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EFFECTS OF RECAPITALIZATION OF COMMERCIAL BANKS ON AGRICULTURAL FINANCE IN GHANA

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BY

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THESIS SUBMITTED TO THE DEPARTMENT OF AGRICULTURAL AND FOOD ECONOMICS, FACULTY OF AGRICULTURE, FOOD AND CONSUMER SCIENCES, UNIVERSITY FOR DEVELOPMENT STUDIES, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF DOCTOR OF PHILOSOPHY DEGREE IN AGRICULTURAL ECONOMICS

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DECLARATION

DECLARATION

I, Akwasi Agyeman Britwum hereby declare that this thesis is the result of my own original work and that no part of it has been presented for another degree in this University or elsewhere:

Akwasi Agyeman Britwum 03/03/2025
(Name of Student) Signature Date

We hereby declare that the preparation and presentation of the thesis was supervised in accordance with the guidelines on supervision of thesis laid down by the University for Development Studies.

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ABSTRACT

This study investigates the effects of recapitalization of commercial banks on agricultural finance in Ghana, with emphasis on sectoral loan disbursement dynamics, agricultural credit risk management strategies, and the determinants of credit appraisal scores. Adopting a mixed-methods approach, the study employs both time series and panel data analyses within the framework of Autoregressive Distributed Lag (ARDL) model and fixed effects regression with robust standard errors, respectively, as well as Impulse Response Functions (IRF) and Forecast Error Variance Decomposition (FEVD).The McNemar's test**,** cluster analysis and Principal Component Analysis (PCA) were utilized to evaluate shifts in agricultural credit risk management practices and appraisal methodologies following recapitalization, as well as the determinants of credit appraisal scores. The ARDL results revealed a negative and significant adjustment coefficient (-0.942, $p < 0.05$), confirming stable long-run dynamics between agricultural finance and the independent variables. In the long run**,** inflation (0.011, $p = 0.037$) and non-performing loans (NPLs) (0.241, $p < 0.05$) had a positive and significant impact on agricultural finance. Conversely, capital adequacy ratio (CAR) (-0.034, $p = 0.001$) and return on equity (ROE) (-0.005, $p = 0.042$) exhibited negative long-run effects, implying that stringent capital requirements and profitability targets constrain agricultural lending. Recapitalization (RECAP) had a positive but statistically insignificant long-run effect (0.119, $p = 0.107$), suggesting that increased capitalization does not automatically translate into agricultural credit expansion**.** This finding aligns with the financial intermediation theory**,** which posits that although recapitalization enhances the lending capacity of banks by strengthening their capital base, credit allocation decisions remain influenced by sectoral risk perceptions and profitability considerations**,** thereby explaining the insignificant long-run impact on agricultural finance. The ARDL model's validity was confirmed through rigorous diagnostic tests, ensuring robustness against heteroskedasticity, autocorrelation, endogeneity, and parameter instability. The ECM results further validated these findings, with an error correction term (ECT) of -0.942 ($p < 0.05$), indicating a rapid and statistically significant adjustment toward long-run equilibrium. In the short run**,** inflation**,** NPLs**,** composite index of economic activities (CIEA)**,** core liquid assets to short-term liabilities (CLSTL)**,** recapitalization**,** COVID-19 dummy**,** and monetary policy rate (MPR) had positive and significant effects on agricultural finance. Notably, GDP in the agricultural sector (lnGDPA) (-1.684, $p = 0.029$) and total assets (lnTA) (-0.03, $p < 0.05$) had negative short-run effects, indicating structural inefficiencies in channeling bank resources to the agricultural sector. The Impulse Response Function (IRF) analysis showed that a shock to recapitalization resulted in a short-lived increase in agricultural finance that dissipated over time, which aligned with the FEVD results, which indicated that recapitalization accounts for only a small but growing share of variance in agricultural finance. The sectoral analysis

employing fixed effects regression demonstrated the heterogeneous impact of recapitalization across economic sectors. While sectors such as services, commerce, and transportation attracted significantly higher loan disbursements relative to agriculture, the mining sector was the only sector with an inverse relationship. This finding confirms a sectoral bias in credit allocation, which necessitates targeted interventions to redirect credit flows toward agriculture. The McNemar's test revealed a strategic shift in agricultural credit risk management strategies, with banks transitioning from traditional collateral-based lending to data-driven, structured risk management approaches, including specialized agricultural credit scoring models. The cluster analysis identified three distinct lender profiles which are collateral-oriented lenders, balanced financial-statement-based lenders, and inclusive development-oriented lenders, with each adopting unique credit appraisal methodologies. Furthermore, Principal Component Analysis (PCA) identified five critical components influencing agricultural credit appraisal scores. These are risk-based factors, regulatory compliance, operational efficiency and technology adoption, market resilience, and collateral strength. These determinants reflect the multifaceted nature of agricultural credit assessment and justify the need for tailored credit models that account for both financial and non-financial borrower characteristics. The findings of the study affirm recapitalization as a secondary driver of agricultural credit, with macroeconomic stability and credit quality serving as primary determinants. This study contributes to literature by providing empirical evidence on the interactions between recapitalization, sectoral loan distribution, and agricultural financing or credit in emerging markets. The findings affirm the need for policy frameworks that not only strengthen financial institutions but also incentivize agricultural lending, ensuring that recapitalization reforms translate into sustained growth within the agricultural sector.

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DEDICATION

This research work is dedicated to my wife, Dr. Priscilla Agyeman Britwum and our kids, Nana Konadu, Nissi and Barima.

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LIST OF ACRONYMS

ADF – Augmented Dickey Fuller

ARDL – Autoregressive Distributed Lag model

BoG – Bank of Ghana

CAR – Capital Adequacy Ratio

CIEA – Composite Index of Economic Activities

CLSTL – Core Liquid Assets to Short Term Liabilities

ECM – Error Correction Model

ERP – Economic Recovery Program

FE – Fixed Effects

FEVD – Forecast Error Variance Decomposition

GDP – Gross Domestic Product

INF – Inflation

INT – Interest

IRF – Impulse Response Function

lnAF – Natural Logarithm of Agricultural Finance

lnGDP – Natural Logarithm of Gross Domestic Product

lnTA – Natural Logarithm of Total Assets

M2 – Broad Money Supply

MPR- Monetary Policy Rate

NPLA – Non-Performing Loans in the Agricultural Sector

NPLs – Non-Performing Loans

PCA – Principal Component Analysis

RE – Random Effects

RECAP – Recapitalization

ROE- Return on Equity

SDI – Specialized Deposits Taking Institutions

VECM - Vector Error Correction Model

CHAPTER ONE

INTRODUCTION

1.1 Background of Study

With a strong and effective agricultural sector, a country may be able to meet the food needs of its population, create opportunities for employment, earn foreign currency, and provide raw materials to feed its industries. Owing to the sector's multifaceted structure, its vitality has a multiplicative impact on any country's industrial structure and social composition. It is incontestable and unarguable that African nations should be self-sufficient in terms of food production and other agricultural products. The continent not only has been bestowed with a lot of naturally occurring farmland, but it also has favorable topographical conditions that encourage agricultural output all year round.

According to empirical data, the global demand and need for food is expected to grow in proportions exceeding 70% in the year 2050, prompting yearly investments in excess of Eighty Billion United States Dollars ($80b), the bulk and substantial part of which is earmarked to emanate from private individuals and firms (The World Bank Group, 2020). Development financial institutions are supposed to offer capital with the goal of achieving sustainable finance in all economic sectors as a result. It is on record that some financial organizations from developed nations offer unique financing initiatives that appear to be aimed at supplying the necessary funding for agriculture (Gerstlberger, 2020). Statistically, worldwide agriculture and farm credit increased by USD 201 billion (or 21 percent) in 2020, from USD 935 billion in 2012 to USD 1, 136 billion (Food and Agriculture Organization, 2022).

Generally, the study, evaluation, and analysis of the financial elements of farm business is often referred to as agricultural finance (Naik, 2021). These financial and monetary considerations cover issues with the production and disposal of agricultural products. The financial side of agriculture, it needs to be emphasized, encompasses the capital needed for it, the necessary funds raised, and the way those funds are used (Havemann et al., 2022). Agricultural finance, a key component of agricultural economics, is concerned with the administration and governance of financial farm units, as well as the supply and delivery of banking services (Onyiriuba et al., 2020). The need to invest in agriculture has gained an upward phenomenon in recent times as a result of the sharp increase in global population and the shifting dietary preferences of the expanding middle class in emerging nations toward higher-value agricultural products. Additionally, the requirements for expenditure to make agriculture more resilient are amplified and increased by climate threats.

Globally, studies have shown that agricultural financing is critical for achieving food security, reducing poverty, and promoting sustainable development (Viana et al., 2022; Wudil et al., 2022; Barrett, 2021). Unfortunately, the agricultural sector often faces challenges in accessing credit or financing due to its high-risk nature, seasonal variability, and lack of collateral. Financial institutions often play a key role in providing agricultural finance, but their ability to lend is influenced by their financial health, regulatory environment, and risk management practices.

In theoretical literature, recapitalization, according to Akande et al. (2020), comprises the issue of debt instrument, issuance of additional shares by existing stockholders, new investors, or a combination of the two by a company. In classical literature, recapitalization's objectives are to provide banks more clout in the market; hasten the process of reforms; and reorganization and reformation in order to achieve an efficient, clear, open, accountable and modest financial services sector (Rickards, 2020). A key objective of recapitalization is the need to stop system deterioration, regain public trust, develop robust and strong, capable, and competitive participants in the international space, and ensure longevity and perhaps perpetuity, and many other reasons that serve as a catalyst for better performance (Obuobi, 2019).

Recapitalization can strengthen the ability of financial institutions to lend to the agricultural sector through the improvement of their financial stability, and risk-bearing capacity. A case in point is after the 2008 global financial crisis, recapitalized banks in developed countries increased lending to agriculture, contributing to the sector's recovery and growth (Öztürk, 2024).

Agriculture is a key sector in Africa, and it contributes significantly to GDP, employment, and food security (Diallo & Wouterse, 2023). Empirically, several studies have described the issues with the agriculture sector in African nations, including works by Bjornlund et al. (2020), Zerssa et al. (2021), and Kim et al. (2020). It is worthy of mention that the main obstacle to agricultural development, as noted by the researchers above as well as others, is low investment or financing, in addition to the issue of peasant farmers' limited access to modern technologies. A malicious and vicious cycle caused by insufficient financing for agriculture has been reproducing itself on the continent.

In most African nations, improving access to funds marks an epoch making in the expansion of agriculture and economic sectors, as well as for improving people's standard of living. Available records as of 2017 gave indications that, the anticipated yearly financing shortfall for the agro-industry in jurisdictions which form part of countries south of the Sahara was One Hundred and Eighty Billion United States Dollars ($180b) (Garside et al., 2019). From time immemorial, agricultural funding has been largely unimpressive, accounting for over four per cent (4%) of total risk assets or loans in the entire economy of Africa (Koloma & Kemezi, 2022). Kituyi (2021) opined that for development experts and professionals throughout the developing world, scaling up agricultural finance to significantly improve and advance food security and fight poverty has been a crucial but elusive objective.

In many developing countries and in Africa, the financial sector has witnessed phenomenal changes in their operations as far as banking is concerned, especially over the past twenty years (Ocampo & Ortega, 2022). As a result of its outstanding importance to the economic growth of countries, bank recapitalization has generated and sparked debate across the entire public spectrum, among civil society organizations, bankers, policy makers and economic researchers. Researchers have opined that banking sector recapitalization is essentially a part of the restructuring of the entire financial services sector to enable banks to reorient and reposition themselves in the performance of their functions so as to achieve impressive financial performance and meet certain deliverables (Anastasiou, 2023). Recapitalization is, therefore, part of the entire approach employed to address the menace in the banking sector, including liquidity challenges and capital impairment, and to avert financial difficulties (Taskinsoy, 2023).

Again, in Africa, recapitalization has been used to address financial instability, as well as improving regulatory compliance, and promoting economic growth (Yakubu & Bunyaminu, 2023). For example, several African countries have implemented recapitalization programs to strengthen and make robust their banking sectors and enhance financial inclusion. Recapitalization is therefore particularly important in Africa, where financial institutions often face challenges such as weak corporate governance, high non-performing loans, high loan loss rates and limited access to capital.

Recapitalization can therefore improve the financial health of banks in Africa, enabling them to increase lending to agriculture. For example, recapitalized banks in Kenya and Nigeria have expanded their agricultural loan portfolios, and this has contributed to the sector's growth (Bolarinwa, 2023). This notwithstanding the impact of recapitalization on agricultural financing in Africa is understudied, accentuating the need for further research.

Access to financing as some studies have detailed, is of great importance to the development of the agricultural sector in Ghana primarily for providing working capital support, acquiring inputs (plants and agro-chemicals) and hiring labor, including the purchase of plant and equipment and the acquisition of machinery (Thapa, 2019). The fact that financing is virtually non-existent or inadequate where available, limits the total acreage of land that can be cultivated, thereby restricting and limiting the expansion of the agricultural sector which has dire macroeconomic effects and consequences (Zakharin et al., 2021). In Ghana, the key actors that play significant roles in funding projects and activities in the agricultural sector are microfinance companies, commercial banks, rural banks and savings and loans companies (Twumasi et al., 2020).

The three principal classifications of Ghana's financial system are the formal, semi-formal, and informal systems (Howard et al., 2020). In order to provide financial services under Bank of Ghana regulation, formal financial institutions must first be incorporated under the

Companies Act 2019 (Act 992), which grants them legal identities as limited liability companies. Subsequent to that, the Bank of Ghana (BoG) must grant them a license under the Banks and Specialized Deposit Institutions (SDI) Act 2016 (Act 930) Law 1989 or the Non-banking Financial Institution Law 1993. A key and instrumental component of the modern economy is the banking system. Banks, the world over, continue to play significant roles in the economies of countries, particularly in the financial sector of nations where it is on record that their capital markets are not efficient and lack sufficient strength.

In Ghana, the banking sector has expanded and grown exponentially after the central bank started granting universal banking licenses in 2003 to commercial banks. This notwithstanding, there are still drawbacks and limitations that should never be ignored (Kodiah, 2022). The banking industry prior to the granting of the universal banking license was smaller due to a constrained capacity for transactions. Again, in Ghana, three recapitalization programs have been implemented in the banking industry over the last sixteen years. Prior to the year 2007, banks were expected to maintain a minimum regulatory capital of GH¢7 million. There was a directive from the central bank for all banks to recapitalize and meet a minimum capital threshold of GH¢60 million in the year 2007. In the year 2012, banks were again directed to recapitalize and meet a minimum regulatory capital of GH¢120 million, and in the year 2017, the minimum capital for banks was raised to GH¢400 million by the central bank (Obuobi, 2019).

Generally, it is acknowledged (though not sufficiently and adequately emphasized) that financial institutions' nonconformity and deviation from accepted standards in the management of risk, particularly credit risk, has been one of the factors contributing to the severe financial crisis that has been ongoing since mid-2007. All commercial banking operations involve some level of risk, with credit risk being the most significant. Its adverse impacts include deteriorating loan portfolios, poor credit quality, increased impairment charges and increased loan loss rate. These have severe ramifications, and in some instances, can lead to the collapse of banks.

Notwithstanding the fact that inefficient credit risk management remains one of the key sources of a serious banking crisis, credit provision continues to be the principal activity of every bank in the world. According to Didier et al. (2021), the risk of debtors defaulting in part or whole of their obligations constitutes a key risk faced by banks, which can be expensive compared to other types of risks faced by banks. This is attributed to the fact that credit risk has marauding consequential effects on the financial performance of banks. The financial services sector in Ghana, therefore, has had a myriad of challenges especially between the years 2017 and 2019. This marked the period when the licenses of a number of financial institutions in the country were revoked as a result of inefficiencies and instability in that sector. The main cause of the revocation of the licenses of the financial institutions were as a result of poor corporate governance practices and poor credit quality which had caused the capital of those banks to be seriously impaired (Blankson et al., 2022; Bank of Ghana, 2018).

1.2 Problem Statement

In recent times, recapitalization program has been introduced in many countries especially in Africa notably Ghana and Nigeria (Akrofi & Antwi, 2020*).* In the year 2023, the Central Bank of Nigeria (CBN) announced that banks would be required to recapitalize to be able to service the $1 Trillion GDP economic vision (by 2030) of the new President (Khadijat, 2024). Similarly, Ghana's central bank, the Bank of Ghana (BOG) announced in 2018 that all commercial banks should recapitalize from One Hundred and Twenty Million Ghana Cedis to Four Hundred Million Ghana Cedis, in an effort to strengthen the banking sector and boost economic activities (Ghartey, 2022).

There are growing interests in the impacts of recapitalization policies enacted by central banks on agricultural finance (Rajagopalan, 2023). The concern that the increase in the minimum capital requirement of banks may lead to a simultaneous rise in lending rates, which may affect agricultural finance is a case in point. Again, some researchers have opined that recapitalization which often results in some mergers and acquisitions of banks, may create fewer strong banks which may create quasi-monopolies and reduce competition considerably in the industry and worse of all, reduce availability of agricultural credit in rural areas (Ifeanyi & Nfor, 2022; Feyen et al., 2021; Moturi, 2021; Brugger & Brugger, 2020; Ogbola, 2020).

Furthermore, it has been argued variously that there are unintended consequences of the policy of recapitalization on the affordability of financial products designed for agriculture (DePamphilis, 2019). When financial institutions recapitalize, they become stronger, especially when there are mergers and acquisitions. Such institutions stand to have an upper hand in bargaining as far as rates, fees and commissions are concerned. Stakeholders in the agricultural sector will therefore have to pay more for such services offered by financial institutions, resulting in increased financial costs and ultimately, the reduced profitability of their operations.

Another problem that has been identified to be associated with recapitalization is the issue of moral hazard, which is explained in this context as the sudden growth in the risk appetites of financial institutions which feel they may be immune from the adverse impact of this action (Didier et al., 2021). The resulting effect is that banks and allied financial institutions due to their increased risk appetites may thaw their stringent lending policies and lend to obligors in the agricultural sector who may not be entirely eligible for credit facilities (Sgambati, 2019). Banks' non-performing loans (NPLs) and loan loss rates may grow, leading to consequences for other stakeholders as restrictions on agricultural financing may be introduced. Eventually, agricultural productivity may be reduced following the inadequate flow of funding from financial institutions.

There are also instances of financial institutions wielding weighty regulatory influence after recapitalization. Such regulatory influences are occasioned by the increased capital base and resources of banks which have recapitalized and have become well placed to lobby and influence regulators to promulgate rules and policies concerning the banking landscape in their favor (James & Quaglia, 2020). In such instances, the power of regulators are diminished as they become amenable to dictates and influences from powerful financial institutions. The requirement to recapitalize at times leads to the purchase of other financial institutions that lean more towards agricultural credit, which results in considerable reduction in the number of banks that may be ready to support lending in the agricultural sector (Shapiro & Hanouna, 2019). The situation of reduced competition created often results in higher interest, fees and commission charges which affect the cost of credit in the agricultural sector.

Deduced from the preceding paragraph, the incidence of regulatory influence has direct ramification on regulators being independent of promulgating rules and policies to govern the banking landscape (Igan & Lambert, 2019). Such banks invariably may take on excessive risk as far as agricultural credit is concerned since rules have been made lax in their favor due to regulatory influence.

Better still, sectoral concentrations to the neglect of the agricultural sector is a key challenge related to banks' recapitalization. Following increased capital bases as well as mergers and acquisitions, financial institutions become dominant in the economy and the market (Carstens et al., 2021). Financial institutions, because of the boost in their market power, may prefer concentrating on sectors they deem more profitable and less risky, to the detriment of the agricultural sector. As hinted previously, such near-monopolies create situations where high interest rates as well as fees and commissions are charged, ultimately increasing the financial costs of stakeholders in the agricultural sector. Consequently, lending options for the agricultural sector become skewed and this affects agricultural finance.

Generally, recapitalization of banks which intuitively is expected to lead to a strong financial sector that can take on big ticket credits, may contrastingly result in difficulties in terms of access of agricultural credit (Dziwornu et al., 2024). The researchers (Dziwornu et al., 2024) opine that, recapitalization of banks in the context of quasi-monopolies created may reduce access to credit to small-scale farmers and/or make cost of finance extremely high for them through increased interest rates and bank charges, which can lead to reduced growth rate in the agricultural sector.

Antwi (2020) asserts that recapitalization of banks in Ghana has been an epoch making in the financial development of the country. Notwithstanding its phenomenal benefits, the researcher also shares the view that the policy can have adverse impacts on agricultural finance in the context of accessibility to the small-scale farmer and the emphasis given to sectors assumed to be more lucrative to the detriment of the agricultural sector.

Alhassan et al. (2022) are also of the view that the latest recapitalization program that commenced in 2019 in Ghana has had remarkable effects on key sectors of the economy, especially the agricultural sector. Again, the researcher is of the view that the impact of the recapitalization program on agricultural finance is still veiled at this point in time, and there is therefore the necessity to assess the effects as far as agricultural lending is concerned.

Langyintuo (2020) laments the lack of clarity of the recapitalization policy on access to credit for the small-scale farmer and other stakeholders in the agricultural sector in Ghana. Financial institutions often cite high credit risk, lack of collateral, and market volatility as barriers to agricultural lending. The recapitalization of banks, intended to enhance financial stability and lending capacity, was expected to mitigate some of these constraints. However, empirical evidence on whether the policy has actually improved agricultural credit allocation remains limited. There is also a lack of precise understanding on how the recapitalization policy has had an effect on the cost of credit for farmers and perception of agricultural credit risk among finance professionals and bankers.

Feyen and Huertas (2019) are of the view that even though the program of recapitalization of banks has been a recent worldwide phenomenon which is aimed at providing a robust financial sector institution, there are limited studies and an obvious gap on its effects on agricultural credit, as well as credit risk management strategies that banks have employed after the program to prevent incidence of rise in agricultural sector NPLs. This presents a critical concern due to the important role of agriculture in the economies of many developing and developed countries. There is therefore the need to research into the effects of recapitalization of commercial banks on agricultural finance.

Better still, there is currently no research after the recapitalization period that has established the effect of the recapitalization effort on the scope of financing granted to the agricultural sector. None, from the extant literature reviewed by far has investigated the heterogeneous effects of recapitalization on sectoral loans relative to the agricultural sector. Furthermore, despite the role of the importance of the management of credit risk in banks, especially with regards to businesses related to agriculture and their lending practices, no research after the recent recapitalization in 2019, has investigated changes in agricultural risk management and appraisal processes for banks in Ghana.

It is in light of these problems and gaps in the literature that this research seeks to identify the implications of the recapitalization of banks on agricultural financing in Ghana, and to assess the degree of heterogeneity in sectoral lending relative to the agricultural sector as well as changes in the agricultural credit risk management practices of banks after the recapitalization.

1.3 Research Objectives

The main objective of this study is to assess the impact of recapitalization on agricultural finance in Ghana by analyzing the extent of funding provided to the agricultural sector after the recapitalization. Specifically, the research aims to:

1. To assess the effects of recapitalization of commercial banks on agricultural finance in Ghana.

2. To analyze the heterogeneous effects of recapitalization on the disbursement of loans in various sectors relative to the agricultural sector in the Ghanaian financial landscape.
3. To investigate agricultural credit risk management strategies used before and after the recapitalization of financial institutions.

   To evaluate the agricultural credit appraisal process and determinants of credit appraisal scores.

1.4 Research Questions

The following questions are posed to enable the researcher to accomplish the objectives of the study.

1. What are the effects of recapitalization of commercial banks on agricultural finance in Ghana?
2. What are the heterogeneous effects of recapitalization on the disbursement of loans in various sectors relative to the agricultural sector in the Ghanaian financial landscape?
3. What are the agricultural credit risk management strategies used before and after the recapitalization of financial institutions?
4. What are the processes involved in agricultural credit appraisal and determinants of agricultural credit appraisal scores?

1.5 Justification of the Study

In every economy, the financial sector forms the bedrock for the development of all key sectors including the agricultural sector. The provision of finance to the agricultural sector through credit arrangements allows stakeholders in the sector to expand their farm operations and agribusiness activities. The financial sector, however, are at times bedeviled with challenges such as impaired and delinquent risk assets, insolvency and corporate governance issues that threaten their existence. These challenges also hinder access to agricultural credit, ultimately leading to low productivity in the sector. In that regard, therefore, many countries have promulgated recapitalization programs in an effort to strengthen the financial sector to be able to support productive sectors within their economies such as the agricultural sector. As such, this research will address issues regarding agricultural finance in the country which will be beneficial for the regulator in addressing challenges and shortcomings thereof. The findings of the study will also provide clarity on cases of skewed financing and credit arrangement to the detriment of the agricultural sector, which will allow the Bank of Ghana to advance deliberate policies to promote agricultural finance in the country.

The findings of this study will provide bankers and bank managers with the blueprint to base their convictions on developing new products that will increase lending in the agricultural sector. Such products will be tailor-made to address specific challenges confronting obligors in the agricultural sector and the difficulties that small-scale farmers encounter in accessing credit.

Again, the findings of the study will throw light on how the recapitalization program has impacted on lending across different sectors in the country. It will further increase awareness on the impacts of the program on lending across sectors, relative to the agricultural sector. This will therefore provide an understanding on the need to have deliberate policies enacted to boosted agricultural credit in the country.

Additionally, this study will provide illumination on how recapitalization influences the disbursement of loans across sectors and the behavior of banks in response to regulatory changes. Such knowledge can guide reforms in the banking sector in future. From the academic point of view, this study also sheds light on the bank recapitalization and sector lending patterns, which adds to the body of literature on banking and finance.

This work of research will also add to the body of empirical research on funding for sustainable agriculture, particularly from the viewpoint of developing economies. As sustainable financing in agriculture is an important tool for food security and economic growth, this study which also examines effective credit risk management strategies will inform practices that promote sustainable lending.

Finally, this study will bring to light the way agricultural credit risk is managed in the country. Since recapitalization often comes with structural changes to financial institutions such as increased capitalization, strategic shifts, and changes in management, it is important that an assessment on how these changes impact the way credit risk is managed is cardinal. This study therefore provides an evaluation on credit risk management strategies used before and after the recapitalization to enable regulators to assess the effectiveness of credit risk in the financial sector.

1.6 Limitations of the Study

A key limitation of this study is the issue of the extent that the findings can be applicable to other geographical landscapes and economies. As the country's agricultural sector, as well as financial institutions are unique and have been affected by peculiar trends over the years, the findings may not be generalized over other jurisdictions.

Furthermore, the analysis of the objectives that required an official from each of the 23 banks could not support the employment of advanced econometric models. Currently, there are only 23 banks in Ghana after the recapitalization and this sample size did not allow for the adoption of advanced techniques such as regression analysis.

Exogenous factors such as the geopolitical turbulence in Russia and Ukraine, suspension of government flagship programs as fertilizer subsidy and planting for food and jobs as well as the Domestic Debt Exchange after the recapitalization program, may be the cause of significant macroeconomic fluctuations in the country. This observation is a key limitation as an objective of the study employed time series data on inflation and interest rates which their volatility as a result of the exogenous issues may introduce some noise in the analysis and findings of this research. This may affect the ability to appreciate the real impacts of recapitalization program on agricultural finance.

Limited related research in this study that addresses the research questions hindered the building of methodologies and tools of analysis that had reference points from prior studies. Drawing meaningful conclusions from related studies applicable to heterogeneous impacts of recapitalization on sectoral loans disbursement relative to the agricultural sector and impacts on agricultural finance was limited.

1.7 Organization of the Study

This study has been organized into five chapters, each captioned based on the scope of work done. The first chapter gives an introduction on agricultural finance and recapitalization of financial institutions. It also contains sections that highlight the problem statement, the research questions and objectives, the justifications as well as the limitations of the study.

The second chapter gives a detailed literature review of related studies conducted, explanations of concepts employed, an overview of recapitalization as well as agricultural finance and trends in agricultural finance. Other sections also detail explanations of various econometric models employed and an empirical study, too.

Chapter three of this study provides an exhaustive methodological approach to achieving the objectives of the research. It touches on the conceptual, economic and geographical scope of the study, the study design, the sample size and sampling procedure as well as the reliability and validity of the research instruments employed. Other sections focus on a comprehensive discussion on the theoretical framework as well as the analytical framework.

Chapter four of the study presents the analysis and discussions to make meaning of the results featured. The various sections are discussed as per each objective and touch on the econometric models used to analyze the study data as well as relevant theories that can be linked to the results under each objective highlighted. The final section discusses the results of the primary data that analyzes the results of the final two objectives. The fourth chapter employs tables, and figures to aid the discussion.

The final chapter of this study summarizes the findings of the research and makes policy recommendations. The policy recommendations have been organized per each objective. There is a section after the final chapter that presents an appendix of the research questionnaires employed, and a tabular summary of the objectives, methodologies, and means of analysis, findings and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Chapter two of the research focusses on reviewing relevant literature comprehensively on the subject area. The conceptual issues of agricultural finance and recapitalization of banks are discussed on various perspectives in terms of definition, causes and trends. As part of the review, there was an extensive appraisal of relevant theoretical and empirical literature, related to the research area.

2.2 Overview of the Banking Industry

Historically, banking in Ghana began in 1896, occasioned by the move of the colonial authorities to start a financial services sector in the Gold Coast, as the country was referred to then. Thus, the British Bank of West Africa (now the Standard Chartered Bank), was started in response to the desires of the colonial government. Subsequently, the Barclays Bank DCO (now Absa Bank Ghana Ltd) in 1917 entered into the financial services space in the Gold Coast and commenced the businesses of providing commercial banking services (Anum, 2020). Both banks, the British Bank of West Africa and Barclays Bank DCO, were subsidiaries of reputable banks in the United Kingdom.

Their main business was to finance the trading activities of the major merchandizing companies from the United Kingdom who were doing trade business in the Gold Coast. At the time, they only financed trade activities between the Gold Coast and Great Britain. Thus, these banks neglected the financial inclusion needs of the local economy and the people, and this generated a lot of pressure from the locals towards the colonial government

(Lassou et al., 2019). As a result of the continuous agitations on the financial exclusion meted against the indigenous people, the colonial government mandated Sir Cecil Trevor in 1951, to conduct research into the feasibility of banking business in the Gold Coast (Davidson & Louis, 2023). This was to precede, based on the findings of the study, the establishment of a national bank. He recommended the formation of a bank that has part-ownership from the government with local management and staff. He also indicated that the main objective of the bank was to operate as a value adding financial institution for the indigenous businesses as well as serve as a banker to the government. The new bank was to have a novel mandate then, as a banker to the government and had the task of assisting in the issuing of government bonds on the capital market. Thus, in 1953 and based on the favorable recommendations of the study, the Bank of Gold Coast was established (Wiafe, 2021).

Over the years, there have been different legal inroads in the Ghanaian banking system both at the central banking level as well as within the commercial banking space. In terms of the central banking laws, the first law was the Bank of Ghana Ordinance (Number 34) which was passed in March 1957 to establish the Bank of Ghana and has been appropriately amended and replaced over the years. In 1963, the Bank of Ghana Act of 1963 (Act 182) was promulgated to repeal and replace the ordinance. The central bank, later in 1965 revised portions of Act 182 (Amendment Act of 1965, Act 282). Together, these two Acts (182 and 282) governed the practice of banking in Ghana until their replacement in 1992 by the Bank of Ghana Law of 1992 (PNDC Law 291). The Bank of Ghana Act, 2002 (Act 612) was the result of the repeal and replacement of PNDC Law 291, after a decade of operation. Currently, Bank of Ghana operates under the Bank of Ghana Amendment Act, 2016 (Act 918).

Between 1980 and 1990, there was an unprecedented loosening of government grip and control in the banking space. This period also marked the economic recovery phase and the entire liberalization process, was grounded on the promulgation in 1989 of the Banking Law, PNDC Law 225. The government of Ghana in 1975 acquired 40 per cent stake in the two pioneer banks, Standard Chartered Bank Limited and Barclays Bank Limited. This ownership was later given to the private sector in 1992, as part of the government's agenda towards the privatization of some state-owned banks.

The period of liberalization of the financial services sector at the time witnessed the entry into the banking space of a myriad of foreign banks. Other indigenous banks also sprung up during the period. The repeal of the Banking Law 1989 (PNDCL 225) saw the promulgation of the Banking Act, 2004 (Act 673). The Banking Act, 2004 (Act 673), was the driving force behind the abolition of secondary reserves, and modification of the minimum capital requirement of banks, as well as the introduction to universal banking (Wiafe, 2021). In February, 2004, the central bank lifted restrictions on the scope of banking in Ghana and introduced the universal banking business license (Kodiah, 2022). This move witnessed the directive for the capital requirement for foreign banks to be increased to Sixty Million Ghana Cedis (GH¢60 million) and Twenty-Five Million Ghana Cedis (GH¢25 million) for indigenous banks (Twumasi-Ampong, 2020).

The Banking (Amendment) Act, 2007 (Act 738) was passed to amend the Banking Act of 2004 (Act 673) to consolidate the law relating to the business of banking in Ghana. The

Foreign Exchange Act 2006 (Act 723), Credit Reporting Act 2007 (Act 726), Borrowers and Lenders Act 2008 (Act 773), Home Mortgage Finance Act 2008 (Act 770) and Anti-Money Laundering Act 2008 (Act 749) are some of the legislations passed to strengthen the sector. In recent past, the attempt to ensure sound regulation has led to the promulgation of the Banks and Specialized Deposit-Taking Institutions Act, 2016 (Act 930) and the Deposit Protection Act, 2016, (PwC, 2018).

Despite the attempt to enact policies that will create a robust regulatory structure for the financial services sector in Ghana, the industry has been bedeviled with challenges and has culminated in the withdrawal and annulment of the licenses of some banks (BoG, 2018). In 2017, the central bank directed all commercial banks in the country to increase the minimum capital requirement from One Hundred and Twenty Million Ghana Cedis (GH¢120 million) to Four Hundred Million Ghana Cedis (GH¢400 million) to take effect by the end of December 2018 (BoG, 2019). As of June 2018, thirty-four (34) banks were operating in Ghana with Class 1 banking license (PwC, 2018). Consequently, the recapitalization has resulted in the reduction of the commercial banks from 34 to 23, as of the year 2019 (BoG, 2019).

On asset quality in the financial services sector in Ghana, the central bank usually reports on the stock of non-performing loans through its banking sector report issued periodically. According to the November 2018 financial services sector report by the Bank of Ghana, the level of NPLs in Ghana's banking industry, which stood at GH¢8.3 billion in October 2017, reduced to GH¢7.14 billion in October 2018 (BoG, 2018). The stock of non-performing loans ratio in the industry contracted by 14 per cent as compared to the year before when it had grown by 27.2 per cent. The improvement in non-performing loans ratio in the sector was largely driven by the various policies as well as the efficient monitoring of effective credit risk management practices of the various commercial banks which sought to create a robust and stabilized banking industry (PwC, 2018). This achievement, according to the report, did not stand in isolation of strict controls of the credit policies of the banking sector and also the transformation of the debts in the energy sector into bonds.

2.3 History of Recapitalization of Banks in Ghana

Banking in Ghana commenced in the 1950s following the establishment of the Standard Chartered Bank and the Barclays Bank DCO. Subsequently, the Bank of Ghana was established in 1953 by the Bank of England (Stockwell, 2013). At the time, the Bank of Ghana was operationalized into two, thus, the Ghana Commercial Bank which will later become the largest commercial bank in Ghana having all public sector accounts domiciled there and also, the Bank of Ghana, which became the central bank.

The Gold Coast became Ghana after gaining self-government from Britain in 1957. As anticipated, the central bank took control over the issuing of currency and money supply and introduced Cedi as a replacement for the previous currency notes in 1958. Ghana Commercial Bank started managing the finances of the majority of government agencies and public enterprises after assuming the position and duties of government bankers.

The operations of all commercial banks in Ghana are supervised and regulated by the Bank of Ghana. After independence in 1957, the government established additional banks to facilitate the rapid economic development of the country. These banks were mandated to provide distinct services to meet the economic and financial needs of the populace. The

National Investment Bank and Agricultural Development Bank were tasked with promoting investment banking and agricultural development respectively, in the country. The Merchant Bank and Social Security Bank were also mandated to promote banking among traders and merchants and promote the culture of savings among the citizenry, respectively. These banks were legally incorporated between the years 1957 and 1965. The object of the founding of these banks at the time were to have some state banks which will provide specific services in accordance with the economic philosophy of the country at the time (Oduro, 2016).

Due to the adoption of socialist ideology in the 1960s, the country witnessed some economic turbulence which manifested themselves in trade deficits, currency depreciation and challenges with imports and exports (Obuobi et al., 2019). Up until 1983 when economic socialism gave way to a capitalist economy, this dilemma persisted which resulted in periodic economic challenges at various times. The timing of the economic crisis therefore, and their connection to increasingly deteriorating economic conditions in the late 1970s is worth noting (Obuobi et al., 2019).

To achieve fast industrialization, there were myriads of government interventions in key aspects of the economy. As part of an overarching plan to industrialize the economy, various financial policies were devised. By the 1970s, concerns like credit limitations and interest rate regulations had ensured that the government's flagship initiatives and key industries had difficulties accessing finance (Amanor & Chichave, 2016).

Around the same time, the government had increased the tax commitments and liabilities of the banking industry, in order to generate substantial revenue. The banks were again

made to observe stringent cash reserve requirements and this, together with other inimical and restrictive policies, led to significant banking sector distortions (Alagidede, 2016).
In 1982, the government of Ghana commenced a program to privatize state-owned banks, as part of deregulation in the financial sector. This resulted in an increase in the number of private banks in the country and the admission of several international institutions into the banking space (Obuobi et al., 2019).

In an effort to rebuild the economy and buck the general trend of economic decline, a program for economic recovery was started in 1983 prior to the commencement of the Financial Sector Adjustment Program. This made it abundantly evident to the managers of the economy that if reforms were to culminate in a sustainable rebound of economic stability and growth, a reorganization of the country's ailing banking and financial sector needed to be pursued.

The acute economic challenges witnessed the initiation of the Economic Recovery Program (ERP) in 1983 by the government. Key among its objectives was the need to ensure a robust economy which could support growth of the private sector. Furthermore, the program was also expected to achieve improvements in the country's foreign exchange regime, deregulation of various economic activities and extensive measures to ensure price stabilization (Aryeetey & Fenny, 2017).

In 1987, the government of Ghana initiated the Financial Sector Adjustment Program to improve banking and the financial sector, which had witnessed serious turbulence (Frimpong, 2021). The program was expected to improve savings culture and deposit mobilization in the banking space, reduce the unbanked population and ensure a healthy competition in that sector. There was, however, a large disparity between deposits and lending rates at the time.

In 1989, a law was passed that allowed qualifying government entities to submit applications for the award of licenses to establish banks in the country. As a result, some corporate entities such as the Meridian (BIAO) Trust Bank, CAL Merchant Bank, Allied and Metropolitan Bank and Ecobank, were granted banking licenses to operate as banks (Osei et al., 2019).

In the year 2004, a new banking act was passed with the objective of amending the minimum capital requirement and completely abolish the system of banks maintaining a secondary reserve. Subsequently, the minimum capital was raised from Seven Million Ghana Cedis (GH¢7 million) to Sixty Million Ghana Cedis (GH¢60 million) in the year 2007. In the year 2012, the minimum capital was raised again to One Hundred and Twenty Million Ghana Cedis (GH¢120 million), in order to strengthen banks and to support economic growth (Ackah & Asiamah, 2016).

The commencement of universal banking in the country as a policy direction by the Bank of Ghana resulted in the abolition of the three-system of banking which were development, commercial and merchant banking. At various times from the start of the granting of universal banking license and as part of measures to meet new capital requirements, many banks have either been merged or acquired. Cases in point is the acquisition of Intercontinental Bank by Access Bank, the takeover of The Trust Bank by Ecobank and the purchase of HFC Bank by the Republic Bank of Trinidad and Tobago (Mensah & Onumah, 2017).

In recent times, the Bank of Ghana commenced an operation to clean-up the banking system in order to protect and safeguard depositors' funds and prevent the collapse of the system through widespread bankruptcies (Amenu-Tekaa, 2022). This exercise was warranted by poor management, inefficient credit risk management practices and serious impairment of the capital of some commercial banks in the country. The central bank was driven to further investigate all banks in order to ensure a healthy financial sector, which development was occasioned by the mishandling and misapplication of depositors' funds and serious breach of regulatory capital requirements. As a result, the central bank decided initially to shut down Capital Bank and UT Bank, which allowed the GCB Bank to take control of them through a directive of the government of Ghana. Subsequently, Bank of Ghana revised the minimum capital requirement for all commercial banks in the country including new entrants from One Hundred and Twenty Million Ghana Cedis (GH¢120 million) to Four Hundred Million Ghana Cedis (GH¢400 million). This represented an increase of over 200%, which needed to be met by December, 2018, in accordance to Section 28(1) of Act 930 (The Banks and Specialized Deposit-Taking Institutions Act, 2016). According to the Bank of Ghana, the recapitalization was necessitated by the urgent need to stabilize the economy, strengthen the banking system to ensure that banks were positioned to absorb shocks and support businesses (Bank of Ghana, 2019). At the time, banks were given three alternatives for raising more capital: capitalizing income surplus, injecting new capital, or combining both of these.

Out of the 34 universal banks which existed before the recapitalization process commenced, 20 commercial banks had met the new capital requirement of Four Hundred Million Ghana Cedis (GH¢400 million) at the expiration of the deadline. According to the

Bank of Ghana, sixteen banks met the new capital requirement through either new capital injection or capitalizing their retained earnings (BOG, 2019). The banks which recapitalized as at the December, 2018 deadline included Ecobank, Stanbic Bank, CGB Bank, Barclays Bank, Standard Chartered Bank and Zenith Bank. The rest are Access Bank, Bank of Africa, FBN Bank, Cal Bank, United Bank for Africa, Societe Generale Bank, Guaranty Trust Bank, Republic Bank and Fidelity Bank.

During the period of the recapitalization, Bank of Ghana approved three requests from some commercial banks for mergers, as they were unable to comply with the capital requirements. Thus, First Atlantic Bank merged with Energy Bank, Omni Bank and Sahel Sahara merged and First National Bank and Ghana Home Loans Bank also merged as well (BOG, 2019). Subsequently, three banks were formed that joined the list of banks that had met the new capital requirement through injection of new capital or capitalization of their income surplus.

Five indigenous banks which had difficulties meeting the new capital requirement received funds from pension funds through the Ghana Amalgamated Trust Limited, which served at the time as a special purpose holding company. These banks are Prudential Bank, Omni-Sahel Sahara Bank, Universal Merchant Bank, Agricultural Development Bank and the National Investment Bank. These banks, according to the central bank, had been assisted to recapitalize because of their proven track record of efficient corporate governance practices and their solvent financial standing (Bank of Ghana, 2019).

During the period of the clean-up, the central bank revoked the licenses of nine commercial banks in the country. These banks, according to the Bank of Ghana, had seriously impaired capital which meant that they were insolvent and unable to pay their depositors. These banks included the Royal Bank, Beige Bank, Construction Bank, UT Bank, Heritage Bank, Sovereign Bank, Premium Bank, Unibank and Capital Bank (BOG, 2019).

2.4 Conceptual Review of Recapitalization

Reviews from the extant literature indicate that recapitalization has been variously defined by academicians and authors. Acharya (2020) defines the concept of recapitalization as a financial rescue strategy initiated by the central bank of a nation that may involve capital injections, and/or the outright purchase of banks that are under-capitalized by well-capitalized banks.

Dahir (2019) defines recapitalization as the increase in the capital base to serve as a buffer and again, as a safety net that can absorb the ripples and waves caused by financial crisis due to various reasons, and as a tool to stem the adverse impact of such crisis. Adetona et al. (2020) also defines recapitalization as the change in the capital structure of an organization.

Furthermore, reviews and studies from the literature indicates largely that, recapitalization of banks ensure that these banks become more resourced to accommodate big ticket lending, ensure their efficiency and have sufficient buffers to withstand adverse macroeconomic conditions and thus, subsequently be able to compete in an economy along the framework of stability, which is consistent with the Basel III capital requirements (Dombret, 2020). With regards to banking stability, market share and survival are the two main performance issues. Bank survival generally plays an important role in the strategic decisions of regulators, and this always necessitates periodic recapitalization programs

(Akujuobi et al., 2021). There are a number of businesses and financial institutions which have as their main focus, an increase in market share and this they use to benchmark their performance with their peers (Le & Ngo 2020).

A key aspect of bank recapitalization is the participation in the stock market by troubled financial institutions that have issues with capital impairment and insolvency. Capital can be injected through the issue of shares or the participation and engagement of private investors (Merton & Thakor, 2022). Therefore, Bersch et al. (2020) opined that the primary aim of recapitalization is for financial institutions to efficiently manage the risk of insolvency or liquidity challenges. The researchers were of the view that in order for banks to mitigate such risks of insolvency, there may be the need to raise capital from the stock market to promote growth of these financial institutions in their balance sheet and invariably create a sound and robust banking environment.

Generally, banks' recapitalization is also occasioned by significantly reduced capital adequacy ratios below the regulatory benchmark of the jurisdiction. There are therefore positive effects of recapitalization on the minimum capital base of banks, their lending capabilities and their profitability (Ogbola, 2020).

Dafe and Rethel (2022) also opine that hitherto weak banks become strengthened and receive significant boost in their market shares and have sufficient buffers to withstand systemic and macroeconomic risks owing to bank recapitalization. The researchers further assert that recapitalized banks demonstrate an improved capital base that is able to accommodate big ticket lending and are able to withstand the ramifications of banking crisis.

Shahin et al. (2021) in their study that employed return on equity, return on assets and net interest margin as proxies for analyzing bank performance, found a positive significant effect of banks' recapitalization on their performance.

2.5 Methods of Recapitalization

Ray (2022) suggests that mergers and acquisitions are the most popular methods of recapitalization of banks. Ogbola (2020) also hints that mergers and acquisitions as methods of recapitalization are key mechanisms that result in the external growth of financial institutions. Dikko and Alifiah (2021) are of the opinion that there are three main approaches to banks' recapitalization. These are equity issuance which is the sale of shares and stock to investors (either private or public), government intervention and sale of banks (mergers and acquisitions). The researchers explain government intervention as the protection provided by the central bank to financial institutions through bailouts.

2.5.1 Mergers and acquisitions

Generally, mergers and acquisitions are the key approach through which banks recapitalize. Mergers and acquisitions usually have a simultaneous effect of increasing the balance sheet sizes of banks and increasing the expansion and growth of the financial services sector. This has continued to be a viable alternative for banks to survive and for businesses to stay in operation.

Recapitalized banks are able to develop international influence and sometimes have global presence, especially through mergers and acquisitions. Such banks, through the process of mergers and acquisitions, are able to gain recognition and popularity and fastidiously achieve economies of scale and economies of scope in their operations, irrespective of whether the process was through private placement or public offering.

2.5.2 Equity issues

Equity issue is another approach adopted by banks that are experiencing challenges with capital impairment and insolvency and need to raise new capital or meet regulatory capital requirement (Gourinchas et al., 2020). Impliedly, businesses with stronger growth rates and capital constraints will choose equity offerings because these deals allow investors access and entry to public funds (Jensen, 2019).

Dikko and Alifiah (2020) indicated that banks that have challenges with meeting regulatory capital requirements have the option of issuing equity to private investors or floating shares in public offerings in order to raise substantial amounts of cash, as a method of recapitalization. Nonetheless, in instances where the existing shareholders are not enthused nor share in the opinion of acquiring more equity, they can sell their rights to new investors. Moreover, Shrivastav and Ramudu (2020) suggest that in order for financial institutions like banks to prevent and avoid becoming insolvent, they must recapitalize, which is in their common best interest.

2.5.2.1 Initial public offering

Initial Public Offering (IPO) is an approach or method through which a private company issues its initial and primary sale of shares with the aim to raise money on the stock market and become a publicly traded corporation (Hartana, 2019). Financing decisions for businesses are often difficult to assess and appraise, but they typically hinge and are contingent on the accessibility of financial instruments and other sources of funding (Omotosho, 2021).

Thus, the contemporary financial ecosystem and equity capital raised via IPO give business owners numerous alternatives to raise funds in various capital markets. However, Ali (2020) noted that securities traded through initial public offerings are beneficial to their subscribers in the following ways: raising equity and capital to ensure expansion and growth of businesses, having access to relevant information in an efficient market, improving the financial position of the business entity and boosting the confidence of financiers and private investors. Similar to this, Jog & Otchere (2019) provided evidence that a reliable underwriter lowers the long-term underperformance linked to IPO. Choosing the right moment to go public is one of the most crucial components of an IPO because timing affects the company's growth and prospects as well as its existing operating conditions and market dynamics (Meluzin et al., 2018).

