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Effects of monetary policy on performance of agricultural firms listed on Nairobi Securities Exchange.

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EFFECTS OF MONETARY POLICY ON PERFORMANCE OF AGRICULTURAL FIRMS LISTED ON NAIROBI SECURITIES EXCHANGE

BY:

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DECLARATION

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the dissertation contains no material previously published or written by another person except where due reference is made in the dissertation itself.

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DEDICATION

This study is dedicated to my parents, spouse and friends who have been inspiring me constantly in my life journey.

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LIST OF ABBREVIATIONS AND ACRONYMS

CBK - Central Bank of Kenya

CBR - Central Bank Rates

CRR - Cash Reserve Ratio

EPS – Earnings Per Share

ER - Exchange Rate

GDP - Gross Domestic Product

KBRR - Kenya Banks' Reference Rate

MDGs - Millennium Development Goals

MP - Moral Persuasion

NACOSTI - National Commission for Science, Technology and Innovation

NSE – Nairobi Securities Exchange

OLS - Ordinary Least Squares

OMO - Open Market Operations

ROA - Return on Assets

ROE - Return on Equity

SMEs – Small and Medium Enterprises

SPSS – Statistical Package for the Social Sciences

TE - Targeted Easing

DEFINITION OF TERMS

Central Bank Rate - the interest rate commercial banks and other financial institutions are charged on loans they receive from the federal government bank.

Monetary Policy – deliberate actions adopted by the Central Bank to ensure the supply of money is in line with price and growth objectives of the government to maintain the economy's price stability.

Open Market Operations - the sale or purchase of government or other eligible securities thereby altering the reserve base of banks and their credit creating capacities, aggregate demand and general level of economic activity.

Performance of firms – is a measure of firm's effectiveness, profitability, return on assets and return on equity, market share, growth and customer satisfaction.

Reserve Requirement - it sets the minimum fraction of customer deposits and notes that each commercial bank must hold as reserves to ensure that it is able to meet liabilities in case of sudden withdrawals.

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ABSTRACT

The general objective of this study was to investigate the effects of monetary policy on the performance of agricultural firms listed in Nairobi Securities Exchange. The study was guided by specific research objectives including examining how the performance of agricultural firms listed at the NSE was affected by the Central Bank rate, change of reserve requirement and open market operations. The study was founded on the monetarist theory and the financial repression theory. An empirical literature review was done and research gaps were identified.

This study adopted explanatory research design that was used to state the relationship that exists between monetary policy and performance of agricultural firms listed on NSE, hence investigating the causal effect among the variables in the study. The dependent variable was performance of agricultural firms listed on NSE, while the Central Bank rate, the change in reserve requirement and open market operations were the independent variables. Exchange rate and climate change were used as control variables. The study used all the agricultural firms listed on the NSE. The study used secondary data from annual reports of the agricultural firms and published reports by the Central Bank. The data collected were analyzed using both descriptive and inferential statistics by the assistance of the Statistical Package for Social Sciences (SPSS). The model indicated that increase in Central Bank rate negatively affected the performance of the agricultural firms, an increase in cash reserve requirement had a negative effect and an increase in the Treasury bills rate had a positive effect. Additionally, an increase in exchange rate had a positive impact on performance of agricultural firms while increased precipitation levels negatively influenced the performance of listed agricultural firms. The study recommended Central Bank to maintain an optimal CBK rate, ensure enough cash flow in the economy and stability in the currency. It also recommended more use of technology in crop production to reduce dependence on rain in agricultural production. The study recommended further research including fiscal policies on both listed and unlisted agricultural firms.

CHAPTER ONE
INTRODUCTION

1.1 Background of the Study

The agricultural sector is largely influenced by both fiscal and monetary policies (Aroriode & Ogunbadejo, 2014). The agricultural sector in Kenya has attracted considerable government policy attention overtime due to its crucial role in economic development. The strong linkages between agriculture and other sectors of the economy have necessitated a robust understanding of the influence of monetary policy outcomes on agriculture. Agricultural sector integration with other sectors both at the domestic and international levels tends to significantly affect costs of farm inputs, product prices, and agricultural income and profitability levels. This is particularly true with respect to monetary variables such as exchange rates, interest rates, and inflation as well as their impacts on the agricultural sector.

1.1.1 Monetary policies

Monetary policy is the deliberate actions and decisions of the Central Bank to influence the economy's credit availability and money supply by altering interest rates to align with government price and growth objectives. The main purpose of monetary policy is ensuring price stability by controlling exchange rate and inflation rate (Central Bank of Kenya, 2017). In other economies, the goals of monetary policy are to stabilize prices, maintain equilibrium of balance of payments, creation of jobs, growth of output and for sustainable development. The monetary policy instruments can be direct such as cumulative credit ceilings, exchange control, deposit ceilings and special deposits whereas the indirect policy instruments include Cash Reserves Ratio, open market operations, liquidity ratio, minimum discount rate and selective credit policies (Okay, 2010). Kenya use different instruments to pursue its monetary policy objectives such as; Open Market Operations (OMO) which involves purchase or sales of government or other eligible securities to control money supply and credit conditions (Nzotta, 1999), Central Bank Rates (CBR) whose change in direction and magnitude signal the monetary policy stance, Standing Facilities, Cash Reserve Ratio (CRR) which is a proportion of commercial mandatory liability deposit, Foreign Exchange Market Operation, Kenya Banks' Reference rate (KBRR), Broad Money Supply (M2) and horizontal repos (Central Bank of Kenya, 2014). The Moral Persuasion (MP) is another instrument that the Central Bank uses as a swaying tool in persuading the commercial banks to adopt certain policy and to operate in a given direction so as to meet the government economic objectives. Therefore, monetary policy becomes a crucial economic variable influencing many sectors of the economy in which agriculture is part (Bonilla, 2019).

The Central Bank rate is the interest rate that commercial banks and other financial institutions are charged on loans they receive from the federal government bank. Discount rate is the interest rate in analyzing discounted cash flows to decide on the present value of future cash flows (Acharya, Eisert, Eufinger & Hirsch, 2019). Most countries with reserve requirements, direct lending of reserves has a role in monetary policy. Countries that do not impose reserve requirement, however, the central banks supplies reserves by directly lending to banks, and is an important tool in regulating the interest rate.

The role of monetary policy in promoting economic growth dates back to the time of Adam Smith and notable monetary economists such as Fishers, Tobin and Friedman. Since then, there has been a growing consensus among monetary economists and policy practitioners that monetary policy matters significantly for growth at least in the short-run. However, the focus of monetary policy researchers has recently shifted from whether or not money matters, to investigating the role of monetary policy in real sector growth. Among several aspects that have received considerable policy attention is the impact of monetary policy shocks on various economic sectors. Evidence has shown varying responses of different economic sectors to monetary shocks (Egbunike & Okerekeoti, 2018).

Changes in monetary policy variables such as interest rate, exchange rate or inflation might significantly impact the prices and incomes of the agricultural economy. One of such is the fluctuation in the value of the local currency relative to other currencies which has considerable implications for agricultural trade. For example, an expansionary monetary policy stance is likely to reduce the value of the local currency which may in turn, stimulate exports and increase aggregate demand for agricultural commodities. Similarly, increase in inflation is likely to heighten prices of both farm inputs and outputs, and, therefore affect investment decisions. Also, changes in monetary policy stance affect the interest rate which in turn influences farmers' decision to borrow credit. Monetary authorities such as the central banks implement monetary policy decisions using various instruments such as credit policy, bank reserve requirement, open market operations and interest rate policy. In particular, adjustment in the policy rate determines the rate that banks charge each other for short-term loans. These changes are reflected in other short-term interest rates which ultimately affect borrowing costs for firms and households (Benazic & Rami, 2016). For example, a fall in policy rate will lead to a corresponding reduction in bank lending rate. This will translate to cheap borrowing cost and in turn encourage agricultural households and firms to increase production. The money market provides a trading intermediary where funds from surplus units are deployed to deficit units. Since agricultural investments such as farming require

funding; farmers, agro-processors and other agricultural sector stakeholders participate actively in the money market (Muroyiwa, Sitima, Sibanda & Mushunje, 2014).

1.1.2 Nairobi Securities Exchange

The Nairobi Securities Exchange (NSE) was established in 1954 as Nairobi Stock Exchange. It evolved and changed name to Nairobi Securities Exchange in the year 2011. NSE is a stock exchange platform which facilitates trading activities for foreign and local investors who want to be exposed to Kenya's rising economy. The Capital Markets Authority of Kenya regulates the NSE. NSE is governed by a board of directors and is listed on its own exchange. It currently has 64 companies listed in 13 different sectors, with a market capitalization of Kenya shillings 1.99 trillion (Nairobi Securities Exchange, 2022). It launched the NSE All-Share Index (NASI) in 2008, which included all listed securities, to give investors a comprehensive performance measure of the market. The base value as of January 2008 was 100. Additionally, the NSE and Financial Times Stock Exchange (FTSE) launched the FTSE Kenya 25 indices to measure the top 25 firms and FTSE NSE Kenya 15 which are benchmarks of performance (Nairobi Securities Exchange, 2022).

1.1.3 Agricultural firms

At the NSE there are seven listed agricultural firms; Limuru Tea, Williamson Tea, Eaagads Limited, Kakuzi, Rea Vipingo Plantations, Kapchorua Tea and Sasini PLC (Nairobi Securities Exchange, 2021). The agricultural firms are crucial links between farmers and markets through processing of crops and selling agricultural products. The firms are regulated by relevant agricultural boards including National Cereals and Produce Board, Kenya Coffee Board and Kenya Sugar Board among others. Agricultural firms listed at the NSE have faced challenges over the past decade due to tough economic times in the country (Kadi, 2019). Investigating whether government regulations and policies have contributed to performance of the listed agricultural firms was of interest for the study.

The Kenyan agricultural sector combines livestock production, fisheries, crop production, and forestry. The Kenyan economy has depended and still depends on agriculture as the mainstay. Agriculture plays a key role in employment and income in rural areas, ensuring food security, poverty alleviation and contributing to international trade (Government of Kenya, 2019). In Kenya, the agricultural sector directly accounts for an estimated 26 percent of the Gross Domestic Product (GDP), and approximately about 27 percent indirectly through other linked sectors, the manufacturing sector, distribution and other sectors. Additionally, the agricultural sector contributes about 65 percent of the total Kenyan exports, 60 percent of total employment and 18 percent of people who are formally employed. The sector largely

contains small scale production of farm ranging about 0.2 hectares and 0.3 hectares, which account for 78 percent agricultural production and 70 percent commercial production (Kenya National Bureau of Statistics, 2019).

