RESIDENTIAL MORTGAGE PORTFOLIO, PRODUCT INNOVATION, FIRM CHARACTERISTICS AND PERFORMANCE OF COMMERCIAL BANKS IN KENYA

BY

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other University.

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MAY GOD BLESS YOU ALL

DEDICATION

I dedicate this PhD thesis to:

My beloved parents, my father Benson Nyang'iye Derio and my mother Dorca Atieno

&

My immediate family

Wife: Hellen; Daughters: Cynthia, Sharon, Gloria and Joy Hilda; Son: Samson Junior.

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LIST OF ABBREVIATIONS AND ACRONYMS

ABS	Asset-Backed Security
ADF	Augmented Dickey-Fuller
ARM	Adjustable-Rate Mortgage
CAMEL	Capital Adequacy, Asset Quality, Management Capacity, Earnings, Liquidity
CAR	Capital Adequacy Ratio
CBK	Central Bank of Kenya
EU	European Union
FRM	Fixed-Rate Mortgage
GCC	Gulf Cooperation Council
GDP	Gross Domestic Product
GLS	General Least Squares
HFC	Housing Finance Company
IFRS	International Financial Reporting Standards
IMF	International Monetary Fund
LTV	Loan-to-Value
MBS	Mortgage-Backed Security
MPT	Modern Portfolio Theory
NIM	Net Interest Margin
NPL	Non-Performing Loan
NSE	Nairobi Securities Exchange
OECD	Organization for Economic Co-operation and Development

OLS	Ordinary Least Squares
OTD	Originate to Distribute
ROA	Return on Assets
ROE	Return on Equity
SACCO	Savings and Credit Co-operative Organization
SGMM	System Generalized Method of Moments
SMM	Secondary Mortgage Market
USA	United States of America
VIF	Variance Inflation Factor

ABSTRACT

In the recent times, residential mortgage portfolio has received much attention from academics, investors and managers as well as from policymakers. This is mainly because of the different aspects through which mortgage portfolio components such as portfolio size, portfolio quality and interest return can impact the performance of commercial banks.This study sought to investigate the relationship between residential mortgage portfolio, product innovation, firm characteristics and performance of commercial banks in Kenya. The specific objectives were to establish the effect of residential mortgage portfolio on bank performance; evaluate the effect of mortgage product innovation on the relationship between residential mortgage portfolio and bank performance; determine the effect of firm characteristics on the relationship between residential mortgage portfolio and bank performance and examine the joint effect of mortgage product innovation and firm characteristics on the relationship between residential mortgage portfolio and bank performance. These objectives had a number of corresponding hypotheses and sub-hypotheses which were tested to achieve the main goal of the study. The study was anchored on the Modern Portfolio Theory, Agency Theory and Asymmetric Information Theory. The study was guided by positivism research philosophy and adopted a correlational descriptive research design. The study collected and utilized panel data from the annual residential mortgage surveys conducted by the Central Bank of Kenya (CBK) on commercial banks covering a thirteen-year period from 2006 to 2018. Secondary data was collected from the financial statements of commercial banks as submitted to the CBK and Kenya Bankers Association (KBA) database. Data was analyzed using descriptive and inferential statistics. Hypotheses were tested through panel regression models and the Baron and Kenny (1986) approach. The results revealed that residential mortgage portfolio attributes, namely: portfolio quality and interest return significantly influence bank performance. The effect of mortgage term on the relationship between mortgage portfolio quality and bank performance was negative and statistically significant. Loan to value (LTV) ratio was, however, found not to significantly intervene the relationship between residential mortgage portfolio and performance of banks operating in Kenya. For firm characteristics, firm age had a significant moderating impact on the relationship between interest return and bank performance, but does not moderate the relationship between portfolio size as well as portfolio quality and bank performance. Finally, the study revealed that product innovation and firm characteristics jointly affect the relationship between residential mortgage portfolio and bank performance. Specifically, firm size and firm age positively influences the relationships and these were statistically significant. The study calls on bank managers to structure their mortgage quality and interest return in a way that ensures better performance. Since mortgage product innovation and bank characteristics influence the relationship between residential mortgage portfolio and bank performance, the study recommends that bank managers pay close attention to the institutional environment and product characteristics in designing their mortgage loan portfolios. Up to 75% of residential mortgage portfolio in Kenya is controlled by six (6) large banks. The inclusion of other banks in the study therefore introduced the problem of missing values on some variables, which affected the normality of the data and choice of the panel regression model to use. Future studies should consider the use of residential mortgage portfolio as a composite variable based on tested methodologies for more insight on bank performance.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

The loan portfolio of commercial banks is normally one of the largest assets on their balance sheet and the predominant source of income. Residential mortgage loans typically constitute a large portion of this portfolio and are one of the key assets in determining bank performance (Martins et al., 2014). The share of commercial banks' loan book in residential mortgages has grown in most countries and is high by historical comparison (Kearns & Woods, 2006). The strong growth in residential mortgage loans is attributed to broadened mortgage contracts and product innovation, among other factors (Gyntelberg et al., 2007). The volume and quality of mortgage loan portfolio held by banks is influenced by firm characteristics such as size, age and ownership (Haas et al., 2010). Gasper (2015) opines that as banks increase their investment in mortgage loans, any widespread shock that hits the property market can have a material impact on their performance. The turbulence observed in international financial systems post 2007 originating from mortgage markets illustrate the close relationship between the real estate sector and soundness of the financial sector (Koetter & Poghosyan, 2008).

Financial institutions hold diversified portfolio of loans in different categories with the objective of generating desired returns to their shareholders and to minimize the risk of default, aligned to the modern portfolio theory (Markowitz, 1952). Residential mortgage portfolio is usually a volatile loan asset for most banks and is exposed to default risks, which results in higher non-performing loans (NPL) than those for loans to other sectors (Davis & Zhu, 2009). This impacts the quality of the loan portfolio and hence bank performance. Residential mortgage loans also generate interest income, which is a prime source of revenue for banks and contributes significantly to their

performance (Misra & Aspal, 2013). Agency theory (Jensen & Meckling, 1976) suggests that divorce of ownership and control in a firm often leads to conflict of interest between agents or managers and their principals who are shareholders of the organization. Heffernan (2005) posits that the positive correlation between bank size and executive compensation can drive bank managers, as agents, to take decisions that may boost the loan portfolio of the bank and also undertake various product innovations in order to grow the asset base of the bank, hence bank size and performance. Bank managers also take decisions on the level and type of customer deposits to accept and loan advances to issue, which impacts the bank's lending capacity.

The imbalance of information held by lenders and borrowers can drive banks to innovate by developing new products that suit the different needs of their customers and achieve a competitive edge in the market, develop new market segments, grow the demand for their products and improve bank performance, aligned to Asymmetric Information Theory (Akerlof, 1970). Martins et al. (2014) argues that banks usually exploit positive real estate market trends to expand their loan portfolio by lowering lending standards and also granting mortgage loans with high LTV ratio and longer mortgage terms. The loan portfolio therefore expands and income received grows as a result of these activities. A downturn in the market could lead to non-performing loans.

The mortgage market plays a crucial role in a country's economy due to its linkage with most macroeconomic variables and also as a determinant of stock market and banking sector performance (Kalra et al., 2000). Renaud (2004) posits that when the mortgage market is functioning well, it can act as a stimulant to economic growth and can positively impact the national economy through construction sector employment, efficient real estate development, capital market development, easier labour mobility,

lower macroeconomic volatility and more efficient resource allocation. It can also generate a strong influence on investments, savings and consumption choices of households and businesses (Kalra et al., 2000). For individual households, buying a house normally involves a large financial outlay and usually requires long-term mortgage financing (Garriga & Hedlund, 2020). Residential mortgage markets are therefore an important contributor to household wealth accumulation and retirement strategy. Capital required for start-up businesses in many countries come from mortgage finance, since housing assets can be used as collateral for economic investment. Homeowners can also borrow against housing wealth through mortgage equity withdrawals (Chiquier & Lea, 2009).

Mortgage history is, however, fraught with booms and busts over time that have seen rapid expansion and success for institutions originating mortgage loans as well as recessions and depressions of devastating consequences on their performance. There are many examples of mortgage market booms and busts that have occurred in the past, such as in the United Kingdom, the United States, Spain and Ireland during the 2008 financial crisis and also in Sweden in the 1990s. Such incidents of mortgage boom-bust episodes may lead to large scale financial instability across countries, often driven by the role of government in the housing market and important differences in countries' mortgage market systems (Westin et al., 2011).

Understanding the performance of commercial banks is important due to the effect the banking sector has on a country's financial stability and economic growth (Martins et al., 2014). For a country, mortgage debt outstanding as the ratio of Gross Domestic Product (GDP) is a good proxy for gauging its mortgage market development (Bank of Ghana, 2007). Whereas outstanding mortgage debt to GDP is 50% to 100% in advanced

economies, and also 20% to 35% in middle income countries, it often accounts for less than 10% in emerging markets (Chiquier & Lea, 2009) and in Kenya, the mortgage penetration is around 2.5% of GDP. This is higher compared to the East African neighbours of Tanzania and Uganda but still below developing country peers such as Colombia (7%) and India (6%), (Central Bank of Kenya (CBK) & World Bank, 2010).

In spite of the recognized social and economic importance, residential mortgage markets have remained relatively under-developed in emerging economies, often accounting for less than 10% of GDP. The mortgage market in these economies is mostly small, depository-based and poorly accessible. Lending institutions are therefore vulnerable to significant interest, credit and liquidity risks as well as high inflation rate, lack of long-term funding and a lack of affordability due to low incomes (Arvanitis, 2013). There has also been a history of weak legal systems, an unstable macroeconomic environment and low growth rates that do not protect lenders' interest adequately, and an underdeveloped infrastructure for origination of mortgage loans. Developing a robust mortgage finance market to improve homeownership rate is therefore paramount in emerging economies as governments manage the challenges of population growth, urbanization and a growing middle class (Chiquier et al., 2004).

1.1.1 Mortgage Portfolio

Chambers et al. (2008) define a mortgage as a loan issued against real property as security. In mortgage financial markets, the debt instrument is based on land and building as collateral. The term mortgage is from the old French words *mort* and *gage*, meaning literally "dead pledge", in the sense that the property is forfeited or "dead" to the customer in case the mortgage loan is not repaid, and the pledge itself is dead if the loan is repaid. According to Roche (1997), a debt used to purchase a home goes by the

name residential mortgage. A residential mortgage therefore refers to a loan that allows a borrower to make many payments over time when the house is pledged as collateral. Such loans form the residential mortgage portfolio in the balance sheet of the issuing institution.

Focus on residential mortgage portfolio of commercial banks is important for three main reasons. First, such portfolios normally make up the largest category in the loan book of most banks, with a weight of up to 33% in some EU countries (Martins et al., 2014). Second, property loans are usually the most volatile loan asset for most banks, which results in higher non-performing loans (NPL) than those for loans to other sectors (Davis & Zhu, 2009). They are also the major source of risk to a bank's performance and have been identified as the main triggers for losses and failures of banks, mostly due to poor portfolio risk management, weak credit standards and an unstable economic environment. Excessive risk taking in mortgage lending is mentioned as a primary contributor to the financial crisis which took place in 2008 (Acharya et al., 2011). Therefore, research focusing on the association between residential mortgage loans and bank performance is important. Finally, contextual differences exist in the characteristics of the mortgage products between countries and financial institutions.

Allen et al. (1995) posits that the relationship between bank performance and mortgage loans can only be significant if the bank holds a sizeable portfolio of such loans and the portfolio can be impacted by variations in real estate values. The value of residential mortgage loans in the books of commercial banks is often exposed to both default and interest-rate risks, which are also driven by movements in real estate values. The value of the secured loan therefore decreases when there is a drop in collateral values, which increases the probability of default. Thus, collateral values impact the value of

mortgage loans and there is an inverse relationship between potential loss to a bank and market value of the mortgaged property. According to Lausberg (2004), issuing of mortgage loans is a risky business, and there is ample evidence from a number of countries of significant bank losses or even failures arising from defaulted mortgage loans.

Misra and Aspal (2013) posits that interest income is a prime source of revenue for banks and contributes significantly to their performance. Abdulrehman and Nyamute (2018) found a positive impact of interest charged on mortgages on the returns of commercial banks. Net interest income indicates the capability of the bank to generate revenue from its lending business. They view net interest margin (NIM) as the difference between interest income on loans issued and cost of funds as reflected in the interest expense paid on customer deposits. The higher the NIM spread, the better the earnings of the financial institution. Mortgage loans are a major contributor to interest income. Garriga and Hedlund (2020) posit that banks set mortgage interest rates based on the default risk profile of each individual borrower.

Mortgage portfolio size has been derived as the proportion of mortgage loans to total loans (Allen et al., 1995; Chen, 2015; Martins et al., 2014), and mortgage portfolio quality as the proportion of non-performing loans in total loans (Allen et al., 1995; Carballo-Huerta & González-Ibarra, 2008; Martins et al., 2014). Mortgage interest return has been measured as net interest income (the difference between the interest income earned from mortgage loans and cost of funds as reflected in the interest expense paid on deposits) (Misra & Aspal, 2013).

1.1.2 Product Innovation

Innovation has been defined as a new idea, devise or method that provides an improved

product or service and can result in a reduction in cost or risk (Frame & White, 2009). Economists view innovation as a process, practice or product which is new to an industry and focus on “innovation speed” within the industry; whereas organization theorists look at innovation as a process, practice or product which is new to a firm and emphasize on “innovation magnitude” (Gopalakrishnan, 2000). Researchers have therefore examined the concept of innovation from many perspectives, including its overall effectiveness in improving performance through market share, increased earnings and lower costs.

Meeus and Edquist (2006) have described product innovation as a process which leads to the sale of a good or service that offer improved functions or characteristics than the ones available in the market. Through product innovation, an organization can gain a competitive advantage by differentiating its products and increasing the quality and variety of goods that allow it to grow market demand and open new growth opportunities (Maier et al., 2013). Production innovation is usually triggered by factors such as the need to replace goods and services that no longer meet the needs of customers, changing business environment, intensity of competition and seasonal variations in demand (Maier, 2018).

There has been tremendous product innovation in the mortgage industry over the past half a century. Characteristics of mortgage products have evolved, with a wide range of mortgage products such interest-only loans, mortgages with adjustable rates (ARMs), negative amortization loans and option ARMs in the market (Warnock & Warnock, 2008). The 2008 financial crisis also led to the introduction of alternative mortgage products such as shared equity models and loans that permit customers to cap their inflation risk (usually via index linking) or the risk associated with interest rate

(via capped mortgages) (Westin et al., 2011). There is also a trend towards higher loan to value (LTV) ratio, resulting in lower down payment for mortgage loans (Gyntelberg et al., 2007). To address the liquidity constraint posed by retail depository mortgage systems, countries have introduced secondary mortgage markets (SMM), which allows the sale of financial assets backed by pools of mortgage loans in the capital market (Chiquier & Lea, 2009). A number of financial institutions also have foreign currency denominated mortgage loans to tap into Diaspora funds. These innovations have increased access to mortgage credit, thus leading to the expansion of the mortgage portfolio of financial institutions.

A well-functioning mortgage finance market normally holds a large number of mortgage products, which are designed to fulfil the requirements of various borrowers and lenders. Customers put a lot of focus on the affordability of the mortgage loan whereas institutions originating loans focus on securing an acceptable risk-adjusted return over the loan term. This often presents a conflict, as an attempt to improve affordability of the mortgage loan to the borrower or return to the lender creates an issue for either party in the transaction (Chiquier & Lea, 2009). Alternative mortgage products have received renewed attention following the 2008 financial crisis to enhance credit risk management. Such alternative products include those where customers do not bear the full interest rate increases; schemes that allow customers to limit the level of interest rate risk they can bear (through capped mortgages) or inflation risk (through index linking) and shared equity models, which allow growth in property values to be shared between the lender and mortgagee (Westin et al., 2011).

In many countries, standard mortgages are being phased out and instead non-standard mortgages are being introduced, resulting in a significant expansion in mortgage credit

portfolio for lenders. Chambers et al. (2008) posits that the market share for non-traditional mortgage products has increased and now make up a significant component of mortgage loan portfolio of lending institutions. The specific features of these non-standard mortgage products are, however, dependent on each country's laws and regulations and also its own particular 'mortgage culture' (Scanlon et al., 2008). Since the share of standard mortgage products is declining, this study put specific focus on the features of non-standard mortgage products. In Kenya, the study established that the mortgage market is still dominated by standard mortgage loans and no banking institution was issuing non-standard mortgage products over the study period.

Innovation magnitude is measured as the number of new loans that an organization adopts as a ratio of the available pool of innovative products (Gopalakrishnan, 2000). A high score is indicative of emphasis on innovative mortgage products. Loan to value (LTV) ratio has been measured as the proportion of mortgage loan to the property value (Martins et al., 2014) and mortgage loan term as the number of years it takes to fully amortize the loan (Martins et al., 2015).

1.1.3 Firm Characteristics

These are the individual attributes which are unique to a firm and could influence its loan origination as well as performance. They include ownership, size, lending capacity and age (Haas et al., 2010; Carter et al., 1998). Such characteristics can impact bank performance, as they influence banking efficiency, quality of the loan portfolio, operating expenses and share of liquid and fixed assets.

Atahau (2014) has defined firm ownership as the proportional dispersion of shareholding in an organization, with focus on how shareholders control its activities

either directly or indirectly. Bank ownership types are normally classified by researchers as domestic and foreign-owned banks to reflect differences arising from performance and risk-taking behaviour. According to Atahau (2014), bank ownership types are classified as domestic and foreign-owned banks, based on equity ownership thresholds or level of control exercised. The International Financial Reporting Standards (IFRS) regards shareholding in excess of 50% as indicative of controlling ownership. Atahau (2014) further observed that government banks in developing economies are more aggressive in lending and are more likely to originate mortgage loans. Haas et al. (2010) posits that foreign banks mainly grant credit to multinational and foreign-owned organizations.

A study by Atahau (2014) has suggested that the performance of domestic banks in emerging economies is usually characterized by low efficiency; poor lending decisions reflected in high non-performing loans (NPLs); inefficient capital allocation and low profits. Lending decisions for such banks is based on motives reflecting relationship or political considerations instead of commercial principles. Foreign banks, however, are more prudent in their lending decisions and as such record lower non-performing loans than other banks. A study by Iannotta et al. (2007) confirmed the relatively low performance of banks owned by the government as compared to other banks in terms of loan quality, insolvency risk and profitability. Foreign-owned banks were found to record better profitability, especially for those banks operating in less competitive markets and also when their holding companies are highly profitable (Chen & Liao, 2011).

Local banks normally have a better understanding of the domestic market and therefore tend to lend on the basis of ‘soft’ qualitative information such as ability of the customer

to repay. Foreign banks, however, have issues evaluating soft information and normally make lending decisions on a transaction-by-transaction basis taking into account hard and quantitative information. The information considered may include credit scoring data, financial ratios calculated from the customer's financial statements and quality of collateral. Such banks therefore issue loans to large businesses and foreign-owned firms as they are normally more transparent than individual borrowers and small local businesses (Haas et al., 2010).

Firm size is also a contributor to the loan portfolio of commercial banks, as big banks enjoy a comparative advantage in originating more loans since they can take advantage of economies of scale in assessing loan applications. Small banks, however, may not lend to many customers because of size limitations and are likely to have smaller mortgage loan portfolios (Haas et al., 2010). Ngigi et al. (2021) posits that bank size is an indicator of the institution's financial strength and its ability to drive business performance in the market in which it operates. Bank size is normally measured in research as the natural logarithm of total assess (Black et al., 2010; Sarkisyan et al., 2009).

Lending capacity also defines a bank's ability to originate mortgage loans. Black et al. (2010) describes a bank's lending capacity as its ability to finance loans with its core deposits. Local banks normally use retail deposits to fund information-intensive loans. "Market-based banks", mostly foreign banks, apply market debt to fund loans that are easier to evaluate. This drives the mortgage origination activity of these banks. Deposits are limited, which means that banks who want to continue funding new mortgages may need to switch from retail deposits to external debt borrowed from the market. External finance involves the payment of a premium, which is passed through to borrowers by

raising loan interest rates. In emerging markets, due to lack of securitization, many banks still fund a significant percentage of their mortgage originations using deposits (Chen, 2015). Central banks in a number of countries have capital adequacy legislations that also affect the proportion of funds available for loan origination. Black et al. (2010) suggests the measure for bank funding or core lending capacity as "loan-to-core deposit ratio". Chen (2015) suggests the measure for lending capacity as the proportion of total demand deposit in total assets.

An organization's age is normally viewed as the period it has been in operation in terms of years, with the result that older firms are better established and possess the knowledge and infrastructure for mortgage origination. Carter et al. (1998) posits that older firms have longer operating histories and face less uncertainty in their performance. Adusei (2011) found that profitability improved as a bank increases in years of operation, explained by deeper knowledge of its customer base and higher confidence gained by suppliers of equity as well as debt finance on the bank's creditworthiness. The bank is therefore able to pursue prudent lending and has enhanced ability to raise funds to support its operation. Age is measured in research as the natural logarithm of the years the organization has been in operation since incorporation (Adusei, 2011).

1.1.4 Bank Performance

Lebas and Euske (2006) define performance as a set of indicators, financial and non-financial, that show how well an organization has achieved its objectives. Richard et al. (2009) posits that firm performance looks at three key areas: shareholder return such as total shareholder return and economic value added; financial performance matrices including rate of return on investment, profits and rate of return on assets; and market

performance matrices such as sales and market share. Due to increasing complexity in the business environment, historical financial measures are less indicative of shareholder value, as this is driven by forward looking non-financial factors such as organization's innovation, employee satisfaction and customer loyalty (Striteska & Spickova, 2012). Bank performance has been defined by Hajer and Anis (2018) as the achievement of the objectives set forth by the institution within the agreed time and with minimal costs while using available resources. Common financial ratios for measuring bank performance include ROA (return on asset), ROE (return on equity), NIM (net interest margin) and PER (price earnings ratio) (Khrawish, 2011).

Academics and practitioners use various performance measures for commercial banks that include economic, traditional and market-based measures. Even though banks have become more sophisticated, their performance drivers remain leverage, efficiency, risk-taking and earnings. Procedures, commonly referred to as CAMEL rating systems, have been developed across countries to generate financial soundness rating for banks and to anticipate those approaching financial distress (Ogilo, 2012). When the CAMEL rating system was introduced around 1979, it had five components. The sixth component, called sensitivity to market risk, was included in 1996, hence the acronym CAMELS (Dang, 2011). The last acronym is not widely applied due to difficulties in measurement. Even though alternative bank performance models exist, the CAMEL system is applied by most banking institutions and has also been recommended by IMF and the Basel Committee on Bank Supervision (Olweny & Sipho, 2011). In Kenya, the CBK applies the CAMEL score to measure the performance of commercial banks in the country. The current study has adopted the composite CAMEL score as the measure of performance.

The CAMEL acronym represents: Capital Adequacy, Asset Quality, Management Capacity, Earnings and Liquidity. Capital Adequacy can be measured by a number of ratios, such as the ratio of capital to assets, Capital Adequacy Ratio (CAR) or the ratio of capital to risk-weighted assets (Dang, 2011). Asset Quality is measured by the proportion of NPLs in total loans (Dang, 2011). Management Capacity is captured by total advances to total deposits (Kabir & Dey, 2012). Earnings ability is estimated using ROE; ROA; NIM and the ratio of cost to income (Dang, 2011). The following ratios are used to measure Liquidity: the ratio of customer deposits to total assets, the ratio of total loan to customer deposits and the ratio of cash to deposits (Desta, 2016). Supervisory authorities in the banking sector assign a CAMEL score to each bank on a scale of one (best) to five (worst) for each factor. Where the average score is below two, the bank is considered to be a high-quality institution, while banks with scores greater than three are considered to be less-than-satisfactory establishments (Dang, 2011).

1.1.5 Commercial Banks in Kenya

Banks have a key role to play in a country's economy. Atahau (2014) has described banks as institutions that are intermediaries between savers and borrowers of funds; underwrite securities; facilitate payment systems; balance inter-temporal risks; ameliorate asymmetric information problems and contribute to economic growth. According to Chen (2015), the main business of banks is holding deposits and making loans. Gasper (2015) posits that commercial banks operate on a highly leveraged balance sheet, have a big role in liquidity creation and works with maturity transformations over a long period of time. They differ from other institutions, such as hedge funds, due to their close connection with the real economy and are therefore obliged to coordinate and take up good investment options.

The banking sector in Kenya is regulated by the Companies Act (CAP 486); Central Bank of Kenya Act (CAP 491); the Banking Act (CAP 488) and a number of prudential guidelines released by the CBK from time to time. The Banking Act (CAP 488) has described a 'bank' as an institution that conducts or proposes to conduct banking operations within the Republic of Kenya, except the Central Bank. CBK Bank Supervision Annual Report (2018) indicated a total of 43 banks in Kenya (1 mortgage finance company and 42 commercial banks) as at 31st December 2018, out of which 40 were privately owned and 3 were government-owned. Out of the 40 private banks, 15 were foreign-owned and 25 were locally-owned. Out of the 25 locally-owned banks, there was 1 mortgage finance company and 24 commercial banks. The 15 foreign-owned commercial banks comprised 12 domestic subsidiaries and 3 branches of foreign banks.

CBK Bank Supervision Annual Report (2018) further observed that commercial banks in Kenya recorded strong performance, with total net assets increasing by 10.4% and pre-tax profits by 14.6% during the period due to growth in loans and advances as well as investment in government securities, which were up 15.1% and 19.0% respectively. Net loans and advances accounted for 52.6% of the overall net assets of the commercial banks and was the most material item in the banks' balance sheet. Asset quality, however, declined, with the ratio of NPLs growing to 12.7% in December 2018 from 12.3% in December 2017, attributable to late payments by public and private entities, decline in business activities and subdued uptake of housing units in the real estate sector.

In Kenya, banking institutions are the dominant originators of mortgage loans (Walley, 2011). According to Mutero (2007), Kenya has had a checkered history of mortgage

finance, with booms and lowdown over the years. The years preceding independence in 1963 were marked by stagnation in the Kenyan mortgage market due to political uncertainty. This, however, gave way to a phase of substantial expansion after independence until 1986 and 1988 when the mortgage industry experienced some stagnation before rebounding back in 1989 and 1990.

Mutero (2007) further observed that a key development took place in 1991, when the interest rate regime was liberalized, with the objective of ensuring a more efficient allocation of resources. The spike in annual inflation in 1993, which averaged around 40%, however, overshadowed the impact of the new interest rate regime. The mortgage industry though registered some expansion despite these setbacks. The change of government in December 2002 saw major policy shifts in the financial sector, with a substantial reduction in public sector borrowing, resulting in Treasury bill yields decreasing to below 3% in 2004 from a high of above 22% in 1996. The fall in Treasury bill yields encouraged commercial banks to focus more on mortgage lending which was more profitable, interest rate on mortgage loans had also fallen significantly to between 12.5% and 14% in 2007 from 31% in 1996, with mortgage uptake increasing as a result.

The market for mortgage loans has increased substantially in recent years, both in the number of loans and value of mortgage loans outstanding (Walley, 2011). Various CBK surveys have established that the mortgage market has significantly improved, growing to Kshs. 224.9 billion in 2018 from Kshs. 90.4 billion in 2011. The number of outstanding Mortgage loans also grew from 16,029 in 2011 to 26,504 in 2018 (CBK Bank Supervision Annual Reports, 2011 - 2018).

Mortgages in Kenya are originated by two types of banking institutions, namely: commercial banks and housing finance companies (HFCs), though commercial banks

dominate the mortgage market. Of the 43 banking institutions, 33 offered mortgages in 2018 compared to 31 in 2017. The bulk of mortgage loans (about 76.1 %) was originated by about 6 commercial banks: 5 institutions in the large peer group (61.1%) and 1 medium sized institution (15.0%) in 2018. In comparison, 2017 had 75.5% of mortgage loans issued by 5 banks in the large peer group (55.6%) and 1 medium sized bank (20.9%). NPL in the mortgage sector grew by 40% between 2017 and 2018 (CBK Bank Supervision Annual Report, 2018).

Kenya largely funds its mortgage loans from short-term deposits. The country has a sizeable investor base comprising pension funds, insurance companies and individual investors, which are potential investors in a secondary mortgage market (Walley, 2011). Introduction of a secondary mortgage market is long overdue, though discussions are still on-going (Mutero, 2007).

Walley (2011) observed that some competition and product innovation have been introduced by the new entrants into the mortgage market in Kenya, formerly dominated by a few players, such as choice of fixed-rate mortgages, one hundred percent financing and home equity loans secured by mortgaged properties. Product range is, however, still limited largely because mortgage institutions provide standard mortgage products only and not non-standard mortgage products. This scenario has been well captured by Feather and Meme (2019) who argued that housing finance in Kenya is dominated by standard mortgage products, unlike in developed countries that have both standard and non-standard mortgage products. In addition, there is currently lack of consumer price elasticity which has given commercial banks the opportunity to charge high interest rates. Due to lack of a secondary mortgage market, there are no linkages to the capital market.

1.2 Research Problem

Residential mortgage loans are usually a volatile component of a bank's loan portfolio and have a high potential to impact commercial bank performance (Davis & Zhu, 2009). Loan portfolio is also a major source of risk for financial institutions and can impact their safety and soundness. The composition of a bank's loan portfolio and its impact on performance is normally a debate between concentration and diversification strategies employed by the firm. Traditional banking theory supports loan portfolio diversification as it reduces the risk of bank failure and results in lower financial intermediation costs (Martins et al., 2014). Corporate finance theory, however, supports concentration strategy as banks can exploit the benefits of enhanced expertise and monitoring knowledge in a single or few sectors (Atahu, 2014). Concentration in residential mortgage loans by financial institutions, enhanced by use of product innovation, had reached a level that could result in undesirable impact on performance in the event of a significant downturn, as happened during the 2008 financial crisis (Igan & Pinheiro, 2010).

Residential mortgage loans have grown rapidly in the loan book of Kenyan commercial banks in recent years both in value and number of loans due to the growth in housing demand. Though this offers enormous opportunity for banks who issue mortgages to grow their loan book and improve their performance, the banking sector is at risk of over exposure to this asset. The ratio of mortgage NPLs to gross mortgage loans has been growing and had risen above the industry ratio by 2018, which demonstrates the increasing credit risk associated with the growth in mortgage loans, hence impact on bank performance. The mortgage industry in Kenya is also dominated by the large commercial banks, with 76.1% of the loans being originated by six banking institutions in 2018, five of which were from the large peer group (CBK Bank Annual Supervision

Report, 2018). This may be indicative of high risk for medium and small banks or barriers to entry (Ngigi et al., 2021; Odhiambo, 2015).

The housing gap in Kenya is estimated at about 200,000 units per year (Giti et al., 2020). Expanding the mortgage portfolio of financial institutions can significantly contribute to bridging the housing gap that exists in the country. A World Bank survey conducted by Walley (2011) found potential for growth in the residential mortgage market in Kenya to Kshs. 800 billion, which is about 13 times the existing size. Such growth can increase the ratio of mortgage debt to GDP from the existing 2.5% to 32.5%, which compares favorably to South Africa.

Previous studies have put significant attention on the interaction between banking institutions and the mortgage market prior to and post the 2008 mortgage triggered financial crisis. Allen et al. (1995), Martin et al. (2014) and Gasper (2015) confirm the existence of positive and significant relationship between the mortgage loan portfolio and performance of individual banking institutions. Atahau (2014); Black et al. (2010) and Haas et al. (2010) discuss how individual bank characteristics impact bank performance and concur on the significance of these variables to the composition of bank loan portfolios. Majority of these studies, however, focus on mature mortgage markets in the US and Europe, and lately Asia, and therefore their results may not directly be applicable in emerging markets in Africa. A number of these studies are also cross country studies based largely on macro-economic data, with less extant work based on firm level micro-data, and examined variables, time periods and target markets differ greatly.

Most studies have also not taken into account the impact of product innovation and have included only one or two of the individual characteristics of banking institutions

in isolation, though these factors can contribute significantly to the growth of the mortgage portfolio and impact performance of the bank. There are conflicting outcomes in some of the studies as well. Odhiambo (2015) found that the relationship between property finance and the financial performance of banks listed on the Nairobi securities exchange (NSE) is not significant, while Abdulrehman and Nyamute (2018) found a significant relationship between mortgage financing and financial performance of commercial banks in Kenya. Carballo-Huerta and González-Ibarra (2008) found a positive impact of innovative loans on the expansion of mortgage portfolio and profitability, whereas Gopalakrishnan (2000) and Sarkisyan et al. (2009) found no impact. Government owned banks were found to generate a lower volume of NPL and are more profitable in Indonesia (Atahau, 2014), contrary to evidence in other markets (Iannotta et al., 2007). There is therefore a lack of consensus on the impact of the variables in scope for this study on the performance of banks across a number of countries.

A study conducted in an emerging market, where there is tremendous growth potential in mortgage loans, show that mortgage finance models in developed economies may not be wholly adoptable in emerging markets, where the linkage to capital markets is still weak and mortgages are largely funded by deposit liabilities, and recommend innovative products suited to the local markets (Akinwunmi, 2009). These contextual variations need verification through an in-depth empirical study on Kenya. In Kenya, mainstream academic research appears not to have given much consideration to the role of residential mortgage loan portfolio on the performance of banking institutions. Odhiambo (2015) conducted a study based on a narrow sample of nine commercial banks listed on the NSE and concluded that real estate finance has no effect on the financial performance of banks operating in Kenya. Other studies on banking sector in

Kenya have looked at the general determinants of financial performance (Ongore & Kusa, 2013) and financial performance from a credit risk perspective (Ogilo, 2012). This study focused on residential mortgage portfolio, product innovation, firm characteristics and their impact on the performance of banks licensed and operating in Kenya in order to bridge the research gap which still exist. This study therefore, attempted to resolve the following research question: What is the relationship among residential mortgage portfolio, product innovation, firm characteristics and performance of commercial banks in Kenya?

1.3 Research Objectives

The general objective of this study was to investigate the relationship among residential mortgage portfolio, product innovation, firm characteristics and performance of commercial banks in Kenya. The specific objectives were to:

(i) Establish the effect of residential mortgage portfolio on the performance of commercial banks in Kenya;

(ii) Evaluate the effect of mortgage product innovation on the relationship between residential mortgage portfolio and performance of commercial banks in Kenya;

(iii) Determine the effect of firm characteristics on the relationship between residential mortgage portfolio and performance of commercial banks in Kenya;

(iv) Examine the joint effect of mortgage product innovation and firm characteristics on the relationship between residential mortgage portfolio and performance of commercial banks in Kenya.

1.4 Value of the Study

This research contributes to finance theory, practice and policy in many ways. At the core of financial intermediation theory is the maturity conversion of short-term bank

liabilities, such as customer deposits, into long-term bank assets such as mortgage debt. A mortgage loan is therefore a good example of such maturity transformation and generates more agency conflicts and market frictions than in other segments of the financial sector. This study therefore explores the place of mortgage loan portfolio in the maturity transformation process from the perspective of a nascent financial market such as Kenya. Mortgage loans are also becoming important financial assets in developing countries, whose management is at the core of financial sector stability. Market regulators should therefore pay close attention to mortgage product innovations that come into the market and their potential impact on bank performance and the financial system as a whole.

The study findings contribute to finance and banking theory by testing the application of and providing examples for modern portfolio theory; agency theory and asymmetric information theory in the construction of mortgage portfolios of commercial banks in an emerging market. Diversification of loan portfolios by commercial banks contribute to bank profitability and stability, which is herein tested for banks operating in Kenya. The application of agency theory is studied by use of firm characteristics as a moderating variable. Institutional characteristics drive decisions on loan concentration or diversifications and the type of product innovations to undertake, which impact the performance of banks. Asymmetric information theory is tested through the quality and return on the mortgage portfolio, which is largely driven by the level of credit risk institutions originating loans are prepared to take.

The study is also important to lending institutions, the government and real estate investors in less developed markets as well as donor agencies. To bank managers, the study findings infers tools on how to structure their loan mortgage portfolios and offer

evidence on how bank performance is impacted by the volume of mortgage loans held on the balance sheet. To policy makers, the study helps in devising appropriate strategies, options and mortgage infrastructure necessary to accelerate the depth and penetration of mortgage finance in their markets. The study informs government institutions and policy makers on policy formulation for real estate investments. Emerging markets which share key similarities with Kenya also benefit from knowledge gained in this study as bank managers in those markets can use its outcome to structure portfolio size, quality and returns of their mortgages in a way that ensures better performance for their organizations.

1.5 Organization of the Thesis

The report is divided into six chapters: introduction; literature review; research methodology; descriptive data analysis and results; hypothesis testing and discussion of findings; and finally summary, conclusions and recommendations. Coverage of these chapters is discussed below.

The first chapter introduced the key concepts of this study and includes residential mortgage portfolio, firm characteristics, product innovation and firm performance. A description of commercial banks in Kenya is then provided, which is the basis of formulating the research problem, research questions and research objectives. The chapter concludes with a discussion on the value of the study, which justifies the need for research.

The second chapter describes both the theoretical and empirical literature, which brings out the interrelationship among the key variables of the study. Theories anchoring the study includes the Modern Portfolio Theory (Markowitz, 1952), Agency Theory (Jensen & Meckling, 1976) and Asymmetric Information Theory (Akerlof, 1970). The

chapter further summarizes the empirical studies and research gaps identified which is then followed by presentation of the conceptual framework and model as well as the research hypotheses to be tested.

The third chapter describes the research methodology for this study which comprises the research philosophy, research design, population of the study, data collection techniques, diagnostic tests, operationalization of the research variables and data analysis techniques.

Chapter four covers the descriptive data analysis and results and presents the descriptive statics (minimum, maximum, mean, standard deviation, skewness and kurtosis), diagnostic tests (normality, collinearity, independence and heteroscedasticity) and finally assessment of the correlation among the variables.

The fifth chapter presents the test of hypothesis (and sub-hypotheses) and a presentation of research findings. Hypotheses presented have tested the relationship between residential mortgage portfolio and firm performance as well as the moderating impact of firm characteristics and the intervening impact of product innovation. The sixth chapter focuses on summary of findings, conclusions, contribution to knowledge, policy, practice, theory, limitations of the study and suggestions for future research.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter provides an overview of the theoretical and empirical literature relevant to the study. It captures the research gaps, develops a conceptual framework which ties the study variables together and research hypotheses.

2.2 Theoretical Foundation

The theoretical foundation of residential mortgage portfolio and bank performance traverses the corporate finance literature and includes: Modern Portfolio theory, Agency Theory and Asymmetric Information Theory. The theories anchoring the study are discussed below.

2.2.1 Modern Portfolio Theory

This is the main anchoring theory of the study and supports the primary relationship between residential mortgage portfolio and bank performance. Developed by Markowitz (1952), the theory asserts that investors seek to maximize utility and that individuals are risk averse and interested in optimal portfolios. A useful definition of the theory has been provided by Mangram (2013) who suggested that Modern Portfolio Theory (MPT) is viewed as an investment framework for selecting asset portfolios by looking at how they contribute to the maximization of expected portfolio returns as well as the simultaneous minimization of portfolio risks. MPT postulates that in equilibrium, investors select a portfolio that gives them the least variance for the expected level of return or more and the most expected return for a given variance or less. The mean variance principle has resulted in an efficient frontier being formulated out of which investors can select the investment portfolio that meets their risk and return preferences. Diversification is therefore at the core of modern portfolio theory and in more simple

terms, it relates to the popular adage of not putting all eggs in one basket. Knowledge of how to properly measure and price financial risk can lead to correct valuation of risky assets, which results in better allocation of scarce resources. Managers can apply portfolio theory in the efficient allocation of funds received from shareholders to available investment opportunities and individuals can also use portfolio theory principles to choose between risky securities when investing their savings.

Critics of the modern portfolio theory maintain that it is a financial market model that does not reflect how the actual business environment operates and is therefore not an ideal investment strategy (Brodie et al., 2009). In the real world, realized returns from low risk investments tend to be higher than predicted by the theory and lower than expected for high risk securities (Murphy, 1997). Modern portfolio theory focuses on how diversification can reduce risk, but its analysis is not dynamic and assumes that investors care only about risk to wealth in the very short term. Institutions and investors are interested in developing a long-term view of consumption and investment patterns (Campell, 2002). Mean-variance analysis is the foundation of MPT and assumes that financial wealth is separate from income, yet investors typically receive a stream of income which is then applied, together with financial wealth, to make investments (Campell, 2002).

Portfolio management is necessary in lending institutions due to the need to optimize the benefits of diversification and at the same time mitigate the potential negative effects of concentration of risk in one industry, sector or borrower. Banks often pool together a large portfolio of loans with lower perceived risk of default in order to achieve the expected return (Heffernan, 2005). Fikru (2009) posits that commercial banks hold diversified loan portfolios in several categories such as real estate loans,

agricultural loans, manufacturing loans, trade loans and personal/household loans. Such loans, being the major source of revenue, drive bank performance, though they are also associated with default and other inherent risks, which may result in non-performing loans. According to Martins et al. (2014), residential mortgage loans constitute a material component of the loan portfolio of commercial banks and are therefore a key driver of bank performance. Residential mortgage loans also generate interest income, which is a prime source of revenue for banks and contribute significantly to their performance (Misra & Aspal, 2013). As such, the bank manager's main goal is to invest in a loan portfolio that minimizes risk given the expected return of the portfolio, aligned to the modern portfolio theory. Regulatory constraints on what type of securities banks can hold in their loan portfolios, cap on returns that can be paid against deposits and 'reserve' requirements by the government's central bank can, however, limit the returns that banks make on their loan portfolios (Fama, 1980).

Martins et al. (2014) suggested a positive association between the portfolio of residential mortgage loans and performance of banks, as it improves profitability in normal times. The opposite effect is expected during a downturn in the real estate sector. Credit standards tend to deteriorate when there is an upswing in the property market as mortgage originating institutions move to increase their loan portfolios. This may result in an increase in non-performing loans as riskier and less creditworthy customers are granted mortgage loans (Igan & Pinheiro, 2010).

2.2.2 The Agency Theory

Jensen and Meckling (1976) refers to an agency relationship as a contract in which one or more individuals (the principal) engage another individual (the agent) to carry out services on their behalf, which involves the delegation of decision making authority to

the agent. The organization is viewed as a "nexus of contracts between different stakeholders of the organization" (Jensen & Meckling, 1976). In firms, it is common practice for shareholders to delegate decision-making authority to the board of directors who may also delegate power to the chief executive officer. Ownership and control is therefore divorced. Conflicting interests between the executive and shareholders often lead to agency costs as well as sub-optimal allocation of resources within the firm. Agency theory helps in understanding the moderating effect of firm characteristics on the relationship between residential mortgage portfolio and bank performance.