One of the greatest ways for a firm to get equity capital today, according to academics and practitioners in the field of finance, is through an initial public offering (IPO). Liziska and Czapiewski (2018) examined the financial performance for three years in relation to equity raised through an initial public offering on the Bursa Malaysia (Stock Exchange of Malaysia) and concluded that, the three variables of the study, which were earnings to price, cash flows to price and book to market, outperformed growth targets. These findings are supported by market-adjusted returns.

Furthermore, among some of the more advanced microfinance institutions in some countries, raising capital through initial public offerings (IPOs) is now becoming more common. For instance, four prominent microfinance banks in Indonesia, Bangladesh, Mexico, and Kenya are listed on the various stock exchange markets of those countries, according to Ahmad et al. (2020). The four institutions are well known for their strong performance in the microfinance sector.

2.5.2.2 Private placement

Private placement, according to Alovisetti and Ayinehsazian (2020), is a private transaction in which equity or debt instruments sold to investors are not required to be registered. Then again, Batt and Morgan (2020) opined that investors are invited to subscribe or purchase security instruments in a private placement. The researchers are of the view that private placements are a rapid and less hazardous way for businesses to raise money without having to advertise for investors. They are also the least expensive way to raise equity capital because no prospectus is needed or required.

Due to the cheaper cost of raising capital and the ease of working with investors who may be few or large in number, or in some cases single, private placement has a number of advantages over public offerings (De Fontenay, 2019). Additionally, if equity capital is raised through private placements, retail investors who are legally barred from investing will have their economic and voting interests reduced or curtailed (Lim et al., 2021).

Growth prospects, ownership fraction, free cash flow, dividends, overvaluation, firm size, and ownership fraction are six determinant variables of the private placement that Chaung (2020) highlighted as traits of companies that participate in them. In a related study by Shahbaz (2023), the author also listed eight business criteria for private placement. These factors include shareholder structure, expansion, growth and investment prospects, earnings, solvency, cash reserve, dividend, and leverage.

2.5.3 Intervention approach

Government intervention is described by Rostagno et al. (2021) as a phenomenal central bank policy directive in response to continuous and substantial losses in the financial services sector. When the financial system in the United States of America (USA) crumbled within a span of two weeks, it is on record that more than Three Hundred Billion Dollars ($300 billion) in wealth and fortune vanished and this catastrophe traversed other countries of the world, causing the infamous great depression, and this trend of a long-running global financial crisis began (Siegel, 2021). According to the author, in the United States of America the sub-prime mortgage crisis occasioned a snowball effect that spread to other countries, causing their economies to falter and deteriorate, approximately eighty years after the first financial crisis.

According to Biscoff et al. (2023), one of the major methods of bank recapitalization is intervention. For example, in the United States, several efforts have been made to recapitalize banks through government intervention, especially during the ill-famed financial crisis through the Troubled Asset Relief Program (Cesaratto, 2021).

Additionally, research conducted comparing the financial performance of state banks and privately owned banks in India indicated that, as a result of government intervention, public sector banks' efficiency and credibility were higher than those of private banks (Jagannath & Maitra, 2023). Similar research was conducted on the Norwegian banking sector between 1988 and 1991, and it revealed that while both Norway and Japan experienced a financial crisis at the same time, Norway was able to overcome it in just four years, largely as a result of government intervention, while Japan's financial situation persisted (Dikko & Alifiah, 2020).

In contrast, Goodman (2020) examined the three stages of the financial crisis in Japan as well as the major measures taken by the government of Japan to address the crunch and also, demonstrate if interventions by the government were successful or a clear failure over the period. The researchers believed interventions by governments were effective tools for banks recapitalization.

In their study of a broad banking crisis that spanned from 1970 to 2011, Frydman and Xu, (2023) used six indicators to gauge the extent of bank intervention. These indicators were restrictions on deposits, state takeover of banks, restructuring, substantial support to cushion insolvent banks, sizable guarantees or sovereign undertakings and sizable purchase of assets.

In their study on the assessment of the impact of the intervention of government in the financial services sector in five prominent Asian countries; Taiwan, South Korea, Singapore, Japan and Hong Kong, Durrani et al. (2020) noted that, banks performance as measured by the profitability metric, liquidity, and management of credit risk, recorded significant improvement. Additionally, they argued that the evaluative financial metrics determine how the government's action affects bank performance.

Other intervention trials, however, have had opposite and contrary findings. Thus, some scholars contend and posit that government interference creates a quasi-monopolistic situation, invariably reducing competition in the sector (Anagnostopoulos, 2018).

Studies by Bulfone et al. (2023) provided evidence to the effect that state intervention is beneficial to financial institutions with political ties because these institutions are favored to have access to state fiscal assistance ahead of the competition and this has the tendency to negatively affect not only the financial performance of the financial sector but their efficiency too. In a related study, Bashir (2023) detailed other alternatives for state action and intervention which protects banks from challenges and crisis. These options available to the government and state, according to the author, are bailout and broad guarantees.

2.5.3.1 Bailout (capital infusion) approach

The main operations generally recognized in the financial services sector and the expansion of the economy are driven by banks (Aaij et al., 2019). Additionally, when banks are having problems, the government frequently takes steps to lower bank failure rates. Assistance from the state in the form capital injection and are often involved in such measures (Metrick & Schmelzing, 2023). For instance, the United States of America financial market crisis which had significant effects on the banking industry and the economy, caused phenomenal impact in the financial services sector, especially in banking institutions, resulting in an upsurge in insolvency challenges among banks and a considerable decline in banks' ability to recapitalize (Davidescu et al., 2022).

To avert a widespread financial collapse, the global financial crisis also led to a number of public bailouts for the banking industry (Herger, 2023). The main intervention mechanisms for enhancing bank performance are bailouts (capital injections), according to both available literature and national experiences (Hryckiewicz et al., 2020).

On the other hand, there is conflicting evidence in the empirical literature regarding the best bailout strategy to mitigate and stem the unfavorable effects of state interference in the financial services sector, especially in banks. Boccuzzi (2022) in his study noted that various researchers had explored the costs of state bailout intervention approaches and contributions to ensure the timely resolution of challenges related to the banking industry, without arriving at a firm and definite finding.

Furthermore, according to Nistor and Ongena, (2023), the adverse impacts of state involvement and intervention mechanisms on the strength of the banking sector are eliminated by liquidity provisions in the form of rescue measures. When there are inadequate options on the stock market and public investors are virtually non-existent, rescue interventions from the state that seek to inject liquidity and capital comes in as a formidable support (Lin et al., 2019).

Moreover, Gabor (2021) provided evidence that state interventions very often improve the monitoring mechanisms of banks and make them stronger. However, others who oppose these interventions (bailouts) contend that they harm the financial industry more than they help. The frequently used defense is that government interventions lead to a rise in moral hazard because of a loss of market discipline brought on by banks' expectations of bailouts (Peres, 2020). Furthermore, Rayssi et al. (2021) provide evidence that these activities lessen competition in the banking industry and raise the risk that unaided institutions must bear.

2.5.3.2 Blanket guarantee approach

During financial crises, the central banks of many nations often intervene by providing broad guarantees in an effort to increase the approval ratings by the public. According to (Gortsos, 2023), the financial services sector provided banks with protection through intervention by way of blanket guarantees or were bailed out through the actions of regulatory bodies, which are mainly the central banks of countries where these recapitalizations are called in to stabilize the banking sector.

Again, the blanket guarantee approach is initiated by regulatory bodies or central banks as a mechanism to safeguard the banks' non-core functions or as complete protection for bank liabilities. Additionally, blanket guarantees are thought to be a vital tool employed at different times when there is a financial crunch or widespread banking sector insolvency challenges (Laeven & Valencia, 2020).

The other research on intervention through a blanket guarantee has reportedly produced conflicting results, though. For instance, Almeida (2023) found the central bank could provide general assurances to anxious bank depositors to reduce speculative or panic withdrawals.

Although Dobler et al. (2021) noted that blanket guarantees have frequently failed to restore the public's confidence during financial crises. Dikko and Alifiah (2020) find no correlation between blanket guarantees and production, either positively or negatively.

2.5.4 Debt restructuring approach

The debt restructuring approach is often not the only indication of how a company has been bedeviled with financial challenges but may most importantly be justified as an effective strategy to lessen the impact of such financial distress. This allows ailing companies with a good chance of recovery to successfully avoid going bankrupt. According to Tedeschi et al. (2021), debt restructuring is described as a renegotiation to discover a different way to cope with financially challenged enterprises.

Furthermore, a debt restructuring transaction is described as one that specifies and details a debt obligation to replace a new one with the following criteria: the debt's maturity period is extended, mandatory interest payments or principal repayments are scaled back, and the providers of financial capital are handed over with equity instruments (Tan & Luo, 2021).

Better still, Ogbola (2020) underlines that one of the biggest recapitalizations can be successfully accomplished by turning debt of financial institutions or enterprises into shares. The researchers also stated that a different or additional strategy is for the government to put pressure on banks to pursue a more thorough recapitalization through reorganizing the debt of banks or firms with the translation of debt to common stock or ordinary shares and debt relaxation.

Dalio (2022) looked into one hundred and sixty-nine (169) fiscally burdened or troubled enterprises in 1978 and found that debt restructuring helped more than half of them succeed. Damijan (2018) also noted that the processes of debt restructuring appeared to benefit small and medium-sized businesses more than larger ones and that they restored financial soundness and greatly enhanced firm performance in Slovenia.

Furthermore, Kim et al. (2019) demonstrated that selling out shares or common stock during debt restructuring phase increases value to shareholders. However, Busenbark et al. (2022) found that enterprises were unable to enhance their performance even five years after debt restructuring, and they were performing worse than expected by the industry. Jiang et al. (2019) concluded that debt restructuring reduces the industry's capacity, drive, and opportunities for growth.

Some studies have found that debt restructuring has serious economic or financial ramifications or both, on the country if the process is through a state intervention (Kose et al., 2022; Neves et al., 2020; Stiglitz & Rashid, 2020). Some studies have suggested that the debt restructuring process should have laid out contractual agreements to make it effective (Liedgren & Kullberg, 2022).

2.6 Conceptual Review of Agricultural Finance

Generally speaking, agricultural finance is the study, research, and analysis of the financial elements of the farming industry, which is the main sector of an economy (Scott et al., 2022). Thus, agricultural finance is a specialized field of study that focusses on the financial aspects of the agricultural industry, which is one of the main sectors of many economies around the world. This field involves the study, research and analysis of financial elements that are essential to the success and growth of agricultural enterprises.

The financial elements include money concerns related to agricultural product production and disposal. A component of agricultural economics, agricultural finance deals with the administration of financial farm units and the supply and deployment of banking services (Onyiriuba et al., 2020).

A macro and local perspective are both used to analyze agricultural finance. Macro finance is concerned with the numerous funding sources for agriculture in the economy, as well as the lending processes, legislation, regulations, monitoring, and regulatory procedures of various agricultural institutions (Nyoro, 2019). Macro finance focuses on how to use total credit for agricultural development and also detail out comprehensive terms and conditions which support such credit agreements (Ibrahim & Alagidede, 2018). On the contrary, microfinance pertains to the financial administration of a single agricultural firm (Adebisi, 2020).

Agricultural credit risk is a key issue faced by financial institutions and banks. Due to the agricultural sector's volatile nature coupled with several exogenous factors such as weather, market dynamics, macroeconomic conditions and government policies, there is significant credit risk when it comes to lending in that sector (Temsas et al., 2022). Financial institutions therefore employ various credit risk management strategies to mitigate or reduce risk related to agricultural lending. Key determinants that have an influence on agricultural credit risk management strategies include obligor/borrower characteristics (credit worthiness of obligor), structure of facility, collateral type and value, market of agricultural produce, compliance and regulatory factors (Singh, 2021). Other determinants of agricultural credit risk include expertise of bank officers, monitoring and evaluation.

An important aspect of the credit administration of financial institutions when it comes to agricultural lending is the agricultural credit appraisal process (Adams, 2021). It generally involves extensive and rigorous evaluation and analysis of a host of factors to determine the creditworthiness of obligors as well as assessing the risk associated with agricultural lending. Generally, the credit appraisal process includes reviewing of request and supporting documents for credit, analysis of the credit worthiness of obligors, assessment of the security to support credit applications, and most importantly, the repayment capacity of obligors (Yhip, 2020). Other processing includes the assessment of the regulatory environment of obligors, loan structuring and agricultural credit monitoring.

Agricultural finance plays a pivotal role in promoting financial inclusion, especially among smallholder farmers and rural communities. These populations often face significant barriers to accessing formal financial services, including limited collateral, lack of credit history, and geographical isolation (Fahad & Wang, 2018). Developing innovative financial products and services tailored to the specific needs of these small-holder farmers is essential. This includes microfinance initiatives, mobile banking solutions, and agricultural insurance schemes that can mitigate risks associated with crop failures or livestock losses. Furthermore, promoting financial literacy and education in rural areas can empower farmers to make informed financial decisions and effectively manage their resources. Therefore, by enhancing financial inclusion, agricultural finance can contribute to poverty reduction, increased agricultural productivity, and overall rural development.

Most importantly, the integration of environmental, social, and governance (ESG) factors into agricultural lending practices is increasingly vital. Sustainable agricultural finance aims to promote environmentally responsible and socially equitable agricultural practices. Financial institutions should consider the environmental impact of agricultural projects, such as deforestation, water pollution, and greenhouse gas emissions. Promoting sustainable practices in agriculture, such as organic farming, precision agriculture, and agroforestry can contribute to long-term environmental sustainability and enhance the resilience of agricultural systems. Furthermore, ensuring fair labor practices and promoting social equity in agricultural value chains are essential components of sustainable agricultural finance.

It is worthy of mention that adopting a value chain finance approach recognizes the interconnectedness of different actors in the agricultural sector, from input suppliers to processors and marketers (Nkala, 2023). This approach involves providing integrated financing solutions that address the specific needs of each stage of the value chain. By financing the entire value chain, financial institutions can enhance efficiency, reduce transaction costs, and improve access to markets for farmers. This can also promote collaboration and partnerships among different stakeholders, leading to more sustainable and inclusive agricultural development.

Better still, technological advancements, such as digital finance, mobile banking, and data analytics, are transforming the landscape of agricultural finance (Cook et al., 2020). Digital platforms can improve access to financial services, reduce transaction costs, and enhance the efficiency of agricultural lending. Mobile banking solutions can enable farmers to access credit, make payments, and manage their finances remotely. Data analytics can be used to assess credit risk, improve loan appraisal processes, and develop tailored financial products. These technologies have the potential to democratize agricultural finance and empower farmers to participate more fully and wholly in the financial system.

Again, government policies, subsidies, and regulations play a crucial role in shaping the agricultural finance landscape. Thus, evaluating the effectiveness of different policy instruments, such as credit guarantee schemes, interest rate subsidies, and agricultural insurance programs, is essential (Magnan et al., 2022). Governments can also promote agricultural finance by investing in rural infrastructure, supporting agricultural research and development, and creating a favorable regulatory environment (Yahina et al., 2022). Public-private partnerships can also be effective in leveraging private sector resources to support agricultural development.

According to Pan et al. (2024), climate change is a major challenge for the agricultural sector, and it has significant implications for agricultural finance. This is because increased frequency and intensity of extreme weather events, such as droughts and floods, can lead to crop failures and livestock losses, increasing credit risk for financial institutions. Financial institutions therefore need to adapt to these changes by developing climate-resilient financial products and services, such as weather-indexed insurance and climate-smart lending. Promoting climate-smart agricultural practices can also enhance the resilience of agricultural systems and reduce the impact of climate change on agricultural finance.

2.6.1 Nature and scope of agricultural finance

Agricultural financing is studied at both micro and macro levels. Microfinance is concerned with many economic sources of funding for agriculture as a whole (Caballero-Montes, 2023). It also oversees and manages various agricultural credit institutions, as well as the lending process, laws, and regulations (Tsai, 2018). As a result, aggregate farm financing and macro-finance are related. Microfinance is the term used to describe the financial administration of individual farm business units (Sibuea & Siregar, 2023). It also looks at how a single farmer evaluates several credit sources, the sum of credit to be borrowed from each source, and how he distributes the credit among the many purposes on the farm (Kyire et al., 2023).

Microfinance is concerned with a variety of economic funding methods for agriculture. Microfinance is the financial administration of individual farm business units (Kayongo & Mathiassen, 2023). It is also concerned with the future spending of the funds.

2.6.2 Features of agricultural finance

Some of the unique characteristics of agricultural financing are outlined and explored below.

2.6.2.1 Risks in agriculture

In the agriculture industry, risks and uncertainties are challenging to foresee. Droughts, floods, and other natural disasters are just a few of the risks and uncertainties that a farmer must deal with. If one of these events occurs, it could seriously harm the farmer (Fahad & Wang, 2018).

Furthermore, agricultural produce deteriorates sometimes while in storage largely as a result of inadequate suitable storage facilities that can accommodate surplus produce in situations where supply outstrips demand (Jarman et al., 2023). Agriculture has traditionally been a difficult business for commercial banks to handle due to so many unknowns (Nkala, 2023).

2.6.2.2 Difficulties of co-operation in agriculture

The scope for cooperation in the agricultural sector is essentially minimal. This is due to the fact that most farmers are individualistic and skeptical of cooperating for a common objective (Ravikumar et al., 2018). This makes it more difficult for farmers to find affordable credit.

2.6.2.3 Economic lags and holdups in agriculture

There are times during the production process in agriculture that there are insurmountable gaps between labor and compensation, especially when there are obvious cost elements that are incurred (Cook et al., 2020). It is particularly at this time that the sector experiences fluctuating demand, thereby disrupting the fiscal position of farmers. As a result of this, farmers will have to deal with another source of uncertainty. Credit-granting organizations use this as an excuse to deny credit for agricultural activities (Aday, 2020).

2.6.2.4 Lack of proper securities

Large farmers can borrow money from financial institutions because they have their own resources (Magnan et al., 2022). Small farmers struggle to get the credit they need to meet their needs (de Santana et al., 2023). This is because small farmers lack sufficient assets to serve as security for loans and the resources to pay back those debts. Small farmers are consequently compelled to look for financial support from money lenders.

2.6.2.5 The complexity of many industries

Agriculture is a broad sector with a wide range of production and marketing methods. Each region has a different distribution of landholdings and types of land tenure. Because of these inequalities, farmers form a variety of complex partnerships that make funding the agricultural sector difficult (Ouma, 2020).

2.6.3 Challenges of agricultural finance

Agricultural finance is fraught with challenges, some of which have been detailed along the following lines.

2.6.3.1 Complicated procedures of loans

It has been revealed that there are a number of conditions that must be met in order to receive credit (Bryan, 2024). Most farmers lack education and are unable to supply the required information (Shah, 2021). Farmers choose to borrow money from money lenders as a result, even though they have to pay higher interest rates (Ladman, 2021). In addition, there is a protracted period of time between submitting a loan application and having it approved (Alessandri & Bottero, 2020).

2.6.3.2 Wastage of time and manpower

Urban areas are home to the majority of financial institutions including state cooperative banks and private banks (Minetti et al., 2021). Before a loan may be approved, farmers must fulfill a number of requirements which may involve multiple trips to the bank. Time and resources are wasted as a result.

2.6.3.3 Lack of coordination

Lack of coordination between cooperatives and commercial banks when it comes to credit planning is another problem with agricultural finance (Yahina et al., 2022). Credit therefore flows to areas with strong cooperative credit structures, leaving others without such a support at a disadvantage as far as accessing credit is concerned. Therefore, a shortage of money has contributed significantly to low agricultural productivity which has led to cultivator poverty (Reincke et al., 2018).

2.6.3.4 Low rate of share in development

Due to low productivity, agriculture only makes up a small portion of developing economies' growth (Pan et al., 2024). This is as a result of a lack of adoption of new technology. This evidence shows that commercial banks still believe that investing in business and industry is safer than doing so in agriculture (Al-Okaily et al., 2021). Additionally, a large share of all credit facilities is taken by wealthy farmers, leaving poor farmers at the mercy of dishonest moneylenders (Baradaran, 2020). The pattern of loan disbursement by co-operatives which are run by prosperous farmers completely isolating the poor farmers is also a case in point (Mohlala, 2020).

2.7 Trends in Agricultural Finance

Bank of Ghana, which is the country's central bank was established in 1957 just after independence. Government policies were then geared toward holistic development at a period which witnessed insufficient support for agriculture from both the public and private sectors (Kwame, 2020).

To increase production for export and food security, the First Republic's government swiftly implemented interventionist policies in the agriculture sector (Raheem et al., 2021). The interventions included the establishment of cooperative and state farms to grow crops like corn and rice. As at the time that the Structural Adjustment Programme commenced in 1983, these interventions were still active.

It was in response to these intervention programs of the commencement of cooperative and state farms that the government of Ghana established the Agricultural Development Bank in 1965 (Kunkel, 2022). The Agricultural Development Bank was mandated to provide finance to small agribusinesses and farmers who raise crops and cattle. In 1976, the government established the Rural and Community Banks, which were charged with the mandate to support and help economic activities in the rural areas such as agriculture (Danquah et al., 2017). Since then, the number of communities that these Rural and Community Banks mobilize and provide loans have climbed to over 500. Consequently, the government established the Apex Bank in the year 2000, which was mandated to regulate the banking operations of the Rural and Community Banks (Afari, 2021).

Again, in the year 2000, the Export Development and Investment Fund (EDAIF) was established and was charged with supporting Ghana's commerce activities. In 2011, it underwent a transformation to have mandatory oversight over the country's agro-processing activities (Owoo & Lambon-Quayefio, 2017). For the first phase of its "Cassava Integrated Enterprise Development Project" which aims to produce and process cassava on a big scale in three towns that produce it in three different regions for industrial usage and export, EDAIF received approval for Ten Million Ghana Cedis (GH¢10 million) in 2016 (Owoo & Lambon-Quayefio, 2017).

At various times in the history of the country, Bank of Ghana has initiated several intervention programs in the agricultural sector of the country. Such interventions include the Cocoa Bill Financing Scheme (1958), the Grains Bill Financing Scheme (in the 1970s) and the Grains Warehousing Company (1975) (Kolavalli & Vigneri, 2018). Other intervention programs in the agricultural sector initiated by the Bank of Ghana includes the Shai Hills Cattle Ranch (1973), the Wulugu Livestock Company (1979), the Agricultural

Development Company and the Jukwa, Okumanin, Fosu and Akwamsrem (JOFA) projects.

In 1979, 300 hectares of plantations were cultivated, which were part of the JOFA initiative. The funding was provided by the Bank of Ghana through the Agricultural Development Bank and this project performed satisfactorily in the Central and Eastern regions. It was in subsequent years that the State Farms Corporation took over this project. In 1983, right after the enactment of the Structural Adjustment Policy (SAP), the central bank realigned and reinforced its support for agriculture in the country. This was done through indirect programs like:

a. the creation of a monitoring team under the auspices of the Rural Finance and Inspection Department which will oversee the activities and operations of all the Rural and Community Banks;

b. the management of both donor and government funds and execution of projects that have the objective to ensure the development of food crops in the country;

c. The Ghana Women Fund Program, the Community Banks Refinance Program, and the Special Rural Credit Program.

The Ministry of Finance's assisted Rural Finance Programme (RAFiP) aims to give underprivileged rural residents and smallholder farmers credit facilities, extension services and training on various risk management practices (Naab, 2019). This programme has the goal to ensure that the rural folks, specifically women, the under-privileged and the youth, are assisted to be able to maintain a certain level of acceptable standard of living that is sustainable over time. It does this through connecting farmers with rural financial institutions.

Ghana's rural microfinance institutions (MFIs) have shown they can improve their own performance and are eager to assist an inclusive rural finance environment as major RAFiP partners. RAFiP encourages innovation in the microfinance industry since it is crucial that financial strategies, goods, and services are created to cater to the unique demands of underprivileged rural residents.

By executing its mandate of boosting performance of the various rural finance institutions under its ambit, building capacities among the public and sensitization of customers on various aspects of microfinance, RAFiP provides immense benefits to the country's microfinance institutions and the larger rural finance system. Consequently, productivity at various levels of the agricultural value chain is enhanced and farmers are afforded the chance to maximize the productivity of the acreage of land they cultivate.

The establishment and formation of the Out-grower and Value Chain Fund (OVCF) by the Ghanaian government in the year 2010, was the culmination of financial and extension support through bilateral association with Germany, through the KfW Development Bank (Naqvi et al., 2018). KfW Development Bank has been a strategic partner of the government of Ghana and has been providing sustainable and technical capacity building initiatives to farmers since 1961.

The OVCF provides credit support vehicle or tool which is used by the banking industry to provide funding for medium- and long-term initiatives. It is intended to close a financial hole in agriculture. The overall objective is to increase target group income, particularly for farmers that operate sub-optimum farmlands, enhance competition among farmers who operate on a commercial basis and other players along the agricultural value chain. The OVCF is also mandated to ensure the economic development of small-scale farmers,

farmers in rural communities who are under-privileged and provide support in the various poverty reduction programs and schemes. Therefore, the OVCF's main goal is to lend money on medium to long-terms to value chains that are commercially viable, especially out- grower programs. The development of small-scale commercial farms necessitates appropriate market connections and production management that ensures the produce meets the standards of the market. A key benefit of the OVCF is the immense support that it offers the out-grower farmers. The OVCF has a binding contract with the out-growers to provide technical assistance with a technical coordinator as lead facilitator, financial assistance which operates under some financial institutions, with some participating banks readily providing credit assistance and other essential services. Donor partners charged minimal interest rates so that participating financial institutions could lend money at prices below market rates.

The United States Agency for International Development (USAID) established the Financing Ghanaian Agriculture Project (FinGAP) in July, 2013, to address a significant barrier impeding the growth of commercial agriculture in Ghana: access to financing required to enable investment in agricultural value chains (Obiri, 2015).

USAID FinGAP was a comprehensive intervention that used a variety of pay for results approaches and substantial technical support to concurrently address impediments to the supply and demand for finance as well as the enabling environment. The initiative was created to support USAID's overarching objective of promoting broad-based, sustained, and equitable economic growth by facilitating extensive financing for three value chains crucial for food security in Ghana: rice, maize, and soy.

The Rural Enterprises Program was developed in the framework of Ghana's priorities for the growth of micro and small-scale enterprises and agricultural modernization, and it was launched by the Ghanaian government in December 2013 (Ali et al., 2021). The Rural Enterprises Program received funding from the International Fund for Agricultural Development (IFAD) to implement its activities. The Bank of Ghana provided oversight responsibilities on the initiatives of the International Fund for Agricultural Development in the country. Some of the key initiatives of the IFAD project include the Smallholder Credit Input Supply and Marketing Project (SCIMP), the Rural Financial Services Project, the Rural Enterprises Project and the Upper West Agricultural Development Project. The Bank of Ghana directly oversees the activities of the Matching Grant Facility, which is also an IFAD project that assists farmers who want to purchase machinery, and the Rural Enterprises Development Fund.

The establishment of the Ghana Export-Import Bank (EXIM Bank) in the year 2016, is another tool the government of Ghana employed to support agricultural finance in the country. The Exim Bank is an amalgamation of three state institutions, namely, the Export Development and Investment Fund (EDAIF), the Exim-Guaranty Company Limited (ECL) and the Export Finance Company Limited (EFCL). An Act of Parliament established the EXIM Bank; Act 2016 (Act 911) and it has a mandate to aid the Ghanaian government's pursuit of a workable and sustainable export-led economy (Agyapong, 2020). The Act of Parliament that establishes the Exim Bank also charges it to support agriculture in the country with regards to funding, facilitating the country’s export trade and ensuring that Ghana is competitive in terms of capacity and resources in the global market. The Exim Bank, among its five-year strategic goals (2017-2022) was tasked to increase the revenue derived from Ghana's non-traditional export from US$2.4 billion to $US5 billion. Also, key among its strategic framework was the mandate to reduce Ghana's import of poultry by US$300 million. The Exim Bank was also tasked to ensure the development of crops like avocado, cassava and oil palm and increase their exports. In the year 2017, the Exim Bank became a key partner of one of the government's flagship initiatives, the One District One Factory initiative, providing financial assistance to key players to support it.

Again, in the year 2017, the government launched another flagship project which is the Planting for Food and Jobs (PFJ) initiative. The rationale for this initiative was the need to ensure that modern practices were adopted in agriculture with the anticipated increase in food security, increased employment opportunities and considerable reduction in poverty. This initiative was expected to ensure the structural transformation of the economy.

This initiative has five components which are;

I. providing farmers with improved seeds at discounted costs (a 50% subsidy);
II. providing farmers with fertilizers at discounted prices (a 50% discount offer);
III. providing extension service to farmers which is supposed to be free;
IV. after-harvest ready markets for the products of farmers;
V. and E-Agriculture, a technological platform that uses a database system to track the actions and progress of farmers.

2.8 Autoregressive Distributed Lag Model (ARDL)

The Autoregressive Distributed Lag (ARDL) model was developed by Pesaran and Shin (1998). It was later extended by Pesaran, Shin and Smith (2001) and it is widely used econometric technique for modeling the relationships between variables in the presence of mixed orders integration especially when some are I(0) and others are I(1). Its main advantage in a time series analysis is the fact that it allows for both short run and long run relationships to be estimated simultaneously by using an unrestricted error correction mechanism (ECM).

The mathematic representation of the general ARDL (p, q) model for a dependent variable Y_t and an independent variable X_t is expressed as;

$Y_t = \alpha + \sum_{i=1}^{p} \beta_i Y_{t-1} + \sum_{j=0}^{q} \delta_j X_{t-j} + \varepsilon_t \ldots \ldots$ Equation 1

Where;

Y_t is the dependent variable

X_t is the independent variable

β_i and δ_j are the short run coefficients

α is the intercept

ε_t is the white noise term

P and q are the respective lag lengths of both the dependent and independent variables

In the context of agricultural finance, ARDL model can be used to examine the effects of macroeconomic and bank-specific variables on agricultural lending over time. Given the potential lags in the financial transmission mechanisms, ARDL appears ideal for capturing the lagged or delayed effects of banks recapitalization on agricultural credit.

2.9 Error Correction Model

The ECM is a statistical technique that is derived from the ARDL model when a long-run relationship or cointegration exists among variables (Matashu & Skhephe, 2022). It captures the speed at which deviations from the long run equilibrium adjust back or are corrected in the short run after some shocks. It is based on Engle and Granger's (1987) two-step procedure where they demonstrated that if two or more time series variables are cointegrated, their short term dynamics can be modeled while their long run equilibrium relationships are accounted for. The mathematical expression of the ECM is stated as follows;

$\Delta Y_t = \gamma_0 + \gamma_1 \Delta X_t + \gamma_2 (Y_{t-1} - \theta X_{t-1}) + \eta_t \ldots \ldots$ Equation 2

Where;

ΔY_t and ΔX_t are first differences

γ_2 represents the error correction term (ECT)

$Y_{t-1} - \theta X_{t-1}$ is the lagged residual from the cointegration equation

As far as this study is concerned, ECM assists in analyzing how deviations in lending caused by recapitalization or macroeconomic shocks are corrected or adjusted over time. This gives an indication of the resilience of financial institutions in agricultural credit.

2.10 Fixed Effects and Random Effects Regression

Fixed effects (FE) and random effects (RE) regressions are two extensively used econometric techniques for analyzing panel data. The fixed effects regression which is also known as the within-group analysis or entity specific analysis, controls for unobserved heterogeneity among entities. Fixed effects regression assumes that the entity specific effects are constant over the course of time and models these entity specific effects as fixed parameters (Broll et al., 2023). Thus, fixed effects regression tackles issues with unobserved factors that change across entities but are also constant over the course of time, as it accounts for individual characteristics. Fixed effects regression also tackles or helps to reduce endogeneity and reverses causality, which makes the model appropriate for causal inference (Leszczensky & Wolbring, 2022).

Random effects regression, which is also known as between group or entity specific analysis models effects specific to the entity as the randomness of variables, following certain (distributional) assumptions (Broll et al., 2023). By implication, the random effects regression assumes that the effects are not correlated with the independent variables. When the entity specific effects demonstrate variability and are not correlated with the explanatory variables, random effects regression is able to provide more efficient parameter estimates (Antonakis et al., 2021).

The choice between fixed effects and random effects regression is often done with the aid of diagnostic test as the Hausman test. Thus, the Hausman test is a statistical test that is used to determine the appropriateness of either the fixed effects or random effects regression (Abdullah et al., 2022). Its primary purpose is to evaluate whether the differences in the estimates of the parameters between the fixed and random effects are statistically significant.

2.11 The Relationship between Capital Adequacy Ratio and Credit

Capital Adequacy Ratio (CAR) is a regulatory measure that evaluates a bank's financial strength to effectively absorb losses and still remain solvent. It represents a key component of the Basel Accords, which are established as international banking regulations to ensure the stability of the banking system across the world (Keqa, 2021). Generally, CAR is calculated by dividing a bank's capital by its risk-weighed assets, expressed as a percentage.

The determination of capital adequacy requirements for banks, one of the pillars of the Basel III, has as an aim ensuring that banks maintain sufficient capital to adequately cover their risks (Lee et al., 2024). Basel III, an international regulatory framework developed by the Basel Committee on Banking Supervision, seeks to enhance the soundness and stability of the global banking system. There are implications for credit in the implementation of the Basel III, since this affects the capital allocation of banks and risk management practices (Pervez et al., 2022).

Several studies have opined that higher capital adequacy requirements are often associated with increased credit availability (Obadire et al., 2022; Le et al., 2023; Kim & Katchova, 2020; De Jonghe et al., 2020; Awdeh & El-Moussawi, 2022). This is attributed to the fact that when banks have stronger capital buffers, they are able to absorb losses and therefore have more appetite to extend credit to borrowers. On the contrary, other researchers are of the view that the transition to Basel III requirements may result in credit contraction (Porretta et al., 2020; Abderrazak & Lemqeddem, 2022; Pépy & Williams, 2022). This is explained by the need for banks to adjust their capital positions in order to comply with the new regulation. In the long term, however, the resulting increased stability and resilience in the banking system will support the continued provision of credit. Works by some scholars suggest evidence pointing to stricter capital requirements under Basel III resulting in higher interest rates on loans, especially for borrowers and sectors identified as risky (de Bandt et al., 2022; Csengo & Ayadi, 2023; Galardo & Vacca, 2022). This is also explained by the fact that banks may pass on the higher cost involved in holding capital to obligors in the form of higher interest rates on loans contracted.

2.12 Cointegration

Cointegration is an econometric tool that is used to assess the long run equilibrium relationships among variables, notably non-stationary variables in a time series (Gianfreda t al., 2023). The tool was originally developed by Clive Granger and other economists in the 1960s and 1970s (Frey & Gullo, 2020). These academicians were motivated by the need to explore the possibility of non-stationary items demonstrating properties of long-term equilibrium relationships. As far as econometric modeling is concerned, non-stationary data has phenomenal limitations. Non-stationary data generally have their mean, variance and autocorrelation not being stable over time. Popular and known traditional transformation methods as differencing have the potential of veiling the long-term relationships between variables. With cointegration, this situation is averted as the model circumvents this by identifying linear combinations of the variables that have unit root but may exhibit stationarity. Therefore, when two or more series in the data share the same or similar stochastic trend by integrating individually into order one, they are defined to be cointegrated (Gianfreda et al., 2023). Impliedly, even though there might be short term variations or deviations, the variables may maintain an equilibrium long-term relationship. A key methodological approach as far as cointegration is concerned is the Engle-Granger method. This is a two-way approach that involves a regression of the long-term relationships between the variables that have unit root (Sahed et al., 2020). Stationarity tests such as ADF is used to check the presence of unit root in the residuals. Residuals that are stationary or do not possess unit root highlight cointegration.

2.13 Vector Error Correction Model

The Vector Error Correction model (VECM) plays a role in modeling the dynamic relationships among variables that are cointegrated (Vuluka, 2020). With VECM, there is the factoring of short run dynamics and adjustments in the long run equilibrium as it builds on the concept of cointegration. Vector error correction usually emanates from the situation where time series variables that have unit root demonstrate features of a long run equilibrium relationship, notwithstanding that they are integrated individually at order one (Shao et al., 2021). Consequently, the error correction model ensures that deviations or digressions from the long run equilibrium is corrected and brought back to equilibrium over time.

2.14 Granger Causality Test

The Granger Causality Test (Granger, 1969) examines if the past values of a variable X_t helps to predict another variable Y_t. This test is a predictive relationship and not done to establish true causality. The mathematical expression of the bivariate Granger Causality Test is stated as follows;

$Y_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i Y_{t-i} + \sum_{j=1}^{q} \beta_j XX_{t-j} + \varepsilon_t \ldots \ldots$ Equation 3

$X_t = \delta_0 + \sum_{i=1}^{p} \delta_i X_{t-1} + \sum_{j=1}^{q} \theta_j Y_{t-j} + \mu_t \ldots \ldots$ Equation 4

If β_j is jointly significant, X granger-causes Y.

2.15 Empirical Review of Literature

This section reviews literature on related works as far the interaction between recapitalization, macroeconomic variables and bank-specific variables on agricultural finance is concerned, as well as sectoral credit dynamics. The section also reviews literature on credit risk management strategies, credit appraisal process and the determinants of credit appraisal scores.

Studies in developed economies often focus on the impact of regulatory changes and financial crises on agricultural lending (Poczter, 2016; Mariathasan and Merrouche, 2012). Research may therefore examine how increased capital requirements affect the allocation of credit to different sectors, including agriculture. Developed countries often have more sophisticated financial markets, so the impact of recapitalization might manifest differently. Studies on the impact of the 2008 financial crisis on agricultural lending in the US and Europe are cases in point (Beccalli et al., 2018; Ahrendsen et al., 2003). In developed economies, recapitalization often leads to increased risk aversion among banks which can negatively impact lending to sectors perceived as high-risk, such as agriculture. Also, regulatory changes have a significant influence on the allocation of credit, with capital requirements potentially diverting funds away from agricultural lending.

Also, developing countries often face unique challenges, such as underdeveloped financial markets, limited access to credit in rural areas, and high levels of informality in the agricultural sector (Dao & Nguyen, 2020). Studies in these settings may therefore examine the impact of recapitalization on financial inclusion, rural development, and food security (Gizaw et al., 2024; Akpansung & Gidigbi, 2014). Developing countries often have less regulatory oversight, and therefore the effect of recapitalization can be different than in developed countries (Islam, 2020). In developing countries, recapitalization can have mixed effects on agricultural finance. While it can strengthen the financial sector, it can also lead to a concentration of lending in urban areas and a reduction in credit availability for rural farmers (Asuquo & Ibiyingibo 2021).

African countries face specific challenges related to agricultural finance and these include high levels of poverty, vulnerability to climate change, and limited access to technology (Boateng & Dean, 2020). As a result, studies in this context may examine the impact of recapitalization on agricultural development, food security, and rural livelihoods. The effect of recapitalization, once again, is often tied to the countries' dependence on agriculture. In African countries, recapitalization can have a significant impact on agricultural finance, particularly in rural areas. According to Shah (2021), the effectiveness of recapitalization in promoting agricultural development is often influenced by the availability of supporting infrastructure and the quality of agricultural extension services.

Some studies specific to Ghana have examined the impact of recent recapitalization efforts on the country's agricultural sector (Oduro, 2024; Obuobi et al., 2019). These research focus on the effects on specific agricultural sub-sectors, such as cocoa production or aquaculture. Ghana has had multiple recapitalization efforts, and as a result the long term effects are able to be reviewed. Recapitalization in Ghana has had mixed effects on agricultural finance, with some evidence suggesting a reduction in credit availability for small-scale farmers (Oduro, 2024). The impact of recapitalization is therefore, often influenced by the specific characteristics of the agricultural sector and the effectiveness of government policies.

2.15.1 Empirical literature on the interaction between recapitalization, and macroeconomic variables on agricultural finance

Obuobi et al. (2019) conducted a study on assessing the impact of bank recapitalization on the performance of Ghana's banking sector. Employing a quantitative research design that included an ex-post facto approach, the authors analyzed secondary data from 2007 to 2018. The researchers adopted descriptive statistics and independent sample t-test to analyze bank performance indicators such as profit before tax, return on equity, growth in risk assets (credit) and non-performing loans. It was revealed in the study by the authors that recapitalization of banks led to enhanced performance in profitability and credit allocations to various sectors including the agricultural sector.

In investigating the impact of bank recapitalization on the performance of the agricultural sector in Nigeria, Bernadette (2017) employed data spanning from 1980 to 2015 and adopted a time series data framework. The researcher employed regression analysis for this study. Controlling for macroeconomic indicators, the study established the relationship between recapitalization of banks and agricultural output through credit expansion. The study found a positive correlation between bank recapitalization and growth in the productivity of the agricultural sector, buoyed by expanded access to credit.

The chunk of the literature that has been written on this subject focuses heavily on the growth and robustness of the financial sector and economic, as well as the financial performance of banks and macroeconomic conditions (Zeqiray et al., 2020; Abdu, 2022; Júlio & Maria, 2024). In economic literature, there is a knowledge gap and scanty related works concerning the correlation that exists between the expansions of the financial sector as far as capitalization is concerned and financing agricultural production.

Financial institutions typically offer effective ways of raising and allocating cash in the economy, helping to promote both economic and agricultural development (Raifu & Aminu, 2020). The authors investigated the effects of financial developments on agricultural finance in Nigeria. Employing the autoregressive distributed lag method of estimation in an annual data spanning from 1981 to 2016, the authors concluded that financial development initiatives have a positive effect on agricultural finance.

In analyzing the impact of recapitalization of banks on lending and bank risk following the financial crisis in Asia in 1997, Poczter (2016) employed unique bank-level data as well as difference-in-differences. The researcher found that there was a resultant increased lending, especially with larger banks to key sectors such as agriculture.

Akinkoye and Oyelami, (2014) investigated that impact of the recapitalization of banks on Nigeria's real sector, with a focus on agriculture. The authors employed a mixed research approach where quantitative data was combined with qualitative data which was gathered from interviews with various stakeholders in the banking industry and the agricultural sector. In their study, the Vector Autoregression was employed to assess the dynamic relationship between bank recapitalization and outputs from the real sectors including agriculture. The researchers found that bank recapitalization resulted in increase in credit to the agricultural sector, which ultimately led to increase in the sector's Gross Domestic Product.

In examining the features of public recapitalization of banks since 2008 and their relationship with bank credit or lending, Mariathasan and Merrouche (2012) conducted analysis that covered 15 OECD (Organisation for Economic Cooperation and Development) countries. The researchers found that large recapitalizations resulted in sustained loan growth.

Using datasets that emerged from the balance sheet of banks and firm level financial statements, Kashara et al. (2024) studied the effects of government bailout through capital injections to banks that were financially distressed during the Japanese banking crisis in 1997. Employing a treatment variable in a linear regression, the researchers found that banks increased lending to productive sectors including the agricultural sector after the recapitalization.

In investigating how capital regulation, including recapitalization in the banking industry affects the behavior of banks, Beccalli et al. (2018) investigated the effects of the policy among European banks between 2002 and 2014. The researchers also employed 306 seasoned equity offerings (SEOs) in their study and adopted a baseline fixed effect model. To also account for non-homogenous variance in their sample, they run three fixed effects models. The researchers found a decrease in lending in the short term followed by a subsequent increase in lending after the recapitalization of banks.

Oduro (2024) analyzed the effect of recapitalization of banks on dividend policies on the financial sustainability of rural and community banks in Ghana. Adopting a panel data approach and collecting data from multiple rural and community banks, the researcher employed both fixed and random effects model to evaluate the impact of recapitalization on financial sustainability metrics. The analysis revealed that recapitalization has a positive impact on financial sustainability of rural and community banks.

Ahrendsen et al. (2003) investigated the effects of mergers of banks, as a form of recapitalization, on agricultural lending among commercial banks. The study examined datasets of agricultural loan portfolios of banks that had been involved in mergers from 1994 to 2001. The researchers employed regression analysis to estimate static and dynamic restructuring as well as the direct and external effects of mergers. The study found that mergers as a form of recapitalization had a negative effect on the growth of agricultural credit.

In analyzing the interactions effects between agro-based production and economic development as well as financial development on agricultural finance, Zheng and Jean-Petit (2023) employed datasets from 350 banks between 2010 and 2019. Employing the Generalized Method of Moments (GMM) techniques, the study found that even though financial development had a positive influence on economic development, it had an insignificant effect on agricultural finance. This suggests that recapitalization, an aspect of economic development, does not directly increase lending in the agricultural sector.

Shaw et al. (2013) employed a tractable general equilibrium model with a banking system and investigated the macroeconomic implications on capital requirements. The authors found contradictory evidence against the hypothesis of a credit crunch where the increase of a bank’s capital requirement does not automatically increase a bank’s equilibrium quantity of loans. This was based on the caveat that such banks had the option of responding to capital requirements and accumulating more equity.

Also, Karim et al. (2014) conducted a study that compares Islamic and conventional banks in 14 countries which are members of the Organization of Islamic Conference (OIC) countries between 1999 and 2009. The study found that there was a strong positive relationship between capital requirements and credit growth.

Dao and Nguyen (2020) investigated the determinants of capital adequacy ratio and bank performance in Vietnam between 2010 and 2017. Using 128 datasets among 16 commercial banks in Vietnam, the authors found that there was a positive relationship between capital adequacy ratio and the performance of banks as well as credit growth and GDP growth.

Bateni et al. (2014) investigated the influential factors among Iranian private banks over capital adequacy ratio from the period between 2006 and 2012. The study found a positive relationship between capital adequacy ratio and loan assets ratio.

Furthermore, Nameen et al. (2018) investigated how capital adequacy ratio impacts lending of banks and their deposits behavior. Analyzing a dataset from 25 Pakistani banks for a study period of 10 years, the researchers employed panel data and found that CAR has an effect on change in loans.

Ananou et al. (2021) conducted research that investigated how liquidity had an impact on Dutch banks. Employing the difference-in-differences approach, the authors found that liquidity had a significant effect on the composition of loans among Dutch banks and loan portfolios too.

Thamae and Odhiambo (2022) reviewed theoretical and empirical literature on the impacts of the bank regulations such as recapitalization on lending across different regions and countries. The authors found negative results in some instances implying that the trade-offs between cost and benefit is a key factor. According to the authors, there were instances in the review of their empirical literature where static and dynamic models were employed and where they found positive results between bank regulations and lending.

Jiang et al. (2023) investigated the impact of bank capital and liquidity on lending in Middle East and North Africa. Employing unbalanced panel dataset from 55 banks spanning from 2010 to 2020, the researchers found a positive relationship between liquidity and bank lending. The authors opined that their results were robust to principal component analysis and other techniques such as the bootstrapped-based bias correction fixed effects.

Gjeçi et al. (2023) also investigate the relationship between NPLs and the lending behavior of banks. Employing bank level data across 42 countries which spanned from the period from 2000 to 2017, the researchers found a statistically significant negative relationship between NPLs and bank credit growth.

Huljak et al. (2022) employed a panel Bayesian VAR model to investigate the impact of NPLs on bank lending. The results of an impulse response function revealed that an increase in the change in NPL ratios which is caused by exogenous factors tend to decrease the lending volumes of banks. Also, the forecast error variance decomposition shows that shocks to the NPLs ratio explain a large proportion of the variables in the VAR.

Haroon et al. (2020) used a dynamic panel approach to investigate the effects of macroeconomic indicators on NPLs including agricultural NPLs. The study sampled 37 banks in Pakistan for the period between 2004 and 2017. The findings of the study revealed that whereas GDP had an inverse relationship with NPLs, inflation and exchange rates had positive relationship with NPLs.

In a study conducted by Lemma-Lalisho (2022), the researcher investigated the determinants of NPLs in the Development Bank of Ethiopia. Specifically, the study examined, among other things, the effects of macroeconomic variables on NPLs including agricultural sector NPLs in the Development Bank of Ethiopia. Using datasets spanning from 1990 to 2019, the researcher adopted the ARDL model in time series data framework. The researcher observed that there was a significant negative relationship between inflation, GDP, interest rate and NPLs in the Development Bank of Ethiopia.

Nasya (2020) conducted a study on the effects of macroeconomic variables on NPLs of banks in Bangladesh using datasets from 1972 to 2017. Adopting the ARDL and Error Correction Model (ECM) in the framework of time series data, the researcher examined seven independent variables including three macroeconomic variables (broad money supply, GDP and real exchange rate) and considered NPLs, including NPLs in the agricultural sector as the dependent variable. Further using the unit root test to determine the stationarity in the time series data, the researcher revealed that there existed a significant positive relationship between broad money supply and NPLs. There was however, a negative relationship between real exchange rates, GDP and NPLs.

