

**THE EFFECT OF FINANCIAL INNOVATIONS ON RISK
MANAGEMENT BY COMMERCIAL BANKS IN KENYA**

BY

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DECLARATION

This research project is my original work and has not been submitted for any academic award in any university.

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DEDICATION

I dedicate this project to my wife Olpha Moraa, and Mr. and Mrs. Bonyi Osoro and the extended family for showing their sincere support towards my academic work. God Bless you All.

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LIST OF ABBREVIATIONS

ABS	Asset Backed Securitization
ATM	Automated Teller Machines
CBK	Central Bank of Kenya
CDO	Collateralized Debt Obligation
GCI	Global Competitiveness Index
LDC	Less Developed Country
LDC	Less Developed Country
MPT	Modern Portfolio Theory
NSE	Nairobi Securities Exchange
RTGS	Real Time Gross Settlement
SPSS	Statistical Package for Social Sciences

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ABSTRACT

The rapid rate of change in the financial sector no doubt calls for an assessment of the efficacy of risk management systems of financial institutions on one hand and devising appropriate regulatory responses to the challenges that these changes may pose, on the other. Financial innovation means to change present financial system and adopt new financial tools in order to gain potential profits that cannot be obtained by present financial system and financial tools. It is a slowly-continued development process driven by a desire for profits. The research objective was to establish the effect of financial innovations on risk management of commercial banks in Kenya. The researcher adopted a descriptive research design in this study. The target population for this study constituted all the commercial banks in Kenya, a total of 43 in number. Secondary data was collected from official documentation with commercial banks for a period of 10 years from 2004 - 2014. The Statistical Package for Social Sciences (SPSS version 22.0) was used for the regression model. The research findings revealed that money transacted through agency banking and via mobile transactions had the greatest influence on the equity loan ratio. A positive relationship was noted between inflation rates, interest rates and value of money transacted through agency banking. The researcher concluded indeed banks in Kenya operate in a risky environment, however, they have managed to mitigate risks through investments in more secure money transfers for instance internet banking and mobile banking. The study recommends that the Kenyan government should promptly provide incentives towards research and development so that banks can continue to come up with more financial innovations. Additionally, Kenyan commercial banks should continue to make sustainable industry linkages with service providers in the mobile phones industry not forgetting internet service providers.

CHAPTER ONE: INTRODUCTION

1.1 Background of the Study

In the recent years, the banking environment has witnessed a tremendous transformation as banks scramble for customers (Lundvall, 2010; Frank and Hesse, 2009). The rapid rate of change in the financial sector no doubt calls for an assessment of the efficacy of risk management systems of financial institutions on one hand and devising appropriate regulatory responses to the challenges that these changes may pose, on the other. Financial innovations are at the center of the debate on how to shape the future global financial system. The dominant view prior to the crisis of 2007-2009 was that financial innovations are beneficial for the financial system. The experience of the crisis has led to at least partial reassessment of this view. Many policy makers now argue that the use of financial innovations needs to be restricted or prohibited. There is also general concern that financial innovations, while beneficial under normal economic conditions, may amplify shocks in times of crisis.

Financial innovation seems to occur in various forms and financial institutions, and can diffuse into any sectors of the economy. It is observed that many new types of financial assets and liabilities have emerged recently (Judge, 2012). Some of these new elements appear in what we might strictly call “banking”, as commercial banks are major financial service providers in many economies. For the stock risk, financial innovation is the best way for improving the asset structure and defending risks. Kenya’s commercial banks mostly focus on traditional operations. Liabilities mainly locate on public deposits and savings. Assets are mainly loans for enterprises. However, the irrational loan structure, term limits, and rates structure lead to bad liquidity of loans. As a result, banks that

mainly depend on interests from loans operate hard due to the poor-quality assets. These banks face higher risks. By developing new businesses, banks can speed up the circulation of capitals. On one hand, it can improve the safety of assets by higher profitability and liquidity. Then, banks can actualize the maximum effect of total assets. On the other hand, it can separate banks' assets as much as possible, which can help to escape from higher risks caused by centering in few customers, reducing banks' losses and improving banks' assets quality and governance level.

