significant under FMOLS, all the other variables have retained their positive or negative signs and their significance levels. Concerning the true effect of ROE on lending rates (LR) we select a negative significant effect based on the FMOLS, DOLS, and TSLS results and reject that of the GMM. However, in all, the GMM also seems to confirm the overall explanatory power of the model as it even has a much higher R squared statistic (R square=0.532413), although the p-value of the J-statistic is statistically non-significant ($p > 0.05$).

The Generalized Method of Moments was applied to an adjusted sample of 20 observations from 2018M05 to 2019M12. The estimation weighting matrix (HAC) was based on a Bartlett kernel and a Newey-West fixed bandwidth = 3.0000. The Standard errors & covariance were

computed using the HAC weighting matrix based on the Quadratic-Spectral kernel and the Newey-West fixed bandwidth = 3.0000. Model Convergence was achieved after 1 iteration. The Instruments used were LR, LR-squared, 1year lagged LR-squared, GRR, GRR-squared, 1 year lagged GRR-squared, ROA, ROA-squared, 1-year lagged ROA-squared, ROE, ROE-squared, 1-year lagged ROE-squared, CLATTA, CLATTA-squared, 1 year lagged CLATTA-squared, SDR, SDR- squared, 1 year lagged SDR-squared, TDR, TDR-squared, 1-year lagged TDR-squared.

INF, INF-squared, 1-year lagged INF-squared, ER, ER-squared, 1-year lagged ER-squared, MS, MS-squared, 1 year lagged MS-squared and a constant (C).

Table 4.6: Generalised Method of Moments (GMM) Regression Estimation Results

Dependent Variable: LR

The Generalized Method of Moments was applied to an adjusted sample of 20 observations from 2018M05 to 2019M12. The estimation weighting matrix (HAC) was based on a Bartlett kernel and a Newey-West fixed bandwidth = 3.0000. The Standard errors & covariance were computed using the HAC weighting matrix based on the Quadratic-Spectral kernel and the Newey-West fixed bandwidth = 3.0000. Model Convergence was achieved after 1 iteration. The Instruments used were LR, LR-squared, 1year lagged LR-squared, GRR, GRR-squared, 1 year lagged GRR-squared, ROA, ROA-squared, 1 year lagged ROA-squared, ROE, ROE-squared, 1 year lagged ROE-squared, CLATTA, CLATTA-squared, 1 year lagged CLATTA-squared, SDR, SDR- squared, 1 year lagged SDR-squared, TDR, TDR-squared, 1 year lagged TDR-squared, INF, INF-squared, 1 year lagged INF-squared, ER, ER-squared, 1 year lagged ER-squared, MS, MS-squared, 1 year lagged MS-squared and a constant (C).

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GRR	0.129061	0.179380	0.719482	0.4901
ROA	0.583016	0.165556	3.521554	0.0065
ROE	0.747460	0.226228	3.304015	0.0092
CLATTA	-1.768798	0.553338	-3.196594	0.0109
SDR	21.79484	6.946056	3.137729	0.0120
TDR	-12.85264	4.018571	-3.198311	0.0109
INF	2.182166	0.881131	2.476552	0.0352
ER	-54.84933	16.64042	-3.296151	0.0093
MS	-0.000126	3.86E-05	-3.277772	0.0096
C	276.0939	77.06583	3.582573	0.0059
@TREND	0.947797	0.340279	2.785356	0.0212

R-squared	0.532413	Mean dependent var	22.54950
Adjusted R-squared	0.012872	S.D. dependent var	5.322982
S.E. of regression	5.288613	Sum squared resid	251.7249
Durbin-Watson stat	1.873130	J-statistic	7.304351
Instrument rank	21	Prob(J-statistic)	0.696434

Source: Author's estimation, 2020

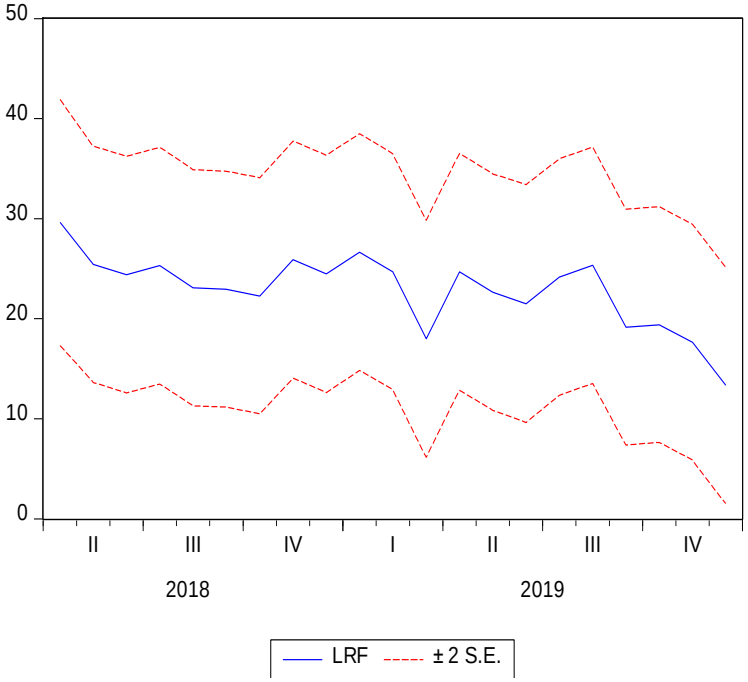
b. Testing the Forecasting Ability of the FMOLS Model