Critics of agency theory maintain that it is excessively narrow, addresses no clear problem and has few testable implications (Eisenhardt, 1989). Agency theory is also criticized using stewardship theory which posits that stewards (agents) derive greater satisfaction from meeting firm objectives than by self-serving behavior (Davis et al., 1997) and that achievement of organizational success also provides utility to the agent. Agency theory makes the assumption that human beings are motivated largely by self-interest, yet human demographics, including the level of income; gender; age and education, are not included in the development of the theory (Kusiluka, 2012).

Heffernan (2005) posits that financial intermediation inherently suffers from agency conflicts. "The principal-agent theory can be applied to explain the nature of contracts between the shareholders of a bank (principal) and its management (agent) and the depositors (principal) and the bank (agent)". Lea (1996) posits that as innovation continues in the mortgage market, divergence of incentives between mortgage originators, servicers and investors becomes high and this can impact bank performance.

Functional separation (or unbundling) in mortgage loan process where separate

specialists perform the activities of loan origination, funding, servicing and risk management can generate a wide variety of investors, which creates agency conflicts arising from a divergence of incentives between the various parties (Chiquier & Lea, 2009). Bank managers, as agents, are involved in decisions on loan concentration or diversification and the type of product innovation to undertake, which drive the total assets of the bank, hence firm size, as well as performance. Bank managers also take decisions on the level and type of customer deposits to accept and loan advances to issue, which impacts the lending capacity of the bank.

Theoretical analysis of Agency theory has largely focused on aspects of business that deal with corporate finance, corporate governance and managerial economics. Mortgage finance, despite its relatively high vulnerability to agency conflicts, has not been given comprehensive treatment in the literature.

Loan portfolio composition depends on a bank's ownership structure, liquidity and innovation capacity among other factors (Berger et al., 2005). Both domestic and foreign banks, irrespective of size and age, operate on the principle of profit maximization and bank managers, as agents, are expected to pursue this principle for the interest of their shareholders. A challenge may, however, arise where there is conflicting interest between bank managers and shareholders, as managers may act unethically to protect and enhance their own personal interest and ignore the interest of their shareholders. Such agency problems may determine the type of loans the bank invests in, when to book a provision for non-performing loans and the returns to be received from the loan portfolio.

2.2.3 Asymmetric Information Theory

The theory of information asymmetry was pioneered by Akerlof (1970) in the study of

the market for used cars, known in the literature as the market for 'lemons'. He demonstrated how asymmetric information can result in market failure. The theory defines how an imbalance of information between buyers and sellers can skew the price charged for goods and services in the market. This is the well-known lemons problem where inferior goods can displace products of higher quality in the market. Spence (1973) later pursued the solution to asymmetric information through a study of signaling in labour markets between employer and employee and found that it does not always help to remove inefficiency. Rothschild and Stiglitz (1976) extended the analysis through the concept of screening in the insurance market. Since then, the concept of information asymmetry has become a valuable tool to explain diverse sets of market frictions.

Asymmetric information theory anchors the intervening effect of product innovation on the relationship between residential mortgage portfolio and bank performance and can be distinguished by whether there is adverse selection or moral hazard. Moral hazard, also referred to as post-contractual opportunistic behavior, arises when the agent fails to put forth enough effort as agreed with the principal. Examples of moral hazard include; carelessness, fraud, shirking, larceny, cost-padding, among others (Eisenhardt, 1989). Adverse selection or pre-contractual opportunistic behavior on the other hand arises when there is misrepresentation of ability by the agent (Eisenhardt, 1989). This may occur when a product is consumed only by a group of people who offer the highest risk.

Informational asymmetries are particularly endemic in financial markets. Individuals who borrow are not usually honest about their true strengths and weaknesses, nor entrepreneurs about their projects, due to the rewards associated with exaggerating positive qualities. Verification of such information provided by investors may also be

costly or impossible (Leland & Pyle, 1977). Kau et al. (2012) posits that adverse selection is endemic in the primary mortgage market as the institution originating the loan most often does not know all the characteristics of the borrower. Most often, investors who are more likely to default in loan repayment tend to go for larger loans. Moral hazard is, however, more common in the secondary mortgage market as the institution originating the loan has no incentive to ensure only good quality loans are issued, since the loans are intended for customers in the secondary mortgage market who are not in a position to know its quality. Some researchers have identified moral hazard as the main cause of the 2008 financial crisis, as the risks embedded in mortgage lending became so widely dispersed that no single person or entity had to worry about the quality of mortgage loans being originated.

Information asymmetry and associated moral hazard and adverse selection may manifest itself during the expansion in residential mortgage loans, especially when there is a boom in the property market. Herring and Wachter (1999) argues that lending institutions tend not to properly evaluate the default risk of loans associated with property when there is an upswing in the real estate market. Banks normally exploit such positive market trends to expand their loan portfolio by lowering lending standards as loan applications increase and also grant mortgage loans with high LTV ratio by meeting the full purchase price and additional expenses such as stamp duty and other fees (Martins et al., 2014). The perceived lower risk of mortgage financing also leads to excessive lending to riskier borrowers at low interest rates, as banks disregard the dangers of adverse selection (Jimenez et al., 2006). The loan portfolio therefore expands and income received grows as a result of these activities. A reversal in the market would, however, leave households with mortgage debts that exceed the value of the property, leading to default in loan repayment and non-performing mortgage loans.

Overall quality of the mortgage loan portfolio may also decline for the lending institution. In line with asymmetric information theory, the impact of residential mortgage loans on bank performance therefore varies with movements in the property market (Chan et al., 1986).

Even though asymmetric information theory provides the justification for regulating quality; acknowledges the meaning of information as a market determinant and has wide application across a number of academic disciplines, most asymmetric information models deal with highly simplified versions of markets and only consider asymmetries in one direction (Auronen, 2003). Though a large volume of theoretical literature is available on the importance of asymmetric information, only few empirical studies have been conducted to test its direct effects due to the difficulty in identifying exogenous information measures. Asymmetricity of information in the loan market can be reduced through intermediary market institutions such as guarantees for goods, brand-names, chains and franchising (Auronen, 2003). Borrower specific information can also be verified independently by institutions such as the employer, bankers and credit bureaus (Cao, 2005). The mortgage loan process overcomes the information asymmetry of a borrower through collateralization (Chiquier & Lea, 2009). Adverse selection can be reduced by offering a variety of contracts that can suit the different categories of borrowers, while moral hazard can be addressed by having the originator continuing to bear part of the risk on the loan by keeping the mortgage in its balance sheet (Kau et al., 2012).

2.3 Review of Empirical Literature

Many empirical studies have evaluated the impact of residential mortgage portfolio, product innovation and firm characteristics on the performance of banking institutions.

The focus of some of these studies has been purely on one or two of these variables as drivers of performance in commercial banks, whereas others have looked at more variables. This chapter reviews empirical studies on the relationships between residential mortgage portfolio and bank performance; residential mortgage portfolio, product innovation and bank performance; residential mortgage portfolio, firm characteristics and bank performance and relating all these variables are reviewed.

2.3.1 Mortgage Portfolio and Firm Performance

The association between the mortgage market and performance of financial institutions has received significant attention in research over the last few decades. Most studies have observed that an improvement in the portfolio of residential mortgage loans results in better performance for commercial banks, especially during an upturn in the property market. It is therefore hypothesized that residential mortgage loans have a positive relationship to bank performance. During a downturn in the property market, however, high exposure to the real estate sector can potentially lead to increase in default risk, with non-performing loans being recorded (Martins et al., 2016).

A study on the impact of mortgage financing on the financial performance of commercial banks operating in Kenya was conducted by Abdulrehman and Nyamute (2018). Applying Ordinary Least Squares (OLS) regression model, it established a significant effect of mortgage loans on commercial banks' financial performance and a positive impact of interest charged on bank returns. It recommended enhanced mortgage origination and higher interest charges in order for banks to grow their businesses. The study has however not taken the cost of funds into account, as it is based on gross interest paid on mortgage loans instead of net interest income. The impact of property finance on the performance of banks operating in Kenya which are

listed on the NSE, was studied by Odhiambo (2015) who evaluated the nine listed banks from 2009 to 2013. The study used a panel regression model and established no significant impact of property finance on the financial performance of commercial banks listed on the NSE. Instead, size of the bank, bank's cost of operation, market structure and foreign ownership had significant influence on bank performance, and recommended robust housing sector strategies by key stakeholders to increase mortgage loan uptake in the Country. This study is, however, based on a small sample size and a short period of time and may therefore not be representative of the banking institutions in Kenya.

The close link between the real estate sector and bank performance has also been studied by Davis and Zhu (2009) from the perspective of commercial mortgage loans. They examined the nexus between commercial property prices and the lending decision of banks with specific focus on the pricing of loans and loan volume growth by using the net interest margin (NIM) as a proxy for performance. The study covered 904 banks across 15 industrialized economies in the OECD over the period 1989 to 2002. Applying the General Least Squares (GLS) panel estimation with random-effects model, the study found that property prices have a material impact on the operation and performance of banks. They found evidence indicating that the impact was more closely related to bank size, bank capital and direction of real estate price movements. Focus of the study is, however, on commercial property prices and its relationship with financial performance of banking institutions.

Another study focusing on the European real estate market by Gaspar (2016) confirmed the positive impact of the real estate sector on bank performance. It evaluated factors connecting the real estate market to the banking system in France, Portugal, Sweden

and United Kingdom during the period 2000 to 2014 and found that the sector is important in determining the profits of the banking system. However, it is a cross-country study based on bank stock returns instead of a mortgage portfolio framework and applies exogenous factors such as interest rate and house price index as control variables. Martins et al. (2016) also found that movements in the real estate market have an impact on listed banks, especially smaller banks and those with large volumes of mortgage loans. This was also confirmed by Allen et al. (1995) who evaluated whether changing real estate values affect bank returns and found a positive and significant relationship for banks that hold a significant amount of real estate loans on their balance sheet. The two studies are, however, macro studies with market variables as explanatory factors instead of bank-level data.

Using the CAMEL rating system, Igan and Pinheiro (2010) investigated the determinants of delinquency on real estate loans by all commercial banks in the US from 1987 to 2006. Applying a panel data model with time-fixed-effects and also controlling for size, growth, and exposure to real estate, they found that variations in income and interest rates are the key determinants of aggregate delinquency rate. They also found that banks with rapid loan growth are more likely to see a deterioration in their soundness. The study, however, has a narrow focus on bank delinquency. Other aspects of the mortgage loan portfolio, such as volume of mortgage loans and interest income, are not taken into account.

2.3.2 Mortgage Portfolio, Product Innovation and Firm Performance

Product innovation in the mortgage industry has led to increased access to mortgage credit and growth in the mortgage loan portfolio of financial institutions, resulting from new and expanded range of products (Warnock & Warnock, 2008); higher LTV ratios

due to lower down payments for mortgage loans (Gyntelberg et al., 2007) and the introduction of secondary mortgage markets which have allowed mortgage-backed securities to be traded in capital markets (Chiquier & Lea, 2009).

Studies have, however, observed that mortgage product innovations such as higher LTV ratios and longer repayment periods can generate increased default risk especially during a downturn in the property market, resulting in loan-loss provisions. In an emerging market such as Kenya, which is dominated by the primary mortgage market, it can be hypothesized that the intervention of product innovation attributes on the association between residential mortgage portfolio and bank performance is positive.

A lot of mortgage product innovation has taken place in the USA over the years and Chen (2015) used a System Generalized Method of Moments (SGMM) panel methodology to investigate what determines commercial banks' choice of the Originate-to-Distribute (OTD) model of lending and its impact on credit supply during the period 2006 to 2009, and found strong evidence that OTD has a positive impact on banks' capital and liquidity performance, which improves mortgage loan origination, though it increases default risk thus making banks less stable. Context of the study is, however, a mature mortgage market in the USA with a well-established capital market to promote securitization. Outcome may therefore not be generalizable to emerging economies.

Thakor (2011) looked at the incentive for banks to innovate in their loan portfolios, the impact of such innovation on bank profitability and how such innovation can result in a financial crisis. The study contended that banks have a choice either to issue standard loans since historical information is already available or design and issue new and innovative loan products where historical data is limited, with potential disagreement

on default probabilities as there is little information on such products. The study found that banks make no profits on the standard loans and positive profits on innovative loan products, which is a strong incentive for banks to innovate. Innovation however has a downside as investors could disagree with the bank on the value of such new products and could therefore withdraw funding, which can precipitate a financial crisis. This study is, however, a hypothetical model which is not based on empirical research.

In Mexico, a study conducted by Carballo-Huerta and González-Ibarra (2008) found that growth in residential mortgage credit was attributable to product innovation such as inflation-indexed mortgage loans; higher LTV ratio and introduction of mortgage-backed securities, largely issued in local currency, among other factors. These conclusions are, however, qualitative and are not based on any in-depth statistical analysis, as only descriptive statistics and trends were reviewed. Another study in the USA by Gopalakrishnan (2000) analyzed the impact of innovation speed and magnitude on performance of 101 banks in four northern states over the period 1982 to 1993. It found that innovation speed generated positive effect on the rate of Return on Assets (ROA) while innovation magnitude (number of new products adopted) had little impact. The study further observed that bank performance can only benefit from innovation magnitude when new products or processes are adopted quickly. The study, however, looked at product innovation in general, with no specific focus on residential mortgages.

A study focusing on how securitization impacts commercial bank performance was conducted by Sarkisyan et al. (2009) in the USA using a propensity score matching methodology between 2001 and 2008 and found no evidence of significant causal effect. Instead, securitizing banks were found to be more profitable institutions, though

with higher cost of funding and credit risk exposure than non-securitizing banks. The context of this study is, however, a mature mortgage market compared to emerging markets.

2.3.3 Mortgage Portfolio, Firm Characteristics and Firm Performance

Bank demographics such as ownership, size, age and lending capacity are key determinants of the volume and quality of the loan portfolio of commercial banks and hence performance (Haas et al., 2010). Whether a bank is foreign or domestic may drive the level of aggression in credit origination and the prudence exercised in lending decisions, which affects the size and quality of the loan portfolio and level of non-performing loans. On relative terms, large banks tend to show a lower ratio of non-performing loans than small banks in their balance sheets (Martins et al., 2014). Large banks are also expected to originate more loans by exploiting economies of scale in assessing loan applications. Firm characteristics can therefore be hypothesized to significantly intervene the link between mortgage portfolio and performance of commercial banks.

The impact of bank ownership on loan portfolio returns was analyzed by Atahau (2014) who applied multiple and panel fixed-effects regression models to 109 banks in Indonesia during a 9-year period to establish the impact of loan portfolio concentration and composition across bank ownership categories on loan portfolio risks and returns, and found that government-owned banks had the lowest NPL while foreign-owned banks were less profitable. The study measured loan portfolio return by loan interest income and established that foreign banks were not as profitable as domestic and government owned banks, another misalignment to other research findings, as foreign banks are known to enjoy better interest rates in emerging markets and hence better

returns. It was the recommendation of the study that central banks should take ownership differences into account when designing or reviewing credit regulations as well as realignment of various economic sectors that the banks focus on. The study, however, focused only on interest income rather than CAMEL variables as the measure of performance. Its findings on government banks having the lowest NPL and foreign banks being less profitable contradict other research findings.

Another study focusing on how non-performing loans in different loan categories are impacted by bank characteristics was conducted by Louzis et al. (2011) who carried out a post 2008 financial crisis examination of the Greek banking sector to establish the microeconomic (firm-specific) and macroeconomic determinants of NPLs. Applying a panel data model with dynamic effects to 9 banks during the period 2003 to 2009 and with a split of the loan portfolio into business, consumer and mortgage loans, they found that factors such as lending rates, the real GDP growth rate, public debt and unemployment rate have a significant effect on the level of non-performing loans. Other factors such as efficiency and performance which are specific to the bank support the hypothesis 'bad management', which links these factors to management quality. In addition, they found evidence of a 'Too Big To Fail' impact for business and mortgage loan portfolios. The study also found that mortgage loans were the least impacted by the macroeconomic environment whereas business loans were highly sensitive to GDP growth rate and consumer loans to changes in the lending rates. The context of this study is, however, a market that was heavily impacted by the 2008 mortgage triggered financial crisis, with a well-developed secondary mortgage market.

On funding options for mortgage loans, Black et al. (2010) used a panel regression and time-series model to examine the mortgage funding behaviour of 3 groups of banks in

the USA: traditional, transition and market-based banks and found that traditional banks are largely funded by retail deposits while market-based banks are funded with external debt. The study, however, used business strategy to categories banks into traditional, transition and market-based banks rather than ownership types which is bank specific and easier to measure.

Haas et al. (2010) explored the impact of bank demographics (such as size and ownership) on the composition of the loan portfolio of 220 banks across 20 transition countries during the period 2005 and, applying Ordinary Least Squares (OLS) regression model, found that size and ownership are important drivers of bank loan portfolio composition. This is, however, a cross-country study not based on firm-level data.

2.3.4 Mortgage Portfolio, Product Innovation, Firm Characteristics and Firm Performance

The financial crisis in 2008 generated a lot of debate among scholars and researchers on how mortgage lending impacts the performance of banks. Martins et al. (2014) analyzed the impact of residential mortgage loan portfolio on bank performance, while controlling for size and LTV ratio among other variables, and applied a panel dynamic-effects methodology among 555 banks within the EU covering the period 1995 to 2008. The study captured much of the 2008 financial crisis, particularly the high residential mortgage loans seen in a number of markets during the period preceding the financial crisis. It found that bank profitability is improved by high volume of residential mortgage loans on their balance sheets and rising house price leads to a decrease in NPL. The findings can partly be explained by the fact that housing assets are used as security for other loans and also help to reduce credit risk for the bank. Though a cross-country study in advanced mortgage markets, the finding supports the close connection

between residential mortgage loans and bank performance.

Cole and White (2012) used logistic regression model to analyze the role of real estate risk in the failure of 265 commercial banks in the USA during the 2008 financial crisis, covering the years 2004 to 2008 and found that commercial and multi-family mortgages were associated with higher possibility of bank failure while residential single-family mortgages were not. In addition, investments in MBS had marginal or no effect on the likelihood of failure. Antoniades (2015) extended this study by analyzing a sample of 4,320 commercial banks (out of which 301 failed) from 2005 to 2013 and found that investment in MBS mattered only for large banks, with similar outcomes on other variables. Notably, though the two studies focused more on failed banks rather than the overall effect of mortgage loan portfolios on the performance of banks, the 2008 financial crisis, which is their main focus in the study, is a single unusual event.

2.4 Summary of Literature Review and Research Gaps

Empirical research conducted on the relationship among residential mortgage portfolio, product innovation, firm characteristics and bank performance is yet to provide uncontested links among these variables. Most empirical research have evaluated the relationships among just a few of the variables, with conflicting and inconclusive results. Previous studies reviewed pose a number of contextual, methodological and conceptual gaps which are analyzed in this section.

The contextual gaps arise from the fact that most of the studies have focused on mature markets where mortgage lending is more advanced and the secondary mortgage market well developed, with securitization in place. Research being largely contextual, these studies can be replicated in developing economy environments to establish a causal relationship between the study variables. Studies conducted in other markets have also

yielded conflicting results on whether mortgage finance has an impact on bank performance, with some, such as Martins et al. (2014) and Carballo-Huerta and González Ibarra (2008), documenting a positive relationship while others, such as Odhiambo (2015), had a no relationship outcome. Such conflicting and contradictory outcomes can be attributed to the choice of intervening and moderating variables and components of the independent variables applied and also the methodological differences. The concept of residential mortgage portfolio and its impact on the performance of banking institution has not received much attention from researchers in Kenya and not at the depth covered by this study.

Some of the empirical studies reviewed were largely cross-country studies based on macro-economic data rather than micro bank-level variables (Martins et al., 2016; Gaspar, 2016). Other studies were based on small sample size and a short period of time (Odhiambo, 2015). Others were conducted many years ago (Allen et al., 1995) and in some cases focused purely on the 2008 mortgage triggered financial crisis (Cole & White, 2012; Louzis et al., 2011) and not firm performance in normal times. Yet others were qualitative studies not based on any in-depth statistical analysis, as only descriptive statistics and trends were reviewed (Thakor, 2011; Carballo-Huerta & González-Ibarra, 2008).

The impact of bank demographics on the relationship between residential mortgage portfolio and performance is also inconclusive as previous researches have presented conflicting outcomes. For instance, Atahau (2014) found that government banks have the lowest NPL and foreign banks being less profitable, which contradicts other research findings. Another gap arises from the performance variables used in previous studies, which have mostly used one attribute of bank performance measure (Martins

et al., 2014; Gopalakrishnan, 2000), while the current study was based on the CAMEL model and therefore used all the five CAMEL attributes.

Table 2.1 summarizes reviewed empirical studies, the main findings, the knowledge gap and how this study has addressed the knowledge gaps.

Table 2.1: Summary of Literature Review and Knowledge Gaps

Author(s)	Focus of Study	Methodology	Findings	Knowledge Gaps	Current Study Focus
Abdurrahman and Nyamute (2018)	Effect of mortgage loans on the financial performance of commercial banks in Kenya.	OLS regression model	Established a significant effect of mortgage loans on commercial banks financial performance and a positive impact of mortgage interest income on bank returns.	Product innovation not taken into account, cost of funds not considered in interest income and exogenous economic factors used as control variables instead of bank specific factors.	Based on firm level characteristics; includes product innovation and takes cost of funds into account by using net interest margin.
Martins et al. (2016)	The relationship between bank stock returns and real estate market conditions.	Three-factor risk model andan extended Fama-French model.	Statistically significant and positive relationship between real estate market returns and bank stock returns, more so for banks with larger real estate loans.	A macro-variable study which considers bank performance from the perspective of capital markets.	Firm-level study which focuses on bank specific variables as measures of performance in an emerging market.
Gaspar (2016)	Key factors and spillovers connecting the real estate market to the banking system.	Multiple regression model	Real estate is an important factor in profitability of the banking system and that regulators should control massive engagement in mortgage related loans.	A macro-study that uses banks stock return as a measure of performance. Omits product innovation and bank specific characteristicsin the model.	Firm level study that uses internal measures of performance. Product innovation and firm characteristics included in the study.
Odhiambo (2015)	Impact of real estate finance on the financial performance of listed commercial banks in Kenya	Panel regression model	Real estate finance has no impact on financial performance. Size, cost of operations, Market structure and foreign ownership, has significant impact.	Small sample of 9 banks. Looked at overall mortgage loan portfolio. Product innovation omitted. Used financial performance measure (ROA) only.	Census study covering all commercial banks in Kenya. Targets residential mortgage loans. Product innovation included and employs CAMEL score as performance measure.

Author(s)	Focus of Study	Methodology	Findings	Knowledge Gaps	Current Study Focus
Chen (2015)	The incentives for using(OTD) model and its impact on bank credit supply and risk takingbehavior among commercial banks	System Generalized Method (SGM) of moment's methodology.	Positive impact of the OTD model on banks funding and liquidity, negative effect on bank riskiness, with higher default rate, making banks less stable.	Only a single residential mortgage product studied. Also, context is a mature economy where the mortgage market is advanced.	Focus is on the entire residential mortgage products. Context is anemerging market in sub-SaharanAfrica.
Martins et al. (2014)	Residential Property Loans and Bank Performance during Property Price Booms: Evidence from Europe	Dynamic panel regressio nmodel.	High residential mortgage loans improve banks' profitability, though to a lesser extent when there is an upturn in residential property market, and Level of NPL is reduced.	LTV ratio is the only product innovation variable included. Also, only size is included as a moderating variable. Uses financial measures of performance only.	Study includes other product innovation variables and more bank characteristics. CAMEL applied as performance measure. Context is a nascent mortgage market.
Atahau (2014)	Impact of bank ownership types, loan portfolio and loan repayment default risk on banks' loan portfolio returns.	Multiple and panel fixed effects data models.	Government banks have lowest NPL and are less volatile. Foreign banks foundto be less profitable on loan portfolio return as measured by loan interest income.	Uses only loan interest income as a measure of performance. Also two contradictory findings on NPL in government banks and low profitability in foreign banks.	Employs the CAMEL measure of performance. Further research, in a different context, required to confirm the contradictions on the state of NPL and profitability
Cole and White (2012).	Analysis of the reason for the failure of banks in the US during the 2008 financial crisis	Multivariat eLogistic regression model	Banks with high loan allocation to single-family residential mortgage loans are safe while multi-family mortgage loans are more likely to fail.	More focus on collapsed banks during the 2008 financial crisis rather than theperformance of all banks during normal times.	Unit of this study is all commercial banks in normal business operation and not during a financial crisis.

Author(s)	Focus of Study	Methodology	Findings	Knowledge Gaps	Current Study Focus
Thakor (2011)	Incentives by banks to innovate on loan portfolios and financial crises	Equilibrium econometricmodel	Banks make no profit on standard loans and positive profits on innovative loan products, which is a strong incentive for banks to innovate. Risk of a financial crisis, however, exists due to potential disagreements between investors and the bank.	A hypothetical model not based on empirical analysis. No primary or secondary data was collected or analyzed	Empirical study based on paneldata analysis.
Louzis et al. (2011)	Determinants of non-performing loans (NPLs) in the Greek banking sector – separately for each loan category (consumer loans, business loans and mortgages).	Panel dynamic-effects data model	NPL is explained mostly by macroeconomic factorssuch as unemployment, GDP, public debt, interest rates and management quality. Presence of 'Too Big To Fail' evidenced in the study for mortgages loan portfolios	Effect of the recentfinancial crisis in Greece isa structural break impacting the relationship between NPLs and their determinant factors. As such, the outcome of this study lacks general applicability. Also narrow sample of 9 banks only.	Context of the current study is an emerging market with no secondary mortgage market and hence the contagion effect through capital market flows arising from the recent financial crisis is non-existent.
Igan and Pinheiro (2010):	Determinants of delinquency on realestate loans and potential impact on banks' performance.	Panel data model with time fixed-effects.	Income and interest ratesare key determinants of aggregate delinquencyrate, with some impact for unemployment and availability of credit.	Overlooked exposure from asset backed securities (ABS). Product innovation not taken into account. Context is the USA	Product innovation included. The context of a nascent mortgage market where capital markets are not well developed.

Author(s)	Focus of Study	Methodology	Findings	Knowledge Gaps	Current Study Focus
Black et al. (2010)	Banks business strategies and its relationship to mortgage funding and lending.	Panel regression and time-series models	"Traditional banks" hold large core deposits for loan origination whereas. "Market-based banks" use external debt.	Focus is more on role of banks in monetary policy transmission and not much on the effect of mortgage loan portfolios on bank performance.	Focus of current study is on the impact of mortgage loan portfolio on commercial banks' performance and not monetary policy transmission.
Haas et al. (2010)	How loan portfolio composition is impacted by bank characteristics and the institutional environment.	Ordinary least squares (OLS) regression model.	Foreign banks lend to both mortgage customers and affiliates of multinational firms. Government-owned banks focus on state enterprises.	Possible selection bias in sampling as banks thatwere included in the study may not be representative of Bank Scope.	The current study is a census survey of commercial banks registered in Kenya over the study period, and therefore no sampling bias is expected.
Sarkisyan et al. (2009).	Evaluation of whether bank performance improves as a result of securitization.	Propensity score matching model.	Securitization has no impact on bank performance, though securitizing banks aremore profitable.	May not apply in a market where securitization is not developed.	Study focuses on a nascentreal estate economy where securitization is notdeveloped.
Carballo-Huerta and González-Ibarra (2008).	New mortgage products, government incentives and expansion of credit in Mexico.	Standard Hodrick-Prescott model.	Innovations in themortgage market has expanded mortgage credit, amplified by mortgage interest tax breaks and interest subsidy, among other factors.	No in-depth statistical analysis other than descriptive statistics and review of trends. Also based entirely on secondary data.	To be based on panel data analysis with in-depthstatistical analysis.

Author(s)	Focus of Study	Methodology	Findings	Knowledge Gaps	Current Study Focus
Gopalakrishnan (2000)	Effect of innovation speed and magnitude onthe performance of commercial banks, withsize and prior profitability as control variables.	Multiple regression model.	Innovation magnitude has little impact on bank's financial performance, while innovation speed has, though both were found to have beneficial effects on profitability.	Focus is on general innovations in banks. Uses financial measures of performance only. Size and prior profits used as moderating variables.	Targets innovation in residential mortgage market and includes other bank specific characteristics such as age and lending capacity as moderating variables.
Allen etal. (1995).	Impact of changing realestate values on commercial bank returns and its balance sheet.	Seemingly unrelated regression (SUR) model.	A statistically significant and positive impact of changing real estate values on bank monthly returns and interest-ratemovement impact.	Didn't test the association between bank-specific characteristics and the property coefficient. Product innovation not included. Context is the US.	Includes bank individual characteristics as well as product innovation. Context is an emerging economy in sub-Saharan Africa.

2.5 Conceptual Framework

This study is informed by the Modern Portfolio Theory, supported by the Agency Theory and Asymmetric Information Theory, in connecting the conceptualized relationship among residential mortgage portfolio, product innovation, firm characteristics and performance of banks licensed to operate in Kenya. The anchorage of the research on Modern Portfolio Theory is informed by its proposition on how diversification of investments in various asset portfolios can minimize risk and maximize firm returns. The objective is to evaluate if the theory holds even when product innovation and institutional characteristics are introduced. A discussion of the conceptual model and the dependent, independent, moderating and intervening variables as well as the research hypotheses is undertaken.

Figure 2.1 below presents the conceptual framework showing the relationship between residential mortgage portfolio, product innovation, firm characteristics and bank performance based on the research problem formulation, theoretical literature review and a review of empirical studies. Independent variables, intervening variables and moderating variables are defined and tested as non-composite variables while the dependent variable is a composite variable.

Residential mortgage portfolio attributes, which are the independent variables, comprising of mortgage portfolio size, mortgage portfolio quality and mortgage interest return was expected to show a direct relationship with commercial bank performance. Empirical studies have found a strong impact of residential mortgage portfolio attributes on bank performance, especially when the size of mortgage loans held is large (Allen et al., 1995). Residential mortgage loans are normally the most volatile portfolio of bank loans and are exposed to default risks, especially during a downturn in the

property market, which can impact portfolio quality (Martins et al., 2014). Igan and Pinheiro (2010) also found that banks with high loan growth are likely to suffer loan losses and deterioration in their soundness. Misra and Aspal (2013) supports the view that interest income from mortgages is a prime source of revenue for banks and contributes significantly to their performance. The modern portfolio theory by Markowitz (1952) anchors the primary relationship between residential mortgage portfolio and bank performance. This is depicted as H_1 and shows the direct association among the independent and dependent variables.

The conceptual framework predicted that residential mortgage portfolio can impact the performance of commercial banks indirectly through product innovation components such as mortgage term and LTV ratio as intervening variables, anchored by the asymmetric information theory (Akerlof, 1970). The imbalance of information held by lenders and borrowers can drive banks to develop new products that suit the different needs of their customers in order to achieve a competitive advantage in the market, develop new market segments, grow the demand for new and existing products and improve bank performance. Borrowers also come with different risk profiles. The bank must therefore innovate and come up with products that suit the different category of customers that come for loans.

Markets have mortgage terms of 25 years or greater and some have contracts with LTV ratio of 80-100%, and up to 125% in some countries, such as the Netherlands (Gyntelberg et al., 2007). A number of countries also have foreign-currency denominated mortgage loans to tap into the Diaspora and global markets. In Kenya, the study established that most mortgage loans were originated in local currency, hence the omission of currency as an intervening variable. Others have secondary mortgage

markets with mortgage backed securities. Kenya did not have a secondary mortgage market during the study period hence MBS was not included as a component of product innovation. Commercial banks in Kenya were evaluated on how these mortgage product characteristics have contributed to the relationship between residential mortgage portfolio and bank performance. This indirect relationship is shown in the conceptual model by arrows represented by H_2.

The mediating effect of product innovation has been used in previous studies. Sharma et al. (2016) used product innovation as an intervening variable in the study: 'Product innovation as a mediator in the impact of R&D expenditure and brand equity on marketing performance', and concluded that product innovation is important as it allows the firm to develop new customer segments and expand existing product portfolios. Vincent et al. (2004), in a study of: 'Does innovation mediate firm performance? a meta-analysis of determinants and consequences of organizational innovation', found support for product innovation as a partial mediator between organizational variables and financial performance. Gopalakrishnan (2000) also found that the magnitude of innovative products had beneficial effects on credit expansion in the USA.

Residential mortgage portfolio can also influence bank performance through institutional characteristics such as bank ownership, size, age and lending capacity as moderating variables, which is anchored by the Agency Theory (Jensen & Meckling, 1976). Bank managers, as agents to the shareholders, take decisions on which loan products to originate, the type of product innovations to undertake and the returns to be generated by the loan portfolio, which impacts the total assets of the bank, hence firm size, as well as performance. Large banks enjoy comparative advantage by exploiting

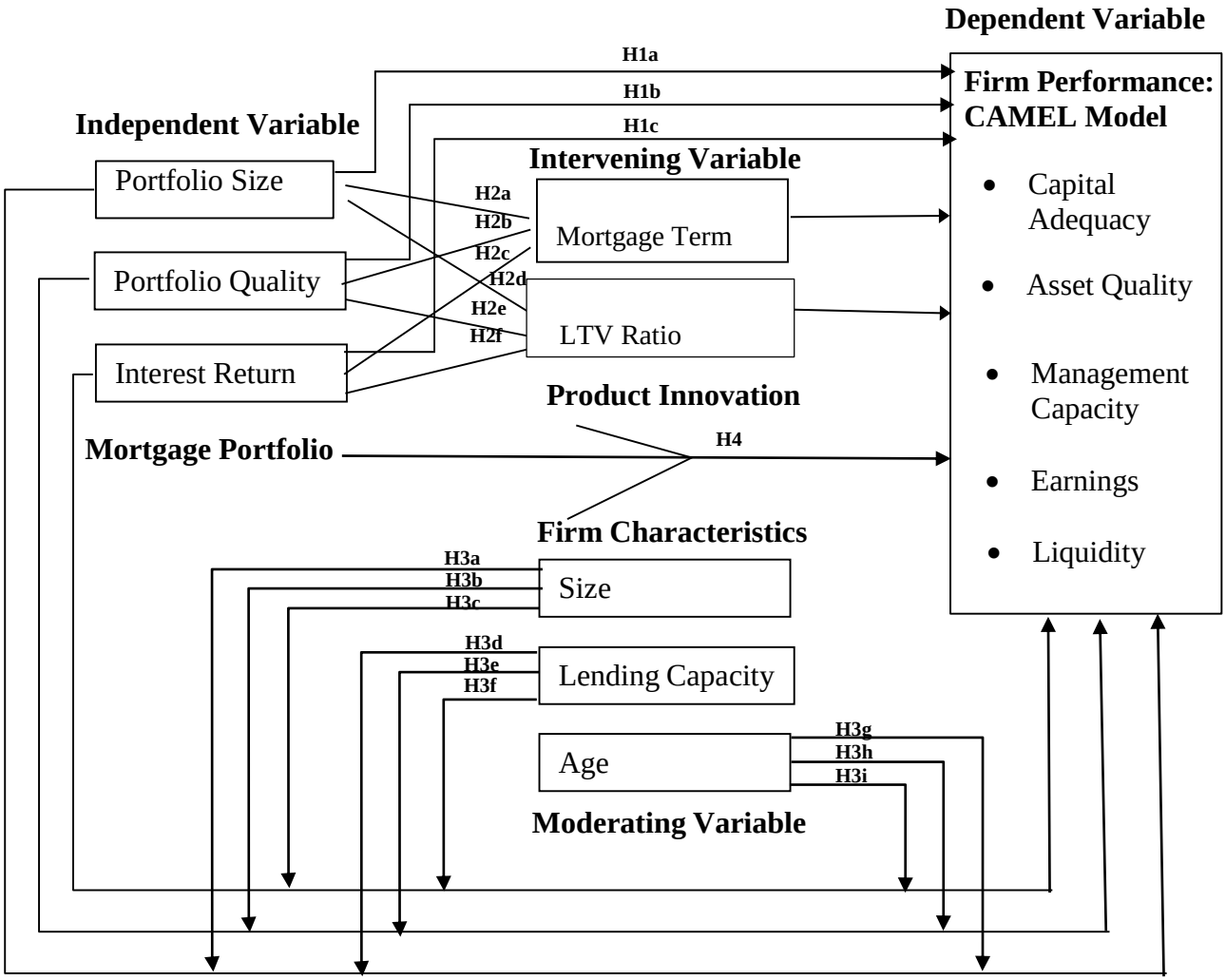
economies of scale to evaluate more loan applications. Bank managers also make decisions on the level and type of customer deposits to accept and loan advances to issue, which impacts the lending capacity of the bank. Loans must be funded and where a market is dominated by retail deposits to fund loans, a bank's lending capacity drives the volume of loans it can originate (Black et al., 2010). Older banks have longer operating histories and less uncertainty on their performance, hence able to originate more loans (Carter et al., 1998).

The role of firm characteristics as a moderating variable in bank performance is supported in studies by Ongore and Kusa (2013), Atahau (2014), Black et al. (2010) and Haas et al. (2010). Such studies used the moderating effect of individual bank characteristics such as size, lending capacity and age in evaluating bank performance. The study found that ownership structure of banks in Kenya remained relatively the same over the study period, with little variability. As such, ownership was dropped as a moderating variable. The loop H_3 depicts the impact of the moderating variables on the dependent – independent variable relationships. Product innovation and firm characteristics can jointly influence the relationship between residential mortgage portfolio and bank performance as shown by the arrow H_4. The joint effect was also tested in this study.

The dependent variable in the study was the composite CAMEL score composed of Capital Adequacy, Asset Quality, Management Capacity, Earnings and Liquidity. CAMEL is an essential tool for identifying the strength and weaknesses of a bank and evaluates any corrective actions that need to be taken. The CAMEL system is applied by most banking institutions and has also been recommended by IMF and the Basel Committee on Bank Supervision (Olweny & Sipho, 2011). The CAMEL score, as a

measure of performance, has been used in previous studies by Ondigo (2016); Kabir and Dey (2012) and Dang (2011). In Kenya, the CBK employs CAMEL rating system to measure the performance of commercial banks.

Figure 2.1: The Conceptual Model



Author (2021)

2.6 Research Hypothesis

Based on the research objectives, the following hypotheses and sub-hypotheses were tested:

H_1: The relationship between residential mortgage portfolio and performance of commercial banks in Kenya is not significant. The following sub-hypotheses were tested:

H_{1a}: The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significant.

H_{1b}: The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significant.

H_{1c}: The relationship between mortgage interest return and performance of commercial banks in Kenya is not significant.

H_2: The relationship between residential mortgage portfolio and performance of commercial banks in Kenya is not significantly intervened by product innovation. The following sub-hypotheses were tested:

H_{2a}: The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly intervened by mortgage term.

H_{2b}: The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly intervened by mortgage term.

H_{2c}: The relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly intervened by mortgage term.

H_{2d}: The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly intervened by loan to Value ratio.

H_{2e}: The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly intervened by loan to Value ratio.

H_{2f}: The relationship between mortgage interest return and performance of

commercial banks in Kenya is not significantly intervened by loan to Value ratio.

H_3: The relationship between residential mortgage portfolio and performance of commercial banks in Kenya is not significantly moderated by firm characteristics. The following sub-hypotheses were tested:

H_{3a}: The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly moderated by firm size.

H_{3b}: The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly moderated by firm size.

H_{3c}: The relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly moderated by firm size.

H_{3d}: The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly moderated by firm lending capacity.

H_{3e}: The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly moderated by firm lending capacity.

H_{3f}: The relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly moderated by firm lending capacity.

H_{3g}: The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly moderated by firm age.

H_{3h}: The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly moderated by firm age.

H_{3i}: The relationship between mortgage interest return and performance of

commercial banks in Kenya is not significantly moderated by firm age.

H_4: The joint effect of product innovation and firm characteristics on the relationship between residential mortgage portfolio and performance of commercial banks in Kenya is not significant and is different from the individual effects. The following sub-hypotheses were tested:

H_{4a}: The joint effect of product innovation and firm characteristics on the relationship between residential mortgage portfolio size and performance of commercial banks in Kenya is not significant and is different from the individual effects.

H_{4b}: The joint effect of product innovation and firm characteristics on the relationship between residential mortgage portfolio quality and performance of commercial banks in Kenya is not significant and is different from the individual effects.

H_{4c}: The joint effect of product innovation and firm characteristics on the relationship between residential mortgage interest return and performance of commercial banks in Kenya is not significant and is different from the individual effects.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

The chapter sets out the methodology applied in this research and documents the research philosophy, research design, population of the study, data collection methods and an overview of the data analysis techniques that was adopted. The chapter also provides an operationalization of the research variables that informed the study and data evaluation procedures.

3.2 Research Philosophy

Research in social science is dominated by two main philosophical schools of thought, namely positivism and phenomenology. Positivism is a strong form of empiricism and its foundation was laid by Auguste Comte (1798-1851). In the 20th century, positivism was transformed into logical positivism by a group of Germans called the Vienna circle. It assumes that knowledge of a social phenomenon is based on what can be observed, measured and recorded, that the external world is real and objective, and that knowledge is only valid if based on observations of the realities of the external environment. It also assumes that generalizable theoretical models can be developed to explain cause and effect relationship between variables, which can be applied to predict study outcomes (Saunders et al., 2009).

Positivism focuses on quantitative data that is gathered objectively and statistically analyzed. Also known as hypothetico-deductive method, positivism starts by setting hypotheses on fundamental laws and then deduces on the observations that demonstrate the truth. It is considered the bridge that links theory and research by testing theory in order to increase predictive understanding of phenomena. Phenomenology, however, is a philosophy that focuses on the immediate experience. As a method of inquiry,

phenomenology describes things the way they are and not as the researcher conceives them to be. It does not start with an established theory but rather proceeds with data collection and data analysis and on that basis concludes on the strength and nature of the relationship between variables.

This research was guided by the positivist philosophy and principles because: the study is scientific since it sought to establish the existence of a correlation between residential mortgage portfolio, product innovation, firm characteristics and performance of commercial banks. It started with theory, defined quantifiable variables and tested theory using empirical data. Data collected was independent; the study was highly structured and statistical analysis resulted in quantifiable and generalizable conclusions.

3.3 Research Design

This is the structure and plan of analysis and involves the what, where, when, how much and by what means of an inquiry. It defines the configuration, framework and organization of the relationship between variables and the process of obtaining empirical evidence to support those relationships (Cooper & Schindler, 2011). Research design helps to ensure that evidence obtained during an investigation addresses the initial research questions as much as possible (De Vaus & de Vaus, 2001). It provides guidance for identifying sources and types of information and is so defined that it permits the collection and analysis of required data to arrive at a solution.