Christodoulou-Volos and Hadjixenophontos (2021) examined the determinant of NPLs in the banking sector in Cyprus. The research adopted the Generalized Method of Moments and correlation analysis as the means of estimations. The study further used a sample of

200 individuals engaged in various sectors including agriculture to conduct the research. The researcher concluded that there existed a positive relationship between inflation, interest rate and NPLs. There was, however, an inverse relationship between GDP and NPLs.

Purwanto and Sun (2021) in a study conducted to establish the determinants of macroeconomic indicators on NPLs on Chinese banks used 70 data points and seven selected companies listed on the Shanghai Stock Exchange in a panel data framework and further applied multiple linear regression as the means of estimation. The researchers concluded that interest rate and inflation rate have a significant negative effect on NPLs. GDP was found to have a negative insignificant effect on NPLs.

Funyina and Muhanga (2021) investigated the effects of bank specific variables and macroeconomic determinants on NPLs in the Zambian banking sector. Using the dynamic panel approach of co-integration as well as the Fully Modified Ordinary Least Square (FMOLS) model, the researchers used datasets spanning from 2010 to 2019 across sixteen banks. It was established that whereas GDP had a significant negative relationship on NPLs, interest rate had a significant positive effect on NPLs. Contrary to the expectation of the researchers, inflation had a significant negative effect on NPLs.

Singh et al. (2021) in research conducted to ascertain the effects of NPLs on the commercial banks in Nepal, used datasets from 2015 to 2019. Using multiple regression analysis, the study established that there existed a significant positive relationship of GDP and inflation on NPLs including agricultural NPLs.

Islam (2020) investigated the short run relationship between credit in the agricultural sector and agricultural productivity while employing other control variables and adopting the autoregressive distributed lag (ARDL) model. The researcher found that, access to agricultural finance in Bangladesh was limited by high interest rates.

2.15.2 Empirical literature on sectoral loan disbursement

It is generally believed that liberalization as well as the strengthening of the financial sector to have adequate capital buffers can enable it to act as the main driver for agricultural growth through agricultural financing. The strengthening of the financial sector is therefore the main catalyst to sustain economic growth whereas its weakening will result in passive responses in its dealing with the real sector's requirements, including those in the agricultural sector (Yindenaba, 2023).

Bridges et al. (2014) investigated how changes in regulatory capital requirements affected lending in banks. The researchers employed panel regressions of bank datasets in the United Kingdom spanning from 1990 to 2011. The researchers found that capital requirements have an effect on heterogeneous lending responses to different sectors of an economy. In their study, following the recapitalization, banks reduced lending to sectors as commercial real estates and other corporates.

Simatupang (1997) investigated the impacts of recapitalization on the performance of banks and real sectoral lending in Indonesia. Following the capital injection of banks by the Indonesian government, the study sought to ascertain, after five years of recapitalization, the real impact of the policy on the performance of banks and economic sectors. The study found a diverse impact of recapitalization across different sectors in

Indonesia. From the study, four sectors including the agricultural sector showed negative or stagnant growth in loans volumes.

Gizaw et al. (2024) investigated sectoral allocation of credit by banks in Ethiopia from 1991 to 2022. Employing a Cross-Section Augmented Error Correction (CS-ECM) model, the researchers found that credits allocated to the agriculture, industry and the services sector was negligible and credit was often misallocated to inefficient sectors of the Ethiopian economy.

Akpansung and Gidigbi (2014) analyzed the impacts of the Nigerian banking reforms on sectoral credit allocations as well as economic growth. Employing the Ordinary Least Square estimation techniques, the researchers found that notwithstanding the significant reduction in the number of banks following the banking sector reforms in Nigeria which included recapitalization, credit allocated to sectors such as agriculture, mining, manufacturing and communication had witnessed increases.

Wambugu (2019) studied the relationship between sectoral credit allocation by banks and their growth in Kenya. Employing the Autoregressive Distributed Lag (ARDL) model, the researcher found that there had been a positive growth in the agricultural sector lending by banks in Kenya. Lending to the manufacturing sector, however, witnessed a negative growth.

Müller and Verner (2023) in their study on the relationship between credit growth, macroeconomic fluctuations and financial crisis, employed a novel database from 117 countries from 1940. The researchers found that in times of economic booms, there is a disproportionate allocation of credit to other sectors, especially real estate, with the agricultural sector receiving fewer credit. The researchers attribute the growth in credit to these sectors to relatively easier lending and collateral conditions for these sectors.

Oladapo and Adefemi (2015) conducted a study that investigated sectoral allocation of credit and economic growth in Nigeria during periods of regulation, deregulation and guided deregulation. The researchers found that there was constrained lending to sectors such as agriculture, manufacturing, mining and construction. The researchers further recommended more favorable disposition of credit to these sectors.

Li (2022) studied the credit allocation from banks to economic sectors including State-Owned Entities (SOEs) in China. Employing the comparative static analysis, the researcher found that there was significant allocation of credit to SOEs because of government intervention. Credit allocation to private entities and other sectors including agriculture was negligible.

Asuquo and Ibiyingibo (2021) studied how bank credit to the agricultural sector affects the performance of that sector as far as its contribution to the Gross Domestic Product of Nigeria is concerned. Employing a time series data from 1981 to 2019, the researchers used an ARDL model, cointegration and Error Correction Model (ECM). The researchers found an insignificant positive relationship between credit to the agricultural sector and its contribution to GDP. The researchers noted that credit allocation to the agricultural sector is small and it is therefore not sufficient on its own to drive agricultural development in Nigeria.

Ubesie et al. (2019) studied the effects of credit allocated to different sectors on the Nigerian economy. The study spanned from the first quarter of 2008 to the last quarter of 2017. Employing the Ordinary Least Square (OLS) regression technique, the study found that there was disparagement in lending to the agricultural sector and this resulted in the insignificant result in the contribution of agriculture to real GDP in Nigeria. The study found similar results as far as sectors like industries, building and construction were concerned.

2.15.3 Empirical literature on credit risk management strategies

Scott et al. (2024) investigated which innovative approaches are employed by banks to mitigate credit risks. The researchers acknowledged the necessity of employing advanced credit risk management strategies to mitigate credit risk, especially in the current volatile economic environment across the world. The researchers found that traditional methods that were employed by most banks in addressing credit risks have become redundant and insufficient to address the complexities of modern financial markets. Such traditional approaches, according to the researchers, include historical data analysis and credit scoring. The study found advanced techniques such as the employment of machine learning models to predict probability of defaults, advanced analytics, visualization tools, block chain technology and algorithms and cutting-edge credit risk management techniques that advanced financial institutions and banks are employing to mitigate credit risk.

Using a qualitative research approach to investigate agricultural credit risk management policies by banks in Ghana, Nyebar et al. (2023) used semi-structured questionnaire in interviewing ten credit managers from each of the ten commercial banks that was studied.

The researchers found challenges with agricultural credit risk management such as poor book-keeping practices by obligors, no insurance schemes and lack of collateral. The research also established the absence of banking professionals with adequate knowledge of agriculture.

Studies by Boateng and Dean (2020) examined how borrower characteristics influenced agricultural credit risk management strategy. Using logistic regression, the authors investigated the relationship between borrower characteristics and credit risk and found that credit history, demand for obligor's agricultural products are key determinants of agricultural credit risk management.

Titus (2020) opined that agricultural credit which is well structured with appropriate security and repayment schedules are effective credit risk management strategies as they are linked with lower defaults. Using Mann-Whitney U test and Kendall's coefficient of concordance, the author found that financial institutions can mitigate credit risk by granting agricultural loans that are tailored to seasonal cycles and cash flows.

Fatemi and Fooladi (2006) conducted research on the credit risk management practices employed in the largest financial institutions in the United States of America (USA). The researchers employed the use of questionnaires that were mailed to the top 100 banking firms that had their headquarters in the USA. It was revealed in their study that counterparty default risk was phenomenal among the credit risks that banks faced, and a key strategy developed to mitigate this is the proprietary or vendor-marketed model.

In a study that focusses on risk management tools and a correlation between agricultural credit and risk management strategies, Helen (2023) opined that tools for managing agricultural credit risks include diversification of agricultural activities, group credit, guarantees, cash collateral/lien and effective loan structuring. The researcher sampled employees from three commercial banks in Nigeria and used the frequency table and chi-square as the means of analysis.

Rehman et al. (2019) conducted a study to identify the risk management strategies employed by commercial banks in the Baluchistan region of Pakistan. The researchers employed an explanatory study which analyzed the opinion of employees of commercial banks on credit risk management strategies that were effective in mitigating credit risk. From the study, it was revealed that corporate governance of firms that had requested credit facilities was deemed as the most important credit risk management strategy. Portfolio diversification and hedging were deemed as other important credit risk management strategies employed by banks in the Baluchistan region of Pakistan.

Ho and Yusoff (2009) conducted a study to investigate the types of credit risk management strategies employed by banks in Malaysia. The study employed a sample of fifteen banks and used primary data to achieve their research objectives. The study found that key credit risk management strategies employed by banks in Malaysia includes loan diversification, training and development of staff.

Omowole et al. (2024) investigated innovative approaches of credit risk management strategies that are employed by microfinance institutions. The study found that in current times, traditional methods of credit risk management may be ineffective. The study also found that innovative client profiling techniques as well as behavioral data, the use of big data to drive decision making on credit analysis, the use of predictive analysis and machine learning algorithms, real-time loan monitoring systems, enhanced training for credit officers and regular compliance checks are some of the modern and advanced credit risk management strategies employed by microfinance institutions.

Njanike (2009) studied how the lack of effective credit risk management strategies led to the collapse of the banking system in Zimbabwe between 2003 and 2004. The study identified credit scoring, assessment of obligors' financial statements and the update of insider lending policies as key credit risk management practices that could have partly averted the crisis.

Naresh and Rao (2015) investigated the credit risk management practices adopted by banks in India. The researchers employed the use of questionnaire and found that, credit risk management practices employed by Indian banks include risk-based pricing, credit insurance and derivatives, tightening (where loanable funds are reduced) and diversification of loan portfolio.

Addy et al. (2024) conducted a study on the use of predictive analysis in credit risk management among banks. The researchers employed qualitative research and reviewed literature extensively as well as reviewing real-world case studies. The researchers found that advanced credit risk management strategies include the integration of predictive analysis, the employment of machine learning algorithms, and ethical and regulatory compliance. They also identified challenges of credit risk management as data quality, scarcity of talent in credit risk departments of banks as well as ethical considerations.

Kwagara (2006) investigated credit risk management strategies employed by microfinance institutions in Kenya. The researcher employed primary data and further obtained information from journals and brochures on credit risk management. Results from 40 respondents indicated that majority of microfinance institutions in Kenya activated recovery exercise when an obligor defaulted on one repayment. Covenants with obligors on disposal of collateral, capacity as well as the character of obligors were key credit risk management strategies employed by microfinance institutions in Kenya.

Gyamfi (2012) studied the effectiveness of credit risk management strategies employed by microfinance institutions in Accra. 20 microfinance institutions were randomly selected. The researcher found that credit risk management strategies employed by these institutions include credit insurance, training and development of credit staff and the adoption of credit policy manuals.

2.15.4 Empirical literature on credit appraisal and credit scores

Chilukuri and Rao (2014) studied the credit appraisal process of banks. The study employed secondary as well as an extensive review of prudential requirements such as the Basel accord guidelines. The researchers found that loan review mechanism was an effective tool employed by banks in their credit appraisal system. The researchers also found that the review mechanism had as part of its scope the meeting of documentation requirements as conditions precedent and subsequent to disbursement, disbursement, and monitoring loan performance.

Sharma and Kalra (2015) studied the credit appraisal system of banks as far as micro, small and medium enterprises (SMEs) are concerned. The researchers acknowledged that the credit appraisal process starts with the first entry of the prospective borrower into the bank. The study indicated that the credit appraisal process include technical feasibility of the project for which the loan is being sought, financial feasibility to indicate if the business of the obligor will remain a going concern during the tenor of the facility, availability of security, personal interview by the credit officer with the obligor, market enquiries into obligors product line and capacity in the market and reviewing credit reference bureau report on obligor.

Hossain (2014) investigated the credit appraisal system of Uttara Bank Limited in Bangladesh in an exploratory study. The researcher found that the credit appraisal process in Uttara Bank Limited includes the evaluation of loan applications, preparing credit memos for loan approvals and monitoring of the credit facility after disbursement to mitigate against the incidence of missed repayments.

Bogatsu (2019) investigated the credit appraisal techniques of Land Bank, South Africa using structured questionnaires that were administered by the bank's employees in the Credit Department. The author found that agricultural credit appraisal techniques adopted by Land Bank include review of financial statements, high credit scores, strength of relationship with client and strong collateral.

Mohanty and Prakash (2019) investigated the credit appraisal process of project finance among banks in India. Their research article found that key project finance appraisal includes pre-screening, entity appraisal and review of project throughout its lifecycle.

Chepkorir (2011) conducted a study that investigated the credit appraisal processes for MSMEs of commercial banks in Kenya and established the relationship between the appraisal process and non-performing loans. The researcher employed descriptive survey designs on 41 commercial banks in Kenya. Primary data was also collected by the researcher by means of semi-structured questionnaire and further adopted multivariate statistics in analyzing the data. The study found that some of the appraisal techniques used by banks in Kenya include reviewing income statements, balance sheets, accounts receivables, and evaluating history of obligor involvement in business.

Ndero et al. (2019) conducted research on the relationship between credit appraisal process and the performance of loans in Uasin Gishu County of Kenya. The population of the study was the 39 commercial banks in the Uasin Gishu County of Kenya. The researcher found that the credit appraisal process was conducted through the 5Cs of credit, through credit scores and through credit reference bureau.

Onay and Öztürk (2018) conducted a review of credit scoring in the era of big data. The study surveyed credit scoring literature spanning over 41 years (1976 – 2017). The study also employed content analysis to review academic papers from 147 journals. The researchers found that some determinants include the use of non-traditional data sources as well as alignment of ethics and regulations in the business model of obligors.

Arya et al. (2013) in their work on the Anatomy of Credit Scores sought to investigate the determinants of credit scores. The researchers found that some of the determinants of credit scores are trustworthiness, availability of management team, income, and behavioral factors.

2.16 Theoretical Review

There are several theoretical frameworks within which recapitalization and agricultural finance can be placed.

2.16.1 The theory of finance and growth

Levine (1997) first proposed the finance and growth hypothesis. Levine opined that the role played by banks as financial intermediaries is essential for economic growth and expansion. The proponent of the theory further asserts that key economic sectors such as manufacturing rely on financial support from banks for their growth and development. As a result, financial institutions affect the production of each economic sector, including the agricultural sector. There is a favorable association between finance and Gross National Product per capita (Ghosh, 2015). Therefore, this theory emphasizes strongly the role the financial system plays in key economic sectors such as agriculture, particularly in developing nations where a strong financial system will assist economic growth.

2.16.2 Pecking order theory

The pecking order theory, also known in the world of corporate finance as the pecking order model, was first advanced by Myers and Majluf (1984). The theory postulates that finance managers consider a stratified hierarchy of financing or funding for their projects and investments. On top of the hierarchy in considering a source of financing for a project is income surplus or retained earnings, followed by debt and finally through equity (Mohamed, 2021). Therefore, agricultural finance managers may consider debt first over equity finance in instances where they need funding for agricultural projects and investments. Similarly, small businesses other than agricultural firms will have a strong preference for debt or external financing as against equity, to raise funds to increase their productivity and ultimately, increase the country’s GDP (Mazikana, 2019).

2.16.3 The financial accelerator theory

The main proponents of the financial accelerator theory are Bernanke, Gertler, and Gilchrist (1999). According to the theory, credit markets are procyclical, and the balance sheet effect as well as the system of information asymmetry that exist between obligors and lenders, both serve to magnify and spread shocks from the financial system to the economy.

The financial accelerator theory discusses how the significant impacts of credit transactions of companies are caused by little economic shocks. Again, the theory also suggests that because of economic shocks, borrowers may lack the capacity to borrow and may avoid borrowing or seeking other forms of external financing.

2.16.4 Financial Intermediation Theory

The financial intermediation theory was advanced by Gurley and Shaw (1960). The theory explains the role of financial institutions such as banks and microfinance institutions in facilitating the flow of funds from savers to borrowers. Financial intermediaries reduce transaction costs, mitigate information asymmetry, and manage risks, thereby enabling efficient allocation of resources in an economy.

Recapitalization strengthens the financial health of these institutions by increasing their capital base, which enhances their ability to intermediate funds. With a stronger capital base, therefore, financial institutions can expand their lending activities, including to high-risk sectors like agriculture. In Ghana, where agriculture is a critical sector but often underserved due to perceived risks, recapitalization can enable financial institutions to increase the volume of agricultural loans/credit, offer more favourable loan terms such as lower interest rates, and longer repayment periods or tenors) and also develop specialized financial products tailored to the needs of farmers and agribusinesses.

The financial intermediation theory also places emphasis on the role of financial intermediaries in reducing information asymmetry through credit screening and monitoring, which is particularly important in agricultural finance due to the sector's unique risks such as weather, and price volatility.

Some empirical studies have shown that well-capitalized banks are more likely to increase lending to underserved sectors like the agricultural sector (Mishra et al., 2021; Brewer et al., 2022). Also, in Ghana, recapitalization policies have been linked to improved financial stability and increased lending capacity (Mensah, 2022).

In the context of this study therefore, the financial intermediation theory provides a background for understanding how recapitalization strengthens the ability of financial institutions to support agricultural finance by improving their lending capacity and risk management capabilities.

2.16.5 Sectoral Allocation Theory

The sectoral allocation theory was advanced by McKinnon (1973) and it explains how financial institutions allocate credit across different sectors based on risk and return trade-offs, regulatory requirements, as well as institutional priorities. This theory suggests that credit allocation is generally influenced by factors such as sectoral risk profiles, profitability, and government policies.

Recapitalization increases the financial resources available to institutions, which enables them to reallocate credit across sectors. In Ghana, recapitalization may lead to a shift in credit allocation, with some sectors such as the agricultural sector benefiting more due to government policies promoting agricultural development such as subsidies, and the high potential impact of agricultural financing on economic growth and poverty reduction. On the contrary, sectors perceived as less risky or more profitable such as the manufacturing and services sectors may also attract significant credit, leading to heterogeneous effects. The sector allocation theory therefore helps to explain how recapitalization influences the relative share of loans disbursed to the agricultural sector compared to other sectors.

In Ghana, studies have shown instances of uneven distribution of credit across sectors, with agriculture often receiving a smaller share despite its economic importance (Quartey et al., 2012). This notwithstanding, research has also shown that recapitalization of financial institutions can lead to a reallocation of credit towards priority sectors, particularly in developing countries (Saini & Ahmad, 2024). The sectoral allocation theory therefore provides a tool for analyzing how recapitalization affects the distribution of loans across sectors and throws light on factors that influence credit allocation decisions as far as banks in Ghana are concerned.

2.16.6 Information Asymmetry Theory

The information asymmetry theory is rooted in the work of Akerlof (1970), and it explains how unequal access to information between lenders and borrowers can lead to adverse selection and moral hazard. In the context of credit markets, lenders may face challenges in assessing the creditworthiness of borrowers or obligors, leading ultimately to higher risks and stricter lending criteria.

Due to the sector's unique risk, agricultural finance is particularly susceptible to information asymmetry and the lack of reliable data on agricultural actors, farmers and agribusinesses. Recapitalization can enable financial institutions to adopt more sophisticated credit risk management strategies, such as improved credit assessment, appraisal and scoring models. Again, it can also spearhead the use of data to assess creditworthiness, as well as the development of risk-sharing mechanisms such as insurance. The information asymmetry theory helps explain how recapitalization reduces the risk aversion of financial institutions such as banks, enabling them to adopt more effective risk management strategies for lending to the agricultural sector. Some empirical studies have shown that recapitalization improves the risk management capabilities of financial institutions, particularly in high-risk sectors like agriculture (Berger & DeYoung, 1997; Nyebar et al., 2023). In Ghana, the adoption and use of innovative risk management tools has been linked to increased lending to the agricultural sector (Frimpong et al., 2022).

2.17.7 Behavioral Finance Theory

The main proponents of the behavioral finance theory are Kahneman and Tversky (1979). The theory explains how psychological factors and cognitive biases influence financial decision making. The theory challenges the traditional assumption of rational behavior, explaining how factors such as risk perception, overconfidence, and herd behavior can affect lending decisions.

Generally, the credit appraisal process involves assessing the creditworthiness of borrowers based on factors such as financial history, referencing scores from credit bureau reports, collateral, and repayment capacity. The behavioral finance theory suggests that lenders' perceptions of risk and their decision-making processes can be influenced by cognitive biases, such as the overemphasis on collateral rather than the viability of agricultural projects, herd behaviours, where lenders follow the actions of their peers rather than conducting independent assessments. The theory also opines that recapitalization may change the risk appetite of financial institutions, leading to more objective and data-driven credit appraisal processes. Furthermore, the theory helps explain how psychological factors influence the determinants of credit appraisal scores in agricultural finance.

Research has shown that behavioral factors play a significant role in credit appraisal processes, particularly in high-risk sectors like agriculture (Céu et al., 2024). In Ghana, some studies and research have documented the impact of cognitive biases on lending decisions, particularly in the context of agricultural finance (Appiah-Twumasi et al., 2022). Therefore, the behavioral finance theory provides a basis for evaluating the credit appraisal process in agricultural finance, stressing the role of psychological factors and cognitive biases in determining credit appraisal scores.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

Chapter three of the study gives a vivid and apt description of the methodology of the research. The chapter therefore describes the study area, the study design, sample size and sampling procedure, data collection and sources, reliability, and validity of research instrument as well as the theoretical framework and empirical model.

3.2 Research Philosophy

This study investigating the effects of recapitalization of commercial banks on agricultural finance is guided by a pragmatic research philosophy. Pragmatism, as a philosophical stance, emphasizes the practical consequences of research and the usefulness of findings in addressing real-world challenges (Kelly & Cordeiro, 2020). It rejects the notion of a single, absolute truth and instead focuses on what works in practice to achieve desired outcomes (Morgan, 2014). This aligns perfectly with the research objectives, which seek to assess the effects of recapitalization on agricultural finance and provide actionable recommendations for policymakers and financial institutions in Ghana.

Pragmatism's emphasis on problem-solving and its focus on the practical implications of research make it a particularly suitable philosophy for this study. The research aims to inform policy and practice in the Ghanaian financial and agricultural sectors by providing evidence-based perspectives into the effectiveness of recapitalization as a tool for promoting agricultural finance. This focus on real-world impact is a hallmark of pragmatic research.

Furthermore, a pragmatic approach allows for the integration of both quantitative and qualitative methods to gain an understanding of the research problem. In this study, quantitative time series data on agricultural finance, macroeconomic indicators, and bank-specific variables are complemented by qualitative data gathered through interviews with bank managers and credit officers. The qualitative data will provide an evaluation into the mechanisms through which recapitalization affects agricultural lending, thereby validating the interpretation of the quantitative findings.

The pragmatic philosophy has directly shaped the research design in several ways. Firstly, it has led to the selection of research methods that are best suited to address the research questions, including Autoregressive Distributed Lag model, the Error Correction Model, Granger-Causality test and Forecast Error Variance Decomposition. These methods allow for a rigorous and detailed examination of the relationships between recapitalization and agricultural finance. Secondly, the focus on practical implications has guided the development of specific policy recommendations based on the research findings. Finally, pragmatism's flexibility has allowed for an iterative approach to the research process, enabling adjustments to the research design as needed based on preliminary findings.

While some critics argue that pragmatism can be overly focused on practical solutions at the expense of theoretical development, this study aims to contribute to both. By grounding the empirical analysis in relevant theoretical frameworks such as the transaction cost theory, information asymmetry theory, and the pecking order theory and by carefully considering the policy implications of the findings, the research seeks to advance both theoretical understanding and practical solutions in the area of agricultural finance and bank recapitalization.

3.3 The Study Area

The study area of a research implies the scope of the research which encapsulates all classifications, concepts and sets that describes the phenomenon being studied (Jaakkola, 2020). In this study, the researcher categorizes the study area into a geographical scope which describes the geographical location of the area of research, and a conceptual scope which describes the subject matter of the research.

3.3.1 Geographical scope of the study area

This study focusses on Ghana which has witnessed a couple of recapitalizations of financial institutions since independence. Ghana, administratively, has sixteen regions and it covers a total land area of 238,535km^2 (Kudo, 2021). The country is boarded to the north by Burkina Faso, to the east by the Republic of Togo, to the west by Ivory Coast and to the south by the Gulf of Guinea and Atlantic Ocean. Figure 1 below depicts a map of the administrative regions of Ghana.

Figure 3. 1: Administrative Regions of Ghana

Figure 3.1 is a depiction of the administrative regions of Ghana. Currently, there are sixteen administrative regions, and all the banks have the national headquarters in the capital of the Greater Accra Region, which is also the capital city of Ghana. Most banks currently operating in the country have dominant branch presence in the Greater Accra, Ashanti, Western and Northern Regions of the country.

3.3.2 Economic scope of study area

Ghana's Gross Domestic Product (GDP) grew by 5.1% in the year 2021, and this was largely based on increases in household consumption (Anaman & Adjei, 2021). The country currently has a population of thirty-one million and the economic outlook has been described as positive, following the establishment of the Ghana Covid 19 Alleviation and Revitalization of Enterprises Support Program. Ghana's tight monetary policy places restrictions on investments since there is a direct correlation between the monetary policy and lending rates of banks. Table 1 below gives a brief overview of the economic situation of Ghana, from the years 2015 to 2022.

Table 3. 1 : Economic Data of Ghana

Economic Indices	2015	2016	2017	2018	2019	2020	2021	2022
Population (million)	27.7	28.3	28.9	29.6	30.2	32.2	32.8	34.1
GDP per capita (USD)	1721	1926	2014	2173	2164	2177	2363	2565
Public Debt (% of GDP)	55.1	57.3	57.2	59.1	62.7	79.1	82.1	90.7
Inflation Rate (CPI-%)	17.7	15.4	11.8	9.4	7.9	9.9	10	54.1
Policy Rate (%)	26	25.5	20	17	16	14.5	13.4	27
External Debt (% of GDP)	42.2	38.8	38.4	36.3	32.5	35.3	35.8	62.1
Economic Growth (%)	2.2	3.4	8.1	6.3	6.5	0.5	5.4	3.7

Source: 2022 Mid-Year Budget Statement, Ministry of Finance (Ghana)

3.3.2.1 Analysis of Ghana's GDP

The Ministry of Finance projected in the 2022 budget that real GDP will grow by 5.8% and the GDP growth originating from non-oil revenue to grow by 5.9%. Contrary to expectations, the novel e-levy introduced by the government faced challenges with its approval by parliament, due to the inadequate political capital the ruling government was confronted with. The entire population was also peeved with its implementation resulting in revenue projections in the 2022 budget not being met. Consequently, real GDP was 3.3% and 4.8% for the first and second quarters, respectively in 2022. Similarly, non-oil GDP was 3.7% and 6.6% for the first and second quarters respectively in 2022.

3.3.2.2 Real GDP growth per sector

In the 2024 budget statement, the Ministry of Finance indicated that the agricultural sector grew by 6.3% as at the first half of the year 2023. This feat was replicated by the services sector, which also grew by 6.3% and was followed by the industry sector which declined by -2.2%.

Table 3. 2: Real GDP growth per sector

Sector	Agriculture	Industry	Services	GDP Growth Rate
2017	6.2	15.6	3.4	8.13
2018	4.9	10.5	2.8	6.2
2019	4.7	-2.5	0.7	6.51
2020	7.3	15.6	3.4	0.51
2021	8.5	-0.5	9.4	5.36
2022	4.2	0.9	5.5	3.24
2023 (1st Half)	6.3	-2.2	6.3	3.2

Source: 2024 Budget and Economic Policy, Ministry of Finance (Ghana)

The Ministry of Finance records that the growth in the agricultural, industry and services sector was at 6.3%. -2.2% and 6.3%, respectively, for the first half of 2023. During the same period, the industry sector, as recorded by the Ministry of Finance, contracted by 0.3%. Real GDP growth for 2019 and 2020, as illustrated in Table 3.2, were at 6.5% and 0.5%, respectively.

3.3.3 Conceptual scope of the study area

This research covers the banking industry in Ghana before and after the recapitalization. Thus, the study's duration began from 2015 to 2018, to signify the period before the recapitalization. The study period then extended from the period after the recapitalization, which was from 2019 to 2022. Again, the study focuses on the agricultural sector loan portfolio of all the banks for the periods before and after the recapitalization period in Ghana. Conceptually, the study focusses on those financial institutions in Ghana, which have been granted universal banking license by the Bank of Ghana. There are currently twenty-three banks in Ghana.

3.3.3.1 Assessment of origin and categorization of banks

The study focused on agricultural lending of all 23 banks in the country. The table below depicts the banks categorizing them into foreign, regional and indigenous.

Table 3. 3: Origin and Categorization of Banks in Ghana

Bank	Origin	Categorization	Year of Commencement		No. of Branches in Ghana
			World	Ghana	
Absa Bank Ghana Ltd	South Africa	Regional	1991	2020	95
ccess Bank Ghana Ltd	Nigeria	Regional	1989	2009	53
DB Bank Ltd	Ghana	Indigenous	1965	1965	82
ınk of Africa Ghana Ltd	Morocco	Regional	1997	1982	26
ıl Bank PLC	Ghana	Indigenous	1990	1990	32
onsolidated Bank Ghana Ltd	Ghana	Indigenous	2018	2018	113
cobank Ghana Ltd	Nigeria	Regional	1985	1990	67
3N Bank Ghana Ltd	Nigeria	Regional	1894	1996	21
delity Bank Ghana Ltd	Ghana	Indigenous	2006	2006	73
rst Atlantic Bank Ghana Ltd	Ghana	Indigenous	1996	1996	35
rst National Bank Ghana Ltd	South Africa	Regional	1838	2015	11
CB Bank Ltd	Ghana	Indigenous	1953	1953	196
ıaranty Trust Bank Ghana Ltd	Nigeria	Regional	1990	2004	34
ıtional Inv. Bank Ltd	Ghana	Indigenous	1963	1963	51
nniBSIC Bank Ghana Ltd	Ghana	Indigenous	2019	2019	42
udential Bank Ltd	Ghana	Indigenous	1993	1993	44
epublic Bank (Ghana) PLC	Trinidad & Tobago	Foreign	1837	2019	42
ciete General Ghana Ltd	France	Foreign	1864	1975	49
anbic Bank Ghana Ltd	South Africa	Regional	1992	1999	40
andard Chartered Bank (Ghana) Ltd	United Kingdom	Foreign	1862	1896	23
United Bank for Africa (Ghana) Ltd	Nigeria	Regional	1949	2005	30
Universal Merchant Bank Ltd	Ghana	Indigenous	1972	1972	37
Zenith Bank (Ghana) Ltd	Nigeria	Regional	1990	2005	40

Source: Bank of Ghana

From table 1, it can be established that there are currently 10 regional banks in Ghana. Banks classified as foreign are 3 in the country while indigenous banks are also 10 in number.

3.4 Research Design and Methodology

This study employed a mixed research method that combined qualitative and quantitative approaches for data collection and analysis. To accomplish the goals, the quantitative approach used both time series (objective one) and panel data (objective two) analysis. The study's adoption of the mixed method approach, coupled with time series and panel data analysis offered methodological rigor to address the study's objectives. The quantitative models captured macro level relationships and sectoral dynamics. The qualitative analysis also provided the institutional and managerial context underpinning the research to ensure that the study's findings are relevant to Ghana's financial sector.

To better comprehend the concepts of agricultural risk management techniques used by banks before and after the re-capitalization period, on the other hand, both qualitative and quantitative approaches were used in the collection and analysis of non-numerical and numerical data respectively. The adoption of a mixed research approach which integrated both qualitative and quantitative methodologies, was necessitated by the complex nature of agricultural risk management strategies employed by banks before and after the recapitalization period. The qualitative approach was essential for capturing non-numerical views from key stakeholders such as bank officials. This therefore provided contextual understanding of risk management practices and operational adjustments as far as agricultural credit is concerned. This qualitative approach and perspective were cardinal more especially as certain aspects of credit risk management such as institutional behavior and policy responses, cannot be adequately quantified.

Conversely, the quantitative approach allowed systematic analysis of numerical data, such as macroeconomic figures and sectoral loan disbursements. This facilitated the identification of trends, patterns, causal relationships and correlations in bank performance concerning agricultural financing across both pre- and post-recapitalization periods. Quantitative analysis further enabled empirical validation of the observed qualitative findings, ensuring that these findings were not only contextually grounded but also statistically robust.

The research methodology focuses on the specific techniques, tools, and procedures which are employed to implement the research design (Khoa et al., 2023). It provides detailed descriptions of how data was collected, analyzed, and interpreted. For this study, the research methodology has been compartmentalized into quantitative and qualitative methodology.

For the quantitative methodology, time series was employed in analyzing Objective 1 (effects of recapitalization on agricultural lending). The models employed under the time series include Autoregressive Distributed Lag (ARDL) model, Error Correction Model (ECM), Impulse Response Functions (IRF), and Forecast Error Variance Decomposition (FEVD). The ARDL model is employed because it captures both short- and long-run dynamics, while the ECM quantifies the speed of adjustment toward equilibrium. The IRF and FEVD provide understanding into the dynamic responses and variance contributions of key variables following recapitalization shocks. The diagnostic tests that were conducted include stationarity tests, structural stability test, test for heteroskedasticity and serial correlation test. For Objective 2 (heterogeneous effects of recapitalization on sectoral loans disbursement relative to the agricultural sector), a panel data was adopted and the models employed include random effects regression (for comparative purposes) and the fixed effects regression with robust standard errors, which was selected as the preferred model based on the results of the Hausman test, ensuring control for unobserved heterogeneity. The fixed effects model was chosen to accurately estimate the heterogeneous impacts of recapitalization across sectors relative to agriculture, after robust statistical testing indicated its superiority over the random effects model.

For the qualitative methodology, data was collected through interviews with the use of questionnaires. The interviews were conducted with key official in the credit department from each of the 23 commercial banks in Ghana. Content and thematic were used to extract key themes related to agricultural credit risk management strategies and credit appraisal processes. The McNemar's Test was employed to test for significant shifts in credit risk management strategies before and after the recapitalization of banks. Cluster analysis was also employed which categorized banks based on their credit appraisal methodologies, revealing three distinct lender profiles. Also, the Principal Component Analysis (PCA) adopted to identify key determinants of agricultural credit appraisal scores, thus providing empirical validation for credit assessment criteria.

3.5 Sample Size and Sampling Procedure

The population of this research includes all financial institutions registered under the Banks and Specialized Deposit (SDI) Act 2016 (Act 930) Law 1989 or the Non-banking Financial Institution Law 1993 in Ghana. These financial institutions include banks, savings and loans companies and microfinance institutions.

The availability of financial reports served as a screening criterion to ensure access to consistent and reliable financial data. Therefore, the sample comprised all twenty-three universal banks in Ghana. Again, purposive sampling was employed in selecting officers on credit/lending schedules and credit risk officers of all the twenty-three banks to assist in gathering the primary data for the study. Specifically, the research involved selecting credit risk officers and officials on credit schedules from each of the twenty-three banks being studied. This means that the selection of credit risk officers was not done randomly but based on the researcher's judgment and expertise. Purposive sampling was chosen because the study sought to analyze agricultural credit risk management strategies and credit appraisal processes before and after recapitalization. These aspects are highly technical and institution specific. Credit officers chosen to administer the questionnaire are the most relevant respondents because they are directly involved in loan appraisal, credit risk assessments, and decision-making processes related to agricultural financing. Their specialized knowledge ensures that the responses reflect accurate institutional practices.

The credit (risk) officers then assisted in gathering the primary data required for the study, which included information on banks' credit risk management practices, and credit appraisal processes. Furthermore, the study used data from the Bank of Ghana on the loan portfolios of the agricultural sector for all twenty-three banks for a period comprising of four years before the recapitalization and four years after the recapitalization. The selection of a four-year period before and after the 2019 (most recent) recapitalization was guided by both data availability and analytical rigor. This study faced significant limitations in accessing data from banks that were liquidated, merged, or subject to legal proceedings following the recapitalization. Therefore, extending the analysis to a longer period would have resulted in a substantial reduction in data availability, which could have potentially introduced bias and reduced the robustness of the findings.

3.6 Data Sources and Collection

The study relied on the collection of primary data and analysis of secondary data. Questionnaires were used to collect the primary data. This targeted the key management staff of banks in Ghana. Secondary data was gathered from the financial statements of banks as well as portfolio information on agricultural finance from the various banks.

The first and second objectives were based on secondary data collected from the sector loan portfolios of the banks. Data collected included the disclosure of sectoral disbursement of loans of all 23 banks from January 2015 to December 2022, as was received from the Bank of Ghana. Data was also obtained on bank specific variables like capital adequacy ratio and non-performing loans in the agricultural sector as well as macroeconomic (interest rates and inflation) indicators from the Bank of Ghana. The third and fourth objectives were achieved through the administration of questionnaire to officials at the credit department of the head offices of the various banks.

3.7 Reliability and Validity of the Research Instrument

Reliability and validity of research instruments refers to the appropriateness of a research method, instrument, or technique in assessing and measuring a phenomenon (Khoa et al., 2023). Whereas reliability measures the consistency of the measure, validity measures the precision of the measure.

3.7.1 Reliability of research instrument

To check the reliability of the research instrument, the Cronbach Alpha test statistic was employed. The adoption of the Cronbach Alpha test statistic was to ensure that the research instrument, that is the questionnaire, is consistent and yields the same results on repeated trials by different respondents. The Cronbach Alpha was adopted as an instrument of reliability since it is also a coefficient of consistency.

Furthermore, to ensure the validity of the research, a respondent each for all the 23 banks was selected based on their role (officials at the credit departments of the various banks) and expertise. Follow-up interviews were conducted for each of the respondents to affirm the consistency of the responses in order to ensure data accuracy.

Finally, to assess test-retest reliability, the same participants or respondents (credit officers) who administered the questionnaire on credit risk management strategies and credit appraisal scores were requested to repeat the exercise after one month. A Pearson correlation analysis between the initial and follow up responses yielded a reliability coefficient of $r = 0.89$, indicating strong consistency in responses over time. Also, the Intraclass Correlation Coefficient (ICC) was computed at 0.91, confirming excellent reliability. These results suggest that the research instrument demonstrated a high level of stability and appropriateness for this study.

3.7.2 Validity of research instrument

To achieve, firstly, a criterion validity for this study, responses from bank executives and results from reviews of policies of banks of different origins (in order to determine their heterogeneous appetite for agricultural lending) were compared with other valid opinions of officials of the Ghana Banking College. Criterion validity, therefore, implies the extent to which the result of a measure is comparable to other opinions and theories, to ensure accuracy and precision (Mohajan, 2020).

Another validation process that was adopted in this study is the seeking of the opinions of some banking professionals and some officials of the Ghana Banking College on the structure of the questionnaires on credit risk management practices and the appetite of the different origins of banks to agricultural financing.

3.8 Conceptual Framework of the Study

The key variables in the study and the association existing between them are conceptualized as depicted in Figure 3.2. The conceptual framework for this research is developed and built on the hypothesis that agricultural finance, following the recapitalization of banks, has experienced an increase. In this study therefore, the increase in agricultural finance is conceptualized as the dependent variable. This conceptual framework seeks to examine the effects of different factors on the loans disbursed in the agricultural sector with a focus on macroeconomic indicators and bank-specific variables.

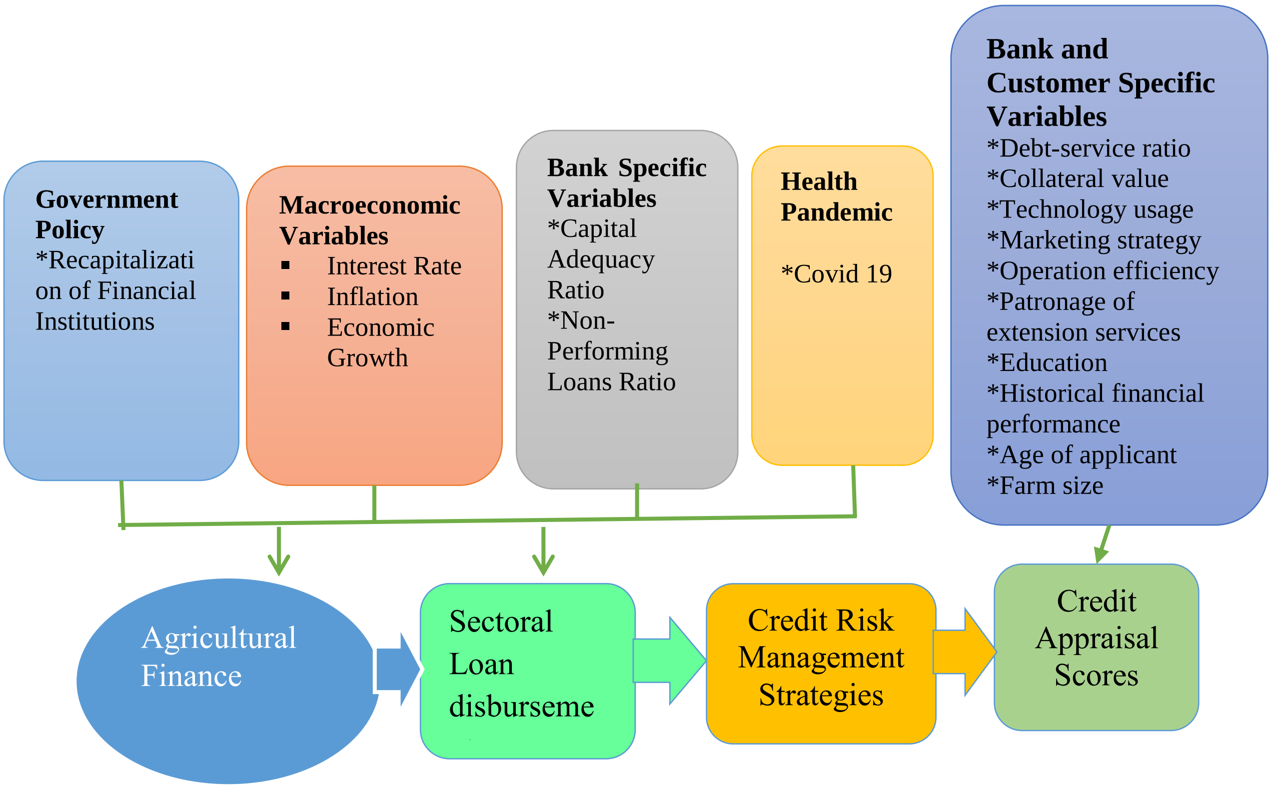

Figure 3. 2: Conceptual Framework of Recapitalization and Agricultural Finance

Source: Author's construct (2023)

The study hypothesizes significant association between macroeconomic vectors (inflation, interest rate and economic growth) as well as bank specific determinants (Capital adequacy ratio and non-performing loans ratio) on agricultural finance, after the recapitalization of financial institutions in the country. The conceptual framework in Figure 3.2 integrates various macroeconomic, bank-specific, and customer-specific variables to explore and examine how recapitalization influences agricultural finance, sectoral loan disbursement, credit risk management strategies, and credit appraisal scores. The framework outlines the relationships between external shocks (such as government policies and health pandemics) and internal bank processes, with a particular focus on agricultural lending or credit.

In this study, recapitalization serves as a key exogenous variable influencing banks' lending or credit behavior. While increased capitalization can enhance the ability of banks to extend loans, this framework hypothesizes that the impact on agricultural finance might not be direct or immediate. Instead, recapitalization may have heterogeneous effects across different economic sectors, depending on how banks reallocate their resources post-recapitalization. Therefore, key assumptions include the fact that strengthened capital positions may lead to increased lending but could also cause sectoral shifts where banks prioritize low-risk sectors such as commerce and service, over agriculture. Another key assumption is that recapitalization might improve the capital adequacy ratio but may not necessarily translate into increased agricultural credit due to perceived risks in the sector.

From Figure 3.2, the macroeconomic variables employed include interest rates, inflation and GDP in the agricultural sector. Interest rates directly affect borrowing cost. High interest rates discourage agricultural lending due to lower profit margins in the sector. Conversely, lower interest rates may stimulate lending (Abadi et al., 2023). Inflation also affects the real value of loans and repayments. High inflation can deter lending as it increases uncertainty, while stable inflation encourages financial institutions to extend credit (Belinska et al., 2023).

Economic growth in the agricultural sector increases demand for credit, much as expanding businesses require capital. A growing agricultural GDP may incentivize banks to allocate more credit to the sector (Medhi & Goswami, 2023). From the study, the expected influence is that macroeconomic stability enhances agricultural financing and inflation and interest rate shocks may have short-lived impacts but economic growth fosters sustained lending.

The COVID-19 pandemic introduced systemic risks that affected all sectors of the Ghanaian economy, including agriculture. This variable examines how external health shocks influence the lending decisions of banks as far as credit to the agricultural sector is concerned. The expectation is the initial tightening of credit due to heightened and increased risks. Also, over time, monetary policy responses such as reduced interest rates may mitigate and diminish these effects.

The bank-specific variables employed in the study are Capital Adequacy Ratio and Non-Performing Loans (NPLs). A higher level of CAR after the recapitalization should strengthen the ability to lend. Also, recapitalization might initially reduce NPLs, but riskier agricultural loans could increase them over time. The expected influence is that although CAR enhances financial resilience, it does not guarantee sector-specific lending. Again, NPL ratios may have a delayed or lagged negative impact on agricultural finance.

From Figure 3.2, the bank and customer-specific variables employed represent both the operational capabilities of financial institutions and the characteristics or behaviours of applicants of agricultural loans. They include debt-service ratio, collateral value, technology usage and operational efficiency, marketing strategy and patronage of extension services as well as historical financial performance. The expected influence is that higher operational efficiency and technology adoption enhance creditworthiness. Also, demographic characteristics such as age and education influence risk perceptions among lenders.

From Figure 3.2, agricultural finance is the central dependent variable in this conceptual framework. It represents the total credit extended to the agricultural sector and is influenced by all the outlined variables. The expected influence is that recapitalization's direct impact on agricultural finance may be weak and slow to materialize. Also, credit allocation decisions are mediated by macroeconomic conditions, sectoral profitability, and borrower characteristics.

Again, from Figure 3.2, sectoral loan disbursement assesses the heterogeneous effects of recapitalization by comparing loan disbursement patterns across sectors relative to agriculture. The expected influence is that sectors such as commerce, service and manufacturing may attract credit allocation after recapitalization due to perceived lower risks. Also, agriculture might receive relatively less credit unless specific policies target this sector.

The conceptual framework in Figure 3.2 also examines how recapitalization influences the adoption of new agricultural credit risk management strategies. The pre-recapitalization strategies include collateral lending, credit scoring and loan-to-value assessments while the post-recapitalization strategies include enhanced monitoring and evaluation, specialized agricultural credit scoring models and improved collateral options. The expectation is the recapitalization leads to strategic shifts in credit risk management from the rigid collateral-based lending practices to more data-driven approaches. Also, from Figure 3.2, the credit appraisal scores determine the likelihood of loan approval and are influenced by both bank and customer-specific variables. From the study, the Principal Component Analysis (PCA) revealed that factors such as debt-service ratio, collateral value, and operational efficiency are the most significant determinants of credit scores. It was also revealed that banks cluster into distinct groups based on their appraisal methodologies, including collateral-oriented lenders, balanced lenders, and development-oriented lenders.

This conceptual framework depicted in Figure 3.2 aligns and is consistent with financial theories such as risk-based lending theory, where banks prioritize risk-mitigating factors like collateral and debt-service ratios; the financial intermediation theory where efficient intermediation reduces information asymmetries, encouraging sectoral credit allocation; the credit rationing theory where credit is rationed based on risk profiles, often disadvantaging the agricultural sector; the behavioral finance theory where lender perceptions influence the allocation of credit, especially under a condition of uncertainty.

Finally, the conceptual framework depicted in Figure 3.2 justifies the study's employment of the mixed methods approach as it integrates quantitative techniques such as ARDL models, panel regressions, Impulse Response Functions (IRF), and Forecast Error Variance Decomposition (FEVD) to analyze dynamic relationships. It also justifies the inclusion of qualitative approaches such as thematic analyses of credit risk management strategies, supported by the McNemar's test, cluster analysis and principal component analysis.

3.8.1 Agricultural finance

Agricultural finance is the total amount of credit extended to the agricultural sector for agricultural purposes. It serves as an important driver of development in the agricultural sector, and it impacts on the productivity and sustainability of the sector (Nasereldin et al., 2023).

