Residential Mortgage Portfolio, Product Innovation and Performance of Commercial Banks in Kenya

Samson Akumu Nyang’iye, Cyrus Iraya, and Duncan Elly Ochien

ABSTRACT

This study sought to investigate the relationship between residential mortgage portfolios, product innovation, and performance of commercial banks in Kenya. The study was anchored on the Modern Portfolio Theory, Agency Theory, and Asymmetric Information Theory. The study adopted a correlational descriptive research design and data collected from the annual residential mortgage surveys conducted by the central bank of Kenya (CBK) on commercial banks covering a 13-year period from 2006 to 2018. Further, the financial statements of commercial banks and Kenya Bankers Association database were used as a source of secondary data. Data were analyzed via panel data approaches. The Baron and Kenny (1986) approach was used to test the hypothesis. The results revealed that residential mortgage portfolio attributes, namely: portfolio quality and mortgage interest return significantly influence bank performance. The effect of mortgage terms on the relationship between mortgage portfolio quality and performance was negative and statistically significant. Loan to value (LTV) ratio was however found not to significantly intervene in the relationship between residential mortgage portfolios and the performance of banks operating in Kenya. From the findings, the study suggested that bank managers pay attention to the institutional environment and product characteristics in designing their mortgage loan portfolios.

Keywords: Commercial Banks, Kenya, Performance, Product Innovation, Residential Mortgage Portfolio.

I. INTRODUCTION

A residential mortgage 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. 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). Residential mortgage loans, however, are usually a volatile component of a bank’s loan portfolio and have a high potential to impact commercial bank performance (Davis & Zhu, 2009). The share of commercial banks’ loan books 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).

Innovation has been defined as a new idea, device, or method that provides an improved product or service and can result in a reduction in cost or risk (Frame & White, 2009). Financial institutions hold a diversified portfolio of loans in different categories to generate desired returns to their shareholders and minimize the risk of default, aligned with the modern portfolio theory (Markowitz, 1952). Developed by Markowitz (1952), the modern portfolio theory asserts that investors seek to maximize utility and that individuals are risk-averse and interested in optimal portfolios. The proponent presented it as a foundation 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.

Bank managers must therefore aim to invest the funds available to the organization in loan portfolios that balance the trade-off between optimum return and minimum risk in order to deliver value to the owners of the business. Agency theory (Jensen & Meckling, 1976) suggests that divorce of ownership and control in a firm often leads to a conflict of interest between agents or managers and their principals who are shareholders of the organization. Bank managers, as agents, are involved in decisions on which loan products to invest in and the type of product innovations to undertake in order to maximize returns for their principals, the shareholders (Cao, 2005).

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 the 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 labor mobility, lower macro-economic volatility, and more efficient resource allocation. Mortgage history is however fraught with booms and busts.
over time that has 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 (Martin et al., 2014). 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%) (CBK & World Bank, 2010). 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 ratings for banks and to anticipate those approaching financial distress (Ogilo, 2012).

Despite the existence of alternative bank performance models, the Capital Adequacy, Asset Quality, Management Capacity, Earnings and Liquidity (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 components 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 for Capital Adequacy (Dang, 2011).

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. CBK Bank Supervision Annual Report (2018) indicated a total of 43 banks in Kenya (1 mortgage finance company and 42 commercial banks) as of 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 a 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.

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 an 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 its 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 6 banking institutions in 2018, 5 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 Ksh 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 the financial crisis. Allen et al. (1995), Martin et al. (2014) and Gasper (2015) confirm the existence of a positive and significant relationship between the mortgage loan portfolio and the 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. The 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 applied to 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, though these factors can contribute significantly to the growth of the mortgage portfolio and impact the 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 Abdulehman 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 positive impact of innovative loans on the expansion of mortgage portfolios 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 the evidence in other markets (Iannotta et al., 2007). There is therefore lack of consensus on the impact of the variables in the scope of 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, shows 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 of Kenya.

In Kenya, mainstream academic research appears not to have given much consideration to the role of residential mortgage loan portfolios 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 the banking sector in Kenya have looked at general determinants of financial performance (Ongore & Kusa, 2013) and financial performance from a credit risk perspective (Ogilo, 2012). This study, therefore, attempted to resolve the following research question: What is the relationship between residential mortgage portfolio, product innovation, and performance of commercial banks in Kenya.