Research designs can take the following three broad forms, namely, descriptive research design; causal research design and exploratory research design. The main purpose of a descriptive research design is to ascertain and describe the characteristics of a person, event or situation and the discovery of association among variables of interest (Cooper & Schindler, 2011). Descriptive designs use a wide range of study

methods to investigate one or more variables, such as survey studies, which allows for the collection of large volumes of data that can be analyzed for frequencies, averages and patterns; case studies which is a contextual study of fewer events or conditions and their characteristics, and correlation studies which can be described as a quantitative research involving the evaluation of two or more variables to show the presence of a relationship (or co-variation) among them (Waters, 2005) and making of predictions regarding the relationships. Descriptive designs could be either cross-sectional, which requires taking a sample of data based on the focus population and assessing their attributes only once, or longitudinal, in which sample attributes are assessed repeatedly over time (Sekaran, 2010).

Causal research design is concerned with the cause-effect relationship between variables while the primary objective of exploratory research design is to seek new ideas or insights. Exploratory studies are normally undertaken when only little information is known about the situation at hand or data is not available on how similar issues or research problems have been addressed in previous studies.

This study adopted a correlational descriptive research design, as it sought to establish the relationships amongst residential mortgage portfolio, product innovation, firm characteristics and performance of banks over time. Application of panel or longitudinal data involved multiple entities each of which had repeated measurements at different time periods and has the advantage of monitoring the behavior of entities over time. Given that mortgage portfolio and firm characteristics are variables which change with time and data is also collected at specific points in time, the longitudinal design is adopted to help detect changes in the relationships and the variables over time. In longitudinal studies, same variables are measured at each point on the time scale.

3.4 Population of the Study

Population can be defined as a group of people, objects or institutions with similar observable attributes. The unit of analysis for this study was the banking institutions in Kenya, which are registered and were involved in mortgage lending during the study period. CBK bank supervision annual reports covering the study period indicated the following registered commercial banks and mortgage finance companies in Kenya from 2006 to 2018.

Table: 3.1 Study Target Populations

Year	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**Total**
Target	45	45	45	45	44	44	44	44	44	43	43	43	43	**572**

Source: CBK Supervision Annual Reports

The focus population for this research was therefore all the licensed banks and mortgage finance companies which were operating in Kenya during the study period. Choice of banking institutions was guided by the fact that they are the main originators of mortgages in the formal sector. Commercial banks in Kenya are few in number and therefore a census study was conducted.

3.5 Data Collection Techniques

The focus of this research was the association between residential mortgage portfolio and performance of banks using both financial data (financial ratios, income statements and balance sheets) as well as non-financial information (firm ownership and firm age) pertaining to the Kenyan commercial banks. To fulfil the defined objectives of this research, panel data from the annual residential mortgage surveys conducted by CBK was obtained. In addition, secondary information was collected mainly from the financial reports as submitted and analyzed in various CBK bank supervision annual

reports and also from the Kenya Bankers Association database. The data collected was transformed into ratios and percentages to allow for analysis and interpretation.

The banking sector regulatory environment provides a platform for access to standard performance information from secondary sources (Gopalakrishnan, 2000). Statistical information for banks was therefore obtainable as all banks file their returns with CBK, which was accessed from the CBK library and website. It is also important to note that the CBK has been carrying out an annual survey on residential mortgage lending in Kenya since 2010, with each banking institution completing and submitting a questionnaire on their mortgage lending practices, mortgage products and characteristics, non-performing mortgage loans and mortgage market constraints. The first survey conducted by CBK, in collaboration with the World Bank, collected baseline data on residential mortgages for the period 2006 to 2010, with CBK annual surveys continuing thereafter. This informed the choice of 2006 to 2018, a period of 13 years, as the study period.

3.6 Operationalization and Measurement of the Study Variables

Operationalization can be defined as the process of allocating symbols to the study variables in such a way that measurement becomes possible (Sekaran, 2010). This study is based on four variables, namely residential mortgage portfolio, product innovation, firm characteristics and performance of commercial banks, which were operationalized in accordance with other studies carried out previously. Residential mortgage portfolio was divided into three sub-variables: portfolio size (the proportion of outstanding residential mortgage loans in total loans), portfolio quality (residential mortgage non-performing loans as a ratio of gross residential mortgage loans) and mortgage interest return (interest income generated by residential mortgage loans less interest expenses

paid on customer deposits). Residential mortgage portfolio attributes were operationalized as non-composite variables in accordance with studies by Chen (2015), Martins et al. (2014), Misra and Aspal, (2013) and Allen et al. (1995).

Product innovation attributes were mortgage term (average length of mortgage contracts in years) and LTV ratio, defined as the proportion of the mortgage loan to property value. These attributes were operationalized as non-composite variables based on studies by Martins et al. (2015) and Li (2014). Firm characteristic attributes (size, lending capacity and age) were operationalized as non-composite variables in line with studies by Chen (2015), Adusei (2011), Black et al. (2010), Sarkisyan et al. (2009) and Carter et al. (1998). Performance measure was based on a composite CAMEL model, consisting of five attributes, namely Capital Adequacy, Asset Quality, Management Capacity, Earnings and Liquidity. The composite CAMEL model measure was adopted from Kabir and Dey (2012) and Ondigo (2016). Table 3.2 gives a summary of the variables and their measurements.

Table 3.2: Summary of Study Variables and their Measurements

Variables	Indicators	Definition of indicators	Measurement	Source	Data Source
Residential Mortgage Portfolio	Portfolio Size	Value of residential mortgage loans outstanding at the end of each period expressed as a ratio of total loans	$\frac{\text{Residential Mortgage Loans}}{\text{Outstanding Total Loans}}$	Chen, 2015; Martins et al., 2014; Allen et al., 1995	CBK Annual Residential Mortgage Survey Reports; Kenya Bankers Association Reports
	Portfolio Quality	Non-performing residential mortgage loans at the end of each period expressed as a ratio of residential mortgage loans	$\frac{\text{Residential Mortgage NPL}}{\text{Gross Residential Mortgage Loans}}$	Martins et al., 2014; Allen et al., 1995	
	Interest Return	Interest income generated by residential mortgage loans (based on average annual mortgage interest rates) less the amount of interest expense paid on customer deposits.	Residential mortgage net interest margin (NIM)	Misra and Aspal, 2013	
Firm Characteristics	Size	Total Assets of the banking institution	Natural logarithm of total assets.	Chen, 2015; Black et al., 2010; Sarkisyan et al., 2009	CBK bank Supervision Annual Reports
	Age	The years the firm has been in operation since incorporation	Natural logarithm of the number of years in operation	Adusei, 2011; Carter et al., 1998	
	Lending Capacity	Ability of the banking institution to originate loans from primary deposits	$\frac{\text{Total Loans}}{\text{Core Deposits}}$	Black et al., 2010	
Product Innovation	Mortgage Term	Average length of mortgage contracts (years).	Loan Term = Average loan term in years.	Martins et al., 2015; Li 2014	CBK Annual Residential Mortgage Survey Reports

	LTV Ratio	Average ratio of mortgage loan to the value of mortgaged property	LTV = Average loan to value ratio	Martins et al., 2015; Martins et al., 2014	
Firm Performance (CAMEL Score)	Capital Adequacy (C)	The level of capital available to finance the operations of the banking institution	$\frac{\text{Total Capital}}{\text{Total Risk Weight Assets}}$	Dang, (2011; CBK	Mortgage Survey Reports
	Asset Quality (A)	A measure of the quality of the loan portfolio of a bank	$\frac{\text{Non-Performing Loans}}{\text{Gross Loans}}$	Dang, 2011; CBK	
	Management Capacity (M)	Ability of management and board of the financial institution to identify, assess and control its risk exposure and ensure a sound and efficient operation.	$\frac{\text{Total Advances}}{\text{Total Deposits}}$	Kabir & Dey, 2012; Ondigo 2016	
	Earnings (E)	Measures a bank's overall performance through profitability and asset ratios.	$\frac{\text{Total Profits}}{\text{Total Assets}}$	CBK	
	Liquidity (L)	Ability to maintain sufficient liquid assets to meet bank's financial obligations as they arise.	$\frac{\text{Net Liquid Assets}}{\text{Total Assets}}$	Desta, 2016; CBK	
	Composite Index	Geometric mean of the 5 CAMEL component ratings	$\sqrt[5]{C * A * M * E * L}$	Ondigo, 2016; Kabir & Dey, 2012; Dang, 2011	

Source: Researcher (2021)

3.7 Model Specification

Panel data normally involves time as well as cross-sectional dimensions; therefore, it inherits the shortcomings of cross-sectional and time-series data. Such shortcomings are addressed by the choice of the model to use in panel data analysis. According to Gujarati et al. (2009), choice of the model in panel data estimation is driven by the assumption made on the slope coefficients, the intercept and the error term. The three forms of regression models which are commonly used in the analysis of panel data are: the pooled regression, the fixed-effects model and the random-effects model.

According to Wooldridge (2016), the pooled regression model assumes that data has no time-series or cross-sectional effects, whereas the fixed-effects model assumes that individual specific impacts are time invariant and are considered as a component of the intercept. The fixed-effects model is suitable and normally used where the individual specific intercepts are correlated with one or more predictor variables. Depending on the number of attributes being studied, it has a disadvantage as the degrees of freedom increases with increase in the number of variables. Another disadvantage is that estimations are linearly determined. On the other hand, the random-effects model makes the assumption that individual effect (heterogeneity) is not correlated with any regressors.

The intercept reflects the grand mean across space and time and there is no correlation and autocorrelation between and within error terms. Its advantage over the fixed-effects model is that it uses minimal degrees of freedom as there is no need to estimate a large number of cross-sectional intercepts. It is appropriate for studies where the intercept of the cross-sectional data is not correlated with the regressors.

The study employed Hausman's (1978) approach to determine the appropriateness of fixed or random effects models. The Hausman specification test tries to find whether there is considerable link between the unobserved firm specific effects and the explanatory variables. The test provides for the aspects that are unobserved in the equation that may or may not have an effect on the predictors incorporated in the equation to obtain the fitness of usability of fixed or random effects model (Greene, 2008). The null hypothesis is not rejected if the p-value is greater than 0.05 while vice versa if the p-value is less or equal to 0.05 level of significance, implying that fixed-effects model is preferred (Orayo & Mose, 2016).

The presence of outliers may help explain heteroscedasticity in the data (Gujarati et al., 2009). Existence of outliers and skewness may also generate unequal variances in the data. The study used the box plot to identify the outliers and addressed them by removing the observations.

3.8 Diagnostic Tests

The standard regression model makes a number of assumptions and this needs to be tested and confirmed so as to ensure reliability and validity of the estimated coefficients and inferential statistics. The assumptions include multivariate normality, no or little multicollinearity and no heteroscedasticity or autocorrelation. To establish if the data in the study fit the regression model assumptions, a number of diagnostic tests were performed. Further, in order to appreciate the extent of deviations and trends in the data, descriptive statistics, consisting of standard deviation and annual mean were calculated.

3.8.1 Data Stationarity

The unit root test is a test of stationarity of the time series. The unit root assessment relates closely to the concept of integration, where a variable set is considered integrated

with the order of 1(*d*) if, for example, it becomes stationary after differentiating *d* times (Engle & Granger, 1987). Non-integrated variables make regression results unstandardized and perhaps spurious. If in the end, two or more variables move together, the difference between them can be a constant and forms a co-integrated equation, which defines a long- run equilibrium association (Hall et al., 1989). Lack of co-integration may suggest that the variables have no long-run correlation and move randomly away from one other (Dickey & Fuller, 1981).

A number of models are available that can be used to establish the presence of panel data unit-roots; these includes the Durbin-Watson (1950) test; Philip-Perron (1988) (PP) test; Dickey-Fuller (1979) (DF) test and Augmented Dickey-Fuller (ADF) (1981) test, among others. This study used the panel data unit root tests to explore the data stationarity. The study used the Fisher unit root test for unbalanced panels as opposed to Levin Lin Chiu panel for strongly balanced panels. The null hypothesis assumes that panel data contains unit roots for all the variables. To reject the null hypothesis, the results should show absence of a unit root for all the variables, supported by p-values<0.05. A unit-root assessment was necessary in the current study in order to assess the number of times the time series data can be differentiated to achieve stationarity.

3.8.2 Normality Test

A standard assumption in finance research requires relevant variables to have multivariate normal distribution (Richardson & Smith, 1993), which means the error terms have a symmetric distribution or centered at zero. Non-normality is a violation of this requirement,which may lead to flawed hypothesis testing. There are various tests of multivariate normality, which includes: Kolmogorov-Smirnov, Jarque-Bera test,

Shapiro-Wilk test, Skewness and Kurtosis tests, Anderson-Darling test and Pearson's Chi-square test.

The standard models for testing normality, such Kolmogorov-Smirnov is deficient in their application to panel data as lack of causality may arise and this could cause problems. In order to address this, Galvao et al. (2013) developed the one-way error component model for testing normality, skewness and kurtosis for panel data. This test together with Shapiro Wilk test was used in this study. The former test is based on the moment conditions of the within and between transformation and is applied in practice using a cross sectional bootstrap procedure. It was used in this study as a confirmatory test for normality as it is mostly used with aggregated data as the one used in this study. Based on the model test, the joint test for normality is not significant for ($p<0.000$ and $p<0.0003$), which would lead to the null hypothesis of normality in the data being rejected. This is supported by the Kurtosis and Skewness results in the descriptive statistics (Górecki et al., 2020).

3.8.3 Multicollinearity Test

Multicollinearity is assumed to exist when one or more independent variables are highly correlated with one another. When multicollinearity is severe, there can be difficulties in interpreting the test results since the regression model established will contain high standard errors of individual coefficients, thus making the model quite sensitive to minor variations in the specifications (Brooks, 2008). The variance inflation factor (VIF) has been applied to assess the presence of multicollinearity. It is an assessment of how the variance in the regression coefficients estimated is inflated as opposed to when the independent variables are not linearly related. VIF =I/ (1-R2), a reciprocal of tolerance. Multicollinearity exists where the VIF> 10. Highly correlated independent

variables are removed from the model.

3.8.4 Heteroscedasticity Test

A key assumption of the standard linear regression is that the variance of the error term is constant, that is homoscedastic. Heteroscedasticity occurs when the deviation in the error terms differ across observations. The presence of heteroscedasticity leads to a bias in the standard errors, which in turn may lead to a bias in test statistics and confidence intervals. Heteroscedasticity can be assessed through visual inspection, Breusch-Pagan test and White's general test, among others. This study adopted the modified Wald test, which was assessed for all the four panel regressions, to test for heteroscedasticity. The null hypothesis was that the error terms were homoscedastic or had a constant variance.

The study also tested for heteroscedacity using the scatter plot test, which is a visual examination of the normal probability plot of the regression standardized residuals against standardized predicted values in the form of a scatter plot. If the errors form a specific pattern, then it implies that there is heteroscedasticity while when there is no standard pattern of residuals then it infers homogeneity of variances. The solution to heteroscedasticity was the application of robust standard errors.

3.8.5 Autocorrelation Test

Autocorrelation, or serial correlation, may occur when covariance between error terms is zero ($\text{cov}(\varepsilon_i, \varepsilon_j) = 0$, for $i \neq j$) or follows an auto correlated pattern. This happens in time-series studies when the errors in one period get carried over to the next period. The disturbance term relating to an observation is assumed not to be influenced, in the standard regression model, by the disturbance term for any other observation. The presence of autocorrelation leads to the generation of smaller standard errors and hence inaccurate hypothesis testing. The study used Wooldridge test to establish the existence

of autocorrelation in the panel data. The null hypothesis (H_0) stated that there is no autocorrelation. In the event that it is present, the solution was to employ robust standard errors.

3.9 Data Analysis

Data analysis can be defined as the use of reasoning to appreciate the consistency in gathered data and summarizes relevant details revealed by the investigation. It involves the application of inferential and descriptive statistics to understand the information collected for the study (Zikmund et al., 2013). The current study is guided by positivism philosophy and has therefore applied the inferential and descriptive statistics in the data analysis. The study has adopted the data analysis process suggested by Sekaran (2010), which includes four steps, namely: getting the collected information ready for data analysis, including editing the data for accuracy, consistency and completeness; getting a feel of the data based on descriptive statistics; checking the goodness of fit of the collected data using diagnostic tests and finally hypothesis testing based on panel regression models. The study utilized unbalanced panel data from the annual residential mortgage surveys conducted by the Central Bank of Kenya and combined both longitudinal and time-series data dimensions. In order to assess the underlying features of the collected data and give the basis for further data analysis, descriptive statistics such as maximum, minimum, mean, standard deviation, skewness and kurtosis were computed for each of the variables.

This study also used correlation analysis to assess the significance of the association between residential mortgage portfolio and firm performance; residential mortgage portfolio and product innovation; product innovation and firm performance and also the joint relationship between all the variables. Hypotheses were examined using panel regression models. The Baron and Kenny (1986) proposal was applied to assess the

mediating and moderating impact of product innovation and firm characteristics respectively on the association between residential mortgage portfolio and firm performance.

Data analysis conducted was in alignment with those applied in previous research to assess the main effects, mediation, moderation and joint effects (Martins et al., 2014; Odhiambo, 2015; Atahau, 2014; Black et al., 2010). Previous research where multiple measures of performance have been used include Ongore and Kusa (2013) who applied three measures of financial performance (ROA, ROE & NIM) and Ondigo (2016) who used CAMEL model to measure performance based on each of the components (Capital Adequacy, Asset Quality, Management Capacity, Earnings, and Liquidity) as well as the composite CAMEL score. This study has adopted the composite CAMEL model to measure bank performance.

3.9.1 Residential Mortgage Portfolio and Firm Performance

Panel regression model(s) was applied to assess the relationship between residential mortgage portfolio and performance of commercial banks in Kenya. Residential mortgage portfolio attributes consisted of mortgage portfolio size, mortgage portfolio quality and mortgage interest return. Three equations, based on the sub-hypotheses, were therefore developed to test the relationship as follows:

$CAM_{it} = \alpha + \beta_1 PS_{it} + \varepsilon_{it}$ …….…….. (3.1(a))
$CAM_{it} = \alpha + \beta_1 PQ_{it} + \varepsilon_{it}$ ……..……..……..…… (3.1(b))
$CAM_{it} = \alpha + \beta_1 IR_{it} + \varepsilon_{it}$ ……..…… (3.1(c))

Where:

CAM_{it} = Performance of bank i at time t, measured by CAMEL composite score of performance that was computed as the geometric mean of the CAMEL attributes

α = Intercept or constant

β_1 = regression coefficient

PS =Portfolio size measured by the weight of outstanding residential mortgage loans in bank total loans

PQ = Portfolio quality, represented by the proportion of non-performing residential mortgage loans in gross mortgage loans
IR = Interest return, residential mortgage net interest income
ε = the error term, which accounts for the unexplained variations

3.9.2 Residential Mortgage Portfolio, Product Innovation and Firm Performance

The study adopted Baron and Kenny's (1986) approach in testing the intervening impact of product innovation on the association between residential mortgage portfolio and performance of banks. The model is guided by four assumptions that must be met for intervening effect to be confirmed as existing.

First, the independent variable must relate directly to the dependent variable in step one. This is a necessary condition and states that there has to be a statistically significant relationship between the independent and the dependent variables in the absence of the mediating (third) variable. In the context of the current study, the independent variable, residential mortgage portfolio, had three attributes, namely: mortgage portfolio size (PS), mortgage portfolio quality (PQ) and mortgage interest return (IR), which must have a significant and direct (primary) relationship with firm performance attribute, CAMEL (dependent variable) of commercial banks. The study would continue to the second intervention assessment condition only if the first condition has been satisfied. In this case any of the residential mortgage portfolio components must satisfy this condition. This was tested through equations 3.1 as defined in section 3.9.1 above.

Secondly, the independent variable must relate directly with the mediating variable without the dependent variable. That is, in the second intervention assessment, there has to be a statistically significant relationship between the independent variable and the intervening variable in the absence of the dependent variable. In the current study's context, the independent variable attributes; mortgage portfolio size (PS), mortgage

portfolio quality (PQ) and mortgage interest return (IR), must have a statistically significant and direct relationship with product innovation attributes: mortgage term (MT) and loan to value (LTV) ratio. This was tested through the following panel regression models:

$MT_{it} = \alpha + \beta_1 PS_{it} + \varepsilon_{it}$ ..... (3.2(a))
$MT_{it} = \alpha + \beta_1 PQ_{it} + \varepsilon_{it}$ ..... (3.2(b))
$MT_{it} = \alpha + \beta_1 IR_{it} + \varepsilon_{it}$ ..... (3.2(c))
$LTV_{it} = \alpha + \beta_1 PS_{it} + \varepsilon_{it}$ ..... (3.2(d))
$LTV_{it} = \alpha + \beta_1 PQ_{it} + \varepsilon_{it}$ ..... (3.2(e))
$LTV_{it} = \alpha + \beta_1 IR_{it} + \varepsilon_{it}$ ..... (3.2(f))

Where:

MT_{it} = Mortgage term, measured by average length of mortgage contract
LTV_{it} = Mortgage loan to value ratio measured by average ratio of mortgage portfolio over the value of mortgaged property

α; β_1; PS; PQ; IR; and ε as defined in section 3.9.1 above.

Thirdly, the mediator variable must have a direct association with the dependent variable, while holding constant the indirect effect of the independent variable on the dependent variable. That is, there has to be a statistically significant relationship between the intervening variable and the dependent variable in the absence of the independent variable. In the context of the current study, product innovation attributes (mediating variable) must have a statistically significant direct relationship with performance (dependent variable) in the absence of residential mortgage portfolio (independent variable) effect in the model. The third step was tested through the following panel regression model:

$CAM_{it} = \alpha + \beta_1 MT_{it} + \varepsilon_{it}$ ..... (3.3(a))
$CAM_{it} = \alpha + \beta_1 LTV_{it} + \varepsilon_{it}$ ..... (3.3(b))

Where:

π_{it}; α; β_1; MT; LTV and ε as defined in step 2 and section 3.9.1 above

Fourthly, when the study controls for the mediation effect in the model, the independent variable becomes non-statistically significant with the dependent variable for a full mediation. Alternatively, the effect reduces materially for a partial intervention to have occurred. In other words, when the study controls for the impact of the intervening variable on the dependent variable in the prediction model, the impact of the independent variable on the dependent variable becomes non-statistically significant in the presence of the intervening variable for a full mediation or reduces materially for a partial intervention.

In the context of this study, controlling for the intervening effect of product innovation in the model, mortgage portfolio size (PS), mortgage portfolio quality (PQ) and mortgage interest return (IR), effect on CAMEL must reduce materially for a partial mediation or no longer holds for a full intervention. Mediation analysis as proposed by Baron and Kenny (1986) was conducted using the panel regression models through the following equation:

$$CAM_{it} = \alpha + \beta_1 PS_{it} + \beta_2 MT_{it} + \varepsilon_{it} \quad \text{(3.4(a))}$$
$$CAM_{it} = \alpha + \beta_1 PS_{it} + \beta_2 LTV_{it} + \varepsilon_{it} \quad \text{(3.4(b))}$$
$$CAM_{it} = \alpha + \beta_1 PQ_{it} + \beta_2 MT_{it} + \varepsilon_{it} \quad \text{(3.4(c))}$$
$$CAM_{it} = \alpha + \beta_1 PQ_{it} + \beta_2 LTV_{it} + \varepsilon_{it} \quad \text{(3.4(d))}$$
$$CAM_{it} = \alpha + \beta_1 IR_{it} + \beta_2 MT_{it} + \varepsilon_{it} \quad \text{(3.4(e))}$$
$$CAM_{it} = \alpha + \beta_1 R_{it} + \beta_2 LTV_{it} + \varepsilon_{it} \quad \text{(3.4(f))}$$

Where:

CAM_{it}; α; β_1, β_2; PS; PQ; IR; MT; LTV and ε as defined in step 2, 3 and section 3.9.1 above

3.9.3 Residential Mortgage Portfolio, Firm Characteristics and Firm Performance

The study applied the panel regression models to assess the moderating impact of firm characteristics (size, lending capacity and age) on the relationship between residential mortgage portfolio attributes and firm performance based on the methodology proposed by Baron and Kenny (1986). The models assessed were the following:

$$CAM_{it} = \alpha + \beta_1 PS_{it} + \beta_2 SIZE_{it} + \beta_3 (PS_{it} * SIZE_{it}) + \varepsilon_{it} \ldots\ldots\ldots \text{(3.5 (a))}$$
$$CAM_{it} = \alpha + \beta_1 PS_{it} + \beta_2 LC_{it} + \beta_3 (PS_{it} * LC_{it}) + \varepsilon_{it} \ldots\ldots\ldots\ldots \text{(3.5 (b))}$$
$$CAM_{it} = \alpha + \beta_1 PS_{it} + \beta_2 AGE_{it} + \beta_3 (PS_{it} * AGE_{it}) + \varepsilon_{it} \ldots\ldots\ldots\ldots \text{(3.5 (c))}$$
$$CAM_{it} = \alpha + \beta_1 PQ_{it} + \beta_2 SIZE_{it} + \beta_3 (PQ_{it} * SIZE_{it}) + \varepsilon_{it} \ldots\ldots\ldots \text{(3.5 (d))}$$
$$CAM_{it} = \alpha + \beta_1 PQ_{it} + \beta_2 LC_{it} + \beta_3 (PQ_{it} * LC_{it}) + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots \text{(3.5 (e))}$$
$$CAM_{it} = \alpha + \beta_1 PQ_{it} + \beta_2 AGE_{it} + \beta_3 (PQ_{it} * AGE_{it}) + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots \text{(3.5 (f))}$$
$$CAM_{it} = \alpha + \beta_1 IR_{it} + \beta_2 SIZE_{it} + \beta_3 (IR_{it} * SIZE_{it}) + \varepsilon_{it} \ldots\ldots\ldots\ldots \text{(3.5 (g))}$$
$$CAM_{it} = \alpha + \beta_1 IR_{it} + \beta_2 LC_{it} + \beta_3 (IR_{it} * LC_{it}) + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots \text{(3.5 (h))}$$
$$CAM_{it} = \alpha + \beta_1 IR_{it} + \beta_2 AGE_{it} + \beta_3 (IR_{it} * AGE_{it}) + \varepsilon_{it} \ldots\ldots\ldots\ldots\ldots \text{(3.5 (i))}$$

Where:

$SIZE$ = Firm size, measured as the natural logarithm of total assets
LC = Lending capacity, measured by the proportion of total loans to core deposits
AGE = Firm age, measured by natural logarithm of years in existence
$\beta_1 - \beta_3$ = regression coefficients

CAM_{it}; α; PS; PQ; IR and ε as defined in section 3.9.1 above.

3.9.4 Residential Mortgage Portfolio, Product Innovation, Firm Characteristics and Firm Performance

Panel regression model(s) was used to assess the joint effect of product innovation and firm characteristics on the relationship between residential mortgage portfolio and bank performance. The hypothesis was tested based on each mortgage portfolio component as follows:

$$CAM_{it} = \alpha + \beta_1 PS_{it} + \beta_2 MT_{it} + \beta_3 LTV_{it} + \beta_4 SIZE_{it} + \beta_5 LC_{it} + \beta_6 AGE_{it} + \varepsilon_{it} \ldots\ldots\ldots\ldots \text{(3.4(a))}$$
$$CAM_{it} = \alpha + \beta_1 PQ_{it} + \beta_2 MT_{it} + \beta_3 LTV_{it} + \beta_4 SIZE_{it} + \beta_5 LC_{it} + \beta_6 AGE_{it} + \varepsilon_{it} \ldots\ldots\ldots\ldots \text{(3.4(b))}$$
$$CAM_{it} = \alpha + \beta_1 IR_{it} + \beta_2 MT_{it} + \beta_3 LTV_{it} + \beta_4 SIZE_{it} + \beta_5 LC_{it} + \beta_6 AGE_{it} + \varepsilon_{it} \ldots\ldots\ldots\ldots \text{(3.4(c))}$$

Where:

$\beta_1 - \beta_6$ = regression coefficients

CAM_{it}; α; PS; PQ; IR; MT; LTV; $SIZE$, LC; AGE and ε as defined in sections 3.9.1; 3.9.2 and 3.9.3 above

The objectives, hypotheses as well as sub-hypotheses, analytical method and interpretation of the results are summarized in Table 3.3 below.

Table 3.3: Summary of Statistical Test of Hypothesis

Objective	Hypothesis	Analytical Method	Interpretation
Establish the effect of residential mortgage portfolio on the performance of commercial banks in Kenya.	**H_1**: The relationship between residential mortgage portfolio and performance of commercial banks in Kenya is not significant. Thefollowing sub hypotheses were tested: **H_{1a}:** The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significant. **H_{1b}:** The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significant. **H_{1c}:** The relationship between mortgage interest return and performance of commercial banks in Kenya is not significant.	• Panel regression models: $CAM_{it}=\alpha+\beta_1 PS_{it}+\varepsilon_{it}$……. (3.1(a)) $CAM_{it}=\alpha+\beta_1 PQ_{it}+\varepsilon_{it}$…… (3.1(b)) $CAM_{it}=\alpha+\beta_1 IR_{it}+\varepsilon_{it}$……...(3.1(c))	• Effect exist if any of the β-values is significant • Beta value show the strength of the relationship ($\beta 1 \neq 0$, P < .05) reject H_0. ($\beta 1 \neq 0$, P >.05) fail to reject H_0.
Evaluate the effect of mortgage product innovation on the relationship between residential mortgage portfolio and performance of commercial banks in Kenya.	**H_2:** The relationship between residential mortgage portfolio and performance of commercial banks in Kenya is not significantly intervened by product innovation. The followingsub-hypotheses were tested: **H_{2a}:** The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly intervened by loan to value ratio. **H_{2b}:** The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly intervened by loan to value ratio.	The mediating impact of product innovation was analyzed in line with 4 steps as recommended by Baron and Kenny (1986) using hierarchical regression model as follows: **Step 1** $CAM_{it}=\alpha+\beta_1 PS_{it}+\varepsilon_{it}$……..… (3.1(a)) $CAM_{it}=\alpha+\beta_1 PQ_{it}+\varepsilon_{it}$…… (3.1(b)) $CAM_{it}=\alpha+\beta_1 IR_{it}+\varepsilon_{it}$…..……(3.1(c)) **Step 2** $MT_{it}=\alpha+\beta_1 PS_{it}+\varepsilon_{it}$…….....(3.2 (a)) $MT_{it}=\alpha+\beta_1 PQ_{it}+\varepsilon_{it}$…….....(3.2 (b)) $MTit=\alpha+\beta_1 IR_{it}+\varepsilon_{it}$……,...(3.2 (c)) $LTV_{it}=\alpha+\beta_1 PS_{it}+\varepsilon_{it}$…….....,..(3.2 (d)) $LTV_{it}=\alpha+\beta_1 PQ_{it}+\varepsilon_{it}$…….…(3.2 (e)) $LTV_{it}=\alpha+\beta_1 IR_{it}+\varepsilon_{it}$…...…...…(3.2 (f))	• Effect exist if any of the β-values is significant • Beta value will show the strength of the relationship Significant β1-β2, in steps 1-3 i.e. $\beta 1 \neq 0$, P < 0.05 in each case.

	H_{2c}: The relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly intervened by loan to value ratio **H_{2d}:** The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly intervened by mortgage term **H_{2e}:** The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly intervened by mortgage term **H_{2f}:** The relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly intervened by mortgage term	**Step 3** $CAM_{it}=\alpha+\beta_1 MT_{it}+\varepsilon_{it}$.....(3.3(a)) $CAM_{it}=\alpha+\beta_1 LTV_{it}+\varepsilon_{it}$.....(3.3(b)) **Step 4** $CAM_{it}=\alpha+\beta_1 PS_{it}+\beta_2 MT_{it}+\varepsilon_{it}$....(3.4(a)) $CAM_{it}=\alpha+\beta_1 PS_{it}+\beta_2 LTV_{it}+\varepsilon_{it}$...(3.4(b)) $CAM_{it}=\alpha+\beta_1 PQ_{it}+\beta_2 MT_{it}+\varepsilon_{it}$...(3.4(c)) $CAM_{it}=\alpha+\beta_1 PQ_{it}+\beta_2 LTV_{it}+\varepsilon_{it}$..(3.4(d)) $CAM_{it}=\alpha+\beta_1 IR_{it}+\beta_2 MT_{it}+\varepsilon_{it}$....(3.4(e)) $CAM_{it}=\alpha+\beta_1 R_{it}+\beta_2 LTV_{it}+\varepsilon_{it}$...(3.4(f))	
Determine the effect of firm characteristics on the relationship between residential mortgage portfolio and performance of commercial banks.	**H_3:** The relationship between residential mortgage portfolio and performance ofcommercial banks in Kenya is not significantly moderated by firm characteristics. The followingsub-hypotheses were tested: **H_{3a}:** The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly moderated by firm size. **H_{3b}:** The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly moderated by firm size. **H_{3c}:** The relationship between mortgage interest	The moderating effect of firm characteristics was analyzed in accordance with the approach recommended by Baron and Kenny (1986) through the following panel regression models: $CAM_{it}=\alpha+\beta_1 PS_{it}+\beta_2 SIZE_{it}+\beta_3(PS_{it}*SIZE_{it})+\varepsilon_{it}$.....(3.5(a)) $CAM_{it}=\alpha+\beta_1 PS_{it}+\beta_2 LC_{it}+\beta_3(PS_{it}*LC_{it})+\varepsilon_{it}$.....(3.5(b)) $CAM_{it}=\alpha+\beta_1 PS_{it}+\beta_2 AGE_{it}+\beta_3(PS_{it}*AGE_{it})+\varepsilon_{it}$.....(3.5(c))	• Effect exist if there is significant interaction • Beta value will show the strength of the relationship If $\beta_1-\beta_3\neq 0$, P < 0.05 desired. ($\beta_1-\beta_3\neq 0$, P >.05) fail to reject H_{03}

	return and performance of commercial banks in Kenya is not significantly moderated by firm size. **H_{3d}:** The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly moderated by firm lending capacity. **H_{3e}:** The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly moderated by firm lending capacity. **H_{3f}:** The relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly moderated by firm lending capacity. **H_{3g}:** The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly moderated by firm age. **H_{3h}:** The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly moderated by firm age. **H_{3i}:** The relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly moderated by firm age.	$CAM_{it}=\alpha+\beta_1 PQ_{it}+\beta_2 SIZE_{it}+\beta_3(PQ_{it} * SIZE_{it}) + \varepsilon_{it}$……..(3.5 (d)) $CAM_{it}=\alpha + \beta_1 PQ_{it} + \beta_2 LC_{it} + \beta_3(PQ_{it} * LC_{it}) + \varepsilon_{it}$……..…..(3.5 (e)) $CAM_{it}=\alpha+\beta_1 PQ_{it}+\beta_2 AGE_{it}+\beta_3(PQ_{it} * AGE_{it}) + \varepsilon_{it}$……...……..(3.5 (f)) $CAM_{it}=\alpha+ \beta_1 IR_{it}+\beta_2 SIZE_{it}+\beta_3(IR_{it} * SIZE_{it}) +\varepsilon_{it}$……..…..(3.5 (g)) $CAM_{it}=\alpha+\beta_1 IR_{it}+\beta_2 LC_{it}+\beta_3(IR_{it} * LC_{it}) + \varepsilon_{it}$……..(3.5 (h)) $CAM_{it}=\alpha+\beta_1 IR_{it}+\beta_2 AGE_{it}+\beta_3(IR_{it} * AGE_{it}) + \varepsilon_{it}$……..……..(3.5 (i))	

Examine the joint effect of mortgage product innovation and firm characteristics on the relationship between residential mortgage portfolio and performance of commercial banks in Kenya.	**H_4:** The joint effect of product innovation and firm characteristics on the relationship between residential mortgage portfolio and performance of commercial banks in Kenya is not significant andis different from the individual effects. **H_{4a}:** The joint effect of product innovation and firm characteristics on the relationship between residential mortgage portfolio size and performance of commercial banks in Kenya is not significant and is different from the individual effects. **H_{4b}:** The joint effect of product innovation and firm characteristics on the relationship between residential mortgage portfolio quality and performance of commercial banks in Kenya is not significant and is different from the individual effects. **H_{4c}:** The joint effect of product innovation and firm characteristics on the relationship between residential mortgage interest return and performance of commercial banks in Kenya is not significant and is different from the individual effects.	Panel regression models: $CAM_{it} = \alpha + \beta_1 PS_{it} + \beta_2 MT_{it} + \beta_3 LTV_{it} + \beta_4 SIZE_{it} + \beta_5 LC_{it} + \beta_6 AGE_{it} + \varepsilon_{it}$.....(3.4(a)) $CAM_{it} = \alpha + \beta_1 PQ_{it} + \beta_2 MT_{it} + \beta_3 LTV_{it} + \beta_4 SIZE_{it} + \beta_5 LC_{it} + \beta_6 AGE_{it} + \varepsilon_{it}$.....(3.4(b)) $CAM_{it} = \alpha + \beta_1 IR_{it} + \beta_2 MT_{it} + \beta_3 LTV_{it} + \beta_4 SIZE_{it} + \beta_5 LC_{it} + \beta_6 AGE_{it} + \varepsilon_{it}$.....(3.4(c))	• Effect exist if any of the β-values is significant • Beta value will show the strength of the relationship (Any $\beta_1 - \beta_6 \neq 0$, $P < .05$) reject H_4. (All $\beta_1 - \beta_6 \neq 0$, $P > .05$) fail to reject H_4.

CHAPTER FOUR:
DESCRIPTIVE DATA ANALYSIS AND RESULTS

4.1 Introduction

The chapter explains the data capture rate, trend analysis, descriptive statistics, diagnostic tests, selection of panel data analysis model and correlation assessment of the study variables. The research aimed to determine the relationship among residential mortgage portfolio, mortgage product innovation, firm characteristics and performance of banks licensed and operating in Kenya.

4.2 Panel Data Capture Rate

This study utilized panel data from the residential mortgage surveys conducted by the CBK on an annual basis as well as secondary data on commercial banks as contained in the CBK and the Kenya Bankers Association database. CBK, as the banking sector regulator, originates the mortgage survey by sending questionnaires to commercial banks, then validates, consolidates and publishes the survey outcome in their annual supervision reports. All commercial banks are required to submit their financial performance records to the CBK, which are analyzed and reported in the annual banking supervision reports and are available to the public. The research department of the Kenya Bankers Association also collects a number of financial data from commercial banks.

The current study was a census study, which targeted all licensed banks operating in Kenya, spanning the period 2006 to 2018. Four commercial banks which did not hold any residential mortgage loans in their balance sheet during the thirteen-year period were excluded from the study. Banks which had no outstanding mortgage loans in some of the periods represented the missing values in the study. This implied that the study

used unbalanced panel data with values taken in Kenya shilling millions (Kshs. Mln.). The yearly target and data collected for analysis were as shown in Table 4.1 below.

Table 4.1: Panel Data Capture Rate

Year	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**Total**
Target	45	45	45	45	44	44	44	44	44	43	43	43	43	**572**
Excluded	4	4	4	4	4	4	4	4	4	4	4	4	4	**52**
Collected	41	41	41	41	40	40	40	40	40	39	39	39	39	**520**
Percentage	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	91%	**91%**

Source: CBK Supervision Annual Reports

The study successfully collected 520 data points compared to the target of 572 data points, representing a data capture rate of 91%. The data collected was from all registered commercial banks that held outstanding residential mortgage loans in their books over the thirteen-year study period. This was an unbalanced panel data and the data capture rate of 91% as tabulated above was considered adequate for analysis.

4.3 Descriptive Statistics

Descriptive statistical analysis included mean, standard deviation, skewness, kurtosis, minimum and maximum in order to visualize and obtain the extent of deviation in the panel data. Mean, measuring central tendency of the data, revealed the most typical value in the panel data series, while standard deviation was used to measure dispersion of the values from the mean. Skewness was used to measure the symmetry or lack of symmetry in the panel data set while Kurtosis measured peakedness or flatness of the panel data in comparison to a normal distribution. A normally distributed data set has a kurtosis ranging from -3 to +3 and a skewness ranging from -1.96 to +1.96 (Gujarati et al., 2009). The descriptive statistical analysis outcome of the study variables is shown in Table 4.2 below.

Table 4.2: Descriptive Statistics of the Variables

Variable	Obs	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
CAMEL	444	0.1768	0.0873	0.0163	0.8077	3.1124	16.5731
Portfolio Size	409	0.0904	0.1709	0.0000	0.9975	3.8870	19.1146
Portfolio Quality	407	0.0543	0.1050	0.0000	0.8300	3.7258	21.1822
Interest Return	380	3.6495	2.4011	-3.9728	8.6557	-0.4172	2.8551
Firm Size	475	10.0941	1.5185	1.2238	13.3403	-0.4060	4.8852
Lending Capacity	517	0.7769	0.5560	0.0000	8.7240	7.1483	96.2364
Firm Age	499	3.0393	0.9640	0.0000	4.8040	-0.5719	3.5395
Mortgage Term	417	2.4963	0.4268	1.0986	3.2189	-0.5401	2.5487
LTV Ratio	419	0.8413	0.7694	0.6500	1.0000	-1.3952	3.1721

Table presents descriptive statistics of all variables based on a sample of 520 firm-year observations for mortgage finance institutions in Kenya. Independent variables: mortgage portfolio size, mortgage portfolio quality, interest return, lending capacity, firm age, firm size, mortgage term, LTV ratio. Dependent variable: CAMEL

Source: Research Data 2021

In Table 4.2 above, mortgage portfolio size (which was measured as the proportion of residential mortgage loans outstanding to total loans at the end of each period) reported a mean score of 0.0904, skewness of 3.8770 and kurtosis of 19.1146. This indicates that most mortgage institutions portfolio size is 9%, which implies that portfolio size of the banking institutions in Kenya is relatively low. This is linked to the low uptake of mortgage products in Kenya as evidenced in the number of mortgage loan accounts in Kenya (Dondi & Ouma, 2017). Data on portfolio size is positively skewed and exhibits high peakedness.

Mortgage portfolio quality (measured as the proportion of residential mortgage NPLs in gross mortgage loans at the end of each period) demonstrated a portfolio quality of 0.0543, with a skewness score of 3.7258 and kurtosis of 21.1822. Average mortgage portfolio quality of 5.4% is higher than the overall industry NPL to gross loans as reported by CBK (CBK bank supervision annual report, 2018). Data on portfolio quality exhibited positive skewness and high peakedness. The descriptive statistics on mortgage interest return demonstrated a mean score of 3.6495, skewness of -0.4172 and Kurtosis of 2.8551, showing that net mortgage interest is about Kshs. 38.455 million (antilog of 3.6495). Data on net mortgage interest exhibited negative skewness and normal peakedness.

On firm characteristics, firm size gave a mean score of 10.0941 (Kshs. 24,199.81 million), skewness of -0.4060, and kurtosis of 4.8852. This signifies that the banks have a strong asset base. Similar findings were made by Bhagat et al. (2015) and Nyabaga and Matanda (2020) who concluded that financial institutions have a strong asset base in Kenya. Data on firm size exhibited negative skewness and high peakedness. The lending capacity of the financial institutions (which was measured by the proportion of

total loans in core deposits) had a mean score of 0.7769 or 77.7%, with a positive skewness at 7.1483 and high peakedness with a kurtosis of 96.2364. The average firm age was 21 years (antilog of 3.0393) which is the mean score. This implies that mortgage institutions in the Kenyan banking industry are the older financial institutions. Data on firm age exhibited negative skewness (score of -0.5719) and a high level of peakedness (kurtosis of 3.5395).