In Kenya, the agricultural sector has been crucial for economic growth, with a majority of rural livelihoods being supported by the sector. The policies of the agricultural sector are in the Agricultural Sector Strategy Framework, a revision of the Strategy for Revitalizing Agriculture, are in harmony with the Kenya Vision 2030 (Government of Kenya, 2019). Since the rural areas have majority of the poor populations, the sector is crucial to poverty reduction and food security realization as highlighted in the Millennium Development Goals (MDGs)(Mabiso, Pauw & Benin, 2012). This means that improvement of agricultural sector is important in economic growth and alleviating poverty in developing countries. Despite its contribution to the economy, Kenya agricultural production is averagely two to three times lower than many international economies (Kenya Bankers Association, 2018).

1.2 Statement of the Problem

The government uses monetary policies to regulate different elements of the economy. There is need for government intervention in the agricultural sector as it is an important part of the economy in food supplies. Monetary policies are used to regulate food prices, the cost of living and in regulating overall economic growth. These monetary policies adopted by the government influence the profitability of agricultural firms listed at the Nairobi Securities Exchange (Chesang, 2017). Monetary policies are used to stabilize the Kenyan shilling which has been weakening in the recent years (Meshack & Nyamute, 2016) hence dictating prices of agricultural products for export. Studies have highlighted the effects of monetary policies on performance of firms (Cheng, 2018; Mohammadzadeh, 2018; Kithandi, 2022), however these studies have been for firms in other sectors and not listed agricultural organizations.

Wagan, Zhang, Hakimzadi & Shah (2018) assessed the effects of monetary policy on agricultural growth and food prices in India and Pakistan. The study indicated that strict monetary policies greatly cut the agricultural production and food inflation, while the unemployment rate in rural areas increases. Both countries pursued contractionary monetary policies which increased the short-term interest rates. The study assessed effects of monetary policies on the agricultural growth and food prices and not monetary policies to performance of agricultural firms. Muroyiwa, Sitima, Sibanda & Mushunje (2014) also conducted a study to evaluate the monetary policy actions and agricultural sector outcomes in South Africa. The study indicated that it is important for agricultural sector policy makers as well as governments to carefully consider the relationship between agricultural sector,

macroeconomic environment and stock prices. The study covered the agricultural sector and not specific to listed agricultural firms, which the current research seeks to study.

A study by Ogbanje & Okpe (2022) in Nigeria indicated a bidirectional relationship between the monetary policies and the performance of agricultural sector. A conclusion was made that monetary policy influenced performance of agricultural sector in the short-run. The study used the Granger Causality approach which is different from the multiple regression model used in this study. In Kenya, the impact of monetary policy on performance of agricultural sector has been assessed by Adongo, Otieno, Zeph & Muyima (2020). The study findings indicated that agricultural GDP is positively affected by greater money supply, whereas the exchange rate negatively affects the agricultural sector performance. It concluded that to realize the full potential of the agricultural sector, the government should increase its budgetary allocation which supports agriculture and committing to have monetary policies that stabilizes the exchange rate. This study was about the impact of monetary policy on performance of agricultural sector in general but the current study is specific to agricultural firms listed at the Nairobi Securities Exchange.

A review of previous studies highlights that there are insights explaining monetary policies used by the government and how the monetary policies affect the performance of firms in the economy. The studies on monetary policies on the agricultural firms listed at the Nairobi Securities Exchange, however, are not adequately done to give sufficient knowledge on the effects to the sector. These insights are important to address the correct use of monetary policies in supporting better performance of listed agricultural firms. Previous studies have not specifically addressed how the monetary policies in totality affect how NSE listed agricultural firms perform. To address the inadequacy of existing studies on the agricultural listed firms and hence provide more useful insights, this study assessed the effects of monetary policies on the performance of agricultural firms listed on the Nairobi Securities Exchange.

1.3 Research Objectives

1.3.1 General objective

The objective of this study was to assess the effects of monetary policies on the performance of agricultural firms listed at the Nairobi Securities Exchange.

1.3.2 Specific objectives

i. To examine the effect of Central Bank rate on performance of agricultural firms listed on NSE.
ii. To evaluate the effect of change of reserve requirement on performance of

agricultural firms listed on NSE.

iii. To determine the effect of open market operations on performance of agricultural firms listed on NSE.

1.4 Research Questions

i. Does Central Bank rate affect the performance of agricultural firms listed on NSE?

ii. Does change of reserve requirement affect the performance of agricultural firms listed on NSE?

iii. Does open market operations affect the performance of agricultural firms listed on NSE?

1.5 Significance of the Study

Government

The monetary policies formulated and implemented by the central bank are expected to be better informed due to insights given by this study. Given that the variables being discussed are directly under them, they are expected to control them effectively and efficiently for the development of the economy through the agricultural sector.

Agricultural firms

The firms are directly affected by the monetary policies implemented by the government and need to adjust accordingly to improve their performance. The agricultural firms will use the findings of this study to become better prepared for different monetary policy changes to maintain their performance. The firms can also use the findings to push for monetary policies that will improve their performance.

Scholars

Additional information on the effects of monetary policies on performance of listed agricultural firms will be available to scholars. The study highlighted the research gaps that other scholars in the field can fill up and hence continue contributing to the current large academic knowledge. Other scholars will use the findings in this study as literature review and in building their cases.

1.6 Scope of the Study

This study covered 30 years from 1991 to 2020. The study used secondary data as published in the listed agricultural firms' financial statements and annual reports. Data on Central bank rate, cash reserve requirement and exchange rate were extracted from the Central bank of Kenya annual reports. The data were analyzed using both descriptive and inferential statistics by the use of statistical software (SPSS).

1.7 Chapter Summary

In this chapter, a detailed background of the study was discussed. The statement of the problem highlighted the gap that exist and why this study was done. The general objective of this study was to examine effects of monetary policies on the performance of agricultural firms listed on the NSE. The objectives that guided the study were; to examine the effect of interest rates on performance of agricultural firms listed on NSE, to determine the effect of exchange rates on performance of agricultural firms listed on NSE, to evaluate the effect of inflation rate on performance of agricultural firms listed on NSE. This study will benefit the government, agricultural firms and scholars. The study used secondary data from agricultural firms and central bank's annual reports for the years 1991 to 2020. Chapter two presented the literature review of the study in relation to the research objectives.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

The study had a theoretical review of relevant theories used to back up the study. The empirical review discussed previous studies in accordance to where they were done, the period they were done in and the outcomes. From these studies, the gaps were established which formed the basis of this study.

2.2 Theoretical Literature

This study was founded on the monetarist theory and the financial repression theory.

2.2.1 Monetarist Theory

Friedman (1963) proposed the theory with a view that interest rates are everywhere and always a monetary phenomenon. The theory further assumes that if growth in money supply exceeds real growth rate then interest rates rise. In agreement is a model by Harberger (1963), with the assumption that there is a price adjustment with oversupply of money in the money market. This assumption forms basis for inverting the real demand for money and controlling interest rates. Different disequilibria in different open economies money markets lead to volatility in interest rates, specifically the external markets, domestic markets and labor market. The three main sources that lead to increases in interest rates are foreign prices, cost push factors and excess money supply (Were & Wambua, 2013). The monetarist theory is similar to Keynes liquidity preference theory but adds cost push factors and foreign prices as sources of increase in interest rates.

The theory has been criticized on the basis that governments would less likely implement theoretically optimal policies. The critics argue that the theory assumes that macroeconomic revolution policies are made by wise people who are acting under no political pressures or opportunities, and the guiding economic technocrats are disinterested. The critics argue that this assumption of electoral, bureaucratic and political behavior to be an unrealistic.

In relation to this study, the monetarist theory postulates that a growing money supply above real growth leads to the rise in interest rates. The theory views volatility of interest rates to arise from three main sources, that is, foreign prices, excess money supply and cost push factors. The volatility in interest rates also arises from the disequilibria in different money markets, specifically, foreign markets, domestic money market and the labor market. The Central Bank will therefore address the different disequilibria in the markets to control the interest rate. Interest rates policies influence the cost of borrowing for the agricultural firms and additionally affect the financial performance through the ROA, ROE and EPS.

2.2.2 Financial Repression Theory

This theory was proposed by McKinnon and Shaw (1973). One of the proponents of the theory is the reflection of the need of adequate savings in less-developed countries to finance their investment projects for economic development. This accumulation of savings is impeded by low bank deposit and loan rates and administrative financial repressions. Government liberalization financial policies could be implemented to reverse this effect thereby allowing the deposit rates to be at equilibrium rates in the market. As a result, the inflation rate and real income growth are thereby controlled. Money supply does increase in this case due to the expansion of output in effort of sustained higher transaction level rather than prerequisite of the preferred government financing investment projects. The theory was a divergence from the initial use of monetary policy tools by government to use funds on selected investment programs, imposing the interest rate ceilings and having in place a requirement by commercial banks of holding high amount of reserves with the Central Bank (Loizos, 2018).

The financial repression theory assumes that commercial banks are dominant in less-developed countries' financial system. The capital markets in these countries are also assumed to be underdeveloped (Yülek, 2017). The optimal use of the household savings between assets that are unproductive and deposits is questioned. These unproductive assets include cash, foreign securities and real durable assets like land. The unproductive assets thus are not available for financing the domestic investment. An assumption is made that household savings is allocated to only unproductive assets or deposited at banks which may not be accurate. Another assumption is that a positive relationship between the real interest rate and demand for deposits (Yülek, 2017). This analysis implies that having deposit rate ceilings which maintain them below the equilibrium levels shift funds to unproductive assets from deposits, thereby reducing funds available for investment. Savings are thus affected since they are mainly deposits, preceding investment as the source of funds. Consequently, since savings are influenced by real deposit rate, lower deposit rate lowers the deposits that are available to finance investments.

The theory has been criticized by structuralists including Van Wijnbergen, Buffie, Kohsaka and Taylor (Loizos, 2018) who structured their models on other assumptions of product, labor and money markets. A commonality in their models is the role of institutions on determining the wage rate and the influence of inflation on the markup pricing of working capital costs, imports and labor. The power balance between workers and capitalists is critical in inflation determination rather than the assumption that monetary policies determine

inflation. The theory is also criticized for being implausible and theoretical inadequacy in assessing the policies of financial sector. The implication of the assumption of perfect markets competition undermines analysis of bank behavior and the effects of government interventions.

In relevance to the study, the financial repression theory notes that the government lowers the Central Bank and deposit rates that impede savings and spurs investment in firms including agricultural firms. The government implements financial liberalization policies in an effort to maintain the Central Bank rate at equilibrium with market rates, thereby controlling the inflation rate and real income growth rate. These government interventions through monetary policies increase firm output levels since money supply is increased at high level of transaction. The performances of agricultural firms are better from higher productivity due to increased investments. The theory highlights that agricultural firms listed at the NSE can easily attract more investment due to government lowering the Central bank rates.

2.3 Empirical Literature

The study reviewed several similar studies that have been conducted before to highlight their findings, context of study, methodologies they used and period of study. Gaps in the reviewed studies were established to form the basis of this study.