The forecasting power of the FMOLS multivariate regression model was also checked. The results indicated strong forecasting power of the FMOLS model. According to Pindyck and

Rubinfeld (1998, pp. 210–214): "if your prediction is ―strong, the proportions of bias and variance should be minimal, so that most biases can be focused on the proportions of covariance."

Consistent with Pindyck and Rubinfeld (1998), most of the forecasting bias, that is 85.4472% is found in the covariance proportion, whilst the variance and bias proportions demonstrate only very low predictive biases of 14.2474%, and 0.03054%, respectively.

Figure 4.3: Forecasting Ability of the FMOLS Regression Model



Forecast: LRF	
Actual: LR	
Forecast sample: 2018M04 2020M01 I...	
Included observations: 21	
Root Mean Squared Error	3.967560
Mean Absolute Error	2.643835
Mean Abs. Percent Error	NA
Theil Inequality Coefficient	0.085511
Bias Proportion	0.003054
Variance Proportion	0.142474
Covariance Proportion	0.854472
Theil U2 Coefficient	0.741646
Symmetric MAPE	18.33840

Source: Author's estimation, 2020

4.2.8 Diagnostic Tests on the FMOLS Model

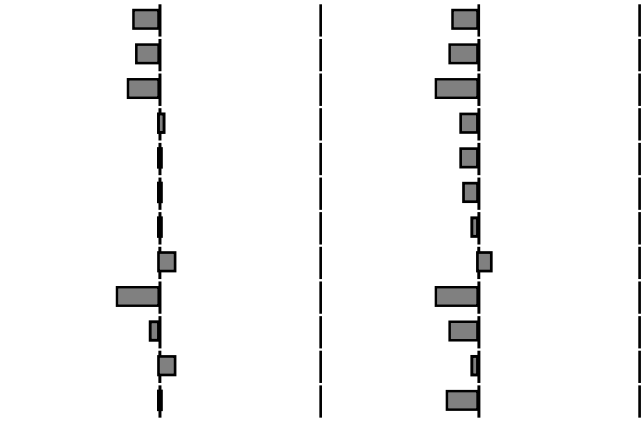
a. **Serial Autocorrelation**

The autocorrelations and partial autocorrelations are all very much greater than zero at all lags and the *Q* statistics are insignificant (p>0.05). This implies there is no serial autocorrelation in the FMOLS regression residuals which is good and was expected of the FMOLS model. The FMOLS model was conceived by Phillips and Hansen (1990), using annoyance parameter

kernel algorithms, which distress the asymptotic distribution of the OLS estimator (Shahbaz, 2009). The asymptotic utility of the regressors can be triumphed by amending the least squares to exemplify serial association effects and endogeneity tests resulting from the group between them (Phillip & Hansen, 1990; Shahbaz, 2009).

Figure 4.4: Serial Autocorrelation Test

Date: 05/26/20 Time: 09:24
There were 20 included observations spanning the period 2018M04 to 2020M01.



Autocorrelation	Partial Correlation		AC	PAC	Q-Stat	Prob*
		1	-0.167	-0.167	0.6441	0.422
		2	-0.154	-0.187	1.2271	0.541
		3	-0.192	-0.271	2.1824	0.535
		4	0.037	-0.108	2.2194	0.695
		5	0.007	-0.114	2.2208	0.818
		6	0.021	-0.083	2.2341	0.897
		7	0.024	-0.026	2.2532	0.945
		8	0.105	0.097	2.6611	0.954