3.8.2 Predictor variables

From the study, the conceptual framework integrates a set of predictor variables which play an important role in agricultural financing following the recapitalization of banks. The variables are included in the study based on their significance in influencing the amount of credit extended within the agricultural sector. The predictor variables in this study include three macroeconomic indicators and two bank specific variables.

3.8.2.1 Macroeconomic indicators

- Inflation: Inflation can influence the demand for agricultural credit as it can influence the purchasing power of farmers and businesses under the sector as well as the real value of loans. Businesses under the agricultural sector as well as farmers may be discouraged from borrowing due to the uncertainty regarding future repayment values (Tarkom & Ujah, 2023).
- Interest rates also have significant effects on the borrowing decisions in the agricultural sector. High interest rates may have a deterrent effect on farmers and businesses under the agricultural sector from accessing credit, leading to reduced investment in the sector (Dziwornu et al., 2023).
- Economic Growth: When the economy of a jurisdiction experiences growth, agricultural activities, and production increases, which results in higher demand for financing to support agricultural expansion and development (de Janvry & Sadoulet, 2020).

3.8.2.2 Bank-specific variables

- Capital Adequacy Ratio (CAR): Generally, CAR gives an indication of a bank's financial stability and its ability to withstand and absorb losses. Banks which have higher CAR are more able to extend more credit to the agricultural sector (Bernanke, 2023).

- Non-Performing Loans (NPLs): NPLs as a ratio measures the quality of a bank's loan book portfolio. Banks which have lower NPLs are more able to extend credit to the agricultural sector as they demonstrate a lower default risk (Kibet, 2020).

3.8.3 Sectoral loans disbursement

Generally, recapitalization has varied implications on how banks operate as they may change their lending patterns and risk appetite in response to the increased capital requirements (Bishof et al., 2023). The study looks at the various economic sectors that receive credit from banks. Banks that are well-capitalized may extend credit and allocate them differently across sectors.

Various macroeconomic indicators may influence the allocation of loans to sectors. These include inflation, interest rates, GDP growth and sector-specific economic conditions. Where there are changes in sectoral lending patterns, there is an implication for the overall economic growth. Sectors that receive more credit may witness an increased investment and expansion, compared to other sectors (Evemy et al., 2023).

3.8.4 Credit risk management strategies and credit appraisal scores

Recapitalization trigger changes in agricultural credit risk management strategies. This is attributed to the fact that the policy of recapitalization involves increased lending, which has an influence on how financial institutions effectively manage credit risk. Credit appraisal scores represent the quantitative assessment of the creditworthiness and financial strength of obligors, and the risk associated with agricultural lending (Rozhkova, 2021).

Credit appraisal scores also reflect the overall quality of credit risk assessment with higher scores indicating an instance of reduced credit risk (Gershon et al., 2020).

Macroeconomic factors such as inflation, interest rates and GDP growth have influence over the effectiveness of agricultural credit risk management strategies (Twum et al., 2021). Thus, in a weak economic environment, the probability that obligors may default on their loans is high hence the need for effective credit risk management strategies and credit appraisal scores during the credit appraisal process.

3.9 Variables and their Units of Measurement

This section describes the variables, their unit of measurement and their selection which is grounded in theoretical underpinnings and empirical evidence related to the effects of recapitalization of banks on agricultural finance. The variables include key bank-specific variables, macroeconomic conditions and policy interventions. Table 3.4 illustrates the various variables employed in the study and their units of measurement.

Table 3. 4: Units of Measurement of Variables

Variable	Description	Units
lnAF	Log of Agricultural Finance	GHS (Ghana Cedis)
Inflation	Annual Inflation Rate	% (Percentage)
Interest	Annual Interest Rate	% (Percentage)
lnGDPA	Log of Agricultural Gross Domestic Product	GHS (Ghana Cedis)
lnNPLA	Log of Non-Performing Agricultural Loans	GHS (Ghana Cedis)
lnTA	Log of Total Assets	GHS (Ghana Cedis)
CAR	Capital Adequacy Ratio	% (Percentage)
CLSTL	Core Liquid Assets to Short-Term Liabilities Ratio	Ratio (Unitless)
RECAP	Recapitalization Dummy Variable	0 = Before Recapitalization, 1 = After Recapitalization
Covid	COVID-19 Pandemic Dummy Variable	0 = Before Covid, 1 = After Recapitalization
ROE	Return on Equity	% (Percentage)
CIEA	Composite Index of Economic Activities	Index Value
lnM2	Log of Broad Money Supply	GHS (Ghana Cedis)
MPR	Monetary Policy Rate	% (Percentage)

Source: Author’s analysis from secondary data (2023)

From Table 3.4, the dependent variable employed for this study is lnAF (log of agricultural finance). It is measured in Ghana Cedis (GHS) and it represents the total credit allocated to the agricultural sector by financial institutions. A log transformation is applied to normalize the distribution and hence to mitigate heteroskedasticity and ensure model efficiency (Villadsen & Wulff, 2021). It is also used as the response variable to analyze how the recapitalization of banks affects the volume of credit to the agricultural sector.

The core independent variable of interest in this study is bank recapitalization which is represented or operationalized as a dummy variable (0 to signify the period before recapitalization and 1 for the period after recapitalization). Its inclusion allows for assessing whether recapitalization has led to a structural shift in lending towards the agricultural sector.

Also, from Table 3.4, lnTA (log of total assets) serves as a proxy for bank size and it indicates the financial capacity of institutions to absorb credit risk. It is measured in Ghana Cedis (GHS). After the recapitalization, larger banks are expected to have increased lending capabilities due to their stronger capital reserves.

Again, from Table 3.4, capital adequacy ratio (CAR), which is measured as a percentage (%) is another independent variable employed in this study. CAR reflects the financial soundness of banks and their ability to withstand credit risk (Siddique et al., 2022). Generally, regulatory frameworks often link CAR to expansion of credit, which makes it a critical explanatory variable.

Furthermore, another variable that has been employed in this study is the Core Liquid Assets to Short-Term Liabilities Ratio (CLSTL). This is a ratio and has no unit of measurement. It is an indicator that is cardinal in capturing the liquidity effects of recapitalization.

Return on Equity (ROE), which is measured as a percentage, is another independent variable employed in the study. ROE represents the profitability and operational efficiency of banks (Khan, 2022). Bank that are more profitable will be more inclined to extend credit to productive sectors such as agriculture after the recapitalization.

Inflation is also an independent variable employed in this study. It is measured in percentage. As a macroeconomic variable, inflation affects the real credit demand and repayment capacity of obligors. When inflation rate is high, it erodes the real value of loan repayments which increases credit risk for banks.

Interest rate as measure as a percentage represents the cost of borrowing. An increase in interest rate increases the cost of agricultural credit which can dampen the demand for credit in the agricultural sector. Its inclusion in the model ensures that changes in agricultural finance are not solely attributed to recapitalization.

The monetary policy rate (MPR) is another independent variable employed in the study and it is measured as a percentage. Higher MPR, generally, leads to tightened liquidity and reduced credit, necessitating its inclusion in this study.

Log of Broad Money Supply (lnM2) as measured in Ghana Cedis captures overall liquidity conditions in the economy. Its inclusion in this study is due to its alignment with credit such that, higher money supply is expected to ease credit conditions and promote increased lending.

Log of Gross Domestic Product in the Agricultural Sector (lnGDPA) reflects the overall productivity in the agricultural sector. It is measured in Ghana Cedis. A growing agricultural sector GDP is expected to enhance creditworthiness and attract more lending.

Better still, the log of Non-Performing Loans in the Agricultural sector (lnNPLA) is a variable that explains credit risk within the agricultural sector. It is measured in Ghana Cedis.

Composite Index of Economic Activities (CIEA) has also been employed as an independent variable in this study. It is measured as an index value, and it is an aggregate indicator of overall economic activity. The CIEA variable prevents omitted variable bias related to macroeconomic fluctuations.

Finally, given that the study covers the period before and after the Covid19 pandemic, it is important to control its impact on financial conditions. It is a dummy variable represented by 0 for the period before Covid-19 and 1 for the period after the pandemic. Its inclusion helps to disentangle the effects of the pandemic from those of recapitalization.

3.10 Ethical Clerance

Ethical clearance for this study was obtained from the Heads of Credit Departments to engage credit officers from the 23 commercial banks that participated in this research. Again, formal permission was sought from the Bank of Ghana to access sectoral data, which they provided via official correspondence. All ethical protocols, including informed consent, confidentiality, and data protection, were strictly adhered to throughout the research process.

All participants, including credit officers from the 23 commercial banks, were provided with detailed information about the study's purpose, procedures, potential risks, and benefits. Participation was voluntary, and written informed consent was obtained prior to data collection.

To protect the identities of participants and their respective institutions, data anonymization techniques were employed. All personal identifiers were removed, and responses were reported in their aggregate form. Data was securely stored and accessible only to the researcher, ensuring strict confidentiality.

3.11 Analytical Framework

In this section, the analytical frameworks adopted to achieve the objectives of the research are presented.

3.11.1 Effects of recapitalization of financial institutions on agricultural finance

The first objective was based on secondary information collected from the sector loan portfolios of the banks from the central bank. Monthly data was collected from the aggregate of sectoral disbursement of loans, capital adequacy ratio, non-performing loans according to sectors and sectoral performing loans of all 23 banks in Ghana from January 2015 to December 2022. Macroeconomic data was also accessed from the composite index of economic activities of the BoG website on economic data.

A rigorous assessment was made to ensure that the data obtained was well structured with no values missing. Further assessment was done to ensure that the various data obtained was appropriate for each column and classified accurately with time as data/time, represented binary variables (recapitalization and Covid-19) as integers and financial indicators as floats.

In testing for the presence of unit root among the the variables, the Augmented Dickey-Fuller (ADF) test was conducted. To achieve stationarity for the variables which had unit roots after the initial ADF test, differencing was employed as the main data transformation technique. Differencing removes trends and seasonality in a time series which often leads to stationarity (Ryan et al., 2024). The econometric expression for the first-order differencing for the dependent variable that had to be transformed to achieve stationarity is:

$DlnAF_t = DlnAF_t - DlnAF_{t-1}$

The expression for the first-order differencing for the independent variables are:

$DInflation_t = DInflation_t - DInflation_{t-1}$

$DInterest_t = DInterest_t - DInterest_{t-1}$

$DlnGDPA_t = DlnGDPA_t - DlnGDPA_{t-1}$

$DlnNPLA_t = DlnNPLA_t - DlnNPLA_{t-1}$

$DCAR_t = DCAR_t - DCAR_{t-1}$

$DCLSTL_t = DCLSTL_t - DCLSTL_{t-1}$

$DRECAP_t = DRECAP_t - DRECAP_{t-1}$

$DCovid_t = DCovid_t - DCovid_{t-1}$

$DlnM2_t = DlnM2_t - DlnM2_{t-1}$

$DMPR_t = DMPR_t - DMPR_{t-1}$

As mentioned in the previously, the ARDL was employed to establish the long-run and short-run relationships between the variables. The econometric expression of the ARDL in the context of this study is stated below;

$$DlnAF_t = c + \sum_{j=0}^{p} \phi_i\, DInflation_{t-1} + \sum_{j=0}^{q} \beta_j\, DInterest_{t-j} +$$

$$\sum_{j=0}^{q} \eta_j\, DlnGDPA_{t-J} + \sum_{j=0}^{q} \varkappa_i\, DlnNPLA_{t-J} + \sum_{j=0}^{q} \Upsilon_i\, CIEA_{t-j} +$$

$$+ \sum_{j=0}^{q} \zeta_j\, DRECAP_{t-j} + \sum_{j=0}^{q} \omega_j\, lnTA_{t-j} + \sum_{j=0}^{q} \varphi_j\, dCLSTL_{t-j} +$$

$$\sum_{j=0}^{q} 6_j\, dCAR_{t-j} + \sum_{j=0}^{q} \varkappa_j\, ROE_{t-j} + \sum_{j=0}^{q} \kappa_j DCovid_{t-j} + \sum_{j=0}^{q} \xi_j DlnM2_{t-j} +$$

$$\sum_{j=0}^{q} \delta_j DMPR_{t-j} + \mathrm{U}_t \;\ldots\ldots\ldots \text{Equation 5}$$

Where;

$DlnAF_t$ is the dependent variable at time *t* (natural logarithm of agricultural finance)

c is the constant term (intercept)

$DInflation_{t-1}, DInterest_{t-j}, DlnGDPA_{t-J}, DlnNPLA_{t-j}, CIEA_{t-j}, DRECAP_{t-j}, lnTA_{t-j}, DCLSTL_{t-j},$

$DCAR_{t-j}, ROE_{t-j}, DCovid_{t-j}, DlnM2_{t-j}, DMPR_{t-j}$

are the current and lagged values of the independent variables

U_t is the error term (disturbance term)

$\phi_i, \beta_j, \Upsilon_i, \delta_i, \zeta_j, \omega_j, \varphi_j, \sigma_j, \varkappa_j, \delta_{j,}\ \varkappa_j, \xi_j, \eta_j$ are the coefficients of the short-run effects of each independent variable on the dependent variable.

Further to the fitting of the ARDL model, a Bounds Test was conducted to evaluate the existence of a long-run cointegration relationship among the variables within the ARDL framework. The econometric expression of the Bounds Test hypothesis in the context of this study is detailed as follows;

$\Delta y_t = c + a_0 y_{t-1} + \beta_1 x_{t-1} + \sum_{i=1}^{p} \phi_i \, \Delta y_{t-i} + \sum_{j=0}^{q} \theta j \, \Delta x_{t-j} + u_t \ldots \ldots$ Equation 6

$\Delta y_t$is the dependent variable at time t (lnAF)

x_{t-1} is the lagged value of the independent variables

Δ is the difference operator ($\Delta y_t = y_t - y_{t-1}$)

c is the constant term (intercept)

$a_0$is the coefficient of the lagged independent variable, indicating its long-run relationship

β_1 is the coefficient for the lagged independent variable indicating the long-run impact on the dependent variable

p and q are the maximum lag lengths for the dependent and independent variables

u_t is the error term (disturbance term)

Again, the econometric expression of the ECM which captures the short run dynamics while also accounting for the long run equilibrium relationships among the variables is depicted below;

$$\Delta DlnAF_t = c + \lambda(DlnAF_{t-1} - \beta_0 - \beta_1 DInflation_{t-1} - \beta_2 DInterest_{t-1} - \beta_3 CIEA_{t-1} - \beta_4 DlnGDPA_{t-1} - \beta_5 DlnNPLA_{t-1} - \beta_6 DCLSTL_{t-1} - \beta_7 DCAR_{t-1} - \beta_8 ROE_{t-1} - \beta_9 DRECAP_{t-1} - \beta_{10} DCovid_{t-1} - \beta_{11} lnTA_{t-1} - \beta_{12} DlnM2_{t-1} - \beta_{13} DMPR_{t-1}) + \sum_{i=1}^{p} \emptyset_i \, \Delta \mathrm{DlnAF}_{t-i} + \sum_{j=1}^{q} \omega_J \, \Delta DInflation_{t-j} + \sum_{k=0}^{q} \Upsilon_k \, \Delta DInterest_{t-k} + \sum_{m=0}^{q} \phi_m \, \Delta CIEA_{t-m} + \sum_{n=0}^{q} \zeta_n \, \Delta DlnGDPA_{t-n} + \sum_{o=0}^{q} \eta_o \, \Delta DlnNPLA_{t-o} + \sum_{p=0}^{q} \xi_p \, \Delta DCLSTL_{t-p} + \sum_{r=0}^{q} \theta_r \, \Delta DCAR_{t-r} + \sum_{s=0}^{q} \kappa_s \, \Delta ROE_{t-s} + \sum_{s=0}^{q} \kappa_s \, \Delta DRECAP_{t-s} \sum_{s=0}^{q} \sigma_y \Delta lnTA_{t-y} + + \sum_{s=0}^{q} \eta_v \Delta DCovid_{t-v} + \sum_{s=0}^{q} \xi_w \Delta DlnM2_{t-w} + \sum_{s=0}^{q} \delta_x \Delta DMPR_{t-x} + u_t \; \ldots \ldots \text{Equation 7}$$

Where;

$DlnAF_t$ is the dependent variable at time t

c is the constant (intercept)

λ is the error correction coefficient that indicates the speed of adjustment (the speed of adjustment back to equilibrium)

$DlnAF_{t-1}, DInflation_{t-1}, DInterest_{t-1}, CIEA_{t-1}, DlnGDPA_{t-1}, DlnNPLA_{t-1}, DCAR_{t-1}, ROE_{t-1}, lnTA_{t-1,} DCLSTL_{t-1}, DRECAP_{t-1}, DCovid_{t-1}, DlnM2_{t-1}, DMPR_{t-1}$ are the lagged values of the dependent and independent variables

p and q are the maximum lag lengths for the dependent and independent variables

u_t is the error term (disturbance term)

The preliminary data analysis will be conducted to determine the stationarity of the data or not. Stationarity assesses the constancy of the mean, variance and autocorrelation over the period of the data (Suchar & Nardin, 2022). The hypothesis that will be tested is stated as follows;

H_0: The time series data has unit root (is not stationary)

H_1: The time series data does not have unit root (is stationary)

3.11.1.1Forecast Error Variance Decomposition (FEVD)

Forecast Error Variance Decomposition (FEVD) is a statistical technique which is employed to quantify the relative contribution of each independent variable to the forecast error variance of the dependent variable over different time horizons (Celani, 2023). It particularly helps to assess the extent to which fluctuations in the dependent variable of the first objective, DlnAF (first-differenced logarithm of agricultural finance), are driven by shocks originating from the explanatory variables. The econometric expression of the FEVD is expressed as;

$$FEVD_{ij}(h) = \frac{\sum_{t=0}^{h}(\emptyset_{t,j}^{2}\,\delta_{\epsilon j})}{\sum_{t=0}^{h}(\sum_{j=1}^{n}\emptyset_{t,j}^{2}\delta_{\epsilon j})} \text{ … …Equation 8}$$

Where:

$FEVD_{ij}(h)$is the proportion of forecast error of variance in the dependent variable, DlnAF explained by shocks to the independent variables

$\delta_{\epsilon j}$ is the variance of shock j

The Vector Error Correction Model (VECM) is used to assess the changing aspects of multiple time series variables that have unit root and are possibly cointegrated (Cubadda & Mazzali, 2024). The model highlights the short-term relationship and adjustments towards a state of long run relationships. By this, the VECM depicts a system of equation consisting of variables being expressed as a function of its lagged values on the one hand,

and lagged differences of the cointegrated variables on the other hand. This expression therefore demonstrates the eventual short run deviations and the long run equilibrium relationships among the variables. The long-term relationship in the VECM is represented by the cointegrating variables or vectors and the adjusting coefficients which defines the speed at which the variables or phenomenon is able to adjust to the variations in the equilibrium relationships (Mohammed, 2020).

In the context of this study, the model for instance can depict how a change in inflation in the previous period can affect the current performance of agricultural finance, in defining the short-term dynamics of this model. As far as the long-term equilibrium relationship is concerned, it can be explained contextually as a variation in agricultural finance in the long run equilibrium which may be attributed to short term fluctuations. The error correction term, therefore, explains the speed at which this phenomenon is able to adjust back to normal or stable relationship. The econometric model for the VECM in the context of this study is stated is stated as;

$$\Delta Y_t = \alpha + \beta_1 X_{1t} + \beta_2 X_{2t} + \cdots + \beta_k \Delta X_{kt} + \gamma(Y_{t-1} - \beta_0 - \sum_{i=1}^{k} \beta_i X_{it-1}) + \varepsilon_t \ldots$$

Equation 9

Where:

ΔY_t is the first order difference of the dependent variable or variable of interest, agricultural finance

$\Delta X_{1t}, \Delta X_{2t}, \ldots, \Delta X_{kt}$ is the first order difference of the independent variables (interest rate, inflation, GDP, CAR, NPLA, Recapitalization and Covid 19)

Y_{t-1} and X_{it-1} is the lagged values of the dependent and independent variables (respectively)

α is the intercept

$\beta_1, \beta_2, \ldots, \beta_k$ are coefficients of the independent variables

Υ represents the coefficient of the error correction term (represents the adjusting speed that restores the long run equilibrium relationship).

3.11.2 Heterogeneous effects of recapitalization on loan disbursement

This section of the data analysis for objective two analyzes the heterogeneous effects of recapitalization on the disbursement of loans across various sectors, relative to the agricultural sector. Econometric models were adopted to examine the relationships between the bank specific variable notably, capital adequacy ratio, macroeconomic indicators, and the natural logarithm of total loans disbursement. The scope of the study is from January 2015 to December 2022 and this covered all 23 universal banks in Ghana.

Panel data was adopted as it has the advantage of handling both time series and cross-sectional dimensions (Xu, 2023). This allowed for the highlight of the effects of recapitalization on loan disbursement over time while considering variations across different sectors.

Sec_ID represents the different sectors and it is a categorical variable

The econometric model for the random effects regression is stated as;

$$lnLD_{it} = \beta_0 + \beta_1 * lnNPLs_{it} + \beta_2 * CAR_{it} + \beta_3 * Inflation_{it} + \beta_4 * Interest_{it} + \beta_5 * RECAP_{it} + \beta_6 * Covid_{it} + \alpha_i + \varepsilon_{it} \ldots\ldots \text{ Equation 11}$$

αi refers to the individual random effects which captured the unobserved sector specific heterogeneity.

A test was then conducted to ascertain between the OLS and random effects regression, which was more robust. The Breusch Pagan Lagrange Multiplier (LM) test was therefore conducted to ascertain if there was the presence of heteroskedasticity that violates the OLS assumption. This test, according to Huang et al. 2022, is a diagnostic test that checks the presence of heteroskedasticity in a regression model by contrasting the residuals in the regression model to the predicted values of the independent variables. This enables the confirmation of a relationship between the residuals and the predictors. The hypothesis for this test is stated as follows;

H_0: Across all the observations, there is a constant variance of the residuals (absence of heteroskedasticity)

H_1: Across all the observations, the variance of the residuals is not constant (presence of heteroskedasticity)

In an econometric sense, this test regresses the squared residuals from the regression model on the independent variables, thereby ascertaining whether a significant relationship exists (Kebalepile & Chakane, 2023). From the study conducted, the p-value of less than the chosen significance level of 0.05 was used to determine the rejection of the null hypothesis. The Breusch-Pagan LM test therefore affirmed the presence of heteroskedasticity, which violates the assumption of the OLS model leading to its rejection in the study (Alabi et al., 2020).

From the rejection of the OLS model in the study, the fixed effects regression model was adopted to test its appropriateness as against the random effects regression. Therefore, the study further assessed whether the fixed effects regression, within the framework of robustness, was more appropriate compared to the random effects regression following the rejection of the OLS model. Thus, the Hausman test, which is a diagnostic tool, and a specification test was used to determine whether the random effects model was more appropriate, or the fixed effects model was a better model to adopt. The hypothesis that was tested is stated as follows;

H_0: Random effects model is more appropriate

H_1: Fixed effects model is more appropriate

In the study, the test results from the Hausman test indicated that the p-value was less than the chosen significance level of 0.05, which led to the rejection of the null hypothesis. Flowing from this, the fixed effects regression with robust standard errors was therefore chosen since it accounts for the sector-specific effects in the study, and the independent variables. The econometric model that explains the fixed effects with robust standard error is stated as;

$$lnLD_{it} = \beta_0 + \beta_1 * lnNPLs_{it} + \beta_2 * CAR_{it} + \beta_3 * Inflation_{it} + \beta_4 * Interest_{it} + \beta_5 * RECAP_{it} + \beta_6 * Covid_{it} + \theta + \varepsilon_{it} \ldots \ldots \text{ Equation 12}$$

Where;

θ refers to sector specific fixed effects to capture unobserved heterogeneity

ε_{it} refers to the error term that captures the unobserved variation of each sector at time t

Further to the above, further analysis which was aimed at analyzing the heterogeneous effects of recapitalization on the disbursement of loans across sectors relative to the agricultural sector was conducted. By contrasting the performance of other sectors to agriculture, which was the base sector, an analysis was done to ascertain how recapitalization has affected the disbursement of loans across these sectors. A sector specific analysis was therefore conducted with the use of fixed effects regression with robust standard errors, since it can account for the unobserved sector specific impacts of the recapitalization, while controlling for sector specific variations. The econometric model employed for the sector-specific analysis is stated as follows;

$$lnLD_{it} = \alpha + \sum_{j=2}^{9} \gamma j \, SecID_{ij} + \beta_1 lnNPLs_{it} + \beta_2 CAR_{it} + \beta_3 Inflation_{it} + \beta_4 Interest_{it} + \beta_5 RECAP_{it} + \beta_6 COVID_{it} + \varepsilon_{it} \; \dots \dots \; \text{Equation 13}$$

Where;

α is a constant

γj represents the coefficients of the sector dummies (j is a range from 2 to 9, which covers the various sectors in the study)

$lnNPLS_{it}$, CAR_{it}, $Inflation_{it}$, $Interest_{it}$, $RECAP_{it}$, $COVID_{it}$ are the independent variables for sectors i at time t

ε_{it} is the error term

3.11.3 Agricultural credit risk management strategies used before and after the recapitalization of banks

To achieve objective three of the study, two different analytical approaches were employed. These are the content and thematic analysis to attain understanding into the qualitative features of credit risk management practices and descriptive statistics which aided in assessing the quantitative changes in the various credit risk management practices.

Due to the small sample size, that is 23 banks, content and thematic analysis was a viable option in investigating the agricultural credit risk management strategies of banks in Ghana before and after the recapitalization. Questionnaires were the main instrument of data collection on the agricultural credit risk management strategies of the various banks. Twenty-three (23) respondents from each of the commercial banks who are at the credit departments were interviewed.

In order to be able to analyse the information gathered from the respondents, a coding scheme was developed. The information included relevant thematic findings as agricultural credit risk management strategies, agricultural credit risk management challenges, effectiveness of agricultural credit risk management strategies before recapitalization, new agricultural credit risk management strategies after recapitalization, effectiveness of the new agricultural credit risk management strategies and the challenges with the new agricultural credit risk management strategies.

The Cronbach Alpha was the used to check the internal consistency and the reliability of the questions in each of the identified themes. According to Aithal and Aithal (2020), the Cronbach Alpha assesses the internal consistency and set of items within a thematic area, by ascertaining whether the set of items are measuring the same area consistently.

Descriptive statistics was employed in determining the quantitative aspects of the various agricultural credit risk management strategies before and after the recapitalization of banks. The statistics included central tendencies including the mean, the shape of the various distributions like kurtosis and measures of variability like standard deviations and standard error and relative importance index which assesses the significance of items within a dataset.

Again, the McNemar's test, as employed in this study, is a non-parametric statistical test used for paired nominal data in order to assess whether there is a significant change in a categorical outcome before and after an in event (Kumar-M & Mishra, 2024). In the context of this study therefore, the categorical outcome is the agricultural credit risk management strategies employed before and after the recapitalization of banks.

For a 2X2 contingency table, the McNemar's test statistic (x^2) is computed as follows;

$x^2 = \frac{(b-c)^2}{b+c} \ldots \ldots$ Equation 14

Where;

b is the number of banks that used the strategy before recapitalization but not after

c is the number of banks that did not use the strategy before but employed it after

The McNemar's test formula follows a chi-square distribution with one degree of freedom (df = 1) (Luo & Liu, 2024).

3.11.4 Agricultural credit appraisal process and credit appraisal scores

The final objective investigated the agricultural credit appraisal process that the 23 banks in the country employ to assess their loan applications. The objective also examined the agricultural credit appraisal scores of various deliverables and parameters that are assigned obligors.

The questionnaire was administered to officials who are at the credit departments in all the 23 banks. Thus, a respondent was chosen from each bank. Content and thematic analysis was once again employed in achieving this objective. A coding scheme was once again developed and the information contained relevant thematic findings as application of agricultural credit appraisal process for banks, various agricultural credit appraisal processes, challenges of agricultural credit appraisal and the determinants of agricultural credit appraisal scores.

For each of the items in the questionnaire related to this objective, descriptive statistics which include sum, mean, standard deviation and standard error were computed to understand the nature of responses and distribution across all the banks. To assess the internal consistency of the questionnaire and ensure that all items were reliably measuring the same construct, the Cronbach Alpha was adopted.

Agricultural credit appraisal process is cardinal in determining the creditworthiness of borrowers and the allocation of credit to the agricultural sector (Guo et la., 2024). A cluster analysis technique was employed to assess and cluster credit appraisal factors. This section therefore details the methodological approach that was used to evaluate the clustering of the credit appraisal factors. Thus, a clustering-based framework was adopted, which employed centroid-based clustering techniques in order to optimize the grouping of observations based on their characteristics.

The clustering of agricultural credit appraisal factors was executed by minimizing the within-cluster variance. The mathematical formulation of this clustering process is expressed as;

$$\min_{C1, C2, \dots, Ck} \sum_{i=1}^{k} \sum_{xj \in Ci} || x_j - \mu_i ||^2 \dots \dots \text{ Equation 15}$$

Where,

K is the number of clusters

C_i is cluster i

x_j is observations (appraisal factors)

μ_i is centroid cluster i

$||x_j - \mu_i||^2$ is the squared Euclidean distance between observation x_j and cluster centroid μ_i

For this study, each appraisal factor or observation was assigned to the nearest centroid and thus, minimizing within-cluster variance.

In order to validate the appropriateness of the assigned cluster, the study employed three key statistical indicators. These are distance to centroid, correlations with centroid and silhouette score and they essentially ensured the accuracy of the clustering process.

The distance to centroid is the proximity of an observation to its respective centroid is a primary criterion for cluster assignment (Młodak, 2021). The distance metric is expressed as:

Distance to centroid ((D_j):

$$D_j = ||x_j - \mu_i|| \; \ldots \ldots \text{ Equation 16}$$

A lower value of D_j suggests a stronger fit within the cluster.

Also, in order to assess the strength of the relationship between an appraisal factor and its assigned cluster, the correlation with the cluster centroid was computed as stated below;

$$Corr_j = \frac{\sum(x_j - \bar{x})(\mu_i - \bar{\mu})}{\sqrt{\sum(x_j - \bar{x})^2 \sum(\mu_i - \bar{\mu})^2}} \; \ldots \ldots \text{ Equation 17}$$

A value of 1, in the cluster assignment, indicates a perfect correlation which implies that the variables strongly belong to its assigned cluster.

In a cluster analysis technique, the silhouette score measures the degree of cohesion within a cluster relative to the separation from the nearest alternative cluster (Sridevi et al., 2022). This is expressed as follows;

$S_j = \frac{b_j - a_j}{\max(a_j, b_j)}$ … … Equation 18

Where;

a_j is the average intra-cluster distance (cohesion)

b_j is the average nearest cluster distance (separation)

S_j ranges from -1 to 1:

Closer to 1 is a well clustered observation

Near 0 is borderline clustering

Negative values are misclassified observation.

Finally, assessing agricultural creditworthiness through the employment of credit appraisal scores is influenced by multiplicity of factors that collectively shape the credit appraisal process. Identifying and quantifying these determinants is a key aspect of the understanding the framework employed by banks in evaluating agricultural loan applications. In order to achieve this, the Principal Component Analysis is employed as a dimensionality reduction technique which extracts the most significant determinants. The econometric expression of the PCA is as follows;

$\mathrm{F_k} = \sum_{j=1}^{p} \lambda_{kj} X_j + \varepsilon_k$… … Equation 19

Where;

F_k is k^{th} principal component (latent factor)

λ_{kj} is factor loading of variable X_j on component k

X_j is the original credit appraisal score variable

ε_k is the error term or the residual variance

Generally, PCA is derived from the eigenvalue decomposition of the covariance or the correlation matrix $\sum$ of X:

$\sum V = V\Lambda$ … … Equation 20

The eigenvalue decomposition ensures that the extracted components are able to retain the maximum variance within the dataset and this minimizes redundancy among variables (Xia et al., 2021). Thus, in the context of this study, the PCA allows for a determination of the key drivers that influence agricultural credit appraisal scores.

This decomposition ensures that the extracted components retain the maximum variance within the dataset while minimizing redundancy among variables. The application of PCA in this study allows for a rigorous determination of the key drivers influencing agricultural credit appraisal scores, providing valuable insights into the most critical factors that financial institutions prioritize when assessing agricultural loan applications.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

Chapter four presents the data results and discussions of the study. The chapter, where appropriate, presents illustrations of the descriptive and inferential statistics of the variables adopted and discusses the findings. The results from appropriate diagnostics tests and analytical techniques that transform the data to aid cogent analysis, and discussions are presented and discussed. Lastly, the results and discussions of each objective of the study are presented in this chapter as well.

4.2 Descriptive Statistics

This section presents the descriptive statistics for the variables employed in the econometric analysis of the effects of recapitalization of financial institutions on agricultural finance. These descriptive statistics provide a preliminary overview of the characteristics of each variable employed in the study. Table 4.1 summarizes the descriptive statistics for all the variables including the number of observations, mean standard deviation, skewness and kurtosis.

Table 4. 1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max	25th Pctile	Median	75th Pctile	Skewness	Kurtosis
Time (Months, Jan 2015 - Dec 2022)	96	48.5	27.86	1	96	24.5	48.5	72.5	0	1.8
lnAF (Log of Agricultural Finance, GHS)	96	21.18	0.28	20.64	21.94	20.93	21.2	21.33	0.29	2.63
Inflation (Annual Rate, %)	96	11.83	9.76	5.4	59.7	7.33	8.32	11.45	3.12	12.95
Interest (Annual Rate, %)	96	25.09	3.36	20.04	35.58	22.25	24.21	27.93	0.36	2.68
lnGDPA (Log of Agricultural GDP, GHS)	96	21.37	0.13	21.2	21.59	21.25	21.36	21.48	0.22	1.74
lnNPLA (Log of Non-Performing Agricultural Loans, GHS)	96	19.9	0.38	19.07	20.41	19.62	20.06	20.2	-0.76	2.14
lnTA (Log of Total Assets, GHS)	96	25.39	0.37	24.61	25.92	25.12	25.39	25.73	-0.37	2.16
CAR (Capital Adequacy Ratio, %)	96	18.3	1.74	14.18	21.84	17.08	18.4	19.56	-0.32	2.59
CLSTL (Core Liquid Assets to Short-Term Liabilities Ratio)	96	31.08	3.08	24.19	36.67	29.09	31.57	33.32	-0.54	2.46
RECAP (Recapitalization Dummy)	96	0.5	0.5	0	1	0	0.5	1	0	1
Covid (COVID-19 Pandemic Dummy, 1=2020-2021, 0=Otherwise)	96	1.38	0.49	1	2	1	1	2	0.52	1.27
ROE (Return on Equity, %)	96	20.82	4.03	7.32	32.21	18.88	21.05	22.26	-0.3	4.86
CIEA (Composite Index of Economic Activities, %)	96	6.28	6.38	0.46	39.42	2.68	4.26	7.78	2.82	12.92
lnM2 (Log of Broad Money Supply, GHS)	96	10.98	0.45	10.21	11.81	10.68	11.02	11.43	-0.1	1.91
MPR (Monetary Policy Rate, %)	96	19.23	4.43	13.5	27	15.25	18	23	0.37	1.68

Source: Author's analysis from secondary data (2023)

From Table 4.1, the mean value of the log of agricultural finance, lnAF (GHS) is 21.8 and the median of 21.2 suggests an approximate symmetry with low variability in the log of agricultural finance as evidenced by the standard deviation of 0.28. The recorded skewness is 0.29 which indicates a slight tendency towards higher values. The Kurtosis of 2.63, which is less than 3, indicates platykurtic distribution implying fewer extreme values in the log of agricultural finance.

Interest rate has a mean of 25.09% and median of 24.21% which implies a relatively balanced distribution. The skewness of 0.36 implies that it is slightly right skewed which suggests more high-interest rate periods. The kurtosis of 2.68 indicates a platykurtic distribution, which implies that interest rate variations are concentration more around the mean.

From Table 4.1, lnGDPA has a low standard deviation of 0.13 (GHS) which suggests that the fluctuations are minimal. The recorded skewness and kurtosis are 0.22 and 1.74, which is almost normal.

Furthermore, lnNPLA recorded a mean and median of 19.9 (GHS) and 20.06 (GHS), respectively, which are close and indicate balanced distribution. The left skewness suggests few instances of low non-performing loans as most of the variables are concentrated towards the higher end. The recorded kurtosis of 2.14 indicates moderate distribution which implies fewer extreme loan defaults.

Again, CAR as measured as a percentage, has a mean of 18.3% and a median of 18.41%, indicating a relatively symmetric distribution. The standard deviation of 1.74% shows moderate variability in CAR across the banks. The recorded kurtosis of 2.59% suggests a platykurtic distribution. The fact that the mean is well above the typical regulatory minimums suggests that on average, banks maintained healthy capital buffers.

Also, the mean and median values of 31.08 and 31.57 for CLSTL ratio indicate a relatively balanced distribution. The standard deviation of 3.08 reflects the moderate variability in the liquidity position of the banks. The skewness of -0.54 suggests a slight tendency towards high liquidity levels, with some few banks having lower liquidity. The kurtosis of 2.46 implies a platykurtic distribution which indicates the CLSTL values are less concentrated around the mean. The left skew indicates that most banks maintained relatively high liquidity levels.

Recapitalization has a mean and median of 0.5 which suggests an even split between the period after the last recapitalization (from January 2019) and the period before this last recapitalization. The skewness and kurtosis of 0 and 1 indicate a perfectly uniform distribution which is expected for a dummy variable.

From Table 4.1, the mean and median of lnM2 are 10.98 (GHS) and 11.02 (GHS), which are almost identical indicating a normal distribution. The slight left skew of -0.1 and kurtosis of 1.91 suggests moderate peakedness, which indicates a well-behaved monetary expansion. The standard deviation of 0.45 indicates low variability in the log of broad money supply.

Finally, from Table 4.21, the mean and median of MPR of 19.23% and 18%, respectively, suggest a relatively high-interest rate environment. The standard deviation of 4.43% indicates moderate variability in MPR. The positive skewness of 0.37% indicates a tendency toward periods with higher MPR values.

4.3 Trend Analysis

This section presents the results of the Mann-Kendall trend test. The Mann-Kendall trend test is a non-parametric statistical test which is used to identify monotonic trends in a time series data (Alashan, 2024). It is useful as it does not assume any specific distribution for the data and robust to outliers. It also assesses whether there is a statistically increasing or decreasing trend in the levels of each variable over the study period (January 2015 to December 2022). Sen's slope estimator is employed to determine the magnitude and direction of the trend. Table 4.2 depicts the results of the Mann-Kendal trend test including the Kenall's Tau, the S statistic, the p-value, Sen's slope and the 95% confidence intervals for the slope. Table 4.2 also indicates the direction of the trend and its statistical significance.

Table 4. 2: Mann-Kendall Trend Test

Variable	Kendall's Tau	S Statistic	p-value	Sen's Slope	Lower Bound (95% CI)	Upper Bound (95% CI)	Trend Direction	Statistical Significance
Time	1	4560	< 0.0001	1	1	1	Increasing	Yes
lnAF	0.711	3240	< 0.0001	0.009	0.007	0.01	Increasing	Yes
Inflation	0.467	2126	< 0.0001	0.08	0.058	0.103	Increasing	Yes
Interest	-0.658	-2994	< 0.0001	-0.107	-0.114	-0.099	Decreasing	Yes
lnGDPA	1	4560	< 0.0001	0.005	0.004	0.005	Increasing	Yes
lnNPLA	0.445	2030	< 0.0001	0.009	0.006	0.011	Increasing	Yes
lnTA	1	4560	< 0.0001	0.012	0.012	0.013	Increasing	Yes
CAR	0.356	1621	< 0.0001	0.033	0.023	0.043	Increasing	Yes
CLSTL	-0.567	-2581	< 0.0001	-0.089	-0.102	-0.074	Decreasing	Yes
RECAP	0.711	2304	< 0.0001	0.011	0	0.014	Increasing	Yes
Covid	0.688	2160	< 0.0001	0	0	0.013	Increasing	Yes
ROE	-0.078	-356	0.26	-0.015	-0.044	0.011	No Trend	No
CIEA	0.104	473	0.134	0.02	-0.007	0.051	No Trend	No
lnM2	0.966	4406	< 0.0001	0.016	0.016	0.016	Increasing	Yes
MPR	-0.554	-2407	< 0.0001	-0.109	-0.13	-0.094	Decreasing	Yes

Source: Author's analysis from secondary data (2023)

Table 4.2 depicts the results of the Mann-Kendall trend test. The time variable of 1 shows a strong upward trend is evidenced by the Kendall's Tau of 1 and Sen's Slope of 1. The time variable naturally increases since it represents the months from January 2015 to December 2022 and it provides the foundation for analyzing the macroeconomic and bank-specific indicators over the study period.

From Table 4.2 the logarithm of agricultural finance (lnAF) has a Kendall's Tau of 0.711 and a Sen's slope of 0.009, which are statistically significant. This significant positive trend in lnAF suggests that agricultural credit has grown steadily over the study period. This finding aligns with the financial intermediation theory which postulates that stronger capital base improves credit supply.

Also, inflation witnessed an increasing trend with a Kendall's Tau of 0.467 and Sen's slope of 0.08. By implication, inflation rate exhibits a strong upward trend which largely reflects Ghana's macroeconomic volatility over the study period. Generally, persistent inflation erodes the real value of credit or loan and may increase the default risks in the agricultural sector due to higher cost of input (Adams, 2021). This aligns with the credit rationing theory where inflationary pressures has a tendency to lead to higher interest rates and possible constraints in lending.

From Table 4.2, interest rates witnessed a decreasing trend as evidenced by the Kendall's Tau and Sen's slope of -0.658 and -0.107, respectively. This suggests a general monetary easing policy over the study period. The lower interest rates recorded typically simulate borrowing which may have contributed to the rising trend in lnAF. This finding supports the Keynesian liquidity preference theory where lower interest rates enhance the demand for credit.

Furthermore, GDP in the agricultural sector (lnGDPA) witnessed an increasing trend over the study period as evidenced by the Kendall's Tau of 1 and Sen's slope of 0.005. This result points out to growth in the agricultural sector buoyed by potentially greater access to credit (lnAF) and this supports Schumpeter's hypothesis which posits that financial development enhances economic growth.

Better still, non-performing loans in the agricultural sector (lnNPLA) witnessed an increasing trend over the study period which is statistically significant. This is evidenced by the Kendall's Tau of 0.445 and Sen's slope of 0.009. This increasing trend in lnNPLA suggests worsening or deteriorating credit quality which could be as a result of inflationary shocks leading to higher production costs and default risks and structural weakness in loan monitoring within the agricultural sector. This finding is consistent with the asymmetric information theory where higher lending to risky obligors or borrowers leads to moral hazard and adverse selection.

From Table 4.2 total assets of banks (lnTA) witnessed an increasing trend over the study period, which is statistically significant. The continuous growth in lnTA therefore aligns with the recapitalization program as its impact has strengthened the balance sheets of banks. This finding aligns with the Modigliani and Miller's capital structure theory which stresses on capital adequacy for financial stability.

Moreover, capital adequacy ratio (CAR) also witnessed increasing trend as evidenced by the Kendall's Tau of 0.356 and Sen's slope of 0.033. The increasing trend of CAR confirms that the banking sector has become resilient after the recapitalization. This supports the Basel III regulatory framework that posits that strengthening capital positions reduces systemic risks.

The ratio of core liquid assets to short term liabilities (CLSTL) witnessed decreasing trend as evidenced by the Kendall's Tau and Sen's slope of -0.567 and -0.089, respectively, which is statistically significant. This result indicates increased liquidity risk exposure by the banks which could make them more vulnerable to shocks in the credit market.

From Table 4.2, the monetary policy rate (MPR) witnessed a decreasing trend as evidenced by the Kendall's Tau of -0.554 and the Sen's slope of -0.109. The downward trend in MPR over the period indicates a loosening monetary policy stance by the central bank. Lower MPR may have been the contributing factor to increasing lending in the agricultural sector.

4.4 Effects of recapitalization financial institutions on agricultural finance

This section details the analysis of data to analyze the effects of recapitalization of commercial banks on agricultural finance. The Autoregressive Distributed Lag model (ARDL), a robust statistical tool, was employed to evaluate the relationships between the independent variable and dependent variables. The dependent variables are as follows; Inflation, Interest, lnGDPA (Natural logarithm of GDP in the agricultural sector), lnNPLA (Natural logarithm of Non-performing loans in the agricultural sector), lnTA (Natural logarithm of Total Assets of banks), CAR (Capital Adequacy Ratio), CLSTL (Core Liquid Assets to Short Term Liabilities of Banks), RECAP (Recapitalization), Covid-19, ROE

(Return on Equity of Banks), CIEA (Composite Index of Economic Activities). lnM2 (Natural Logarithm of Broad Money Supply) and MPR (Monetary Policy Rate). The dependent variable for this study is lnAF (Natural logarithm of agricultural finance).

4.4.1 Test for stationarity

As a prerequisite regarding the modelling of time series data, stationarity of the variables was checked. This was to ensure that the mean, variance and covariance of the variables employed in the study are the same or remain constant over time. Table 4.3 depicts the results of the stationarity test conducted using the Augmented Dickey Fuller test (ADF).

Table 4. 3: ADF Test for Stationarity before Differencing

Variable	Test Statistic (Z(t))	1% Critical Value	5% Critical Value	10% Critical Value	p-value	Stationary?	Integration Order
lnAF	-1.241	-3.517	-2.901	-2.586	0.656	No	I(1)
Inflation	-2.547	-3.520	-2.903	-2.588	1.000	No	I(1)
Interest	-1.279	-3.522	-2.905	-2.590	0.997	No	I(1)
lnGDPA	-2.277	-3.525	-2.907	-2.592	0.999	No	I(1)
lnNPLA	-2.306	-3.527	-2.909	-2.594	0.170	No	I(1)
lnTA	-5.325	-3.530	-2.911	-2.596	0.000	Yes	I(0)
CAR	-2.307	-3.532	-2.913	-2.598	0.170	No	I(1)
CLSTL	-2.442	-3.535	-2.915	-2.600	0.130	No	I(1)
RECAP	-0.989	-3.537	-2.917	-2.602	0.757	No	I(1)
Covid	-0.762	-3.540	-2.919	-2.604	0.830	No	I(1)
ROE	-4.722	-3.542	-2.921	-2.606	0.000	Yes	I(0)
CIEA	-3.492	-3.545	-2.923	-2.608	0.008	Yes	I(0)
lnM2	-0.196	-3.547	-2.925	-2.610	0.972	No	I(1)
MPR	-0.010	-3.550	-2.927	-2.612	0.959	No	I(1)

Source: Author's analysis from secondary data (2023)

Table 4.3 is a depiction of the ADF test statistics for each variable employed in this research. From the table, only lnTA and ROE were stationary as their p-values were less than the chosen significance level of 0.05. This necessitated the need to transform the variables which were not stationarity through the differencing approach. The results of the first-order differencing are therefore displayed in Table 4.4.

Table 4. 4: ADF Test for Stationarity after Differencing

Variable	Test Statistic (Z(t))	1% Critical Value	5% Critical Value	10% Critical Value	p-value	Stationary?	Integration Order
DlnAF	-9.163	-3.518	-2.901	-2.586	0.000	Yes	I(0)
DInflation	-4.945	-3.426	-2.899	-2.584	0.000	Yes	I(0)
DInterest	-5.877	-3.432	-2.903	-2.588	0.000	Yes	I(0)
DlnGDPA	-7.018	-6.715	-2.905	-2.590	0.000	Yes	I(0)
DlnNPLA	-10.040	-7.421	-2.907	-2.592	0.000	Yes	I(0)
DCAR	-9.180	-3.624	-2.909	-2.594	0.000	Yes	I(0)
DCLSTL	-13.334	-3.104	-2.911	-2.596	0.000	Yes	I(0)
DRECAP	-9.695	-3.001	-2.913	-2.598	0.000	Yes	I(0)
DCovid	-9.695	-3.021	-2.915	-2.600	0.000	Yes	I(0)
DlnM2	-7.503	-4.235	-2.917	-2.602	0.000	Yes	I(0)
DMPR	-8.350	-5.321	-2.919	-2.604	0.000	Yes	I(0)

Source: Author's analysis from secondary data (2023)

Table 4.4 is an illustration of the results of the first-order differencing that was employed to transform the non-stationary variables. From the results, all the non-stationary variables became stationary after the first-order differencing was employed.

4.4.2 Test for multicollinearity

A key diagnostic check, multicollinearity, was conducted to evaluate the extent to which the independent variables are correlated with each other in the regression model. The Variance Inflation Factor (VIF) was employed to check for this. The results of the VIF is illustrated in Table 4.5.