2.3.1 Central Bank rate and performance of agricultural firms

Ogbanje and Okpe (2022) studied the effect of monetary policy and agricultural sector performance in Nigeria applying the Granger causality approach. The study used secondary data obtained from the Central Bank of Nigeria between 1981 and 2020. The instruments used in the model were money supply (MS), monetary rediscount rate (MR), exchange rate (ER), prime lending rate (PR) and agricultural sector implicit price deflator (ASI) while agricultural sector performance was proxied by the gross domestic product for the sector. After first differencing, the augmented Dickey-Fuller test confirmed the stationarity of the variables. Optimal lag selection-order recommended four lags. The study applied the vector autoregressive model, pairwise Granger causality test and Wald coefficient test to show the robustness and validation of the causality test. The results indicated a bidirectional relationship between monetary policy and agricultural sector performance. Specifically, the study revealed that money supply had a high-level coefficient implying that there was variation in money supply that highly influenced economic growth especially the agriculture sector. The study recommended that monetary policy authority in Nigeria should note that changes to money supply, monetary rediscount rate, exchange rate, prime lending rate and agricultural sector implicit price deflator (ASI) would affect agricultural sector performance

in the short run as well as the overall macroeconomic growth; and policy decisions that are aimed at altering agricultural sector performance would affect monetary rediscount rate, exchange rate, and prime lending rate.

Egbunike and Okerekeoti (2018) studied the interrelationship between macroeconomic factors, firm characteristics and financial performance of quoted manufacturing firms in Nigeria. The study examined the effect of interest rate, inflation rate, exchange rate and the gross domestic product (GDP) growth rate, while the firm characteristics were size, leverage and liquidity. The dependent variable financial performance is measured as return on assets. The study used the *ex post facto* research design with the population of all manufacturing firms on the Nigerian Stock Exchange. The study concluded that exchange rate and interest rate have no significant effect on the return on assets, but GDP growth rate and inflation rate had a significant influence on the return on assets. The study highlighted the implications of monetary factors on the firm's profitability and characteristics. The study was however on manufacturing firms and conclusions cannot be used for this study on agricultural firms.

Odalo, Achoki and Njuguna (2016) studied the influence of interest rate on the financial performance of agricultural firms listed at the Nairobi Securities Exchange. The study adopted a descriptive and explanatory research design. All the listed agricultural firms were used in the study. Primary data was collected using questionnaires while the secondary data was collected using data collection sheets from the firms as well as from the Nairobi Securities Exchange and CMA records. The study used panel data methodology was employed using a multivariate regression model to test the hypotheses and link the variables. The study findings revealed that interest rate has a positive and significant relationship with ROA, ROE and EPS. In addition, the findings also indicate that interest rate moderate the effect of financial performance of agricultural firms listed at the Nairobi Securities Exchange. The study recommended that financial institutions and banks in Kenya should assess their clients which include agricultural firms listed in NSE while setting up interest rates policies, as ineffective interest rate policies can increase the level of interest rates and consequently cost of borrowing and negate financial performance of the borrowing firms. The Central Bank should apply stringent regulations on interest rates charged by financial institutions so as to regulate their interest rate spread.

2.3.2 Change of reserve requirement and performance of agricultural firms

The reserve requirement, also known as cash reserve ratio, is a central bank regulation employed by most, but not all, of the world's Central Banks (MacCarthy, 2016). It sets the minimum fraction of customer deposits and notes that each commercial bank must hold as

reserves rather than lend out. These required reserves are normally in the form of cash stored physically in a bank vault or deposits made with a central bank. The required reserve ratio is sometimes used as a tool in monetary policy that affects the country's borrowing and interest rates by changing the amount of funds available for banks to make loans with (MacCarthy, 2016). Reserve requirements are perceived to promote the overall performance of commercial banks and their engagement in corporate social responsibility activities.

Abidi and Lodhi (2015) conducted a study on the relationship between reserve requirement ratio and banks profitability in Pakistan. The study emphasized on the effects of changes in cash reserve requirement (CRR) on commercial banking profitability and how it affects the return on equity (ROE) and return on assets (ROA). The research relied on secondary quantitative time series data for a period of ten years 2005-2014. Empirical analysis of the study was done using correlation analysis followed by linear regression. The study findings revealed that CRR taken as a measure for reserve requirement has a significant inverse relationship on the financial performance of the banks', and is measured by ROA and ROE. The results of the research indicated that CRR is negatively associated with bank profitability. The researcher concluded that changes in CRR have an inverse impact on banks profitability. According to the findings, increase in CRR by SBP, ROE, and ROA falls for banks and vice versa.

Lin and He (2020) studied the effect of a Targeted Easing (TE) policy, an unconventional monetary policy tool initiated by the Chinese central bank to reduce reserve requirement ratios of agricultural financial institutions. Utilizing a longitudinal sample of Chinese agriculture firms and a matching sample of nonagricultural industrial firms between 2012 and 2017, the study found that the TE policy successfully achieves its intended policy goal to boost lending to the agriculture sector. Results from the study's difference-in-differences estimations indicate that agriculture firms' loan intensity increases significantly more than the matching nonagricultural firms' under TE relative to the non-TE period. The study also documents heterogeneous TE effects and find that agricultural firms with smaller risks, larger financing constraints, and larger loan intensity benefit significantly more from a TE policy than their counterparts. In addition, the TE policy effect is more salient during a contractionary period than in an expansionary period. Overall, the results indicate that targeted easing does achieve its intended policy goal by boosting lending to agriculture businesses.

Barroso, Gonzalez and Ferdinandus (2017) estimated the impact of reserve requirements (RR) on credit supply in Brazil, exploring a large loan-level dataset. The researchers used a

difference-in-difference strategy, first in a long panel, then in a cross-section. In the first case, the study estimated the average effect on credit supply of several changes in RR from 2008 to 2015 using a macroprudential policy index. In the second, they used the bank-specific regulatory change to estimate credit supply responses from a countercyclical easing policy implemented to alleviate a credit crunch in the aftermath of the 2008 global crisis; and from its related tightening. The study findings showed evidence of a lending channel where more liquid banks mitigate RR policy. Exploring the two phases of countercyclical policy, the results indicated that the easing impacted the lending channel on average two times more than the tightening. Foreign and small banks mitigate these effects. Finally, the research opined that banks are prone to lend less to riskier firms.

MacCarthy (2016) conducted a study on the effects of cash reserve ratio (CRR) on the financial performance of commercial banks in CSR Ghana. He used secondary data from the Bank of Ghana on banks' cash reserve ratios and data on corporate social responsibility engagement and return on investment from the 2013 annual reports of 20 commercial banks. The study revealed that cash reserve ratio positively affects the performance of commercial banks. However, the study showed that cash reserve ratio negatively relates to the banks' level of engagement in corporate social responsibility. The study also highlighted that cash reserve ratio significantly and strongly predicts the financial performance of commercial banks regarding return on investment. The research recommended that banks should enhance their engagements in corporate social responsibility activities in order to improve bank-customer relationships as well as customer patronage.

Orji, Gbuabor, Ugwu and Anthony-Orji (2019) conducted a study on the impact of cash reserve requirement on credit to SMEs in both short run and long run in Nigeria. To capture both objectives, the research used the ARDL model. Annual data from 1981-2017 was used as the variables. Findings from the study showed that cash reserve ratio has an insignificant impact on credit to SMEs, both in the short run and in the long run in Nigeria. Secondly, lending interest rate was found to have a significant negative impact on credit to SMEs. The study thus suggested that governments and banks should avoid concentrating on the use of cash reserve ratio only in order to increase credit to SMEs in Nigeria. The study highlighted that to increase the liquidity ratio of banks and in turn increase access to credit by SMEs, there is a need to regulate the commercial banks' asset base. Moreover, as a matter of necessity, the government should appropriate and monitor the judicious disbursement of interest-free loans to Nigerian SMEs because these would boost productivity and in the long run, the economy. The above study focused on SMEs and thus there is a need to study the

impact of reserve requirements on agriculture firms.

2.3.3 Open market operations and performance of agricultural firms

OMO is a major instrument of monetary policy under the market-based system of monetary management. It is deployed by monetary authorities in regulating the cost and availability of credit in the banking system and thus influences the level of money supply. OMO ensures that monetary expansion or contraction is carried out by altering the reserve base of banks, thereby enhancing or limiting their credit creation capabilities. For instance, if an expansionary monetary policy is being pursued, the Central Bank purchases government securities from the deposit money banks, which causes their reserves to rise and hence increase their credit creation ability. Similarly, in conducting a contractionary monetary policy, the Central Bank sells government securities to commercial banks. This will cause their reserves to fall thereby limiting their credit creation abilities.

Bassey, Akpan and Umoh (2018) assessed the effectiveness of open market operations instruments of monetary policy management in Nigeria. The investigation was conducted using Ordinary Least Squares method of estimation. Unit Root and Co-integration were conducted for suitability of the variables. The empirical results indicated a significant relationship between monetary policy instruments such as OMO and broad money supply were proximate targets for monetary policy management. This implies that Open Market Operations has been an effective instrument of monetary policy management in Nigeria. The study further showed that monetary policy rate could serve as a veritable instrument for the control of money supply and effective monetary policy management in the economy.

Mashinini, Dlamini and Dlamini (2019) examined the effects of monetary policy on agricultural output in Eswatini. The study used annual data from 1980 to 2016. The study used the Error Correction Model (VEC). The empirical results showed that in the long run, agriculture GDP, exchange rate, interest rate, inflation, broad money supply, and agriculture credit have a negative effect on agriculture GDP in Eswatini. In the short run, the study indicated that the variation in agriculture GDP is largely and significantly caused by lagged agricultural GDP, interest rate, exchange rate as well as inflation. The study revealed that money supply and agriculture credit contributed less than 1 percent respectively to the variation in agricultural GDP. The study recommended that programs aimed at availing affordable credit to farmers should be prioritized to cushion the agriculture sector against adverse monetary policy shocks in the short to medium term, especially interest rates, to ensure continuous production.

Ajudua, Davis and Okonkwo (2015), examined the effects of monetary policy variables on the agricultural gross domestic product in Nigeria by employing an Ordinary Least Squares (OLS) method. The study used time series data from 1986 to 2013. The results of the granger causality test revealed that there is a unidirectional causality relationship from interest rates to agriculture gross domestic product, indicating that interest rates do influence agriculture output. The results further revealed that there is a positive and significant relationship between money supply and agriculture gross domestic product while a negative and significant relationship was observed against the interest rates.

Adongo, Otieno and Muyima (2020) examined the impact of monetary policy on the performance of the agricultural sector in Kenya. The study examined annual data for the period from 1981 to 2019, the study conducted empirical analysis to determine the relationship between monetary policy and agricultural domestic product using OLS regression model. The monetary policy instruments that were selected were broad money supply (M2), Central Bank Rates (CBR), Cash Reserve Ratio (CRR) and Exchange Rate (ER). Both ADF and Philip-Perron unit root tests were done to confirm if the variables were stationary and Johansen Co-integration test was done to confirm short and long run relationships. The empirical findings indicated that broad money supply has a positive influence on agricultural GDP while exchange rate displayed a negative impact on the performance of the agricultural sector. The study recommended that government should increase the allocation for agriculture on the budget and to have a monetary policy commission commitment to maintain exchange rate volatility in order to realize the full potential of the agricultural sector.