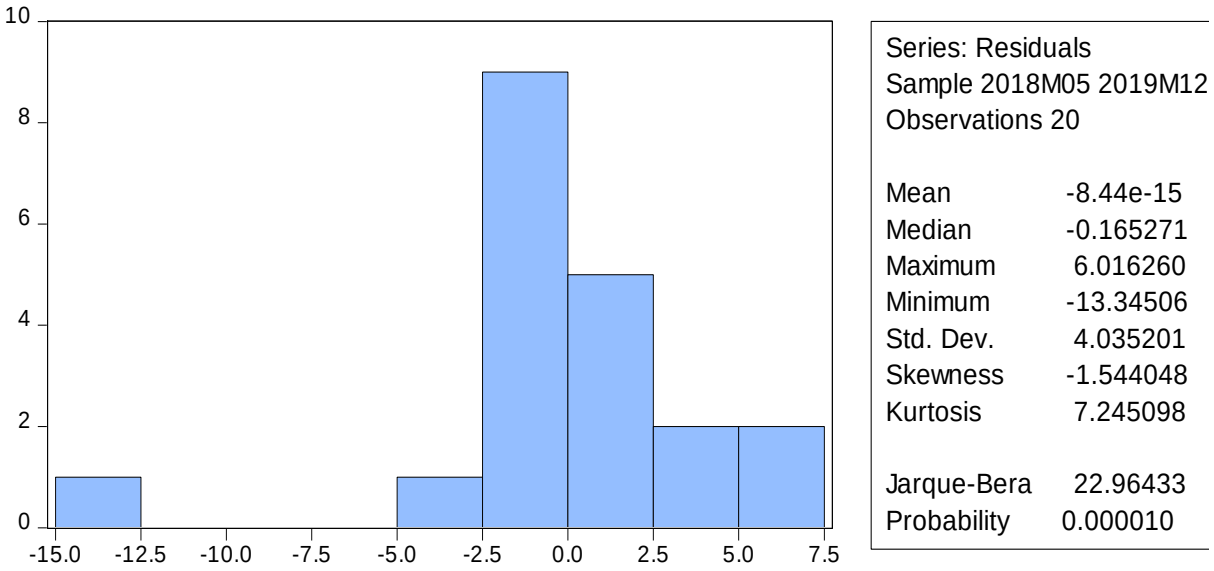
*Probabilities may notbe valid for this equation specification.

Source: Author's estimation, 2020.

a. **Normality Test**

The histogram would be a bell-shape that would not be important if the residuals were commonly spread. Although the statistics of Jarque-Bera are important, we infer that the residual regression is not normal asymptotically ($p=0.002 \geq 0.05$). Though not very desirable, asymptotic normality is a large sample OLS estimation property, and the researcher could have done nothing to deal with this issue simply due to very limited time-series data observations employed in the analysis panning the period April 2018 to December 2019.

Figure 4.5: Asymptotic Normality Test



Source: Author's estimation, 2020

4.3 Discussion

Reference rates are widely adopted interest rates that connect payments under a financial contract to normal money market interest rates. A vast variety of reference interest rates are utilized in local and foreign capital markets, including a broad range of unsecured and protected money markets in several currencies. As a result, how reference rates are generated and implemented is critical for the operation of financial markets.

Reference rates are ordinarily inaugurated interest rates which join payments to standard monetary market interest rates per the financial contract. In the domestic or international capital markets, a wide assortment of indices is exploited, including an amalgam of unsecured and covered money markets in several currencies. Thus, it becomes imperative for financial market operations how reference rates are produced and applied.

In April 2018, the BoG launched the Ghana Reference Rate (GRR) model for the computation of loan rates in Ghana in alliance with the Ghana Association of Bankers. The GRR model was espoused to meet the BoG's undertaking to budge towards a more market-based concept of a

benchmark rate setting, add more market driving variables, augment credit lending stability, and make the switch between the Central Bank's (BoG) rate and the banks ' lending rate simpler. It is also intended for the banking industry to be a standard benchmark as it encompasses observable variables of business, such as the 91-day T-bill rate, Monetary Policy Rate, and Interbank Lending rate in combination with the Cash Reserve Requirement and the Cash-in-Vault (Bank Ghana, 2018).

However, the macro dynamic, practical linkages between the GRR model and Ghanaian interest rates are not analyzed in a single sample, though a variety of additional studies examine interest rates and their impact on commercial bank credit rates (e.g., Wang & Lee, 2009; Haughton & Iglesias, 2012; Hofmann, 2006; Sorensen and Werner, 2006; Égert et al., 2007; van Leuvensteijn et al., 2013; Belke et al., 2013). Moreover, Ghana studies have focused mainly on the effect on lending rates (Cobbinah, 2011), bank interest rate spread determinants in Ghana (Churchill, Kwaning & Ababio, 2014; Uzeru, 2012), or on macroeconomic interest rate spread variables in Ghana (Sheriff, et al., 2014). None of the studies specifically examined the question of whether the GRR is related to the rates of commercial bank loans.

The study employs the non-experimental, quantitative-correlational, ex-post-facto design within the time series framework. Besides, it utilises secondary, quantitative data, in particular the lending rate, the GRR, and the control variables gathered from the website of the Bank of Ghana (BoG), reflecting monthly time series data for the period from April 2018 to January 2020, covering only the post-GRR implementation period for Ghana.