Table 4. 5: Test for Multicollinearity

Variable	VIF	1/VIF
DInflation	2.08	0.481577
lnTA	1.8	0.554957
CIEA	1.66	0.603231
DlnGDPA	1.64	0.610956
ROE	1.59	0.629533
DInterest	1.52	0.658603
DMPR	1.47	0.678214
DCLSTL	1.18	0.849974
DCovid	1.17	0.851245
DlnM2	1.13	0.88687
DCAR	1.13	0.888156
DRECAP	1.11	0.898609
DlnNPLA	1.04	0.962941
Mean VIF	1.42	

Source: Author's analysis from secondary data (2023)

Table 4.7 shows the results of the VIF that was employed to check for multicollinearity. From the table, there was no multicollinearity among the variables as evidenced the VIF of less than 10 and the degree of tolerance of more than 0.1 (1/VIF<0.1) (O'Brien, 2007).

4.4.3 Test for Omitted Variables Bias

The linktest was employed to test for omitted variables bias. Table 4.6 depicts the results of the test conducted.

Table 4. 6: Test for Omitted Variables Bias

DlnAF	Coefficient	Std. Error	t-statistic	p-value	[95% Conf. Interval]
_hat	0.9554455	0.1305163	7.32	0	[0.6962289, 1.214662]
_hatsq	1.780918	1.422259	1.25	0.214	[-1.043811, 4.605647]
_cons	-0.0041497	0.0072409	-0.57	0.568	[-0.0185307, 0.0102314]

Source: Author's analysis from secondary data (2023)

From Table 4.6, the coefficient for _hat which is the predicted values is 0.955, which is statistically significant (p<0.001). This implies that the predicted values are positively associated with the actual values. Again, the coefficient of _hastsq (which is the squared predicted values) is 1.781. This is not statistically significant and by implication, there is no strong evidence of omitted variable bias, based on this test.

4.4.4 Heteroskedasticity test

A test was conducted to check for heteroskedasticity in the regression models. By definition, heteroskedasticity refers to the situation where the variance of the errors in the model varies across observations (Alabi, 2021). Table 4.9 depicts the test for heteroskedasticity.

Table 4. 7: Breusch-Pagan / Cook-Weisberg Test for Heteroskedasticity

Statistic	Value
Chi-squared (chi2(1))	0
Prob > chi2	0.9616

Source: Author's analysis from secondary data (2023)

Table 4.7 depicts the test results for heteroskedasticity. The null hypothesis for the test is that there is homoskedasticity or constant variance. The chi-squared test statistic of 0.00 indicates that there is no heteroskedasticity on the fitted values. This is affirmed by the associated p-value of 0.962, which is higher than the chosen significance level of 0.05, resulting in the failure decision to reject the null hypothesis.

4.4.5 Test for autocorrelation

Autocorrelation is an occurrence where the residuals of a model are correlated with each other (Kumar, 2023). This can lead to imprecise and inefficient estimates. The Breusch-Godfrey LM test was employed to check for autocorrelation. This is depicted in Table 4.8.

Table 4. 8: Breusch-Godfrey LM Test for Autocorrelation

Statistic	Value
Lags (p)	1
Chi-squared (chi2(1))	0.021
Degrees of Freedom (df)	1
Prob > chi2	0.8852

Source: Author's analysis from secondary data (2023)

Table 4.8 is a depiction of the Breusch-Godfrey LM test for autocorrelation. The null hypothesis states that there is no serial correlation or there is no correlation in the residuals. The chi-squared test statistic of 0.02 indicates a low level of correlation in the residuals. Again, the associated p-value of the chi-squared test statistic of 0.089 which is higher than the chosen significance level of 0.05, affirms the failure decision to reject the null hypothesis. Impliedly, there is no evidence of autocorrelation in the residuals of the regression model.

4.4.6 Test for endogeneity

To address endogeneity concerns in the study, instrumental variables estimation was employed using the Two-Stage Least Squares (2SLS) regression with DInflation, DInterest, lnTA, DCAR, DCovid, ROE, CIEA, DCLSTL, DRECAP, DlnM2, and DMPR serving as instruments for DlnNPLA and DlnGDPA**.** The results of the endogeneity test are depicted in Table 4.11.

Table 4. 9: Durbin and Wu-Hausman Test for Endogeneity

Test Type	**Test Statistic**	**Degrees of Freedom (df)**	**p-value**	**Decision (5% Significance Level)**
Durbin (score) chi2	1.56351	2	0.4576	Fail to reject H0 (Variables are exogenous)
Wu-Hausman F	0.702803	2, 84	0.4981	Fail to reject H0 (Variables are exogenous)

Source: Author's analysis from secondary data (2023)

Table 4.9 depicts the results of the Durbin test and Wu-Hausman test for endogeneity. The null hypothesis is that the variables are exogenous. Given that the p-values of both Durbin and Wu-Hausman tests are greater than 0.05, the decision rule to fail to reject the null hypothesis was applied. Therefore, there is no statistical evidence to support the presence of endogeneity in this model.

4.4.7 Cumulative sum test for parameter stability

In order to assess the stability of the regression parameters over time, the Cumulative Sum (CUSUM) test was employed. The CUSUM test helps to identify if there are structural breaks in the model (Phiri & Wang, 2022). The structural breaks can affect the validity of the results of the regression. Table 4.12 depicts the results of the CUSUM test.

Table 4. 10: CUSUM Test Result

Statistic	Value
Number of Observations	95
Null Hypothesis (H0)	No structural break
Test Statistic	0.2338
1% Critical Value	1.143
5% Critical Value	0.9479
10% Critical Value	0.85

Source: Author's analysis from secondary data (2023)

Table 4.10 depicts the results of the CUSUM test. The null hypothesis is that there are no structural breaks in the parameters of the regression model. From Table 4.10, the test statistic of 0.234 is significantly lower than all the critical values at the chosen significance levels. This therefore provides a strong basis to fail to reject the null hypothesis. It can therefore be concluded that there are no structural breaks in the regression parameters.

4.4.8 Selection order criteria for ARDL

In order to ensure robust econometric modelling of this research, the selection-order criteria were employed to determine the optimal lag length of the Autoregressive Distributed Lag Model (ARDL) that was employed in this study. Table 4.11 illustrates the selection order criteria.

Table 4. 11: Selection Order Criteria

Lag	Log Likelihood (LL)	LR Statistic	df	p-value	FPE	AIC	HQIC	SBIC
0	-232.646				1.30E-15	5.42079	5.57664	5.80708
1	297.192	1059.7	196	0	8.5e-19*	-1.91631*	0.421321*	3.87798*
2	461.898	329.41	196	0	2.20E-18	-1.22854	3.29089	9.97376
3	682.902	442.01	196	0	2.90E-18	-1.77807	4.92315	14.8322
4	991.679	617.55*	196	0	1.70E-18	-4.25669*	4.62633	17.7616

Source: Author’s analysis from secondary data (2023)

Table 4.11 depicts the selection order criteria for the ARDL model. The column marked LR tests whether the model with its current lag length is better than the model with one fewer lag. The columns marked FPE, AIC, HQIC and SBIC are the Final Prediction Error (which measures the forecast accuracy in the model), Akaike Information Criterion, Hannan-Quinn Information Criterion and the Schwarz Bayesian Information Criterion. In order to balance goodness of fit with parsimony, a lag length of 1 is selected as appropriate as ARDL, as it is the choice suggested by the HQIC, SBIC and FPE criteria. The lag suggestions of 1 by the SBIC, HQIC and FPE criteria, while AIC suggests a lag of 4 affirms the latter’s tendency to overfit.

4.4.9 ARDL Regression

The ARDL model has been employed in this study as it has the ability to accommodate variables that are integrated of different orders. Again, the model's ability to analyze both short-run and long-run relationships in time series data that exhibit varying orders of integration as well as its ability to also test and estimate cointegration relationships justify why it was employed in this study. Table 4.12 illustrates the results of the ARDL regression.

Table 4. 12: ARDL Regression

Variable	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
ADJ					
DlnAF L1.	-0.942396	0.093657	-10.06	0	[-1.128852, -0.755939]
LR					
DInflation	0.011338	0.005344	2.12	0.037	[0.0006996, 0.021977]
DInterest	-0.03217	0.017697	-1.82	0.073	[-0.067402, 0.003063]
DlnGDPA	-2.505386	3.016148	-0.83	0.409	[-8.510074, 3.499303]
DlnNPLA	0.240958	0.057734	4.17	0	[0.126018, 0.355898]
lnTA	-0.021753	0.026844	-0.81	0.42	[-0.075194, 0.031689]
ROE	-0.00488	0.002358	-2.07	0.042	[-0.009574, -0.000186]
CIEA	0.001186	0.001258	0.94	0.349	[-0.001318, 0.003689]
DCAR	-0.034301	0.009938	-3.45	0.001	[-0.054086, -0.014517]
DCLSTL	0.003554	0.004928	0.72	0.473	[-0.006256, 0.013364]
DRECAP	0.118879	0.072908	1.63	0.107	[-0.026270, 0.264029]
DCovid	0.044507	0.074159	0.6	0.55	[-0.103132, 0.192146]
DlnM2	-0.272206	0.285593	-0.95	0.343	[-0.840778, 0.296367]
DMPR	0.030877	0.012006	2.57	0.012	[0.006974, 0.054780]
SR					
DInterest L1.	0.029009	0.012357	2.35	0.021	[0.004409, 0.053609]
_cons	0.622775	0.65306	0.95	0.343	[-0.677368, 1.922918]

Source: Author's analysis from secondary data (2023)

From Table 4.12, the coefficient of the lagged dependent variable (DlnAF) is -0.942. This is statistically significant and indicates the speed of adjustment towards long-run equilibrium. Therefore, a 1% increase in the rate of change of agricultural finance in the previous period is associated with a 0.942 per cent decrease in the rate of change of agricultural finance in the current period, holding all other variables constant. This suggests a strong mean-reverting process in agricultural finance, where deviations from the long run equilibrium are corrected relatively quickly.

From Table 4.12, the long-run coefficient for inflation is 0.011. This coefficient is statistically significant at the 5% significance level, suggesting a positive long run relationship between inflation and agricultural finance. Specifically, a one percentage point increase in the annual inflation rate is associated with a 0.11 per cent increase in the rate of change of agricultural finance in the long run, all things being equal. While this effect is statistically significant, its economic significance may be limited, given the small magnitude of the coefficient. This result can be attributed to instances of output prices rising faster than input costs. In situations where actors in the agricultural sector experience price increases for their products which rise faster than prices they pay for inputs, there can be a temporary boost in profitability (Belinska et al., 2023). Such a situation makes these actors in the agricultural sector and farmers more credit-worthy which encourages banks to extend more credit. Thus, farmers and other actors in the agricultural sector may be more willing to take on debt once they anticipate higher future revenues. Furthermore, rising food price my signal increased demand for agricultural products (Nguyen et al., 2022). This therefore encourages farmers to invest in and expand production which leads to higher demand for credit. Again, some studies have shown that rising food prices can lead to an increase in the value of agricultural land which is used as collateral for loans and stored commodities used as hypothecated stock (Ambler et al., 2023; Gundogdu, 2023). This therefore increases the appetites of banks to provide more credit to the agricultural sector.

From Table 4.12, the coefficient of interest rate -0.032 is marginally significant at a p-value 0.073. A one percentage point increase in interest rates will result in a 0.32 per cent reduction in the rate of change of agricultural finance in the long run. This finding makes intuitive sense when interest rates rise, there is an increase in cost of borrowing (Abadi et al., 2023). As a result, farmers and agricultural businesses are saddled with the burden of higher monthly amortizations on loans. This therefore discourages farmers and agricultural businesses from taking loans or credit for operational expenses and capital investments. Agricultural finance therefore decreases as potential obligors choose to avoid high interest-bearing debt. Deduced from above, profitability may decline if cost of financing or credit exceeds returns from agricultural production (Sánchez et al., 2022). The resulting effect is a reduced investment in the agricultural sector which may also lower the demand for credit, as agricultural businesses and farmers may prioritize paying off existing debt over taking on new credit or loans. Similarly, higher interest rates may reduce the risk appetites of banks when lending to sectors such agriculture (Bourne & Graham, 2021). Banks may tighten their credit standards or apply stringent procedures as requiring increased collateral or higher credit worthiness from obligors. This can therefore reduce access to finance for smaller agricultural businesses and farmers, especially those with credit histories that are less established (Turvey et al., 2021). As a consequence, investment in the agricultural sector in expansion and modernization may stagnate, which further reduces the demand for credit or agricultural finance. This negative finding between interest rate and agricultural finance aligns with the work of Islam (2020) who found that access agricultural finance is constrained by high interest rates.

The negative relationship between interest rates and agricultural finance is primarily supported by neoclassical economic theory, notably the principle of cost of capital. Interest rates represent the cost of borrowing money. For agricultural producers, this is the cost of obtaining loans for inputs (such as seeds, fertilizers, equipment), land rental, or other investments. Therefore, when interest rates rise, the cost of borrowing increases. This makes agricultural projects that were previously profitable at lower interest rates less attractive or even unprofitable. As a consequence, farmers and agricultural businesses are less likely to borrow money for investment or expansion when interest rates are high, leading to a decrease in the demand for agricultural credit.

Furthermore, the ARDL results in Table 4.12 indicate that non-performing loans in the agricultural sector have a statistically positive relationship with agricultural finance in the long run. The positive coefficient of 0.241, which is statistically significant, implies that a (1%) increase in the rate of change in non-performing loans in the agricultural sector results in an increase of 0.241 per cent in the rate of change agricultural finance. This result indicates that a debt restructuring practice where banks may engage in debt collection to allow agricultural businesses and farmers to manage their existing debt efficiently. Debt restructuring involves extending the loan limits and amount or adjusting repayment schedules (Prosper, 2023). Banks therefore maintain relationships with obligors while providing new credit or loan terms, to assist them to be able to pay for their expired or delinquent facilities. This therefore can lead to an increase in the overall credit to the agricultural sector even when NPLs in the sector are high. This finding aligns with the concept of information asymmetry. Banks, possessing private information about borrowers' long-term prospects, may choose to restructure loans rather than writing them off immediately. This strategy also aligns with the principles of relationship lending, where banks invest in long-term relationships with obligors, even during periods of financial distress. By arranging new credit facilities or adjusting loan terms, banks are able to assist agricultural businesses and farmers to overcome temporary difficulties and improve their long-term viability, thus, ultimately maximizing banks' own recovery efforts.

Again, from Table 4.12, ROE has an inverse relationship with agricultural finance. A one percentage point increase in the change in the ROE of banks is associated with a 0.05 per cent decrease in the rate of change of agricultural finance in the long run. This suggests that as banks become more profitable, as evidenced by higher ROEs, they tend to reduce their lending to the agricultural sector. This may be indicative of the risk-averse behavior of profitable banks. There are instances where profitability can make bans more risk averse, prioritizing maintaining their financial performance and shareholder returns (Zheng et al., 2023). As the agricultural sector is perceived as high risk due to factors as longer gestation periods for returns and excessive dependence on weather especially in Ghana, profitable banks may shift their lending portfolios from agriculture to less risky sectors such as commerce, service and manufacturing, to protect their ROEs. Some studies have also shown that in competitive markets, some profitable banks may focus on urban and industrial sectors where the demand for credit is higher and repayment risks are lower (Matthews et al., 2023; Jigeer & Koroleva, 2023, Bezemer et al., 2023). This situation can result in a reduction in agricultural finance as profitable banks tend to allocate their resources to more profitable and risky markets. This inverse finding can be understood through the lens of the portfolio theory. As banks become more profitable, they have more capital to deploy or extend as credit and can afford to diversify their loan portfolios across different sectors to optimize their risk-return trade-off. This diversification may involve shifting funds from agriculture to sectors like commerce, services, and manufacturing, which are often perceived as less risky or offering relatively higher returns.

Furthermore, from Table 4.12, CAR has an inverse relationship with agricultural finance. A one-unit increase in the change in CAR is associated with a 0.34 per cent decrease in the rate of change in agricultural finance in the long run. As banks increase their CAR, they often adopt stricter lending practices and standards to ensure that they are able to maintain adequate capital relative to their risk exposure (Oyetade et al., 2021). This may entail requiring higher credit scores, enhanced collateral options and lower debt-to-income ratios from obligors. This stricter lending requirements may limit access to credit for agricultural businesses and farmers, especially smaller producers who may not have established credit histories. Thakor (2021) opines that when banks maintain higher levels of capital to meet regulatory requirements, they may have less capital available to lend. The researcher asserts that this statement holds true especially if the capital is tied up in low-risk assets or reserves, instead of being deployed as loans. As a result, the opportunity cost associated with holding excess capital can result in fewer funds available to be allocated to agricultural loans, which reduces the overall credit to the agricultural sector. Some banks may also focus on asset quality with an emphasis on maintaining a strong CAR, prioritizing lending to sectors they perceive as low risk or more stable relative to the agricultural sector (Velliscig et al., 2022). Thus, as banks redirect their resources towards safer investments in other sectors, it may be to the detriment of agricultural finance. This finding aligns with the bank lending channel of monetary policy, which posits the importance of a bank's capital position for its lending capacity. When banks prioritize building up their capital buffers, they may have fewer funds available for agricultural loans.

Moreover, the monetary policy rate has a positive significant relationship with agricultural finance, as illustrated in Table 4.12. A one percentage point increase in the monetary policy rate is associated with a 0.31 per cent increase in the rate of change of agricultural finance in the long run. This positive relationship between the MPR and agricultural finance in Ghana is influenced by broader macroeconomic context. There are instances when higher MPRs strengthen the Ghana Cedis, making imported agricultural inputs cheaper (Quaye, 2023). This can invariably reduce the cost of production for farmers and increase their demand for credit as their overall operating expenditure, after taking on more debt and incurring additional interest costs, may not be unmanageable. Also, a higher MPR may signal economic stability and control over inflation which can improve investor and lender confidence (Abdulai, 2022). This can also lead to increased lending to all sectors including agriculture. Also worthy of mention is the initiative by the Bank of Ghana to support agricultural finance through the Ghana Incentive-Based Risk Sharing System for Agricultural Lending (GIRSAL), which was launched in 2016 (Appiagyei, 2023). GIRSAL aims to boost lending in the agricultural sector by providing credit risk guarantees to banks, so at to mitigate the perceived high risk associated with lending to the agricultural sector. This credit risk guarantee initiative by the BOG insulates agricultural lending from the full impact of higher MPR.

From Table 4.12, recapitalization has an insignificant relationship with agricultural finance in the long run. This can be explained by the misalignment of recapitalization objectives and agricultural lending or credit. As the primary objective of recapitalization is to enhance the stability and resilience of the banking sector, this regulatory policy focusses largely on ensuring that banks meet the minimum capital requirements to absorb losses and also reduce systemic risk (Amenu-Tekaa, 2022; Mensah, 2022; Barnett-Quaicoo, 2021). Better still, recapitalization does not specifically target increasing lending to sectors like agriculture that are marked as high-risk. It instead focusses on improving the overall financial health of the country, which may not directly translate into increased agricultural finance. Studies have shown that after recapitalization, banks may become more risk-averse so as to protect their newly strengthened capital base (Modena, 2022; Nsanyan et al., 2021). As the agricultural sector is often perceived as high-risk, recapitalized banks may prefer to lend to sectors they deem as less risky such as the commerce, manufacturing and service sectors rather than agriculture. Bhowmik et al. 2024 found that recapitalized banks may adopt lending practices that are more conservative in outlook. Such conservative practices focus on short term profitability and shareholder returns, rather than long-term developmental goals as agricultural finance. According to Fiador et al. 2022, the urban bias in banking explains why recapitalization has an insignificant relationship with agricultural finance in the long run. The researchers opine that recapitalized banks may continue to focus the bulk of their operations in urban areas, where it is more profitable to do business. This isolates the inclusion, and credit flow to rural areas where the chunk of agricultural activities happens. This finding aligns with the information asymmetry theory in that banks may still perceive agricultural lending as risky due to information asymmetries (difficulty in assessing farmers' and agricultural businesses' creditworthiness). Recapitalization generally does not solve this underlying information problem. This finding corroborates the works of Ahrendsen et al. (2003), Zheng and Jean-

Petit (2023) and Shaw et al. (2013) who found no significant impact of recapitalization on lending.

The short run coefficients in Table 4.12 capture the immediate effects of the independent variables employed in the study on agricultural finance. From Table 4.14, interest rate gas a positive significant relationship with agricultural finance in the short run. A one percentage point increase in the interest rate in the previous period is associated with a 0.29 per cent increase in the rate of change of agricultural finance in the short run. As rising interest rates are often associated with inflationary pressures, which also drives the cost of agricultural inputs such as fertilizers and equipment, farmers and agribusinesses may require increased credit to maintain their production levels. Therefore, demand for agricultural credit may increase in the short run as farmers and agribusinesses borrow or seek financing to cover their operating costs, even as borrowing costs rise.

The ARDL results in Table 4.12 show a statistically significant positive relationship between the lagged interest rate and agricultural finance in the short run. A one percentage point increase in the interest rate in the previous period is associated with a 0.29 per cent increase in the rate of change of agricultural finance in the current period, all things being equal. Farmers and agribusinesses may require additional credit or financing in the short run to manage their working capital and maintain liquidity due to rising interest rates. Even though borrowing is more expensive, they might need short-term loans to cover immediate expenses and cash flow shortfalls that are caused by the increased cost of inputs or delayed payments. This aligns with the liquidity preference theory, where businesses and economic units may prioritize access to cash or liquid assets in uncertain times. Another reason that can be attributed to this finding is speculative demand. If farmers and agricultural businesses anticipate future increases in agricultural commodity prices, they might be willing to borrow at higher interest rates in the short run to finance increased production or increase their stock levels or inventory, assuming that future profits will offset the higher borrowing costs. Furthermore, adjustment lags in production decisions could also contribute to this positive relationship in that, farmers might be locked into existing plans or contracts that require them to borrow in the short run, even if interest rates have risen. Obviously, it takes time to adjust planting decisions, input purchases or other agricultural activities in response to changing borrowing costs.

4.4.10 Bounds test

In order to establish whether there exists a long run relationship among the variables in the context of cointegration analysis, a Bounds Test was employed. The Bounds Test evaluates the possibility of a stable long-term relationship between the dependent variable (lnAF) and one or more of the independent variables, even when such variables may be integrated of different orders (I(0) or I(1). Table 4.13 presents the results of the Bounds Test.

Table 4. 13: Bounds Test

Test Statistic	Value	Critical Values (Kripfganz & Schneider, 2020)		
		10%	**5%**	**1%**
F-Statistic	13.373	I(0): 1.812 I(1): 3.018	I(0): 2.067 I(1): 3.371	I(0): 2.636 I(1): 4.145
t-Statistic	-10.062	I(0): -2.524 I(1): -4.870	I(0): -2.850 I(1): -5.267	I(0): -3.494 I(1): -6.038

Source: Author's analysis from secondary data (2023)

Table 4.13 depicts the results of the Bounds Test. The null hypothesis is that there is no cointegration or long run relationship. From Table 4.13, the F-statistic of 13.373 is significantly greater than the upper bound critical values at all the conventional levels of

1%, 5%, and 10%. Also, the t-statistics appear more extreme than the upper bound critical values at all the conventional levels of 1%, 5% and 10%. The null hypothesis of no long run relationship or cointegration therefore rejected since both test statistics surpass the I(1) bounds. Impliedly, this confirms the presence of a cointegrating relationship.

4.4.11 Error Correction Model (ECM)

Following the results of the Bounds Test, an ECM was established to analyze the relationships among the independent variables on the dependent variable, lnAF. Table 4.14 illustrates the results of the ECM.

Table 4. 14; Error Correction Model

Variable	Coefficient	Std. Error	t-value	p-value	95% Confidence Interval
Dependent Variable: DlnAF					
DInflation	0.0083	0.0013	6.37	0	[0.0057, 0.0109]
DInterest	-0.0053	0.0032	-1.63	0.107	[-0.0118, 0.0012]
DlnGDPA	-1.6836	0.756	-2.23	0.029	[-3.1883, -0.1788]
lnTA	-0.0299	0.0067	-4.44	0	[-0.0433, -0.0165]
ROE	-0.0046	0.0006	-7.84	0	[-0.0057, -0.0034]
CIEA	0.0009	0.0003	2.98	0.004	[0.0003, 0.0016]
DlnNPLA	0.2311	0.0131	17.69	0	[0.2051, 0.2571]
DCAR	-0.0304	0.0022	-13.63	0	[-0.0348, -0.0260]
DCLSTL	0.0047	0.0012	3.78	0	[0.0022, 0.0072]
DRECAP	0.1022	0.0183	5.6	0	[0.0659, 0.1386]
DCovid	0.0388	0.0188	2.07	0.042	[0.0015, 0.0762]
DlnM2	-0.3069	0.0719	-4.27	0	[-0.4500, -0.1638]
DMPR	0.026	0.0028	9.41	0	[0.0205, 0.0315]
ECT	-0.942	0.0304	32.89	0	[0.9395, 1.0605]
_cons	0.86	0.1729	4.97	0	[0.5158, 1.2042]

Source: Author's analysis from secondary data (2023)

From Table 4.16, a one percentage point increase in inflation is associated with a 0.83 per cent increase in the rate of change of agricultural finance in the short run.

This finding aligns with the cost-push inflation theory where rising or increasing prices of agricultural inputs could lead farmers to seek more credit to cover the increased nominal costs of the inputs. Conversely, this may not be sustainable in the long run as if inflation erodes the real incomes of farmers and agricultural businesses, it reduces their repayment capacity. This could subsequently discourage lending and decrease real agricultural finance or credit. Another possible explanation for this finding is that farmers and agricultural businesses may require additional credit or financing in the short run to manage their working capital and maintain liquidity as a result of rising input costs caused by inflation. Even though they may anticipate difficulties in repayment later, they might need short-term loans to cover immediate expenses and cash flow shortfalls. This therefore reflects a liquidity preference for cash in the face of rising costs. Another explanation for this finding is speculative demand. If farmers and agricultural businesses expect agricultural commodity prices to rise more than the increase in input costs (as a result of the same inflationary pressures), they might be willing to borrow at higher nominal rates in the short run to finance increased production or build up inventory or stock, anticipating that future profits will compensate for the higher borrowing costs and increased input costs.

Again, the gross domestic product in the agricultural sector (lnGDPA) has an inverse relationship with agricultural finance in the short run. Though this is counterintuitive, it also reflects the sectoral resource allocation where economic growth diverts resources from agriculture, which is regarded or perceived as less profitable, to other sectors that banks believe are more profitable, thus subsequently reducing agricultural finance.

Furthermore, from Table 4.14, an (1%) increase in total assets is associated with a 0.03 per cent decrease in the rate of change of agricultural finance in the short run. Once again, this aligns with the resource allocation theory where larger financial institutions prioritize other sectors over the agricultural sector, explained by the perceived higher risk or low returns in the sector.

Equally worthy of mention is the inverse relationship between ROE and agricultural finance. A one percentage point increase in ROE is associated with a 0.46 per cent decrease in the rate of change of agricultural finance in the short run. This relationship is statistically significant. This finding may reflect the profit driven lending policies where financial institutions with higher profitability focus less risky sectors in their allocation of credit such as service and commerce sectors.

Moreover, the composite index of economic activities (CIEA) has a positive and statistically significant relationship with agricultural finance. A one index point increase in CIEA is associated with a 0.09 per cent increase in the rate of change of agricultural finance in the short run. According to Corrado et al. (2022), an increase in economic activities, which is measured by CIEA, often reflects higher levels of production, trade and consumption across sectors. There is therefore increased demand for credit, including agricultural finance, as a result of heightened economic activity, as farmers and agribusinesses seek loans to expand production and purchase inputs. Also, finance institutions are more likely to extend credit to the agricultural sector when overall economic activities in the country are favorable. Generally, improved economic activities reduce the perceived risk in lending to agriculture as farmers and agricultural businesses are more likely to generate income and settle their indebtedness during periods of economic growth (Kambali & Panakaje, 2022). Similarly, the CIEA captures how interconnected are the various sector within an economy (Jayne et al., 2021). A rise in economic activities in other sectors such as transportation, services and commerce could have a spillover effect on agriculture through increased demand for agricultural products, improved infrastructure and also enhanced access to financial services. The findings of the positive relationship of CIEA with agricultural finance aligns with the financial intermediation theory. This theory posits that financial institutions such as banks play an important role in channeling funds from savers to borrowers, which facilitates economic growth. Therefore, CIEA serves as a proxy for the entire health of the economy and its positive impact on agricultural finance reflects the mechanisms of risk mitigation, resource mobilization and sectoral synergies (Zheng & Jean-Petit, 2023). The findings of the positive relationship between CIEA and agricultural finance is also consistent with the supply-leading hypothesis. This theory suggests that the financial sector development often precedes and also stimulates economic growth. Impliedly, the positive relationship indicates that financial institutions respond to improved economic conditions by increasing lending or credit to the agricultural sector.

As indicated in Table 4.16, lnNPLA has a positive and statistically significant relationship with agricultural finance in the short run. Specifically, a (1%) increase in non-performing loans in the agricultural sector is associated with a 23.11 per cent increase in the rate of change of agricultural finance in the short run. This appears counterintuitive and paradoxical, but the following theories align with this finding. Regulatory forbearance theory is a key theory that is put forward to support this counterintuitive finding. According to this theory, regulatory forbearance occurs when regulators allow financial institutions to continue lending to clients who are facing challenges, even when such loans are at risk of default. Therefore, this can in the short term or temporarily inflate agricultural finance as banks extend credit to agricultural obligors who may be already struggling to honor their obligations or repay existing loans. This is done to avoid systemic risks in the economy or to support certain key sectors that are deemed critical to the economy, such as agriculture. The distress borrowing hypothesis also aligns with this finding. Distress borrowing occurs when obligors (in this context in the agricultural sector), take on more or additional loans to stay afloat or cover existing debts or to manage financial distress such as crop failure, low prices or weather fluctuations. This can lead to increases in agricultural credit and NPLs, since distressed borrowers are less likely to repay their loans.

Better still, from Table 4.16, a one percentage point increase in CAR is associated with a 3.04 per cent decrease in the rate of change of agricultural finance in the short run. This finding aligns with the capital buffer theory. This theory posits that financial institutions maintain (capital) buffers to absorb potential losses, thereby ensuring stability during economic downturns. Higher CAR are mandatory requirements for banks by regulators to enhance the resilience of financial institutions. This however, have unanticipated consequences for lending by reducing lending capacity, increase risk averse behavior of banks and increasing cost of capital (Olawale, 2024). When regulators require banks to maintain higher CAR, it often translates to financial institutions holding a larger portion of their assets as capital which reduced finds available for lending, constraining credit supply to perceived risky sectors as agriculture which is also deemed as less profitable. In order to maintain higher CAR, banks may become more risk averse and prioritize lending to sectors they consider safer than the agricultural sector. Finally, the holding of higher capital buffers by banks increases the cost of capital for financial institutions, since equity financing is deemed more expensive than debt (Berrospide, J. M., & Edge, 2024). This often results in higher lending rates and also reduced credit availability, particularly to sectors like the agriculture, which may face higher borrowing costs.

Again, from Table 4.16, CLSTL (core liquid assets to short term liabilities) has a positive and statistically significant relationship with agricultural finance in the short term. A one ratio point increase in CLSTL is associated with a 0.47 per cent increase in the rate of change of agricultural finance in the short run. This finding aligns with the liquidity management theory which posits that financial institutions such as banks need to maintain an optimal balance between liquid assets and short liabilities so as to ensure solvency, meet demands for withdrawal and also sustain lending activities. Among other things, a higher CLSTL ratio enhances the lending capacity of financial institutions and helps banks to reduce the risk of liquidity shortages which can disrupt credit and lending activities. Therefore, the agricultural sector, which is regarded as a high-risk sector, is able to benefit from increased lending capacity of financial institutions with strong liquidity positions.

Interestingly also, recapitalization has a positive relationship with agricultural finance. From Table 4.16, the effect of recapitalization is associated with a 10.22 per cent increase in the rate of change of agricultural finance in the short run. This relationship is statistically significant and aligns with the recapitalization hypothesis theory. This theory posits that capital injection into a financial institution such as banks enhances their ability to expand lending activities. Therefore, recapitalization increases the capital base of financial institutions which enables and strengthens them to absorb risk and extend credit and financing to sectors like agriculture (Mensah, 2022). Essentially, recapitalization increases banks' capital adequacy ratio which allows them to absorb more risk and extend more credit (Andersen et al., 2024). When banks' capital base becomes strong subsequently, they are better positioned to lend without any jeopardy on their financial stability. Along with the increased lending comes the appetite to provide more credit to farmers and agricultural businesses. More importantly too, when banks recapitalize, it signals to the market that they are capable of supporting their clients and they are financially sound. There is consequently enhanced trust among borrowers regarding the stability of their bankers (Challoumis & Eriotis, 2024). This increased confidence therefore leads to higher demand for loans from agricultural businesses and farmers, who become aware that they are dealing with robust financial institutions. According to Ghosh (2022), recapitalized banks may develop the appetite to lend to sectors that are perceived as high risk such as the agricultural sector, since they have strong capital cushion. This willingness, impliedly, may result in increased financing for the agricultural sector, which might be deemed too risky by less capitalized institutions. Tran et al. (2024) opine that a well-capitalized bank can manage much better risks associated with lending. Such risks associated with lending include default risks which are very contagious in sectors like agriculture because of its susceptibility to economic fluctuations and exogenous factors. With improved risk management comes the ability of banks to lend or offer credit with more favorable terms such as lower risk premium, lower interest rates and longer tenor, which make it easier for agricultural businesses and farmers to assess credit or financing.

From Table 4.16, COVID-19 has a positive and statistically significant relationship with agricultural finance in the short run. The incidence of COVID-19 is associated with a 3.88 per cent increase in the rate of change of agricultural finance in the short run. This finding aligns with the crisis-induced policy response theory. This theory posits that during economic crisis, governments through their central banks, in order to stabilize their economies, do implement emergency measures to support critical sectors. During the pandemic, many banks in Ghana introduced moratoriums on loan repayments to ensure that there was continued access to finance, particularly for vulnerable sectors like agriculture (Doku, 2021).

Another key finding from the ECM analysis in Table 4.14 is the inverse relationship between money supply and agricultural finance in the short run. A (1%) increase in money supply is associated with a 30.69 per cent decrease in the rate of change of agricultural finance in the short run. In periods where there is an increase in money supply, it results in creased inflation if it outpaces economic growth (Kunwar et al., 2023). There is a decrease in the purchasing power of money when inflation rises. In such inflationary environments lenders and banks may be cautious about lending due to increased borrowing cost. Banks therefore make their lending standards stringent or increase interest rates which could reduce agricultural credit. Central banks also respond to increased money supply with higher interest rate as a combative measure against inflation (Krušković, 2022). This measure is achieved through monetary policy adjustments which includes increasing the monetary policy rate, which subsequently results in increased interest rates. The resultant higher interest rates increase the borrowing cost for agricultural businesses and farmers and as loans become expensive, the demand for credit declines leading to reduced agricultural finance. This finding also aligns with the sectoral allocation inefficiency hypothesis. This theory posits that an increase in money supply may not be evenly distributed across all economic sectors and segments. Excess liquidity, instead, may be channeled to other sectors apart from agriculture such as manufacturing and commerce, which are considered as less risky and more profitable too.

From Table 4.14, the monetary policy rate is associated with an increase in agricultural finance and this relationship is statistically significant. A one percentage point increase in the monetary policy rate is associated with a 2.6 per cent increase in the rate of change of agricultural finance in the short run. This finding aligns with the interest rate channel of monetary policy which posits that changes in the monetary policy rates influence lending behavior of banks through their impact on the rates on deposits and borrowing costs. Thus, higher policy rates attract more deposits and increase funds available for lending. Banks may therefore adjust their risk premiums for agricultural loans, which makes them more attractive notwithstanding the higher interest rates (Medhi & Goswami, 2023).

Finally, from Table 4.14, the error correction mechanism, in econometric models, quantifies the proportion of disequilibrium corrected in each period (Saleh et al., 2023). Therefore, from this study, the error correction mechanism of -0.942 implies that approximately 94.2 per cent of deviations from the long-run equilibrium are corrected within one period. Given that the data is monthly, this means 94.2 per cent of deviations are corrected within one month. This level of correction implies that the model is highly responsive to short term imbalances where most of the adjustments following a shock occurs within the subsequent period. From the foregoing, following any shock such as fluctuations in the macroeconomic indicators or bank-specific variables, the dependent variable (lnAF) will adjust substantially toward equilibrium within the subsequent period (month). This adjustment minimizes any lagged imbalance.

4.4.12 Johansen Test for Cointegration

The study sought to also establish any long-term relationship between some of the variables employed. The adoption of cointegration in the study sought to establish if notwithstanding the short-term fluctuations in some of the variables, notably the macroeconomic and bank-specific variables, there existed a long-term relationship between them and their impact on agricultural finance. Table 4.15 illustrates the results of the cointegration test.

Table 4. 15: Johansen Test for Cointegration

Rank	Parameters (parms)	Log-Likelihood (LL)	Eigenvalue	Trace Statistic	5% Critical Value	Decision (5% Level)
0	110	281.01352	-	307.9383	233.13	Reject H0
1	129	323.75126	0.5972	222.4628	192.89	Reject H0
2	146	351.51837	0.44611	166.9286	156	Reject H0
3	161	378.91192	0.44169	112.1415*	124.24	Fail to Reject H0
4	174	399.80059	0.35882	70.3642	94.15	Fail to Reject H0
5	185	413.37827	0.2509	43.2088	68.52	Fail to Reject H0
6	194	422.09712	0.16932	25.7711	47.21	Fail to Reject H0
7	201	428.15564	0.12094	13.6541	29.68	Fail to Reject H0
8	206	432.71258	0.0924	4.5402	15.41	Fail to Reject H0
9	209	434.97641	0.04702	0.0125	3.76	Fail to Reject H0
10	210	434.98267	0.00013	-	-	-

Source: Author's analysis from secondary data (2023)

Table 4.15 is an illustration of the Johansen test for cointegration which examines the presence of long run equilibrium relationship among the variables employed in the study. From Table 4.15, the trace statistics are compared against the 5% critical value at each rank. The null hypothesis is that there is no cointegration. Up to rank 2, the null hypothesis is rejected implying that there is at least two cointegrating relationships that exist among the variables. Impliedly, the variables have at most two long-run equilibrium relationships. Therefore, the presence of the two cointegrating equations suggests that the system is in a long run equilibrium as lnAF and its determinants move together over time. Consequently, these findings support the adoption of a Vector Error Correction Model (VECM) as it accounts for long run equilibrium while allowing for short run deviations.

4.4.13 Vector Error Correction Model (VECM)

In order to assess the long-term equilibrium relationship and short-term dynamics between agricultural finance and its interactions with the macroeconomic indicators as well as the bank specific variables employed in this study, the VECM was employed. Table 4.16 depicts the VECM.

Table 4. 16: VECM Results

Equation	Parameters	RMSE	R-squared	Chi-square	P-value
DlnAF	44	0.070739	0.581	66.55291	0.0157
DInflation	44	1.49359	0.727	127.8368	0
DInterest	44	0.430032	0.7944	185.4153	0
DlnGDPA	44	0.002761	0.8484	268.5805	0
DlnNPLA	44	0.114744	0.647	87.98813	0.0001
DlnTA	44	0.008654	0.874	333.0966	0
DCAR	44	0.793799	0.5467	57.88006	0.0782
DCLSTL	44	1.38893	0.5902	69.14087	0.0091
DRECAP	44	0.12671	0.2293	14.28388	1
DCovid	44	0.07433	0.7348	132.9995	0
DROE	44	2.84655	0.5865	68.08677	0.0114
DCIEA	44	4.72546	0.5262	53.30973	0.1587
DlnM2	44	0.026613	0.6266	80.53215	0.0006
DMPR	44	0.730713	0.5543	59.68976	0.0575

Source: Author's analysis from secondary data (2023)

From Table 4.16, the R-squared as well as the equation significance (p-value) gives an indication of the goodness of fit and the significance of each equation.

From the VECM results in Table 4.18, the equation for agricultural finance exhibits an R-squared of 0.581, which implies that approximately 58.1% of the variance in the first integrated order or difference of agricultural finance is explained by the model. With a Chi-square statistic which is statistically significant with a p-value of 0.016, it implies that the explanatory variables jointly influence changes in agricultural finance in the short run.

From Table 4.16, inflation, interest rate and lnGDPA demonstrate high degree of fit with R-squared of 0.727, 0.794 and 0.848, respectively with all their corresponding p-values at 0.001. This suggests a strong relationship between inflation, interest rate and lnGDP and also an indication that the model effectively captures the dynamics of adjustments in the variables.

Also, Table 4.17 illustrates part of the VECM results that represent the cointegrating equations estimated using the Johansen's method.

Table 4. 17: VECM Results (Cointegrating Equations)

Equation	Parameters (Parms)	chi2 Statistic	p-value
_ce1	13	1958.965	0

Variable	Coefficient	Std. Error	z-value	P-value	95% Confidence Interval
lnAF	1	.	.	.	.
Inflation	-0.0110164	0.0045492	-2.42	0.015	[-0.0199326, -0.0021001]
Interest	-0.0633234	0.0127526	-4.97	0	[-0.088318, -0.0383287]
lnGDPA	-1.932038	0.5536992	-3.49	0	[-3.017268, -0.8468074]
lnNPLA	-0.2598982	0.0764713	-3.4	0.001	[-0.4097792, -0.1100171]
lnTA	-1.013558	0.1480996	-6.84	0	[-1.303828, -0.7232884]
CAR	-0.0263718	0.0064395	-4.1	0	[-0.038993, -0.0137507]
CLSTL	0.0181704	0.0104692	1.74	0.083	[-0.002349, 0.0386897]
RECAP	0.0530751	0.0333708	1.59	0.112	[-0.0123304, 0.1184806]
Covid	-0.1519462	0.0458057	-3.32	0.001	[-0.2417237, -0.0621686]
ROE	0.0029035	0.0045032	0.64	0.519	[-0.0059225, 0.0117295]
CIEA	0.004723	0.0016599	2.85	0.004	[0.0014697, 0.0079762]
lnM2	1.390021	0.1569732	8.86	0	[1.082359, 1.697683]
MPR	0.0459098	0.0076265	6.02	0	[0.0309621, 0.0608575]
_cons	36.71813	.	.	.	

Source: Author’s analysis from secondary data (2023)

From Table 4.17, the cointegrating equation represents the long run equilibrium relationship among the variables employed in the study. The dependent variable is lnAF which is normalized to1. The coefficients in Table 4.17 indicate the long run elasticities of the variables with respect to agricultural finance. A positive coefficient suggests a positive long run relationship and a negative coefficient implies a negative long run relationship. The Chi-squared statistic of 1958.97 with a p-value of 0.000 indicates that cointegrating equation is significant and this confirms the presence of long run equilibrium relationship. A one percentage point increase in inflation is associated with a 1.10 per cent decrease in agricultural finance in the long run, all other factors held constant. This implies that higher inflation erodes the real value of financial assets which discourages lending to the agricultural sector. This finding aligns with the Fisher Effect theory where high inflation apparently increases nominal interest rates which make credit more expensive and subsequently reduces agricultural financing.

Also, from Table 4.17, a one percentage point increase in interest rates is associated with a 6.33 per cent decrease in agricultural finance in the long run, all other factors held constant. This is attributed to the fact that higher interest rates increase the cost of borrowing and this discourages agricultural businesses and farmers from accessing credit facilities. This finding aligns with the loanable funds theory where high interest rates reduce the demand for credit or loans, especially in sectors like agriculture which can be capital intensive.

Again, lnGDPA has an inverse relationship with agricultural finance in the long run. From Table 4.17, a 1 per cent increase in GDP growth is associated with a 193.2 per cent decrease in agricultural finance in the long run, all other factors held constant. Thus, as the agricultural sector becomes more profitable, its reliance on external financing decreases due to a focus on retained earnings. This finding aligns with the pecking order theory where profitable businesses prefer internal financing over debt, thus reducing the demand for agricultural finance. This finding also aligns with the structural transformation hypothesis in that, as economies develop, capital intensive investments may digress or shift away from agriculture to industry, leading to lower agricultural loans or credit demand.

Moreover, from Table 4.17, lnNPLA has an inverse relationship with agricultural finance in the long run. A 1 per cent increase in non-performing agricultural loans is associated with a 25.99 per cent decrease in agricultural finance in the long run, all other factors held constant. When delinquent loans rise, banks become risk averse and subsequently reduce lending to sectors that have high default rates like the agricultural sector. This finding aligns with the credit risk theory whereas a result of higher loan defaults, banks tighten their credit conditions and restrict lending to the agricultural sector. It also aligns with the financial accelerator theory where increasing bad loans reduce the ability of banks to extend credit or lend, thereby affecting economic segments that are reliant on bank financing.

Furthermore, a 1 per cent increase in total assets is associated with a 101.36 per cent decrease in agricultural finance in the long run, all other factors held constant, from Table 4.19. As banks grow in size, they may diversify their portfolios away from the agricultural sector to more profitable economic sectors kike commerce and manufacturing. This finding aligns with the portfolio theory where banks try to optimize the allocation of their assets to maximize return, which often results in reduced exposure to risky and low margin agricultural loans. The findings also align with the market power hypothesis where larger banks do not have incentive to lend to the agricultural sector since they prioritize higher margin corporate lending.

Better still, from Table 4.17, CAR has an inverse relationship with agricultural finance in the long run. A one percentage point increase in the capital adequacy ratio is associated with a 2.64 per cent decrease in agricultural finance in the long run, all other factors held constant. This finding reflects how stricter regulations can force banks to hold assets which are safer thereby limiting credit to the agricultural sector which is riskier. This finding aligns with the risk-weighted capital allocation model where agriculture has assigned higher weighted risk which discourages bank lending under stricter capital rules.

From Table 4.17, recapitalization does not have a significant impact on agricultural finance in the long run. The presence of recapitalization is associated with a 5.31 per cent increase in agricultural finance in the long run, all other factors held constant. This is explained by the fact that recapitalization does not necessarily translate into increased lending to the agricultural sector. This finding aligns with the moral hazard theory in that banks may use their recapitalized funds to support investments in other sectors they deem more profitable, reducing their impact in farm credit.

Covid-19, from Table 4.19, has a statistically significant inverse relationship with agricultural finance. The incidence of COVID-19 is associated with a 15.19 per cent decrease in agricultural finance in the long run, all other factors held constant. This finding aligns with the credit impact theory where economic shocks disrupt the financial systems and reduces available credit.

From Table 4.17, CIEA has a statistically significant positive impact on agricultural finance in the long run. A one-unit increase in the Composite Index of Economic Activities is associated with a 0.47 per cent increase in agricultural finance in the long run, all other factors held constant. This is as a result of the fact that higher economic activity leads to more extension of credit to the agricultural sector since economic growth boosts investor confidence. This finding aligns with the macroeconomic stability theory in that, economic expansion increases financial intermediation which benefits credit markets.

Broad money supply (M2), from Table 4.19, also has a statistically significant positive impact on agricultural finance. A 1 per cent increase in money supply is associated with a 139 per cent increase in agricultural finance in the long run, all other factors held constant. This explains why more liquidity in the banking systems expands the lending capacity of these financial institutions. This finding aligns with the monetary theory of credit in that, higher money supply reduces the cost of borrowing, which invariably increases the availability of credit.

Finally, the monetary policy rate (MPR), from Table 4.17, also has a statistically positive significant relationship with agricultural finance in the long run. A one percentage point increase in the monetary policy rate is associated with a 4.59 per cent increase in agricultural finance in the long run, all other factors held constant. This also explains why the monetary policy adjustments create improved financial conditions for credit and lending. This finding aligns with the Taylor rule model in that, a well-managed monetary policy rate can result in stabilization of credit markets which benefits the agricultural sector.

4.4.14 Granger Causality Test

Generally, Granger causality test is used to determine if past values of one variable contain predictive information about another variable (Shojaie & Fox, 2022). In this study, the Granger causality test has been employed to assess the causal relationship between indicators of recapitalization of financial institutions and agricultural finance, along with some other macroeconomic variables. The null hypothesis states that the excluded variables do not Granger-cause the dependent variables. Therefore, a rejection of the null hypothesis implies that the excluded variable Granger-causes the dependent variable. Table 4.19 depicts the results of the statistically significant Granger Causality relationships.