2.3.4 Control variables

Exchange rates and precipitation levels are considered important control variables in this study.

2.3.4.1 Exchange rates and performance of agricultural firms

Hongbin, Hong and Yuan (2015) conducted a firm-level investigation of how exchange rate movements affect Chinese exports. The study findings indicated that Chinese exchange rate changes have a very small impact on the price response. The findings further show that there is a high exchange rate pass over into prices denominated into foreign currency, while there is a significant and moderate volume response. Despite high pass-through, exporters who have attained higher productivity price move to market. The study indicated that an appreciation of the renminbi decreases the probability of continuation in the export market. Salamat Ali further conducted a firm-level study in Pakistan on the effects of exchange rate on agricultural exports. By studying how depreciation in currency affect agricultural exports, the

study indicated the extensive and intensive margins are positively affected by exchange rate movement. The study also indicated that the extensive margin of products and firms and the existing markets client base is improved by depreciation. These studies focus on the export side of agricultural products while the current study is on the effects of exchange rates on both exports and imports. The studies were also conducted in different geographical location from the current study.

Tulasombat and Ratanakomut (2015) studied the effect of exchange rates on agricultural goods for export in Thailand. The study findings indicated there was a significant negative effect of exchange rate on the export volumes of total agricultural products. Further, the study indicated that the effects of fluctuations of exchange rate lead to problems to the working of the companies, thereby affecting their performance. Further evidence from China by Xu, Mao and Tong (2016) in their study on the impact of exchange rate movements on multi-product firms' export performance indicates that the export quantities and export prices of firms are negatively affected by real currency appreciation. These studies were however different from the current study due to difference in study area and not specific to the effects on performance of agricultural firms.

In Nigeria, Lambe (2015) assessed the impact of exchange rate risk on banks performance. The study indicated a significant relationship between performance of banks and management of exchange rate and increase in profit after tax increases the exchange rate. The study is similar to the current study since it uses secondary data sources and regression model in analysis. The study however is of banks while the current study is of agricultural firms.

In Kenya, Oiro (2015) studied the real exchange rate volatility and exports in Kenya. The study focused on how export of coffee, tea and horticulture to the European Union were affected by real exchange rate volatility using the Autoregressive Distribution Lag model. The study indicated that the tea and horticulture exports were affected by exchange rate volatility. Chirchir, Muse and Jagong (2015) also studied exchange rate volatility and export performance of tea firms in Kenya. The study indicated that domestic tea prices and exchange rate volatility influenced tea firms export performance. The study further indicated interdependence between macroeconomic stability, exchange rate stability and export performance of tea firms. These studies focused on exchange rate volatility on agricultural exports. The current study will focus on both imports and exports of agricultural firms listed at the NSE.

2.3.4.2 Climate change and performance of agricultural firms

A large part of the Kenya agricultural sector depends on the natural climate conditions for

production. Agricultural firms process the produce from farmers for local sales and export. Prevailing climate conditions therefore affect the quantity of produce that firms can get to process. According to Kenya Private Sector Alliance (2014) report on climate change, extreme weather, changing rainfall patterns and increasing temperatures will make the agricultural sector very vulnerable to climate change. Climate change is expected to lead to more droughts, increased flooding in arable land, more pests, less crop growth days and disrupted agricultural plans due to unpredictable climate conditions. Nikolaou, Evangelinos and Leal (2015) did a system dynamic approach for exploring the effects of climate change risks on firms' economic performance. They indicated that physical risks of climate change will strongly affect the performance of firms due to significant increase in costs. The effects will vary in different sectors and agricultural sector can be adversely affected by adverse weather conditions which increase costs to firms. This study was however on effects of climate change on firms of all sectors while the current study will focus on NSE listed agricultural firms.

Chang-Gil (2012) highlighted the impact of climate change on the agricultural sector by studying the implications of the agro-industry for low carbon, green growth strategy and roadmap for the East Asian region. The result of the study showed participants in the agricultural sector are willing to be participants of carbon reduction programs, necessitating development of customized programs and technologies that increase production. Asayehegn, Iglesias, Triomphe, Pedelahore and Temple (2017) did a study of the Kenyan coffee and dairy sectors on the role of systems of innovation in adapting to climate change. The study emphasized the importance of adopting technological innovations in agricultural practices to increase productivity of farmers and agricultural firms. Sectoral Systems of Innovation (SSI) is used to analyze these factors that highly determine the innovation trends in every sector. These studies however do not focus on how climate change directly affects the performance of agricultural firms but rather on agricultural production levels.

2.4 Summary of research gaps

Table 2. 1 Research Gap Summary

Study	Summary	Research gap fulfilled by current study
Bassey et al. (2018)	Study assessed the effectiveness of open market operations instruments of monetary policy management in Nigeria.	Their study was not specific to the effectiveness of open market operations to performance of firms. The current study was also conducted in Kenya.
Mashinini et al. (2019)	The study examined the effects of monetary policy on agricultural output in Eswatini.	Their study focused on agricultural output which is different from the current study on the performance of agricultural firms. The context of this study was different from the current study.
Adongo et al. (2020)	The study examined the impact of monetary policy on the performance of the agricultural sector in Kenya.	The study was on the performance of the general agricultural firms but the current study was specific to listed agricultural firms at the Nairobi Securities Exchange.
Ogbanje and Okpe (2022)	Their study was on effect of monetary policy and agricultural sector performance in Nigeria applying the Granger causality approach.	This study used a different methodology than the one of this study.
Egbunike and Okerekeoti (2018)	They studied the interrelationship between macroeconomic factors, firm characteristics and financial performance of quoted manufacturing firms in Nigeria.	The study was not specifically on monetary policy and the agricultural sector like the current study.
Orji et al. (2019)	They conducted a study on the impact of cash reserve	The study was conducted on SMEs while this

	requirement on credit to SMEs in both short run and long run in Nigeria.	study focuses on agricultural firms. The context of this study was also different from the current.
Odalo, Achoki and Njuguna (2016)	Study was on the influence of interest rate on the financial performance of agricultural firms listed at the Nairobi Securities Exchange.	The study was updated by the findings of the current study by including effects of introduction and repealing of interest rate caps and other monetary policy tools.

Source: Author (2023)

2.5 Conceptual Framework

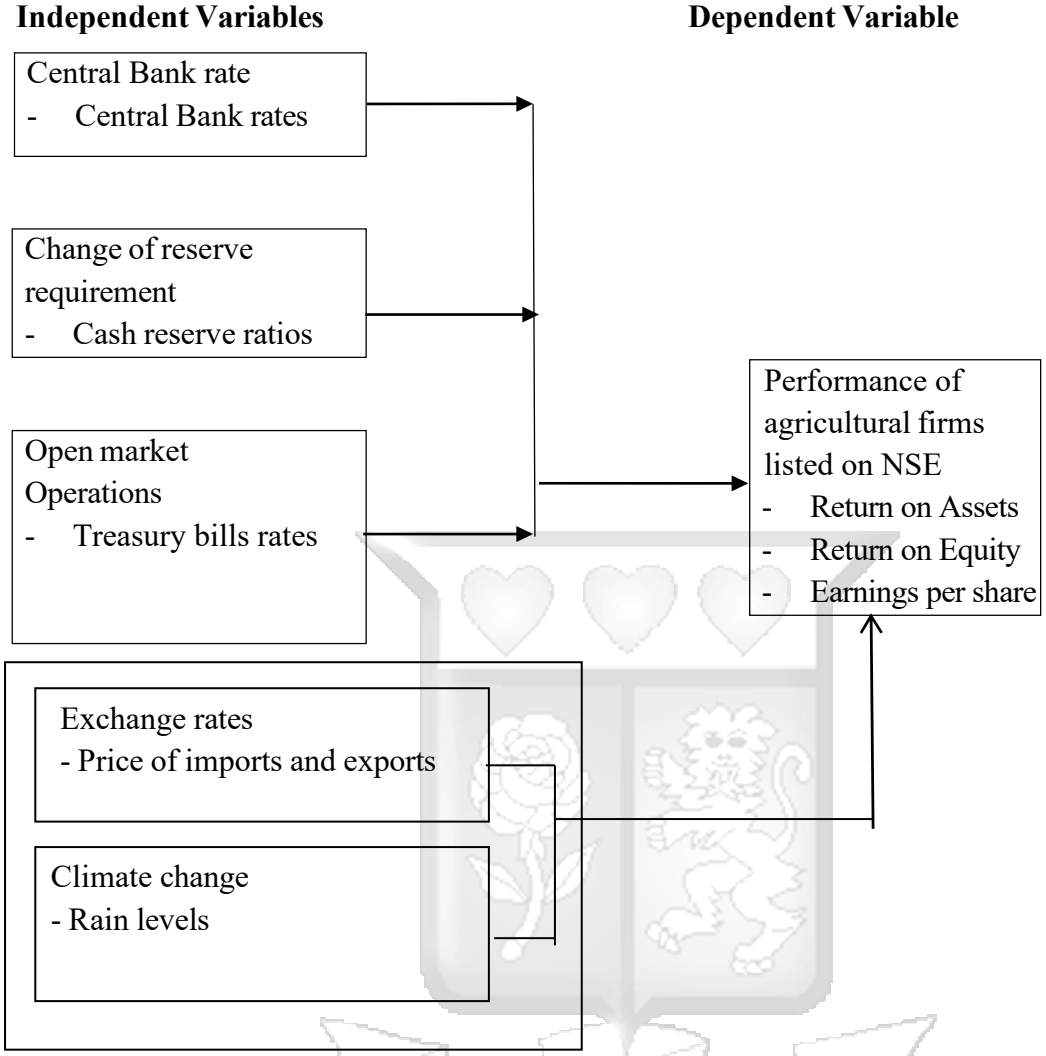


Figure 2. 1: Conceptual Framework

The study anticipated that monetary policy tools, the independent variables, have an effect on the performance of listed agricultural firms. As such, the study investigated the effects of Central Bank rate, change of reserve requirement, open market operations, exchange rates and climate change on the performance of listed agricultural firms as illustrated in Figure 2.1. Open market operations were measured by the buying and selling of treasury bills. The change in reserve requirement was measured by the cash reserve ratio of the period in the study. The study used the Central Bank rates for the study period years 1991 to 2020. The study used exchange rates and climate change as extraneous variables. The study used annual amount rains received to measure climate change. The study measured the performance of listed agricultural firms by taking the average of their annual return on assets, return on equity and earnings per share for the period of study.

CHAPTER THREE
RESEARCH METHODOLOGY

3.1 Introduction

This chapter presented the procedures and the methodology that the study adopted in collecting and analyzing data. The chapter highlighted the research design, the population of the study, sampling frame, sampling techniques and the study's sample size. This chapter also highlighted the data collection methods and instruments to be used to fulfill the objectives of the study.