On product innovation, mortgage term was found to have a mean score of 12.1375 (antilog of 2.4963), which implies that majority of the mortgage facilities that commercial banks offer is for medium term duration of less than 15 years. Data on mortgage term had a negative skewness at a score of -0.5401 and normal peakedness at a score of 2.5487. The mean score of loan to value (LTV) ratio was 0.8413, indicating that the ratio of mortgage loans issued by financial institutions in Kenya to the value of mortgaged property averages 84%. Considering that CBK bank annual supervision report (2018) observed that 75% of the mortgage industry in Kenya is controlled by 6 large banks, it can be suggested that LTV ratio in the table above is influenced by the large financial institutions. LTV ratio exhibited negative skewness at a score of -1.3952 and high peakedness at a score of 3.1721.

Finally, the dependent variable, with CAMEL as the proxy for bank performance, exhibited a mean score of 0.1768 or 1.1934. CBK bank supervision annual report (2018) indicated a satisfactory CAMEL rating for commercial banks in Kenya. CAMEL data is positively skewed at a score of 3.1124 and high peakedness with a kurtosis score of 16.5731.

Most predictor variables, even after data transformation, had skewness and kurtosis outside the range for normally distributed data. Given the consideration that the study

placed on using fixed-effects or random-effects model in data analysis, the outcome of the descriptive statistics tends to support the use of either panel fixed-effects or random-effects model for the current study. The fixed-effects model estimates the variables consistently even when the normality assumption does not hold, so long as the data has a fixed T (time in comparison to the number of observations) and a large N (number of observations) (Wooldridge, 2016).

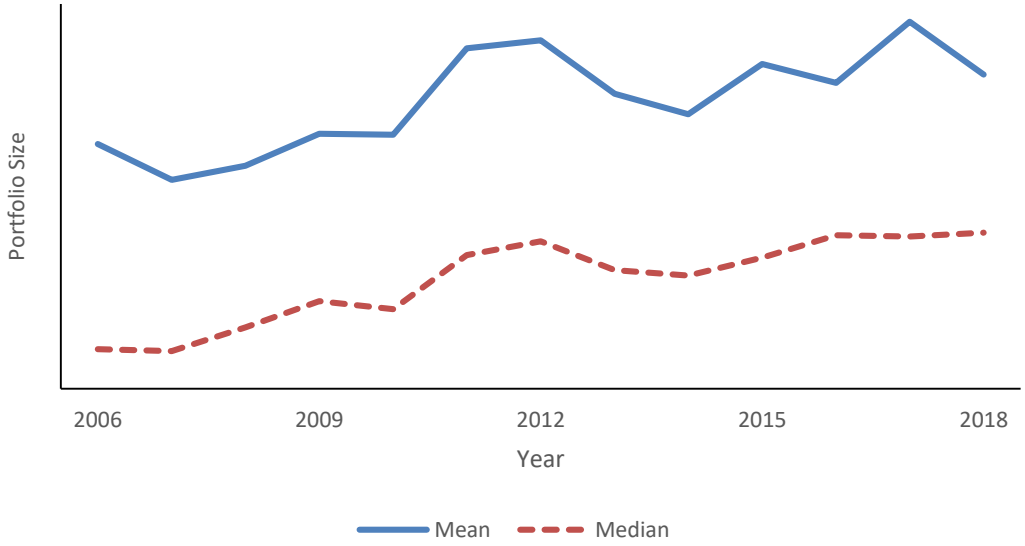
4.4 Trend Analysis

To understand the general behavior of banking institutions issuing residential mortgage loans, their mortgage portfolio size, portfolio quality, interest return and overall bank performance as proxied by CAMEL, a graphical presentation of mean and median for each variable was presented for the period 2006 to 2018 as shown in the figures below.

Figure 4.1 below shows that portfolio size data followed an upward trend for both mean and median throughout the study period. It also shows that the average mortgage portfolio size increased significantly over the study period while the median increased only marginally over the same period. This suggests that larger banks in Kenya experienced a higher increase in mortgage portfolio size as compared to small and medium banks.

The finding also implies that small, medium and large banks disproportionately expanded their mortgage portfolios size, suggesting some form of de-concentration in the mortgage credit market in Kenya. This is supported by CBK supervision annual reports that affirm that commercial banks, their sizes notwithstanding, have been increasing their mortgage portfolio size over the years (CBK bank supervision annual report, 2016).

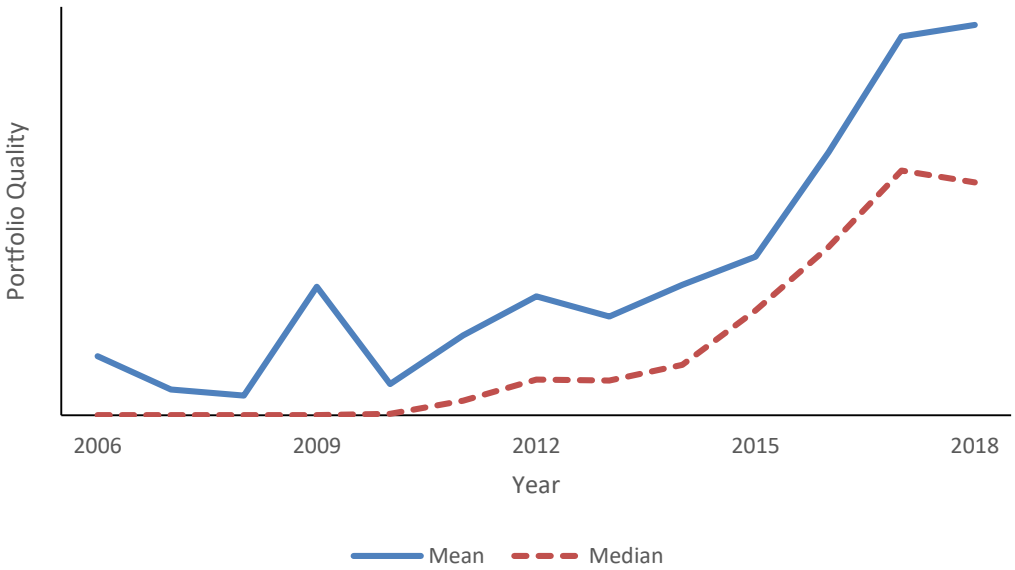
Figure 4.1: Mean and Median Mortgage Portfolio Size over Study Period



Source: Research Data 2021

Figure 4.2 below shows that portfolio quality mean and median for banking institutions originating residential mortgages in Kenya increased during the study period, with average portfolio quality remaining higher than the median.

Figure 4.2: Mean and Median Mortgage Portfolio Quality over Study Period



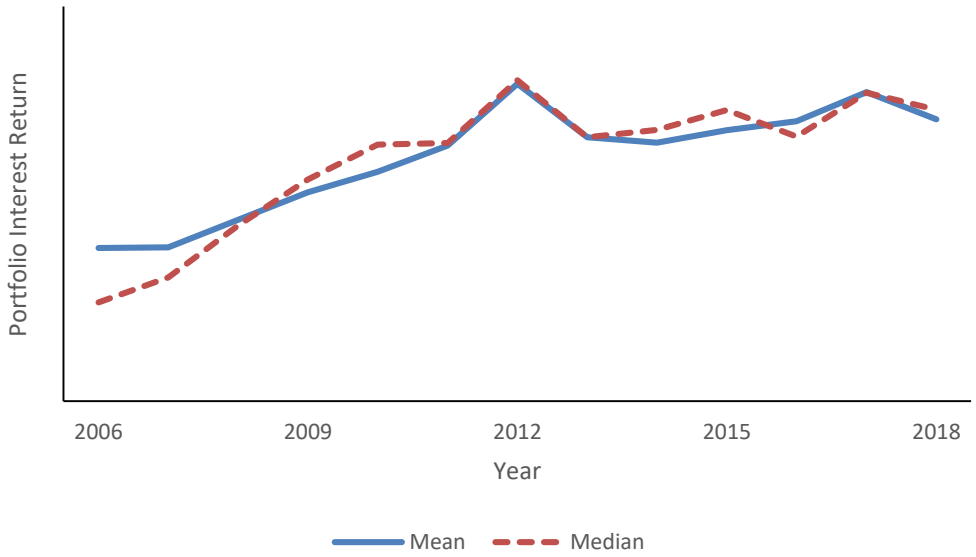
Source: Research Data 2021

This is a pointer to the possibility that both large and small mortgage institutions in

Kenya have issues to do with non-performing mortgage loans. However, this should be interpreted cautiously since 6 large banks account for approximately 75% of the residential mortgage market in Kenya (CBK bank supervision annual report, 2018). The finding also revealed a significant increase in mortgage non-performing loans in the latter part of the study period. This according to Onuko et al. (2015) is possibly linked to the strengthening of credit risk management practices across commercial banks in Kenya.

Figure 4.3 below shows that mean interest return and median interest return were almost at the same level, with an increasing trend over the study period. This suggests that there exist significant returns for both large and small mortgage originating institutions in Kenya. Caution is however required in interpretation since about 75% of the mortgage industry in Kenya is controlled by 6 large commercial banks (CBK bank supervision annual report, 2018).

Figure 4.3: Mean and Median Mortgage Interest Return over Study Period

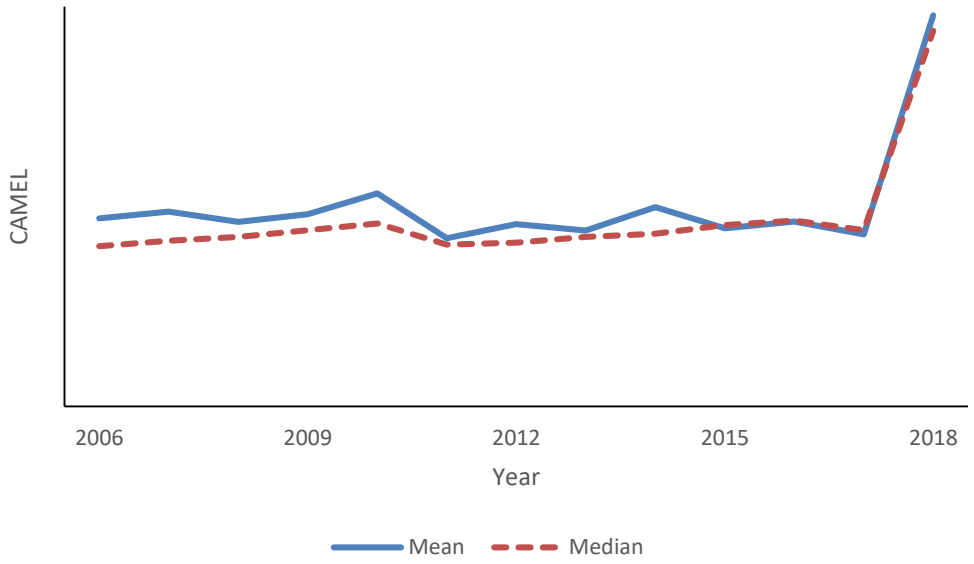


Source: Research Data 2021

Another finding from the mortgage interest return is that both median and mean returns experienced mixed performance, with significant increases over the study period, implying that mortgage interest is an improving source of revenue for the banking industry in Kenya. The mean and median interest returns were also closer to each other, especially in the latter part of the study period, potentially showing the effect of interest rate cap legislation on residential mortgage loans.

Figure 4.4 below indicates that mean CAMEL and median CAMEL are nearly identical over the study period, with mean CAMEL being continuously larger than median CAMEL. This implies that composite CAMEL rating of both large and small mortgage institutions were marginally different in the earlier years and similar in the latter years of the study period. The lower position of median CAMEL in earlier years compared to mean CAMEL may imply that the CAMEL composite score for the larger banks was higher compared to the smaller banking institutions.

Figure 4.4: Mean and Median Performance of Mortgage Institutions over Study Period



Source: Research Data 2021

This can be attributed to increased consolidation of larger banking institutions' market share in the mortgage industry, and as a result these banks have also accounted for the largest portion of non-performing loans thereby affecting their CAMEL ratings. For instance, between 2014- 2016 the 6 large banks accounted for over 60% of non-performing loans (CBK bank supervision annual report, 2017).

4.5 Panel Data Suitability and Diagnostic Test Results

Data was gathered, cleaned and coded. The outliers were examined and removed. A box-plot was run to indicate whether outliers were present in the panel data. As presented in Appendix III, there were few cases of outliers, which were not significant. Unequal variances may exist as a result of the presence of outliers and skewness. The study was expected to utilize either random-effects or fixed-effects model in data analysis.

The study carried out a series of panel diagnostic tests to check reliability and validity of the estimation coefficients. Model suitability tests were also performed to guide the choice of panel data model to apply. The diagnostic tests included the pre-estimation tests such as Fisher-type unit-root test for beta to ascertain the presence of unit root or data stationarity. In addition, the post estimation tests including Shapiro-Wilk test for normality, Variance Inflation Factor (VIF) for multicollinearity, the modified Wald test for heteroscedasticity and Wooldridge test for autocorrelation were conducted. Model suitability tests included the Hausman specification tests.

4.5.1 Panel Unit Root Test Results

The study used the panel-based unit root test to explore the data stationarity between the study variables. The data was unbalanced as a result of the missing values. The null hypothesis for Fisher-type unit-root test assumes that panel data contains unit roots for

all the variables. Results of the data stationarity test are shown in Table 4.3 below.

Table 4.3: Fisher-Type Unit-Root Test

Variable	Inverse chi-squared Statistic	P-value
Portfolio Size	203.7631	0.0000
Portfolio Quality	162.2675	0.0000
Portfolio interest rate	233.7271	0.0000
Mortgage term	223.1266	0.0000
Loan to value ratio	138.4314	0.0000
Firm Size	190.4904	0.0000
Lending capacity	310.3027	0.0000
Firm Age	2132.3659	0.0000
CAMEL	198.8888	0.0000
Number of panels = 40 Avg. number of periods = 12. 48 Ho: All panels contain unit roots Ha: At least one panel is stationary		

Source: Research Data 2021

Table 4.3 results above confirm the absence of unit root for all the variables (p-values<0.05). On the basis of these results, the current research rejected the null hypothesis, which stated that the panel data contained unit roots and concluded that data used in the study variables is stationary. Stationary data is best fit for fixed-effects or random-effects model for data analysis.

4.5.2 Normality Test Results

The current study used Shapiro-Wilk test to assess normality in the panel data set. Outcome of this test is presented in Table 4.4 below. The normality test results show that all variables used in the study had p-values which were far less than 0.05 level of significance required to ascertain normality assumption. This implies that the panel data failed the normality assumption and as such the study undertook a transformation of the dependent variable after conducting a confirmatory test.

Table 4.4: Shapiro-Wilk Test for Normality

Variable	Obs.	W	V	Z	Prob>z
CAMEL	444	0.69572	91.984	10.811	0.00000
Portfolio size	409	0.49521	141.764	11.800	0.00000
Portfolio quality	407	0.64011	100.628	10.982	0.00000
Mortgage interest return	380	0.98468	4.029	3.308	0.00047
Mortgage term	417	0.96924	8.789	5.182	0.00000
LTV ratio	419	0.98556	4.145	3.391	0.00035
Firm size	475	0.95967	12.954	6.143	0.00000
Lending capacity	517	0.58426	144.129	11.967	0.00000
Firm age	499	0.97188	9.442	5.396	0.00000
Joint test for Normality Residuals	360	0.76703	58.371	9.629	0.00000

Source: Research Data 2021

In addition, the study undertook a confirmatory Galvao's one-way error component test of skewness and kurtosis to assess normality in the panel data set. This is mostly used for aggregated or quantitative data as the one used in this study. Outcome of this test is presented in Table 4.5 below. Skewness and kurtosis results in the table show that all variables used in the study fall outside the required skewness of ± 1.96 and standard kurtosis of ± 3 for normality assumption.

Table 4.5: Skewness/Kurtosis Tests for Normality

Variable	Obs.	Pr.(Skewness)	Pr.(Kurtosis)	Adj. chi2(2)	Prob.>chi2
CAMEL	444	0.0000	0.0000	.	0.0000
Portfolio Size	409	0.0000	0.0000	.	0.0000
Portfolio Quality	407	0.0000	0.0000	.	0.0000
Interest Return	380	0.0011	0.6494	9.88	0.0071
Mortgage Term	417	0.0000	0.0213	20.06	0.0000
LTV Ratio	419	0.0038	0.0026	15.11	0.0005
Firm Size	475	0.0004	0.0000	29.64	0.0000
Lending Capacity	517	0.0000	0.0000	.	0.0000
Firm Age	499	0.0000	0.0301	24.26	0.0000

Source: Research Data 2021

Based on the findings, the study rejected the null hypothesis of normality implying that residential mortgage portfolio, product innovation, firm characteristics and performance were not normally distributed. This led to use of non-linear models as a remedy. The dependent variable (CAMEL) was also computed as a natural logarithm.

4.5.3 Multicollinearity Test Results

The study used the VIF to assess the presence or absence of multicollinearity in the identified variables of study. VIF test outcome is presented in Table 4.6 below for all the independent variables. The acceptable VIF ranges between one and ten (1<VIF<10) in the coefficients (Wooldridge, 2016). For each explanatory variable, the VIF was less than 10 and tolerance values (1/VIF) above 0.1, with the highest VIF being 7.92 for mortgage term and the lowest 1.01 for LTV ratio. This shows that the data set had no problem of multicollinearity, implying that research data was good for further analysis.

Table 4.6: Multicollinearity Test

Variable	**VIF**	**Tolerance**
Mortgage term	7.92	0.126218
Mortgage interest return	5.65	0.177145
Lending capacity	3.84	0.260610
Firm size	1.96	0.509967
Portfolio Size	1.72	0.582889
Portfolio Quality	1.59	0.630901
Firm Age	1.57	0.635724
LTV Ratio	1.01	0.992764
Mean VIF	**3.16**	

Source: Research Data 2021

4.5.4 Heteroscedasticity Test Results

The modified Wald test was applied to assess the presence of heteroscedasticity. The assumption in the panel model is that the residuals (unobserved errors) have a constant variance and absence of a constant variance indicates that heteroscedasticity is present. The null hypothesis was therefore that the error terms were homoscedastic or had a constant variance. Outcome of the modified Wald test are shown in Table 4.7 below.

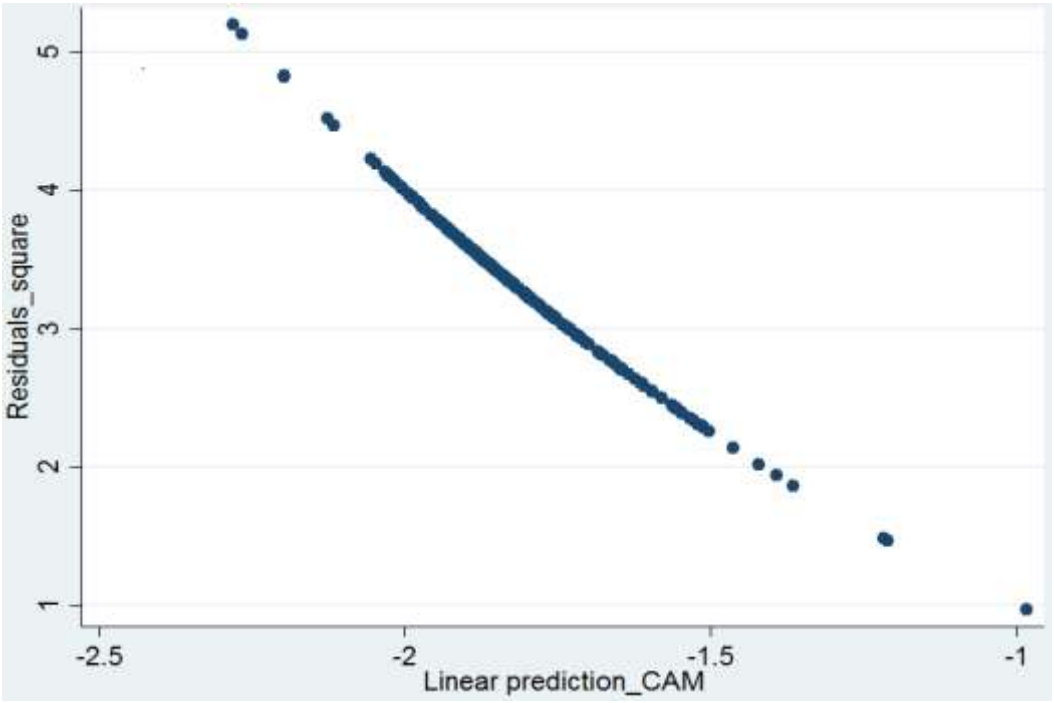
Table 4.7: Breusch and Pagan Lagrangian Multiplier Test

	Variables	**sd = sqrt(Var)**
CAMEL	.0888387	.2980582
e	.0654214	.2557761
u	.0050819	.0712872
Test: Var(u) = 0 chibar2(01) = 5.88 Prob > chibar2 = 0.0076		

Source: Research Data 2021

The outcome shows that the test rejected the null hypothesis of homoscedasticity or constant variance of the idiosyncratic errors of the joint regression analysis. This is because the Breusch and Pagan Lagrangian multiplier test has a p-value of 0.0076. The result therefore shows that heteroscedasticity was present (Moral-Benito et al., 2019). Similar finding is arrived at using the scatter plot test as shown in figure 4.5. To rectify the problem, the study subjected data to robust panel regressions of the standard errors.

Figure 4.5 Scatter Plot Test for Heteroscedasticity



Source: Research Data 2021

4.5.5 Autocorrelation Test Results

Autocorrelation, also referred to as cross-sectional dependence of the error term in each of the regressions, was tested using Wooldridge test for autocorrelation in panel data. The model assumes that cross-sectional dependence of the error terms is absent. The null hypothesis was therefore that there is no cross-sectional dependence in the error terms. Table 4.8 below presents the autocorrelation test results for the joint regression model.

Table 4.8: Wooldridge Test for Autocorrelation in Panel Data

H0: no first-order autocorrelation

F(1, 30) = 10.422

Prob > F = 0.0030

Source: Research Data

As presented in Table 4.8 above, the Wooldridge test result ($P<0.05$) led to a rejection of the null hypothesis. Hence it can be concluded that the data had serial correlation and thus required a remedy. The study therefore subjected the panels to robust regressions of the standard errors.

4.5.6 Hausman Specification Test

The study, in recognition of the need to establish the appropriate panel data analysis method to apply between fixed-effects and random-effects models, conducted Hausman specification test. The null hypothesis stated that the random-effects approach is suitable while the alternative hypothesis supported the fixed-effects model. The decision criteria based on this hypothesis was to reject the null hypothesis in case the p-value was statistically significant ($P < .05$), or otherwise fail to reject the null hypothesis ($P >.05$) in each case.

In the absence of a composite variable for residential mortgage portfolio, product innovation and firm characteristics, panel regression models were run at sub-hypothesis level. The Hausman's test was therefore conducted for each regression model and the results presented under hypotheses testing.

4.6 Correlation Analysis

The Pearson's product-moment correlation was applied in this study to measure the extent to which the study variables are associated with each other. The Pearson's correlation coefficient is used to assess the significance of the linear relationship between two variables (Harring & Wasko, 2011), and the correlation coefficient is denoted by 'r', which can range between -1 to +1. Cooper and Schindler (2011) denotes that a value of -1 means a perfect negative relationship between the variables, which implies that an increase in one variable results in a proportionate decrease in the other variable and vice versa. When the value is +1, it indicates a perfect positive relationship, which implies that the variables change proportionately in the same direction.

The closer the value of correlation coefficient is to either +1 or -1, the higher the relationship between the variables. Pearson's correlation coefficient is applied when the variables in research are either measured by interval or ratio scales (Sekaran, 2006). The outcome of the correlation analysis is presented at a 0.05 level of significance, in line with other studies such as Munjuri (2012), Mwangi (2014) and Ondigo (2016). This study has used a two-tailed test of significance since there were no prior assumptions on the direction of the association between any pair of variables. The correlation analysis outcome is presented in Table 4.9 showing varying degrees of association among the research variables.

As shown in the correlation matrix, the association between bank performances as

measured by the CAMEL score and residential mortgage portfolio dimensions that is portfolio size ($r = 0.1183$, $p<0.05$), portfolio quality ($r = 0.2264$, $p<0.05$) and interest return ($r = 0.0984$, $p<0.05$) are positive and statistically significant. The Pearson's correlation results imply that mortgage portfolio attributes and bank performance move in the same direction.

Table 4.9 Correlation Analysis Table

Variables	CAMEL	Portfolio Size	Portfolio Quality	Interest Return	Mortgage Term	LTV Ratio	Firm Size	Lending Capacity	Firm Age
CAMEL	1.0000								
Portfolio Size	0.1183*	1.0000							
Portfolio Quality	0.2264*	0.5002*	1.0000						
Interest Return	0.0984	0.7484*	0.5209*	1.0000					
Mortgage Term	-0.1859*	0.2016*	0.0912	0.3791*	1.0000				
LTV Ratio	-0.0683	-0.1313*	0.0535	0.1040*	0.1814*	1.0000			
Firm Size	-0.0129	0.2239*	0.3341*	0.7035*	0.3478*	0.2686*	1.0000		
Lending Capacity	-0.0266	0.2401*	0.2155*	0.2459*	0.1808*	0.0460	0.0659	1.0000	
Firm Age	0.0838	0.0246	0.0678	0.2562*	0.1341*	0.2944*	0.4265*	-0.0433	1.0000

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

Source: Research Findings 2021

The correlation between residential mortgage portfolios attributes and product innovation variables (mortgage term and LTV ratio) were assessed. There was a positive association between mortgage term and portfolio size, ($r =0.2016$, $p<0.05$), between mortgage term and portfolio quality ($r = 0.0912$, $p>0.05$) and between mortgage term and interest return ($r =0.3791$, $p<0.05$), which was statistically significant. Similarly, the correlation between LTV ratio and mortgage portfolio attributes exhibited a negative association between LTV ratio and portfolio size ($r =-0.1313$, $p<0.05$), a positive link between LTV ratio and portfolio quality ($r =0.0535$,

p>0.05) and a positive link between LTV ratio and interest return (r =0.1040, p<0.05), all of which were statistically significant except LTV ratio and portfolio quality.

The correlation between product innovation variables and performance as measured by CAMEL was assessed. The findings revealed that there was a negative association between mortgage term and performance (r =-0.1859, p<0.05) and a negative link between LTV ratio and performance (r =-0.0683, p>0.05). The results imply that both the product innovation variables and performance move in the opposite direction.

The correlation between firm characteristics variables and performance was also explored. The findings revealed that there was a negative association between firm size and performance (r =-0.0129, p>0.05), a negative link between lending capacity and performance (r =-0.0266, p>0.05) and also there was a positive association between performance and age of the firm. The findings imply that firm characteristics variables and performance move in the opposite direction. Also, all firm characteristics attributes were not statistically significant.

The correlation results on the relationship among residential mortgage portfolio attributes, firm characteristics and performance were statistically significant and positive. The study examined the association between portfolio size and firm size (r = 0.2239, p<0.05), the association between portfolio quality and firm size (r = 0.3341, p<0.05) and portfolio interest return and firm size (r = 0.7035, p<0.05) from where all associations were significant. For the association between portfolio size and lending capacity (r = 0.2401, p<0.05), the association between portfolio quality and lending capacity (r = 0.2155, p<0.05), portfolio return and lending capacity (r = 0.2459, p<0.05) and between portfolio size (r = 0.0246, p<0.05) or portfolio quality (r = 0.0678, p>0.05)

had a non-significant effect. The results imply that mortgage portfolio attributes, firm characteristics and performance move either in the same direction or in the opposite direction. Further details are as shown in Table 4.9.

Based on the Pearson's correlation outcomes, the association between the study variables is largely moderate, though statistically significant in some of the cases. Cooper and Schindler (2011) provides guidance on the existence of multicollinearity problem, which can occur when the established correlation coefficient for any two independent variables is above 0.8. In Table 4.9 above, none of the relationship between any two variables is above 0.8, meaning that the issue of multicollinearity does not exist and panel data is therefore suitable for analysis.

4.7 Chapter Summary

Chapter four has presented the panel data capture rate, results of the descriptive data analysis on research variables, trend analysis through graphical presentation, diagnostic test results, panel data analysis technique selection and correlation analysis. The data capture rate showed that the study successfully collected 520 data points against a target of 572 from registered commercial banks that held outstanding residential mortgage loans over the study period. This represents a data capture rate of 91% and is considered adequate for panel data analysis.

Results of the descriptive statistical analysis on mortgage portfolio size showed that commercial banks originating mortgages in Kenya had a relatively low portfolio size of 9% on average compared to their total loans, representing a low mortgage uptake in the market. Average mortgage portfolio quality of 5.4% was found to be higher than the overall non-performing loan ratio in the banking sector over the study period, implying a higher credit risk associated with mortgage loans. Portfolio quality exhibited

positive skewness and high peakedness. On interest return, results of descriptive statistics showed average net mortgage interest of Kshs. 38.455 million, with positive skewness and high peakedness.

Descriptive statistic results on product innovation showed average mortgage term of 12.14 years, implying that majority of mortgage facilities originated by licensed banks operating in Kenya are for medium term duration of less than 15 years. Mortgage term data had negative skewness and normal peakedness. LTV ratio was 84.13, indicating that on average, mortgage loans originated by banks operating in Kenya as a ratio of the value of mortgaged property is round 84%. Since around 75% of residential mortgage loans in Kenya are issued by 6 large banking institutions, the LTV ratio is heavily influenced by large banks.

On bank characteristics, firm size had a mean score of 10.0941 (Kshs. 24, 199.81 million), signifying a relatively strong asset base by commercial banks in Kenya. Firm size exhibited negative skewness and high peakedness. Firm age averaged 21 years, implying that majority of the institutions originating mortgage loans are the old banking institutions. Firm age data exhibited negative skewness and high peakedness. Lending capacity had an average score of 77.7%, indicating that some headroom is still available for banks to issue loans from primary deposits. Lending capacity data was positively skewed with high peakedness. CAMEL score had a mean score of 0.1768, with positive skewness and high peakedness. The 2018 CBK bank supervision annual report indicated a satisfactory CAMEL rating for licensed banks operating in Kenya. Outcome of the descriptive statistical analysis tended to support the use of either fixed-effects or random-effects models as most independent variables exhibited skewness and kurtosis outside the range for a normal distribution.

Trend analysis was also conducted on the panel data to visualize the graphical presentation of mean and median for independent and dependent variables, with portfolio size showing an upward trend for both the mean and median over the study period. It denoted a significant increase in the average mortgage size while the growth in median was only marginal during the period, suggesting that larger banks experienced a high increase in portfolio size compared to small and medium banks. Portfolio quality mean and median increased during the period, with the mean remaining higher than the median, suggesting that both large and small banks have issues of non-performing loans. This may be linked to the strengthening of credit standards in the banking sector. The trend analysis results showed a similar movement between mean and median mortgage interest return, suggesting significant returns for both small and large banks in the mortgage sector. The mean and median interest return also moved closer to each other in the latter part of the study period, potentially showing the impact of interest rate capping in the banking sector. The CAMEL score had a near identical mean and median, with mean CAMEL being continuously higher than the median.

Diagnostic tests were done on the assumptions of normality, collinearity, homogeneity, and autocorrelation, with the thresholds and values computed for all variables in this research. Normality test was run using Shapiro-Wilk test, which showed that panel data failed the normality test. This was also confirmed through Galvao's one-way error component test for skewness and kurtosis, which showed that all variables used in the study were outside the required skewness of ± 1.96 and standard kurtosis of ± 3 for normality assumption. This implied the use of alternative approaches such as fixed-effects or random-effects models for panel data analysis was appropriate. To test for multicollinearity, the VIF was applied, with the result showing a VIF of less than 10

and tolerance value above 0.1 for all variables. This indicated that the data set had no problem of multicollinearity and as such, the research data could be used for further analysis. The modified Wald test was run to establish the presence of heteroscedasticity, with the result indicating that heteroscedasticity was present. To address the problem, the study subjected the data to robust panel regression of the standard errors. In order to test for autocorrelation, the Wooldridge test for autocorrelation was applied and there was autocorrelation detected, which was addressed by subjecting the data to robust regression of the standard errors.

In order to establish which panel data analysis model to adopt, other tests were done in addition to the diagnostic tests. Hausman's test was conducted within each individual model under hypothesis testing to confirm which panel analysis model between random-effects and fixed-effects best suit the research data. The decision criterion was to reject the null hypothesis if the p-values were statistically significant ($P < .05$), implying that the fixed-effects model was appropriate, or otherwise fail to reject the null hypothesis if the p-value were insignificant ($P > .05$) in each case, implying that the random-effects model was appropriate. Fisher-type unit root test was used to test data stationarity. The result indicated absence of unit root for all the variables; hence the data was fit for fixed-effects or random-effects model.

Correlation analysis results indicated a positive and statistically significant relationship between bank performance and portfolio size ($r = 0.1183$, $p<0.05$; portfolio quality ($r = 0.2264$, $p<0.05$) and negative significant correlation with mortgage term ($r = -0.1859$, $p<0.05$). There was also a positive and statistically significant correlation between mortgage term and portfolio size ($r = 0.2016$, $p<0.05$), interest return and firm size ($r = 0.2239$, $p<0.05$) among others. Since none of the association between any two variables exceeded 0.8, there was no problem of multicollinearity.

CHAPTER FIVE:
HYPOTHESES TESTING AND DISCUSSION OF FINDINGS

5.1 Introduction

This chapter presents results of the test of the four hypotheses and their respective sub-hypotheses. The study findings, interpretation and discussions are presented as well. The four specific objectives guided the study and were also the basis on which the hypotheses were derived. The first hypothesis tested the direct relationship among residential mortgage portfolio attributes and performance of commercial banks in Kenya and premised that the relationship is not significant. In the absence of a composite index for residential mortgage portfolio, three null sub-hypotheses were derived to test the relationship between portfolio size, portfolio quality as well as interest return and performance of commercial banks in Kenya.

The second hypothesis stated that the relationship between residential mortgage portfolio and performance of commercial banks in Kenya is not significantly intervened by product innovation. This led to testing of the six corresponding sub-hypotheses. The third hypothesis held that the relationship between residential mortgage portfolio and performance of commercial banks in Kenya is not significantly moderated by firm characteristics. This also led to testing of the resulting nine sub-hypotheses. The final hypothesis tested whether the joint effect of product innovation and firm characteristics on the relationship between residential mortgage portfolio and performance of commercial banks is not significant and is different from the individual effects. Three sub-hypotheses, representing the mortgage portfolio components, were tested. Therefore, the four hypotheses and their respective sub-hypotheses were tested and interpreted using the panel data regression techniques.

5.2 Residential Mortgage Portfolio and Performance

The first specific objective was to establish the relationship between residential mortgage portfolio and performance of commercial banks in Kenya. The study addressed this through testing for the first null hypothesis (H_1), which stated that the relationship between residential mortgage portfolio and performance of commercial banks in Kenya is not significant. Residential mortgage portfolio consisted of mortgage portfolio size, mortgage portfolio quality and mortgage interest return. As part of the analysis, the study tested the sub-hypotheses: *H_{1a}: The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significant. H_{1b}: The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significant. H_{1c}: The relationship between mortgage interest return and performance of commercial banks in Kenya is not significant.*

The predicting models tested were stated as below:

$$CAM_{it} = \alpha + \beta_1 PS_{it} + \varepsilon_{it}$$
$$CAM_{it} = \alpha + \beta_1 PQ_{it} + \varepsilon_{it}$$
$$CAM_{it} = \alpha + \beta_1 IR_{it} + \varepsilon_{it}$$

Note: The variables have been defined in section 3.9.1

In estimation, the dependent variable was CAMEL whereas the mortgage portfolio dimensions (portfolio size, portfolio quality and portfolio interest return) were used as the independent variables. The model selection statistics were considered and as can be observed (Table 5.1 below), both random-effects and fixed-effects models were employed in estimating the predicting models. This was based on the Hausman model selection statistics. Model 1 tested sub-hypothesis H_{1a} while model 2 tested sub-hypothesis H_{1b} and model 3 tested sub-hypothesis H_{1c}. The first two models (model 1 and 2) were estimated via random-effects model (Model 1; Hausman Chi2=1.55,

Prob>chi2=0.2129, and model 2; Hausman Chi2=0.80, Prob>chi2=0.3716) whereas the third model was estimated via fixed-effects model (Hausman Chi2=4.45, Prob>chi2=0.0350). From the model fitness statistics, the overall model (model 1) was not significant (since overall p-value of 0.4193 was more than 0.05). On the other hand, the overall models (model 2 and 3) were found to be significant (since overall p-values of 0.0000 and 0.0207 respectively were less than 0.05). This meant that the data fitted these models well. The overall R-squared for the three models (model 1; R2=0.0051, model 2; R2=0.0981 and model 3, R2=0.0039) were all small values, however, this is expected mostly in panel data regression (Orayo & Mose, 2016). The findings are as shown in Table 5.1.

Table 5.1: Panel Regression Analysis between Residential Mortgage Portfolio and Performance of Commercial Banks

Robust Models	**Model 1- (PS & CAMEL)**		**Model 2- (PQ & CAMEL)**		**Model 3- (IR & CAMEL)**	
Variable	**β**	**P-Value**	**β**	**P-Value**	**β**	**P-Value**
Portfolio Size (PS)	0.2886 (0.81)	0.419	-	-	-	-
Portfolio Quality (PQ)	-	-	1.5856 (4.71)	0.000	-	-
Interest Return (IR)	-	-	-	-	0.0556 (2.41)	0.021
Constant	-1.8354 (-40.35)	0.000	-1.8814 (-46.96)	0.000	-2.067 (-24.05)	0.000
Model selection statistics	Hausman Chi2=1.55 Prob>chi2=0.2129		Hausman Chi2=0.80 Prob>chi2=0.3716		Hausman Chi2=4.45 Prob>chi2=0.0350	
Model Fitness statistics	Random-effects GLS regression Number of obs = 369 R-squared: 0.0051 Wald chi2(1) = 0.65 Prob>chi2= 0.4193		Random-effects GLS regression Number of obs = 367 R-squared: 0.0981 Wald chi2(1) = 22.14 Prob>chi2= 0.0000		Fixed-effects (within) regression Number of obs = 344 R-squared: 0.0039 F (1,38) = 5.83 Prob > F= 0.0207	

t-statistic – Values in parenthesis

Source: Research Findings 2021

In testing the first sub-hypothesis, the study assessed the relationship between mortgage portfolio size and bank performance. As presented in Table 5.1 above, in the first model

(Model 1), the findings show that the positive relationship between mortgage portfolio size and performance of commercial banks is not statistically significant (β= 0.2886, p>0.05). The following is the resulting estimated model:

CAM_{it} = -1.8354 + 0.2886PS_{it}…… (5.1)

The result infers that a unit increase in mortgage portfolio size leads to a non-significant increase in performance by 28.9 per cent, holding other factors constant. Based on the finding, the study failed to reject the first sub-hypothesis (H_{1a}) which stated that: *the relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significant.*

To assess the second sub-hypothesis, the study examined the relationship between portfolio quality and performance of commercial banks in Kenya. In the second model (Model 2), the findings show that the positive relationship between mortgage portfolio quality and performance of commercial banks is statistically significant (β= 1.5856, p<0.05). The following is the resulting estimated model;

CAM_{it} = -1.8814 + 1.5856PQ_{it} …… (5.2)

The finding implies that a unit rise in mortgage portfolio quality leads to a significant increase in performance by 158.5 per cent holding other factors constant. Based on the finding, the study rejected the second sub-hypothesis (H_{1b}), which stated that: *the relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significant.*

Further, to assess the third sub-hypothesis, the study analyzed the relationship between mortgage interest return and performance of commercial banks in Kenya. In the third model (Model 3) the findings show that the positive relationship between mortgage

portfolio interest return and performance of commercial banks is statistically significant (β= 0.0556, p<0.05). The following is the resulting estimated model;

CAM_{it} = -2.0666+ 0.0556IR_{it} …… (5.3)

The finding implies that a unit rise in mortgage portfolio interest return leads to a significant increase in performance by 5.6 per cent, holding other factors constant. Based on the finding, the study rejected the third sub-hypothesis (H_{1c}) which stated that: *the relationship between mortgage portfolio interest return and performance of commercial banks in Kenya is not significant.*

5.3 Residential Mortgage Portfolio, Product Innovation and Performance

The second specific objective was to analyze the effect of mortgage product innovation on the relationship between residential mortgage portfolio and performance of commercial banks in Kenya. This was addressed by testing the second null hypothesis (H_2), which stated that the relationship between residential mortgage portfolio and performance of commercial banks in Kenya is not significantly intervened by product innovation. Mortgage product innovation in the study was measured through Mortgage Term (MT) and Loan to Value (LTV) ratio. The study adopted Baron and Kenny's (1986) approach in testing the intervening effect of product innovation. The method is based on the assumption that for intervening effect to be confirmed, certain assumption must be met (called rule of thumb in the model). The model is guided by four assumptions that must be met for intervening effect to be confirmed as existing. Mediation analysis as proposed by Baron and Kenny (1986) was conducted through panel estimation model(s), which were adopted because of the nature of the data gathered.

In order to enhance the assessment clarity, this study analyzed the second null

hypothesis which was disintegrated into the following null sub-hypotheses: *H_{2a}: The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly intervened by mortgage term; H_{2b}: The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly intervened by mortgage term; H_{2c}: The relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly intervened by mortgage term; H_{2d}: The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly intervened by loan to value ratio; H_{2e}: The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly intervened by loan to value ratio, and H_{2f}: The relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly intervened by loan to value ratio.*

The panel models tested are stated below:

Step 1

$CAM_{it} = \alpha + \beta_1 PS_{it} + \varepsilon_{it}$; $CAM_{it} = \alpha + \beta_1 PQ_{it} + \varepsilon_{it}$; and $CAM_{it} = \alpha + \beta_1 IR_{it} + \varepsilon_{it}$

Step 2

$MT_{it} = \alpha + \beta_1 PS_{it} + \varepsilon_{it}$; $MT_{it} = \alpha + \beta_1 PQ_{it} + \varepsilon_{it}$; $MT_{it} = \alpha + \beta_1 IR_{it} + \varepsilon it$; $LTV_{it} = \alpha + \beta_1 PS_{it} + \varepsilon it$; $LTV_{it} = \alpha + \beta_1 PQ_{it} + \varepsilon_{it}$; and $LTV_{it} = \alpha + \beta_1 IR_{it} + \varepsilon_{it}$

Step 3

$CAM_{it} = \alpha + \beta_1 MT_{it} + \varepsilon_{it;}$ and $CAM_{it} = \alpha + \beta_1 LTV_{it} + \varepsilon_{it}$

Step 4

$CAM_{it} = \alpha + \beta_1 PS_{it} + \beta_2 MT_{it} + \varepsilon_{it}$; $CAM_{it} = \alpha + \beta_1 PS_{it} + \beta_2 LTV_{it} + \varepsilon_{it}$; $CAM_{it} = \alpha + \beta_1 PQ_{it} + \beta_2 MT_{it} + \varepsilon_{it}$; $CAM_{it} = \alpha + \beta_1 PQ_{it} + \beta_2 LTV_{it} + \varepsilon_{it}$; $CAM_{it} = \alpha + \beta_1 IR_{it} + \beta_2 MT_{it} + \varepsilon_{it}$; and $CAM_{it} = \alpha + \beta_1 R_{it} + \beta_2 LTV_{it} + \varepsilon_{it}$

Note: The variables have been defined in section 3.9.2

Following the Baron and Kenny (1986) approach, the study estimated the first model (step one) as the base model to determine whether residential mortgage portfolio attributes had a statistically significant effect on CAMEL. In the second step, the study estimated a model to determine whether the independent variables (portfolio size,

portfolio quality and interest return) had a significant influence on the intervening variable (mortgage product innovation components). In the third step, the third model was estimated to determine the effect of the intervening variable (mortgage product innovation attributes) on the dependent variable (CAMEL) and in the fourth step, the fourth model estimated the influence of residential mortgage portfolio variables together with the intervening variable (mortgage product innovation) as an explanatory variable on CAMEL as the dependent variable. The results of the four steps are summarized in the regression Tables 5.2 a-c.