Table 4. 18 : Granger Causality Test Results

Dependent Variable	Excluded Variable (Granger Causal Factor)	chi2	p-value	Causal Relationship?
lnGDPA	CIEA	8.9015	0.003	Yes
lnGDPA	lnM2	4.8772	0.027	Yes
lnGDPA	ALL	50.322	0	Yes
lnNPLA	CLSTL	6.2077	0.013	Yes
lnNPLA	ROE	4.2362	0.04	Yes
lnNPLA	ALL	17.452	0.042	Yes
lnTA	CAR	4.4417	0.035	Yes
lnTA	ROE	7.9691	0.005	Yes
lnTA	ALL	28.597	0.001	Yes
CAR	lnGDPA	4.7023	0.03	Yes
CAR	lnNPLA	4.6556	0.031	Yes
CAR	lnM2	6.5007	0.011	Yes
CLSTL	lnAF	4.3683	0.037	Yes
CLSTL	MPR	21.835	0	Yes
CLSTL	ALL	45.774	0	Yes
ROE	lnAF	9.5822	0.002	Yes
ROE	lnGDPA	3.9478	0.047	Yes
ROE	lnNPLA	13.269	0	Yes
ROE	lnTA	4.2855	0.038	Yes
ROE	ALL	39.224	0	Yes
CIEA	lnGDPA	4.3996	0.036	Yes
CIEA	lnNPLA	4.7513	0.029	Yes
CIEA	lnM2	3.9376	0.047	Yes
lnM2	lnGDPA	6.9587	0.008	Yes
lnM2	lnTA	6.7527	0.009	Yes
lnM2	ALL	25.007	0.003	Yes
MPR	lnGDPA	12.52	0	Yes
MPR	CIEA	4.9706	0.026	Yes
MPR	ALL	44.067	0	Yes

Source: Author’s analysis from secondary data (2023)

From Table 4.18, CIEA Granger causes lnGDPA, as evidenced by the statistically significant p-value of 0.003. This implies that, the overall level of economic activity in Ghana, as measured by CIEA has enough predictive power for future agricultural output. This finding corroborates the Keynesian economic theory, specifically the concept of aggregate demand. The Keynesian theory postulates that economic activity can be driven by aggregate demand which encompasses consumption, investment, net exports and government spending. Therefore, an increase in economic activity in its totality as measured by CIEA can lead to increased consumer spending. As the economy grows, consumers tend to have more disposable income leading to higher consumption and this increased demand for goods and services can simulate agricultural production. Again, an increase in economic activity can lead to increased investment where agricultural businesses and farmers invest in farm machinery, irrigation systems and other inputs, which increases the GDP in the agricultural sector. Furthermore, a component of CIEA which is increased government spending can directly or indirectly benefit the agricultural sector through inter alia, investment in rural infrastructure and support programs for farmers. Also, as the agricultural sector produces goods for exports, a growing economy (measured by CIEA) often leads to increases in such exports which increases the GDP in the agricultural sector.

Table 4.18 also illustrates how lnGDPA is Granger caused by lnM2 with a statistically significant p-value of 0.027. This implies that past changes in lnM2 provide information, albeit statistically significant, in predicting future changes in lnGDPA. Thus, past fluctuations in money supply in the economy can help forecast future changes in agricultural output. This is attributed to the fact that an increase in money supply can enable farmers and agricultural businesses to access agricultural production inputs as well as advanced technologies, which boosts overall output in the sector. This aligns with the quantity theory of money which postulates that an increase in the base of money is directly proportional to the output growth of economic sectors including agriculture. This finding also aligns with the monetary theory, specifically, the monetarist view which also emphasizes strongly on the role of money supply in influencing economic activity including, agricultural sector activities. Thus, an increase in money supply has a demand-side effect where higher money supply can boost aggregate demand, which subsequently leads to increased consumer spending that also in turn stimulates agricultural output (Ezu & Nwobia, 2023).

Interestingly too, lnNPLA is Granger-caused by CLSTL. This provides suggestions that past changes in core liquid assets to short term liabilities (CLSTL) help to predict the future changes in the natural logarithm of non-performing loans in the agricultural sector (lnNPLA). Thus, historical changes in the liquidity position of banks (as measured by CLSTL) provide valid information that can forecast future changes in the level of non-performing loans in the agricultural sector. According to Chakraborty (2022), a bank's liquidity position very often reflects its risk management appetite and its management strategy. Banks that have high CLSTS ratios are more willing to take on riskier loans, especially from sectors like agriculture. The increased lending may lead to higher NPLs in the agricultural sector if they are not effectively managed. This finding also aligns with the concept of liquidity risk management which posits that banks with higher proportion of CLSTL are better positioned, relatively, to absorb unexpected shocks and meet their short term obligations. The reduced liquidity risk can translate into lower levels of non-performing loans. Conversely, banks with lower CLSTL may have or face greater liquidity challenges. In instances of financial stress, they may be more likely to resort to lending practices which are riskier or may be forced to liquidate assets at a loss, which potentially increases the level of non-performing loans.

It is also worthy of mention that from Table 4.18, lnNPLA is Granger-caused by ROE. This gives an indication that past changes in ROE help to predict the future changes in lnNPLA. Impliedly, historical changes with a bank's profit provide information that can forecast future changes in the level of NPLs. This finding aligns with the concept of risk-taking behavior. According to Rakshit and Bardhan (2022), banks with higher profitability may be more inclined to take on higher risks in order to maintain or increase their profitability. Therefore, this increased lending could lead to a higher default rate and consequently, an increase in NPLs. This applies to credit given to the agricultural sector. On the other side of the coin, banks with low profitability may be more cautious in their lending practices so as to improve their financial performance. This can lead to a lower level of NPLs.

From Table 4.18 lnTA is Granger-caused by CAR and this causal relationship has a statistically significant p-value of 0.035. This implies that past changes in CAR help to predict the future changes in lnTA. Thus, historical changes in a bank's CAR significantly influence future changes in the bank's asset size. This finding aligns with bank capital regulation and risk management theories where banks with higher CAR are regarded as more stable and less risky. Such banks are able to expand their lending activities and subsequently acquire more assets to increase their profitability. However, banks with lower CAR are subject to regulatory scrutiny and may often face restrictions on lending (Alnajjar & Othman, 2021). Such banks face limitations on their ability to expand their asset base.

Again, from Table 4.18, lnTA is Granger-caused by ROE with a statistically significant p-value of 0.005. This is an indication that past changes in ROE help to predict future changes in lnTA. Impliedly, historical changes in the profitability of banks have significant changes in banks' overall asset size. This finding aligns with the bank growth and profitability theories. Thus, banks with high profitability are likely to invest their earnings to expand their operations which leads to an increase in their asset base. Bank with low profitability, however, may be constrained in their ability to expand their asset base as they may need to focus on improving their profitability before engaging in any significant asset growth.

Also, CAR Granger causes lnGDPA as evidenced from Table 4.18. To this end, past changes in the CAR of banks significantly predict future changes in lnGDPA. This finding aligns with the findings of Uddin et al., (2021) who found that well-capitalized banks are crucial for economic growth. This includes growth in the agricultural sector. Higher CAR, by implication, shows that banks have stronger financial buffers to absorb potential losses (Moudud-Ul-Huq, (2021). This allows such banks to extend more credit to businesses, including those in the agricultural sector. The increased credit availability can therefore stimulate investment and overall economic activity including agricultural production. Higher CAR also has the potential of reducing risk aversion among banks (AlZoubi, 2021). This can lead to increased lending to a riskier sector like agriculture.

Better still, CAR Granger-causes lnNPLA and this has a statistically significant p-value of 0.031. This finding implies that past changes in CAR can help predict future changes in lnNPLA. Banks that have higher CAR are better equipped to absorb losses (Olawale, 2024). This therefore results in lower levels of NPLs as banks have stronger buffers to withstand loan defaults. Banks with lower CAR may be more prone to engage in riskier lending practices to maintain profitability which has the ability to increase the likelihood of loans defaults, even in the agricultural sector too (Navas et al., 2021).

Moreover, from Table 4.18, CAR Granger-causes lnM2 with a statistically significant p-value of 0.01. This therefore suggests that past changes in CAR help to predict future changes in lnM2. This aligns with the concept of bank lending and money creation. Thus, banks with higher CAR lends more which increases money supply in an economy (De Marko et al., 2021). This is attributed to the fact that banks create money through the lending process. When banks lend money, they invariably create deposits with increases in the overall money supply. Banks that have lower CAR may be constrained as far as lending is concerned and this can limit the growth of money supply.

Furthermore, CLSTL Granger causes lnAF and this is statistically significant at 0.037. This finding therefore suggests that past changes in CLSTL can significantly predict future changes in lnAF. Impliedly, historical changes in a bank's liquidity position (as measured by CLSTL) provide information that can forecast future changes in agricultural credit. This finding aligns with the concept of liquidity risk management and its impact on the lending decisions of financial institutions. Banks with higher proportions of liquid assets relative to short term liabilities are well positioned to absorb unexpected shocks and can also meet short term obligations (Baros et al., 2023). The reduced liquidity risk can be translated into increased lending across all sectors including agriculture. Therefore, banks with strong or ample liquidity are more comfortable extending credit to various sectors such as the riskier agricultural sector. However, banks that have lower CLSTL may have liquidity challenges as in times of distress, they are more likely to restrict lending in order to manage liquidity risk (Gafrej & Boujelbéne, 2022). This has a tendency to negatively impact agricultural finance, since such banks become more cautious about lending to the agricultural sector.

Table 4.18 again illustrates how CLSTL Granger-causes lnAF, which is statistically significant with a p-value of 0.037. This suggests that past changes in CLSTL can significantly predict future changes in lnAF. Thus, historical changes in a bank's liquidity position could provide information that can forecast future changes in agricultural lending. This finding also aligns with the liquidity risk management concept and its impact on lending decisions. Generally, banks that have a higher proportion of their liquid assets relative to short term liabilities stand in a better position to absorb unexpected shocks to meet their short-term obligations (Baros et al., 2023). The reduced liquidity risk can translate into increased lending across all economic sectors including the agricultural sector. Banks that have lower CLSTL may face liquidity challenges and in times of financial stress, they may likely restrict lending to manage liquidity risk, which can negatively impact agricultural finance as such banks become more cautious in lending to the agricultural sector.

From Table 4.18, ROE Granger-causes lnAF. This suggests that past changes in ROE can significantly predict future changes in lnAF. Thus, historical changes in the profitability of banks provide information that can forecast future changes in agricultural lending. This finding aligns well with the profit-driven lending theory which postulates that banks with higher profitability are likely to have great capital and resources available for lending or extension of credit. Banks' increased profitability can incentivize them to expand lending to all sectors, including the agricultural sector, to generate further revenue growth.

4.4.15 Impulse Response Functions

As part of the analysis, this study employs an Impulse Response Function (IRF) to investigate the dynamic relationships between agricultural finance, macroeconomic factors, and the performance of the agricultural sector in Ghana. Generally, responses of variables within a system are traced by IRFs to a shock or impulse in one of the variables. (Koistinen & Funovits, 2022). The results of the IRF analysis are depicted in Table 4.19.

Table 4. 19: Impulse Response Function

Variable (Response to Impulse)	Description	Step 1	Step 2	Step 3	Step 4	Step 5
(1) InAF	Log of Agricultural Finance (GHS)	0	0.833	0.669	0.609	0.518
(2) Inflation	Annual Inflation Rate (%)	0	0.177	0.093	0.071	0.068
(3) Interest	Annual Interest Rate (%)	0	0.219	0.135	0.116	0.092
(4) InGDPA	Log of Agricultural GDP (GHS)	0	0.106	0.089	0.077	0.068
(5) InNPLA	Log of Non-Performing Ag. Loans (GHS)	0	0	0.008	0.007	0.011
(6) InTA	Log of Total Assets (GHS)	0	0.019	0.019	0.018	0.035
(7) CAR	Capital Adequacy Ratio (%)	0	0.004	0.002	0.002	0.005
(8) CLSTL	Core Liquid Assets to Short-Term Liab. Ratio	0	0.07	0.059	0.043	0.128
(9) RECAP	Recapitalization Dummy (1=Before, 0=After)	0	0.023	0.012	0.013	0.012
(10) Covid	COVID-19 Pandemic Dummy (1=2020-21, 0=Oth)	0	0.005	0.006	0.008	0.014
(11) ROE	Return on Equity (%)	0	0.134	0.125	0.126	0.159
(12) CIEA	Composite Index of Economic Activities	0	0.023	0.007	0.023	0.028
(13) InM2	Log of Broad Money Supply (GHS)	0	0.075	0.041	0.061	0.112
(14) MPR	Monetary Policy Rate (%)	0	0	0	0.004	0.005
(15) Own Variable	(Variable Name)	0	0.823	0.707	0.553	0.495

From Table 4.19, a shock to agricultural finance (lnAF) leads to a strong initial increase (0.833 in step 2), followed by a gradual decline over time (0.669 in step 3, 0.609 in step 4, and 0.518 in step 5). This finding suggests that an exogenous shock to agricultural finance has a persistent but diminishing effect, indicating a potential short-run boost before stabilizing. This finding also aligns with the credit channel theory which suggests that an increase in agricultural finance boosts investment and economic activity, but diminishing returns set in over time. It also aligns with the financial accelerator model which portrays how financial conditions magnify business cycles, meaning an exogenous shock to agricultural finance provides a short-term boost before stabilizing.

Also, a shock to inflation leads to an increase (0.177 in step 2), but the effect weakens (0.093 in step 3, 0.071 in step 4, and 0.068 in step 5). This finding suggests that inflationary shocks dissipate quickly, implying that inflation does not exert a strong long-term effect in this system. This finding aligns with the Philips curve which indicates that there is a short-term trade-off between inflation and output. Therefore, the quick dissipation of inflation shocks suggests a relatively flexible price system.

Again, interest rates rise in response to a shock (0.219 in step 2) but decline gradually (0.135 in step 3, 0.116 in step 4, and 0.092 in step 5). This implies a short-term tightening effect on interest rates, followed by stabilization. This finding aligns with the liquidity preference theory which predicts that an initial tightening of liquidity following an increase in interest rate but eventually stabilizes as demand for money adjusts.

From Table 4.19, shock to lnGDPA causes a modest increase (0.106 in step 2, 0.089 in step 3, 0.077 in step 4, and 0.068 in step 5). This shows that the shocks to agricultural GDP have a weak but persistent positive effect over time.

Furthermore, as far as lnNPLA response is concerned, initially there is no effect (0 in steps 1 to 2) but a mild increase occurs in step 3 (0.008) along with recorded fluctuations in later periods (0.007 in step 4 and 0.011 in step 5). This implies that the shocks to NPLs in the agricultural sector take time to materialize with lagged but insignificant effects on the system. This finding aligns with the credit risk theory which opines that defaults on loans occur with a lag as economic conditions exacerbate or deteriorate.

Moreover, a shock to total assets produces a very minor positive effect (0.019 in step 2 and 3, 0.018 in step 4, 0.035 in step 5). The persistence of these small effects indicates that total assets of banks respond weakly to shocks.

From Table 4.19, capital adequacy ratio's response in negligible (0.004 in step 2, 0.002 in step 3-4, 0.005 in step 5). This suggests that capital adequacy does not significantly respond to shocks in the short run. This finding aligns with the Basel Accords (I, II, III) which suggest that much as capital adequacy requirements improve financial stability, there short run response to shocks is limited.

Better still, a positive response is observed for the response of CLSTL to shocks (0.07 in step 2, 0.059 in step 3, 0.043 in step 4, and a sharp rise to 0.128 in step 5). This therefore indicates that liquidity improves gradually and peaks later, possibly as financial institutions adjust and acclimatize to economic shocks.

From Table 4.19, recapitalization's response to shock is weak (0.023 in step 2, declining to 0.012 in later steps), suggesting that recapitalization's impact is short-lived and weak in magnitude. This aligns with the regulatory capital arbitrage theory which suggests that the effects of recapitalization can be short-lived unless it is accompanied by structural banking reforms. This finding also aligns with Modigliani and Miller theory which suggests that recapitalization has a limited effect which is consistent in the weak IRF response, especially in a perfect market.

The response to Covid-19 is negligible (0.005 in step 2, peaking at 0.014 in step 5). This implies that COVID-19 shocks have a weak but slightly growing effect over time.

From Table 4.19, the response of ROE initially increases (0.134 in step 2, 0.125 in step 3), stabilizes, and then peaks in step 5 (0.159). This therefore implies that profitability (ROE) is positively influenced by shocks but with delayed reinforcement. This result aligns with the bank profitability theory which explains that the profitability of the banking sector responds to shocks positively but then adjustments take time.

Composite Index of Economic Activity, from Table 4.19, increases slightly (0.023 in step 2, 0.007 in step 3, and stabilizes at 0.028 in step 5) and this suggests a small but stable economic impact to shocks. These results align with the business cycle theory which suggest that economic activity responds in a weak but persistent way to shocks.

From Table 4.19, broad money supply also shows a moderate initial response (0.075 in step 2, declining to 0.041 in step 3, and then rising to 0.112 in step 5). Impliedly, though there is an initial impact on monetary shocks, over time, they strengthen. This finding aligns with the monetary transmission mechanism which posits that changes in money supply have lagged and persistent effects.

Own Variable Response show autoregressive effects. Each variable exhibits strong autocorrelation implying that a shock to itself has the largest impact in the early periods and declines over time. A case in point is the response of lnAF to its own shock (0.823 in step 2 and gradually declines to 0.495 in step 5). This result indicates that most variables exhibit persistence but gradually return to equilibrium. This finding aligns with the mean reversion in the time series suggesting the gradual return to equilibrium of most economic variables after some exhibiting some persistence.

4.4.16 Forecast Error Variance Decomposition (FEVD)

The study also employed the forecast error variance decomposition (FEVD) to quantify the proportion of forecast errors in the dependent variable, agricultural finance that is explained by shocks to macroeconomic and bank specific variable over different times. The essence of employing the FEVD was to enable the evaluation of persistence as well as the transmission of shocks to make policy recommendations as far as the banking environment and its interaction with agricultural credit is concerned. Table 4.20 illustrates the results of the FEVD.

Table 4. 20: Forecast Error Variance Decomposition

Step	Variable	Shock to	FEVD	Lower	Upper
1	DlnAF	DlnAF	0	0	0
1	DInflation	DlnAF	0.018	-0.03	0.065
1	DInterest	DlnAF	0.002	-0.014	0.018
1	DlnGDPA	DlnAF	0.026	-0.037	0.089
1	lnTA	DlnAF	0.006	-0.024	0.035
1	ROE	DlnAF	0.002	-0.015	0.019
1	CIEA	DlnAF	0.054	-0.031	0.139
1	DlnNPLA	DlnAF	0	0	0
1	DCAR	DlnAF	0	0	0
1	DCLSTL	DlnAF	0	0	0
1	DRECAP	DlnAF	0	0	0
1	DCovid	DlnAF	0	0	0
1	DlnM2	DlnAF	0	0	0
1	DMPR	DlnAF	0	0	0
10	DlnAF	DlnAF	0.017	-0.028	0.063
10	DInflation	DlnAF	0.016	-0.028	0.06
10	DInterest	DlnAF	0.021	-0.026	0.067
10	DlnGDPA	DlnAF	0.02	-0.026	0.067
10	lnTA	DlnAF	0.006	-0.021	0.033
10	ROE	DlnAF	0.002	-0.015	0.019
10	CIEA	DlnAF	0.085	-0.011	0.183
10	DlnNPLA	DlnAF	0	0	0
10	DCAR	DlnAF	0	0	0
10	DCLSTL	DlnAF	0	0	0
10	DRECAP	DlnAF	0	0	0
10	DCovid	DlnAF	0	0	0
10	DlnM2	DlnAF	0	0	0
10	DMPR	DlnAF	0	0	0

Source: Author's analysis from secondary data (2023)

From Table 4.20, the FEVD results are presented for two horizons which are Step 1 (representing short run impact or the immediate response to shocks) and Step 10 (representing long run impact or how the effect evolves over a period of time). Therefore, the FEVD values do represent the proportion of forecast error variance in the dependent variable, lnAF, explained by each variable. The lower and upper bounds in Table 4.18 provide the confidence intervals, which indicate the uncertainty around the estimates.

From Table 4.20, at Step 1, the variance decomposition of agricultural finance is totally or entirely explained by itself (0%) since there is no external shock affecting it at this stage. However, at Step 10, own shocks explain 1.7% of the forecast error variance in agricultural financing, implying that agricultural finance is increasingly influenced by external macroeconomic and financial shocks over time. This finding aligns with the financial development and growth theory which posits that the financial sector to a large extent is influenced by economic and institutional factors and not necessarily self-driven. Thus, the finding that own shocks explain only 1.7% of agricultural finance variance over time implies that external macroeconomic and financial sector conditions do play a critical or important role in shaping the availability of agricultural credit.

Furthermore, from Table 4.20, in the short run (that is Step 1). Inflation accounts for 1.8% of the forecast error variance in agricultural finance. From Table 4.20, it can be observed that over time, its impact slightly declines to 1.6% which suggests a moderate but also persistent level of inflation on agricultural finance. Thus, inflation only weakly influences agricultural finance in both the short run and long run. Therefore, price stability policies only marginally affect the availability of credit in the agricultural sector. From the finding on inflation, it is apparent that central bank interventions as far as the management of inflation may have limited influence on agricultural credit or finance. This finding of the weak influence of inflation on agricultural finance aligns with the agricultural terms of trade theory which explains how relative price movements between agricultural or farm and non-agricultural goods affect incomes and credit demand of farmers and agricultural businesses. The theory suggests that when food prices rise relative to the cost of inputs, agricultural businesses and farmers record high profits, which has an influence on their borrowing behavior. High food inflation improves the revenue of farmers if there is no proportional rise in production costs. This may therefore reduce the immediate need for credit as agricultural businesses and farmers rely on retained earnings rather than external finance. However, if the driver of food inflation increases in input costs, the demand for agricultural credit may increase. From Table 4.20, the FEVD results show a moderate but persistent influence (that 1.8% at Step 1 and 1.6% at Step 10) suggesting that fluctuations in food prices exert a weak influence on agricultural finance.

Moreover, from Table 4.20, the interest rate at Step 1 explains only 0.2% of the variations in agricultural finance. Over time (at Step 10), the influence of interest rate on agricultural finance increases to 2.1%, suggesting a gradual materialization of the effects of interest rates on agricultural finance. In the short run therefore, interest rate changes do not manifest an immediate effect on agricultural finance, explained by fixed term lending contracts. Overtime, however, higher interest rates reduce agricultural credit. Therefore, it can be concluded that monetary policy transmission to the agricultural sector as far as credit is concerned occurs with a lag, which requires long-term interest rate management for total effectiveness. This finding aligns with the interest rate parity theory, even though traditionally, it is applied to the context of exchange rates. Nonetheless, the interest rate parity theory suggests that changes in interest rates affect the allocation of credit. Thus, the lagged effect on agricultural finance implies that banks adjust their lending behavior gradually rather than immediately responding to changes in monetary policy.

Also, from Table 4.20, GDP in the agricultural sector explains 2.6% of the forecast variance error in the short run (that is Step 1). However, this contribution reduces to 2.0% in the long run (that is Step 10) implying a temporary impact on agricultural finance. This implies that growth in agriculture affects finance in the short run, but the importance is diminished in the long run. This can be attributed to structural shifts or substitution effects such as income surplus replacing financing by banks. The finding of the influence of GDP in the agricultural sector on agricultural finance both in the short run and long run aligns with the agricultural-led growth hypothesis which argues that agricultural growth can lead to broader economic development. Temporary surges in investment following periods of growth in the agricultural sector may be linked to short-term effects on credit availability. However, declining long-term effect may imply a switch to other sources of finance such as retained earnings and informal credit markets.

Again, from Table 4.20, banks' asset size shows a stable effect on agricultural finance over the course of time, evidenced by the 0.6% forecast error variance in both the short term (Step 1) and long-term (Step 2). Impliedly, bigger banks do not necessarily contribute more to agricultural credit. Thus, it can be asserted that bank size does not significantly drive financial intermediation in the agricultural sector. This finding aligns with the argument by Oroud et al. (2023) that financial deepening has greater relevance than absolute bank size in the determination of credit allocation.

Finally, from Table 4.20, composite index of economic activity contributes 5.4% to fluctuations in agricultural finance in the short run (Step 1). This grows over time to 8.5% in the long run, and it is one of the most significant long run drivers in this study. Impliedly, economic growth increases the demand for credit and investment in the agricultural sector, and this makes it a key factor influencing agricultural finance. This finding aligns with the Keynesian model as it opines that economic activity, and investments have a close link. From Table 4.20, the increasing influence of economic activity on agricultural finance, that is from 5.4% in Step 1 to 8.5% in Step 10 supports this assertion as growing economic activity leads to higher demand for credit in the agricultural sector.

4.4.17 Alignment of Forecast Error Variance Decomposition with Impulse Response Function

This section establishes an alignment between the FEVD and the IRF. The IRF depicts the directional impact and the persistence of shocks over time while the FEVD quantifies the proportion of forecast error variance in agricultural finance that are attributable to different shocks. This section therefore integrates these results to provide detailed interpretation of the relationships among recapitalization, the macroeconomic variables employed in the study, bank-specific variables and the dynamics of agricultural finance.

A key finding is the limited impact of recapitalization on agricultural finance. In the study, the FEVD results depict that in Step 1, which is the immediate impact period, recapitalization does not explain any variance in agricultural finance (DlnAF). Again, in Step 10 which is a longer horizon, recapitalization's contribution remains at 0 and this suggests that the policy does not directly influence the volatility of agricultural finance in the short term nor long-term. The IRFs also demonstrated that recapitalization had a positive but delayed or lagged effect on agricultural finance. This suggests that while the capital buffers of banks improve following recapitalization, it does not immediately translate into credit expansion in the agricultural sector. Banks may instead prioritize risk mitigation to stabilization of the balance sheet before they adjust their lending behavior. This is confirmation of the results of the FEVD, which shows that other factors explain the fluctuations in agricultural finance more than recapitalization. Recapitalization does not therefore serve as the primary driver of agricultural growth. This finding is consistent with the financial intermediation theory, which posits that whereas capital adequacy enhances financial stability, it does not drive immediate expansion in credit facilities.

Another key finding in this interaction between the IRF and FEVD analysis is the role of macroeconomic variables in agricultural finance volatility. In Step 1 of the FEVD, inflation contributes 1.8% to the variance of agricultural finance while interest rate shocks contribute 0.2%. By Step, the contribution of inflation is around 1.6% while interest rate shocks increase to 2.1%. By implication therefore, inflation and interest rates exert a minor but persistent influence on the fluctuations of agricultural finance. Consistent with this is the IRF's result those shocks to inflation had a small but negative effect on agricultural finance, which reflects the higher cost of borrowing and the reduced credit supply. Again, the IRF response to the shocks in interest rate was also negative and insignificant in the short run. This is corroborated by the FEVD results by demonstrating that while interest rates matter and is important, they do not explain a dominant share of the forecast error variance in agricultural finance. Therefore, given Ghana's high inflationary environment, the market of agricultural credit remains sensitive to the inflationary shocks and interest rates fluctuations.

FEVD shows that GDP in the agricultural sector explains 2.6% of the variance of agricultural finance in Step 1, and this increases to 2.0% by Step 10. This implies that there is a moderate impact of the fluctuations in agricultural GDP on agricultural finance over time. These IRFs also indicate a small but positive response of the agricultural finance to GDP in the agricultural sector and this reinforces the notion that growth in agricultural output supports financial intermediation. Thus, FEVD complemented his result by quantifying the importance of the fluctuations of GDP in the agricultural sector in driving the forecast errors in agricultural finance. This result aligns with the theory of finance and growth where financial deepening supports expansion of sectors, with a bidirectional effect.

Furthermore, FEVD indicates that CAR and recapitalization shocks contribute 0% to the forecast error variance of agricultural finance in all the periods. Impliedly, requirements of regulatory capital alone do not directly impact short-term or long-term variations in agricultural loans. IRFs also demonstrated that shocks to CAR had a negligible effect on agricultural finance and this confirms that capital adequacy alone does not stimulate agricultural lending. This finding is reinforced by FEVD by quantifying the minimal explanatory power in agricultural credit fluctuations. By implication therefore, the strengthening of the capital buffers of banks without a commensurate address to risk-taking incentives will not necessarily improve credit access to the agricultural sector.

It was also revealed that Composite Index of Economic Activity was the most significant driver of the volatility of agricultural finance. The FEVD shows that CIEA explains 5.4% of the variance of agricultural finance in Step 1, and this increases to 8.5% by Step 10. This therefore implies that broader economic activity significantly influences agricultural finance over time. The IRF also demonstrated that the shocks to CIEA also had a strong and persistent positive effect on agricultural finance and this suggest that overall economic condition shape the dynamics of financial intermediation. This is confirmed by the FEVD by quantifying its dominant contribution to the volatility of agricultural finance. These findings are consistent with the pro-cyclicality of bank lending which posits that economic upturns enhance credit, but its downturns restrict it.

4.3 Heterogeneous Effects of Recapitalization on Sectoral Loans Disbursement Relative to the Agricultural Sector

This section presents an empirical analysis of the heterogeneous effects of recapitalization on sector loan disbursement relative to the agricultural sector. The data employed in this study is panel data since it specifically focuses on loan disbursements across nine sectors, including agriculture, from January 2015 to December 2022. This dataset combines a cross-sectional perspective (nine sectors) with a time-series dimension (monthly observations over eight years). The analysis is essentially structured to assess how recapitalization influenced credit allocation across different economic sectors, by employing panel regression techniques. To ensure robust inference and given the potential for both sector specific variations and time-dependent factors, a rigorous econometric approach was adopted.

In order to achieve this objective, both Random Effects (RE) and Fixed Effects (FE) models were initially estimated to compare their respective findings. The Hausman test was then conducted to determine the most appropriate model for the analysis. The results of the Hausman test favoured the Fixed Effects (FE) model, thereby indicating that the unobserved sector-specific effects were correlated with the independent variables and subsequently making the FE model the consistent and efficient estimator for this objective. Consequently, the final estimation was conducted using Fixed Effects with Robust

Standard Errors, which accounts for potential heteroskedasticity and serial correlation, ensuring a more reliable inference.

4.4.1 Descriptive Statistics

The variables adopted in the summary statistics in this objective are depicted in Table 4.21. The descriptive statistics consider the mean, standard deviation, minimum and maximum values of the total observation of 864 observations.

Table 4. 21: Descriptive Statistics

Variable	Mean	Std. dev.	Min	Max	Observations	
id	overall	5	2.583484	1	9	N = 864
between	2.738613	1	9	n = 9		
within	0	5	5	T = 96		
TIME	overall	21534.21	843.9877	20089	22980	N = 864
between	0	21534.21	21534.21	n = 9		
within	843.9877	20089	22980	T = 96		
lnLD	overall	22.01064	0.734405	20.11374	23.987	N = 864
between	0.722254	20.73795	22.97522	n = 9		
within	0.274087	21.38643	23.02242	T = 96		
NPLs	overall	7.93E+08	6.71E+08	6.31E+07	3.16E+09	N = 864
between	6.31E+08	1.38E+08	2.22E+09	n = 9		
within	3.11E+08	1.34E+08	2.63E+09	T = 96		
CAR	overall	18.29726	1.731911	14.17634	21.84069	N = 864
between	0	18.29726	18.29726	n = 9		
within	1.731911	14.17634	21.84069	T = 96		
Inflation	overall	11.82927	9.719436	5.4	59.7	N = 864
between	0	11.82927	11.82927	n = 9		
within	9.719436	5.4	59.7	T = 96		
Interest	overall	25.0851	3.344228	20.04	35.58	N = 864
between	0	25.0851	25.0851	n = 9		
within	3.344228	20.04	35.58	T = 96		
RECAP	overall	0.5	0.50029	0	1	N = 864
between	0	0.5	0.5	n = 9		
within	0.50029	0	1	T = 96		
COVID	overall	1.354167	0.478537	1	2	N = 864
between	0	1.354167	1.354167	n = 9		
within	0.478537	1	2	T = 96		

Source: Author's analysis from secondary data (2023)

From Table 4.21, the overall mean of the logarithm of loan disbursement is compartmentalized between and within groups and this represents the average variable for the disbursements either across different time periods or at a specific point in time, respectively. A total of 864 observations were recorded across a 96 period data points.

The mean between groups is 0.722, approximately. In the table above, the within-group variation in reference to lnLD refers to the average variability across time and sectors (agriculture, electricity, commerce, mining, manufacturing, services, construction, transportation and miscellaneous), among the loan disbursements. The within-group variations indicate the extent to which lnLD fluctuates within each sector, which is independent of other sectors. The high variability implies that, within a specific sector, the loan disbursement witnesses considerable variability over different time periods. The probable cause of this variation could be attributed to issues such as economic cycles including the macroeconomic situation over a period of time or bank-specific reasons such as sectoral risk appetite. The lnLD within-group witnessed a range of between 0.73 and 20.11. With a standard deviation recorded of 20.73, lnLD demonstrates a higher and substantial variability around the mean value.

The mean between-sector variation in the context of lnLD above illustrates the average loan variability across the different sectors depicted, at a specific point in time. This explains how lnLD provides information on the heterogeneity of loan disbursement across sectors at a point in time. From the table, the between-sector variation with a mean of 0.274 for lnLD, defines how much the natural logarithm of loan disbursement varies between different sectors at a point in time. By implication, the mean of 0.274 indicates that there is a moderate variation in the natural logarithm of loan disbursement between the specified sectors. The table further illustrates a range of 20.042 and 21.386 for the minimum and maximum values, respectively.

Table 4.21 further decomposes the variance in NPLs into between-sector and within group components. From the table, the overall mean for NPLs as depicted is 7.93×10^8. The overall standard deviation as depicted in the table is 6.71×10^8. A total of 864 observations were recorded. The mean between-sector variations, from the table, is 6.31×10^8. This figure gives an indication of the average NPLs between sectors or the variation of NPLs between sectors. The range of the between-sector recorded a minimum and maximum values of 1.38×10^8 and 2.22×10^9, respectively. Again, the mean within-group variation indicates a value of 3.11×10^8. This indicates, on the average, the variability of NPLs for each sector across time independent of other sectors. Further to this, the within-group variation shows a range of 1.34×10^8 and 2.63×10^9 for both minimum and maximum values, respectively. A total of 96 time periods were recorded. It is important to note that, the spread in the values of the minimum and maximum values for both between-sector and within-group variations for NPLs is higher, indicating significant variations for NPLs across sectors or significant fluctuations over time.

Furthermore, the overall mean for capital adequacy ratio (CAR) in the table above is 18.297. The overall standard deviation as depicted in the table is 1.732, whereas the minimum and maximum values are 14.176 and 21.841, respectively. The number of observations recorded are 864 across 96 time periods. The mean of between-sector variation for CAR is 0 which implies that on the average, there is no difference in CAR values across the different sectors under consideration. This is further buttressed by the no variation in range and the standard deviation value of 0, as illustrated in Table 10. On the contrary, the mean of within-group variation for CAR is 1.732, suggesting that averagely, CAR fluctuates within a particular sector. The within-group variation minimum and maximum ranges of 14.176 and 21.841, respectively, suggests that the values of CAR within each sector varies within a certain range.

Again, the overall mean value for inflation as illustrated in Table 4.19 above is 11.829 and the standard deviation is 9.719. The range of minimum to maximum values is from 5.4 to 59.7. A total of 864 observations were recorded.

The between-sector mean, standard deviation, minimum and maximum values of 0 are indicative of the fact that on average, there appears to be no difference in inflation between the different sectors under consideration. This implies that inflation is consistent across the different sectors under consideration.

The within-group mean of 9.719 suggests that, on average, a variability of inflation within each of the nine sectors under consideration over time. With a standard deviation of 9.719 and the range of minimum and maximum values from 5.45 to 59.7, there is a strong indication that values for inflation within each sector varies within a particular range over time.

Finally, the overall mean interest and standard deviation recorded in the study are 25.08 and 3.344, respectively. The range of minimum to maximum values as recorded are from 20.040 to 35.580.

The between-sector variations for mean, standard deviation and minimum and maximum values are 0. This indicates a high level of consistency of interest rates across sectors.

The within-sector variation for mean is 3.344 which implies that, averagely, interest rates fluctuate within specific sectors across time. The range of minimum to maximum values from 20.04 to 35.580 is indicative of the fact that interest rates fluctuate within a particular sector over time.

4.4.2Test for Normality

To assess whether the errors or the idiosyncratic errors in the linear regression model adopted or conformed to normal distribution, a test for normality was conducted. With a null hypothesis which suggested that the errors or idiosyncratic errors in the model are normally distributed and the alternate hypothesis which suggests on the contrary that the errors or idiosyncratic errors are not normally distributed, Table 4.22 illustrates the test for normality.

Table 4. 22: Test for Normality

	Observed		Bootstrap		Normal-based	
	Coefficient	std.	err.	z	P>z	[95%
Skewness_e	0.002	0.002	1.300	0.195	-0.001	0.006
Kurtosis_e	-0.000	0.001	-0.130	0.900	-0.002	0.002
Skewness_u	-0.006	0.027	-0.220	0.825	-0.060	0.048
Kurtosis_u	-0.017	0.017	-1.000	0.316	-0.052	0.017

Joint test for Normality on e: $chi^2(2)$ = 1.70 Prob > chi^2 = 0.4280

Joint test for Normality on u: $chi^2(2)$ = 1.05 Prob > chi^2 = 0.5908

Source: Author's analysis from secondary data (2023)

With p-values of 0.428 and 0.591, there was no compelling evidence to reject the null hypothesis at 95% confidence interval. The idiosyncratic errors in the linear regression model are therefore considered to be consistent with normal distribution.

Table 4.22 further illustrates the error term skewness, kurtosis and the idiosyncratic error skewness and kurtosis. According to Campbell and Jacques (2023), a normality assumption in a linear regression is crucial for a valid statistical inference. A significant skewness therefore indicates that, this assumption is violated.

In the test for skewness, the following hypotheses were employed:

H_0: The distribution is symmetric (absence of skewness).

H_1: The distribution is non-symmetric (evidence of skewness).

With a p-value of 0.195, which gives an indication that the skewness is not significant, the author failed to reject the null hypothesis at 95% confidence interval implying the distribution is symmetric. A similar test was conducted in the study to describe the shape of the distribution's tail in relation to its center. Thus, kurtosis, the statistical measure that describes the shape of the distribution's tail relative to its peak was measured (Hatem et al., 2022). The hypothesis tests employed are stated as follows:

H_0: The distribution is normal or mesokurtic (Kurtosis equal to 3)

H_1: The distribution's kurtosis is either leptokurtic or platykurtic (Kurtosis is not equal to 3)

With a p-value of 0.9, the author failed to reject the null hypothesis indicating that the distribution is normal or has tails similar to a normal distribution.

4.4.3 Test for Multicollinearity

A test was conducted to determine the absence of multicollinearity in the regression model. When two or more independent variables in a regression model are highly correlated, multicollinearity occurs which can have an effect on the estimation of the individual contribution to each variable (Shrestha, 2020). Table 4.23 depicts the results of the test which employed the Variance Inflation Factor (VIF).

Table 4. 23: Variance Inflation Factor

Variable	VIF	$^{1}/_{VIF}$
LnLD	6.77	0.148
LnNPLs	4.77	0.21
CAR	4.23	0.236
Inflation	3.62	0.276
Interest	2.4	0.416
RECAP	1.03	0.97
COVID	3.81	0.26

Source: Author's analysis from secondary data (2023

Table 4.23 depicts the results from the test conducted with the VIF to check multicollinearity. The VIF determines the correlation between the independent variables and all other variables in the model and the rule of thumb is that values more than 10 are multicollinear (Duxbury, 2021). The VIF model therefore confirms the absence of multicollinearity in the values in the regression model.

4.4.4 Heteroskedasticity Test

Table 4. 24: Modified Wald Test for Groupwise Heteroskedasticity

Test Name	Hypothesis	Test Statistic	p-value
Modified Wald test for groupwise heteroskedasticity	H0: sigma(i)^2 = sigma^2 for all i	Chi^2 (3) = 452.65	Prob>chi^2 = 0.0000

Source: Author's analysis from secondary data (2023)

This test is adopted to identify the presence of heteroskedasticity in the regression model. The null and alternative hypotheses for the test are stated as;

H_0: The presence of homoskedasticity in the error variance across the observation.

H_1: The presence of heteroskedasticity in the error variance across the observation.

The high value of 452.65 in the chi-square test in Table 4.24 suggests strong evidence against the null hypothesis. The test value is high at 452.65, which indicates a departure, albeit significantly, from the fixed effect assumption of homoskedasticity. The low p-value of 0.00 provides another strong basis of rejecting the null hypothesis. By implication, the rejection of the null hypothesis supports the presence of heteroskedasticity in the fixed effect model, which violates the assumption of homoskedasticity. Thus, the robust option was adopted to correct for heteroskedasticity in the fixed effect model.

4.4.5 Random Effects Regression:

Effects of Recapitalization on Loan disbursement: Robustness Check with Radom Effects Model

In analyzing the heterogeneous effects of recapitalization on loans disbursement across sectors relative to the agricultural sector, it became pertinent to consider an econometric approach which is robust and vigorous. In this study, the results of the random effects regression have been presented in order to have a confirmation of the consistency of the results attained from the regressions of the various models. Thus, with the random effects regression producing almost similar results with the fixed effects with robust standard errors regression, the robustness and confidence in the findings are strengthened (Wooldridge, 2021).

Illustrated in Table 4.25 are the results of the random effects regression analysis. In this context, the random effects model reveals the loan disbursement (lnLD) dynamics across the various sectors, incorporating both time invariant and time varying factors that provide a thorough appreciation of the heterogeneous impact of recapitalization on loan disbursement.

1**Table 4. 25: Random Effects Regression**

lnLD	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
lnNPLs	0.254	0.017	15.15	0	0.221	0.287	***
CAR	-0.014	0.005	-2.64	0.008	-0.024	-0.004	***
Inflation	0.012	0.001	8.43	0	0.009	0.014	***
Interest	-0.014	0.005	-2.93	0.003	-0.023	-0.005	***
RECAP	0.141	0.022	6.33	0	0.097	0.184	***
COVID	0.025	0.025	0.98	0.329	-0.025	0.075	
Constant	17.253	0.46	37.48	0	16.351	18.156	***

Mean dependent var	22.011	SD dependent var	0.734
Overall r-squared	0.558	Number of obs	864
Chi-square	1376.92	Prob > chi2	0
R-squared within	0.619	R-squared between	0.705

*** *p<.01, ** p<.05, * p<.1*

Source: Author's analysis from secondary data (2023)

With an R-squared of 0.558, the implication is that the 55.8% variability of growth in loan disbursement is explained by the explanatory variables. The model's explanatory power, from the chi square's test with a p-value of 0.00, gives an indication that it is significant.

From the table, the R-squared within provides understanding on the explanatory power of the model within individual sectors across time. By implication, the within R-squared of 0.619 shows that about 61.9% of the variability of percentage change in loan disbursement within the sectors is explained by the independent variables.

The R-squared between with a coefficient of 0.705 implies that, about 70.5% of the variability in percentage change in loan disbursement across the sectors is explained by the explanatory variables. This means that 70.5% of the variation in lnLD can be explained by changes in the variables used in the estimation, in this case the bank specific and macroeconomic variables.

From Table, the positive coefficient of 0.254 of lnNPLs suggest a unit's increase in lnNPLs results in 25.4% increase in lnLD. Conversely, a unit's decrease in lnNPLs also results in a 25.4% decrease in lnLD. This relationship is significant with a p-value of 0.00.
Again, from the table, CAR has an inverse relationship with lnLD. By implication, a unit increase in CAR results in a decrease of 1.4% of lnLD. Alternatively, a unit decrease in CAR also results in a 1.4% increase in lnLD. This relationship is statistically significant with a p-value of 0.008.

The random regression results above also point to the fact that inflation has a positive relationship with lnLD. With a coefficient of 0.012, it implies that a unit's increase in inflation will result in a 1.2% increase in lnLD. This relationship, at 95% confidence interval, is statistically significant with a p-value of 0.00.

Interest rate, from Table 4.26 also depicts an inverse relationship with lnLD. A unit's decrease in interest rate is likely to result in an increase in lnLD by 1.4%. A unit's increase in interest rate, however, will result in a 1.4% decrease in lnLD. This relationship, again, is statistically significant with a p-value of 0.003.

From the table above, recapitalization has a positive relationship with lnLD. At a coefficient of 0.141, it implies that a decision to recapitalize will result in an increase of 14.1% of lnLD. This relationship, at 95% confidence interval, is statistically significant with a p-value of 0.00. Intuitively, when banks recapitalize, they have adequate capital to expand their business operations. They are therefore, able to increase loan disbursement and support economic activity so as to increase their interest income. This finding supports the views of Obadire et al. (2022); Le et al. (2023); Kim & Katchova (2020); De Jonghe et al. (2020); Awdeh & El-Moussawi (2022).

Finally, it can be established from the random regression analysis above that Covid has a positive relationship with lnLD. This relationship, however, is not statistically significant.

4.4.6 Hausman Test for Random Effects versus Fixed Effects Regression

A further test to determine the choice between random effects and fixed effects was carried out. Thus, the Hausman test which is employed to determine whether random effects model is consistent and more efficient compared to the fixed effects model or vice versa was adopted. The table below shows the results of the Hausman test conducted.

Table 4. 26: Hausman Test

Test Statistic	Coef.
Chi-square test value	7
P-value	0.008

Source: Author's analysis from secondary data (2023)

Table 4.26 illustrates the results of the Hausman test conducted. The hypothesis that was tested is stated as;

H_0: Random effects model is more consistent and efficient.

H_1: Fixed effects model is appropriate.

From the table, there is strong indication that the results of the Hausman test shows a statistically significant difference between the fixed effects model and the random effects model. With a chi-square test value of 7, the corresponding p-value is 0.008, which gives enough basis to reject the null hypothesis that random effects model is more consistent for the study. Therefore, the fixed effects model is deemed more appropriate from the results of the Hausman test conducted.

4.4.7 Fixed Effects Regression

Table 4.28 shows the fixed effects regression analysis that depicts the relationship between the independent variables and the disbursement of loans across different sectors. The fixed effects regression analysis accounts for the time invariant characteristics specific to each of the nine sectors and also checks biased estimates by capturing unobserved heterogeneity. From the table below, the coefficients give a representation of the average effects or impact of each independent variable on the dependent variable, lnLD, while controlling for sector-specific effects that has the tendency to remain constant over time.

Table 4. 27: Fixed Effects Regression

lnLD	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
lnNPLs	0.25	0.017	14.89	0	0.217	0.283	***
CAR	-0.014	0.005	-2.7	0.007	-0.025	-0.004	***
Inflation	0.012	0.001	8.53	0	0.009	0.014	***
Interest	-0.014	0.005	-3.02	0.003	-0.024	-0.005	***
RECAP	0.14	0.022	6.34	0	0.097	0.184	***
COVID	0.024	0.025	0.93	0.353	-0.026	0.073	
Constant	17.353	0.439	39.57	0	16.492	18.214	***

Mean dependent var	22.011	SD dependent var	0.734
R-squared	0.619	Number of obs	864
F-test	229.493	Prob > F	0
Akaike crit. (AIC)	-604.436	Bayesian crit. (BIC)	-571.105

**** p<.01, ** p<.05, * p<.1*

Source: Author's analysis from secondary data (2023)

From Table 4.27, the R-squared value of 0.619 indicates that approximately 61.9% of the variance of the dependent variable, lnLD is explained by the model. The F-test, as presented in Table 4.27 gives an assessment of the overall significance of the model, which with a p-value of 0.000, there is a strong indication that the model is statistically significant. From the table, lnNPL has a positive relationship with the dependent variable, lnLD. With a co-efficient of 0.25, there is an indication that a unit's increase in lnNPLs results in a 25% increase in lnLD. This relationship, with a p-value of 0 is highly significant at 95% confidence interval.

Again, from Table 4.27, there is a negative relationship between CAR and the dependent variable, lnLD. A unit increase in the CAR results in a 1.4% decrease in lnLD. This relationship is also significant at 95% confidence interval. Furthermore, there is also a positive relationship between inflation and the dependent variable, lnLD. With a co-efficient of 0.012, there is an indication that a unit's increase in inflation will result in a

1.2% increase in lnLD. This relationship is statistically significant at 95% confidence interval.