3.2 Research Philosophy

As defined by Zukauskas, Vveinhardt & Andriukaitiene (2018), research philosophy is a system of researcher's belief and thoughts resulting in reliable new knowledge of the research object. There are four ways of approaching the research philosophies. One approach is the axiology which is of values and value judgments; second is doxology which is of belief-forming processes; third is ontology which is of nature and object existence and forth is epistemology which is about gathering truths and knowledge and their sources (Mkansi & Acheampong, 2012).

In the works of many authors, they have discussed and distinguished four main trends of research philosophy: pragmatic, positivist, realistic and interpretivist (Žukauskas et al., 2018). This study adopted a positivist research philosophy approach since it relied on available quantitative data. The research data was of the past period and no future estimates which may be objective were used. The study is objective and wholly depended on data for its findings, the researcher's personal views will not be considered in this study. This study focused on the effects of monetary policies on performance of agricultural firms and hypotheses developed from the theoretical and empirical review of literature tested, which is characteristic of positivistic philosophy.

3.3 Research Design

According to Groenewald (2004), a research design is a plan or a framework that the researcher needs so as to remain specific on what to observe and analyze, why and how. Basically, research design is coming up with the exact phenomenon to be studied, when, how and for what purpose.

This study adopted explanatory research design. Explanatory research design is concerned with the factors of change (Rahi, 2017). The explanatory research states the relationship that exists between variable. In addition, it gives the effect of one variable on others hence investigating the causal effect among the variables in a study (Akhtar, 2016). The main reason for using an explanatory research design is because it is involved with the "why"

factor in a phenomenon. The study established a model that investigated the relationship between listed agricultural firms' performance and the three tools, that is, Central bank rate, open market operations, reserve requirement and exchange rate and climate change. The performance of listed agricultural firms was the dependent variable and the three monetary tools, exchange rate and climate change were the independent variables. The study tested the strength of the relationship that exists between the independent variables and the dependent variable.

3.4 Population and Census

3.4.1 Population

A population is the entire pool that contains all the elements that the researcher wants to draw a sample from (Cooper & Schindler, 2014). An element is the subject from which the inferences and measurements are drawn from. Saunders, Lewis and Thornhill (2016) describe a population as the universe of people, objects, events or things in a place that have to be studied. The target population of this study was the seven currently listed agricultural firms on NSE (NSE, 2022).

3.4.2 Census

Cooper *et al. (*2014) describe census as the process of collecting, calculating and recording information about the elements of the entire population. The research design highlights the process that is good enough to be followed in order to use census in the study. The study census was the agricultural firms listed on NSE. These firms include Eaagads Limited, Limuru Tea PLC, Williamson Tea Kenya PLC, Kapchorua Tea Company Limited, Rea Vipingo Plantations Limited, Kakuzi PLC and Sasini PLC.

3.5 Data Collection Methods

Zikmund and Babin (2015) define data as raw facts collected together to be analyzed in order to give meaningful information. Data collection is the process of collecting information from all the relevant sources to find answers to research questions, evaluate outcomes and test hypothesis (Hancock & Algozzine, 2017). Data is classified into two; secondary data and primary data.

The study used secondary data hence data collection sheet was used in obtaining this information. There are some objectives in certain studies that can use data that was collected previously by other researchers and this data may include official statistics, administrative records, or other relevant information that is stored by the firm or organization under study (Oladipo et al., 2015). Secondary data is useful and accurate if the source is valid. Therefore, the researcher is supposed to obtain data which is relevant to the study and do an evaluation

on the authenticity of the data to ascertain if the data meets the quality requirements of the study being undertaken currently (Cooper et al., 2014). The main reason for this study using secondary data is because the data is cheap, available, and very accurate for this topic. Institutions such as CBK and KNBS have all the information involving open market operations, change of reserve requirement and Central Bank rate. The study used reports by the Central Bank to get the Central Bank rate, treasury bills rate and reserve requirement of the period of study. On the other hand, listed firms publicly publish their annual reports making it easier to obtain the required data on ROA, ROE and EPS. This enabled the researcher to study all the listed agricultural firms. The study used panel data of between years 1991 and 2020. The study used a fixed effect model since data collected was a census of the seven NSE listed agricultural firms for both the long term and short term periods.

3.6 Variable Operationalization

The dependent variable of the study was performance of listed agricultural firms. Performance was measured by the firms' return on assets, return on equity and earnings per share extracted from the annual reports of the listed agricultural firms. Factor analysis was done on the ROA, ROE and EPS. Independent variables were Central Bank rate, open market operations and reserve requirement. The data for monetary tools were extracted from the Central Bank reports of the study period. The Central Bank rate, the cash reserve requirement rate and treasury bills rate were used as a measure of Central bank rate, reserve requirement and open market operations respectively. The control variables were exchange rate and climate change. The study used the annual average exchange rate of Kenya Shilling against the US dollar for the period and average precipitation rate to represent climate change.

3.7 Data Analysis

Data analysis refers to the procedure of packaging the collected information, arranging its main content in a way that the findings can be communicated and understood easily (Cooper et al., 2014). A systematic numbering was used on each variable to avoid overlaps. The data was keyed into SPSS and both descriptive and inferential statistics were conducted on the data. The correlation analysis was done to find out the relationship among the variables.

The regression model was tested for assumptions of regression before the regression is done. Normality test was done to check if data is normally distributed by testing the skewness and kurtosis by computing the Pearson coefficient. Linearity test checked for linear relationship by computing the Shapiro-Wilk statistic. Homoscedasticity test was to check for homogeneity by computing the Levene statistic. Multicollenearity test checked for inter-correlations among independent variables by computing the VIF and Tolerance. The autocorrelation test checked

for the similarity degree of a particular time series with its lagged version over successive time intervals. Autocorrelation was checked by computing the Durbin Watson statistic.

The multiple regression model was presented as;

$$LnY = \beta 0 + \beta 1 lnX1t + \beta 2 lnX2t + \beta 3 lnX3t + \beta 4 lnX4t + \beta 5 lnX5t + \varepsilon$$

Where:

Y = Performance of agricultural firms listed at NSE

β0 = Constant Term;

β1, β2, β3, β4, β5 = Beta coefficients;

X1= Central Bank rate;

X2= Change of reserve requirement;

X3= Open market operations;

X4= Exchange rates;

X5=Climate change;

t= time index

ε = Error term

The study used a 95% confidence level, reflecting a significance level of 0.05. This showed that for an independent variable to have a significant effect on the dependent variable, the p-value should be below the significance level (0.05).

A composite measure of the firm financial performance was determined by computing an average for each metric. It is important to note that all the measures of the independent variable were time series data. However, the dependent variable had an aspect of panel data but a single composite measure was determined for each time period. Logarithmic transformation was done to linearize the model and enhance normality.

CHAPTER FOUR
RESULTS AND FINDINGS

4.1 Introduction

This chapter presented the findings of the study from the data collected. The study findings and results are based on objectives of the research; effects of Central bank rate, change of reserve requirement, open market operations, exchange rate and climate change on performance of agricultural firms listed at the NSE. The chapter presents the relationship between variables and the performance of firms, and the regression and correlation analysis. The dependent variable was measured by ROA, ROE and EPS. Factor analysis was done to check the suitability of data. The average value of the ROA, ROE and EPS of the firms for each year during the study period was used to generate the value of performance of the firms. ROA was calculated by dividing net income by total assets; ROE by dividing net income by shareholders' equity and EPS was as indicated in the income statement. The cash reserve ratio, CBK rate and treasury bills rate are measured by averaging rates issued by the Central bank. The exchange rate is measured using US dollar to Kenya shillings exchange rate. Climate change is measured using average precipitation of the year.

4.2 Descriptive statistics

The data was checked for descriptive statistics including minimum values, maximum values, the means and standard deviations. A summary of the statistics is presented in table 4.1 below.

Table 4. 1: Descriptive Statistics Summary

Descriptive Statistics	Minimum	Maximum	Mean	Std. Deviation
CBK rate	6.417	15.750	9.528	1.719
Cash reserve requirement	4.417	10	6.388	1.963
Treasury bills rate	3.437	25.832	12.323	6.388
Exchange rate	67.467	106.468	85.320	11.854
Precipitation level	434.607	1146.130	698.204	158.379
ROA	-0.104	0.634	0.077	0.133
ROE	-0.270	7.687	1.866	2.388
EPS	-4.970	31.686	7.499	9.629

Source: Author (2023)

The above table indicates mean for the CBK rate data for the study period was 9.527757 with a standard deviation of 1.7193313 indicating small variation of CBK rate over the study period. The maximum CBK rate value was 15.75 and minimum value of 6.4167. The cash reserve ratio had a maximum value of 10 and minimum value of 4.4167, with a mean value of 6.388 and standard deviation of 1.963. The treasury bills rate for the study period had a mean value of 12.323, with a maximum value of 25.832 and minimum value of 3.437. Further, the standard deviation was 6.388 indicating large variation of Treasury bill rate over the period. Exchange rate over the period had a mean value of 85.320 and standard deviation of 11.854, showing small deviation in exchange rate over the study period. The maximum exchange rate value was 106.468 and minimum was 67.467. The precipitation level had a maximum value of 1146.13 and minimum value of 434.607. The mean value for precipitation was 698.204 with a standard deviation of 158.379, indicating a large variation in precipitation level over the study period. The ROA for the firms had a maximum value of 0.634 and minimum value of -0.104 for the period. The mean value was 0.0769 and a standard deviation of 0.133 showing a large variation in ROA for the study period. The average value for ROE was 1.866 with the maximum and minimum values being 7.687 and -0.27 respectively. The standard deviation was 2.388, indicating a high variation of ROE over the period. The EPS averaged 7.499 with a standard deviation of 9.63 observed, indicating a large variation of EPS for the firms over the study period. The highest value was 31.686 and lowest value was -4.97.

4.2.1 Factor Analysis

Factor analysis results indicated a KMO measure of adequacy with a value of 0.571 and Bartlett's test of Sphericity significance value of 0.00 thus indicating it is not an identity matrix. The communalities value for mean ROA, mean ROE and mean EPS were greater than 0.5, which is, 0.592, 0.886 and 0.909 respectively hence they can be used for the study. A summary of the results is as shown in table 4.2 below.