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5.3.1 Residential Mortgage Portfolio Size, Product Innovation and Performance

The study assessed the intervening effect of the following, first and fourth null sub-hypotheses (H_{2a}, H_{2d}) under mortgage portfolio size; *H_{2a}: The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly intervened by mortgage term, and H_{2d}: The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly intervened by loan to value ratio.* In panel data, before any regression model is run, the researcher is required to choose the appropriate estimation technique from the two main ones, fixed effects and random effects, to use. Each regression model was therefore tested via Hausman's (1978) test for model specification.

The null hypothesis was that if $p < 0.05$, use fixed effects, otherwise apply random effects if $p > 0.05$**.** Both fixed and random effects models were used based on Hausman model specification test. The dependent variable was CAMEL, while the independent variable of interest was mortgage portfolio size with mortgage product innovation attributes (mortgage term and LTV ratio) being the intervening variable. The findings are shown in table 5.2a below.

The Hausman model selection statistics were considered and as can be observed (Table 5.2a), both random-effects and fixed-effects models were employed in estimating the predicting models. The first four models (models 1, 2, 3 and 4) and models 6 and 7 were estimated via random-effects model ($p>0.05$) whereas the fifth model was estimated via fixed-effects regressions ($p<0.05$). From the model fitness statistics, the overall statistics for models (models 1, 2, 3, 5 and 7) was not significant ($p>0.05$). On the other hand, the overall model(s) (model 4 and 6) were found to be significant ($p<0.05$). This meant that the data fitted these models well.

The overall R-squared for all models were small values, less than 5%. Very often, the emerging R-squared in panel data is small in most estimations. In this case, we read the overall p-value to explain model fitness, which is the same message as R-squared gives (Orayo & Mose, 2016).

As indicated in Table 5.2a, the first step tested the link between portfolio size as a component of residential mortgage portfolio and performance of banks via the use of random-effects GLS regression. This is shown in model 1, with a positive but statistically non-significant relationship between commercial banks' performance and mortgage portfolio size. According to Baron and Kenny (1986), this step was important in indicating whether the causal variable correlates with the outcome variable, that is performance. This step indicates whether there is a relationship that can be mediated or intervened.

Based on the first step, it can be stated that the relationship between portfolio size as a component of residential mortgage portfolio and performance of banks does not meet the first assumption of mediation.

Table 5.2a: Panel Regression Analysis between Mortgage Portfolio size, Product Innovation Components and Performance

	Step 1-(CAM)		Step 2-(Product Innovation)				Step 3-(CAM)				Step 4-(CAM)			
Variable	**Model 1- (PS & CAMEL)**		**Model 2- (PS & MT)**		**Model 3- (PS & LTV)**		**Model 4- (MT & CAMEL)**		**Model 5- (LTV & CAMEL)**		**Model 6- (PS, MT & CAMEL)**		**Model 7 – (PS, LTV & CAMEL)**	
	β	**P-Value**	**β**	**P-Value**	**β**	**P-Value**	**β**	**P-Value**	**β**	**P-Value**	**β**	**P-Value**	**β**	**P-Value**
Portfolio Size (PS)	0.2886 (0.81)	0.419	0.3267 (0.98)	0.329	-0.0431 (-1.13)	0.258	-	-			0.3886 (1.06)	0.290	0.3369 (0.86)	0.388
Mortgage Term (MT)	-	-	-	-	-	-	-0.1769 (-3.54)	0.000	-	-	-.1932 (-3.28)	0.001	-	-
LTV Ratio (LTV)	-	-	-	-	-	-	-	-	0.2342 (0.27)	0.787	-	-	0.0505 (0.09)	0.928
Constant	-1.8354 (-40.35)	0.000	2.4598 (39.25)	0.000	0.0682 (70.32)	0.000	-1.3994 (-11.72)	0.000	-2.0465 (-2.82)	0.008	-1.3703 (-10.07)	0.000	-1.8924 (-4.00)	0.000
Model selection statistics	Hausman Chi2=1.55 Prob>chi2=0.2129		Hausman Chi2=0.72 Prob>chi2=0.3977		Hausman Chi2=0.23 Prob>chi2=0.6309		Hausman Chi2=0.31 Prob>chi2=0.5798		Hausman Chi2=8.40 Prob>chi2=0.0037		Hausman Chi2=1.29 Prob>chi2=0.5239		Hausman Chi2=1.48 Prob>chi2=0.4774	
Model Fitness statistics	Random-effects GLS regression Number of obs = 369 R-squared: 0.0051 Wald chi2(1) = 0.65 Prob>chi2= 0.4193		Random-effects GLS regression Number of obs = 394 R-squared: 0.0463 Wald chi2(1) = 0.95 Prob>chi2= 0.3287		Random-effects GLS regression Number of obs= 396 R-squared:0.0050 Wald chi2(1) = 1.28 Prob>chi2=0.2577		Random-effects GLS regression Number of obs = 373 R-squared: 0.0351 Wald chi2(1) = 12.55 Prob>chi2= 0.0004		Fixed-effects Within regression Number of obs = 374 R-squared: 0.0.0025 F (1,37)= 0.07 Prob > F = 0.7873		Random-effects GLS regression Number of obs = 355 R-squared: 0.0468 Wald chi2(2) = 11.21 Prob>chi2= 0.0037		Random-effects GLS regression Number of obs = 356 R-squared: 0.0062 Wald chi2(2) = 0.75 Prob>chi2= 0.6887	

T-statistic – Values in parenthesis

Source: Research Findings 2021

Following the resulting relationship in step one, it is suggested that the intervening effect of either mortgage term and/or LTV ratio will not be tested further. In conclusion thereof, the study failed to reject sub-hypothesis H_{2a} and H_{2d}.

5.3.2 Residential Mortgage Portfolio Quality, Product Innovation and Performance

This sub-objective assessed the intervening effect of mortgage term and LTV ratio on the relationship between mortgage portfolio quality and performance of commercial banks in Kenya. The study assessed the second and fifth sub- hypotheses (H_{2b}, H_{2e}) under mortgage portfolio quality; *H_{2b}: The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly intervened by mortgage term, and H_{2e}: The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly intervened by loan to value ratio.* Both fixed and random effects models were used following Hausman model specification test. The dependent variable was CAMEL, while the independent variable of interest was mortgage portfolio quality, with mortgage product innovation (mortgage term and LTV ratio) being the intervening variable. The findings are shown in table 5.2b.

The Hausman model selection statistics were considered from where both random-effects and fixed-effects models were employed in estimating the predicting models. The first four models (models 1, 2, 3 and 4) and models 6 and 7 were estimated via random-effects model ($p>0.05$) whereas the fifth model was estimated via fixed-effects regressions ($p<0.05$). From the model fitness statistics, the overall statistics for models (models 1, 2, 4, 6 and 7) were significant ($p<0.05$). On the other hand, the overall model(s) (models 3 and 5) were not found to be significant ($p>0.05$). The overall R-squared for all models ranged between 0.5% and 13%. This is however expected mostly

Table 5.2b: Panel Regression Analysis between Mortgage Portfolio Quality, Product Innovation Components and Performance

Robust Models	Step 1-(CAMEL)		Step 2-(Product Innovation)				Step 3-(CAMEL)				Step 4-(CAMEL)			
Variable	Model 1- (PQ & CAMEL)		Model 2-(PQ & MT)		Model 3- (PQ & LTV)		Model 4- (MT & CAMEL)		Model 5- (LTV & CAMEL)		Model 6- (PQ, MT & CAMEL)		Model 7 – (PQ, LTV & CAMEL)	
	β	P-Value	β	P-Value	β	P-Value	β	P-Value	β	P-Value	β	P-Value	β	P-Value
Portfolio Quality (PQ)	1.5856 (4.71)	0.000	-0.5888 (-3.31)	0.001	0.0439 (0.84)	0.400	-	-			1.5110 (4.43)	0.000	1.6093 (4.74)	0.000
Mortgage Term (MT)	-	-	-	-	-	-	-0.1769 (-3.54)	0.000	-	-	-.1303 (-2.20)	0.027	-	-
LTV Ratio (LTV)	-	-	-	-	-	-	-	-	-0.0111 (-0.11)	0.913	-	-	0.0663 (0.12)	0.901
Constant	-1.8814 (-46.96)	0.000	2.5206 (39.16)	0.000	0.8361 (76.02)	0.000	-1.3994 (-11.72)	0.000	-1.8081 (-25.41)	0.000	-1.5615 (-10.91)	0.000	-1.9509 (-4.38)	0.000
Model selection statistics	Hausman Chi2=0.80 Prob>chi2=0.3716		Hausman Chi2=1.66 Prob>chi2=0.1978		Hausman Chi2=1.19 Prob>chi2=0.2750		Hausman Chi2=0.31 Prob>chi2=0.5798		Hausman Chi2=8.40 Prob>chi2=0.0037		Hausman Chi2=0.45 Prob>chi2=0.7990		Hausman Chi2=0.62 Prob>chi2=0.7343	
Model Fitness statistics	Random-effects GLS regression Number of obs = 367 R-squared: 0.0981 Wald chi2(1) = 22.14 Prob>chi2= 0.0000		Random-effects GLS regression Number of obs = 392 R-squared: 0.0059 Wald chi2(1) = 10.94 Prob>chi2= 0.0009		Random-effects GLS regression Number of obs = 394 R-squared: 0.0001 Wald chi2(1) = 0.71 Prob>chi2= 0.3995		Random-effects GLS regression Number of obs = 373 R-squared: 0.0351 Wald chi2(1) = 12.55 Prob>chi2= 0.0004		Fixed-effects Within regression Number of obs = 444 R-squared: 0.0400 F(1,39)= 0.01 Prob > F = 0.9128		Random-effects GLS regression Number of obs = 353 R-squared: 0.1337 Wald chi2(2)= 24.82 Prob>chi2= 0.0000		Random-effects GLS regression Number of obs = 354 R-squared: 0.1115 Wald chi2(2)= 23.03 Prob>chi2= 0.0000	

T-statistic – Values in parenthesis

Source: Research Findings 2021

in panel data regression (Orayo & Mose, 2016).

As indicated in the findings, the first step tested the link between portfolio quality as a component of residential mortgage portfolio and performance of banks via the use of random-effects GLS regression. According to Baron and Kenny (1986), this step was important in indicating whether the causal variable correlates with the outcome variable, that is performance. This is shown in model 1 where a positive and statistically significant relationship between commercial banks' performance and mortgage portfolio quality was found. The finding implies that there is a relationship (positive and significant) that can be mediated or intervened. Based on the first step, it can be stated that the relationship between portfolio quality as a component of residential mortgage portfolio and performance of banks does meet the first assumption of mediation. Then we proceed to the second step.

In the second step, the study conducted a panel random-effects regression analysis between residential mortgage portfolio (portfolio quality) and Mortgage term (model 2) as well as LTV ratio (model 3). The study found a negative and statistically significant relationship between mortgage portfolio quality and mortgage term as a dependent variable (β=-0.5888, $p<0.05$), which implies that a unit increase in mortgage portfolio quality leads to a decrease in mortgage term by 58.9%, holding other factors constant. On the other hand, the relationship between mortgage portfolio quality and mortgage LTV ratio as a dependent variable (β=0.0439, $p>0.05$) exhibited a statistically non-significant positive relationship. This means that a unit increase in mortgage portfolio quality results in a non-significant rise in mortgage LTV ratio by 0.0439 units, holding other factors constant.

Premised on the second assumption, it can be stated that only the relationship between

residential mortgage portfolio quality and mortgage term meet the second assumption for mediation test whereas the relationship between residential mortgage portfolio quality and mortgage LTV ratio fails to meet the second assumption for mediation test. We therefore proceed to step three in determining whether mortgage term intervenes the relationship between residential mortgage portfolio quality and performance of commercial banks in Kenya.

In the third step, the mediating or intervening variables are regressed against bank performance. The finding shows a negative and statistically significant relationship between mortgage term (β=-0.1769, $p<0.05$) and performance in model 4 in the absence of residential mortgage portfolio, the independent variable. This means that a unit increase in mortgage term results in a significant decrease in performance by 17.7%, holding other factors constant. Based on the third assumption and the foregoing findings, it can be stated that the relationship between residential mortgage term and performance does meet the third assumption for mediation.

In the fourth step, the study controls for product innovation attributes in the relationship between residential mortgage portfolio and performance. Step three had confirmed that only mortgage term meets the third assumption for mediation and LTV ratio does not. As indicated in model 6, the study revealed that portfolio quality still showed a statistically significant effect on performance with (β=1.511, $p<0.05$) even when mortgage term is controlled. When the mediation variable is introduced, the relationship between portfolio quality and performance remains positive and statistically significant. This implies that mortgage term partially intervenes the relationship between residential mortgage portfolio quality and performance of commercial banks in Kenya. Based on the findings, the study thus rejected the sub-hypothesis *H_{2b}: The relationship between*

mortgage portfolio quality and performance of commercial banks in Kenya is not significantly intervened by mortgage term.

5.3.3 Residential Mortgage Interest Return, Product Innovation and Performance

This sub-objective was meant to assess the mediating or intervening effect of mortgage term and LTV ratio on the relationship between mortgage interest return and performance of commercial banks in Kenya. The study assessed the third and sixth null sub-hypotheses (H_{2c}, H_{2f}) under mortgage interest return; *H_{2c}: The relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly intervened by mortgage term, and H_{2f}: The relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly intervened by loan to value ratio.* Both fixed and random effects models were used based on Hausman model specification test. The dependent variable was CAMEL, while the independent variable was mortgage interest return with mortgage product innovation components (mortgage term and LTV ratio) being the intervening variable. The findings are shown in table 5.2c below.

From the results, the Hausman model selection statistics were considered from where both random-effects and fixed-effects models were employed in estimating the predicting models. The first three models (models 1, 2, and 3) and model 5 were estimated via fixed-effects regressions ($p<0.05$) whereas the 4th, 6th and 7th models were estimated via random- effects regressions ($p>0.05$). From the model fitness statistics, the overall statistics for models (models 1, 4 and 6) were significant ($p<0.05$). On the other hand, the overall model(s) (model 2, 3, 5 and 7) were not found to be significant ($p>0.05$). The overall R- squared for all models ranged between 0.4% and 4.0%. According to Orayo and Mose (2016), this is however expected mostly in panel

data regressions.

Table 5.2c illustrates the effect of product innovation attributes on the relationship between residential mortgage portfolio and performance of commercial banks in Kenya. From the finding, the first step (model 1), the study evaluated the relationship between mortgage interest return as a component of residential mortgage portfolio and performance of banks through the use of fixed-effects (within) regression. This step is considered important in indicating whether the causal variable correlates with the outcome variable that is performance. This is shown in model 1 where a positive and statistically significant relationship between performance of commercial banks and mortgage interest return was revealed.

The findings imply that there is a relationship (positive and significant) that can be mediated or intervened. Based on the first step, it can be stated that the relationship between portfolio interest return as a component of residential mortgage portfolio and performance of banks does meet the first assumption of mediation. This allows proceeding to the second step.

In step two, the study conducted a panel fixed regression analysis between residential mortgage interest return and mortgage term (model 2) as well as LTV ratio (model 3). The study found a negative and statistically non-significant relationship between mortgage interest return and mortgage term as a dependent variable (β=-0.0287, $p>0.05$), which implies that a unit increase in mortgage interest return leads to a decrease in mortgage term by 2.9% holding other factors constant. Similarly, the relationship between mortgage interest return and LTV ratio as a dependent variable (β=-0.0004, $p>0.05$) exhibited a statistically non-significant negative relationship.

Table 5.2c:Panel Regression Analysis between Mortgage Interest Return, Product Innovation Components and Performance

Robust Models	Step 1-(CAMEL)		Step 2-(Product Innovation)				Step 3-(CAMEL)				Step 4-(CAMEL)			
Variable	Model 1- (IR & CAMEL)		Model 2- (IR & MT)		Model 3- (IR & LTV)		Model 4- (MT & CAMEL)		Model 5- (LTV & CAMEL)		Model 6- (IR, MT & CAMEL)		Model 7- (IR, LTV & CAMEL)	
	β	P-Value	β	P-Value	β	P-Value	β	P-Value	β	P-Value	β	P-Value	β	P-Value
Interest Return (IR)	0.0556 (2.41)	0.021	-0.0287 (-1.99)	0.055	-0.0004 (-0.18)	0.861	-	-			0.3815 (2.26)	0.024	0.0373 (2.21)	0.027
Mortgage Term (MT)	-	-	-	-	-	-	-0.1769 (-3.54)	0.000	-	-	-0.1545 (-2.51)	0.012	-	-
LTV Ratio (LTV)	-	-	-	-	-	-	-	-	-0.0111 (-0.11)	0.913	-	-	-0.1573 (-0.26)	0.799
Constant	-2.0666 (-24.05)	0.000	2.6103 (48.72)	0.000	0.8464 (109.83)	0.000	-1.3994 (-11.72)	0.000	-1.8081 (-25.41)	0.000	-1.5841 (-11.38)	0.000	-1.8393 (-3.54)	0.000
Model selection statistics	Hausman Chi2=4.45 Prob>chi2=0.0350		Hausman Chi2=14.25 Prob>chi2=0.0002		Hausman Chi2=4.48 Prob>chi2=0.0342		Hausman Chi2=0.31 Prob>chi2=0.5798		Hausman Chi2=8.40 Prob>chi2=0.0037		Hausman Chi2=2.70 Prob>chi2=0.2592		Hausman Chi2=4.30 Prob>chi2=0.1166	
Model Fitness statistics	Fixed-effects (within) regression Number of obs = 344 R-squared: 0.0039 F(1,38) = 5.83 Prob > F= 0.0207		Fixed-effects (within) regression Number of obs = 374 R-squared: 0.1129 F(1,36) = 3.95 Prob > F= 0.0546		Fixed-effects (within) regression Number of obs = 375 R-squared: 0.0104 F(1,38) = 0.03 Prob > F= 0.8609		Random-effects GLS regression Number of obs = 373 R-squared: 0.0351 Wald chi2(1) = 12.55 Prob>chi2= 0.0004		Fixed-effects (within) regression Number of obs = 444 R-squared: 0.0400 F(1,39)= 0.01 Prob > F = 0.9128		Random-effects GLS regression Number of obs = 338 R-squared: 0.0402 Wald chi2(2)= 7.97 Prob>chi2= 0.0186		Random-effects GLS regression Number of obs = 339 R-squared: 0.0064 Wald chi2(2)= 4.89 Prob>chi2= 0.0866	

T-statistic – Values in parenthesis

Source: Research Findings 2021

This means that a unit increase in mortgage portfolio interest return results in a non-significant decline in mortgage LTV ratio by 0.0004 units, holding other factors constant. Following the second assumption, it can be stated that both the relationship(s) between residential mortgage interest return and mortgage term, as well as the relationship between mortgage interest return and LTV ratio do not meet the second assumption for mediation test.

Since the assumption of the second step has been violated by both mortgage term and LTV ratio, the study did not therefore proceed to test the subsequent steps. This is because, according to Baron and Kenny (1986) approach, the causal variable, which is mortgage interest return, is not correlated with intervening variable(s), in this case mortgage term and LTV ratio. The study therefore failed to reject sub-hypotheses H_{2c} and H_{2f}.

5.4 Residential Mortgage Portfolio, Firm Characteristics and Performance

The third objective was to determine the effect of firm characteristics on the relationship between residential mortgage portfolio and performance of commercial banks in Kenya. This was hypothesized in the third null hypothesis:

H_3: The relationship between residential mortgage portfolio and performance of commercial banks in Kenya is not significantly moderated by firm characteristics.

In order to approve or disapprove the above hypothesis, the study decomposed and tested the hypothesis into the following nine null sub-hypotheses:

H_{3a}: The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly moderated by firm size.

H_{3b}: The relationship between mortgage portfolio quality and performance of

commercial banks in Kenya is not significantly moderated by firm size.

H_{3c}: *The relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly moderated by firm size.*

H_{3d}: *The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly moderated by lending capacity.*

H_{3e}: *The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly moderated by lending capacity.*

H_{3f}: *The relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly moderated by lending capacity.*

H_{3g}: *The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly moderated by firm age.*

H_{3h}: *The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly moderated by firm age.*

H_{3i}: *The relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly moderated by firm age.*

The panel regression models tested were stated as below:

$$CAM_{it} = \alpha + \beta_1 PS_{it} + \beta_2 SIZE_{it} + \beta_3 (PS_{it} * SIZE_{it}) + \varepsilon_{it}$$
$$CAM_{it} = \alpha + \beta_1 PS_{it} + \beta_2 LC_{it} + \beta_3 (PS_{it} * LC_{it}) + \varepsilon_{it}$$
$$CAM_{it} = \alpha + \beta_1 PS_{it} + \beta_2 AGE_{it} + \beta_3 (PS_{it} * AGE_{it}) + \varepsilon_{it}$$
$$CAM_{it} = \alpha + \beta_1 PQ_{it} + \beta_2 SIZE_{it} + \beta_3 (PQ_{it} * SIZE_{it}) + \varepsilon_{it}$$
$$CAM_{it} = \alpha + \beta_1 PQ_{it} + \beta_2 LC_{it} + \beta_3 (PQ_{it} * LC_{it}) + \varepsilon_{it}$$
$$CAM_{it} = \alpha + \beta_1 PQ_{it} + \beta_2 AGE_{it} + \beta_3 (PQ_{it} * AGE_{it}) + \varepsilon_{it}$$
$$CAM_{it} = \alpha + \beta_1 IR_{it} + \beta_2 SIZE_{it} + \beta_3 (IR_{it} * SIZE_{it}) + \varepsilon_{it}$$
$$CAM_{it} = \alpha + \beta_1 IR_{it} + \beta_2 LC_{it} + \beta_3 (IR_{it} * LC_{it}) + \varepsilon_{it}$$
$$CAM_{it} = \alpha + \beta_1 IR_{it} + \beta_2 AGE_{it} + \beta_3 (IR_{it} * AGE_{it}) + \varepsilon_{it}$$

Note: The variables have been defined in section 3.9.3

To test for the moderating effect, a hierarchical three step linear regression analysis was conducted as suggested by Baron and Kenny (1986). Step one tested the effect of residential mortgage portfolio attributes on the dependent variable (CAMEL score); step two tested the effect of residential mortgage portfolio components and firm characteristic variables on the dependent variable (CAMEL score); and in step three, the interaction terms were introduced in the equation and their impact evaluated while controlling for the effect of residential mortgage portfolio and firm characteristics.

The interaction term was computed as the product of the standardized scores of residential mortgage portfolio and firm characteristics. This involved transformation by standardizing the interaction terms through centering approach thereby creating one interaction variable (residential mortgage portfolio attribute * firm characteristic components). The centering of mean was important as it minimized the possibility of multicollinearity problems in the panel data.

In order to counteract the multicollinearity problem, the continuous variables were standardized or instead converted into z-scores with the mean of zero and the standard deviation of one (1). The interactions led to generating of new multiplicative variables computed for mortgage portfolio size (PS), mortgage portfolio quality (PQ) and mortgage interest return (IR), and the firm characteristic attributes (bank size, lending capacity and age). This generated the interaction terms mortgage portfolio size (PS), mortgage portfolio quality (PQ) and mortgage interest return (IR) as: PS*SIZE, PQ*SIZE, IR*SIZE, and PS*LC, PQ*LC and IR*LC; and also PS*AGE, PQ*AGE, and IR*AGE. In order to confirm moderating effect, the interaction term should be statistically significant.

5.4.1 Residential Mortgage Portfolio Size, firm characteristics and Performance

The study examined the moderation effect of firm size, lending capacity and firm age on the relationship between mortgage portfolio size and performance of commercial banks in Kenya. The study assessed the first, fourth and seventh sub-hypotheses (H_{3a}, H_{3d}, *and* H_{3g}) under mortgage portfolio size. They stated that:

H_{3a}: *The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly moderated by firm size.*

H_{3d}: *The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly moderated by lending capacity.*

H_{3g}: *The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly moderated by firm age.*

From the results, the Hausman model selection statistics were considered from where both random-effects and fixed-effects models were utilized in estimating the predicting models. The three models (model 1, 3, and 6) were estimated via random-effects regression ($p>0.05$) whereas the 2nd, 4th, 5th and 7th models were estimated via fixed-effects regression ($p<0.05$). The findings are as presented in Table 5.3a below.

Table 5.3a indicates that overall, some models were statistically significant since the respective p-values (model 2, 4, 5 and 7) were less than 0.05 despite the explanatory powers being low. Step one tested the significance of the relationship between residential mortgage portfolio size and the dependent variable (CAMEL), which was not confirmed. This is because the p-value ($p=0.419$) was more than 0.05 level. Based on the Baron and Kenny (1986) approach for moderation, there is no essence of further testing since the causal effect of the predictor variable was not established. The study

Table 5.3a: Panel Regression Analysis between Mortgage Portfolio size, Firm Characteristic Components and Performance

	Step 1		Step 2						Step 3					
Variables	**Model 1 – (PS & CAMEL)**		**Model 2 – (PS, FS & CAMEL)**		**Model 3 – (PS, LC & CAMEL)**		**Model 4 – (PS, AGE & CAMEL)**		**Model 5- (PS, FS, PS*FS & CAMEL**		**Model 6- (PS, LC, PS*LC & CAMEL)**		**Model 7- (PS, AGE, PS*AGE & CAMEL)**	
CAMEL	**β**	**P-Value**	**β**	**P-Value**	**β**	**P-Value**	**β**	**P-Value**	**β**	**P-Value**	**β**	**P-Value**	**β**	**P-Value**
Portfolio Size (PS)	0.2887 (0.81)	0.419	0.2624 (0.34)	0.732	0.2301 (0.68)	0.494	0.0736 (0.10)	0.918	0.8333 (0.57)	0.571	0.4732 (0.32)	0.751	-0.1663 (-0.07)	0.945
Firm Size (FS)	-	-	0.1523 (2.66)	0.012	-	-	-	-	0.1579 (2.31)	0.026	-	-	-	-
Lending Capacity (LC)	-	-	-	-	0.0544 (0.69)	0.492	-	-	-	-	0.0769 (0.50)	0.617	-	-
Age	-	-	-	-	-	-	0.02 (1.11)	0.267	-	-	-	-	0.4415 (3.74)	0.001
PS*FS	-	-	-	-	-	-	-	-	-0.0589 (-0.35)	0.730	-	-	-	-
PS*LC	-	-	-	-	-	-	-	-	-	-	-0.2255 (-0.19)	0.852	-	-
PS*AGE	-	-	-	-	-	-	-	-	-	-	-	-	0.0786 (0.10)	0.924
Constant	-1.8354 (-40.35)	0.000	-3.4478 (-5.79)	0.000	-1.8776 (-23.17)	0.000	0.90 (64.65)	0.000	-3.5020 (-5.05)	0.000	-1.8984 (-12.14)	0.000	-3.2602 (-9.18)	0.000
Model selection statistics	Hausman Chi2=1.55 Prob>chi2=0.2129		Hausman Chi2=32.40 Prob>chi2=0.0000		Hausman Chi2=2.53 Prob>chi2=0.2823		Hausman Chi (2)=25.6 Prob>chi2=0.0000		Hausman Chi2=32.82 Prob>chi2=0.0000		Hausman Chi2=3.92 Prob>chi2=0.2698		Hausman Chi2=24.4 Prob>chi2=0.0000	
Model Fitness statistics	Random-effects GLS regression Number of obs = 369 R-squared:0.0051 Wald chi2(1)= 0.65 Prob>chi2= 0.4193		Fixed-effects (within) regression Number of obs = 365 R-squared:0.0003 F(2,38) = 3.70 Prob > F= 0.0340		Random-effects GLS regression Number of obs=369 R-squared:0.0091 Wald chi2(2)= 1.28 Prob>chi2= 0.5261		Fixed-effects (within) regression Number of obs = 362 R-squared: 0.0158 F(2,39) = 10.11 Prob > F= 0.0003		Fixed-effects (within) regression Number of obs = 365 R-squared: 0.0003 F(3,38) = 3.04 Prob > F= 0.0404		Random-effects GLS regression Number of obs = 369 R-squared: 0.0094 Wald chi2(3)= 1.39 Prob>chi2= 0.7074		Fixed-effects (within) regression Number of obs = 362 R-squared: 0.0157 within = 0.1233 F(3,39) = 6.88 Prob > F= 0.0008	

T-statistic – Values in parenthesis

Source: Research Findings 2021

therefore concluded that the *relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly moderated by firm size; the relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly moderated by firm lending capacity and lastly the relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly moderated by firm age.* The study therefore failed to reject sub-hypotheses*:* H_{3a}, H_{3d} and H_{3g}.

5.4.2 Residential Mortgage Portfolio Quality, Firm Characteristics and Performance

The study also examined the moderation effect of firm size, lending capacity and firm age on the relationship between mortgage portfolio quality and performance of commercial banks in Kenya. The study assessed the second, fifth and eighth null sub-hypotheses (H_{3b}, H_{3e}, *and* H_{3h}) under mortgage portfolio quality. They stated that:

H_{3b}: *The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly moderated by firm size*.

H_{3e}: *The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly moderated by lending capacity.*

H_{3h}: *The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly moderated by firm age.*

As indicated in the findings in Table 5.3b below, the Hausman model selection statistics were considered from where both random-effects and fixed-effects models were used in the regression of the predicting models. The three models (model 1, 3, and 6) were estimated via random-effects regressions ($p>0.05$) whereas the 2^{nd}, 4^{th}, 5^{th} and 7^{th}

Table 5.3b: Panel Regression Analysis between Mortgage Portfolio Quality, Firm Characteristic Components and Performance

	Step 1		Step 2						Step 3					
Variables	**Model 1 – (PQ & CAMEL)**		**Model 2 – (PQ, FS & CAMEL)**		**Model 3 – (PQ, LC & CAMEL)**		**Model 4 – (PQ, AGE & CAMEL)**		**Model 5-(PQ, FS, PQ*FS & CAMEL)**		**Model 6- (PQ, LC, PQ*LC & CAMEL)**		**Model 7- (PQ, AGE, PQ*AGE & CAMEL**	
CAMEL	**β**	**P-Value**	**β**	**P-Value**	**β**	**P-Value**	**β**	**P-Value**	**β**	**P-Value**	**β**	**P-Value**	**β**	**P-Value**
Portfolio Quality (PQ)	1.5856 (4.71)	0.000	1.4097 (5.80)	0.000	1.5607 (4.76)	0.000	1.3181 (3.70)	0.001	-0.0169 (-0.01)	0.996	1.9819 (2.09)	0.037	-0.9831 (-0.35)	0.730
Firm Size (FS)	-	-	0.0865 (2.79)	0.006	-	-	-	-	0.0782 (1.29)	0.206	-	-	-	-
Lending Capacity (LC)	-	-	-	-	0.0221 (0.31)	0.760	-	-	-	-	0.0867 (0.47)	0.641	-	-
Age	-	-	-	-	-	-	0.3124 (3.68)	0.001	-	-	-	-	0.3215 (3.65)	0.001
PQ*FS	-	-	-	-	-	-	-	-	0.1409 (0.50)	0.621	-	-	-	-
PQ*LC	-	-	-	-	-	-	-	-	-	-	-0.4276 (-0.47)	0.642	-	-
PQ*AGE	-	-	-	-	-	-	-	-	-	-	-	-	0.7636 (0.85)	0.401
Constant	-1.8814 (-46.96)	0.000	-2.8025 (-8.75)	0.000	-1.9003 (-23.74)	0.000	-2.8986 (-10.83)	0.000	-2.7184 (-4.34)	0.000	-1.9543 (-11.62)	0.000	-2.9342 (-10.54)	0.000
Model Selection Statistics	Hausman Chi2=0.80 Prob>chi2=0.3716		Hausman Chi2=16.89 Prob>chi2=0.0.0002		Hausman Chi2=2.09 Prob>chi2=0.3517		Hausman Chi2=11.36 Prob>chi2=0.0034		Hausman Chi2=15.25 Prob>chi2=0.0016		Hausman Chi2=5.97 Prob>chi2=0.1132		Hausman Chi2=13.37 Prob>chi2=0.0039	
Model Fitness Statistics	Random-effects GLS regression Number of obs = 367 R-squared: 0.0981 Wald chi2(1) = 22.14 Prob>chi2= 0.0000		Fixed-effects (within) regression Number of obs =363 R-squared: 0.0445 F(2,322) = 30.76 Prob > F= 0.0000		Random-effects GLS regression Number of obs=367 R-squared: 0.0985 Wald chi2(2)= 22.93 Prob>chi2= 0.0000		Fixed-effects (within) regression Number of obs = 360 R-squared: 0.0533 F(2,39) = 20.26 Prob > F= 0.0000		Fixed-effects (within) regression Number of obs = 363 R-squared: 0.0484 F(3,38) = 10.03 Prob > F= 0.0001		Random-effects GLS regression Number of obs = 367 R-squared: 0.0979 Wald chi2(3)= 19.02 Prob>chi2= 0.0003		Fixed-effects (within) regression Number of obs = 360 R-squared: 0.0486 F(3,39) = 13.04 Prob > F= 0.0000	

t-statistic – Values in parenthesis

Source: Research Findings 2021

models were estimated via fixed-effects regressions ($p<0.05$). Overall, all models were statistically significant since the respective p-values were less than 0.05 despite their explanatory powers being low.

In the first step, the study tested the significance of the relationship between residential mortgage portfolio quality and the dependent variable (CAMEL) and the relationship was confirmed as positive and statistically significant. This is because the p-value ($\beta=1.5856$, $R^2=0.0981$, $p=0.000$) was less than 0.05. The study thus proceeded to step two from where the relationship between residential mortgage portfolio quality and firm characteristic attributes were tested on performance before inclusion of the interaction terms.

From the findings in Table 5.3b, the percentage of variance in performance of 4.45% in model 2 (R2=0.0445, F=30.76 and $p<0.05$); 9.85% in model 3 (R2=0.0981, Wald chi2 (2) =22.93, and $p<0.05$) and 5.33% in model 4 (R2=0.0533, F=20.26, and $p<0.05$) was accounted for by residential mortgage portfolio quality and firm characteristics. Overall, the models revealed a statistically significant relationship between performance of commercial banks (dependent variable), moderating variables (firm size, lending capacity and firm age) and residential mortgage portfolio (independent variable).

In the third and last step; the study introduced the interaction terms to the equations while controlling for the variables of residential mortgage portfolio quality and firm characteristics. Despite the fact that the overall significance was confirmed (see models 5, 6, 7), at individual level, all interaction terms were reported to have non-significant coefficients: mortgage portfolio quality and firm size ($p=0.621$); residential mortgage portfolio quality versus lending capacity ($p=0.642$) and residential mortgage portfolio

quality and firm age (p=0.401). Based on these results, the study concluded that residential mortgage portfolio quality had no statistical significant effect across the seven models. This includes the respective interactions. In other words, the null hypothesis that there was no significant influence of firm characteristics on the relationship between residential mortgage portfolio quality and performance of commercial banks in Kenya is not rejected.

From the above analysis, the study failed to reject the following null sub-hypothesis: H_{3b}: *The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly moderated by firm size*, H_{3e}: *The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly moderated by lending capacity,* and H_{3h}: *The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly moderated by firm age*.

5.4.3 Residential Mortgage Interest Return, Firm Characteristics and Performance

The study further examined the moderation effect of firm size, lending capacity and firm age on the relationship between mortgage portfolio interest return and performance of commercial banks in Kenya. The study assessed the third, sixth and ninth null sub-hypotheses (H_{3c}, H_{3f}, *and* H_{3i}) under mortgage portfolio interest return. They stated that:

H_{3c}: *The relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly moderated by firm size*.

H_{3f}: *The relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly moderated by lending capacity*.

H_{3i}: The relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly moderated by firm age.

The Hausman model selection statistics were considered from where both random-effects and fixed-effects models were used in the regression of the predicting models. Almost all models (model 1, 2, 4, 5, 6 and 7) were estimated via fixed-effects regression ($p<0.05$) whereas only the third model was estimated via random-effects regressions ($p>0.05$). The findings are as presented in Table 5.3c below. The findings show that, overall, almost all models were statistically significant (model 1, 2, 4, 5 and 7) since the respective p-values were less than 0.05 despite their explanatory powers being low.

In the first step, the study tested the significance of the relationship between residential mortgage portfolio interest return and the dependent variable (CAMEL). The relationship was confirmed as positive and significant ($\beta=0.0556$, $R^2=0.0039$, $p=0.021$). The study thus proceeded to step two from where the relationship between residential mortgage interest return and firm characteristics were tested on performance before inclusion of the interaction terms.

From the findings in Table 5.3c below, the percentage of variance in performance of 0.02% in model 2 ($R^2=0.0002$, $F=9.14$ and $p<0.05$); 0.92% in model 3 ($R^2=0.0092$, Wald chi2 (2) = 4.5, and $p>0.05$), and 1.92% in model 4 ($R^2=0.0192$, $F=9.14$, and $p<0.05$) was accounted for by residential mortgage portfolio interest return and firm characteristics (FS, LC and AGE). The models revealed a statistically significant relationship between performance of commercial banks (dependent variable), moderating variables (firm size, lending capacity and firm age) and residential mortgage portfolio interest retrun (independent variable) except in the third model which was not significant.

Table 5.3c: Panel Regression Analysis between Mortgage Interest Return, Firm Characteristic Components and Performance

	Step 1		Step 2						Step 3					
Variables	**Model 1 – (IR & CAMEL)**		**Model 2 – (IR, FS & CAMEL)**		**Model 3 – (IR, LC & CAMEL)**		**Model 4 –(IR, AGE & CAMEL)**		**Model 5-(IR, FS, IR*FS & CAMEL)**		**Model 6-(IR, LC, IR*LC & CAMEL)**		**Model 7- (IR, AGE, IR*AGE & CAMEL)**	
CAMEL	**β**	**P-Value**	**β**	**P-Value**	**β**	**P-Value**	**β**	**P-Value**	**β**	**P-Value**	**β**	**P-Value**	**β**	**P-Value**
Interest Return (IR)	.0556 (2.41)	0.021	-0.0117 (-0.70)	0.486	0.0307 (2.04)	0.041	0.0171 (0.69)	0.494	-0.1270 (-1.01)	0.320	0.1182 (1.46)	0.152	-0.1334 (-2.09)	0.043
Firm size (FS)	-	-	0.1993 (4.27)	0.000	-	-	-	-	0.1511 (2.03)	0.050	-	-	-	-
Lending capacity (LC)	-	-	-	-	0.0588 (0.70)	0.483	-	-	-	-	0.4114 (1.07)	0.290	-	-
AGE	-	-	-	-	-	-	0.3529 (4.18)	0.000	-	-	-	-	0.1915 (1.76)	0.087
IR*FS	-	-	-	-	-	-	-	-	0.0115 (0.91)	0.368	-	-	-	-
IR*LC	-	-	-	-	-	-	-	-	-	-	-0.0871 (-0.99)	0.329	-	-
IR*AGE	-	-	-	-	-	-	-	-	-	-	-	-	0.0503 (2.32)	0.026
Constants	-2.0666 (-24.05)	0.000	-3.9038 (-8.12)	0.000	-1.9940 (-18.02)	0.000	-3.0471 (-10.87)	0.000	-3.4455 (-4.71)	0.000	-2.3607 (-7.07)	0.000	-2.5997 (-8.32)	0.000
Model Selection Statistics	Hausman Chi2=4.45 Prob>chi2=0.0350		Hausman Chi2=49.96 Prob>chi2=0.0000		Hausman Chi2=4.84 Prob>chi2=0.0888		Hausman Chi2=16.57 Prob>chi2=0.0003		Hausman Chi2=51.77 Prob>chi2=0.0000		Hausman Chi2=8.26 Prob>chi2=0.0409		Hausman Chi2=24.66 Prob>chi2=0.0000	
Model Fitness Statistics	Fixed-effects (within) regression Number of obs = 344 R-squared: 0.0039 F(1,38) = 5.83 Prob > F= 0.0207		Fixed-effects (within) regression Number of obs = 341 R-squared: 0.0002 F(2,37) = 9.14 Prob > F= 0.0006		Random-effects GLS regression Number of obs=344 R-squared: 0.0092 Wald chi2(2)= 4.50 Prob>chi2= 0.1056		Fixed-effects (within) regression Number of obs = 339 R-squared: 0.0192 F(2,38) = 9.14 Prob > F= 0.0006		Fixed-effects (within) regression Number of obs = 341 R-squared: 0.0011 F(3,37) = 6.65 Prob > F= 0.0011		Fixed-effects (within) regression Number of obs =344 R-squared: 0.0108 F(3,38) = 2.09 Prob > F= 0.1183		Fixed-effects (within) regression Number of obs = 339 R-squared: 0.0153 F(3,38) = 6.29 Prob > F= 0.0014	

t-statistic – Values in parenthesis

Source: Research Findings 2021

In the third and last step; the study introduced the interaction terms to the predicting model equations and the corresponding impact evaluated while controlling for the variables of residential mortgage portfolio interest return and firm characteristics. As can be observed in the subsequent models, the percentage of variance in performance, that is 0.11% in model 5 (R^2=0.0011, F=6.65 and p<0.05); 1.08% in model 6 (R^2=0.0108, F=2.09, and p>0.05), and 1.53% in model 7 (R^2=0.0153, F=6.29 and p<0.05) was accounted for by residential mortgage portfolio interest return and firm characteristics (FS, LC and AGE). Except for lending capacity (see model 6), the rest of the models revealed a statistically significant overall relationship between performance of commercial banks (dependent variable), residential mortgage interest return (independent variable), moderating variables (firm size and firm age) and interaction terms (IR*FS and IR*AGE).