The conceptual framework (see Fig. 1) predicted that residential mortgage portfolios can impact the performance of commercial banks indirectly through product innovation components such as mortgage term and LTV ratio as intervening variables. Mortgage product innovations can lead to increased access to mortgage credit; hence expansion of the mortgage portfolio. Thus, the following hypothesis and sub-hypotheses were tested:

**H1:** The relationship between residential mortgage portfolios and the performance of commercial banks in Kenya is not significantly intervened by product innovation. The following sub-hypotheses were tested:

- **H1a:** The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly intervened by mortgage term.
- **H1b:** The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly intervened by mortgage term.
- **H1c:** The relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly intervened by mortgage term.
- **H1d:** The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly intervened by loan to value ratio.
- **H1e:** The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly intervened by loan to value ratio.
- **H1f:** The relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly intervened by loan to value ratio.

**II. METHODS AND MATERIALS**

The study adopted a correlational descriptive research design, as it sought to establish the relationships between residential mortgage portfolio, product innovation, and performance of banks over time. Application of panel or longitudinal data involves multiple entities each of which has repeated measurements at different periods and has the advantage of monitoring the behavior of entities over time.

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. The focus population for this research was therefore all the licensed banks and mortgage finance companies that were operating in Kenya during the study period. The 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. 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.

![Fig. 1. The Conceptual Modely. Source: Researcher (2022).](image_url)
This study is based on variables, namely residential mortgage portfolio, product innovation, and performance of commercial banks, which were operationalized in accordance with other studies carried out previously. The residential mortgage portfolio was divided into three sub-variables: portfolio size (the ratio of outstanding residential mortgage loans to total loans), portfolio quality (residential mortgage non-performing loans as a ratio of gross residential mortgage loans), and mortgage interest return (mortgage net interest income - NIM). These sub-variables 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 ratio 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). 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 On digs (2016).

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), the 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. 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 a 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 the fixed or random effects model (Greene, 2008; Orayo & Mose, 2016).

The standard regression model makes a number of assumptions and these need to be tested and confirmed so as to ensure the reliability and validity of the estimated coefficients and inferential statistics. The assumptions include stationarity, normality, no or little multicollinearity, and no heteroscedasticity or autocorrelation which were performed. Hypotheses were examined using panel regression models. The Baron and Kenny (1986) approach was applied to assess the mediating impact of product innovation on the association between residential mortgage portfolio and firm performance.

III. RESULTS

This section presents the results of the test of the study hypothesis and their respective sub-hypotheses. The study findings, interpretation, and discussions are presented as well. The study was guided by the respective sub hypotheses. The hypothesis stated that the relationship between residential mortgage portfolios and the performance of commercial banks in Kenya is not significantly intervened by product innovation. This led to the testing of the six corresponding sub-hypotheses. The results of the four steps are summarized in the regression Tables I-III.

A. Residential Mortgage Portfolio Size, Product Innovation, and Performance

The study assessed the intervening effect of the following, first and fourth null sub-hypotheses (H1a, H1d) under mortgage portfolio size; H1a: The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly intervened by mortgage term, and H1d: The relationship between mortgage portfolio size and performance of commercial banks in Kenya is not significantly intervened by loan to value ratio. The findings are shown in Table I.

The Hausman model selection statistics were considered and as can be observed (Table I), 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 the 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) were not significant (p>0.05). On the other hand, the overall models (models 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%. This is however expected mostly in panel data regression (Orayo & Mose, 2016).

As indicated in Table I, the first step tested the link between portfolio size as a component of a residential mortgage portfolio and the 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 found. 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 the portfolio size as a component of a residential mortgage portfolio and the performance of banks does not meet the first assumption of mediation. 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 H1a and H1d.

B. Residential Mortgage Portfolio Quality, Product Innovation, and Performance

This sub-objective was meant to assess the intervening effect of the mortgage term and LTV ratio on the relationship between mortgage portfolio quality and the performance of commercial banks in Kenya. The study assessed the second and fifth sub-hypotheses (H1b, H1e) under mortgage portfolio quality; H1b: The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly intervened by mortgage term, and
H1e: 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 the 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 II. 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 the 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 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 portfolios and the 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 portfolios and the 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 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 meets the second assumption for the 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 in the relationship between residential mortgage portfolio quality and the 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 a 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 terms 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 confirmed that only the 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 in the relationship between residential mortgage portfolio quality and the performance of commercial banks in Kenya. Based on the findings, the study thus rejected the sub-hypothesis H1b: The relationship between mortgage portfolio quality and performance of commercial banks in Kenya is not significantly intervened by mortgage term.

C. Residential Mortgage Interest Return, Product Innovation, and Performance

This sub-objective was meant to assess the mediating effect of the mortgage term and LTV ratio on the relationship between mortgage interest return and the performance of commercial banks in Kenya. The study assessed the third and sixth null sub-hypotheses (H1c, H1f) under mortgage portfolio quality: H1c: The relationship between mortgage interest return and performance of commercial banks in Kenya is not significantly intervened by mortgage term, and H1f: 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 the 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 III.