Table 4. 2: Factor Analysis

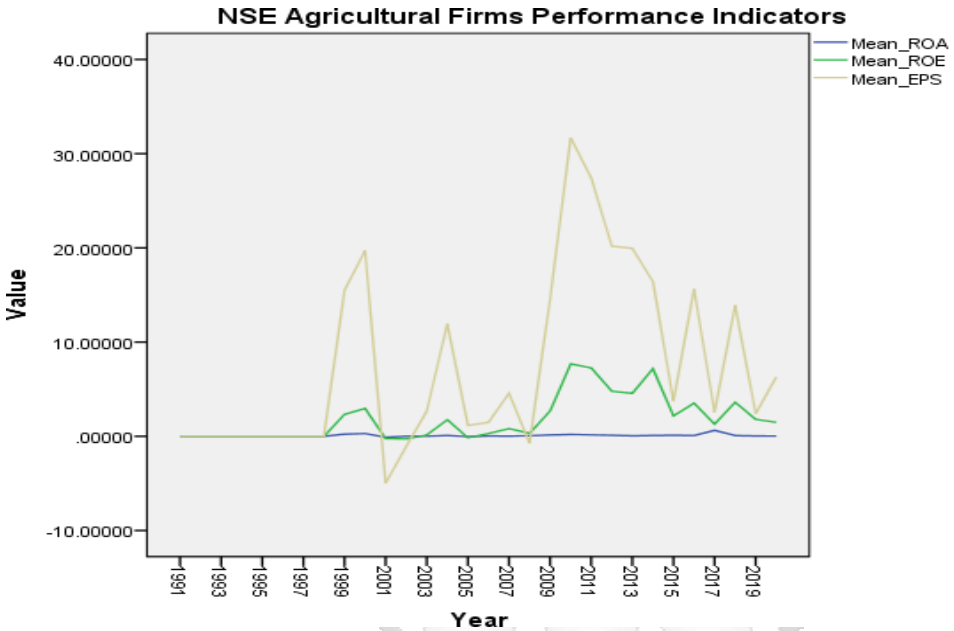
KMO and Bartlett's test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.571
Bartlett's Test of Sphericity	Approx. Chi-Square	58.829
	Df.	3
	Sig.	.000
Communalities Extraction	Mean ROA	.592
	Mean ROE	.886
	Mean EPS	.909

Source: Author (2023)

4.2.2 Performance of agricultural firms listed at the NSE

Performance was measured using the return on assets, return on equity and earnings per share. The mean return on investment was stable over the study period. The mean return on equity was highest between years 2009 to 2013 before gradually reducing from 2015. The mean earnings per share fluctuated yearly with highest value in 2010 (31.68) and negative EPS in 2001 (-4.97).

Figure 4. 1: NSE Agricultural firms' performance indicators

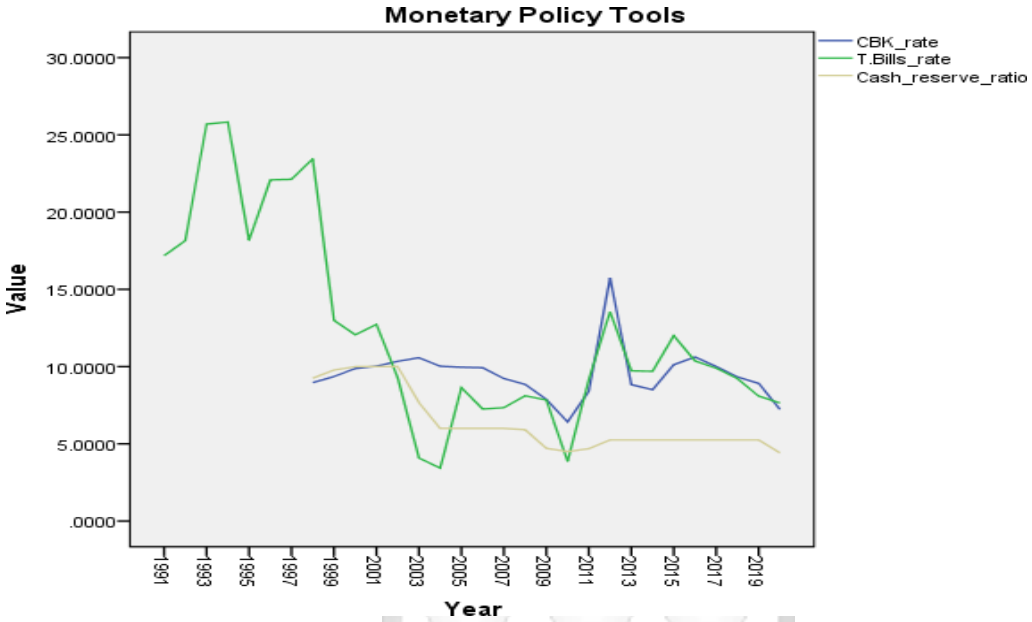


Source: Author (2023)

4.2.3 Monetary policy tools

The CBK rates, cash reserve ratios and treasury bills were the main variables in the study. From 2001 the CBK rate and treasury bills rates were following similar trends. The CBK rate was low in 2010 and highest in 2012. The treasury bills rate was high before 2000 and dropped lowest by 2004. The CRR was high in 2000 to 2002 before dropping and remaining relatively stable.

Figure 4. 2: Monetary policy rates

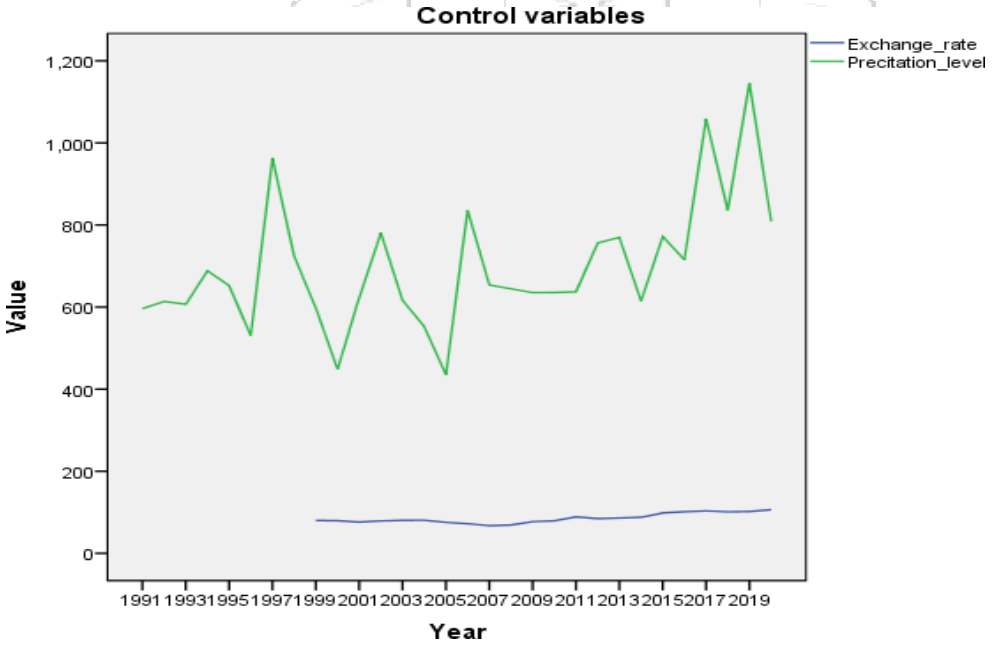


Source: Author (2023)

4.2.4 Control variables

The study used exchange rate and precipitation levels as control variables. Precipitation levels were fluctuating yearly and fairly stable in year 2009 to 2014. The precipitation levels were high in 1997, 2017 and 2019 with low precipitation in 2000 and 2005. Exchange rate declined between 2003 and 2007 before it started to steadily rise.

Figure 4. 3: Control variables



Source: Author (2023)

4.3 Inferential statistics

4.3.1 Correlation

A Pearson Correlation was done between the study variables to highlight the statistical relationship. A summary of the results is as shown in table 4.3 below.

Table 4. 3: Pearson Correlation

		CBK_rate	Cash_reserve_ratio	T.Bills_rate	Exchange_rate	Precitation_level	Performance_Agri.firms
CBK_rate	Pearson Correlation	1	0.182	0.251	-0.044	0.035	-0.136
	Sig. (2-tailed)	.	0.407	0.247	0.844	0.872	0.537
Cash_reserve_ratio	Pearson Correlation	0.182	1	0.455*	-0.407	-0.312	-0.387
	Sig. (2-tailed)	0.407	.	0.029	0.060	0.147	0.068
T.Bills_rate	Pearson Correlation	0.251	0.455*	1	0.177	-0.055	-.431*
	Sig. (2-tailed)	0.247	0.029	.	0.430	0.771	0.017
Exchange_rate	Pearson Correlation	-0.044	-0.407	0.177	1	0.616**	0.137
	Sig. (2-tailed)	0.844	0.060	0.430	.	0.002	0.545
Precitation_level	Pearson Correlation	0.035	-0.312	-0.055	0.616**	1	-0.121
	Sig. (2-tailed)	0.872	0.147	0.771	0.002	.	0.524
Performance_Agri.firms	Pearson Correlation	-0.136	-0.387	-0.431*	0.137	-0.121	1
	Sig. (2-tailed)	0.537	0.068	0.017	0.545	0.524	.

* Correlation is significant at the 0.05 level (2-tailed).

** Correlation is significant at the 0.01 level (2-tailed).

Source: Author (2023)

The results of the correlation analysis indicated a positive relationship between the CBK rate and CRR, Treasury bills rate and precipitation level. There was a negative relationship between the CBK rate and exchange rate and performance of the firms. There is a statistically significant positive relationship between the CRR and the Treasury bills rate, while the relationship with the exchange rate, precipitation level and performance of firms are negative. The Treasury bills rate had a statistically significant negative relationship with performance of firms and the precipitation rate. The relationship between Treasury bills rate and exchange rate was positive. There was a significant positive relationship between the exchange rate and precipitation level. Similarly, the relationship between exchange rate and performance of firms was positive. Further, the analysis indicated a negative relationship between precipitation level and performance of agricultural firms.

4.3.2 Regression Analysis

The study used regression to explain relationship between dependent and independent variables. The study data was first tested for assumptions of regression to see their fitness in use for the study.

4.3.2.1 Normality test

A normality test was done to evaluate the regression assumption of normal distribution of data. The values were between 0.476 and 1.116 for skewness while values for kurtosis lied between -0.247 and 1.72. This shows that the data on independent variable is normally distributed as shown in table 4.4.

Table 4. 4: Normality test

	Skewness	Kurtosis
CBK rate	0.903	1.72
CRR	1.116	-0.361
Treasury bills rate	0.846	-0.247
Exchange rate	0.476	-0.985
Precipitation level	1.074	1.615

Source: Author (2023)

4.2.2.1 Linearity test

A linearity test is done to evaluate existence of linear relationship between performance of NSE listed agricultural firms and CBK rate, CRR, treasury bills rate, exchange rate and precipitation levels. Regression analysis assumes there is a significant linear relationship. The test results shown in table 4.5 indicated presence of a significant linear relationship between the dependent and the independent variables ($p>0.05$).