The data was evaluated employing descriptive statistics and inferential statistics. Following individual unit root tests and the Engle-Granger single equation co-integration experiments coupled with graphical representations, a multivariate linear regression model was employed to assess the impact of the Ghana reference rate (GRR), bank unique variables of profitability,

liquidity, interest expenses, and macroeconomic factors of the exchange rate, money supply, and inflation rate on commercial bank lending rates in Ghana. The parameters of the multivariate regression model have been calculated using the Fully Modified Ordinary Least Squares (FMOLS). Besides, a pairwise Granger causality test was conducted to assess the causal link between the GRR and the lending rate in Ghana. The robustness of the FMOLS multivariate regression results in terms of statistical significance accuracy and the effects of the parameter estimates were tested using three estimators: *Dynamic (DOLS) Estimator, Two-Stage Least and Generalized Moment Methods (GMM).* The predictive potential of the FMOLS model was further ascertained utilizing the bias proportion, variance proportion, and covariance proportions (Pindyck & Rubinfeld, 1998). FMOLS is also checked for serial correlation and asymptotic normality.

4.3.1 Causal Effect of the GRR on Commercial Bank Lending Rates in Ghana

This study focused on five (5) main objectives. The first objective is:

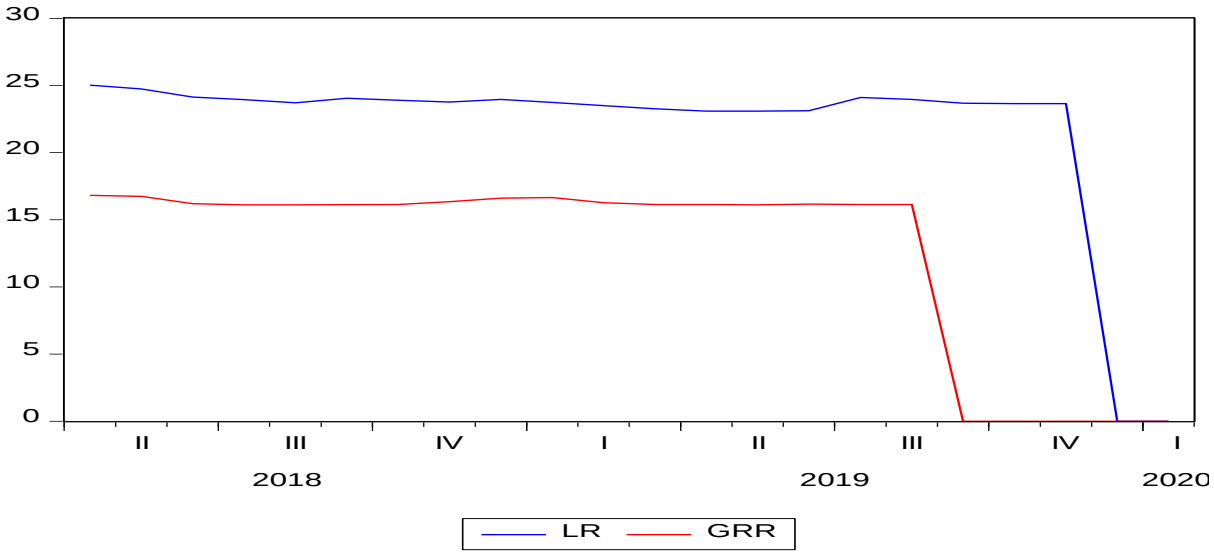
a. to determine the causal effect of the GRR on commercial bank lending rates in Ghana.

The response to this question from the study was that the Ghana Reference Rate has a positive and statistically significant causal impact on the lending rate of commercial banks in Ghana. This conclusion is based on the results of FMOLS and Granger causality. The result suggests that the implementation of the GRR has led to a significant rise in commercial bank loan rates. As Granger himself (1977) put it, GRR and commercial bank loan rates may be seen to be temporally linked. Therefore, instead of claiming that the GRR triggers lending rates, it is more fitting to suggest that the GRR granger causes lending rates or the GRR predicts lending rates. However, as depicted in **Figure 4.2(A)** below, since its launch in April 2018, interest rates have generally declined and have still been higher than the GRR. But it is difficult to say with utter certainty what could have caused the general downturn. Also, the FMOLS model will enable

us to determine the pre-and post-impact of the GRR on lending rates, a task that could only be accomplished through a regression discontinuity design.

Nevertheless, it should be noted that the finding of a significant positive bond between the GRR and the lending rate is largely consistent with previous studies using a monetary policy approach that found that the short-term money market rate (reference rate) had a substantial impact on lending rates. (e.g., Becker et al., 2012; Blot & Labondance, 2013; Mojon, 2000; Espinosa-Vega & Rebucci, 2004; Holton & d'Acri, 2015). The findings of this research focused on the monetary policy perspective, are also very close to those of Cobbinah (2011), which found a very resilient positive relationship between the Bank of Ghana's Base Rate and the Lending Rate in Ghana.

Figure 4.6: Lending Rates and GRR in Ghana from April 2018 to January 2020



Source: Author's estimation, 2020.