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) (models 2, 3, 5, and 7) were not found to be significant (p>0.05). The overall R-squared for all models

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ranged between 0.4% and 4.0%. According to Orayo and Mose (2016), this is expected mostly in panel data regressions.

Table III illustrates the effect of product innovation attributes on the relationship between residential mortgage portfolios and the 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 the 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 the 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 the 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 ($\beta=-0.0287$, $p>0.05$), 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 returns and LTV ratio as a dependent variable ($\beta=-0.0004$, $p>0.05$) exhibited a statistically non-significant negative relationship. 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 the 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) 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 $H_1$; and $H_3$.

IV. DISCUSSIONS

The main objective of the study was to investigate the relationship between residential mortgage portfolios, product innovation, and the performance of commercial banks in Kenya. The study made use of mortgage terms and LTV ratio as product innovation variables. The results revealed that mortgage term has a partial and statistically significant negative mediation effect on the relationship between mortgage portfolio quality and the performance of commercial banks in Kenya. The intervening effect implies that an increase in mortgage terms results in a significant decrease in the performance of commercial banks. This is aligned with a previous study by Mwanga (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.

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 a high probability of borrower default, an impact that reduces mortgage portfolio quality and by extension the portfolio profitability. In this regard, a 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 a higher LTV ratio leads to growth in residential mortgage credit and higher profitability. LTV ratio of less than 90 is considered low according to studies 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 the low LTV limit. Lower LTV ratios within the boundaries of lower limits are also known to mitigate banks’ credit risk and reduce the dependence of banks on market funding (Verbruggen et al., 2015).

V. CONCLUSIONS OF THE STUDY

Based on the null hypothesis, the results of panel data analysis conclude that mortgage term influences the effect of mortgage portfolio quality and mortgage interest return on commercial banks’ performance in Kenya. It however does not mediate the effect of mortgage portfolio size on performance. Put simply, the results demonstrate that improved performance as a result of portfolio quality and mortgage interest return is also subject to the banks’ mortgage term. On the other hand, the mortgage LTV ratio does not influence the impact of mortgage portfolio size, mortgage portfolio quality, and mortgage interest return on commercial banks’ performance. The findings of this research contribute to the pool of knowledge on residential mortgage portfolios, mortgage product innovation, and 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 factors since this is still a nascent area. The contribution of this research to the existing knowledge precedes the contribution to policy and practice.

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TABLE I: PANEL REGRESSION ANALYSIS BETWEEN MORTGAGE PORTFOLIO SIZE, PRODUCT INNOVATION COMPONENTS AND PERFORMANCE

<table>
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<tr>
<th>Variable</th>
<th>Step 1-(CAM)</th>
<th>Step 2-(Product Innovation)</th>
<th>Step 3-(CAM)</th>
<th>Step 4-(CAM)</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>β</td>
<td>P-Value</td>
<td>β</td>
<td>P-Value</td>
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<tr>
<td>Portfolio Size (PS)</td>
<td>0.2886</td>
<td>0.419</td>
<td>0.3267</td>
<td>0.329</td>
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<tr>
<td>Mortgage Term (MT)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>LTV Ratio (LTV)</td>
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<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Constant</td>
<td>-1.8354</td>
<td>0.000</td>
<td>2.4598</td>
<td>0.000</td>
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<td>Model selection</td>
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<td>Model statistics &amp;</td>
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<tr>
<td>Model regression</td>
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<td>Fitness</td>
<td>Number of obs = 369</td>
<td></td>
<td>Number of obs = 396</td>
<td>Number of obs = 373</td>
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<td>-</td>
</tr>
<tr>
<td>Model regression</td>
<td>R-squared: 0.0051</td>
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<td>R-squared: 0.0463</td>
<td>R-squared: 0.0050</td>
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<tr>
<td>Model regression</td>
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<td></td>
<td>Probit: 0.287</td>
<td>Probit: 0.2577</td>
</tr>
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</table>

Table entries: Values in parenthesis.