From Table 4.27, the interest rate has a negative relationship with lnLD. With a co-efficient of -0.014, there is an implication that a unit's increase in interest rates results in a 1.4% decrease in lnLD. This relationship is statistically significant at 95% confidence interval. Recapitalization, from the table has a positive relationship with lnLD. With a co-efficient of 0.14, it implies that after recapitalization, there is an increase in the dependent variable, lnLD by 14% and this relationship is statistically significant. This makes intuitive sense as when banks recapitalize, they are more likely to increase loan disbursement across sectors. This result supports the view of Ogbola (2020) who found that increased capitalization enhances the risk bearing capacity of banks and increases their appetite to extend loans to businesses and individuals. Abbas et al., (2021) corroborates this finding and indicates that this phenomenon, known as the capital buffer effect, leads to well-capitalized banks being more inclined to increase lending which consequently simulates economic growth. Acharya (2023) also opined that recapitalization often leads to changes in the balance sheet of banks and this impact competition in credit disbursement as well as its pricing. The researcher further suggests that banks which are recapitalized and have strengthened capital, may increase lending and consequently, increase competition within the industry driving down interest rates and relaxing the terms of lending to attract more borrowers. Cybo-Ottone & Savorelli (2016) also examines how recapitalization influences the risk preferences of banks based on the composition and attendant increased distribution of credit across sectors and industries. The analysis of the researchers highlights the cardinal role recapitalization plays in determining sectoral loans allocation and its consequential impacts on economic sectoral growth. Brei et al. (2020), however, found a statistically insignificant relationship between bank recapitalization and lending. Hryckiewicz et al. (2023) found that without debt resolution measures, recapitalization do not necessary improve banks' performance and lending activities.

Finally, from the results, COVID has a positive relationship with lnLD. With a co-efficient of 0.024, it implies that the pandemic is likely to result in a 2.4% increase in lnLD. This relationship, however, is not statistically significant. According to McDermott (2023), there is the need to ensure the validity of statistical inference when conducting regression analysis, especially with panel data that has varying time and individual units' dimensions.

4.4.8 Fixed Effects Regression with Robust Standard Errors

In the fixed effects regression model above, there is an assumption of homoskedasticity whereby the variance in error terms is constant across the observations. Therefore, the absence of robust standard errors invariably implies an assumption of homoskedasticity (Oktay, 2022). On the contrary, panel datasets often demonstrate heteroskedasticity which makes a robust approach relevant (Papke & Wooldridge, 2023). Table 4.28 incorporates a robust standard error so that potential concerns on heteroskedasticity will be accounted for. This is also to ensure that standard errors employed in the testing of hypothesis are robust against the assumptions of homoskedasticity, which invariably will enhance the statistical inference's reliability and accuracy drawn from the fixed effects model.

Table 4. 28: Fixed Effects Regression with Robust Standard Errors

lnLD	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
lnNPLs	0.25	0.055	4.55	0.002	0.123	0.377	***
CAR	-0.014	0.005	-3.09	0.015	-0.025	-0.004	**
Inflation	0.012	0.004	2.78	0.024	0.002	0.021	**
Interest	-0.014	0.014	-1.01	0.341	-0.047	0.018	
RECAP	0.14	0.043	3.27	0.011	0.041	0.24	**
COVID	0.024	0.09	0.26	0.801	-0.185	0.232	
Constant	17.353	1.307	13.27	0	14.338	20.368	***

Mean dependent var	22.011	SD dependent var	0.734
R-squared	0.619	Number of obs	864
F-test	24.489	Prob > F	0
Akaike crit. (AIC)	-606.436	Bayesian crit. (BIC)	-577.867

*** *p<.01*, ** *p<.05*, * *p<.1*

Source: Author’s analysis from secondary data (2023)

From Table 4.28, there is a positive relationship between lnNPLs and lnLD. The coefficient of 0.25 gives an indication that a unit’s increase in lnNPLs results in a 25% increase in lnLD. The precision of this estimate is affirmed with the standard error of 0.055. This relationship is statistically significant.

Again, CAR has a negative relationship with lnLD with a coefficient of -0.014. This implies that, a unit’s increase in CAR is likely to result in a 1.4% decrease in lnLD. This relationship is statistically significant. Inflation, from the table has a positive relationship with lnLD. With a coefficient of 0.012, there is an implication that a unit’s increase in inflation is likely to result in a 1.2% increase in loan disbursement. This relationship is also statistically significant and the standard error of 0.004 gives credence to the precision of the estimate.

From Table 4.28, the interest rate with a negative coefficient of 0.014, is not statistically significant. By implication, interest rates do not have any effect or impact on lnLD.

Furthermore, recapitalization has a positive relationship with lnLD. This suggests strongly that an incidence of recapitalization results in an increase in lnLD by 14%. This relationship is statistically significant. Finally, from the results, COVID has a positive relationship with lnLD with a coefficient of 0.024. This relationship, however, is not statistically significant. The reasons attributed to this, based on its intuitive sense, include the following;

- During the pandemic, the government introduced various stimulus measures to mitigate the adverse economic effects on the citizenry (Asare & Barfi, 2021). Many institutions replicated this with banks offering packages such as reduced interest rates, moratorium on repayment of new loans and refinancing of existing loan facilities which also had an accommodation for top-ups. All these are likely to have increased the amount of loan disbursement during the pandemic.
- According to Kimani (2023), sectoral dynamics could also have played a role in increased loan disbursement during the pandemic. Some sectors required increased funding to adapt during the period as their operations needed to respond to a paradigm shift in technological adaptations or investments, implementing health and safety measures and introduction of online work protocols, among others. The Bank of Ghana, during the period introduced monetary policy measures that were aimed at reducing interest rates in order to mitigate the adverse economic effects of the COVID pandemic (Boakye et al., 2022). This invariably contributed to the increased loan disbursement during the pandemic period.

4.4.9 Fixed Effects Analysis of Sectoral Loan Disbursement: Agriculture as the Base Sector

This section presents the fixed effects regression analysis with robust standard errors to examine sectoral variations in loan disbursement, using the agricultural sector as the base or reference sector category. The analysis investigates the heterogeneous impact of recapitalization and other key financial variables on loan disbursement across sectors while controlling for sector-specific and time-invariant effects. By employing a fixed effects approach, the study accounts for unobserved heterogeneity, ensuring that sector-specific characteristics do not bias the estimated relationships.

Table 4. 29: Fixed Effects Regression with Robust Standard Errors for Sectoral Loans Disbursement (Agricultural Sector as Base Sector)

lnLD	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
lnNPLs	0.25	0.017	14.89	0	0.217	0.283	***
CAR	-0.014	0.005	-2.7	0.007	-0.025	-0.004	***
Inflation	0.012	0.001	8.53	0	0.009	0.014	***
Interest	-0.014	0.005	-3.02	0.003	-0.024	-0.005	***
RECAP	0.14	0.022	6.34	0	0.097	0.184	***
COVID	0.024	0.025	0.93	0.353	-0.026	0.073	
Sec_ID : base 1Agric	0	.	.	.	.	.	
2 Mining	-0.139	0.032	-4.34	0	-0.202	-0.076	***
3 Manufacturing	0.772	0.026	29.36	0	0.72	0.823	***
4 Construction	0.772	0.026	29.46	0	0.721	0.824	***
5 Electricity	0.717	0.026	27.35	0	0.666	0.769	***
6 Commerce	1.388	0.036	38.03	0	1.316	1.46	***
7 Transport	0.884	0.025	35.24	0	0.835	0.933	***
8 Services	1.562	0.029	53.77	0	1.505	1.619	***
9 Miscellanous	0.964	0.026	36.64	0	0.913	1.016	***
Constant	16.584	0.435	38.09	0	15.729	17.439	***

Mean dependent var	22.011	SD dependent var	0.734
R-squared	0.947	Number of obs	864
F-test	1080.876	Prob > F	0
Akaike crit. (AIC)	-588.436	Bayesian crit. (BIC)	-517.012

**** p<.01, ** p<.05, * p<.1*

Source: Author's analysis from secondary data (2023)

From Table 4.29, the R-squared value of 0.947 suggests that the independent variables collectively explain approximately 94.7% of the within-variation in the dependent variable, lnLD, across the sectors. The statistical significance of the F-test ($p < 0.01$) confirms the overall goodness of fit, indicating that the model is well-specified.

Better still, from Table 4.29, inflation has a positive relationship with lnLD. With a coefficient of 0.012, it implies that a unit increase in inflation results in a 1.2% increase in lnLD. This relationship is statistically significant at 95% confidence interval, having a p-value of less than 0.01. Again, from the table above, interest rate has an inverse relationship with lnLD. A unit's increase in interest rate results in a decrease of 1.4% in lnLD and vice versa. This relationship is statistically significant.

Furthermore, from Table 4.29, recapitalization has a positive relationship with lnLD. An incidence of recapitalization resulted in a 14% increase in lnLD. This relationship is statistically significant. COVID, from the table above, also has a positive relationship with lnLD. This relationship, however, is not statistically significant. From Table 4.30, the regression analysis also captures the sector-specific coefficients and provides details of how each sector in the study, contributes to the dependent variable, the natural logarithm of loan disbursement, as compared to Agriculture, which in this context is the base sector.

With a coefficient of -0.139, a unit's change in the Mining sector is associated with a decrease of 0.139 units in lnLD compared to Agriculture which is the base sector. The inverse relationship indicates that the Mining sector, compared to agriculture (the base sector), has lower contribution to loan disbursement. This relationship is statistically significant. Therefore, the Mining sector has a negative effect on the total loans distributed, compared to the agriculture sector which is the base sector.

Worthy of mention is the fact that from Table 4.29 above, the Manufacturing sector with its positive coefficient is associated with an increase of 0.772 units in lnLD, when compared with the agriculture sector. The Manufacturing sector therefore makes a positive contribution to total loans when compared to the Agricultural sector. This relationship is significant at 95% confidence interval. Importantly too, the Construction sector with a coefficient of 0.772 units, is associated with a positive contribution to lnLD compared to the agriculture sector. Impliedly, the construction sector has a higher level of total loans compared to the base sector, Agriculture. Construction, therefore, is related to an increase of 0.772 units in lnLD, as compared to the base sector, Agriculture.

Evidence from Table 4.29 above also shows a positive relationship between the Electricity sector and lnLD. With a coefficient of 0.717, there is an indication that the Electricity sector is related to an increase of 0.717 units in lnLD, compared to the agriculture sector. This relationship is also statistically significant at 95% confidence interval. From the table, the Commerce sector has a positive relationship with lnLD, and with the high coefficient of 1.388, it suggests an increase of more than 1.388 units contribution in lnLD, when compared with the base sector, Agriculture over the study period. This relationship is statistically significant, too.

Compared to Agriculture's contribution to lnLD, the Transport sector, from Table 4.29 above, shows an increase of more than 0.884 units, compared to Agriculture. This relationship is statistically significant. With a significant coefficient of 1.562, the Services sector shows a strong relationship with lnLD. The Services sector, from the table indicates that the Services sector witnessed an increase of more than 1.562 units in lnLD, compared to Agriculture. This relationship, again, is statistically significant. Finally, from Table 4.29, the sector identified as Miscellaneous has a positive coefficient of 0.964. Impliedly, the sector identified as Miscellaneous witnessed an increase in lnLD of more than 0.964 units, when compared with the base sector, Agriculture.

4.4.10 Normality Test of Residuals of the Fixed Effects with Robust Standard Errors

An important assumption in regression analysis is the normality of residuals and by implication, any deviation from normality can have an effect on the reliability of the statistical inferences (Franco-Martinez et al., 2023). Therefore, diagnostic checks were conducted on the residuals of the fixed effects regression with robust standard errors to ascertain whether they follow a normal distribution. Table 4.28 illustrates the normality test results.

Table 4. 30: Test of Normality

	Observed		Bootstrap		Normal-based	
	Coefficient	std.	err.	z	P>z	[95%
Skewness_e	0.002	0.001	1.790	0.073	-0.000	0.005
Kurtosis_e	-0.000	0.001	-0.120	0.903	-0.002	0.002
Skewness_u	-0.006	0.024	-0.250	0.802	-0.053	0.041
Kurtosis_u	-0.017	0.022	-0.810	0.420	-0.060	0.025

Joint test for Normality on e: chi2(2) = 3.24 Prob > chi2 = 0.1984

Joint test for Normality on u: chi2(2) = 0.71 Prob > chi2 = 0.6997

Source: Author’s analysis from secondary data (2023)

Table 4.30 illustrates the normality test which includes calculations for skewness and kurtosis for the idiosyncratic error (e) and the individual specific error (μ). To provide a robust estimation of the standard errors, the bootstrap replications, in this context, 50 was adopted. From the table, the individual-specific errors (μ) indicate that their skewness and kurtosis in not significantly different from normal distribution. With p-values in excess of 0.05, there is no strong indication against normal distribution.

Again, from Table 4.30, the idiosyncratic error (e) showed positive skewness and kurtosis near zero. The recorded p-values of 0.073 and 0.903 for both skewness and kurtosis, respectively, does not suggest a strong departure from normality. Furthermore, Table 4.30 provides a joint test to demonstrate the normality of both individual-specific errors and idiosyncratic errors. The chi-square of 3.24 and 0.71 providing p-values of 0.1984 and 0.6997 for the individual-specific and idiosyncratic errors, respectively, do not provide enough evidence against the normality of the errors, since the p-values are more than 0.05. It can therefore be concluded that from Table 4.30, the distributional assumptions for the test of normality are reasonably met. The reliability of the drawn inferences from the fixed effects with robust standard errors are enhanced with the absence of significant deviations from normality.

4.4.11 Theoretical Linkages

The findings of this objective have a direct link with the theory of finance and growth. Aspects of finance and growth theory posit that, the accessibility and efficiency of financial intermediation systems are important for economic growth (Oluranti, 2024; Omete, 2023). By strengthening the financial base of financial institutions through recapitalization, banks are able to channel funds through lending to the productive sectors of the economy. In the context of this objective, therefore, recapitalization influences the disbursement of loans across sectors, thereby simulating growth in these sectors to contribute to economic development.

Another theory that has a direct bearing on this study objective is the pecking order theory. According to this theory, firms have a strong preference for internal financing over external financing, again preferring debt over equity when it comes to external financing in order to maintain optimal capital structures (Sadiq et al., 2023; Mohamed, 2021). In the context of this study, recapitalized banks may show strong preferences in their lending decisions to favor sectors that they rate as lower risk and have higher returns to maintain their desired capital structures. This explains why the findings from the study indicate that seven out of the eight sectors had higher loans disbursement relative to the agricultural sector, as the agricultural sector, comparatively, is deemed to be riskier.

The findings of this objective again, support the financial accelerator theory. As recapitalization strengthens the balance sheet of banks and improves their liquidity, banks are able to provide credit across sectors of the economy to support growth. This includes consistent loans disbursement across sectors even during periods of economic shocks such as was posed by the Covid 19 pandemic.

4.5 Primary Data Analysis

As part of the study, a survey was conducted with the help of a questionnaire and this section presents the findings of the primary study. The questionnaire was administered electronically using Google Forms and a link was shared with prospective respondents who were selected from all the banks in Ghana. The questionnaire was in four parts and this section presents the findings in line with those parts.

4.5.1 Respondents Demographics

In all, there were 23 respondents that is, one respondent from each of the 23 banks in the country providing answers to the questions raised in the questionnaire. All respondents were on schedules related to credit initiation, appraisal, analysis, monitoring, and credit risk prevention. Table 4.32 shows a summary of the key demographics of the respondents in the study. In terms of sex, 5 out of the 23 respondents, representing 21.7 per cent were female and the rest were male. All the respondents were between the ages of 31 and 50 years with the majority of them (60.8 per cent) being between the ages of 31 to 40 years. A total of 9 respondents, representing 39.13% were between the ages of 41 and 50 years. None of the respondents was below 30 years or above 50 years. All the respondents, at least, had a first degree. It can be observed from the results that 4 respondents had only first degree; 19 of them had a master's degree; 8 of them had a master's degree in addition to a professional degree, while 1 respondent had a first degree and a professional qualification.

Table 4. 31: Respondents Demographics

Variable	Options	Frequency	Percentage
Sex	Male	18	78.26
	Female	5	21.74
Age	< 30	0	0.00
	31 to 40	14	60.87
	41 to 50	9	39.13
	>50	0	0.00
Career Experience	< 5yrs	0	0.00
	6 to 10	7	30.43
	11 to 15	10	43.48
	16 to 20	6	26.09
	>20	0	0.00
Current Role Experience	< 5yrs	0	0.00
	6 to 10	7	30.43
	11 to 15	10	43.48
	16 to 20	6	26.09
	>20	0	0.00
Educational levels	First Degree	3	13.04
	First Degree and Professional	1	4.35
	Master Degree	11	47.83
	Master Degree and Professional	8	34.78

Source: Field Survey, 2023

The number of years in career experience of the respondents ranged between 6 years to 20 years. Majority of the respondents had between 11 to 15 years (43.48 per cent) career experience. This was followed by those with between 6 to 10 years (30.43 per cent), then those between 16 to 20 years (26.09 per cent). None of the respondents had less than 5 years of career experience. That stated, the number of years' experience at their current job role ranged between 6 to 20 years. Majority of the respondents had between 11 to 15 years' experience (43.48 per cent) at their current role. This was followed by those with between 6 to 10 years (30.43 per cent) and then 16 to 20 years (26.09 per cent).

4.5.2 Agricultural Credit Risk Management Strategies

The second section of the questionnaire sought to find from the respondents the agricultural credit risk management strategies that are employed by their banks before and after recapitalization, which is the third objective of this study. From the Cronbach's Alpha test statistics shown in Table 4.33, it was observed that the measuring instrument used was internally consistent and thus, produced consistent results on repeated trials. The mean of 0.81 signifies a high level of internal consistency among the items being measured in the questionnaire. Impliedly, the items in the questionnaire are closely related and have a good degree of reliability in measuring the underlying construct.

Table 4. 32: Cronbach Alpha

Number of Items	Variance	Total Variance	Cronbach Alpha
7	4.35	1.34	0.801

Source: Survey Data, 2023

Table 4.32 depicts the resulting opinions of the respondents on the agricultural credit risk management strategies employed by their respective financial institutions. From Table 4.32, it is observed that collateral based lending ranked first (1^{st}) among the agricultural credit risk management strategies with a relative importance index of 0.429. The mean rating is 0.913. The standard error of the mean is 0.282 while the standard deviation is 0.059. Ranked 2^{nd} is risk assessment tools specific to agriculture which has a relative importance index of 0.388, and a mean of 0.826. The standard error for the mean recorded is 0.379 while the standard deviation is 0.079. From the table, loan-to-value for agricultural loans is ranked 3^{rd} with a relative importance index of 0.327. The mean rating is 0.696 and the standard error of the mean is 0.096 and the standard deviation around the mean is 0.4601. Seasonal repayment and credit scoring both ranked 4th with relative importance index of 0.306. Both agricultural credit management strategies recorded a mean of 0.652 and standard deviation of 0.460. The standard errors recorded for both strategies is 0.099. Credit insurance and other risk management strategies both ranked 5th and 6th with a relative importance index of 0.265 and 0.0816, respectively.

Table 4. 33: Agricultural Credit Risk Management Strategies before Recapitalization

Credit Risk Management Strategies	Sum	Mean	Standard Deviation	Standard Error	Rii	Rank
Collateral Based Lending	21	0.913	0.282	0.059	0.429	1
Risk Assessment	19	0.826	0.379	0.079	0.388	2
Loan to Value	16	0.696	0.46	0.096	0.327	3
Credit Scoring	15	0.652	0.476	0.099	0.306	4
Seasonal Repayment	15	0.652	0.476	0.099	0.306	4
Credit Insurance	13	0.565	0.496	0.103	0.265	6
Others	4	0.174	0.379	0.079	0.082	7

Source: Survey Data, 2023

From the study, it was revealed that all banks provided credit facilities to the agricultural sector before and after the recapitalization of banks. This is corroborated by the secondary data obtained from Bank of Ghana on sectoral loans disbursement throughout the study period.

The identified challenges in the management of agricultural credit risk, from the study are insufficient risk assessment tools, inadequate credit scoring models, lack of accurate data on the agricultural sector, limited knowledge in agricultural credit risk, ineffective monitoring and evaluation and others. Their means, standard deviation and standard errors are illustrated in Table 4.34.

Table 4. 34: Agricultural Credit Risk Management Challenges

Challenges	Sum	Mean	Standard Deviation	Standard Error	Rii	Rank
Lack of accurate data on agricultural sector	15	0.652	0.476	0.099	0.147	1
Others	11	0.478	0.5	0.104	0.129	2
Inadequate credit scoring models	14	0.609	0.488	0.102	0.118	3
Ineffective monitoring and evaluation	17	0.739	0.439	0.092	0.111	4
Ineffective monitoring and evaluation	17	0.739	0.439	0.092	0.111	4
Limited knowledge in agricultural credit risk	11	0.478	0.5	0.104	0.081	6
Insufficient risk assessment tools	10	0.435	0.496	0.103	0.059	7

Source: Survey Data, 2023

In Table 4.34, respondents from 15 banks hinted that their banks had as a challenge, the lack of accurate data on agricultural sector. The mean value recorded is 0.651 and the standard deviation around the mean is 0.099. Again, with RII of 0.11, ineffective monitoring and evaluation of agricultural credit ranked 4th in the list of challenges above. The sum of 17 banks which is the highest recorded, indicate the perceived importance of this challenge. The mean recorded is 0.739 and the standard deviation around the mean is 0.439. The standard error recorded is 0.009. Again, from Table 4.35, insufficient risk assessment tools had respondents from 10 banks indicating that it is a challenge, with RII of 0.059. The standard deviation around the mean is 0.496 and the standard error is 0.103.

Table 4.35 illustrates the mean, standard deviation and standard error of responses on the effectiveness of agricultural credit risk management strategies before the recapitalization.

Table 4. 35: Effectiveness of Agric Credit Risk Strategies before Recapitalization

Agric Credit Risk Strategies	Sum	Mean	Standard Dev	Standard Error	Rii	Rank
Collateral Based Lending	77	3.348	1.371	0.286	16.56	1
Risk Assessment	61	2.652	1.237	0.258	13.22	2
Loan to Value	71	3.087	0.88	0.184	12.98	3
Credit Insurance	73	3.174	1.372	0.286	12.52	4
Credit Scoring	64	2.783	1.061	0.221	11.74	5
Seasonal Repayment	76	3.304	1.231	0.257	10.94	6

Source: Survey Data, 2023

Table 4.35 above depicts the responses on the effectiveness of agricultural credit risk management strategies before the recapitalization. Collateral based lending, with an RII of 16.56 also has the highest sum of 77, representing the perceived effectiveness of this risk management strategy across all the 23 banks. The mean recorded for collateral-based lending is 3.348 and the standard deviation around the mean is 1.370. The standard error recorded is 0.286. Risk assessment is ranked second in perceived effectiveness with RII of 16.56. The mean is 2.652 and the standard deviation around the mean is 1.237. The standard error recorded is 0.258. Loan-to-value ratio for agricultural loans is ranked third with RII of 12.98. The sum of perceived effectiveness of this risk management strategy is 71 and the mean is 3.087. The standard deviation around the mean is 0.880 and the standard error is 0.184. Seasonal repayment structure ranked last with RII of 10.94 and sum of perceived effectiveness as a credit risk management strategy being 76. The recorded mean for this strategy is 3.304 and the standard deviation is 1.231. The standard error recorded is 0.257.

Furthermore, the study also investigated if new agricultural credit risk management strategies have been adopted across the banking space in Ghana after the recapitalization exercise. Figure 4.1 depicts the findings on this survey.

Figure 4. 1: New Agricultural Credit Risk Management Strategies by Banks

Source: Survey Data, 2023

From figure 4.1, 17 out of the 23 banks, representing 74% have revised or developed new agricultural credit risk management strategies after the recapitalization period. 6 banks, representing 26% are yet to develop new agricultural credit risk management strategies. Of the 17 banks that have revised and/or developed new agricultural credit risk management strategies after the recapitalization period, the study sought to further identify these new risk management strategies.

The new agricultural credit risk management strategies developed by banks after the recapitalization, from the study includes enhanced agricultural credit risk assessment tools, strengthened and improved monitoring and evaluation of agricultural credit, improved options for collateral, introduction of credit insurance and guarantees for agricultural credit, intensive and increased training in the management of agricultural credit risk and others. Some of these strategies were also found by Helen (2023) in her study on the correlation between agricultural credit and risk management tools. The table below depicts the mean, standard deviation and standard errors of the responses from banks on the development and implementation of these new/revised agricultural credit risk management strategies after the recapitalization period.

Table 4. 36: New Agric Credit Risk Management Strategies after the Recapitalization

New Agricultural Credit Risk Management Strategies	Sum	Mean	Std Deviation	Std Error	Rii	Rank
Strengthened Monitoring and Evaluation	12	0.706	0.456	0.111	6.294	1
Improved Collateral Options	13	0.765	0.424	0.103	6.117	2
Enhanced Risk Assessment Tools	12	0.706	0.456	0.111	4.882	3
Increased Training	11	0.647	0.478	0.116	3.117	4
Introduction of Credit Insurance	8	0.471	0.499	0.121	2.529	5
Specialized Agric Credit Scoring Model	4	0.25	0.433	0.105	1.942	6
Others	1	0.059	0.235	0.057	0.5	7

Source: Survey Data, 2023

From Table 4.36, strengthened monitoring and evaluation with RII of 6.294 ranked first in terms of importance among the banks that have revised their credit risk management strategies for agriculture after the recapitalization period. The mean recorded is 0.706 and the standard deviation is 0.456 around the mean. The standard error recorded is 0.111. Similarly, improved collateral options with RII of 6.117, ranked 2nd in terms of perceived importance by the banks. The recorded mean is 0.764 and the standard deviation around the mean is 0.456. The standard error is 0.103. The introduction of specialized agricultural credit appraisal score ranked 6th with RII of 1.942. The mean recorded is 0.250 and the standard deviation around the mean is 0.433. The standard error recorded is 0.057.

Again, the study investigated the revised/new agricultural credit risk management strategies among banks which had developed new ones after the recapitalization. The statistics on the effectiveness of agricultural credit risk management strategies developed by banks after the recapitalization is depicted in the Table 4.37.

Table 4. 37: New Agric Credit Risk Management Strategies after Recapitalization

Credit Management Strategies After Recap	Sum	Average	Std Deviation	Std Error	Rii	Rank
Strengthened monitoring and evaluation	66	3.882	1.231	0.299	47.159	1
Enhanced risk assessment tools	64	3.765	1.165	0.282	40.63	2
Improve collateral options	62	3.647	1.326	0.322	34.413	3
Increased training and expertise	60	3.529	1.242	0.301	28.509	4
Introduction of credit insurance	55	3.235	1.436	0.348	21.515	5
Introduction of specialized agric scoring model	50	3.125	0.857	0.208	16.513	6

Source: Survey Data, 2023

Table 4.37 depicts new agricultural credit risk management strategies developed by banks after the recapitalization. From the table, enhanced credit risk assessment tools with RII of 47.159 ranked first and recorded its sum of perceived effectiveness as 66. The recorded mean is 3.882 and the standard deviation around the mean is 1.231. The standard error recorded is 0.299. Enhanced risk assessment tools ranked second with RII of 40.63 and mean of 3.764. The standard deviation around the mean is 1.165 and the standard error is 0.282. Introduction to specialized agricultural appraisal scoring model ranked 6th with RII of 16.513. The recorded mean is 3.125 and the standard deviation around the mean is 0.857. The standard error recorded is 0.208.

Better still, the study analysed the challenges faced by banks in managing agricultural credit risks. The summary of statistics on these challenges are depicted in Table 4.38.

Table 4. 38: Current Challenges with Agric Credit Risk Management Strategies

Challenges	Sum	Mean	Std Dev	Std Error	Rii	Rank
High Default Rates	17	0.739	0.439	0.092	38.739	1
Limited expertise in agricultural credit risk	17	0.739	0.439	0.092	30.304	2
Insufficient Collateral Option	15	0.652	0.476	0.099	30	3
Lack of reliable data	17	0.739	0.439	0.092	0.046	4
Inadequate risk assessment	19	0.826	0.379	0.079	0.034	5

Source: Survey Data, 2023

The table above depicts the summary of statistics of the current challenges of agricultural credit risk management strategies. High default rates rank first with RII 38.739. The mean recorded is 0.739 and the standard deviation around the mean is 0.439. The recorded standard error is 0.092. Limited expertise in agricultural credit risk ranks second with RII of 30.304. The mean value recorded is 0.739 and the standard deviation is 0.739. Inadequate risk assessment rank last with RII of 0.039. The mean value is 0.826 and the standard deviation around the mean is 0.379. The recorded standard error is 0.080. The findings on the challenges of agricultural credit risk management strategies were also shared by Nyebar et al. (2023) in the study on agricultural credit risk management strategies in Ghanaian commercial banks.

4.5.3 McNemar's Test for Comparative Analysis

Credit risk management is an important and also critical function in banking, especially in sectors with high volatility and risk, such as agricultural finance. The recapitalization of banks does influence their risk appetite, lending policies and practices as well as credit risk management strategies. Table 4.39 presents a comparative analysis of credit risk management strategies used before and after recapitalization using the McNemar's test statistics and further stresses significant shifts in approach by banks. The findings are interpreted using relevant financial theories to provide a strong analytical framework.

Table 4. 39: Comparative Analysis of Credit Risk Management Strategies before and after the Recapitalization

Credit Risk Management Strategy	Used Before	Used After	Direction of Movement	McNemar's Test Statistic (χ^2)	p-value
Collateral Based Lending	21	13	Dropped (Declined)	8	0.0047
Risk Assessment	19	12	Dropped (Declined)	7	0.0082
Loan to Value	16	12	Dropped (Declined)	4	0.0455
Credit Scoring	15	4	Dropped (Significant Decline)	11	0.0009
Seasonal Repayment	15	11	Dropped (Declined)	4	0.0455
Credit Insurance	13	8	Dropped (Declined)	5	0.0253
Stock Hypothecation	4	1	Dropped (Minimal Decline)	3	0.0833
Strengthened Monitoring and Evaluation	0	12	Newly Adopted	-	-
Improved Collateral Options	0	13	Newly Adopted	-	-
Enhanced Risk Assessment Tools	0	12	Newly Adopted	-	-
Increased Training	0	11	Newly Adopted	-	-
Specialized Agric Credit Scoring Model	0	4	Newly Adopted	-	-

Source: Author's analysis from secondary data (2023)

From Table 4.39, several conventional credit risk management strategies, such as collateral based lending, risk assessment, loan-to-value approaches, credit scoring, seasonal repayment, and credit insurance, have experienced significant declines post-recapitalization. The decline in these strategies aligns and supports financial intermediation and credit rationing theories. The financial intermediation theory posits that banks serve as intermediaries between borrowers and depositors, thereby managing risks efficiently. The observed decline in collateral based lending and loan-to-value approaches after the recapitalization suggests that banks may be shifting away from collateral dependent lending toward more cash flow based lending models that has a focus on business viability rather than asset-backed security.

Better still, the credit rationing theory argues that banks may limit credit access particularly when dealing with asymmetric information and high default risks. The reduction in credit scoring and risk assessment for instance, which both declined significantly, with $\chi^2 = 11$ and $p = 0.0009$ for credit scoring suggests that recapitalized banks may be focusing on alternative risk evaluation techniques rather than traditional credit scoring models. This is further supported by the adoption of enhanced risk assessment tools.

From Table 4.39, it is evident that instead of relying on traditional methods, banks have now adopted strengthened monitoring and evaluation, improved collateral options, and enhanced risk assessment tools. This phenomenal shift in agricultural credit risk management strategies can be explained through the risk-based lending theory which suggests that modern banks prioritize quantitative and qualitative credit risk assessment frameworks rather than static collateral-based methods. The introduction of enhanced risk assessment tools, which have been adopted by 12 banks after the recapitalization aligns with the Basel III principle on stress testing and dynamic credit risk evaluation. Therefore, the increase in monitoring and evaluation practices as has been adopted by 12 banks demonstrates that banks now focus on proactive risk identification and mitigation strategies rather than waiting for defaults to occur. This new transition diminishes the reliance on collateral and static risk assessment as banks seek evolving and dynamic approaches to assessing obligors' behavior and financial health over time.

Also, from Table 4.39, there is an evident adoption of specialized agricultural credit scoring models and increased training after the recapitalization, which emphasizes a sector-specific approach to agricultural lending. These dynamic shifts in agricultural credit risk management strategies align with the institutional theory which posits that financial institutions evolve in response to sectoral dynamics, regulatory frameworks, and industry best practices. The introduction of specialized agricultural credit scoring models, which is adopted by 4 banks suggests an attempt to customize and tailor lending methodologies for the agricultural sector, rather than applying generic credit scoring models.

The findings on the dynamic adoption of increased training of credit officers after the recapitalization aligns with the human capital theory which opines that investment in knowledge and training improves organizational efficiency. The adoption of increased training by 11 banks supports the notion that banks recognize the need for specialized skills in assessing and managing risks in agricultural finance.

Table 4.41 depicts a comparative analysis of credit risk management challenges faced by banks before and after recapitalization and also sheds light on the significant shifts in the nature of challenges encountered.

Table 4. 40: Comparative Analysis of Challenges

Credit Risk Management Challenge	Faced Before	Faced After	Direction of Movement	McNemar's Test Statistic (χ^2)	p-value
Lack of accurate data on agricultural sector	15	17	Increased	2	0.1573
Others	11	-	Discontinued	-	-
Inadequate credit scoring models	14	-	Discontinued	-	-
Ineffective monitoring and evaluation	17	-	Discontinued	-	-
Limited knowledge in agricultural credit risk	11	17	Increased	3	0.0833
Insufficient risk assessment tools	10	19	Increased Significantly	6	0.0143
High Default Rates	-	17	Newly Emerged	-	-
Insufficient Collateral Option	-	15	Newly Emerged	-	-
Lack of reliable data	-	17	Newly Emerged	-	-
Inadequate risk assessment	-	19	Newly Emerged	-	-

Source: Author's analysis from primary data (2023)

Table 4.40 presents a comparative analysis of the credit risk management challenges faced by banks before and after the recapitalization. From Table 4.40, the lack of accurate data on the agricultural sector as an agricultural credit risk management challenge increased from 15 to 17 banks post-recapitalization, while lack of reliable data newly emerged as a challenge faced by 17 banks**.** These findings align with the information asymmetry theory and the theory of adverse selection, which argue and opine that incomplete or inaccurate borrower information leads to inefficient credit allocation and increased risk exposure**.** This persistent and aggravating data challenges indicate that banks still struggle with collecting reliable financial and production data from farmers and agricultural businesses which makes risk assessment difficult.

Furthermore, inadequate credit scoring models and ineffective monitoring and evaluation were challenges previously faced by 14 and 17 banks, respectively, but were diminished post-recapitalization. This therefore suggests a shift away from traditional credit scoring techniques and post-loan monitoring, likely due to the adoption of enhanced risk assessment tools and alternative credit evaluation techniques. These changes align with the risk-based lending theory which emphasizes dynamic credit evaluation over static scoring models.

Again, from Table 4.40, limited knowledge in agricultural credit risk increased from 11 to 17 banks, while insufficient risk assessment tools witnessed significant increases ($\chi^2 = 6$, $p = 0.0143$). This challenge of limited knowledge in agricultural credit risk emphasizes a human capital and institutional capacity gap, which aligns with the human capital theory which argues that a lack of specialized knowledge reduces efficiency in decision-making.

From Table 4.40, newly emerged agricultural credit risk management challenge includes high default rates which is faced by 17 banks post-recapitalization have newly emerged as a critical challenge. Also newly emerged is insufficient collateral options which is faced by 15 banks suggesting that borrowers increasingly lack tangible security, making lending riskier. These newly emerged challenges align with the credit rationing theory, which suggests that when banks perceive higher risk, they may ration credit or charge higher interest rates, which potentially leads to financial exclusion for smallholder farmers.

4.5.4 Agricultural Credit Appraisal Process and Credit Appraisal Scores

This section analyzes data obtained on the final objective which is to analyze the agricultural credit appraisal process and determinants of credit appraisal scores. Responses received on the availability of specific credit appraisal process for agricultural loans in all the banks have been illustrated in Figure 4.2.

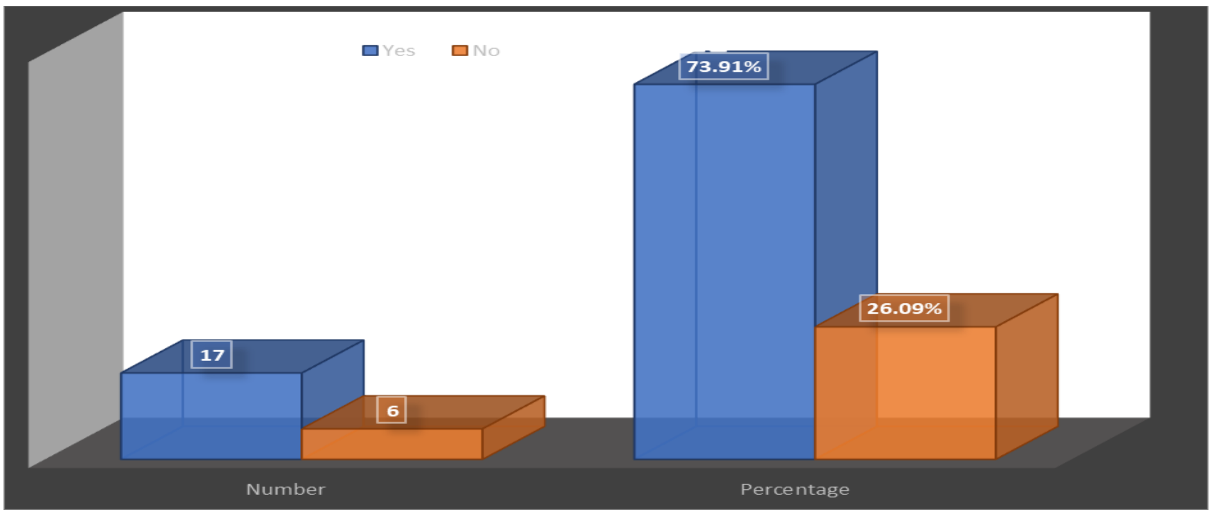

Figure 4. 2: Application of agricultural credit appraisal process for banks

Source: Survey Data, 2023

Figure 4.2 depicts responses received on the availability of credit appraisal process for agricultural loans by all the banks in Ghana for agricultural loans. From the figure, 6 out of the 23 banks, representing 26.09% do not have specific credit appraisal process for agricultural loans. 17 banks, representing 73.91% have credit appraisal process for agricultural loans. Data was also taken on the overview of the credit appraisal process from the 17 banks that have specialized agricultural appraisal procedures.

Table 4.41 depicts the summary of statistics on the survey results of agricultural credit appraisal process of the 17 banks which have specialized agricultural loan appraisal procedures.

Table 4. 41: Agricultural Credit Appraisal Process

Agricultural Credit Appraisal Process	Sum	Mean	Std Deviation	Std Error	Rii	Rank
Evaluation of the obligor's credit history and repayment capacity	13	0.765	0.424	0.103	0.785	10th
Assessment of the obligor's collateral or guarantees provided	12	0.706	0.456	0.111	0.785	10th
Analysis of the financial statements and income generation capacity of obligor	14	0.824	0.381	0.092	0.93	2nd
Review of market/demand prospects for agricultural products	14	0.824	0.381	0.092	0.93	2nd
Consideration of the technical competence and expertise of obligor	13	0.765	0.424	0.103	0.858	7th
Assessment of environmental and social impact of specific agric activities	12	0.706	0.456	0.111	0.786	8th
Evaluation of obligor's business plan and feasibility study	15	0.882	0.322	0.078	1	1st
Examination of obligor's existing relationships and partnerships within the agricultural sector	12	0.706	0.456	0.111	0.786	8th
Assessment of obligor's compliance with regulatory requirements and policies	14	0.824	0.381	0.092	0.93	2nd
Evaluation of obligor's risk management and mitigation strategies	14	0.824	0.381	0.092	0.93	2nd
Analysis of obligor's production capacity and infrastructure	14	0.824	0.381	0.092	0.93	2nd
Consideration of obligor's repayment track record with the bank	11	0.647	0.478	0.116	0.714	12th
Review of obligor's market reputation and industry experience	11	0.647	0.478	0.116	0.714	12th
Others	1	0.059	0.235	0.057	0	14th

Source: Survey Data, 2023

Table 4.41 depicts the descriptive statistics of the data on agricultural credit appraisal processes from the banks. From the table above, credit appraisal processes as analysis of financial statements, review of demand of obligor's agricultural products, assessment of obligor's compliance with regulatory requirements, analysis of obligor's risk management strategies and analysis of obligor's production capacity recorded the highest observation or count of 14, among the banks. These appraisal processes or variables also recorded the same RIIs of 0.929 as shown in the table above, demonstrating their relative importance in the credit appraisal process for all the banks. Their mean values, which are the same is 0.381 and their standard deviations around their mean values are also 0.092. As far as agricultural credit is concerned, a key appraisal process is the evaluation of obligor's business plan and feasibility study, as demonstrated in Table 36, where it ranked first with RII of 1. It also recorded the highest magnitude of observations or counts of 15, among the banks. Both appraisal processes as consideration of obligor's track record with the bank and review of obligor's reputation in the market ranked 12th with a count of 11. The recorded mean value for both variables is 0.478 and the standard deviation around the mean is 0.116. The findings above on the agricultural credit appraisal process were shared by Bogatsu (2019) and Helen (2023).

The study also captured challenges faced by banks in their appraisal of agricultural loan requests. Table 4.42 depicts the results and descriptive statistics of the survey on the challenges faced by banks in their appraisal of agricultural credit.

Table 4. 42: Challenges of Agricultural Credit Appraisal

Challenges	Sum	Mean	Std Deviation	Std Error	Kurtosis
Evaluation of obligor's credit history	8	0.348	0.476	0.099	-1.687
Assessment of obligor's collateral	11	0.478	0.5	0.104	-2.19
Analysis of obligor's financial statement	10	0.435	0.496	0.103	-2.113
Review of demand for obligor's agricultural products	14	0.609	0.488	0.102	-1.951
Consideration of obligor's technical competence	14	0.609	0.488	0.102	-1.951
Environmental and social impact assessment of agric activities	13	0.565	0.496	0.103	-2.113
Evaluation of obligor's business plan	8	0.348	0.476	0.099	-1.687
Examination of obligor's relationship within the sector	8	0.348	0.476	0.099	-1.687
Assessment of obligor's compliance with regulatory requirements	11	0.478	0.5	0.104	-2.19
Evaluation of obligor's risk management strategies	8	0.348	0.476	0.099	-1.687
Analysis of obligor's production capacity	11	0.478	0.5	0.104	-2.19
Consideration of obligor's repayment track record	8	0.348	0.476	0.099	-1.687
Review of obligor's market reputation	6	0.261	0.439	0.092	-0.709

Source: Survey Data, 2023

Table 4.42 depicts the challenges faced by banks in the appraisal of agricultural credit. From the table, review of the demand of obligors' agricultural products and consideration of obligors' technical competence recorded the highest counts (SUM) of 14. Their mean values recorded is 0.609 and the standard deviation around the mean values is 0.488. The recorded standard error is 0.102. The recorded kurtosis of -1.951 is an indication of the fact that the distribution has flatter tail and is therefore platykurtic. From the table, review of obligors' market reputation, as a challenge in the appraisal of agricultural credit, recorded the least count of 6 among the 23 banks. The mean value recorded is 0.261 and the standard deviation around the mean is 0.439. The kurtosis of -0.709 indicates that the distribution has a flat tail compared to a normal distribution. The tail of this distribution is shorter with a flat peak which makes it platykurtic.

4.5.5 Cluster Analysis Technique

Agricultural credit appraisal is an important aspect of financial decision making in the banking sector, particularly in economies where agricultural finance plays a pivotal role in economic development. Given the extreme inherent risks and uncertainties in agricultural credit, banks do employ systematic appraisal techniques to mitigate risks and enhance loan repayment probabilities. This study employs the cluster analysis technique to identify distinct groupings in the agricultural credit appraisal process, by utilizing XLSTAT for segmentation. This analysis supports and aligns with key economic and financial theories that explain credit allocation, risk mitigation, and institutional influences on lending practices.

From Table 4.43, Cluster 1 includes factors such as collateral assessment, environmental impact, industry experience, and repayment behavior. These factors reflect qualitative considerations and outcomes in loan appraisal.

Again, Cluster 2 encompasses financial statements, market demand, business feasibility, regulatory compliance, risk management, and production capacity. This cluster represents or explains the quantitative assessment of obligors, which align with and support the financial stability and operational capacity of applicants or obligors.

Also, Cluster 3 consists only of the “Others” category, suggesting an unclassified or residual grouping that does not, in no way, align with the two primary clusters.

Cluster analysis was conducted on various appraisal factors using XLSTAT, and the results are presented in Table 4.43.

Table 4. 43: Cluster Analysis

Observation	Cluster	Distance to Centroid	Correlation with Centroid	Silhouette Score
Assessment of the obligor's collateral or guarantees provided	1	0.015	1	0.735
Analysis of the financial statements and income generation capacity of obligor	2	0.018	1	0.899
Review of market/demand prospects for agricultural products	2	0.018	1	0.899
Consideration of the technical competence and expertise of obligor	1	0.114	0.994	-0.116
Assessment of environmental and social impact of specific agric activities	1	0.016	1	0.735
Evaluation of obligor's business plan and feasibility study	2	0.091	0.998	0.663
Examination of obligor's existing relationships and partnerships within the agricultural sector	1	0.016	1	0.735
Assessment of obligor's compliance with regulatory requirements and policies	2	0.018	1	0.899
Evaluation of obligor's risk management and mitigation strategies	2	0.018	1	0.899
Analysis of obligor's production capacity and infrastructure	2	0.018	1	0.899
Consideration of obligor's repayment track record with the bank	1	0.08	0.996	0.694
Review of obligor's market reputation and industry experience	1	0.08	0.996	0.694
Others	3	0	1	0

Source: Author’s analysis from primary data (2023)

The cluster analysis results include four key indicators that explain how the variables relate to the identified clusters:

I. Cluster Assignment- Identifies the group to which each factor belongs.

II. Distance to Centroid- Measures how close each observation is to the centre (centroid) of its assigned cluster. A lower distance indicates that the observation is a strong representative of the cluster.

III. Correlation with Centroid- Reflects how strongly the observation aligns with the cluster’s characteristics. A correlation of 1.00 suggests a perfect and strong alignment.

IV. Silhouette Score- Measures the cohesion and separation of clusters. Higher silhouette scores (which are closer to 1) indicate that observations fit well within their assigned clusters, while lower or negative scores suggest some level of misclassification or overlap between clusters.

4.5.5.1 Cluster 1: *Risk-Based Collateral and Creditworthiness Evaluation*

Cluster 1, which is captioned Creditworthiness and Collateral Assessment, signals a strong focus on traditional credit risk assessment criteria. This cluster includes the assessment of obligor's collateral or guarantees, their repayment track record, market reputation, and existing industry relationships. The high correlations with the cluster centroid for these variables, which range from 0.994 to 1.000, indicate a strong alignment with the cluster's characteristics. These findings suggest that banks generally rely heavily on tangible security (collateral) and demonstrated credit history (repayment track record) when evaluating and appraising loan applications.

From Table 4.43, assessment of the obligor's collateral or guarantees provided recorded a distance of 0.015, a correlation of 1.000, and Silhouette Score of 0.735. Consideration of the technical competence and expertise of obligor recorded a distance of 0.114, a correlation of 0.994 and a silhouette score of -0.116. Also, assessment of environmental and social impact recorded a distance of 0.016 a correlation of 1.000 and a silhouette score of 0.735. Furthermore, the examination of existing relationships and partnerships within the agricultural sector recorded a distance of 0.016, a correlation of 1.000 and a silhouette score of 0.735. From Table 4.44 consideration of obligor’s repayment track record with the bank recorded a distance of 0.080, a correlation of 0.996 and a silhouette score of 0.694.

Finally under Cluster 1, review of obligor's market reputation and industry experience recorded a distance of 0.080, and a correlation of 0.996, as well as a silhouette score of 0.694.

The findings under Cluster 1 aligns with the information asymmetry theory. This is because lenders or banks operate under conditions of information asymmetry, where borrowers or obligors have more knowledge about their financial and operational health than banks do. To mitigate this and diminish any adverse effects thereof, banks rely on collateral, repayment history, and industry experience as proxies for borrower reliability. The high correlation scores of 1.000 for collateral assessment and partnerships confirm that these factors are central to bank risk assessment.

Again, the findings under Cluster 1 also align with the credit rationing theory. This is explained by the fact that banks use collateral and repayment history to ration credit, ensuring loans are extended only to obligors with a track record of meeting financial obligations. The high silhouette scores for collateral of 0.735 and repayment track record of 0.694 suggest that these are strong and well-defined variables within the risk assessment framework.

From Table 4.43, the findings under Cluster 1 also align with the transaction cost economics. This is attributed to the fact that lenders prefer borrowers with existing industry relationships as attested to by the silhouette score of 0.735, as they reduce monitoring costs and improve enforcement mechanisms.