4.3.2 Effects of Bank Profitability on Lending Rates in Ghana

The second objective of the study is:

a. to examine the effect of the bank profitability or financial performance indicators of ROA and ROE on lending rates of commercial banks in Ghana.

The study fallouts revealed that ROA's bank profitability indicator has a statistically significant positive effect on the lending rate, while ROE's effect on the lending rate is negatively significant. This means that commercial banks' ROA, on average, may have a substantial effect on bank decisions to raise their lending rates, while ROE has an impact on their decision to decrease lending rates.

ROA is an indicator of financial performance and efficiency of management. This suggests that banks with stronger and more effective management, who are also financially stable, will usually provide very high loan rates to their customers.

ROE measures the returns banks offer to their equity holders. The results of this analysis indicate that banks providing greater returns to their equity owners prefer to provide exceptionally low or competitive market loan rates. In general, lower, or more competitive bank loan rates may be an indication of management quality and good financial performance.

4.3.3 Effect of Bank Liquidity on Lending Rates in Ghana

The third objective of the study is:

a. to assess the extent of bank liquidity variable of Core Liquid Assets to Total Assets ratio in influencing lending rates of commercial banks in Ghana.

The analysis conveyed that the liquidity of the banks (CLATTA) had an insignificant positive relationship with the lending rates. This means that the decisions made by Ghanaian commercial banks to raise their lending rates on average are not greatly influenced by liquidity – their ability to satisfy their short-haul and long-haul liability obligations.

The Core Liquid Assets to Total Assets (CLATTA) ratio offers an indicator of the liquidity required to satisfy the anticipated and unpredictable cash needs. The echelon of liquidity demonstrates the potential of the deposit-taking sector to absorb shocks to their balance sheet.

The inconsequential positive impact of CLATTA on loan rates necessitates that commercial banks offering high or very unattractive lending rates have very attractive liquidity, which is large enough to be able to absorb some blow to their balance sheet.

In other words, offering favorable or low-interest rates may be an indication of a bad bank's liquidity status.

4.3.4 Effects of Bank Interest Expenses on Lending Rates in Ghana

The fourth objective of the study is:

a. to examine the effect of bank interest expense variables of savings deposit interest rates and 3 months' Time Deposits Rates on commercial bank lending rates in Ghana.

The results indicate that all the variables of the Bank's interest rate expense had differential impacts on the Lending Rate in Ghana (LR). Initially, the effect of the Savings Deposit Rate – SDR – on LR is positively significant. This intimates that the desire for banks to pay interest on deposit accounts held by their clients will be a very valuable factor when commercial banks are deliberating raising their loan rates.

Savings Deposits Rates is the interest banks pay to the holders of their savings accounts. A significant positive impact of the SDR on lending rates suggests that the decision of banks to

The analysis conveyed that the liquidity of the banks (CLATTA) had an insignificant positive relationship with the lending rates. This means that the decisions made by Ghanaian commercial provide high lending rates on loans is driven by the need for them to pay large or substantial sums of money, in the form of interest paid to their frequently numerous deposit account holders.

Moreover, the 3-Month-Time Deposit Rate (TDR) has a major negative effect on LR. This insinuates that the decision of banks to reduce their loan rates may be greatly affected by the pressure on them to pay off the interest owed to consumers' time deposits kept by those banks.

A time deposit is an interest-bearing financial account that has a pre-determined maturity date. The most well-known example is the Certificate of Deposit (CD). The funds must stay in the account for the fixed term to receive the interest rate stated. Time deposits typically pay a marginally higher interest rate than a standard savings account. The longer the time to maturity, the higher the rate of interest would be.

The findings of the analysis divulge that banks that pay high-interest rates to their time depositors prefer to deliver slightly lower market loan rates. This may be because the accumulation of time deposits allows banks the capacity to execute their financial intermediation role by "pooling together" time deposit funds and providing them as loans at affordable lending rates, to promote the rise in the quantity of loans sought.

4.3.5 Effects of Macroeconomic Variables on Lending Rates in Ghana

The final objective of the study is:

a. to examine the effect of macroeconomic factors of the exchange rate, money supply, and inflation rates significantly impact commercial bank lending rates in Ghana.

However, the findings suggest that all macro-economic variables still wield a weighty negative effect on commercial bank lending rates in Ghana. Firstly, inflation rates have a negative and significant effect on loan rates. This implies that commercial bank loan rates are spiraling whenever the country's inflation rate is high. Inflation is a long-term spike in the cost of commodities and services triggered by currency devaluation. Inflation is a prodigy in which consumer prices are rising. Inflation necessitates an escalation in the cost of living as the cost of items and services increases. A detrimental collision of inflation rates on loan rates denotes that a prolonged rise in the general costs of merchandise and services within the economy may also lead banks to significantly decrease their lending rates. The discovery of a detrimental impact of inflation on lending rates is in accordance with Uzeru (2012).