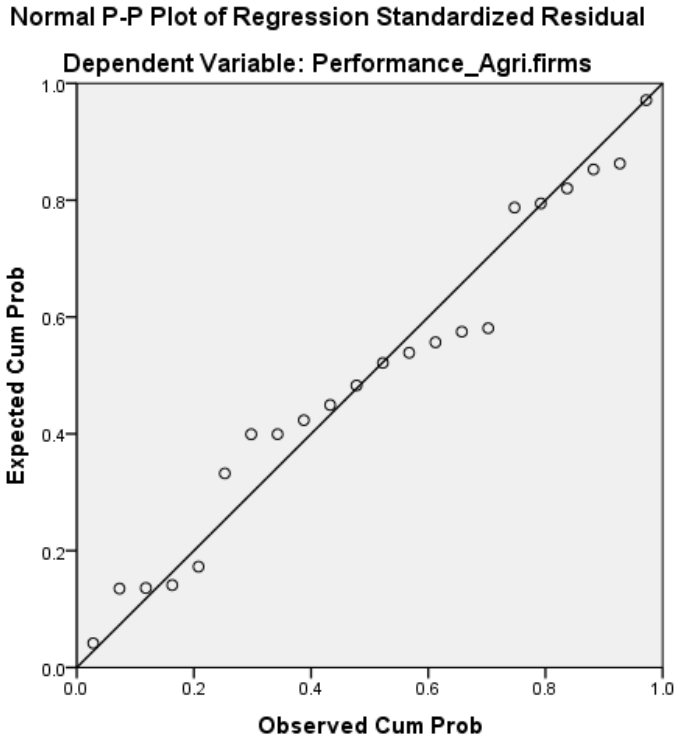
Table 4. 5: Linearity test

Model	Shapiro-Wilk statistic	Sig.
CBK rate	0.808	0.091
CRR	0.738	0.078
Treasury bills rate	0.945	0.252
Exchange rate	0.913	0.053
Precipitation level	0.917	0.065

Source: Author (2023)

Further confirmation of linearity was done using scatter plot. Figure 4.4 shows that there was linearity between the dependent and independent variables

Figure 4. 4: Scatter Plot



Source: Author(2023)

4.3.2.2 Multicollinearity test

Multicollinearity measures the inter-associations among the independent variables. Multicollinearity is tested by the Variance Inflation Factor (VIF). The regression model assumes there is no significant inter-correlations among the independent variables. The VIF values of the study data shown in table 4.6 indicated that inter-correlations were not significant (VIF<10).

Table 4. 6: Multicollinearity test

Model	Collinearity Statistics	
	Tolerance	VIF
(Constant)		
CBK rate	0.763	1.311
CRR	0.649	1.541
Treasury bills rate	0.616	1.622
Exchange Rate	0.497	2.014
Precipitation levels	0.944	1.059

Source: Author (2023)

4.3.2.3 Homogeneity test

A homoscedasticity test was done to evaluate the homogeneity of the data. Homogeneity was tested by the Levene statistics. A significant Levene statistic shows that the data is not homogenous. The study findings as indicated in table 4.7 showed the study data was homogenous at Levene statistic of 3.388 and p=0.068 thus fulfilling the regression assumption of homogeneity of data.

Table 4. 7: Test of homogeneity of variances

Levene Statistic	df1	df2	Sig.
3.388	2	22	.068

Source: Author (2023)

4.3.2.5 Autocorrelation test

This test is done to establish whether the study data has autocorrelation. Regression analysis assumes the error terms are independent. The computed Durbin-Watson statistic of the study is at acceptable range of 1.5 to 2.5 thereby indicating no autocorrelation of the residuals as indicated in the table 4.8.

Table 4. 8: Test for autocorrelation

Durbin-Watson Statistic	Sig.
1.847	.0858

Source: Author (2023)

4.3.2.6 Multiple Linear Regression analysis

A multiple regression analysis was done to evaluate the extent of how performance of listed agricultural firms is affected by CBK rate, CRR, treasury bills rate, exchange rate and precipitation levels. The study results showed R square of 0.321 hence indicated that 32.1% of

the variance of performance of the listed agricultural firms was caused by the independent variables as highlighted in table 4.9 below.

Table 4. 9: Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.567[a]	0.321	0.109	3.859

Source: Author (2023)

The ANOVA showed that at 95% confidence level the F critical was 1.1513 and the P value was 0.0241 indicating that the multiple linear regression model is statistically significant($p<0.05$). The Adjusted R-squared value of 0.109 shows that the model explanatory power is 10.9%. This implies that 10.9% variation in the financial performance of the listed agricultural firms is explained by monetary policy.

Table 4. 10: ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	112.664	21	112.664	1.151	.024[b]
	Residual	238.245	1	11.345		
	Total	350.909	22			

a. Dependent Variable: Performance of listed agri. firms

b. Predictors: (Constant), CBK rate, CRR, Treasury bills rate, Exchange rate, Precipitation level

Source: Author (2023)

Table 4. 11: Coefficient Analysis

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	T	Sig.
1	(Constant)	32.510	25.989		1.251	0.167
	Ln CBK rate		0.08556	-0.192	-2.244	0.041
	Ln CRR		0.22058	-0.476	-2.158	0.047
	Ln Treasury bills rate		0.08882	0.174	1.959	0.056
	Ln Exchange rate		0.11520	0.274	2.092	0.046
	Ln Precipitation levels		0.21652	-0.478	-2.30	0.039

a. Dependent Variable: Performance of listed agri. firms

Source: Author (2023)

From the equation $LnY= \beta0+ \beta1lnX1+ \beta2lnX2+ \beta3lnX3 + \beta4lnX4 + \beta5lnX5$

$Y= 32.510 - 0.192X1- 0.476X2+ 0.174 X3+ 0.274 X4 - 0.478X5$

Where Y is the dependent variable (Performance of listed agricultural firms)

X1=CBK rate

X2=CRR

X3=Treasury bills rate

X4=Exchange rate

X5=Precipitation levels

The model made use of natural logarithm of the variables. Therefore, the coefficients are interpreted in percentage terms because natural logarithm of a variable represents its elasticity. In addition, the rules of natural logarithm and base e indicate that a small change in the natural logarithm of a variable is directly interpretable as a percentage change.

The model showed that a one percent increase in the CBK rate leads to a decrease in performance of listed agricultural firms by 0.192 percent. This relationship was significant as shown by the p value less than 0.05. This indicated that CBK rate increase negatively affected the performance of listed agricultural firms. The model also highlighted that an increase in CRR by one percent leads to a decrease in performance by 0.476 percent. This effect is significant with a p value of less than 0.05. An increase by the Central Bank on CRR therefore had a negative effect on the performance of agricultural firms. The model further indicated that an increase in treasury bills rate by one percent leads to an increase in performance by 0.174 percent. However, this effect was insignificant with a p value greater than 0.05. The model indicated that an increase in exchange rate by one percent leads to an increase in performance by 0.274 percent. This effect is significant ($p>0.05$). The increase in exchange rate therefore had a positive impact on performance of the listed agricultural firms. Note that an increase in exchange rate implies the USD strengthening against the Kenya shillings. This is expected to have a positive effect on exports revenue for the agricultural firms. The model further showed that an increase in the precipitation levels by one percent leads to a decrease in performance of listed agricultural firms 0.478 percent. This effect is significant since the p value is less than 0.05. Increased precipitation levels therefore negatively influence the performance of listed agricultural firms. This is an interesting results that might call for an interrogation of other underlying factors.

CHAPTER FIVE
DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The chapter highlights discussion of the study and the conclusions drawn from study findings on the five research objectives of the study. Recommendations are made on the relationship between CBK rate, cash reserve requirement, open market operations, exchange rate and climate change on the performance of NSE listed agricultural firms.

5.2 Summary

The aim of the study was to determine the effects of monetary policy on performance of agricultural firms listed on NSE. In particular, the objectives of the research were to examine the effect of Central Bank rate on performance of agricultural firms listed on NSE; to evaluate the effect of change of reserve requirement on performance of agricultural firms listed on NSE and to determine the effect of open market operations on performance of agricultural firms listed on NSE. Explanatory research design was adopted to evaluate the relationship between CBK rate, CRR, OMO, exchange rate, climate change and performance of listed agricultural firms.

The study population included the currently listed seven agricultural firms at the NSE. Census was used for the study and all the firms were included in the study. Secondary data for the years 1991 to 2020 extracted from the Central Bank reports and annual reports of the agricultural firms were used. Descriptive statistics and trend analysis were done and reflected in tables and graphs. Multi linear regression was run to determine the relationship between the dependent and independent variables.

The first objective investigated the effect of the Central Bank rate on performance of agricultural firms listed on NSE. The study results indicated a fluctuation in the CBK rates over the study period with a highest value of 15.75% in 2012 and lowest value of 6.42% in 2010. The results of Pearson Correlation showed that there is a negative relationship between CBK rate and performance of listed agricultural firms (r= -0.136). The regression analysis indicated that a one percent increase of the CBK rate leads to a decrease in performance of listed agricultural firms by 0.192 percent.

The second objective evaluated the effect of change of reserve requirement on performance of agricultural firms listed on NSE. The study findings showed that the cash reserve requirement fluctuated slightly over the study period. The maximum value of CRR was 10%, a minimum value of 4.42% and the mean value was 6.38%. The Pearson Correlation results indicated a negative relationship between the CRR and performance of listed agricultural

firms (r=-0.387). The regression model indicated that an increase in CRR by one percent leads to a decrease in performance by 0.476 percent.

The third objective determined the effect of open market operations on performance of agricultural firms listed on NSE. The study results showed that the treasury bills rate has fluctuated over the study period with a maximum value of 25.83, minimum of 3.44 and mean of 12.32. The correlation coefficient showed there was a negative relationship between treasury bills rate and performance of listed agricultural firms (r=-0.431). The results of the multiple regression model indicated that an increase in treasury bills rate by one percent leads to an increase in performance by 0.174 percent.

The first control variable examined the effect of exchange rates on performance of agricultural firms listed on NSE. The study findings showed a steady rise in the exchange rate over the study period. The highest exchange rate recorded was 106.47 Ksh/dollar and minimum were 67.47Ksh/dollar. The Pearson Correlation coefficient indicated there was a positive relationship between exchange rate and performance of listed agricultural firms (r= 0.137). The multiple linear regression model indicated that an increase in exchange rate by one percent leads to an increase in performance by 0.274 percent.

The second control variable investigated the effects of climate change on the performance of agricultural firms listed on NSE. The study findings indicated a fluctuation in the precipitation levels across the study period. The highest level recorded was 1143.16mm, lowest value was 434.61mm and mean was 698.2mm. The Pearson Correlation results indicated a small negative relationship between precipitation levels and performance of listed agricultural firms (r=-0.121). The findings of the multiple linear regression showed that an increase by one percent of the precipitation level leads to a decrease in performance of listed agricultural firms by 0.478 percent.

5.3 Discussion

5.3.1 Effect of CBK rate on the performance of listed agricultural firms

The Central Bank rate affects the profitability and performance of firms in the economy. The CBK rate is used by the government in trying to control borrowing levels and hence investment in the economy. The findings of this study findings agree with the study by Mabati and Onserio (2020) which investigated the effect of the Central Bank rate on the

financial performance of commercial banks in Kenya and established a correlation between the average Central Bank rate, average inflation rate, average liquidity rate and the return on assets. The results of this study also agree with the findings of the study by Osamwonyi and Michael (2014) in Nigeria that interest rates had a significant negative effect on the profitability of listed commercial banks.