TABLE II: PANEL REGRESSION ANALYSIS BETWEEN MORTGAGE PORTFOLIO QUALITY, PRODUCT INNOVATION COMPONENTS AND PERFORMANCE

<table>
<thead>
<tr>
<th>Variable</th>
<th>Step 1-(CAM)</th>
<th>Step 2-(Product Innovation)</th>
<th>Step 3-(CAM)</th>
<th>Step 4-(CAM)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>β</td>
<td>P-Value</td>
<td>β</td>
<td>P-Value</td>
</tr>
<tr>
<td>Portfolio Quality (PQ)</td>
<td>1.5856</td>
<td>0.000</td>
<td>-0.5888</td>
<td>(-3.31)</td>
</tr>
<tr>
<td>Mortgage Term (MT)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>LTV Ratio (LTV)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Model selection</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model statistics &amp;</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model regression</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fitness</td>
<td>Number of obs = 367</td>
<td></td>
<td>Number of obs = 396</td>
<td>Number of obs = 373</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Model regression</td>
<td>R-squared: 0.0051</td>
<td></td>
<td>R-squared: 0.0463</td>
<td>R-squared: 0.0050</td>
</tr>
<tr>
<td>Model regression</td>
<td>Probit: 0.4193</td>
<td></td>
<td>Probit: 0.287</td>
<td>Probit: 0.2577</td>
</tr>
</tbody>
</table>

Table entries: Values in parenthesis.
### TABLE III: PANEL REGRESSION ANALYSIS BETWEEN MORTGAGE INTEREST RETURN, PRODUCT INNOVATION COMPONENTS AND PERFORMANCE

<table>
<thead>
<tr>
<th>Robust Models</th>
<th>Step 1-(IR &amp; CAMEL)</th>
<th>Step 2-(IR &amp; MT)</th>
<th>Step 3-(IR &amp; LTV)</th>
<th>Step 4-(MT &amp; CAMEL)</th>
<th>Step 5-(LTV &amp; CAMEL)</th>
<th>Step 6-(IR, MT &amp; CAMEL)</th>
<th>Step 7-(IR, LTV &amp; CAMEL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variable</td>
<td>β</td>
<td>P-Value</td>
<td>β</td>
<td>P-Value</td>
<td>β</td>
<td>P-Value</td>
<td>β</td>
</tr>
<tr>
<td>Interest</td>
<td>0.0556</td>
<td>0.021</td>
<td>-0.0287</td>
<td>0.055</td>
<td>-0.0004</td>
<td>0.861</td>
<td>-</td>
</tr>
<tr>
<td>Return (IR)</td>
<td>(2.41)</td>
<td></td>
<td>(-1.99)</td>
<td>0.055</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mortgage</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Term (MT)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>LTV Ratio</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Constant</td>
<td>-2.0666</td>
<td>0.000</td>
<td>2.6103</td>
<td>0.000</td>
<td>0.8464</td>
<td>0.000</td>
<td>-1.3994</td>
</tr>
<tr>
<td>Model selection statistics &amp; Model fitness</td>
<td>Hausman Chi2=4.45</td>
<td>Prob&gt;chi2=0.0350</td>
<td>Fixed-effects (within) regression</td>
<td>Hausman Chi2=14.25</td>
<td>Prob&gt;chi2=0.0002</td>
<td>Fixed-effects (within) regression</td>
<td>Hausman Chi2=4.48</td>
</tr>
<tr>
<td>Number of obs = 344</td>
<td>R-squared: 0.0039</td>
<td>F(1,38) = 5.83</td>
<td>Prob &gt; F= 0.0207</td>
<td>Number of obs = 374</td>
<td>R-squared: 0.1129</td>
<td>F(1,36) = 3.95</td>
<td>Prob &gt; F= 0.0546</td>
</tr>
</tbody>
</table>

- Values in parenthesis.
VI. POLICY IMPLICATIONS

The outcomes of this research have a number of implications for the banking regulators, commercial bank managers and shareholders, depositors, borrowers, and investors in general. Bank managers and the board of management are interested in the direct effect of residential mortgage portfolios on bank performance. This study provided a profound pointer to the bank’s management decision process. The fact that statistically significant relationships are found between residential mortgage portfolio attributes and performance shows that mortgage portfolio management directly influences the bank’s performance. Thus, there is a need for commercial banks in Kenya to put more emphasis on loan portfolio management for better performance. Further, commercial bank management needs to appreciate the micro-economic factors, mortgage portfolio, and bank performance. The fact that mortgage product innovation ultimately relates to residential mortgage portfolio and bank performance can be a wake-up call on the need for bank managers to pay attention to institutional environment and product characteristics.

VII. 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 portfolios, mortgage product innovation, and commercial banks’ performance. The study was focused on mortgage portfolios 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.

VIII. SUGGESTIONS FOR FUTURE RESEARCH

There is a 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 product innovation in the relationship between residential mortgage portfolios and the performance of banks. Nonetheless, there are other important factors that need to be factored in future studies. For instance, loan characteristics have been found to be an important mediating factor in loan portfolios. More studies need to test the mediating effect of loan characteristics in the association between mortgage portfolios and bank performance in Kenya and beyond.

REFERENCES