Secondly, exchange rates have a negative and significant effect on loan rates. Adding that commercial bank lending rates would be lower if the exchange rates were relatively slumped. In finance, the exchange rate is the rate at which one currency is traded for another. That is often known to be the value of the currency of one nation in comparison to another currency. The US dollar exchange rate system to GHS was applied in this analysis. As a result, a substantial negative collision of the exchange rate on the lending rate (LR) implies that Ghana's commercial banks are in a sturdier position to give attractive (low) interest rates on their loans while the exchange rate regime is also favorable. Lízal and Schwarz (2013) pointed out how foreign exchange (FX) interventions is massively effective for small open economies such as the Czech Republic in regulating lending rates where the use of standard operating instruments (such as the repo or reference rate) is no longer a choice. They expound that the control of the exchange rate on the loan rate may be very similar because the import price system and the actual interest rate market function in the same direction. Franta et al. (2014) maintain that central banks such as the Czech Republic operate elevated exchange rates to lower loan rates through what they call 'a form of quantitative easing.'

Third, the broad money supply has a hefty negative bang on the lending rate in Ghana. This designates that, as the volume of broad money supply in the economy upswings, loan rates often decline. In economics, broad money is a function of the amount of capital or money supply in the national economy, covering both highly liquid 'narrow money' and less liquid forms. A major negative bang of the broad money supply (MS) on lending rates denotes that more money in circulation could cause banks to lessen their lending rates. This is very evident that if people have sufficient broad money (at hand or in the bank as deposits) they are less likely to take up bank loans. Thus, it seems that a rise in the volume of money supplied to the economy could dwindle pressure for bank loans, contributing to a reduction in lending rates.

However, the analysis found that the broad money supply (MS) had a sizeable negative impact on bank lending rates which may not align with Amidu (2006).

The disparity in the findings stems from the methodology. Whereas this analysis devotes the FMOLS estimator, Amidu (2006) exercised only the OLS method, also known as the Static OLS (SOLS). But the FMOLS algorithm is superior to the OLS model. The FMOLS estimator (Phillips & Hansen, 1990) uses the nuisance parameter kernel estimators that affect the asymptotic distribution of the OLS estimator (Shahbaz, 2009). Asymptotic usefulness is achieved by changing the least squares to take account of serial correlation results and endogeneity steps in regressors resulting from cointegrating interactions (Philip & Hansen, 1990; Shahbaz, 2009).

4.4 Conclusion

The chapter focused on the analysis and discussion of results of the study. The descriptive statistics of the study which includes all the variables used for the estimation are shown using their mean, median and minimum as well as maximum values. The adoption of the Fully Modified Ordinary Least Square (FMOL) estimation for the study showed that there were many data points for the study over a specified period. The study also further reveals the use of the Augmented Dickey Fuller Test and the Philip Perron test to check for the confirmation or otherwise of unit root and stationarity of the data. It was revealed that almost all the variables were non-stationary apart from the Lending rate which was the dependent variable. The cointegration analysis of the data was also done. The results of the study were done based on the multivariate regression analysis using the FMOL model and the Generalized Methods of Moment (GMM). The Granger causality test also applied to show the causality between the GRR and the lending rates in Ghana. It was revealed that GRR does not granger causality lending rates and the lending rates does not also granger cause GRR.

CHAPTER FIVE

SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS

5.1 Introduction

This section presents the overview of the study, draws some conclusions based on the findings, and makes some recommendations for policy and management intervention. It also illustrates the shortcomings of the research and provides a way for future studies.

5.2 Summary

Reference rates are broadly negotiated interest rates relating payment to standard monetary market interest rates in compliance with a financial contract. Local and international financial markets use a broad range of reference interest rates, with a vast array of unsecured and regulated currency markets in many currencies. As a consequence, the method of producing and using reference rates is important for financial market activity. In April 2018, the BoG launched the Ghana Reference Rate (GRR) model for calculating the lending rate in Ghana in collaboration with the Ghana Association of Bankers. The goal of introducing the GRR model was to meet the BoG's commitment that a more market-based base rate mechanism would be adopted, more market-oriented variables would be added, lending was more stable, and transmission from the Central Bank (BoG) to the lending rate for the banks would be improved. It was also supposed to act as a single baseline for banking as it concentrated on observable price adjustments such as the Monetary Policy Rate, Treasury Bill Rate for the 91-day duration, and the Interbank Lending Rate, along with the Cash balance and Cash-in-Vault criteria (Bench of Ghana, 2018).

However, the macro dynamic hyperlink between the GRR model and interest rates in Ghana is not explored in a single paper.

While abundant other studies have investigated interest rates in Ghana and abroad and their impact on commercial bank loan rates, none of these studies has investigated whether the GRR is or is not correlated with commercial bank loan rates. This thesis uses ex-post facto, non-experimental, and quantitative-correlational architecture in the context of the time series. Furthermore, it uses secondary, quantitative data, specifically the credit rates, the GRR, and the control variables derived from the Bank of Ghana website (BoG) representing the monthly time series data for the period April 2018 to January 2020, covering the Ghana post-GRR period only.