Despite significance illustrated via F and Wald chi tests (see models 5 and 7), at individual level, the interaction in model 6, IR*LC (β=-0.0871, p=0.329) was reported to have a non-significant effect on performance. Based on these results, the study concluded that interaction terms in models 5 and 6 had no statistical significant effect. In other words, the null hypothesis that there was no significant moderating influence of firm characteristics (firm size and lending capacity) on the relationship between residential mortgage portfolio interest return and performance of commercial banks in Kenya is not rejected.

The study therefore concluded that the interaction terms for models 5 and 6 were not statistically significant indicating that firm characteristics (firm size and lending capacity) had no moderating effect on the relationship between residential mortgage portfolio interest return and performance of the commercial banks in Kenya. On the other hand, the interaction terms for model 7, IR*AGE (β=0.0503, p=0.026) was

statistically significant, indicating that firm characteristics (firm age) had a moderating effect on the relationship between residential mortgage portfolio interest return and performance of the commercial banks in Kenya.

Based on the findings, the study concluded that the third and sixth null sub-hypotheses (*H_{3c}, and H_{3f}*) under mortgage portfolio interest return; stating stated that; (*H_{3c}) the relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly moderated by firm size, as well as, (H_{3f}): The relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly moderated by firm lendingcapacity* are not rejected. However, the ninth sub null sub-hypothesis (*H_{3i}*) stating that *the relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly moderated by firm age* was rejected.

5.5 Residential Mortgage Portfolio, Mortgage Innovation, Firm Characteristics and Performance

The fourth specific objective of the study was to examine the joint effect of mortgage product innovation and firm characteristics on the relationship between residential mortgage portfolio and performance of commercial banks in Kenya. The objective was tested in the fourth null-hypothesis as:

H_4: *The joint effect of Product innovation and firm characteristics on the relationship between residential mortgage portfolio and performance of commercial banks in Kenya is not significant and is different from the individual effects.*

In order to approve or disapprove the above hypothesis, the study decomposed the hypothesis into the following three null sub-hypotheses:

H_{4a}: *The joint effect of Product innovation and firm characteristics on the relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significant and is different from the individual effects.*

H_{4b}: *The joint effect of Product innovation and firm characteristics on the relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significant and is different from the individual effects.*

H_{4c}: *The joint effect of Product innovation and firm characteristics on the relationship between mortgage interest return and performance of commercial banks in Kenya is not significant and is different from the individual effects.*

Panel regression models were used to assess the hypothesized relationships. The panel regression models tested for each mortgage portfolio component was stated as below:

$$CAM_{it} = \alpha + \beta_1 PS_{it} + \beta_2 MT_{it} + \beta_3 LTV_{it} + \beta_4 SIZE_{it} + \beta_5 LC_{it} + \beta_6 AGE_{it} + \varepsilon_{it}$$
$$CAM_{it} = \alpha + \beta_1 PQ_{it} + \beta_2 MT_{it} + \beta_3 LTV_{it} + \beta_4 SIZE_{it} + \beta_5 LC_{it} + \beta_6 AGE_{it} + \varepsilon_{it}$$
$$CAM_{it} = \alpha + \beta_1 IR_{it} + \beta_2 MT_{it} + \beta_3 LTV_{it} + \beta_4 SIZE_{it} + \beta_5 LC_{it} + \beta_6 AGE_{it} + \varepsilon_{it}$$

Note: The variables have been defined in section 3.9.4

In the model estimation, the dependent variable was performance measured via CAMEL score whereas the mortgage portfolio dimensions (portfolio size, portfolio quality and portfolio interest return) were used as the independent variables. To determine whether product innovation and firm characteristics impacted the hypothesized relationships, the study estimated the direct relationship between the different dimensions of residential mortgage portfolio and performance. The study performed a model specification test as described by Hausman (1978) to determine the best model between random-effects and fixed-effects. From the findings in Table 5.4, models 1 and 3 were estimated via random-effects model (Hausman p value>0.05) whereas the other models were estimated through fixed-effects model (Hausman p-

value<0.05). From the model fitness statistics, the overall model (model 1) was the only model which was not significant (p=0.4193). On the other hand, all other models were found to be significant (p<0.05). This meant that the data fitted these models well. The overall R-squared for the models were all small values ranging between 0.4% and 9.8%. The findings are as shown in Table 5.4 below.

Given that residential mortgage portfolio, product innovation and firm characteristics were composed of different components, the condition for the hypothesis to be rejected was that at least one component of the independent, mediation and moderating variables is significant in the model. From the results, the percentage of variance of performance of 0.51% in model 1 (R2=0.0.0051, Wald chi2(1) =0.65 and p>0.05); 9.81% in model 3 (R2=0.0981, Wald chi2(1) =22.14, and p<0.05) and also 0.39% in model 5 (R2=0.0486, F=5.83, and p<0.05) was accounted for by residential mortgage portfolio size, portfolio quality and interest return respectively.

From the multiple panel data regressions, majorly fixed-effects regressions models (that is model 2, 4 and 6), they predicted the combined effect of the independent variables, intervening variables and moderating variables on the dependent variable. These models revealed a statistically significant relationship between performance of commercial banks (dependent variable, measured by CAMEL), residential mortgage portfolio (independent variable measured by portfolio size, portfolio quality and interest return), product innovation (intervening variable, measured by mortgage term and LTV ratio) and moderating variables (measured by firm size, lending capacity and firm age).

Table 5.4: Panel Regression Analysis of the Joint Effect of Product Innovation and Firm Characteristics on the Relationship between Mortgage Portfolio Components and Performance

	CAMEL, PS, Joint				CAMEL, PQ, Joint				CAMEL, IR, Joint			
Variables	**Model 1: PS**		**Model 2: Joint**		**Model 3: PQ**		**Model 4: Joint**		**Model 5: IR**		**Model 6: Joint**	
CAMEL	**β**	**P-Value**	**β**	**P-Value**	**β**	**P-Value**	**β**	**P-Value**	**β**	**P-Value**	**β**	**P-Value**
Portfolio Size (PS)	0.2887 (0.81)	0.419	-0.0888 (-0.13)	0.899	-	-	-	-	-	-	-	-
Portfolio Quality (PQ)	-	-	-	-	1.5856 (4.71)	0.000	1.1771 (3.00)	0.005	-	-	-	-
Interest Return (IR)	-	-	-	-	-	-	-	-	.0556 (2.41)	0.021	-0.0170 (-0.92)	0.362
Mortgage Term (MT)	-	-	-0.0829 (-1.11)	0.275	-	-	-0.0650 (-0.85)	0.399	-	-	-0.0399 (-0.55)	0.586
LTV Ratio (LTV)	-	-	0.1043 (0.14)	0.891	-	-	0.0703 (0.10)	0.922	-	-	-0.0473 (-0.06)	0.954
Firm Size (FS)	-	-	0.1066 (1.57)	0.125	-	-	0.0666 (1.06)	0.297	-	-	0.1391 (2.07)	0.046
Lending Capacity (LC)	-	-	0.0462 (0.66)	0.514	-	-	0.0273 (0.41)	0.686	-	-	0.0443 (0.66)	0.515
AGE	-	-	0.2610 (2.37)	0.023	-	-	0.1974 (2.15)	0.039	-	-	0.1927 (1.90)	0.065
Constants	-1.8354 (-40.35)	0.000	-3.7093 (-4.28)	0.000	-1.8814 (-46.96)	0.000	-3.1500 (-3.64)	0.001	-2.0666 (-24.05)	0.000	-3.7688 (-4.21)	0.000
Model selection statistics	Hausman Chi2=1.55 Prob>chi2=0.2129		Hausman Chi2=34.75 Prob>chi2=0.0000		Hausman Chi2=0.80 Prob>chi2=0.3716		Hausman Chi2=16.81 Prob>chi2=0.0094		Hausman Chi2=4.45 Prob>chi2=0.0350		Hausman Chi2=35.53 Prob>chi2=0.0000	
Model Fitness statistics	Random-effects GLS regression Number of obs = 369 R-squired: 0.0051 Wald chi2(1) = 0.65 Prob>chi2= 0.4193		Fixed-effects (within) regression Number of obs = 344 R-squired: 0.0203 F (6, 35) = 4.42 Prob > F= 0.0020		Random-effects GLS regression Number of obs = 367 R-squired: 0.0981 Wald chi2(1) = 22.14 Prob>chi2= 0.0000		Fixed-effects (within) regression Number of obs = 342 R-squired: 0.0794 F (6,36) = 6.88 Prob > F= 0.0001		Fixed-effects (within) regression Number of obs = 344 R-squired: 0.0039 F (1,38) = 5.83 Prob > F= 0.0207		Fixed-effects (within) regression Number of obs =330 R-squired: 0.0170 F (6, 35) = 4.48 Prob > F= 0.0018	

t-statistic – Values in parenthesis

Source: Research Findings 2021

From the findings, the overall relationship between mortgage portfolio size and performance of commercial banks turned from being statistically insignificant (Wald chi2 (1) = 0.65, p=0.4193) to being statistically significant (F (6, 36) = 4.42, p=0.0019). This was as well associated with a significantly improved R-squared from R^2=0.51 in model one to R^2= 2.02 in model two hence $\Delta R^2 = 1.51$. Also, further observation of the findings show that at least one component of the moderating variable, that is firm age in model two (p=0.023) is significant in the joint model. Despite the relationship between portfolio size and performance remaining statistically non-significant, it can be concluded that product innovation and firm characteristics significantly influence the relationship between portfolio size and performance of commercial banks.

From the findings, the association between mortgage portfolio quality and performance of commercial banks maintained the overall significance; model 3 (Wald chi2 (1) = 22.14, p=0.000) and model 4 (F (6,369) = 6.88, p=0.005). This was as well associated with a significantly reduced R-squared from R^2=9.81 in model three to R^2= 7.89 in model four hence $\Delta R^2 = -1.92$. Also, further observation of the finding show that mortgage portfolio quality (p=0.005) and at least one component of the moderating variable, that is firm age in model four (p=0.039) are statistically significant in the joint model. It can therefore be concluded that product innovation and firm characteristics significantly influence the relationship between residential mortgage portfolio quality and performance of commercial banks.

Further, the study examined whether product innovation and firm characteristics significantly influence the relationship between mortgage interest return and performance of commercial banks. The effect of association between mortgage portfolio interest return and performance of commercial banks maintained the overall

significance; model 5 (F (1, 38) = 5.83, p=0.0207) and model 6 (F (6, 35) = 4.48, p=0.0018). Just like residential mortgage portfolio size, this was associated with a significantly improved R-squared from R^2=0.39 in model five to R^2= 1.7 in model six hence $\Delta R^2 = 1.31$.

Despite the fact that mortgage interest return was not significant in model 6 (p=0.362), the finding show that at least one component of the moderating variable, that is firm size (p=0.0.046) is statistically significant in the joint model. It can therefore be concluded that product innovation and firm characteristics significantly influence the relationship between residential mortgage interest return and performance of commercial banks.

Table 5.5: Summary of Statistical Tests of Hypotheses and Interpretation of Results

Research Objectives	**Hypothesis/ Sub-Hypothesis**	**Results**	**Remarks**
Establish the relationship between residential mortgage portfolio and performance of commercial banks in Kenya.	**H_1:** The relationship between residential mortgage portfolio and performance of commercial banks in Kenya is not significant.	Statistically significant relationships between two residential mortgage portfolio attributes and performance	Rejected **H1b** and **H1c**. Failed to reject **H1a**
	H1a: The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significant.	Positive and statistically insignificant relationship between mortgage portfolio size and performance (β= 0.2886, t= 0.81, P>0.05).	Failed to reject the sub-hypothesis
	H1b: The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significant.	Statistically significant positive relationship between mortgage portfolio quality and performance (β=1.5856, t= 4.71, P<0.05).	Sub-hypothesis rejected
	H1c: The relationship between mortgage interest return and performance of commercial banks in Kenya is not significant.	Statistically significant positive relationship between mortgage interest return and performance (β=0.0556, t= 2.41, P<0.05)	Sub-hypothesis rejected

Research Objectives	Hypothesis/Sub -Hypothesis	Results	Remarks
Evaluate the effect of mortgage product innovation on the relationship between residential mortgage portfolio and performance of commercial banks in Kenya.	**H2:** The relationship between residential mortgage portfolio and performance of commercial banks in Kenya is not significantly intervened by product innovation.	Mortgage Term has a partial mediation effect on mortgage portfolio quality.	Rejected **H2b;** while failed to reject **H2a**, **H2c, H2d, H2e** and **H2f**
	H2a: The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly intervened by Mortgage Term	Failed step 1 of testing for mediation, with a positive but statistically insignificant relationship between portfolio size and CAMEL (β=0.2886, t= 0.81, P>0.05).	Failed to reject the Sub-hypothesis
	H2b: The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly intervened by mortgage term	When the model controls for mortgage term, the relationship between portfolio quality and performance remains statistically significant but with a lower coefficient, confirming partial mediation effect (β=1.5110, t= 4.43, P<0.05)	Sub-hypothesis rejected
	H2c: The relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly intervened by mortgage term	Failed step 2 of testing for mediation, with a negative and statistically insignificant relationship between interest mortgage return and mortgage term (β=-0.0287, t= -1.99, P>0.05)	Failed to reject the Sub-hypothesis
	H2d: The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly intervened by LTV ratio	Failed step 1 of testing for mediation, with a positive but statistically insignificant relationship between portfolio size and CAMEL (β=0.2886, t= 0.81, P>0.05).	Failed to reject the Sub-hypothesis

Research Objectives	Hypothesis/Sub-Hypothesis	Results	Remarks
Evaluate the effect of mortgage product innovation on the relationship between residential mortgage portfolio and performance of commercial banks in Kenya.	**H2e:** The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly intervened by LTV ratio	Failed step 2 of testing for mediation, with a negative and statistically insignificant relationship between interest mortgage return and LTV ratio (β=0.0402, t= 0.74, P>0.05)	Failed to reject the Sub-hypothesis
	H2f: The relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly intervened by LTV ratio	Failed step 2 of testing for mediation, with a negative and statistically insignificant relationship between mortgage interest return and LTV ratio (β=-0.0012, t=-0.55 , P>0.05)	Failed to reject the Sub-hypothesis
Determine the effect of firm characteristics on the relationship between residential mortgage portfolio and performance of commercial banks in Kenya	**H_3:** The relationship between residential mortgage portfolio and performance of commercial banks in Kenya is not significantly moderated by firm characteristics.	Firm age moderates the relationship between portfolio size and performance and lending capacity the relationship between interest return and performance	Rejected sub hypotheses **H_{3i}** and failed to reject: **H_{3a}, H_{3b}, H_{3c}, H_{3d}, H_{3e}, H_{3f}, H_{3g}, H_{3h}**
	H_{3a}: The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly moderated by firm size.	Failed step 1 of testing for moderation as the relationship between mortgage portfolio size and performance is not statistically significant (β=0.2887, t= 0.81, P>0.05)	Failed to reject sub hypothesis
	H_{3b}: The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly moderated by firm size.	Relationship between interaction term of mortgage portfolio quality and firm size with performance is positive but is not statistically significant (β=0.1409, t= 0.50, P>0.05)	Failed to reject sub hypothesis

Research Objectives	Hypothesis/Sub-Hypothesis	Results	Remarks
Determine the effect of firm characteristics on the relationship between residential mortgage portfolio and performance of commercial banks in Kenya	**H_{3c}:** The relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly moderated by firm size.	Relationship between interaction term of mortgage portfolio return and firm size with performance is positive but is not statistically significant (β=0.0115, t= 0.91, P>0.05)	Failed to reject sub hypothesis
	H_{3d}: The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly moderated by lending capacity.	Failed step 1 of testing for moderation as the relationship between mortgage portfolio size and performance is not statistically significant (β=0.2887, t= 0.81, P>0.05)	Failed to reject sub hypothesis
	H_{3e}: The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly moderated by lending capacity.	Relationship between the interaction term of mortgage portfolio quality and lending capacity with performance is negative but not statistically significant (β=-0.4276, t= -0.47, P>0.05)	Failed to reject sub hypothesis
	H_{3f}: The relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly moderated by lending capacity.	Relationship between the interaction term of mortgage interest return and lending capacity with performance is negative and but statistically insignificant (β=-0.0871, t= -0.99, P>0.05)	Failed to reject sub hypothesis
	H_{3g}: The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly moderated by firm age.	Failed step 1 of testing for moderation as the relationship between mortgage portfolio size and performance is not statistically significant (β=0.2887, t= 0.81, P>0.05)	Failed to reject sub hypothesis

Research Objectives	Hypothesis/Sub-Hypothesis	Results	Remarks
Determine the effect of firm characteristics on the relationship between residential mortgage portfolio and performance of commercial banks in Kenya	**H_{3h}:** The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly moderated by firm age	Relationship between interaction term of mortgage portfolio quality and firm age with performance is positive but is not statistically significant (β=0.7636, t= 0.85, P>0.05)	Failed to reject sub hypothesis
	H_{3i}: The relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly moderated by firm age.	Relationship between interaction term of mortgage interest return and firm age with performance is positive and statistically significant (β=0.0503, t= 2.32, P<0.05)	Sub- hypothesis rejected
Examine the joint effect of mortgage product innovation and firm characteristics on the relationship between residential mortgage portfolio and performance of commercial banks in Kenya.	**H_4:** The joint effect of product innovation and firm characteristics on the relationship between residential mortgage portfolio and performance of commercial banks in Kenya is not significant and is different from the individual effects.	Statistically significant effect on bank performance in the joint models upon introduction of product innovation and firm characteristics, at least with one component variable recording a statistically significant relationships	Hypothesis Rejected
	H_{4a}: The joint effect of product innovation and firm characteristics on the relationship between residential mortgage portfolio size and performance of commercial banks in Kenya is not significant and is different from the individual effects.	Despite a statistically non-significant relationship between portfolio size and performance in the joint model (β= -0.0888, t=-0.13, P>0.05), one of the component variables, firm age, registered a statistically significant effect (β= 0.2610, t=2.37, P>0.05). Hence product innovation and firm characteristics have a joint and significant effect on the relationship between portfolio size and performance of commercial banks in Kenya	Hypothesis Rejected

Research Objectives	Hypothesis/Sub-Hypothesis	Results	Remarks
Examine the joint effect of mortgage product innovation and firm characteristics on the relationship between residential mortgage portfolio and performance of commercial banks in Kenya.	**H_{4b}:** The joint effect of product innovation and firm characteristics on the relationship between residential mortgage portfolio quality and performance of commercial banks in Kenya is not significant and is different from the individual effects.	Statistically significant relationships between portfolio quality and bank performance (β=1.5856, t=4.71, P<0.05) and a statistically significant effect with firm age (β=0.1976, t=2.51, P<0.05). Hence product innovation and firm characteristics have a joint and significant effect on the relationship between portfolio quality and performance of commercial banks in Kenya	Hypothesis Rejected
	H_{4c}: The joint effect of product innovation and firm characteristics on the relationship between residential mortgage interest return and performance of commercial banks in Kenya is not significant and is different from the individual effects.	Despite a statistically non-significant relationship between mortgage interest return and performance in the joint model (β=-0.0170, t=-0.92, P >0.05), one of the component variables, firm size, registered a statistically significant relationship (β=0.1391, t=2.07, P<0.05). Hence product innovation and firm characteristics have a joint and significant effect on the relationship between mortgage interest return and performance of commercial banks in Kenya	Hypothesis Rejected

5.6 Discussion of the Hypotheses Tests and Research Findings

The main objective of the study was to investigate the relationship among residential mortgage portfolio, product innovation, firm characteristics and performance of commercial banks in Kenya. The following discussion presents the hypothesis test results in accordance with the specific study objectives, which have been summarized in Table 5.5 above.

5.6.1 Residential Mortgage Portfolio and Performance

The first specific objective of the study was to establish the relationship between residential mortgage portfolio and performance of commercial banks in Kenya. Residential mortgage portfolio affected the performance of banks through mortgage portfolio size, mortgage portfolio quality and mortgage interest return. The study hypothesized that the relationship between residential mortgage portfolio attributes and performance is not significant. Detailed results are presented in Table 5.1. The findings showed that mortgage portfolio size has a positive and statistically insignificant relationship with bank performance whereas mortgage portfolio quality and interest return both have a positive and statistically significant relationship with performance. This suggests that portfolio size has no impact on the performance of commercial banks in Kenya, whereas improvement in mortgage portfolio quality and mortgage interest return generates a positive and significant impact on bank performance.

On portfolio size, the finding is consistent with a previous research by Odhiambo (2015) who looked at the impact of property finance on the performance of commercial banks listed on the NSE and concluded that there was no significant impact. The finding, however, contradicts a study by Abdulrehman and Nyamute (2018) that looked at the effect of mortgage financing on the financial performance of commercial banks in Kenya and established a significant relationship. Studies by Martins et al. (2016) and Allen et al. (1995) established a significant relationship between bank performance and mortgage portfolio size for banks that hold a sizeable portfolio of mortgage loans. In this study, the descriptive statistics established that commercial banks in Kenya hold an average of 9% of their total loans in the form of residential mortgages, which is relatively low compared to more developed markets and may explain the insignificant relationship between mortgage portfolio size and bank performance.

The finding on mortgage portfolio quality implies that improvements in portfolio quality results in better performance for banks. A higher portfolio quality is synonymous with good credit standards and, therefore, higher profitability. Igan and Pinheiro (2010) found a strong link between portfolio quality and performance of banks in a study of the determinants of delinquency on real estate loans and potential impact on banks' performance in the USA. Another possible explanation for the significant effect of mortgage portfolio quality on bank performance is found in Onchomba et al. (2018) who linked this to the credit risk and its impact on bank income. Accordingly, they state that loan portfolio quality represents the loan portfolio at risk of non-payment by clients and this affects bank income. An increase in loan portfolio quality will lead to an increase in income due to reduced mortgage losses. This has the effect of improving the performance of commercial banks. Hence, the study concluded that higher mortgage portfolio quality may serve to create a circle of positive performance for the banks in the short run as well as the long run.

The finding on mortgage interest return is consistent with studies by Misra and Aspal (2013), Memmel (2014) and Abdulrehman and Nyamute (2018) who found a positive and statistically significant relationship between interest return and bank performance. The positive impact of mortgage interest return on performance suggests that banks in Kenya have mortgage net interest income that is positive.

5.6.2 Residential Mortgage Portfolio, Product Innovation and Performance

The second specific objective of the study was to evaluate the effect of mortgage product innovation on the relationship between residential mortgage portfolio and performance of commercial banks in Kenya. The study hypothesized that the relationship between residential mortgage portfolio and performance is not

significantly intervened by product innovation. The study made use of mortgage term and LTV ratio as product innovation variables. Mortgage currency was not included since the study established that residential mortgage loans in Kenya are mostly issued in local currency. Product range was also excluded due to the fact that banks in Kenya originated standard mortgage loan products only. Data collected revealed that non-standard mortgage products were not issued by any commercial bank during the study period. Baron and Kenny (1986) approach was applied to test the mediating effect of product innovation. Detailed results are presented in section 5.3.

The results revealed that mortgage term has a partial and statistically significant negative mediation effect on the relationship between mortgage portfolio quality and performance of commercial banks in Kenya. The intervening effect implies that an increase in mortgage term results in a significant decrease in performance of commercial banks. This is aligned to a previous study by Mtwanga (2019) who observed a significant and negative relationship between mortgage period and default rate for mortgage loans in Tanzania. Walley (2011) also posits that longer maturity periods for loans improve affordability for the borrower, which can lead to an expansion of the loan portfolio. However, such long repayment periods increase the default risk on the loan. Mortgage term however did not have a statistically significant intervening effect on the relationship between mortgage interest return and bank performance. Results of descriptive statistics showed that mortgage term in Kenya averages 12 years, which is considered of medium term duration of less than 15 years. In addition, there was low variability in the mortgage term within individual banks, which may account for the lack of a statistically significant intervening effect on the relationship between interest return and bank performance. Low variability in data is one possible cause for statistical insignificance in research findings (Ware & Munafò, 2015).

LTV ratio was found not to mediate the relationship between residential mortgage portfolio and bank performance. The finding is aligned to the theoretical argument by Lin et al. (2011) which states that the higher the LTV ratio, the riskier the loan is for any lender, because a high LTV ratio would lead to high probability of borrower default, an impact that reduces mortgage portfolio quality and by extension the portfolio profitability. In this regard, low LTV ratio has been seen as holding great potential for better performance of mortgage portfolios. It however contradicts previous studies by Carballo-Huerta and González-Ibarra (2008) who found that higher LTV ratio leads to growth in residential mortgage credit and higher profitability. LTV ratio of less than 90 is considered low according to a study by Pirgaip and Hepsen (2018). The mean score of LTV ratio was established as 84 in the descriptive statistical analysis. Thus, based on this definition, it can be assumed that the LTV ratio among commercial banks in Kenya is still within the boundaries of low LTV limit, hence no impact on the relationship between residential mortgage portfolio and bank performance. Lower LTV ratios within the boundaries of lower limit are also known to mitigate banks' credit risk and reduce the dependence of banks on market funding (Verbruggen et al., 2015).

5.6.3 Residential Mortgage Portfolio, Firm Characteristics and Performance

The third specific objective of the study was to determine the effect of firm characteristics on the relationship between residential mortgage portfolio and performance of commercial banks in Kenya. Firm characteristics consisted of firm size, lending capacity, firm age and ownership. However, the ownership variable was not utilized because of the lack of variability, ownership of commercial banks in Kenya having remained largely the same over the study period. Hence the analysis on the impact of firm characteristics on the relationship between residential mortgage portfolio and firm performance was based on firm size, firm age and lending capacity. The study

hypothesized that the relationship between residential mortgage portfolio attributes and performance is not significantly moderated by firm characteristics. Baron and Kenny (1986) approach was applied to test the effect of moderation, with detailed results presented in section 5.4 of the study.

The findings show that bank age has a positive and statistically significant moderating effect on the relationship between mortgage interest return and bank performance. The result is consistent with a previous study by Adusei (2011) who found that profitability improved as a bank increases in years of operation since they have a deeper knowledge of their customer base, and also by Carter et al. (1998) who concluded that older firms have longer operating histories and face less uncertainty in their performance.

The finding also established that lending capacity had a statistically non-significant moderating effect on the relationship between mortgage portfolio variables and bank performance. This finding contradicts previous studies by Black et al. (2010) who concluded that traditional banks are largely funded by retail deposits and benefit from positive net interest return as cost of funds is mostly lower than borrowing rates, and Afrifa et al. (2019) who found that lending capacity results in better performance by banks. Chen (2015) also posits that many banks in emerging markets fund a significant percentage of their mortgage loans using customer deposits due to lack of securitization. A bank's lending capacity, driven by available deposits, can drive the expansion of its mortgage loan portfolio and performance through higher interest returns. Descriptive statistical analysis in the study showed that lending capacity was 77.7% on average, which suggests that most banks still have space to originate more loans from customer deposits without the need for external funding.

Bank size did not have a statistically significant moderating effect on the relationship

between mortgage portfolio variables and bank performance. Theoretically, increased size is presumed to confer benefits which can enhance profitability and lending capacity of banks thereby allowing them to offer more mortgages (Santos & Winton, 2019). The result contradicts previous studies by Haas et al. (2010) who found that bank demographics such as size is an important driver of bank loan portfolio composition and performance, and also by Nyabaga and Matanda (2020) who found firm size to be linked to increase in bank's loan portfolio size and profitability.

5.6.4 Residential Mortgage Portfolio, Product Innovation, Firm Characteristics and Performance

The fourth and last specific objective of the study was to examine the joint effect of mortgage product innovation and firm characteristics on the relationship between residential mortgage portfolio and firm performance of commercial banks in Kenya. The study hypothesized that the joint effect is not significant and is different from the individual effects. Detailed results are presented in section 5.5 of the study.

Findings revealed that for firm characteristics, firm size and firm age had a positive and statistically significant relationship with performance in the joint models while lending capacity did not exhibit a statistically significant relationship. On product innovation, both mortgage term and LTV ratio did not show a statistically significant effect on bank performance in the joint model. The fourth null hypothesis was therefore rejected. The result is in alignment with a previous study conducted by Martins et al. (2014) who found that bank profitability is improved by residential mortgage portfolio after controlling for institutional and product innovation characteristics.

5.7 Summary of the Hypotheses Tests Results

In summary, the findings of the study demonstrated that residential mortgage portfolio

significantly affects the performance of commercial banks in Kenya (H_1) through mortgage portfolio quality and mortgage interest return but not through mortgage portfolio size. Secondly, product innovation does affect the relationship between residential mortgage portfolio and performance of commercial banks in Kenya (H_2). This was occasioned by the finding that mortgage term mediates the relationship between residential mortgage portfolio quality and performance of commercial banks in Kenya (H_{2b}). Thirdly, firm characteristics moderate the relationship between residential mortgage portfolio and performance of commercial banks (H_3). This was affirmed in sub-hypothesis (H_{3i}). Fourthly, there is a joint effect of product innovation and firm characteristics on the relationship between residential mortgage portfolio and performance of commercial banks in Kenya.

CHAPTER SIX: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

The research set out to investigate the relationship among residential mortgage portfolio, product innovation, firm characteristics and performance of commercial banks operating in Kenya. This chapter presents the key findings and study summary, conclusions of the study as guided by the findings and implications to knowledge, theory, policy and practice. Lastly, the chapter provides shortcomings of this study and suggestions for research in future.

6.2 Summary of the Study

The primary objective of this research was to investigate the relationship among residential mortgage portfolio, product innovation, firm characteristics and performance of commercial banks licensed and operating in Kenya. To achieve the aforementioned primary objective, the study assessed the four conceptualized variables: residential mortgage portfolio as the predictor variable, product innovation as the intervening variable, firm characteristics as the moderating variable and firm performance, as measured by the CAMEL score, as the dependent variable.

Residential mortgage portfolio as measured in the study comprised of mortgage portfolio size, mortgage portfolio quality and mortgage interest return. Mortgage portfolio size was measured as the proportion of residential mortgage loans outstanding to total loans. Portfolio quality was assessed as the proportion of mortgage non-performing loans (NPL) in the banks gross mortgage loans, while interest return was assessed as the natural logarithm of mortgage net interest (which was measured as the average interest income earned from residential mortgage loans less average interest

expense paid on customer deposits). The mediating variable in the study was mortgage product innovation, measured using two variables, namely: mortgage term and LTV ratio. Mortgage term was measured as the average length of mortgage contracts (in years) while LTV ratio was assessed as the proportion of the average value of the mortgage loan to the value of mortgaged property. The moderating variable, firm characteristics, was composed of three attributes: firm size, firm age and lending capacity. Firm size was measured as the natural logarithm of total assets of the banking institution. Age was assessed as the natural logarithm of the years, since incorporation, that the bank has been in operation. Lending capacity was assessed as the proportion of total loans to core deposits of the banking institution. The performance of the bank was measured through the CAMEL composite score.

The study adopted positivism research philosophy as it strove to test the series of quantitative hypotheses to assess the four specific objectives. This philosophical orientation was considered appropriate because of the overwhelming evidence supporting the study's research question with more definite goals for hypothesis testing. Besides, the study variables were measured using ratios and the inferential statistics were based on the hypothesis test results on the relationships among the study variables. This study adopted a correlational descriptive research design because the hypotheses were clearly stated and aligned with the investigation of the main research question. The research was a census study, which targeted all licensed commercial banks, which were operating in Kenya over the thirteen-year study period. The study used data collected from the annual residential mortgage surveys conducted by the central bank of Kenya as well as secondary data from CBK bank annual supervision reports as well as the Kenya bankers' association database and transformed them into panel data as shown in Appendix IV.

As preliminary to null hypothesis assessments, the study generated descriptive statistics to provide a bird's eye view of the panel data applied in the study. This included mean, standard deviation, maximum, minimum, skewness and kurtosis. Further, to assess the linear regression assumptions, the study performed the panel data diagnostic tests, which included panel unit root test and Hausman test to check for model suitability. Besides, regression assumptions such as normality, multicollinearity, autocorrelation, and heteroscedacity were tested. The inferential statistics generated were from correlation analysis and panel regression models (fixed and random effects models). This was because of non-normality of the data. The mediation and moderation assessment steps proposed by Baron and Kenny (1986) were followed in the intervention effect assessment and also in moderation effect evaluation.

6.3 Summary of the Key Research Findings

The first specific objective established the relationship between residential mortgage portfolio and performance of commercial banks in Kenya. The study addressed this through testing of the first null hypothesis (H_1) using panel regression models. The second specific objective evaluated the effect of mortgage product innovation on the relationship between residential mortgage portfolio and performance of commercial banks in Kenya. This was evaluated through testing the second null hypothesis (H_2) with guidance of the assessment process proposed by Baron and Kenny (1986). The third specific objective determined the impact of firm characteristics on the association between residential mortgage portfolio and performance of commercial banks licensed and operating in Kenya. The study used the third null hypothesis (H_3) to assess the moderating impact of firm characteristics on the relationship between residential mortgage portfolio and bank performance. The fourth specific objective examined the joint effect of mortgage product innovation and firm characteristics on the relationship

between residential mortgage portfolio and performance of commercial banks in Kenya. The study evaluated the joint effect through the fourth null hypothesis (H_4) assessment.

In the preliminary analysis, the descriptive statistics revealed that commercial banks licensed and operating in Kenya have on average mortgage portfolio size of 9%, which suggests that most banks have a low mortgage portfolio size. Results indicated that commercial banks have a mortgage portfolio quality of 5.4%. This suggests that mortgage portfolio quality amongst most commercial banks in Kenya is still relatively poor. Furthermore, the analysis showed that on average, banks' net interest income on mortgages was Kshs. 38.455 million. This implies that net interest return linked to mortgages is positive. In regards to firm characteristics, firm size had a mean value 10.0941 (Kshs. 24,199.81 million), which indicates that most banks have a strong asset base. On average, banks have an age of 21 years, which indicates that most banks in Kenya are old financial institutions. The finding further revealed that the average lending capacity was 77.7%, which suggests that most banks still have space to originate more loans from customer deposits. On product innovation, mortgage term was found to have a mean value of 12.1375, implying that majority of the mortgage facilities are of medium term duration of less than 15 years. Loan to value (LTV) ratio indicated an average of 84%, which shows that LTV ratio in Kenya is within the low boundary limit.

The first specific objective was addressed through the first null hypothesis (H1), which premised that the association between residential mortgage portfolio and performance of commercial banks is not significant. The study found that the relationship between bank performance and mortgage portfolio quality was positive and statistically significant and also for mortgage interest return, though the relationship between bank

performance and mortgage portfolio size was positive but statistically insignificant. Based on these results, the study rejected the first null hypothesis (H_1) and stated that residential mortgage portfolio significantly impacts the performance of banks licensed and operating in Kenya through portfolio quality and interest return.

The second specific objective was tested through the second null hypothesis (H_2), which premised that the association between residential mortgage portfolio and performance of banks licensed and operating in Kenya is not significantly intervened by product innovation. This was tested by using the four steps proposed by Baron and Kenny (1986).

There were six sub-hypotheses given that mortgage portfolio was in the form of mortgage portfolio size, mortgage portfolio quality and mortgage interest return while mortgage product innovation was in terms of mortgage term and loan to value ratio. In the first set under the second objective focusing on mortgage term, the first sub-hypothesis, H_{2a}: The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly mediated by mortgage term, the research failed to reject the sub-hypothesis because it failed step 1 of testing for mediation, with a positive but statistically insignificant relationship between portfolio size and bank performance.

On the second sub-hypothesis, H_{2b}: The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly mediated by Mortgage term was rejected since when the model controls for mortgage term, the relationship between portfolio quality and bank performance remains statistically significant but with a lower coefficient, confirming a partial mediation effect. In the third sub-hypothesis H_{2c}: The relationship between mortgage interest return and

performance of commercial banks in Kenya is not significantly mediated by mortgage term, was upheld as it failed step 2 of testing for mediation, with a negative and statistically insignificant relationship between mortgage interest return and mortgage term.

In the second set under the second objective focusing on the impact of LTV ratio, the fourth sub-hypothesis H_{2d} stated that: The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly intervened by loan to value ratio. The study failed to reject the sub-hypothesis as it failed step 1 of testing for mediation, with a positive but statistically insignificant relationship between portfolio size and bank performance.

On the fifth sub-hypothesis, H_{2e}: The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly mediated by loan to value ratio was upheld since it failed step 2 of testing for mediation, with a negative and statistically insignificant relationship between mortgage portfolio quality and LTV ratio. Similar to the foregoing finding, in the sixth sub-hypothesis, H_{2f}: The relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly mediated by loan to value ratio was upheld as it failed step 2 of testing for mediation, with a negative and statistically insignificant relationship between mortgage interest return and LTV ratio.

The third specific objective was assessed through the third null hypothesis (H_3) which stated that: The relationship between residential mortgage portfolio and performance of commercial banks in Kenya is not significantly moderated by firm characteristics. The hypothesis had nine sub-hypotheses given that residential mortgage portfolio was considered in terms of mortgage portfolio size, mortgage portfolio quality and mortgage

interest return while firm characteristics was considered in terms of firm size, lending capacity and firm age.

For the first set under the third objective focusing on firm size, the first sub-hypothesis, H_{3a}: The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly moderated by firm size was upheld in the study as it established that the relationship between portfolio size and bank performance was statistically insignificant, thus failing step 1in the Baron and Kenny (1986) approach for moderation.

The second sub- hypothesis, H_{3b}: The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly moderated by firm size was also upheld in the study as it found that the relationship between the interaction term of mortgage portfolio quality and firm size with bank performance was positive but not statistically significant. Similarly, the third sub-hypothesis, H_{3c}: The relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly moderated by firm size was also upheld as the study found that the relationship between the interaction term of mortgage interest return and firm size with performance was positive but not statistically significant. Thus, firm size does not moderate any of the relationships.

Within the second set under the third objective focusing on lending capacity, the fourth sub-hypothesis, H_{3d}: The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly moderated by lending capacity, was upheld as the study established that the relationship between portfolio size and bank performance was statistically insignificant, thus failing step one in the Baron and Kenny (1986) approach for moderation.

Similarly, the fifth sub-hypothesis, H_{3e}: The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly moderated by lending capacity, was upheld as the study found that the negative relationship between the interaction term of mortgage portfolio quality and lending capacity with bank performance was not statistically significant. On the sixth sub-hypothesis, H_{3f}: The relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly moderated by lending capacity, was also upheld since the study found that the negative relationship between the interaction term of mortgage portfolio return and lending capacity with bank performance was statistically insignificant.

Within the third set under the third objective focusing on firm age, the seventh sub-hypothesis, H_{3g}: The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly moderated by firm age, was upheld as the study established that the relationship between portfolio size and bank performance was statistically insignificant, thus failing step1 in the Baron and Kenny (1986) approach for moderation. The eighth sub-hypothesis, H_{3h}: The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly moderated by firm age, was upheld since the study established that the relationship between the interaction term of mortgage portfolio quality and firm age with bank performance was not statistically significant.

The ninth sub-hypothesis, H_{3i}: The relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly moderated by firm age, was rejected. This is because the positive relationship between the interaction term of interest return and firm age with bank performance was statistically significant. Thus,

firm age moderates the relationship between interest return and bank performance.

The fourth specific objective was examined through the fourth null hypothesis (H_4), which stated that the joint effect of product innovation and firm characteristics on the relationship between residential mortgage portfolio and performance of commercial banks in Kenya is not significant and is different from the individual effects. This was tested for each independent variable. The study found that firm size had a statistically significant effect on the relationship between interest return and performance. Similarly, firm age had a statistically significant effect on the relationship between portfolio size and performance and also with portfolio quality. In addition, residential mortgage portfolio quality had a statistically significant effect on performance in the joint model. Based on the study results, the fourth hypothesis (H_4) was rejected. Thus, the joint effect of product innovation and firm characteristics on the relationship between residential mortgage portfolio and performance of commercial banks in Kenya is significant and different from the individual effects.

6.4 Conclusions of the Study

Based on the first null hypothesis (H_1) results, the study concluded that residential mortgage portfolio significantly affects performance of banks licensed and operating in Kenya. This implies that commercial banks that increase their residential mortgage portfolio are more likely to have better performance. Results of the study also confirmed that, of the components of residential mortgage portfolio, mortgage portfolio quality have the highest contribution to performance of commercial banks followed by mortgage interest return.

Portfolio size has no contribution to bank performance. This finding provides evidence that interest income with respect to the banks' residential mortgage portfolio hold a

positive contribution to improving performance of banks. The effect on bank performance is strongest through mortgage portfolio quality, perhaps in part because the non-performing mortgage loans level is observed at an average of 5.4%, with significant increase noted in the latter period of the study. The finding therefore suggests that for improvement in performance of commercial banks to occur, the mortgage portfolio contributions through portfolio quality and interest return should be ensured through sound credit management practices.

Based on the second null hypothesis (H_2), results of panel data analysis showed that mortgage term influences the effect of mortgage portfolio quality on commercial banks' performance in Kenya. It, however, does not mediate the effect of mortgage portfolio size and mortgage interest return on bank performance. Put simply, the results demonstrate that improved performance as a result of portfolio quality is also subject to the banks' mortgage term. On the other hand, mortgage LTV ratio does not influence the impact of mortgage portfolio size, mortgage portfolio quality and mortgage interest return on commercial banks' performance.

On the third null hypothesis (H_3) the study concluded that firm size as a bank characteristic does not moderate the relationship between bank performance on the one hand and mortgage portfolio size, mortgage portfolio quality and mortgage interest return on the other hand. It can therefore be deduced that firm size does not have any influence on the association between bank performance and the residential mortgage portfolio attributes.

Similarly, lending capacity was confirmed not to intervene the relationship between mortgage portfolio attributes and performance of commercial banks. In other words, the ability of the bank to originate more loans has no impact on the relationship between

residential mortgage portfolio and bank performance. Firm age, however, moderates the relationship between mortgage interest return and bank performance, though it does not moderate the relationship between bank performance and both mortgage portfolio size and portfolio quality. This implies that older banks can improve their performance through better management of their interest regimes.

Finally, the fourth null hypothesis (H_4) results indicated that jointly, mortgage portfolio quality, firm size, and firm age significantly affect performance of commercial banks thus inferring that firm size and firm age attributes significantly affects the association between residential mortgage portfolio and performance of banks licensed and operating in Kenya. This finding confirms that the performance of banks offering residential mortgages is determined by some bank specific micro-economic factors of the financial institution.

6.5 Contributions of the Study

The findings of this research contribute to the pool of knowledge on residential mortgage portfolio, mortgage product innovation, firm characteristics and bank performance concepts. In addition, it has several implications for the commercial banks' management, bank regulators and potential investors. Finally, the study creates support for the modern portfolio theory by affirming its application following the inclusion of mediating and moderating factors since this is still a nascent area. The contribution of this research to the existing knowledge precedes the contribution to policy and practice and ends with the contribution to finance theory.