The Central Bank rate is the base rate for bank lending rates. The government can use a change in the CBK rate to expand or reduce investments in the economy (Osamwonyi & Michael, 2014). The introduction of interest rate caps, for example, was aimed to stabilize the bank lending rates and spur investments, however, commercial banks preferred government bonds than to lend loans to borrowers. The study findings support that for a better trade environment for the agricultural firms the CBK rate needs to be lower and lending institutions to be regularized to provide loans for agricultural production. The study findings by Odalo, Achoki and Njuguna (2016) however had differing results from this study. It revealed that interest rate has a positive and significant relationship with ROA, ROE and EPS. It also indicated that interest rate moderates the effect of financial performance of agricultural firms listed at the NSE.

One of the key elements of the economy is the CBK rate. The results show that higher CBK rate reduce the performance of agricultural firms. Lending institutions prefer to give out loans when interest rates are higher, provided that their risk is adequately covered. The growth and sustainability of agricultural firms may be impacted by the effective application of expansionary and contractionary policies in managing CBK rates.

5.3.2 Effect of CRR on performance of listed agricultural firms

Cash reserve requirement is integral in regulating the cash flow and firm profitability in the economy. The study results indicated that the CRR has a negative relationship with performance of listed agricultural firms. This study's findings are similar to study by Kithandi (2022) on monetary policy and financial performance of commercial banks in Kenya which indicated there is a negative relationship between cash reserve ratio requirement and return on equity. The study conclusion was that the performance of commercial banks was affected by monetary policies. Study by Akinleye & Oluwadare (2022) in Nigeria that investigated cash reserve requirement and profitability of banks for the years 2010 to 2019 further complemented the findings of this study. Their study findings indicated that the return on assets of Deposit Money Banks (DMBs) in Nigeria was significantly and negatively impacted by the cash reserve ratio.

5.3.3 Effect of Open Market Operations on performance of listed agricultural firms

This study's results agree with the study conducted by Mbogo (2020) that investigated the effect of monetary policy tools on the performance of the listed banking sector at the NSE. According to the study's findings, open market transactions have a favorable impact on stock performance. The study added that more open market trading improves listed banks' share performance. The study made the suggestion that in order to create policies that would support the achievement of the functions of the banking sector, policymakers should assess the degree of co-movement between monetary policy tools and the share performance of listed banks.

This study's findings differ from the study by Akeem et al. (2022) which examined the impact of monetary policies on the operation of Nigeria's listed deposit money banks. The study's conclusions indicated that open market transactions had no appreciable beneficial impact on the profitability of Nigeria's listed deposit money institutions. The study's key finding was that, when monetary policies are combined, they have a considerable impact on how profitable Nigerian listed deposit money institutions are.

5.3.4 Effect of Exchange rate on performance of listed agricultural firms

Since some of the final products produced by agricultural firms are exported, exchange rates have an impact on their financial performance. The financial performance of agricultural firms suffers as a result of shilling's devaluation against the dollar. The results are consistent with the research on publicly traded manufacturing enterprises in Nigeria by Egbunike et al. (2018). The study's findings showed that the financial performance of manufacturing firms was not significantly impacted by the exchange rate.

According to the findings of Osho and Efuntade (2019), there is a slight but favorable correlation between the exchange rate and the financial success of Nigerian businesses. Several agricultural firms that conduct business both domestically and abroad are impacted by the exchange rate's potential instability. Thus, agricultural firms must create effective strategies to control foreign exchange risk (Osho & Efuntade, 2019). For agricultural firms that conduct worldwide business, it may not be beneficial to employ certain unstable currencies. Agricultural firms may benefit from using tactics like future markets, currency swaps, and forward markets to protect themselves from exchange rate fluctuations and unpredictability.

A company's earnings per share, anticipated costs and revenues, and profit margin are all factors that can be positively or negatively impacted by exchange rate swings and variability.

According to Ayinde (2014), a depreciation in the value of the currency increases the cost of importing capital and raw materials, which has a knock-on effect on production costs and lowers company profitability. The agricultural firms can choose to pass these expenses along to their clients, which could have unfavorable consequences like losing business to rival companies in the sector.

Agubata and Odubuasi (2018) assessed the impact of the exchange rate on the financial performance of manufacturing firms in Nigeria's food, tobacco, and beverage industries. The results of this study showed that, although the impact on these organizations' financial performance is beneficial, it is not considerable. Inyiama and Ozouli (2014) discovered that although the impact of exchange rates on net asset value per share is positive, they are not statistically significant. According to the long-term coefficient, there is a weakly negative correlation between the firm's net asset value per share and the exchange rate. An increase in the exchange rate has an impact on the inverse relationship between it and net asset value, which may have an impact on the firm profitability due to the strong demand for foreign exchange.

5.3.5 Effect of Climate change on performance of listed agricultural firms

Kenyan agriculture is susceptible to climate change; hence adaptation strategies are needed to maintain agricultural productivity, lower susceptibility, and improve the agricultural system's resistance to climate change. The effects of climate change on crop output as well as the main agricultural sector adaptation alternatives were thoroughly reviewed by Aryal et al. (2020) in their study. The study showed that although there are agricultural techniques that aid in agricultural adaptation to climate change, the institutional framework to put those technical solutions into practice and spread them around still needs to be developed. Rather than just concentrating on agricultural technology, it is crucial to consider how to implement the necessary institutional change, raise money to invest in these improvements, and establish dynamic policies for long-term climate change adaptation in agriculture.

5.4 Conclusions

The study results indicated that there is a negative relationship between the CBK rate and performance of listed agricultural firms. The study therefore concludes that CBK rate negatively affects the performance of NSE listed agricultural firms. The study findings also indicated that the cash reserve ratios had a negative relationship with the performance of listed agricultural firms. The study thereby concludes that change of reserve requirement negatively affects the performance of agricultural firms listed at the NSE. Further, the results

of the study showed that the performance of listed agricultural firms has a positive relationship with the Treasury bills rate. The study concludes that open market operations positively affect the performance of listed agricultural firms. Additionally, this study finding showed a positive relationship existed between the exchange rate and performance of listed agricultural firms. The conclusion of the study was that the exchange rate positively affects the performance of listed agricultural firms. Finally, the study findings indicated a negative relationship existed between precipitation level and the performance of listed agricultural firms. The study therefore concludes that climate change negatively affects the performance of listed agricultural firms.

5.5 Recommendations

5.5.1 Recommendations for Improvement

5.5.1.1 Effect of CBK rate on performance of listed agricultural firms

The study recommends that the Central Bank of Kenya should act on stabilization of the CBK rate to ensure stability in prices at all economic periods including during economic shocks. The CBK rate should also be minimized to lower the cost of business in the economy and thus to the agricultural sector to increase firm performance.

5.5.1.2 Effect of CRR on performance of listed agricultural firms

The study recommends that the Central Bank should ensure enough cash flow to the economy by reducing the cash reserve requirements rate to commercial banks. Sufficient cash flow in the economy will increase consumption, production and thus performance of firms. The study also recommends the Central Bank to manage inflation levels in the economy by maintaining optimal CRR, thereby ensuring continued consumption and production of firms.

5.5.1.3 Effect of Open Market Operations on performance of listed agricultural firms

This study recommendation is that more government issues on the stock market should be done to further improve performance of firms. The Central Bank needs to increase investment confidence in the economy by maintaining a good Treasury bills rate. Higher financial liquidity available for firms for investment will increase productivity and thus improve performance.

5.5.1.4 Effect of Exchange rate on performance of listed agricultural firms

The study recommends a stability in the Kenyan shilling against the US dollar to be competitive in the global marketplace. A balance has to be reached and maintained in ensuring the exchange rate improves export of Kenyan products while ensuring the local agricultural firms make a good income from the exports. The government policies on

exchange rate need to be anchored on ensuring that the value of the Kenyan shilling and local supply of the dollar aligns with movements in the global market.

5.5.1.5 Effect of Climate Change on performance of listed agricultural firms

The study recommends that firms better prepare farmers for production in different climate conditions. The study also recommends more use of technology in crop production by the agricultural firms to improve productivity. Reduced dependence on rain in agricultural production will improve overall production and therefore better firm performance.

5.6.1 Recommendations for Further Research

This study was on the effects of monetary policies on the performance of NSE-listed agricultural firms. The study recommends further research to be conducted on other policies including fiscal policies that could affect the performance of listed agricultural firms. Further research needs to be done on the effects of monetary policies on all agricultural firms including the unlisted firms. Additionally, the study also recommends investigating the effects of monetary policies on the performance of firms in Kenya.

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APPENDIX

Data Collection Sheet

Year	Average CBK rate	Treasury bills issues	Cash reserve ratio	Exchange rate	Average precipitation level
2020					
2019					
2018					
2017					
2016					
2015					
2014					
2013					
2012					
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Eaagads Limited	ROA	ROE	EPS
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Kapchorua Tea Company Limited	ROA	ROE	EPS
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Rea Vipingo Plantations Limited	ROA	ROE	EPS
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Kakuzi PLC	ROA	ROE	EPS
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Sasini PLC	ROA	ROE	EPS

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Ethics Approval

Strathmore UNIVERSITY

31st January 2023

Mr Dushime Blaise Pascal,
dushimeblz@gmail.com

Dear Mr Dushime,

RE: Effects of Monetary Policy on Performance of Agricultural Firms Listed on Nairobi Securities Exchange

This is to inform you that SU-ISERC has reviewed and **approved** your above **SU-master's (Strathmore University)** research proposal. Your application reference number is **SU-ISERC1544/23.** The approval period is from **31st January 2023 to 30th January 2024.**

This approval is subject to compliance with the following requirements:

i. Only approved documents including (informed consents, study instruments, and MTA) will be used
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by SU-ISERC.
iii. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to SU-ISERC within 48 hours of notification
iv. Any changes, anticipated or otherwise, that may increase the risks or affect the safety or welfare of study participants and others or affect the integrity of the research must be reported to SU-ISERC within 48 hours
v. Clearance for the export of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to the expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days of completion of the study to SU-ISERC.

Before commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology, and Innovation (NACOSTI) https://research-portal.nacosti.go.ke/ and obtain other clearances needed.

Yours sincerely,

for: **Dr Ben Ngoye,**
Secretary; SU-ISERC

Cc: Prof Fred Were,
Chairperson; SU-ISERC

Ole Sangale Rd, Madaraka Estate. PO Box 59857-00200, Nairobi, Kenya. Tel +254 (0)703 034000
Email admissions@strathmore.edu www.strathmore.edu

NACOSTI License

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: 662028

Date of Issue: 21/February/2023

RESEARCH LICENSE

This is to Certify that Mr.. Blaise Pascal Dushime of Strathmore University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Nairobi on the topic: Effects of Monetary Policy on Performance of Agricultural Firms Listed on Nairobi Securities Exchange for the period ending : 21/February/2024.

License No: NACOSTI/P/23/23620

662028

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Verification QR Code

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See overleaf for conditions