Descriptive statistics and inferential statistics have helped to analyze the results. The multivariant linear regression model was used to research the effect of Ghana's reference rate (GRR), the bank basic variables of profitability, liquidity, interest spending, and macro-economic factors of exchange rates, money supply, and inflation after performing single-unit root tests and single-equation co-integration experiments, along with graphic representations. By deploying the Fully Modified Ordinary Least Squares, the parameters of the multivariate regression are computed.

The robustness of the FMOLS multivariate regression results in terms of statistical significance accuracy and the effects of the parameter estimates were verified utilizing three estimators: *Dynamic (DOLS) Estimator, Two-Stage Least Squares (TSLS),* and *Generalized Methods of Moment (GMM)*. The predictive potential of the FMOLS model was further calculated using the bias proportion, variance proportion, and covariance proportions (Pindyck & Rubinfeld, 1998). The FMOLS model is also checked for serial correlation and asymptotic normality.

The robustness and precision of the FMOLS multivariate regression have been tested using 3 estimators in terms of statistical significance performance, including the *Dynamic Ordinary Least Squares (DOLS), Two-stage least square (TSLS)*; and *Generalized Methods of Moments (GMM)*. Furthermore, the FMOLS model's predictive potential was determined with Pindyck

and Rubinfeld's (1998) bias proportion, variance proportion, and covariance proportions. Besides, serial correlation and asymptotic normality are verified in the FMOLS model. The study sought to achieve five (5) main objectives. Below is a description of the results of this research:

a. With regard to the first research objective; to estimate the causal effect of GRR on the commercial bank lending rate in Ghana, the study has showed that, based on the FMOLS result and Granger causality checks, the Ghana Reference Rate had a strong and statistically relevant causal impact on the commercial bank lending rate in Ghana. The results signal that the implementation of the GRR has contributed to a sizeable increase in commercial bank loan rates, indicating the transient relationship between the two variables.
b. With respect to the second research objective, in assessing the impacts of the bank profitability or financial performance metrics of ROA and ROE on the lending rate of commercial banks in Ghana, the findings revealed that the bank profitability variable of ROA exerts a statistically significant positive influence on the lending rate, while the impact of ROE on the lending rate is negatively significant.
c. In relation to the third research objective on the assessment of the extent of Core Liquid Assets to Total Assets (CLATTA) of the bank liquidity variable influences the lending rate of commercial banks in Ghana, the study suggested that the Core Liquid Assets to Total Assets (CLATTA) of banks have an insignificant positive relationship with the Lending Rate.
d. With reference to the fourth research objective, on the effects of bank interest rate expense variables on savings deposit interest rates and the 3-month time deposit rate on commercial bank lending rates in Ghana, the research results indicate that all bank interest rate expense variables have had differential effects on lending rates in Ghana.

First, the influence of the Savings Deposit Rate – SDR – on the lending rate is positively significant, while the 3-Month-Time Deposit Rate (TDR) has a substantial negative impact on the lending rate in Ghana.

e. Regarding the final research objective of the study, on the macroeconomic factors of the exchange rate, money supply, and inflation rates effect on commercial bank lending rates in Ghana, the findings indicate that all the macroeconomic variables of inflation, exchange rate, and money supply have a negative and significant influence on commercial bank lending rates.

5.3 Conclusion

Few observations can be extracted from the results of this study. Firstly, the Ghana Reference Rate is simply a significant monetary policy mechanism adopted by the BoG to satisfy the BoG's dedication to shift towards a more market-based structure of the base rate setting, to integrate more market-oriented variables, to grow the flexibility of credit lending, and to improve the communication rate between the Central Bank (BoG) and the lending rate of the banks, and also meant to serve as the only benchmark for the banking sector since it is based on market observable variables/factors such as the 91-day Treasury Bill Rate, Monetary Policy Rate, the Interbank Lending Rate combined with the Cash Reserve Requirement and the Cash-in-Vault.

The findings from this study indicating that the GRR has a positive and statistically significant unidirectional causal impact on commercial bank lending denotes that the GRR is directly proportional to the lending rates and has contributed to a significant upswing in commercial bank loan costs since its introduction in April 2018.

Secondly, it is inferred, contingent upon this analysis, that the lending rate in Ghana is affected not only by the GRR, but also by bank unique variables of profitability, interest expense, and liquidity, together with macroeconomic factors. Therefore, the conclusion is drawn, that highly

efficient banks with higher ROE's appeared to offer more competitive (lower) loan rates on the market. But highly ineffective banks (low-ROA banks) may also offer loans with favourable or low-interest rates.