6.5.1 Contribution to Knowledge

The findings support the existing body of knowledge on residential mortgage portfolio, mortgage product innovation, firm characteristics and performance in terms of

conceptualization and relationships. The study provides clarity on the concept of residential mortgage portfolio as a predictor for bank performance. This finding contributes to the pool of literature, which over the years have attempted to establish the existence of a linear relationship between residential mortgage portfolio and performance of banks (Martins et al., 2014; Odhiambo, 2015). However, these studies found mixed results, with Martins et al. (2014) and Abdulrehman and Nyamute (2018) confirming a significant effect while Odhiambo (2015) concluding a non- significant effect. Unlike the current study that included three components of residential mortgage portfolio, the aforementioned studies only used one or two variables of residential mortgage portfolio in isolation.

The current study, unlike the previous studies conducted in Kenya, employed panel regression approaches (fixed and random effects). Hence the study findings not only show the importance of including more variables when testing for the impact of residential mortgage portfolio but also the need to use different panel data approaches suitable to the collected data. The study found that residential mortgage portfolio positively affects performance of banks registered and operating in Kenya through portfolio quality and interest return. This can be attributed to the conceptualization of residential mortgage portfolio and the methodology used. In light of the study findings, the importance of conceptual definition and methodology has been strengthened in the literature.

Another influence of the thesis relates to the introduction of mortgage product innovation and firm characteristics as mediator and moderator variables respectively in explaining the residential mortgage portfolio and bank performance relationship. Conversely, the existing studies have either included mediating factors or moderating

factors in testing the relationships between residential mortgage portfolio and bank performance. The current study not only extends this knowledge by including both factors on mortgage portfolio-bank performance relationship but also confirms which factors are important in the developing country context.

6.5.2 Contributions to Policy and Practice

The outcome of this research has a number of contributions to the banking regulators, commercial bank managers and shareholders, depositors, borrowers and investors in general. Bank managers and board of management are interested in the direct effect of residential mortgage portfolio on bank performance. This study provided a profound pointer in the bank management decision making process. The fact that statistically significant relationships are found between residential mortgage portfolio attributes and performance shows that mortgage portfolio management directly influences bank performance. Thus, there is need for the commercial banks in Kenya to put more emphasis on mortgage portfolio management for better performance.

Therefore, this study assists commercial banks management to appreciate the importance of micro-economic factors on the mortgage portfolio and bank performance relationship. The fact that mortgage product innovation and bank characteristics ultimately relates with residential mortgage portfolio and bank performance can be a wake-up call on the need for bank managers to pay more attention to the institutional environment and product characteristics.

The findings indicate further affirmation for the supervisory bodies, such as the Central Bank of Kenya, with their capital limit ratio to banks. This is because the study indicates that lending capacity does not moderate the mortgage portfolio-bank performance relationships. However, this study contributes to the debate on whether CBK should

increase the capital limit ratio or reduce it. This is because the study indicated that the level of retail deposits held by a bank and ability to originate more loans have no impact on financial returns from their mortgage portfolios. Secondly, the study demonstrates the importance of having a mortgage term policy in the country by the CBK, which should balance the need to grow the uptake of residential mortgage loans in the country and the negative impact of a longer mortgage term on portfolio quality. Although the banking industry currently has no policy on mortgage term, commercial banks in Kenya have maintained their mortgage terms at less than 15 years, albeit informally. However, there is need for CBK to consider introduction of a mortgage term policy to ensure uniformity and compliance.

6.5.3 Contributions to Theory

The positivist philosophical orientation guided the study with a clear intent to test empirically the four study hypotheses. The testing aimed at either qualifying or disqualifying the existing theoretical notion of modern portfolio theory, agency theory and asymmetric information theory. To enhance the understanding between residential mortgage portfolio and bank performance, modern portfolio theory anchored the study. The study acknowledges that investment in residential mortgage portfolios that minimizes risk and maximizes returns can impact the performance of banks positively, which is aligned to the modern portfolio theory. This postulation was confirmed in the study further strengthening the theory application.

The finding that residential mortgage portfolio positively relates with performance is an exciting phenomenon, expected considering the logic of modern portfolio theory assumptions. However, the logic of this assumption has scarcely been tested in the African context through the inclusion of bank specific characteristics and mortgage

product innovation. This research affirms that the relationship between residential mortgage portfolio and performance holds under the mentioned factors. This confirms the usefulness of the theory in the presence of moderating and mediating variables. Therefore, modern portfolio theory fully supports the relationship between residential mortgage portfolio and bank performance even when bank characteristics and mortgage product innovation attributes are included.

6.6 Limitations of the Study

This research confined itself to the registered commercial banks with their financial records published during the study period, from 2006 to 2018. The discussion is limited to relationships between residential mortgage portfolio, bank characteristics, mortgage product innovation and commercial banks' performance. However, the study had challenges with introduction of ownership structure that is unique to the Kenyan banking industry. Despite its expected moderating effect, the study established lack of variability as the ownership structure of commercial banks registered and operating in Kenya have remained relatively the same during the period of study. This is a key limitation as the ownership structure is a major determinant of residential mortgage portfolio, bank characteristics and mortgage product innovation among banks.

The study was focused on mortgage portfolio and bank performance in Kenya. In reality, 6 banks control around 75% of the residential mortgage portfolio market in Kenya as opposed to all the licensed banks included in the analysis. The researcher is well aware of the reason that limiting the study to the 6 banks would have contributed to more robust findings. This is because the introduction of other banks led to issues of data quality, particularly in regard to missing values as most of the banks were missing data on some variables. Resultantly, this had the likelihood of affecting the strength of

panel regression model and by extension the findings. Another likely outcome of the missing data was its impact on the panel regression model selected. Missing data is a factor that affects normality of data, and the likelihood that it affected the normality of the study data cannot be ignored given that the data was not normal. As a result, the researcher had to shift from using the ordinary least squares model to panel fixed and random effects models to account for this. The impact of missing data on the study findings cannot be gainsaid.

6.7 Suggestions for Future Research

The study mainly hypothesized on residential mortgage portfolio effect on bank performance. However, there is need for research on other commercial real estate portfolios that are emerging in the Kenyan banking space such as malls and office space or even mixed development mortgages. The study included the role of bank characteristics and product innovation on the relationship between residential mortgage portfolio and performance of banks. Nonetheless there are other important factors that need to be factored in future studies. For instance, borrower characteristics such as income, gender, level of education and other loan characteristics like loan size, loan purpose and charges, have been found to be important moderating and mediating factors respectively in loan portfolios. Future studies should therefore test the moderating role of borrower characteristics and mediating effect of other loan characteristics on the association between mortgage portfolio and bank performance in Kenya and beyond.

Based on the research findings, the study made use of residential mortgage portfolio as a non-composite variable. However, there is need for studies that can use a composite variable for residential mortgage portfolio attributes based on tested methodologies. This will help provide more insight on how residential mortgage portfolio affects bank

performance through a different conceptualization.

The current study focused on commercial banks in Kenya and how residential mortgage loans impact their performance. There is an emerging market for residential mortgage loans among SACCO's in the country. Future studies should consider the impact of such residential mortgage loans on the performance of SACCO's as well as their contribution to the housing gap that exist in Kenya. In addition, the study was conducted within the context of the Kenyan residential mortgage market. With the continuing growth in the membership of the East African Community, future research should consider a comparative study that looks at the residential mortgage market in the entire region with a view to informing common policy decisions and validating the findings of the current study.

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APPENDICES

Appendix I: List of Banking Institutions in Kenya

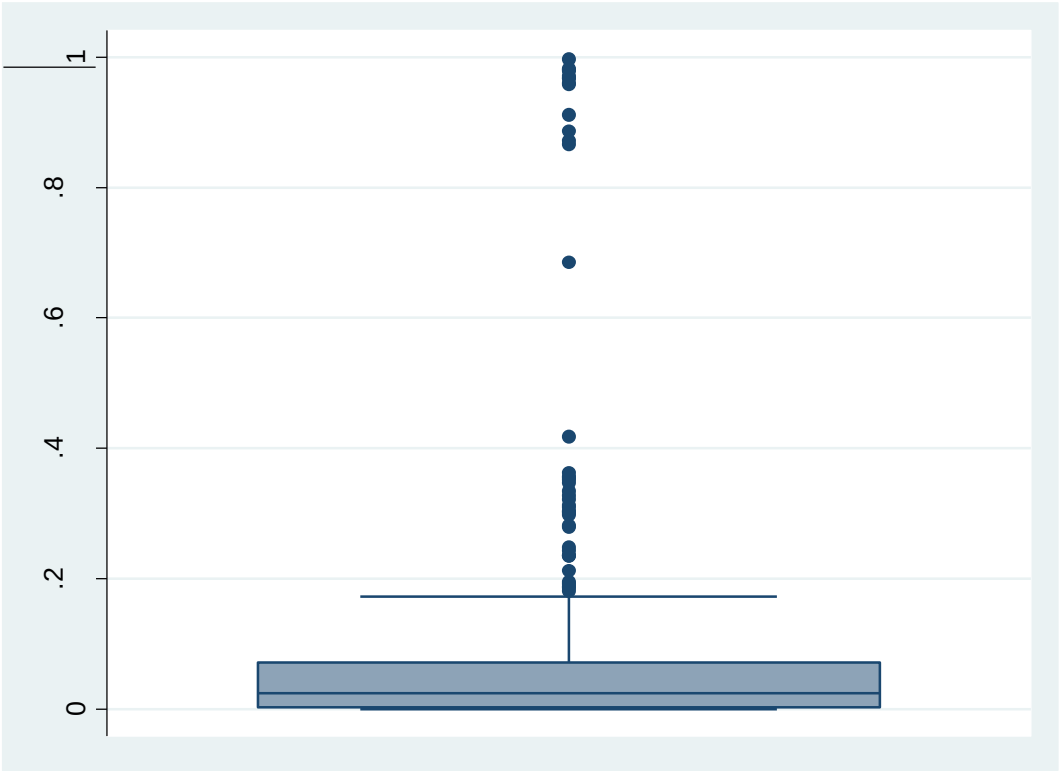
1	Kenya Commercial Bank Ltd	26	Guardian Bank Ltd
2	Housing Finance Company Ltd	27	Paramount Universal Bank Ltd
3	Cooperative Bank of Kenya Ltd	28	Giro Commercial Bank Ltd
4	Standard Chartered Bank Ltd	29	Bank of India
5	CfC Stanbic Ltd	30	Spire Bank Ltd
6	Equity Bank Ltd	31	Middle East Bank Ltd
7	Barclays Bank Ltd	32	Oriental Commercial Bank Ltd
8	Chase Bank (K) Ltd	33	Victoria Commercial Bank Ltd
9	Commercial Bank of Africa Ltd	34	UBA Bank of Kenya Ltd
10	Jamii Bora Bank Ltd	35	Habib Bank Ltd
11	I&M Bank Ltd	36	Transnational Bank Ltd
12	Family Bank Ltd	37	Imperial Bank Ltd
13	Consolidated Bank Ltd	38	Dubai Bank Ltd
14	NIC Bank Ltd	39	Charterhouse Bank Ltd
15	Development Bank Ltd	40	Citibank N.A.
16	Fidelity Bank Ltd	41	Credit Bank Ltd
17	National Bank of Kenya Ltd	42	GT Bank Ltd
18	African Banking Corporation Ltd	43	Habib A.G. Zurich
19	Bank of Africa Ltd	44	Sidian Bank Ltd
20	Ecobank Ltd		
21	First Community Bank Ltd		
22	Gulf African Bank Ltd		
23	Bank of Baroda Ltd		
24	Diamond Trust Bank of Kenya Ltd		
25	Prime Bank Ltd		

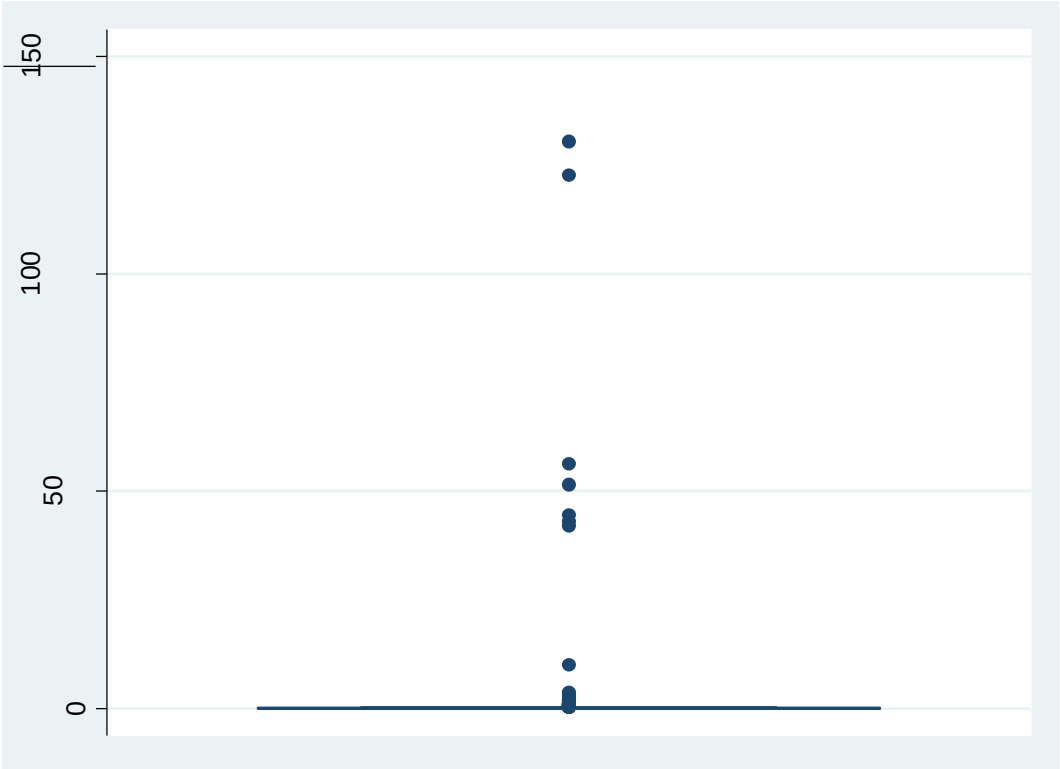
CBK (2018)

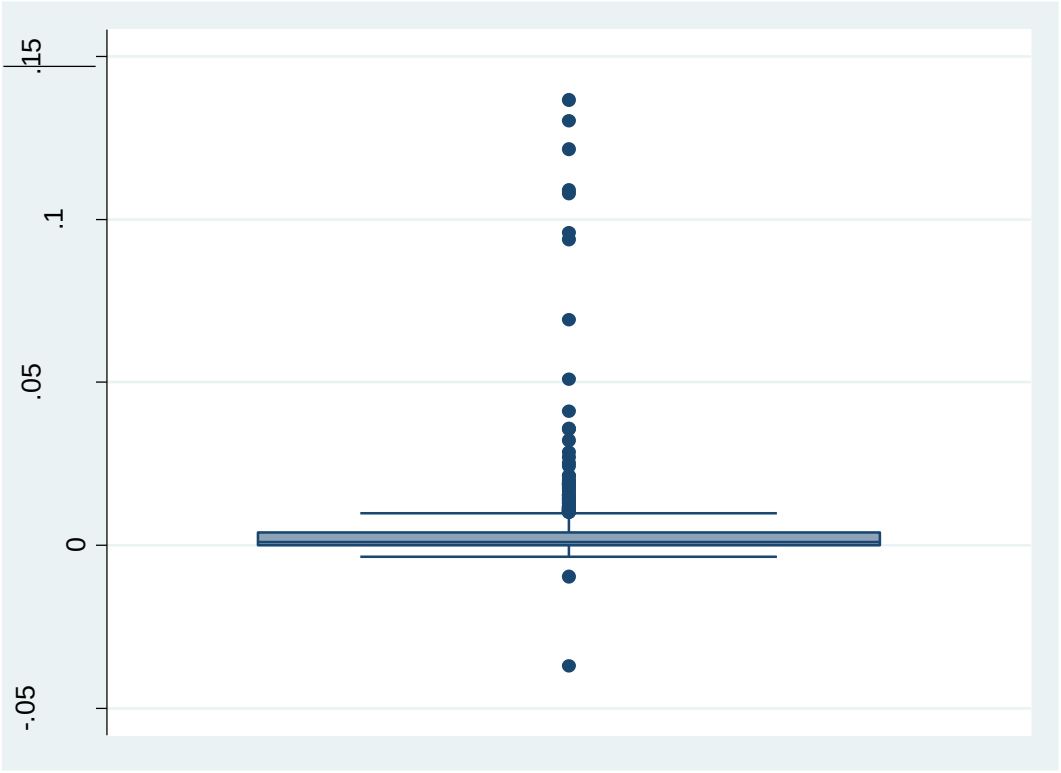
Appendix II: Data Collection Form (2006 – 2018)

Variables	Indicators	Study Period												
		2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Residential Mortgage Portfolio	**Portfolio Size**													
	• Mortgage Loan Outstanding													
	• Gross Loans													
	Portfolio Quality													
	• Non-Performing Mortgage Loans													
	• Mortgage Loan Outstanding													
	Interest Return													
	• Mortgage Interest Income													
	• Deposit Interest Expense													
	• Gross Loans													
Product Innovation	**Mortgage Term**													
	• Average Mortgage Term (Years)													
	LTV Ratio													
	• Average Loan to Value (LTV) Ratio													
Firm Characteristics	**Firm Size**													
	• Total Assets													
	Lending Capacity													
	• Total Loans													
	• Core Deposits													
	Firm Age													
	• Age in years (Since Incorporation)													
Firm Performance	**Capital Adequacy**													
	• Total Capital													
	• Total Risk Weighted Assets													
	Asset Quality													
	• Non-Performing Loans (NPL)													
	• Gross Loans													
	Management Capacity													
	• Total Advances													
	• Total Deposits													
	Earnings													
	• Profit Before Tax													
	• Total Assets													
	Liquidity													
	• Net Liquid Assets													
	• Total Assets													

Appendix III: Box-Plot Tests for Outliers



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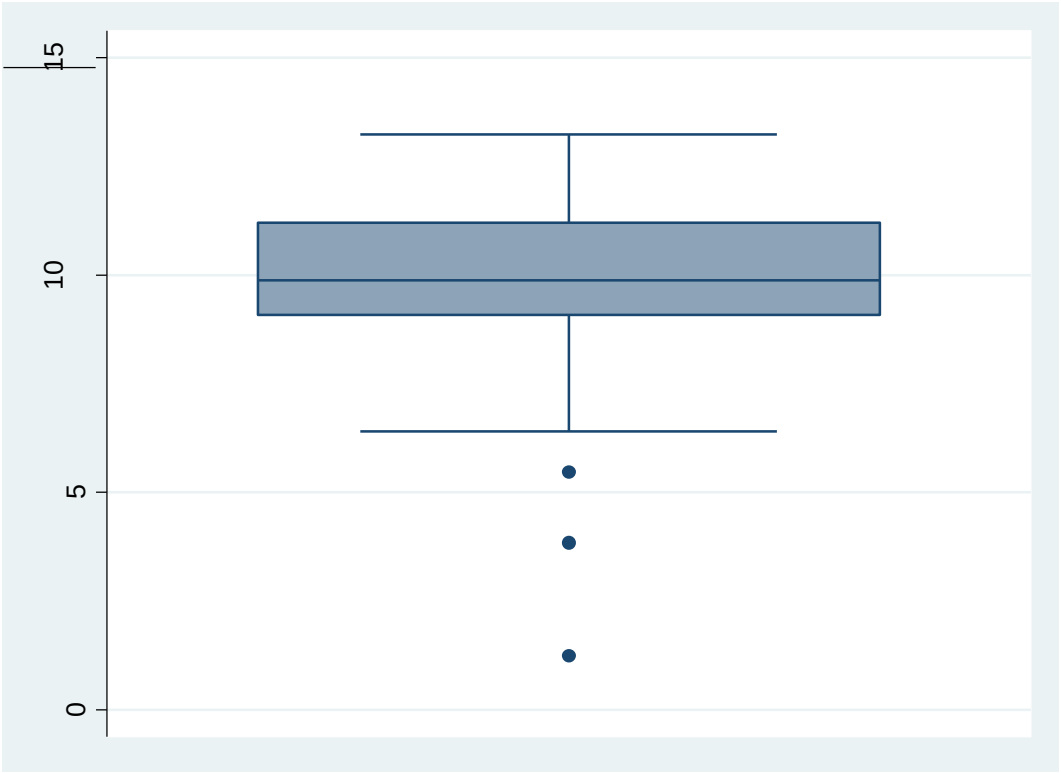
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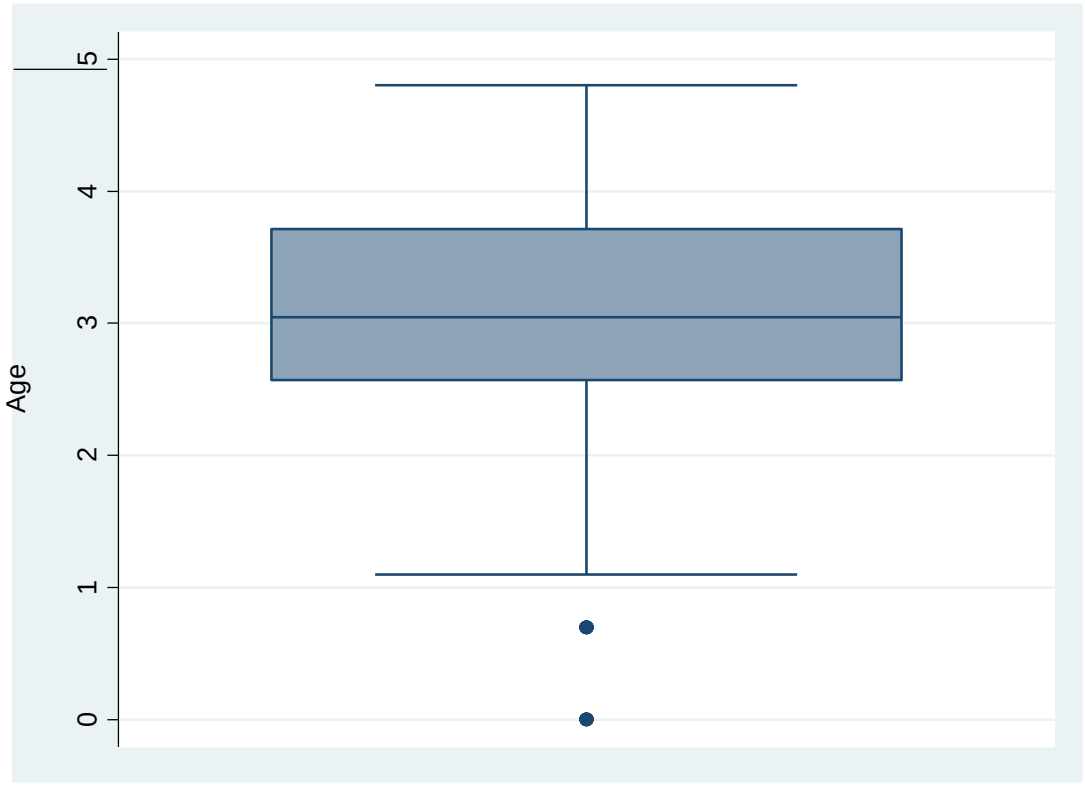
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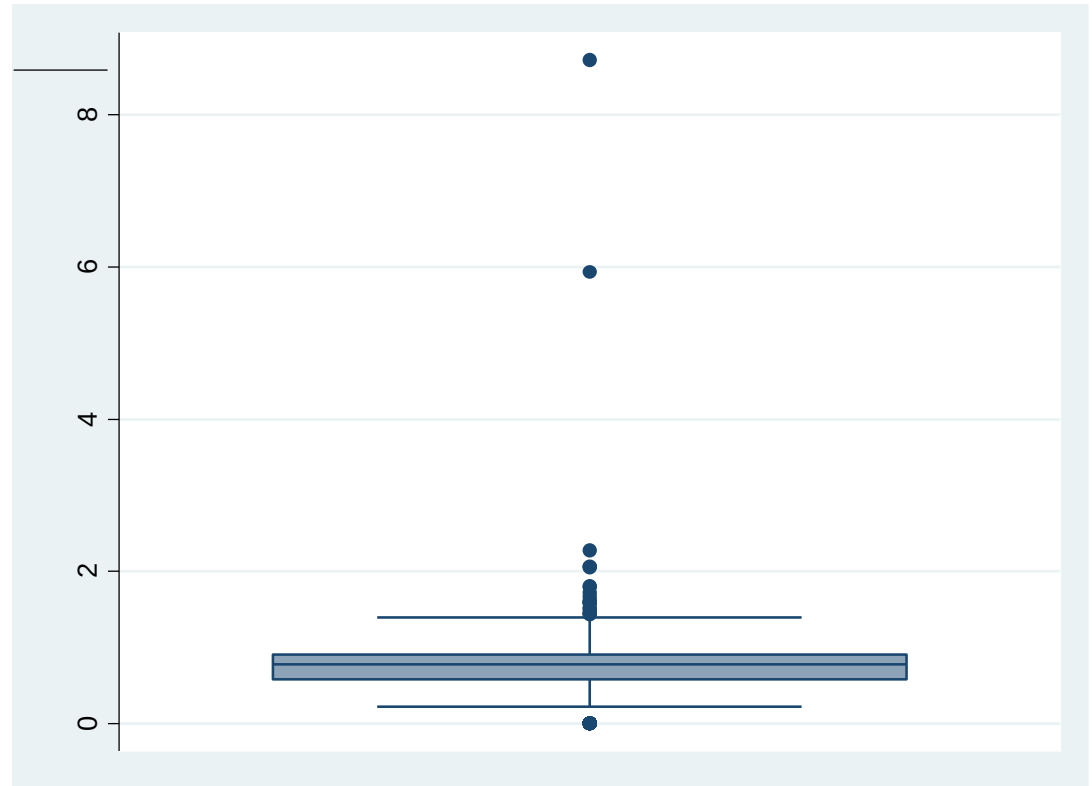
2
3
4
5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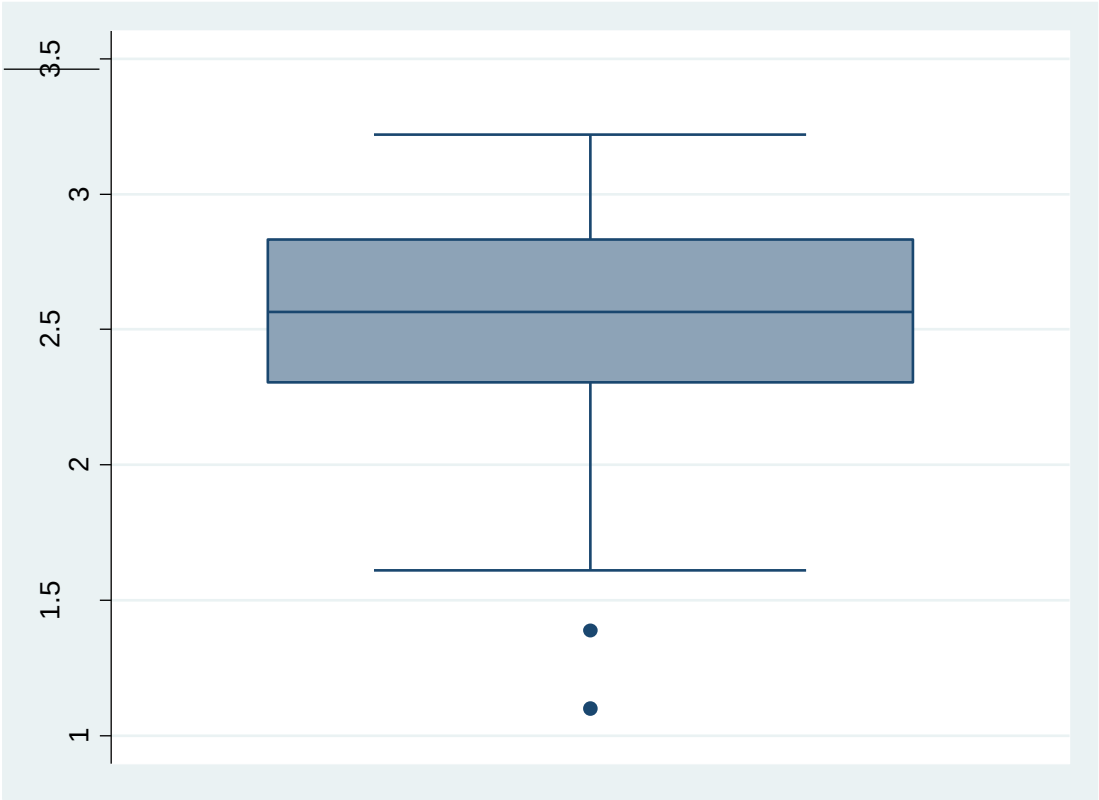
6
8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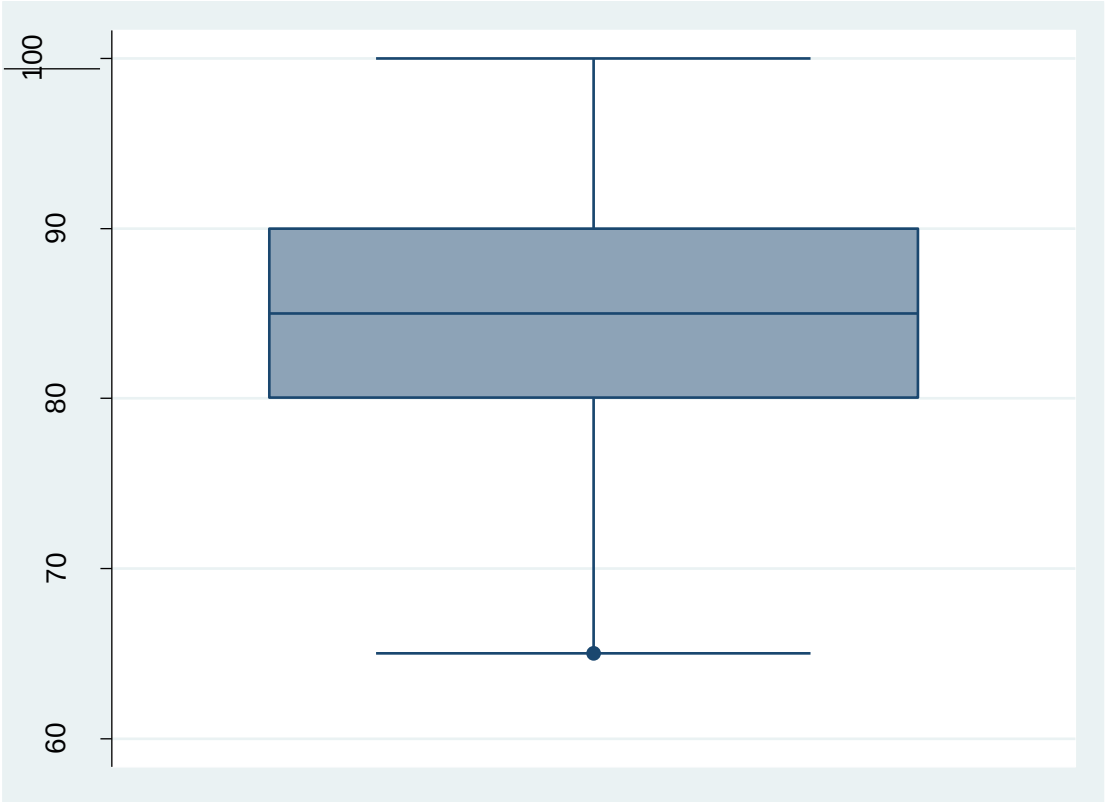
2.5
2
1.5
1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80
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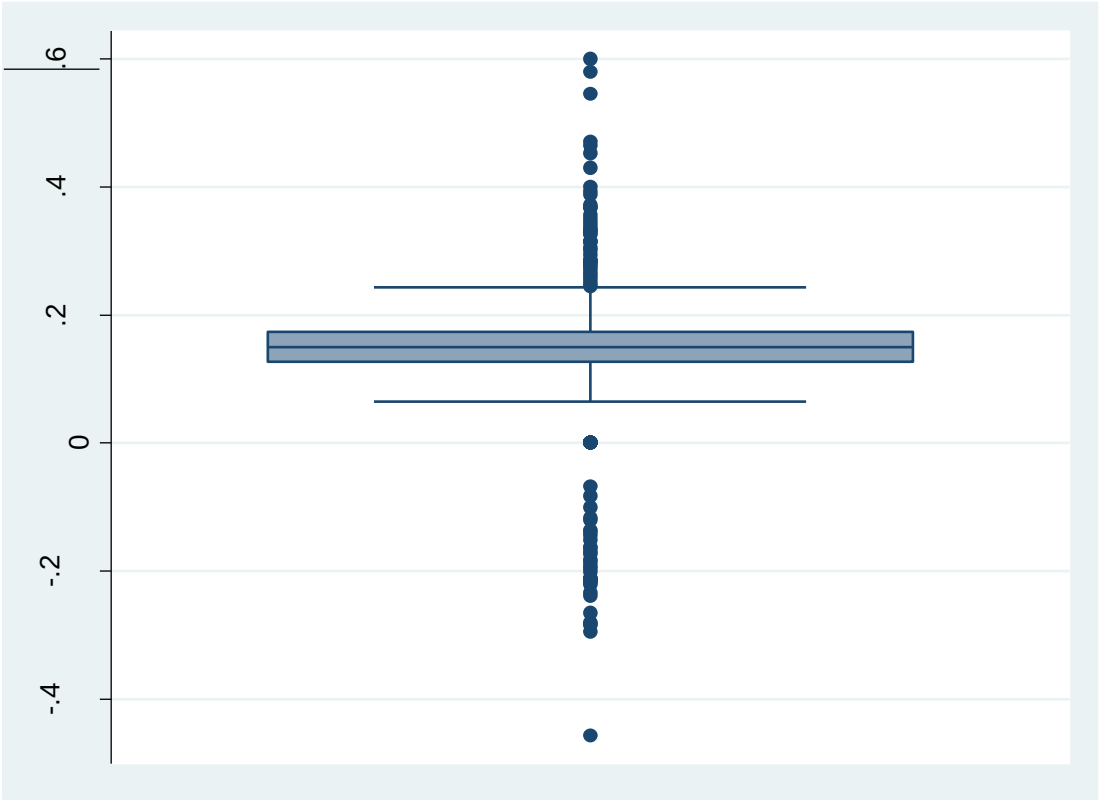
60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Appendix IV: Research Data

Bank	Year	PS	PQ	IR	FS	LC	AGE	MT	LTV	CAM
ABC	2006	0.01	0.00	0.35	8.79	0.74	3.09	2.08	0.90	0.14
ABC	2007	0.01	0.00	0.34	8.83	0.71	3.14	2.08	0.90	0.14
ABC	2008	0.01	0.00	0.53	8.79	0.71	3.18	2.30	0.90	0.15
ABC	2009	0.01	0.00	0.70	9.12	0.59	3.22	2.08	0.90	0.15
ABC	2010	0.01	0.00	0.77	9.24	0.67	3.26	2.08	0.90	0.16
ABC	2011	0.17	0.01		9.43	0.70	3.30	2.30	0.90	0.14
ABC	2012	0.15	0.02	4.76	9.86	0.66	3.33	1.61	0.90	0.13
ABC	2013	0.19	0.02	4.73	9.89	0.70	3.37	2.30	0.90	0.14
ABC	2014	0.07	0.08	3.95	9.97	0.84	3.40	1.10	0.90	0.13
ABC	2015	0.13	0.04	2.58	10.00	0.99	3.43	1.61	0.90	0.16
ABC	2016	0.06	0.07	3.17	10.02	0.93	3.47	2.30	0.90	0.15
ABC	2017	0.04	0.07	3.11	10.12	0.83	3.50	1.61	0.90	0.14
ABC	2018	0.03	0.16	2.52	10.21	0.82	3.53	1.39	0.80	0.35
Barclays	2006	0.01	0.00	4.63	11.91	0.84	4.50	2.89	0.90	0.16
Barclays	2007	0.02	0.00	5.14	12.06	0.99	4.51	2.89	0.90	0.12
Barclays	2008	0.02	0.01	5.59	12.04	0.88	4.52	2.83	0.90	0.15
Barclays	2009	0.03	0.01	5.71	12.04	0.78	4.53	2.77	0.90	0.18
Barclays	2010	0.03	0.00	5.92	12.06	0.75	4.54	2.83	0.90	0.21
Barclays	2011	0.04	0.01	6.30	12.03	0.84	4.55	3.00	0.90	0.19
Barclays	2012	0.04	0.00	6.38	12.13	0.78	4.56	3.00	0.90	0.18
Barclays	2013	0.04	0.01	6.23	12.24	0.80	4.57	3.00	0.90	0.15
Barclays	2014	0.04	0.01	6.30	12.33	0.78	4.58	2.51	0.90	0.16
Barclays	2015	0.04	0.01	6.16	12.39	0.90	4.60	2.56	0.90	0.15
Barclays	2016	0.04	0.01	6.33	12.47	0.89	4.61	2.64	0.90	0.17
Barclays	2017	0.05	0.02	5.63	12.51	0.95	4.62	2.60	0.90	0.13
Barclays	2018	0.05	0.03	5.88	12.69	0.90	4.62	2.55	0.90	0.25
BOA	2006	0.02	0.00	1.04	9.05	0.82	0.69	2.71	0.90	0.07
BOA	2007	0.01	0.00	0.88	9.46	0.90	1.10	2.71	0.90	0.10
BOA	2008	0.01	0.00	1.16	9.42	0.85	1.39	2.89	0.90	0.08
BOA	2009	0.01	0.00	1.13	9.74	0.74	1.61	2.71	0.90	0.10
BOA	2010	0.01	0.01	1.96	10.17	0.72	1.79	2.71	0.90	0.11

Bank	Year	PS	PQ	IR	FS	LC	AGE	MT	LTV	CAM
BOA	2011	0.02	0.00	3.22	10.56	0.90	1.95	2.89	0.90	0.10
BOA	2012	0.04	0.00	4.39	10.80	0.86	2.08	3.00	0.90	0.10
BOA	2013	0.06	0.03	3.92	10.87	0.85	2.20	3.00	0.90	0.12
BOA	2014	0.05	0.01	4.11	11.04	0.94	2.30	3.00	0.90	0.09
BOA	2015	0.04	0.10		11.15	0.86	2.40	3.00	0.90	0.18
BOA	2016	0.08	0.09	5.06	10.93	1.02	2.48	2.30	0.90	
BOA	2017	0.06	0.00	4.36	10.90	1.06	2.56	2.30	0.90	0.10
BOA	2018	0.14	0.06		10.80	0.88	2.64	2.48	0.90	0.40
BoB	2006	0.01	0.00	1.61	9.46	0.45	3.97	2.30	0.80	0.15
BoB	2007	0.01	0.00	1.27	9.84	0.57	3.99	2.30	0.80	0.14
BoB	2008	0.00	0.00	1.24	9.82	0.62	4.01	2.20	0.80	0.15
BoB	2009				10.02	0.51	4.03	2.30	0.80	0.18
BoB	2010	0.00	0.00	1.30	10.38	0.54	4.04	2.40	0.80	0.17
BoB	2011	0.02	0.02	3.08	10.51	0.65	4.06	2.08	0.80	0.14
BoB	2012	0.02	0.00	3.44	10.74	0.60	4.08	2.30	0.80	0.14
BoB	2013	0.02	0.01	2.90	10.86	0.57	4.09	2.30	0.80	0.15
BoB	2014	0.02	0.00	3.10	11.03	0.60	4.11	1.89	0.80	0.16
BoB	2015	0.02	0.05	3.17	11.13	0.61	4.13	2.20	0.80	0.19
BoB	2016	0.02	0.03	3.94	11.33	0.59	4.14	2.20	0.80	0.21
BoB	2017	0.02	0.03	4.05	11.47	0.60	4.16	2.20	0.80	0.20
BoB	2018	0.03	0.09	4.11	11.72	0.43	4.17	2.48	0.65	0.31
BoI	2006	0.01	0.03	0.58	9.16	0.46	3.97	2.30	0.90	0.14
BoI	2007	0.01	0.02	1.24	9.40	0.42	3.99	2.30	0.90	0.17
BoI	2008	0.02	0.01	2.17	9.40	0.44	4.01	2.20	0.90	0.19
BoI	2009	0.06	0.00	3.37	9.65	0.43	4.03	2.19	0.90	0.17
BoI	2010	0.05	0.00	3.37	9.89	0.37	4.04	2.35	0.95	0.16
BoI	2011	0.01	0.00	0.04	10.06	0.40	4.06	2.25	0.90	0.16
BoI	2012	0.01	0.00	2.19	10.12	0.55	4.08	2.30	0.90	0.14
BoI	2013	0.01	0.00	1.86	10.33	0.47	4.09	2.30	0.80	0.14
BoI	2014	0.01	0.00	2.35	10.44	0.50	4.11	2.26	0.95	0.12
BoI	2015	0.01	0.00	2.27	10.65	0.73	4.13	2.30	0.95	0.17

Bank	Year	PS	PQ	IR	FS	LC	AGE	MT	LTV	CAM
BoI	2016	0.02	0.00	3.06	10.78	0.61	4.14	2.30	0.90	0.17
BoI	2017	0.01	0.00	2.84	10.94	0.66	4.16	2.05	0.90	0.17
BoI	2018	0.02	0.00	2.34	11.05	0.48	4.17	2.15	0.90	0.30
CBA	2006	0.02	0.00	3.56	10.71	0.47	3.66	2.94	0.85	0.14
CBA	2007	0.02	0.00	3.68	10.84	0.55	3.69	2.89	0.90	0.14
CBA	2008	0.03	0.00	4.42	10.82	0.71	3.71	3.09	0.90	0.13
CBA	2009	0.03	0.00	4.84	10.98	0.79	3.74	2.71	0.83	0.13
CBA	2010	0.03	0.03	5.03	11.06	0.73	3.76	2.89	0.90	0.16
CBA	2011	0.07	0.03	4.20	11.33	0.62	3.78	3.00	0.90	0.14
CBA	2012	0.07	0.05	6.05	11.52	0.55	3.81	3.00	0.90	0.14
CBA	2013	0.05	0.02	4.00	11.74	0.65	3.83	3.22	0.90	0.14
CBA	2014	0.04	0.03	4.27	12.08	0.76	3.85	2.56	0.90	0.13
CBA	2015	0.04	0.03	4.30	12.20	0.72	3.87	2.56	0.90	0.14
CBA	2016	0.05	0.08	5.70	12.26	0.65	3.89	2.94	0.90	0.17
CBA	2017	0.05	0.04	5.61	12.34	0.60	3.91	2.60	0.90	0.16
CBA	2018	0.06	0.03	5.44	12.36	0.65	3.93	2.80	0.90	0.16
CfC	2006	0.06	0.00	4.06	10.37	0.62		2.89	0.90	0.11
CfC	2007	0.14	0.00	5.30	11.36	0.96		2.89	0.90	0.10
CfC	2008	0.12	0.00	5.84	11.33	0.76		2.71	0.90	0.13
CfC	2009	0.13	0.00	6.40	11.50	0.83	0.00	2.77	0.90	0.11
CfC	2010	0.11	0.00	6.56	11.58	0.83	0.69	2.89	0.90	0.10
CfC	2011	0.14	0.01	5.97	11.85	0.87	1.10	2.89	0.90	0.11
CfC	2012	0.14	0.02	6.61	11.80	0.89	1.39	3.00	1.00	0.13
CfC	2013	0.17	0.01	6.62	12.05	0.74	1.61	3.00	1.00	0.14
CfC	2014	0.15	0.03	6.91	12.05	0.93	1.79	2.77	0.90	0.17
CfC	2015	0.14	0.05	6.40	12.20	0.96	1.95	2.77	0.90	0.16
CfC	2016	0.13	0.04	6.75	12.23	0.96	2.08	3.00	0.90	0.16
CfC	2017	0.14	0.06	7.11	12.39	0.89	2.20	3.00	0.90	0.14
CfC	2018	0.16	0.05	7.16	12.55	0.79	2.30	3.00	0.90	0.27
Chase	2006	0.14	0.00	3.11	8.48	0.64	2.71	2.83	0.90	0.13
Chase	2007	0.11	0.00	3.59	9.26	0.79	2.77	2.77	0.80	0.12