Finally, the negative silhouette score of -0.116 for technical competence suggests some level of overlap between risk-based creditworthiness assessment under Cluster 1 and financial viability evaluation under Cluster 2. This finding aligns with real world banking practices where technical expertise is not assessed in isolation, but rather in conjunction with an obligor's overall financial health. While the clustering model employed in this study places this factor within Cluster 1, its weak cohesion within this category implies that banks do weigh it differently depending on the obligor's financial strength and business viability.

4.5.5.2 Cluster 2: Financial and Business Viability Evaluation

From Table 4.43, analysis of financial statements and income generation capacity recorded a distance of 0.018, a correlation of 1.000 and a silhouette score of 0.899. Review of market/demand prospects for agricultural products recorded a distance of 0.018, a correlation of 1.000 and a silhouette score of 0.899. Further to this, evaluation of business plan and feasibility study recorded a distance of distance of 0.091, a correlation of 0.998, and a silhouette score of 0.663**.** Again, from Table 4.43 assessment of compliance with regulatory requirements and policies recorded a distance of 0.018, a correlation of 1.000, and silhouette score of 0.899. Evaluation of risk management and mitigation strategies recorded a distance of 0.018, a correlation of 1.000, and a silhouette score of 0.899. Finally, analysis of production capacity and infrastructure recorded a distance of 0.018, a correlation of 1.000, and silhouette score of 0.899.

The findings in Cluster 2 (financial and business viability evaluation) align with the pecking order theory where banks prefer borrowers and obligors with strong financial statements and income generation capacity as they have lower default risks. Thus, the high silhouette scores of 0.899 for financial statements and market demand assessment confirm that these are important and critical considerations in lending decisions.

Again, the findings in Cluster 2 also align with the **i**nstitutional theory. From Table 4.43, regulatory compliance appears in this cluster recorded a silhouette score of 0.899 which supports the notion that lending institutions do align their decisions with legal and regulatory frameworks. The findings in Cluster 2 also align with resource-based view theory. With the inclusion of production capacity and infrastructure which recorded a silhouette score of 0.899, it suggests that banks consider borrowers' internal resources as indicators of their ability to generate returns.

4.5.5.3 Cluster 3: Miscellaneous Factor (Others)

Cluster 3 represents factors that do not fit into the primary dimensions of credit appraisal. The silhouette score of 0.000 and the distance to centroid score of 0.000 suggest that these elements do not contribute significantly to the structured appraisal process. Cluster 3 also represents factors that do not fit into the primary dimensions of credit appraisal identified in this study. Once again, the silhouette score of 0.000 and distance to centroid of 0.000 indicate that these factors lack cohesion with either of the two main clusters in the preceding sessions and do not significantly contribute to the structured appraisal process. This suggests that elements categorized under Cluster 3 are either miscellaneous considerations that are not central to credit decision-making or are outliers that may require alternative assessment techniques. Finally, the silhouette score of 0.000 implies that these factors are equally distant from all identified clusters which make their classification ambiguous. Similarly, a distance to centroid of 0.000 means that they are either standalone or do not exhibit strong similarities with other appraisal dimensions that are regular with all banks. Therefore, in practical banking applications, these factors include qualitative judgments, discretionary considerations or external socio-economic influences that are not quantifiable within the structured credit appraisal framework of banks.

The institutional theory provides a robust theoretical framework for Cluster 3. This theory posits that organizational decisions, which includes credit appraisal, are shaped not only by rational financial metrics but also by social norms, regulatory frameworks, and institutional pressures, amongst others. As banks do not operate in a vacuum or in isolation, their lending practices are influenced by external institutional forces, including government policies, industry regulations, and informal banking norms. Therefore, the 'Others' category in Cluster 3 may reflect institutional influences that are difficult to quantify but nonetheless do impact credit appraisal decisions. For instance, banks may consider factors such as government directives on agricultural lending, political stability, or unwritten industry practices or conventions when appraising agricultural credit. Such considerations, as listed in the preceding lines do not fit neatly into financial or risk-based clusters but remain relevant in real-world banking decisions. The low silhouette score of 0.000 and distance to centroid score of 0.000 further reinforce the notion that such factors are contextual and varies across institutions and policy environments rather than following a standard, quantifiable pattern.

Finally, the findings of Cluster 3 align with the credit rationing theory. This theory explains why banks may limit lending despite strong demand, notably because of information asymmetry and risk considerations. The presence of Cluster 3 therefore, suggests that certain appraisal factors may not contribute meaningfully to lending decisions, supporting the notion that banks often make lending choices based on risk-adjusted returns rather than an exhaustive evaluation of all possible factors. A case in point is where, a borrower's market reputation or past regulatory compliance may appear in Cluster 1 or 2, but other softer, non-quantifiable considerations that includes political affiliations, informal network ties, or subjective risk perceptions may cause it to fall into Cluster 3. Thus, the 0.000 silhouette score implies that these factors do not strongly align with or support any primary dimension but can still influence discretionary decision making in cases where traditional credit risk models do not provide clear-cut or precise answers. This further aligns with credit rationing theory argument that banks often ration credit instead of raising interest rates, implying that some factors in Cluster 3 may act as informal exclusion criteria that prevent certain borrowers from accessing agricultural financing or credit despite meeting standard appraisal requirements.

4.5.6 Determinants of Agricultural Credit Appraisal Scores

Further data was collected on the credit appraisal scores related to agricultural facilities. Table 4.44 illustrates the descriptive statistics of the determinants of agricultural credit appraisal scores employed by banks. The statistics show the mean, standard deviation, and standard errors.

Table 4. 44: Determinants of Agricultural Credit Appraisal Scores

Determinants of Agricultural Credit Appraisal Scores	Sum	Mean	Std Deviation	Std Error	Kurtosis
Debt-Service Ratio	17	0.739	0.439	0.092	-0.709
Collateral Value	21	0.913	0.282	0.059	8.605
Technology usage	15	0.652	0.476	0.099	-1.687
Operation Efficiency	10	0.435	0.496	0.103	-2.113
Marketing strategy	11	0.478	0.5	0.104	-2.19
Compliance with environmental regulations	18	0.783	0.412	0.086	0.161
Adaptation and mitigation strategies	12	0.522	0.5	0.104	-2.19
Patronage of extension services	13	0.565	0.496	0.103	-2.113
Farm management, expertise and education	21	0.913	0.282	0.059	8.605
Historical Financial Performance	15	0.652	0.476	0.099	-1.687
Seasonality	15	0.652	0.476	0.099	-1.687
Age of applicant	15	0.652	0.476	0.099	-1.687
Others	14	0.609	0.488	0.102	-1.951

Source: Survey Data, 2023

In Table 4.44, collateral value and farm management expertise recorded the highest sums or counts of 21 among the banks. Their mean values, standard deviation, standard errors, and kurtosis recorded are 0.913, 0.282, 0.059 and 8.605, respectively. The high positive kurtosis for both determinants shows that the distribution has a heavy tail and sharp peak. The distribution is therefore leptokurtic. Compliance with environmental regulations ranked third with a count of 18 among banks. Its mean value recorded is 0.783 and the standard deviation around the mean is 0.412. With a kurtosis of 0.161, it implies that the distribution is close to zero and hence normal. Two perceived important determinants of agricultural credit appraisal scores, historical financial performance and seasonality recorded 15 counts among the banks in Ghana. The recorded mean value is 0.652 for both determinants and the standard deviation around the mean is 0.476. The standard error recorded is 0.099. The negative kurtosis of -1.687 indicates that the distributions have a flatter peak and lighter tail. The distribution, therefore, is platykurtic. Operational efficiency recorded the least number of counts of 10 among the banks. Its mean value recorded is 0.435 and the standard deviation around the mean value is 0.496. Its kurtosis of -2.113 is less concentrated around the mean implying a distribution with a shorter tail and flatter peak.

4.5.6.1 Principal Component Analysis

Principal Component Analysis (PCA) was employed to extract the most significant determinants of credit appraisal scores that explain creditworthiness by aggregating numerous financial and operational indicators into fewer components. Table 4.45 depicts the results of the PCA.

Table 4. 45: Results of PCA

Component	Eigenvalue	Variance Explained (%)	Cumulative Variance (%)
F1	4.743	94.87	94.87
F2	0.251	5.01	99.88
F3	0.006	0.12	99.99
F4	0	0.001	100
F5	0	0	100

Source: Author’s analysis from primary data (2023)

From Table 4.45, the first component (F1) captures 94.87% of the total variance, indicating that most of the variation in credit appraisal scores is driven by this factor. The highest correlations are observed with collateral value (0.989), financial performance (0.989), and debt-service ratio (-0.962). The second component (F2) also contributes an additional 5.01%, capturing marketing strategy, operational efficiency, and compliance factors. The third component (F3) adds minimal variance (0.12%) and primarily reflects borrower-specific characteristics like age and extension service patronage. The fourth component (F4) contributes 0.001% of the total variance which indicates an extremely marginal influence on credit appraisal scores. However, its correlation structure suggests, albeit primarily that it captures seasonality effects and farm-level adaptation and mitigation strategies. This implies that while these factors do not significantly drive overall creditworthiness, they may still play a minor role in some specific contexts such as seasonal credit needs and resilience against climate related financial shocks.

Finally, the fifth component (F5) accounts for 0.00% of the variance, and this signifies an almost negligible contribution to explaining credit appraisal scores. The factor loadings suggest that it captures residual noise or other unaccounted minor variations, and this potentially includes idiosyncratic borrower behaviors or administrative inconsistencies in loan assessments. Table 4.46 captures the principal components and their linkages to the determinants of agricultural credit appraisal.

Table 4. 46: Principal Components and Their Linkages to Credit Appraisal Determinants

Principal Component (Factor)	Key Contributing Variables	Percentage Contribution (%)	Aligned Determinants of Agricultural Credit Appraisal Scores	Theoretical Justification
F1: Primary Risk Factor	Debt-Service Ratio, Historical Financial Performance	19.5 - 20.6	Debt-Service Ratio, Historical Financial Performance	Risk-Based Lending Theory, Credit Scoring Theory
F2: Regulatory and Compliance Factor	Compliance with Environmental Regulations, Extension Services, Farm Management Expertise	24.5 - 29.5	Compliance with Regulations, Patronage of Extension Services, Farm Management Expertise	Environmental Risk Theory, Human Capital Theory
F3: Operational Efficiency and Technology Adoption Factor	Technology Usage, Farm Management Practices, Adaptation Strategies	20.9 - 55.7	Technology Usage, Adaptation & Mitigation Strategies, Operational Efficiency	Technology Adoption Model, Climate Finance Theory
F4: Market Resilience and Seasonality Factor	Marketing Strategy, Seasonality, Cash Flow Variability	49.1 - 49.9	Marketing Strategy, Seasonality, Market Stability	Market-Oriented Lending Theory, Agricultural Lending Models
F5: Collateral and Alternative Risk Factor	Collateral Value, Demographic Variables (Age of Applicant)	49.3 - 49.6	Collateral Value, Age of Applicant, Other Demographic Factors	Collateral Theory of Credit, Demographic Credit Models

Source: Author's analysis from primary data (2023)

From Table 4.46, the PCA results reveal that five principal components explain the variance in credit appraisal scores**,** with each aligning with key financial and operational determinants. These are outlined in the preceding units.

From Table 4.46, there is a strong negative correlation (-0.962) between debt-service ratio and F1which indicates that highly leveraged borrowers are deemed riskier by lenders.

Borrowers with poor historical financial performance score lower on credit appraisals which reinforces the credit scoring theory, which also prioritizes past repayment behaviour as a key predictor of default risk.

From Table 4.46, there is a significant contribution of F2 (~29%) which explains that lenders consider environmental compliance, farm management expertise, and extension services in their assessments. Compliance reduces regulatory risks, while access to extension services enhances borrower knowledge and risk mitigation strategies which align with the human capital and environmental risk theories**.**

From Table 4.46, variables such as technology adoption and adaptation strategies contribute significantly to F3 (20-55%) which emphasizes that efficient, technology-driven farming improves creditworthiness. This finding aligns with the technology adoption model which suggests that digitization and mechanization reduce operational risks.

Again, marketing strategy and seasonality contribute significantly to F4 (49.1-49.9%) which indicates that farmers with stable market linkages and diversified cash flows score higher on credit appraisals. This finding supports the market oriented-lending theory, which posits that access to structured markets reduces demand-side risks and enhances credit worthiness.

Finally, the high contribution of collateral (49.3 – 49.6%) to F5 confirms its crucial role in credit approvals, as supported by the collateral theory of credit. Borrower age and demographic factors have a moderate influence from Table 4.46 with experienced farmers generally receiving higher credit scores, as lenders perceive them as less risky.

4.5.7 Credit Appraisal by Ghanaian Banks: A Mixed-Method Analysis

Credit appraisal is a crucial aspect of financial intermediation, playing a key role in sound lending decisions. In Ghana, where the agricultural sector significantly contributes to economic development, the effectiveness of credit appraisal practices by banks greatly influences the accessibility and availability of agricultural finance or credit. However, the credit appraisal process is complex, as it requires a combination of quantitative financial assessments and qualitative judgment to evaluate borrower creditworthiness.

This study employs a mixed methods approach to examine how banks in Ghana conduct credit appraisals. By integrating quantitative techniques, such as cluster analysis, with qualitative reports gathered from interviews with banking professionals, this study provides an evaluation of the key factors driving loan approval decisions. The study investigates important credit appraisal criteria including collateral requirements, financial statement analysis, risk mitigation strategies, regulatory compliance, and market conditions, and as well as their relative importance in the lending process.

Given the recent financial sector reforms and the recapitalization of banks in the country, the study assesses whether these policy changes have influenced credit evaluation standards, particularly in the agricultural sector. The study thus combines statistical evidence with qualitative narratives and bridges the gap between theoretical credit assessment models and real-world banking practices.

4.5.7.1 Quantitative Findings: Cluster Analysis

The cluster analysis aimed to categorize the key factors influencing agricultural credit appraisals among banks in Ghana. The appraisal criteria were grouped into distinct clusters based on their impact on loan approval decisions. Four key indicators were used in the clustering process notably, cluster assignment, distance to centroid, correlation with centroid, and silhouette score, which assessed the cohesion and separation of clusters.

Cluster 1 included collateral assessment, repayment track record, industry experience, environmental and social impact, and borrower partnerships in the agricultural sector. The high correlation scores (close to 1.000) for collateral and industry relationships indicate that these factors are central to credit risk assessment. A negative silhouette score for technical competence (-0.116) suggests some overlap with another cluster, implying that banks assess this factor in conjunction with financial viability rather than as a standalone criterion. These findings align with information asymmetry theory, credit rationing theory, and transaction cost economics, demonstrating how banks use collateral and relationships to mitigate risk and reduce monitoring costs.

Cluster 2 included financial statement analysis, business plan evaluation, risk management strategies, and borrowers' production capacity. These variables showed strong correlations with the centroid (close to 1.000), highlighting their significance in assessing the long-term sustainability of agricultural businesses. The high silhouette scores suggest that banks follow a well-defined financial assessment framework to distinguish viable borrowers from high-risk applicants.

Cluster 3 focuses on regulatory compliance, market demand for agricultural products, and macroeconomic factors such as inflation and interest rates. These variables influence banks' strategic lending decisions.

4.5.7.2 Qualitative Methods of Agricultural Credit Appraisal

To complement the quantitative cluster analysis, in-depth interviews were conducted with loan officers and risk analysts to explore the subjective criteria and experiences shaping agricultural credit decisions. The findings revealed five key themes:

- ✓ Risk Mitigation Through Collateral and Track Record

Loan officers emphasized that collateral serves as a psychological commitment mechanism rather than a mere financial safeguard. One respondent reported that; "In agricultural lending, we don't just look at the land title or machinery as collateral. Rather, we assess how committed the farmer is to repayment, which is reflected in their past behaviour with us.

This aligns with the high silhouette scores observed for collateral assessment in the quantitative results.

- ✓ *Challenges in Evaluating Technical Competence*

Many bank officials admitted difficulties in assessing a farmer's technical skills and business knowledge, reinforcing the negative silhouette score (-0.116) observed in the quantitative results. A senior credit analyst remarked; *"Some farmers are highly skilled in production but lack the financial discipline to manage cash flow. This makes it hard for us to separate technical competence from financial viability."*

✓ *The Role of Market Demand in Loan Approval*

Interviewers confirmed that market conditions play a critical role in loan disbursement decisions. A bank officer explained; *"Even if a farmer has strong financials and good collateral, if they are producing crops with declining market demand, the loan committee will likely reject the application."* This finding supports the high correlation scores (1.000) for market demand and financial statement analysis in the quantitative findings.

✓ *Regulatory Compliance as a Growing Priority*

Loan officers indicated that regulatory policies increasingly influence lending decisions, especially following recent banking sector reforms. One respondent stated; *"Since the recapitalization, we have stricter compliance checks. If a borrower fails basic financial transparency tests, we decline their application immediately."* This provides qualitative validation for the high silhouette scores (0.899) for regulatory compliance in the cluster analysis.

✓ *Subjectivity and Institutional Differences in Credit Appraisal*

The qualitative findings suggest that different banks apply different weightings to credit appraisal factors. Some institutions prioritize cash flow analysis, while others rely more on collateral and past relationships. An indigenous bank manager shared; *"Unlike commercial banks, we don't require strict financial statements from our borrowers. Instead, we look at community reputation and existing partnerships."*

4.5.7.3 Integration of Qualitative and Quantitative Findings

The qualitative findings validate and contextualize the quantitative findings in this study. While the cluster analysis statistically groups factors into risk-based lending (Cluster 1) and financial viability (Cluster 2), the qualitative interviews explain why banks rate certain criteria over others.

Collateral and repayment history remain central to risk assessment, and this reinforces the high silhouette scores observed in Cluster 1. Market demand and financial statements are crucial and important decision points, validating their prominence in Cluster 2.

Technical competence is not evaluated in isolation, explaining its low silhouette score in the cluster analysis. Institutional policies create variations in credit appraisal that a purely quantitative model cannot fully capture.

CHAPTER FIVE

SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS

5.1 Introduction

Chapter five of the study presents a summary of the findings of the analysis of the data conducted in the previous chapter. Further to this, chapter five of the study makes policy recommendations and suggestions for additional research into agricultural finance especially, as far as its performance after recapitalization of financial institutions is concerned.

5.2 Summary of Key Findings

The study, broadly, investigated the effects of recapitalization of commercial banks on agricultural finance in Ghana. Decomposing this goal, the study also analyzed the heterogeneous effects of recapitalization on the disbursement of loans in various sectors relative to the agricultural sector in the Ghanaian financial landscape, agricultural credit risk management strategies used before and after the recapitalization of financial institutions in Ghana and agricultural credit appraisal process and credit appraisal scores. Thus, the study had both secondary and primary data components. Some macroeconomic indicators and bank specific variables were employed to achieve the first and second objectives.

To examine the effects of recapitalization of financial institutions on agricultural finance in Ghana, this study employed an Autoregressive Distributed Lag (ARDL) model. Owing to the dynamic nature of financial sector reforms and their impact on credit allocation in Ghana, the ARDL was selected due to its ability to capture both short and long run relationships between recapitalization and agricultural finance, handle variables integrated at different orders, that I(0) and I(1) and then indicate the speed of adjustment of agricultural finance following structural shocks like recapitalization. Some diagnostic tests were employed in order to strengthen the robustness of the results. These tests include stationarity tests, serial correlation tests, heteroskedasticity tests, impulse response functions (IRF) and forecast error variance decomposition (FEVD). From the study, the Bounds Test for Cointegration confirmed a stable long run relationship between agricultural finance, macroeconomic and bank-specific variables. Recapitalization had a positive but weak long-run effect on agricultural finance. Impliedly, while an increase in capitalization improves the resilience of financial institutions, its direct transmission into the expansion of agricultural credit is slow and limited in magnitude. In the short run, recapitalization had an initial positive effect on agricultural finance but this was not sustained over time, which corroborates with previous studies on financial sector reforms in emerging markets. GDP in the agricultural sector exhibited a significant positive effect on agricultural finance and this suggested that sectoral economic growth increased access to credit. Non-performing agricultural loans showed a lagged but weak negative effect which suggested that credit risk impedes agricultural lending but with delayed realization. Also, inflation and interest rates had short-lived negative impacts, and this confirms that monetary tightening and price instability constrains credit allocation to the agricultural sector. The Error Correction Model (ECM) coefficient was negative and statistically significant, and this indicates a moderate speed of adjustment to long run equilibrium following shocks. From the analysis of the Impulse Response Function, a shock to recapitalization led to an initial increase in agricultural finance. However, the effect dissipated over time, and this suggest that recapitalization alone is not sufficient to sustain growth in credit in the agricultural sector without complementary policies. Also, the response of GDP in the agricultural sector to recapitalization was weak and this indicates that structural improvements in the banking sector do not automatically translate into real sector credit expansion. Also, non-performing loans demonstrated a delayed and lagged response to recapitalization, and this implies that credit risks materialize gradually after financial reforms. The FEVD analysis revealed that recapitalization accounts for a small but growing share of variations in agricultural finance over time. This confirms the role of recapitalization as a secondary driver rather than a primary determinant of agricultural credit. It was also revealed that GDP in the agricultural sector as well as NPL in the sector contributed significantly to fluctuations in agricultural finance. This reinforces the importance of macroeconomic stability and credit quality in enhancing agricultural sector financing. The results of the FEVD also indicated that liquidity measures as measured by the ratio of the Core Liquid Assets to Short Term Liabilities and Capital Adequacy Ratio had negligible effects on agricultural finance, implying that measures of financial stability alone do not drive growth in credit to the agricultural sector.

In the analysis of the heterogeneous impacts of recapitalization on loan disbursement across various sectors relative to the agricultural sector, multiple econometric models were analyzed and presented. Thus, random effects models were considered and presented even though it was not chosen as the ultimate method for the analysis, as the fixed effects model with robust standard errors was selected. The rational for this was to present a reference point estimates to enable the identification of trends and relationships within the data. A Breusch-Pagan LM test was conducted which indicated the presence of potential heteroskedasticity, necessitating the choice to examine more robust and sophisticated econometric models. The random effects regression was also analyzed and presented due to its capability of determining variations across sectors, while being able to control for differences between them. Interestingly, the results from the Hausman test suggested that the fixed effects model was more appropriate. From the results of the fixed effects regression with robust standard errors, it was revealed that percentage change in NPLs, inflation and recapitalization had a positive significant relationship with percentage change in lnLD, the dependent variable. Sector specific analysis on loan disbursement relative to the agricultural sector revealed that only the mining sector had an inverse relationship with lnLD, compared to the agricultural sector which is the base sector. Therefore, with a coefficient of -0.139, mining was associated with a decrease of 13.9% in lnLD compared to agriculture. This relationship was statistically significant. The other eight sectors all had a statistically significant positive relationship with lnLD. Impliedly, the other eight sectors, compared to agriculture, all had a higher contribution to loan disbursement. The relationships were statistically significant. Thus, the services, commerce and transportation for example were associated with an increase in lnLD of more than 156.2%, 138.8% and 88.4%, respectively, when compared to the base sector, agriculture.

The study further analyzed the agricultural credit risk management strategies used before and after the recapitalization of banks in the country using primary data collected from 23 banks. From the analysis, it was revealed that the credit risk management strategies used before the recapitalization included collateral-based lending, risk assessment, loan-to-value, credit scoring, seasonal repayment and credit insurance with relative importance indices of 0.429, 0.388, 0.327, 0.306, 0.306 and 0.265, respectively. From the study, it was revealed that the credit risk management strategies adopted by banks after the recapitalization are strengthened monitoring and evaluation, improved collateral options, enhanced risk assessment tools, increased training, introduction of credit insurance and specialized agricultural scoring model. These new credit risk management strategies adopted by banks after the recapitalization had relative importance indices of 6.294, 6.117, 4.882, 3.117, 2.529, 1.942 and 0.5, respectively. The McNemar Test was conducted in this study to examine whether there have been significant changes in agricultural credit risk management strategies following the recapitalization of banks in Ghana. It was revealed from the study that there was a decline in the use of traditional risk management approaches as credit risk management strategies. This is evidenced by the McNemar's test of $\chi^2 = 8$, $p = 0.0047$ for collateral based lending, $\chi^2 = 4$, $p = 0.0455$ for loan-to-value. Credit insurance also declined suggesting a lower reliance on third-party risk sharing mechanism. The findings suggest a strategic shift by banks away from rigid, and collateral based lending towards alternative credit risk management approaches. Following the recapitalization, banks have introduced strengthened monitoring and evaluation, improved collateral options, enhanced risk assessment tools and specialized agricultural credit scoring models. The adoption of these strategies reflects a more data-driven and structured risk management approach (monitoring and regulatory compliance). Finally, the study investigated the agricultural credit appraisal process and the determinants of credit appraisal scores used by banks in Ghana. It was revealed that the credit appraisal process by banks included the evaluation of obligor's credit history and repayment capacity which had a mean of 0.765 and standard deviation around the mean of 0.424, assessment of obligor's collateral which had a mean of 0.706 and standard deviation around the mean of

0.456, analysis of financial statement and income generation capacity of obligor which had a mean of 0.824 and standard deviation around the mean of 0.381 and review of market prospects of agricultural products which had a mean of 0.824 and 0.381. The rest of the appraisal processes included consideration of technical competence and expertise of obligor which had a mean of 0.765 and standard deviation around the mean of 0.424, assessment of environmental and social impact of agricultural activities which had a mean of 0.706 and standard deviation around the mean of 0.456, evaluation of obligor's business plan and feasibility study which had a mean of 0.882 and standard deviation around the mean of 0.322, examination of obligor's existing relationships and partnerships within the agricultural sector which also had a mean of 0.706 and standard deviation around the mean of 0.456. The other agricultural credit appraisal processes as were revealed by the study are assessment of obligor's compliance with regulatory requirements and policies, evaluation of obligor's risk management and mitigation strategies, analysis of obligor's production capacity and infrastructure, consideration of obligor's repayment track record with the bank and review of obligor's market reputation and industry experience. Also, the cluster analysis was performed to categorize banks based on their agricultural credit appraisal methodologies revealed three distinct clusters with varying approaches to credit evaluation. Cluster 1 involved those banks that are collateral-oriented lenders or the risk averse group which constitute 40% of banks. These banks prioritize collateral or guarantees in loan appraisal and focus heavily on obligor reputation and repayment history too. These banks are also more conservative in lending and prefer established agribusinesses. The correlation with centroid of 0.966 to 1.000 confirmed their high consistency in decision making. Cluster 2 involved banks that are financial-statement-based lenders or the balanced lenders who constitute 35% of banks. This group rely on financial statement analysis and income projections in credit appraisal. They also evaluate market/demand prospects, regulatory compliance and business feasibility. Finally, they are also more willing to extend loans to mid-sized agribusinesses with emphasis on financial transparency. Cluster 3 which was categorized as 'Others' are the inclusive and development-oriented leaders, and they make up 25% of banks. This group consider social and environmental impact factors in lending decisions as well as relying on non-traditional credit indicators such as the experience of farmers, business relationship and agronomic competence, as part of the credit appraisal process. Finally, they prioritize development impact over strict financial performance in their credit appraisal process. The cluster analysis therefore reveals that banks in Ghana exhibit diverse methodologies or processes in agricultural credit appraisal.

From the study, the determinants of agricultural credit appraisal scores are debt-service ratio, collateral value, technology usage, operational efficiency, marketing strategy, compliance with environmental regulations, adaptation and mitigation strategies, patronage of extension services, farm management, expertise and education, historical financial performance, seasonality, debt-service ratio, and age of applicant. Principal Component Analysis was conducted to identify the most influential decisions that determines agricultural credit appraisal scores. The Principal Component Analysis confirmed that agricultural credit scoring is multifaceted with banks considering borrower risk, regulatory compliance, operational efficiency, market conditions and collateral strength in their lending decisions.

5.3 Conclusions

Conclusively, it needs to be highlighted that the inverse relationship (significant) between recapitalization and agricultural finance indicates one of a desired goal of achieving a robust financial sector that can support various economic units but also deliberately shy in its lending to the agricultural sector.

Furthermore, recapitalization has had a heterogeneous impact on loan disbursement across sectors relative to the agricultural sector. Holding the agricultural sector as the base sector, the commerce sector, from the study, recorded the most substantial increase in loan disbursement compared to the agricultural sector. Other macroeconomic indicators such as inflation and interest rates also had a positive influence on loan disbursement.

Agricultural credit risk management strategies, as well as credit appraisal scores needs to be periodically reviewed based on the credit appetite for the various sectors. From the study, the determinants of credit appraisal scores are varied and needs to also be reviewed, periodically.

5.4 Policy Recommendations

The following recommendations are suggested to address each of the objectives of this study.

5.4.1 Recommendations for Policy Makers (Bank of Ghana)

It is recommended that the Bank of Ghana should introduce mandatory lending quotas where commercial banks allocate a minimum percentage of their total loan portfolio to the agricultural sector. Again, interest rate incentives should be provided and reduced capital reserve requirements for banks that exceed agricultural lending thresholds. Furthermore, it is recommended for the need to promote the establishment of a Research and Innovation Fund focused on developing customized agricultural financial products aligned with sector-specific risks and demands.

The Bank of Ghana should implement targeted policies that incentivize sectoral rebalancing by ensuring that agriculture receives preferential lending treatment in post-recapitalization environments. Again, the central bank should introduce loan guarantee schemes to de-risk agricultural lending, making it more attractive for commercial banks.

The Bank of Ghana should develop nationally standardized agricultural credit risk frameworks that regulate risk assessment practices across all banks. Also, the central bank should establish regulatory sandboxes that will enable innovation in agricultural risk assessment and also allow banks to test new risk management technologies.

It is recommended that the Bank of Ghana should develop sector-specific credit appraisal guidelines that mandate banks to integrate agriculture-specific risk factors into their evaluation processes. Also, the Bank of Ghana should provide funding and regulatory support for the development of specialized agricultural credit scoring models that account for sectoral risks such as weather patterns and market volatility.

3.11.2 Recommendations for Banks

Banks should develop sector-specific loan products with flexible repayment terms that align with agricultural production cycles. Also, it is recommended that banks should establish dedicated agricultural finance divisions with specialized expertise in managing agricultural risks and opportunities.

It is recommended that banks should incorporate sectoral risk assessment tools that recognize the diverse risk profiles across sectors, ensuring agriculture is fairly evaluated. It is also recommended that banks should adopt balanced portfolio strategies to prevent sectoral biases, particularly in favor of low-risk sectors like commerce and services.

It is recommended that banks invest in machine learning, predictive analytics, and AI-based tools to improve the accuracy of agricultural risk assessments. Banks should also expand collateral options beyond traditional assets to include warehouse receipts, crop insurance, and supply chain financing instruments. There is also the need for banks to implement real-time monitoring systems to track agricultural loan performance, using Key Performance Indicators (KPIs) and portfolio quality dashboards.

It is again recommended that banks should introduce agricultural-specific scoring models incorporating factors like seasonality, crop yield projections, and market demand volatility. There is the need for banks to adopt holistic appraisal methodologies that balance quantitative indicators (financial viability) with qualitative factors (experience of farmers, environmental impact, and market conditions). It is also recommended that banks should form sector-focused appraisal teams with expertise in agricultural value chains to improve decision-making accuracy.

3.11.3 Recommendations for other stakeholders

It is recommended that the Ministry of Food and Agriculture, in collaboration with development partners, should design financial literacy programs for farmers to enhance creditworthiness. The Ministry should also encourage the formation of farmer cooperatives that can access group loans under more favorable terms.

Stakeholders should as the Ministry of Agriculture should promote partnerships between agribusinesses and financial institutions to facilitate supply chain financing models that bridge financing gaps. It is further recommended that the Ministry should strengthen the agro-processing sector, enabling it to act as an anchor client that can influence lending flows to primary agricultural producers.

The Ministry of Agriculture should collaborate with insurance firms to develop affordable agricultural insurance products, reducing the risk exposure for both farmers and lenders. The Ministry of Agricultural should also enhance agricultural extension services that provide farmers with training in best practices, risk management, and financial planning.

The Ministry of Finance should conduct training workshops for farmers and agribusinesses on how to prepare robust business plans that align with lender appraisal criteria. It is recommended that the Ministry should establish data-sharing platforms between banks, agricultural agencies, and farmers to reduce information asymmetries during appraisal.

3.11.4 Recommendations for future research

Future research should conduct longitudinal studies to examine how recapitalization impacts agricultural lending over longer periods. Again, future research should assess the impact of newly developed agricultural financial products on lending performance and credit uptake in the sector.

It is recommended that future research can conduct comparative analyses to explore the differential impacts of recapitalization on various economic sectors, with a focus on the agricultural sector. Furthermore, future research can examine the structural barriers preventing agriculture from benefiting equally from recapitalization-driven credit expansions.

Future research should examine how emerging technologies like block chain and satellite imagery can improve agricultural credit risk assessments. Again, future researches should investigate how perceived risks differ among financial institutions regarding agricultural lending and how these perceptions affect lending decisions.

Future research should evaluate the performance and predictive accuracy of different agricultural credit scoring models in the Ghanaian context. Future research should also investigate the role of non-financial factors such as environmental sustainability and social capital in credit appraisal outcomes for agricultural loans.

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APPENDICES

Appendix 1: Research Questionnaire

This research aims to;

- Investigate and analyse agricultural credit risk management strategies before and after the recapitalization of banks in Ghana.
- To investigate the agricultural credit appraisal process and determinants of credit appraisal scores

Please read each question carefully and select the most appropriate response based on your knowledge or experience. All questions in this questionnaire are close ended, meaning you will be provided with predetermined answer choices. Thank you for your valuable contribution.

A. <u>REFERENCE INFORMATION</u>

A2. Name of Bank ………………………………………………

A3. Bank Branch: ………………………………….

<u>B. SOCIO-DEMOGRAPHIC DATA</u>

1. Sex of respondent – Male { } Female { }
2. Respondent's Age – 20 – 30years [ ] 31 – 40 years [ ] 41 – 50 years [ ] 51 – 60 years [ ]
3. Respondent's level of education – 1st Degree [ ] 1st Degree & Professional Qualification [ ] Master's Degree [ ] Master's Degree and Professional Qualification [ ] Ph.D [ ] Ph.D and Professional Qualification [ ]
4. Work experience in the bank (in years) – 1 – 5years [ ] 6 – 10 years [ ] 11 – 15 years [ ] 16 – 20 years [ ] 21 – 25 years [ ]
5. Experience in banking – 1 – 5 years [ ] 6 – 10 years [ ] 11 – 15 years 16 -20 years [ ] 21 – 25 years [ ] 26 – 30 years [ ] 31 – 35 years [ ]
6. Job position of respondent _____________
7. Level of management of respondent within the bank – Lower Level [ ] Middle Level [ ] Senior Level [ ]
8. Does your position entail managing agricultural credit Yes [ ] No [ ]
9. Did your job role entail managing agricultural credit before the Covid 19 pandemic? Yes [ ] No [ ]
1. Does your job role entail agricultural credit after the Covid-19 pandemic? Yes [ ] No []

C: <u>AGRICULTURAL CREDIT RISK MANAGEMENT STRATEGIES</u>

I. Section : Before the Recapitalization of banks

5. Indicate if your bank provided agricultural credit before the recapitalization? Yes [ ] No [ ]
6. From the list indicated below, select the main challenges of agricultural credit risk management before the recapitalization?
   I. Inadequate risk management assessment tools and techniques
   II. Inadequate credit score grid/ templates for borrowers of agricultural credit

III. Insufficient and inaccurate data on the performance of the agricultural sector
IV. Lack of expertise/ insufficient knowledge on credit risk management for the agricultural sector
V. Ineffective monitoring and evaluation on agricultural sector (credit) portfolios
VI. Others (kindly specify)

7. Did your banks have specific agricultural credit risk management strategies before the recapitalization? Yes [ ] No [ ]
8. If yes, select the agricultural credit risk management strategies employed/used by your bank before the recapitalization (Select all that applies)
    I. Collateral lending
    II. Credit score grid/ models for agricultural sector obligors
    III. Agricultural risk assessment tools
    IV. Loan to value ratio for agricultural sector credit/ facilities
    V. Tailored repayments according to seasonal dynamics
    VI. Insurance (credit) or guarantees for agricultural credit/ facilities
    VII. Others (kindly specify)
9. On a scale of 1 to 5 (1 being the lowest score and 5 the highest score), kindly rate the effectiveness of agricultural credit risk management strategies used by your bank before the recapitalization.

I. Collateral lending
II. Credit score grid/ models for agricultural sector obligors
III. Agricultural risk assessment tools
IV. Loan to value ratio for agricultural sector credit/ facilities
V. Tailored repayments according to seasonal dynamics
VI. Insurance (credit) or guarantees for agricultural credit/ facilities
VII. Others (kindly specify)

Section II – After the Recapitalization of Banks

11. Indicate if your bank has revised and implemented new agricultural credit risk management strategies after the recapitalization of banks. Yes [ ] No [ ]
12. If your answer to the question above is yes, kindly select all the revised/ newly implemented agricultural credit risk management strategies after the recapitalization of banks.
    I. Enhanced agricultural credit risk management assessment tools
    II. Introduction of specialized agricultural scoring grid/templates
    III. Effective monitoring and evaluation of performance of agricultural credit portfolios
    IV. Widened/ improved collateral options for agricultural credit
    V. Insurance (credit) or guarantees for agricultural credit/ facilities
    VI. Introduction of enhanced agricultural credit risk management training programs.
    VII. Others (kindly specify)
13. On a scale of 1 to 5 (1 being the lowest score and 5 being the highest score), rate the effectiveness of the revised agricultural credit risk management strategies employed after the recapitalization of banks.

I. Enhanced agricultural credit risk management assessment tools
II. Introduction of specialized agricultural scoring grid/templates
III. Effective monitoring and evaluation of performance of agricultural credit portfolios
IV. Widened/ improved collateral options for agricultural credit
V. Insurance (credit) or guarantees for agricultural credit/ facilities
VI. Introduction of enhanced agricultural credit risk management training programs.
VII. Others (kindly specify)

Section III- General Assessment

14. What is your view of the impact of the recapitalization of banks on agricultural credit/ facilities' availability and agricultural credit risk management strategies with regards to your bank?
    I. Significant
    II. Moderate
    III. Neutral/ No (significant) impact
    IV. Weakened
    V. Undecided/ Not sure
15. Identify the major challenges faced by your bank in the management of agricultural credit risk management strategies.
    I. High agricultural NPLs/ defaults
    II. Limited options of collateral for agricultural credit
    III. Inadequate/ lack of reliable data
    IV. Insufficient agricultural credit risk assessment and monitoring tools
    V. Lack of experienced staff or limited expertise in agricultural credit risk management.
    VI. Others (kindly specify)

<u>D. THE AGRICULTURAL CREDIT APPRAISAL PROCESS OF BANKS</u>

Section I – The Credit Appraisal Process

1. Kindly indicate if your banks employs specific agricultural credit appraisal process Yes [ ] No [ ]

2. Kindly indicate by listing all that applies, your bank's agricultural credit appraisal process;

I. A process of evaluation of (agricultural sector) obligors' credit history and their ability to repay facilities.
II. An assessment of obligor's collateral/ guarantees offered as security for the facility
III. A detailed analysis of the financial statements of the obligors (including cashflows), and the proved income generation ability of their activities/ ventures
IV. A thorough review of obligors' market dynamics and demand prospects of obligors' products
V. An analysis of the experience and competence of the obligor
VI. An analysis of the environmental and social effects of the activities of the obligor
VII. An analysis of obligor's business plan (including favorable results of feasibility studies conducted)
VIII. An evaluation of obligors' strength of relationship with other farmers, partnerships and membership standing of cooperatives within the agricultural sector

IX. An analysis of obligors' adherence to regulatory practices/requirements
X. An assessment of obligors' risk management profile as well as adaptation and mitigation practices/ strategies with regards to sustainability
XI. An assessment of obligors' production strength and existing infrastructure to support production/ expansion
XII. An assessment of obligors' agricultural credit repayment record/ history in the bank (if any)
XIII. An assessment of obligors' character/ reputation and experience in the industry/sector
XIV. Others (kindly specify)

Section II – The Determinants of Agricultural Credit Appraisal Scoring Grid (Scores)

1. Kindly indicate, from the list below, the factors that are considered by your bank in determining the agricultural credit appraisal process.
    I. An assessment of the credit history (if any) of obligors and their repayment history (if any) and capacity.
    II. Collateral (not encumbered) coverage and guarantees offered by obligors
    III. An analysis of the financial statements of obligors as well as the income generation capacity of their activities/ventures
    IV. An assessment of the demand of obligors' products and a detailed market analysis of obligors' agricultural products
    V. Obligors' expertise and competence (technical/behavioral)
    VI. Social and environmental impact of obligors' agricultural (business) activities
    VII. Presence of skilled and experienced management team
    VIII. Age of obligor
    IX. Seasonality of obligors' activities and products
    X. Educational level of obligor
    XI. Others (kindly specify)
2. On a scale of 1 to 5 (1 being the lowest and 5 being the highest score), kindly rate the significance and importance of each of the listed determinants of the agricultural credit appraisal process.
    I. An assessment of the credit history (if any) of obligors and their repayment history (if any) and capacity__________
    II. Collateral (not encumbered) coverage and guarantees offered by obligors _____________
    III. An analysis of the financial statements of obligors as well as the income generation capacity of their activities/ventures ____________
    IV. An assessment of the demand of obligors' products and a detailed market analysis________________
    V. Obligors' expertise and competence (technical/behavioral) ___________
    VI. Social and environmental impact of obligors' agricultural (business) activities _____________
    VII. Presence of skilled and experienced management team __________________
    VIII. Age of obligor _________________
    IX. Seasonality of obligors' activities and products ______________

X. Educational level of obligor _______________

XI. Others (kindly specify) _____________

Section III – Data Collection and Analysis of Agricultural Credit

1.Indicate if your bank maintains a database of credit appraisal scores of the obligors' agricultural credit? Yes [ ] No [ ]

2. If your answer to the question above is yes, specify the length of period the database on agricultural credit appraisal scores cover. 1 – 5years [ ] 6 – 10 years [ ] 11 – 15 years [ ] 16 - 20 years [ ]

3. Kindly indicate the length of period the database of agricultural credit appraisal scores is updated.

I. Daily basis
II. Weekly basis
III. Monthly basis
IV. Quarterly basis
V. Annual basis

4.If yes, please provide the time period covered by the credit appraisal score database: 1 – 5 [ ] 6 – 10 [ ] 11 – 15 [ ]

1. How often is the credit appraisal score database updated?
   a) Daily
   b) Weekly
   c) Monthly
   d) Quarterly
   e) Annually

Section IV – Challenges and Recommendations of the Agricultural Credit Appraisal Process

1. Indicate by selecting from the list below, the challenges your bank is confronted with in the agricultural credit appraisal process.

I. A process of evaluation of (agricultural sector) obligors' credit history and their ability to repay facilities.
II. An assessment of obligor's collateral/ guarantees offered as security for the facility
III. A detailed analysis of the financial statements of the obligors (including cashflows), and the proved income generation ability of their activities/ ventures
IV. A thorough review of obligors' market dynamics and demand prospects of obligors' products
V. An analysis of the experience and competence of the obligor
VI. An analysis of the environmental and social effects of the activities of the obligor
VII. An analysis of obligor's business plan (including favorable results of feasibility studies conducted)
VIII. An evaluation of obligors' strength of relationship with other farmers, partnerships and membership standing of cooperatives within the agricultural sector
IX. An analysis of obligors' adherence to regulatory practices/requirements
X. An assessment of obligors' risk management profile as well as adaptation and mitigation practices/ strategies with regards to sustainability
XI. An assessment of obligors' production strength and existing infrastructure to support production/ expansion

XII. An assessment of obligors' agricultural credit repayment record/ history in the bank (if any)
XIII. An assessment of obligors' character/ reputation and experience in the industry/sector
XIV. Others (kindly specify)

2. Kindly recommend factors, from the list below that will improve the agricultural credit appraisal process, as well as the determination of agricultural credit appraisal scores of obligors.

I. Improve the availability and access to data on obligors through collaborations with credit reference bureau and other institutions.
II. Employ the use of improved agricultural credit scoring grid/templates
III. Develop training schemes to enhance the capacity of credit analysts on agricultural facilities/credit
IV. Expand the collateral options acceptable for obligors of agricultural credit
V. Encourage and improve collaboration among allied financial institutions on agricultural credit appraisal processes.
VI. Collaborate for the setting up of standards across the financial industry on agricultural credit appraisal.
VII. Employment of technologies for collecting data on obligors, agricultural credit analysis and agricultural credit risk assessment.
VIII. The implementation of periodic and regular monitoring and evaluation of the agricultural credit appraisal process.
IX. Foster collaborations between financial institutions and obligors of agricultural credit to improve understanding on requirements for agricultural credit.
X. Improve strategies to mitigate agricultural credit risk such as insurance schemes
XI. Encourage collaboration with authorities and regulators to ensure adherence to processes and requirements to counter credit risk
XII. Encourage the assessment of environmental and social consequences of activities to boost sustainable agricultural practices.
XIII. Encourage the sharing of obligors' agricultural credit information to credit reference bureaus and other financial institutions, as well as information on agricultural credit appraisal processes.
XIV. Others (kindly specify)

Appendix 2: Summary of Objectives, Methods, Key Findings, Conclusions and Policy Recommendations

Objectives	Methods of Analysis	Key Findings	Conclusions and Implications	Policy Recommendations
1. To assess the effects of recapitalization of financial institutions on agricultural finance in Ghana.	ARDL regression for long-run and short-run relationships; Error Correction Model (ECM) to determine speed of adjustment; Diagnostic tests including stationarity, heteroskedasticity, serial correlation, IRFs, and FEVD.	- Long-run: Recapitalization has a positive but weak effect on agricultural finance. - Short-run: Positive initial effect, but unsustained over time. - Inflation and interest rates have short-lived negative impacts. - GDP in agriculture positively influences agricultural finance. - Non-performing loans (NPLs) have a lagged negative impact.	Recapitalization strengthens bank resilience but does not automatically translate into increased agricultural lending. The agricultural sector remains constrained by risk perceptions and macroeconomic instability. Macroeconomic growth in agriculture drives credit demand.	The Bank of Ghana should introduce targeted incentives to enhance agricultural lending. Policies to improve credit risk frameworks and address macroeconomic instability are essential for sustained agricultural financing.
2. To investigate the heterogeneous effects of recapitalization on sectoral loan disbursement relative to the agricultural sector.	Panel data analysis: Random and fixed effects regressions; Hausman test for model selection; Fixed effects regression with robust standard errors used for final estimation.	- Only the mining sector shows an inverse relationship (-13.9%) with loan disbursement compared to agriculture. - Commerce, services, and transportation sectors receive significantly higher loan disbursements (+156.2%, +138.8%, +88.4% respectively) relative to agriculture.	Recapitalization led to sectoral shifts in loan allocation, favoring lower-risk sectors like commerce and services. Agriculture remains deprioritized due to higher perceived risks.	Sector-specific lending policies should be introduced to rebalance credit distribution, ensuring agriculture receives sufficient credit post-recapitalization. Incentive structures could make agricultural lending more attractive to financial institutions.
3. To evaluate agricultural credit risk management strategies used	McNemar's test for assessing changes in risk management strategies; Descriptive statistics for relative	- Pre-recapitalization strategies: Collateral-based lending, risk assessment, loan-to-value, credit scoring.	Recapitalization triggered strategic shifts from traditional, rigid lending practices to data-driven, structured credit risk	Regulatory frameworks should encourage adoption of advanced credit scoring models for agriculture. Continuous training for

before and after recapitalization.	importance; Thematic and content analysis for qualitative aspects.	- Post-recapitalization strategies: Strengthened monitoring and evaluation, improved collateral options, enhanced risk assessment tools, increased training, specialized agricultural scoring models.	management. Banks adopted more dynamic risk assessment frameworks, improving agricultural credit evaluations.	credit officers in sector-specific risk assessment techniques is recommended.
4. To examine the agricultural credit appraisal process and determinants of credit appraisal scores.	Cluster analysis to group banks by appraisal methodologies; Principal Component Analysis (PCA) to identify key determinants of credit scores.	- Credit appraisal processes included assessment of collateral, financial statements, market prospects, technical expertise, and compliance.	Credit appraisal processes remain heterogeneous, influenced by both institutional risk preferences and borrower characteristics. Operational efficiency, technology adoption, and regulatory compliance emerged as key determinants of agricultural loan approvals.	Standardized agricultural credit appraisal frameworks should be developed to reduce disparities among banks. Incentivizing development-oriented lending could help align commercial banking practices with agricultural sector needs.