Thirdly, it is concluded that offering favourable or low-interest rates is not inherently an indication that commercial banks have a good liquidity position. This is because it was concluded from this study's analysis that banks that pay high-interest rates to their 3-month depositor appear to give slightly lower market loan rates. In essence, the decision of banks to give high (low) lending rates on loans may be tremendously influenced by the pressure on them to pay high (low) interest to their deposit account owners.

Fourthly and finally, it concluded that banks require a favourable macroeconomic climate to give lucrative lending rates. Banks are in a stronger position to provide competitive (low) interest rates on their loans when the exchange rate system is favourable. Further, it can be concluded that rises in the volume of money supplied to the economy could decrease the need for bank loans, contributing to lower lending rates. In addition, the findings show that both macroeconomic growth, exchange rates, and money supplies influence the rate of commercial bank lending adversely and substantially. Three assumptions are drawn in this relation.

Firstly, a significant negative impact of inflation rates on loan rates means that a prolonged elevation in the general costs of merchandise and services within the economy may also lead banks to a substantial diminution in their lending rates.

Secondly, a significant negative influence of exchange rates on lending rates implies that banks are in a stronger position to provide competitive (low) interest rates on their loans while the exchange rate environment is still advantageous. A desirable exchange rate system is one in which the domestic currency appreciates in comparison to the benchmark foreign currency. Hence, Commercial bank loan rates would also be lower in Ghana if the value of the cedi in Ghana appreciates in comparison to the US dollar.

Finally, a significant negative effect of broad money supply on lending rates indicates that a rise in the amount of liquidity supplied to the economy may minimize the demand for bank loans, contributing to a reduction in lending rates.

5.4 Recommendations

The following recommendations are based on the analysis of this study. First, from the conclusion of the research, we can see that the GRR affects commercial bank lending rates in Ghana. The only alternative now would be the borrower's credit risk premium. This can be regulated by the BoG, but it still relies on the macro-economic environment of the country. The credit risk premium component of the loan rate should be minimized for the investment borrowers in Ghana. So now that we have discussed one aspect of the determination of the lending cost via this study, namely, the GRR, the Bank of Ghana should take steps to lessen the credit risk premium of borrowers especially for investment borrowers.

Second, because the ROE of commercial banks has a significant negative influence on their loan costs, the Managements of Commercial Banks in Ghana must put in the effort of increasing the return on equity of the banks by investing in profitable ventures such as agriculture and industrial sectors of the Ghanaian economy. This would not only increase shareholder capital from a sound corporate governance viewpoint but would also greatly reduce lending rates. Moreover, the analysis showed that the Savings Deposit rate had a positive and significant impact on the lending rate, while the 3-Month-Time Deposit rate had a significant negative influence on the lending rate in Ghana. Based on this result, one way by which the Management of Commercial Banks could then offer competitive (low) interest rates would be to decrease the savings deposit rate and increase the 3-month time deposit rate.

Finally, the findings of the study indicate that all the macroeconomic factors including inflation, exchange rates, and money supply have a negative and significant effect on commercial bank lending rates. This implies that the Bank of Ghana together with the Ministry

of Finance needs to ensure a stable macroeconomic environment where high inflation rates are effectively managed to fall below appropriate thresholds to support commercial banks in lowering their lending rates. In addition, this study shows that commercial banks in Ghana are in a stronger position to offer competitive (low) interest rates on their loans when the exchange rate regime is favourable. The BoG and the ministry of Finance who manage the fiscal aspect of the Ghanaian economy must also strive to create a desirable economic growth and exchange rate system, one in which the local currency (Ghana cedi) is appreciated in contrast to the standard foreign currency (US dollar).

The study also showed that the broad money supply had a substantial negative effect on lending rates, indicating that a rise in the quantity of money supplied to the economy could decrease demand for bank loans, contributing to a reduction in lending rates. The BoG and the GoG should then work jointly to guarantee that the quantity of broad money supplied to the economy is successful in reducing the rate of commercial bank lending in Ghana.

5.5 Limitations of the Study

This research, like every other study, had certain drawbacks. These are elaborated below;

a. Design Limitations**:** Due to the absence of data, this study could not apply the more robust regression discontinuity design which is known to be a more robust quasi-experimental design for imputing causality in time series analysis than the Granger Causality and Multivariate regression models employed in this study.
b. Data Limitations**:** The single equation cointegration analysis revealed that the lending rate, the GRR, and the other control variables were integrated. It would have been more interesting to introduce the Autoregressive Distributed Lag (ARDL) to examine the short-term and long-term dynamic impact of the GRR on lending prices of commercial banks. However, this was not feasible due to very limited monthly time series data observations extending from only April 2018 to January 2020.

5.6 Further Studies

Further studies may concentrate on the determinants of the credit risk premium of commercial banks in Ghana. The results of such studies would enable banks to make accurate and efficient interest rate decisions by applying not only the GRR formula but also the related decision variables that permit banks to manage their individual credit risk premiums.

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