Bank	Year	PS	PQ	IR	FS	LC	AGE	MT	LTV	CAM
Chase	2008	0.08	0.00	3.70	9.24	0.74	2.83	2.77	0.80	0.10
Chase	2009	0.07	0.01	4.03	9.49	0.69	2.89	2.89	0.90	0.12
Chase	2010	0.05	0.01	3.94	9.99	0.68	2.94	2.83	0.85	0.12
Chase	2011	0.04	0.01	3.93	10.51	0.75	3.00	2.71	0.80	0.11
Chase	2012	0.05	0.02	4.70	10.80	0.83	3.04	2.71	0.80	0.10
Chase	2013	0.05	0.05	4.44	11.25	0.79	3.09	2.71	0.70	0.12
Chase	2014	0.06	0.11	5.15	11.58	0.71	3.14	2.40	1.00	0.15
Chase	2015	0.05	0.09	6.24	8.09	0.00	3.18	2.48	1.00	
Chase	2016	0.00	0.63	6.22		0.00	3.22	2.04	1.00	
Chase	2017	0.00	0.83	6.13		0.00	3.26	2.04	1.00	
Chase	2018					0.00	3.30			
ConsoIidated	2006				8.32	1.10	2.83			0.13
ConsoIidated	2007				8.62	1.11	2.89			0.12
ConsoIidated	2008				8.45	1.11	2.94			0.14
ConsoIidated	2009	0.05	0.00	3.89	8.93	0.93	3.00	2.71	0.80	0.15
ConsoIidated	2010	0.12	0.00	4.18	9.26	0.83	3.04	2.71	0.80	0.15
ConsoIidated	2011	0.28	0.02		9.64	0.82	3.09	2.71	0.80	0.13
ConsoIidated	2012	0.36	0.07	5.58	9.80	0.80	3.14	3.00	0.80	0.14
ConsoIidated	2013	0.31	0.09	5.33	9.73	1.01	3.18	3.00	0.80	
ConsoIidated	2014	0.30	0.24	5.25	9.62	1.01	3.22	3.00	0.80	
ConsoIidated	2015	0.28	0.27	4.74	9.56	1.02	3.26	2.71	0.80	0.11
ConsoIidated	2016	0.06	0.18	3.38	9.54	1.08	3.30	2.30	0.80	
ConsoIidated	2017	0.06	0.20	3.46	9.51	0.75	3.33	2.20	0.80	
ConsoIidated	2018	0.06	0.20	3.36	9.46	1.21	3.37	2.30	0.80	0.43
Co-op Bank	2006				11.25	0.91	3.64			0.16
Co-op Bank	2007				11.42	0.83	3.66			0.16
Co-op Bank	2008				11.34	0.92	3.69			0.17
Co-op Bank	2009	0.00	0.00	1.87	11.65	0.72	3.71	2.40	0.90	0.16
Co-op Bank	2010	0.00	0.00	3.42	11.94	0.73	3.74	2.48	0.90	0.14
Co-op Bank	2011	0.02	0.02	5.52	12.03	0.80	3.76	2.44	0.90	0.13
Co-op Bank	2012	0.05	0.05	6.61	12.20	0.75	3.78	2.48	0.90	0.16

Bank	Year	PS	PQ	IR	FS	LC	AGE	MT	LTV	CAM
Co-op Bank	2013	0.04	0.08	6.74	12.34	0.80	3.81	2.40	0.90	0.15
Co-op Bank	2014	0.03	0.15	5.98	12.55	0.84	3.83	2.35	0.90	0.16
Co-op Bank	2015	0.09	0.06		12.74	0.81	3.85	2.40	0.90	0.15
Co-op Bank	2016	0.07	0.07	6.96	12.77	0.94	3.87	2.48	0.90	0.17
Co-op Bank	2017	0.04	0.11	6.50	12.86	0.92	3.89	2.46	0.90	0.17
Co-op Bank	2018	0.05	0.10	6.57	12.92	0.85	3.91	1.95	0.90	0.32
Credit Bank	2006				7.87	0.81	2.56			0.22
Credit Bank	2007	0.00	0.00	-1.56	8.24	0.66	2.64			0.21
Credit Bank	2008	0.01	0.00	-0.26	8.20	0.71	2.71			0.17
Credit Bank	2009	0.01	0.00	-0.18	8.25	0.74	2.77			0.18
Credit Bank	2010	0.02	0.00	1.08	8.42	0.68	2.83			0.15
Credit Bank	2011				8.59	0.80	2.89			0.17
Credit Bank	2012				8.77	0.70	2.94			
Credit Bank	2013				8.90	0.82	3.00			0.13
Credit Bank	2014				9.09	0.82	3.04			
Credit Bank	2015				9.24	1.02	3.09			0.15
Credit Bank	2016				9.41	0.93	3.14			0.14
Credit Bank	2017				9.58	1.36	3.18			0.13
Credit Bank	2018				9.79	1.06	3.22			0.28
Development	2006				8.24	1.33	2.30			0.23
Development	2007				8.80	1.58	2.40	2.71	0.80	0.16
Development	2008	0.19	0.01	4.19	8.78	1.59	2.48	2.83	0.75	0.17
Development	2009	0.35	0.00	4.14	9.02	2.04	2.56	2.89	0.75	0.22
Development	2010	0.30	0.00	4.55	9.27	1.39	2.64	3.00	0.70	0.22
Development	2011	0.36	0.03		9.35	1.50	2.71	2.71	0.70	0.21
Development	2012	0.35	0.06	5.19	9.50	1.07	2.77	2.71	0.70	0.17
Development	2013	0.31	0.07	4.52	9.65	1.04	2.83	3.00	0.70	0.18
Development	2014	0.36	0.15	3.57	9.74	1.10	2.89	2.71	0.70	0.21
Development	2015	0.30	0.26	5.87	9.74	0.94	2.94	2.71	0.70	0.19
Development	2016	0.30	0.38	4.64	9.71	1.52	3.00	2.94	0.70	0.19
Development	2017	0.36	0.26	4.69	9.70	1.67	3.04	2.30	0.70	0.16

Bank	Year	PS	PQ	IR	FS	LC	AGE	MT	LTV	CAM
Development	2018	0.33	0.03		9.64	1.79	3.09	2.57	0.70	0.47
DTB Bank	2006				10.17	0.85	4.09			0.10
DTB Bank	2007	0.01	0.00	2.24	10.65	0.96	4.11	3.00	0.90	0.10
DTB Bank	2008	0.01	0.00	2.67	10.64	1.06	4.13	2.89	0.90	0.12
DTB Bank	2009	0.01	0.00	3.15	10.77	1.18	4.14	3.00	0.90	0.12
DTB Bank	2010	0.01	0.00	3.98	10.98	1.17	4.16	3.00	0.90	0.14
DTB Bank	2011	0.01	0.00		11.26	0.86	4.17	2.94	0.90	0.11
DTB Bank	2012	0.01	0.00	3.53	11.46	0.84	4.19	3.00	0.90	0.13
DTB Bank	2013	0.01	0.00	2.76	11.65	0.90	4.20	3.00	0.90	0.13
DTB Bank	2014	0.01	0.01	3.10	11.86	0.94	4.22	2.48	0.90	0.12
DTB Bank	2015	0.00	0.07	2.98	12.16	1.02	4.23	2.52	0.90	0.14
DTB Bank	2016	0.00	0.04	3.52	12.41	0.83	4.25	2.56	0.90	0.15
DTB Bank	2017	0.00	0.03	3.56	12.51	0.82	4.26	2.53	0.90	0.16
DTB Bank	2018	0.01	0.06	3.73	12.55	0.74	4.28	2.71	0.90	0.29
Dubai Bank	2006				7.43	1.35	1.79			0.19
Dubai Bank	2007				7.68	1.28	1.95			0.18
Dubai Bank	2008				7.40	1.44	2.08			0.14
Dubai Bank	2009				7.67	1.72	2.20			0.14
Dubai Bank	2010				7.54	1.18	2.30			0.12
Dubai Bank	2011				7.75	1.23	2.40			0.18
Dubai Bank	2012	0.00	0.00		7.86	1.60	2.48	2.30	0.80	
Dubai Bank	2013	0.00	0.00		7.98	2.06	2.56	2.30	0.80	0.16
Dubai Bank	2014	0.00	0.00	-0.71	8.16	0.00	2.64	2.30	0.80	0.15
Dubai Bank	2015				1.22	0.00	2.71			
Dubai Bank	2016					0.00	2.77			
Dubai Bank	2017				9.24	0.00	2.83			
Dubai Bank	2018				8.57	0.00	2.89	2.48	0.80	
Ecobank	2006	0.21	0.00			0.00		2.08	0.80	0.39
Ecobank	2007	0.17	0.00		9.44	0.00		2.30	0.75	0.36
Ecobank	2008	0.16	0.00	4.25	9.26	0.87		1.95	0.80	0.14
Ecobank	2009	0.11	0.00	4.38	9.69	0.80	0.00	2.08	0.75	

Bank	Year	PS	PQ	IR	FS	LC	AGE	MT	LTV	CAM
Ecobank	2010	0.09	0.00	4.93	10.20	0.79	0.69	2.08	0.70	0.16
Ecobank	2011	0.17	0.16	5.55	10.21	0.81	1.10	2.08	0.70	0.12
Ecobank	2012	0.07	0.16	5.00	10.37	0.73	1.39	2.30	0.70	
Ecobank	2013	0.07	0.22	4.62	10.52	0.79	1.61	2.30	0.80	
Ecobank	2014	0.03	0.09	3.86	10.73	0.74	1.79	2.08	0.70	
Ecobank	2015	0.04	0.18	4.81	10.87	0.90	1.95	1.95	0.70	0.10
Ecobank	2016	0.03	0.16	3.57	10.76	0.85	2.08	1.79	0.70	
Ecobank	2017	0.03	0.10	3.64	10.89	0.49	2.20	2.20	0.70	
Ecobank	2018	0.04	0.10	3.27	10.91	0.34	2.30	2.30	0.90	0.29
Equity Bank	2006				10.02	0.69	0.69			0.13
Equity Bank	2007	0.00	0.01	1.30	11.26	0.71	1.10	2.71	0.80	0.17
Equity Bank	2008	0.01	0.01	3.69	11.25	0.92	1.39	2.77	0.80	0.17
Equity Bank	2009	0.01	0.01	4.27	11.50	1.00	1.61	2.89	0.80	0.18
Equity Bank	2010	0.01	0.01	4.50	11.80	0.84	1.79	2.89	0.80	0.16
Equity Bank	2011	0.03	0.01	6.10	12.08	0.89	1.95	3.00	0.80	0.15
Equity Bank	2012	0.03	0.01	6.15	12.28	0.90	2.08	3.00	0.80	0.19
Equity Bank	2013	0.03	0.04	6.44	12.38	0.99	2.20	3.00	0.80	0.18
Equity Bank	2014	0.03	0.03	6.64	12.53	0.95	2.30	2.71	0.80	0.16
Equity Bank	2015	0.03	0.03	6.72	12.74	0.97	2.40	2.71	0.80	0.15
Equity Bank	2016	0.04	0.09	6.37	12.85	0.80	2.48	2.30	0.80	0.18
Equity Bank	2017	0.04	0.13	6.38	12.92	0.74	2.56	1.61	0.80	0.14
Equity Bank	2018	0.04	0.10	6.24	12.99	0.68	2.64	1.61	0.80	0.22
Family Bank	2006	0.00	0.10	1.40				2.30	0.90	
Family Bank	2007	0.02	0.00	2.74	9.28	0.76		2.30	0.90	0.16
Family Bank	2008	0.03	0.00	3.11	9.25	0.84	0.00	2.30	0.88	0.15
Family Bank	2009	0.09	0.00	4.64	9.52	0.77	0.69	2.08	0.90	0.13
Family Bank	2010	0.06	0.00	4.78	9.91	0.69	1.10	1.95	0.90	0.16
Family Bank	2011	0.02	0.00	3.91	10.17	0.81	1.39	2.08	0.90	0.14
Family Bank	2012	0.06	0.00	5.42	10.34	0.80	1.61	1.61	0.90	0.18
Family Bank	2013	0.01	0.01	4.03	10.68	0.84	1.79	1.61	0.90	0.17
Family Bank	2014	0.07	0.00	5.78	11.03	0.84	1.95	1.61	0.90	0.17

Bank	Year	PS	PQ	IR	FS	LC	AGE	MT	LTV	CAM
Family Bank	2015	0.06	0.01	5.76	11.30	0.92	2.08	1.61	0.90	0.15
Family Bank	2016	0.06	0.03	4.87	11.15	1.29	2.20	2.08	0.90	0.14
Family Bank	2017	0.08	0.07	5.10	11.14	0.99	2.30	1.82	0.90	
Family Bank	2018	0.08	0.09	5.11	11.11	0.98	2.40	1.95	0.90	0.33
Fid/SB Bank	2006				7.86	0.78	2.30			0.13
Fid/SB Bank	2007	0.01	0.00	-0.30	8.39	0.79	2.40	2.08	0.80	0.13
Fid/SB Bank	2008	0.01	0.00	0.76	8.37	0.76	2.48	2.30	0.80	0.07
Fid/SB Bank	2009	0.02	0.00	1.40	8.62	0.68	2.56	2.30	0.80	0.09
Fid/SB Bank	2010	0.02	0.00	2.21	9.01	0.64	2.64	2.30	0.80	0.18
Fid/SB Bank	2011	0.05	0.00	-2.63	9.29	0.70	2.71	2.30	0.80	0.13
Fid/SB Bank	2012	0.04	0.44	2.91	9.37	0.66	2.77	1.95	0.80	0.13
Fid/SB Bank	2013	0.02	0.22	2.63	9.46	0.67	2.83			0.15
Fid/SB Bank	2014	0.10	0.04	4.55	9.71	0.77	2.89	1.61	0.80	0.14
Fid/SB Bank	2015	0.23	0.13	4.72	9.62	0.96	2.94	1.61	0.80	0.16
Fid/SB Bank	2016					0.00	3.00	1.61	0.80	
Fid/SB Bank	2017	0.24	0.49			0.00	3.04	1.61	0.80	
Fid/SB Bank	2018	0.12	0.77	4.99	11.17	0.47	3.09	2.14	0.80	0.45
First CB	2006									
First CB	2007				8.07	0.00				
First CB	2008				8.06	0.42		2.30	0.70	
First CB	2009				8.40	0.63	0.00	2.30	0.75	
First CB	2010	0.39	0.00	4.81	8.76	0.53	0.69	2.71	0.80	
First CB	2011				9.08	0.55	1.10	2.71	0.80	0.14
First CB	2012				9.21	0.63	1.39	2.30	0.80	0.17
First CB	2013	0.02	0.00	2.43	9.33	0.74	1.61	1.61	0.80	0.13
First CB	2014	0.01	0.15	2.05	9.63	0.75	1.79	3.00	0.90	0.12
First CB	2015	0.07	0.09	4.20	9.59	0.90	1.95	3.00	0.90	0.09
First CB	2016	0.08	0.14	2.49	9.61	0.94	2.08	2.71	0.90	
First CB	2017	0.19	0.17	4.69	9.76	1.61	2.20	3.00	0.90	0.22
First CB	2018	0.18	0.33	4.43	9.79	0.75	2.30	2.30	0.70	0.37
Giro Comm.	2006	0.01	0.00	0.97	8.65	0.71	2.64	2.71	0.70	0.14

Bank	Year	PS	PQ	IR	FS	LC	AGE	MT	LTV	CAM
Giro Comm.	2007	0.02	0.00	1.88	8.72	0.67	2.71	2.89	0.70	0.13
Giro Comm.	2008	0.01	0.00	1.06	8.69	0.71	2.77	2.71	0.70	0.14
Giro Comm.	2009	0.01	0.00	0.89	8.86	0.64	2.83	2.71	0.70	0.15
Giro Comm.	2010	0.01	0.00	0.91	9.23	0.61	2.89	2.71	0.70	0.18
Giro Comm.	2011				9.38	0.64	2.94	2.89	0.70	0.12
Giro Comm.	2012				9.42	0.92	3.00	3.00	0.70	0.13
Giro Comm.	2013	0.06	0.01	3.22	9.52	0.61	3.04	3.00	0.70	0.16
Giro Comm.	2014	0.03	0.00	2.64	9.62	0.63	3.09	3.00	0.70	0.15
Giro Comm.	2015	0.03	0.00	1.63	9.67	0.73	3.14	2.89	0.70	0.13
Giro Comm.	2016				9.70	0.00	3.18	1.91	0.70	
Giro Comm.	2017					0.00				
Giro Comm.	2018					0.00				
Guardian	2006				8.65	0.90	2.40			0.17
Guardian	2007	0.00	0.00	-0.50	8.75	0.88	2.48	1.79	0.70	0.14
Guardian	2008	0.00	0.00	-0.78	8.62	0.93	2.56	1.61	0.70	0.15
Guardian	2009	0.00	0.00	-1.03	8.90	0.81	2.64	1.79	0.70	0.15
Guardian	2010			-1.57	8.99	0.79	2.71	1.61	0.75	0.16
Guardian	2011				9.09	0.87	2.77	1.95	0.70	0.14
Guardian	2012				9.37	0.74	2.83	1.61	0.70	0.14
Guardian	2013	0.03	0.00	3.20	9.46	0.82	2.89	1.61	0.70	0.15
Guardian	2014	0.04	0.00	2.74	9.59	0.81	2.94	1.79	0.70	0.15
Guardian	2015	0.04	0.00	1.75	9.59	0.79	3.00	1.61	0.70	0.16
Guardian	2016	0.06	0.00	3.51	9.60	0.78	3.04	1.61	0.70	0.15
Guardian	2017	0.10	0.17	4.13	9.67	8.72	3.09	1.61	0.70	0.16
Guardian	2018	0.10	0.21	3.91	9.69	0.75	3.14	1.79	0.70	0.33
Gulf African	2006									
Gulf African	2007				8.52	0.00				
Gulf African	2008				8.52	0.56	0.00			
Gulf African	2009				8.96	1.36	0.69			
Gulf African	2010				9.17	0.77	1.10			0.10
Gulf African	2011	0.08	0.00	4.33	9.47	0.69	1.39	2.71	0.80	0.12

Bank	Year	PS	PQ	IR	FS	LC	AGE	MT	LTV	CAM
Gulf African	2012	0.11	0.00	4.71	9.52	0.82	1.61	3.00	0.80	0.12
Gulf African	2013	0.11	0.03	4.66	9.68	0.84	1.79	3.00	0.80	0.15
Gulf African	2014	0.06	0.03	4.48	9.89	0.89	1.95	3.00	0.80	0.15
Gulf African	2015	0.05	0.06	4.22	10.12	0.83	2.08	2.83	0.80	0.18
Gulf African	2016	0.06	0.19	3.90	10.21	0.79	2.20	2.71	0.80	0.17
Gulf African	2017	0.04	0.10	3.70	10.35	0.77	2.30	2.55	0.80	0.12
Gulf African	2018	0.03	0.01	3.22	10.41	0.90	2.40	2.56	0.80	0.31
Habib Bank	2006	0.03	0.00		8.27	0.31	3.91			0.10
Habib Bank	2007	0.03	0.00		8.43	0.34	3.93			0.16
Habib Bank	2008	0.03	0.00		8.41	0.42	3.95			0.16
Habib Bank	2009	0.02	0.00		8.46	0.39	3.97			0.18
Habib Bank	2010	0.01	0.00		5.46	0.35	3.99			0.58
Habib Bank	2011	0.01	0.00		8.68	0.42	4.01			0.15
Habib Bank	2012	0.01	0.00		8.86	0.31	4.03	1.61		0.24
Habib Bank	2013				9.00	0.37	4.04			0.23
Habib Bank	2014				9.15	0.38	4.06			0.22
Habib Bank	2015				9.23	0.78	4.08			0.21
Habib Bank	2016				9.43	0.46	4.09			
Habib Bank	2017					0.66	4.11			
Habib Bank	2018					0.43	4.13			
HFC	2006	0.96	0.28	6.70	9.35	1.14	3.71	2.89	0.85	0.14
HFC	2007	0.96	0.18	6.80	9.66	1.06	3.74	3.00	0.85	0.13
HFC	2008	0.97	0.11	7.15	9.57	1.16	3.76	3.00	0.85	0.19
HFC	2009	0.97	0.07	7.54	9.87	1.27	3.78	3.00	0.85	0.15
HFC	2010	0.84	0.06	7.69	10.29	1.35	3.81	3.00	0.85	0.18
HFC	2011	1.00	0.06	8.12	10.37	1.38	3.83	3.00	0.85	0.17
HFC	2012	0.98	0.08	8.35	10.61	1.35	3.85	3.00	0.85	0.17
HFC	2013	0.98	0.09	7.82	10.75	1.35	3.87	3.00	0.85	0.16
HFC	2014	0.98	0.09	7.76	11.01	1.27	3.89	3.00	0.90	0.15
HFC	2015	0.87	0.06	7.57	11.14	1.30	3.91	3.00	0.85	0.15
HFC	2016	0.91	0.11	7.61	11.13	1.46	3.93	2.71	0.85	0.15

Bank	Year	PS	PQ	IR	FS	LC	AGE	MT	LTV	CAM
HFC	2017	0.89	0.16	6.88	11.04	1.43	3.95	2.30	0.90	0.12
HFC	2018	0.68	0.15	6.51	10.95	1.44	3.97	2.56	0.90	0.37
I&M Bank	2006	0.02	0.00	2.62		0.00	3.47	2.71	0.80	0.02
I&M Bank	2007	0.02	0.00	2.73	10.52	0.00	3.50	2.71	0.80	0.02
I&M Bank	2008	0.02	0.00	2.51	10.51	0.93	3.53	2.71	0.80	0.15
I&M Bank	2009	0.03	0.00	3.19	10.70	0.72	3.56	2.64	0.85	0.14
I&M Bank	2010	0.02	0.00	3.90	11.04	0.79	3.58	2.64	0.80	0.13
I&M Bank	2011	0.03	0.00	1.36	11.25	0.84	3.61	2.56	0.80	0.13
I&M Bank	2012	0.04	0.01	5.17	11.42	0.85	3.64	2.71	0.80	0.11
I&M Bank	2013	0.04	0.00	5.20	11.61	0.99	3.66	2.71	0.80	0.11
I&M Bank	2014	0.04	0.01	5.06	11.83	1.05	3.69	2.48	0.80	0.15
I&M Bank	2015	0.03	0.01	5.11	11.90	1.01	3.71	2.48	0.80	0.17
I&M Bank	2016	0.03	0.03	5.41	12.01	0.88	3.74	2.46	0.80	0.17
I&M Bank	2017	0.03	0.09	5.41	12.12	0.96	3.76	2.43	0.80	0.19
I&M Bank	2018	0.03	0.09	5.25	12.34	0.82	3.78	2.56	0.80	0.34
Imperial	2006	0.00	0.00		9.43	0.81	2.48	2.71	0.80	0.14
Imperial	2007	0.01	0.00		9.53	0.85	2.56	2.71	0.80	0.15
Imperial	2008	0.02	0.00	2.04	9.51	0.83	2.64	2.71	0.80	0.15
Imperial	2009	0.01	0.00	1.98	9.66	0.82	2.71	2.71	0.80	0.17
Imperial	2010	0.01	0.00	2.36	9.87	0.86	2.77	2.71	0.80	0.18
Imperial	2011				10.15	0.80	2.83	2.71	0.80	0.17
Imperial	2012				10.45	0.71	2.89	2.71	0.80	0.16
Imperial	2013	0.02	0.08	3.37	10.67	0.79	2.94	2.71	0.80	0.16
Imperial	2014	0.02	0.26	3.49	10.94	0.68	3.00	2.71	0.80	0.15
Imperial	2015				6.41	0.00	3.04			
Imperial	2016					0.00	3.09			
Imperial	2017					0.00	3.14			
Imperial	2018					0.00	3.18			
Jamii Bora	2006					0.00				0.65
Jamii Bora	2007					0.00				0.71
Jamii Bora	2008					0.00	0.00			0.23

Bank	Year	PS	PQ	IR	FS	LC	AGE	MT	LTV	CAM
Jamii Bora	2009					0.00	0.69			0.22
Jamii Bora	2010				7.45	0.74	1.10			
Jamii Bora	2011	0.17	0.42	2.53	7.64	0.00	1.39	2.71	0.80	
Jamii Bora	2012	0.15	0.03	3.65	8.15	1.18	1.61	2.71	0.90	0.21
Jamii Bora	2013	0.16	0.02	4.31	8.86	1.15	1.79	2.71	0.90	0.13
Jamii Bora	2014	0.16	0.05	4.78	9.48	0.76	1.95	2.30	0.80	0.13
Jamii Bora	2015	0.42	0.03	6.89	9.73	0.98	2.08	2.30	0.80	0.09
Jamii Bora	2016	0.33	0.28	5.40	9.66	1.32	2.20	2.71	0.80	
Jamii Bora	2017	0.32	0.28	5.65	9.46	1.59	2.30	2.67	0.80	
Jamii Bora	2018	0.30	0.67	5.19	9.21	2.27	2.40	2.48	0.80	0.60
KCB Bank	2006	0.08	0.10	6.13	11.66	0.75	4.70	3.00	0.90	0.16
KCB Bank	2007	0.09	0.07	6.47	12.11	0.84	4.71	3.14	0.90	0.15
KCB Bank	2008	0.10	0.05	6.94	12.07	0.92	4.72	3.22	0.90	0.14
KCB Bank	2009	0.15	0.04	7.24	12.10	0.74	4.73	3.22	0.90	0.16
KCB Bank	2010	0.11	0.04	7.78	12.32	0.96	4.74	3.22	0.90	0.20
KCB Bank	2011	0.10	0.06	7.67	12.55	0.88	4.74	3.22	0.90	0.16
KCB Bank	2012	0.16	0.07	8.25	12.63	0.86	4.75	3.22	0.90	0.17
KCB Bank	2013	0.17	0.07	7.86	12.69	0.87	4.76	3.22	0.90	0.18
KCB Bank	2014	0.16	0.06	8.30	12.84	0.93	4.77	3.22	0.90	0.17
KCB Bank	2015	0.15	0.06	8.28	13.06	0.93	4.78	2.71	0.90	0.16
KCB Bank	2016	0.15	0.07	8.66	13.13	0.97	4.79	2.30	0.90	0.18
KCB Bank	2017	0.16	0.07	7.44	13.23	0.94	4.80	2.30	0.90	0.15
KCB Bank	2018	0.15	0.08	7.27	13.34	0.91	4.80	2.30	0.90	0.24
Mid Eas	2006	0.00	0.00	-1.47	8.55	0.89	3.26	2.71	0.95	0.12
Mid Eas	2007	0.00	0.00	-1.09	8.15	1.03	3.30	2.64	0.90	0.14
Mid Eas	2008	0.01	0.00	-0.17	8.10	0.89	3.33	2.71	0.90	0.16
Mid Eas	2009	0.01	0.00	0.29	8.06	0.87	3.37	2.56	0.90	0.13
Mid Eas	2010	0.02	0.09	0.94	8.30	0.89	3.40	2.71	0.95	0.12
Mid Eas	2011				8.44	0.97	3.43	2.64	0.90	0.14
Mid Eas	2012				8.68	0.82	3.47	2.71	0.90	0.11
Mid Eas	2013	0.00	0.00	-0.07	8.66	1.06	3.50	2.71	1.00	0.19

Bank	Year	PS	PQ	IR	FS	LC	AGE	MT	LTV	CAM
Mid Eas	2014	0.01	0.00	0.84	8.69	0.90	3.53	2.71	0.78	0.21
Mid Eas	2015	0.01	0.00	0.20	8.64	0.98	3.56	2.71	0.80	0.18
Mid Eas	2016	0.02	0.29	1.47	8.56	1.03	3.58	2.64	0.90	
Mid Eas	2017	0.02	0.47	1.08	8.54	0.30	3.61	2.56	0.90	
Mid Eas	2018	0.01	0.32	-0.35	8.59	0.77	3.64	2.56	1.00	0.46
NBK	2006				11.16	2.05	3.64			0.15
NBK	2007				10.71	0.36	3.66			0.18
NBK	2008	0.03	0.00	3.53	10.66	0.32	3.69	2.71	0.90	0.17
NBK	2009	0.03	0.00	3.93	10.87	0.34	3.71	2.89	0.90	0.20
NBK	2010	0.03	0.00	4.18	11.00	0.45	3.74	2.89	0.95	0.17
NBK	2011	0.11	0.03	6.04	11.14	0.51	3.76	3.00	0.90	0.16
NBK	2012	0.14	0.14	6.35	11.11	0.68	3.78	3.00	0.90	0.16
NBK	2013	0.12	0.11	6.38	11.43	0.53	3.81	3.22	1.00	0.16
NBK	2014	0.03	0.08	4.45	11.72	0.65	3.83	3.22	1.00	0.15
NBK	2015	0.03	0.12	5.30	11.74	0.66	3.85	3.00	1.00	0.15
NBK	2016	0.03	0.22	4.10	11.65	0.70	3.87	2.56	1.00	0.11
NBK	2017	0.03	0.12	4.44	11.61	0.72	3.89	2.64	1.00	0.13
NBK	2018	0.03	0.06		11.65	0.67	3.91	2.64	1.00	0.55
NIC Bank	2006					0.00	2.71	2.71	0.90	0.07
NIC Bank	2007	0.01	0.01	2.21	10.68	0.00	2.77	3.00	0.90	0.04
NIC Bank	2008	0.01	0.01	3.24	10.66	0.88	2.83	3.00	0.90	0.13
NIC Bank	2009	0.01	0.01	3.44	10.74	0.92	2.89	2.89	0.85	0.14
NIC Bank	2010	0.01	0.01	3.90	10.91	0.95	2.94	3.00	0.90	0.14
NIC Bank	2011	0.00	0.00	2.96	11.21	0.88	3.00	3.00	0.90	0.13
NIC Bank	2012	0.01	0.00	4.23	11.53	0.89	3.04	3.00	0.90	0.14
NIC Bank	2013	0.02	0.01	3.75	11.63	0.96	3.09	3.00	0.90	0.14
NIC Bank	2014	0.02	0.02		11.83	1.06	3.14	3.22	0.90	0.17
NIC Bank	2015	0.03	0.01	4.56	11.96	1.06	3.18	3.00	0.90	0.19
NIC Bank	2016	0.02	0.02	5.00	11.99	1.09	3.22	3.00	0.90	0.19
NIC Bank	2017	0.02	0.25	4.80	12.17	0.91	3.26	2.30	0.90	0.18
NIC Bank	2018	0.02	0.24	4.60	12.18	0.87	3.30	2.71	0.90	0.34

Bank	Year	PS	PQ	IR	FS	LC	AGE	MT	LTV	CAM
Oriental	2006	0.00	0.00	-1.77	7.66	1.30	2.71	1.95	0.90	
Oriental	2007	0.00	0.00	-2.11	7.93	1.24	2.77	1.95	0.90	0.36
Oriental	2008	0.00	0.00	-1.80	7.74	1.10	2.83	2.08	0.90	0.25
Oriental	2009	0.00		-1.76	8.14	0.94	2.89	1.95	0.90	0.18
Oriental	2010	0.00	0.00	0.17	8.42	0.84	2.94	1.79	0.90	0.21
Oriental	2011	0.01	0.00		8.52	0.88	3.00	1.95	0.90	0.21
Oriental	2012	0.00	0.00	0.26	8.74	0.82	3.04	1.95	0.90	0.18
Oriental	2013	0.00	0.00	-0.98	8.85	0.84	3.09	2.08	0.90	0.18
Oriental	2014	0.00	0.00	-1.67	8.97	0.81	3.14	1.61	0.90	0.15
Oriental	2015	0.00	0.00	-1.06	9.05	0.90	3.18	2.71	0.90	0.15
Oriental	2016	0.00	0.00	0.68	9.20	1.02	3.22	2.71	0.90	0.14
Oriental	2017				9.27	1.00	3.26			0.16
Oriental	2018				9.26	1.12	3.30			0.33
Paramount	2006	0.07	0.00	2.78	8.01	0.85	2.40	1.95	0.70	0.18
Paramount	2007	0.07	0.00	2.90	8.18	0.91	2.48	1.95	0.70	0.18
Paramount	2008	0.08	0.00	3.19	7.88	1.03	2.56	1.79	0.70	0.18
Paramount	2009	0.10	0.00	3.24	8.14	0.66	2.64	1.79	0.70	0.18
Paramount	2010	0.09	0.00	2.72	8.39	0.61	2.71	1.95	0.70	0.27
Paramount	2011				8.46	0.71	2.77	2.08	0.70	0.22
Paramount	2012				8.89	0.55	2.83	2.08	0.70	0.18
Paramount	2013	0.01	0.00	1.43	8.99	0.61	2.89	1.95	0.70	0.17
Paramount	2014	0.04	0.14	3.42	9.25	0.67	2.94	1.95	0.70	0.19
Paramount	2015	0.05	0.09	2.94	9.26	0.80	3.00	1.95	0.70	0.16
Paramount	2016	0.06	0.07	2.65	9.15	0.81	3.04	2.30	0.70	0.16
Paramount	2017	0.05	0.03	2.45	9.16	0.81	3.09	1.79	0.70	0.16
Paramount	2018	0.05		2.21	9.20	0.79	3.14	2.08	0.75	0.39
Prime	2006	0.01	0.00	0.85	9.43	0.62	2.64	2.30	0.80	0.12
Prime Bank	2007	0.01	0.00	1.38	9.93	0.64	2.71	2.30	0.80	0.14
Prime Bank	2008	0.00	0.00	0.92	9.90	0.63	2.77	2.30	0.80	0.14
Prime Bank	2009	0.01	0.00	1.61	10.09	0.58	2.83	2.20	0.80	0.13
Prime Bank	2010	0.01	0.00	2.80	10.39	0.60	2.89	2.30	0.80	0.11

Bank	Year	PS	PQ	IR	FS	LC	AGE	MT	LTV	CAM
Prime Bank	2011	0.01	0.00	0.61	10.47	0.66	2.94	2.30	0.80	0.13
Prime Bank	2012	0.02	0.00	3.34	10.68	0.59	3.00	2.30	0.80	0.13
Prime Bank	2013	0.02	0.00	2.24	10.81	0.68	3.04	2.30	0.80	0.13
Prime Bank	2014	0.01	0.00	4.33	10.91	0.78	3.09	2.19	0.80	0.13
Prime Bank	2015	0.01	0.00	4.09	11.08	0.82	3.14	2.30	0.80	0.13
Prime Bank	2016	0.01	0.07	2.73	11.09	0.82	3.18	2.56	0.80	0.16
Prime Bank	2017	0.01	0.00	2.41	11.24	0.69	3.22	2.56	0.80	0.15
Prime Bank	2018	0.00	0.17	1.89	11.50	0.54	3.26	2.40	0.80	0.31
Sidian Bank	2006					0.00	1.95			0.16
Sidian Bank	2007					0.00	2.08			0.25
Sidian Bank	2008					0.00	2.20			0.39
Sidian Bank	2009					0.00	2.30			0.40
Sidian Bank	2010					0.00	2.40			0.44
Sidian Bank	2011					0.00	2.48			0.16
Sidian Bank	2012					0.00	2.56			0.35
Sidian Bank	2013					0.00	2.64			0.23
Sidian Bank	2014					0.00	2.71			
Sidian Bank	2015				9.86	1.00	2.77			0.17
Sidian Bank	2016	0.00	0.00	0.28	9.95	1.06	2.83		0.80	0.13
Sidian Bank	2017	0.08	0.22		9.87	5.93	2.89		0.80	
Sidian Bank	2018	0.07	0.18		10.14	0.85	2.94		0.90	0.33
Spire Bank	2006					0.00	2.40			0.26
Spire Bank	2007					0.00	2.48			0.18
Spire Bank	2008					0.00	2.56			0.22
Spire Bank	2009					0.00	2.64			0.31
Spire Bank	2010					0.00	2.71			0.36
Spire Bank	2011					0.00	2.77			0.10
Spire Bank	2012					0.00	2.83			0.21
Spire Bank	2013					0.00	2.89	3.00	0.80	0.12
Spire Bank	2014	0.00	0.00	1.79		0.00	2.94	3.00	0.80	0.81
Spire Bank	2015	0.01	0.19	1.90	3.83	0.00	3.00	3.00	0.80	

Bank	Year	PS	PQ	IR	FS	LC	AGE	MT	LTV	CAM
Spire Bank	2016	0.23	0.00		9.53	0.98	3.04	3.00	0.80	
Spire Bank	2017	0.25	0.01	4.30	9.32	1.28	3.09	2.56	0.80	
Spire Bank	2018	0.07	0.35	2.65	9.13	0.94	3.14	2.30	0.80	
StandChart	2006	0.08	0.00	5.66	11.65	0.57	4.56	2.71	0.80	0.14
StandChart	2007	0.09	0.00	6.02	11.52	0.55	4.57	2.71	0.80	0.14
StandChart	2008	0.10	0.00	6.12	11.50	0.58	4.58	2.77	0.80	0.13
StandChart	2009	0.09	0.00	6.18	11.73	0.66	4.60	2.71	0.80	0.12
StandChart	2010	0.08	0.00	6.52	11.87	0.61	4.61	2.77	0.80	0.12
StandChart	2011	0.08	0.02	5.64	12.01	0.79	4.62	2.71	0.80	0.10
StandChart	2012	0.09	0.02	6.90	12.18	0.81	4.62	2.71	0.80	0.13
StandChart	2013	0.08	0.01	6.41	12.30	0.85	4.63	2.71	0.80	0.11
StandChart	2014	0.10	0.01	6.46	12.31	0.84	4.64	2.77	0.80	0.20
StandChart	2015	0.14	0.01	6.49	12.36	0.71	4.65	2.71	0.80	0.19
StandChart	2016	0.17	0.02	6.93	12.43	0.69	4.66	2.77	0.80	0.20
StandChart	2017	0.15	0.02	6.79	12.56	0.65	4.67	2.77	0.80	0.18
StandChart	2018	0.19	0.02	6.82	12.56	0.60	4.68	2.72	1.00	0.33
Transnation	2006	0.01	0.00	0.50	7.94	1.27	3.04	1.79	0.90	0.24
Transnation	2007	0.05	0.00		8.22	0.86	3.09	1.79	0.90	0.26
Transnation	2008	0.08	0.02	2.68	8.13	0.93	3.14	1.79	0.90	0.28
Transnation	2009	0.09	0.06	3.37	8.22	1.09	3.18	1.79	0.90	0.26
Transnation	2010	0.03	0.11	2.27	8.47	0.74	3.22	1.79	0.90	0.28
Transnation	2011	0.02	0.00	2.23	8.89	0.69	3.26	1.79	0.90	0.23
Transnation	2012	0.04	0.13	3.29	9.08	0.71	3.30	1.79	0.90	0.23
Transnation	2013	0.02	0.03	2.33	9.18	0.65	3.33	1.79	0.90	0.19
Transnation	2014	0.09	0.00	4.14	9.23	0.86	3.37	1.79	0.90	0.16
Transnation	2015				9.26	0.97	3.40			0.17
Transnation	2016				9.26	0.89	3.43			0.16
Transnation	2017				9.24	0.59	3.47			0.15
Transnation	2018				9.23	0.99	3.50			0.39
UBA Bank	2006					0.00				
UBA Bank	2007					0.00				

Bank	Year	PS	PQ	IR	FS	LC	AGE	MT	LTV	CAM
UBA Bank	2008					0.00				
UBA Bank	2009				7.10	0.00				
UBA Bank	2010				7.77	0.24	0.00			
UBA Bank	2011				8.07	0.41	0.69			
UBA Bank	2012				7.98	0.37	1.10			
UBA Bank	2013				8.22	0.32	1.39			
UBA Bank	2014	0.01	0.00	-1.48	8.47	0.22	1.61	2.71	0.80	
UBA Bank	2015	0.00	0.00	-3.58	8.96	0.67	1.79	2.83	0.80	0.15
UBA Bank	2016	0.00	0.00	-2.56	8.63	1.81	1.95	2.71	0.80	0.13
UBA Bank	2017				8.78	0.85	2.08			0.12
UBA Bank	2018	0.00	0.00		9.64	0.60	2.20			0.28
Victoria	2006	0.01	0.01	0.09		0.60	2.30	2.40	0.90	0.09
Victoria	2007	0.01	0.01	0.34	8.40	0.70	2.40	2.30	0.90	0.09
Victoria	2008	0.01	0.01	-0.03	8.40	0.78	2.48	2.30	0.90	0.09
Victoria	2009	0.03	0.01	1.72	8.54	0.78	2.56	2.48	0.90	
Victoria	2010	0.02	0.01	1.74	8.73	0.71	2.64	2.40	0.90	
Victoria	2011	0.02	0.00	0.10	8.94	0.70	2.71	2.30	0.90	
Victoria	2012	0.01	0.00	1.77	9.24	0.70	2.77	2.48	0.90	
Victoria	2013	0.00	0.00	-0.64	9.52	0.92	2.83	2.30	0.90	
Victoria	2014	0.00	0.00	-1.31	9.76	0.89	2.89	2.48	0.90	
Victoria	2015	0.00	0.00	-3.97	9.90	0.94	2.94	2.30	0.90	
Victoria	2016	0.01	0.00	1.88	10.02	0.97	3.00	2.40	0.90	
Victoria	2017				10.17	1.01	3.04	2.48	0.90	0.07
Victoria	2018	0.00	0.00	1.08	10.38	0.98	3.09	2.30	0.80	0.24