The past twenty years have seen revolutionary changes in the structure of the world's financial markets and institutions and in essentially how they are used to provide new investment opportunities and ways of managing risk. "Those financial innovations came about in part because of a wide array of new security designs, in part because of the advances in computer and telecommunications technology and in part because of important advances in the theory of finance (Merton, 1986)." There is now such an intensity of concern by managers, regulators, politicians, and the press over the new activities and risks of financial institutions relative to their traditional risks such as real estate loans or Less Developed Country (LDC) debt. Certainly, there has not yet been a major financial crisis associated with these new activities and instruments of the kind associated with defaults by countries and the thrifts in the 1970s and 1980s.

Financial innovation may reduce risk. Adaptive behavior may occur in the insurance world when a new form of insurance or its pricing triggers significant behavior change (Mote, 1983). One current example of this is emerging in the case of personal lines of insurance where telematics" are increasingly used to set auto insurance premiums that are

more in line with risk. Once drivers know that their premium reflects such factors as their average speed, top speed, aggressive braking and aggressive acceleration, many of them respond by changing their driving style. The consumers have adapted to the insurance pricing in a predictable manner, but because the financial innovation is out-of-sample, the degree of adaptation is not known a priori.

1.1.1 Financial Innovation

Lerner and Tufano (2011) defines financial innovation as the act of creating and promoting new financial instruments, as well as new financial technologies, institutions and markets. The financial innovation concept is mainly derived from Joseph Schumpeter's economic innovation concept. Financial innovation means to change present financial system and adopt new financial tools in order to gain potential profits that cannot be obtained by present financial system and financial tools. It is a slowly-continued development process driven by a desire for profits. If, for instance, financial innovations are used to improve risk management and risk control, they can insulate the financial system against negative shocks. Or they may increase speculative risk-taking by financial institutions and cause institutions to become dependent on the functioning of the markets for these innovations. In this case financial innovation can result in greater vulnerability in times of stress.

One recent innovation in the structured finance area is the introduction of collateralized debt obligations (CDO). According to Longstaff and Rajan (2006) these instruments, which were first introduced in the mid-1990s, are now in excess of \$1.5 trillion. Like ABS, CDOs are also liabilities issued by financial-institution-sponsored trusts, which essentially pool and restructure the priority of cash flows associated with other types of

risky financial assets, including senior and mezzanine ABS, high-yield corporate bonds, and bank loans.

Perhaps the key thinker about the role of innovation within the capitalist system is Joseph Schumpeter, the Austrian economist, who first described the critical part played by entrepreneurial innovation both in creating new ideas and in displacing established products, processes and industries: The fundamental impulse that sets and keeps the capitalist engine in motion comes from the new consumer goods, the new methods of production or transportation, the new markets, the new forms of industrial organization that capitalist enterprise creates. This process of Creative Destruction is the essential fact about capitalism (Kutler, 2010).

Financial innovation, like other economic behaviors, generally arises in anticipation of material gains following a cost-benefit analysis. The innovation makes possible either a reduction in costs or an increase in revenues, or both. On the cost-reducing side, in particular, exogenous technological change provides room for cost reduction that induces innovation. For example, advances in information technology have significantly lowered the cost of accounting-intensive products such as mutual funds. The recent analysis of the effects of using credit derivatives on bank behavior in the syndicated loan market indicated banks' gross positions (the sum of protection bought and sold) in credit derivatives are significantly negatively related to the loan spread they charge to the average corporate borrower (Goderis, Marsh, Vall-Castello and Wagner, 2007). By contrast, banks' net positions in credit derivatives do not display any association with loan spreads.

1.1.2 Risk Management

Human endeavors are always vulnerable to risk. However, as first clearly set out by the economist Frank Knight in 1921, risk comes in two different types: risk and uncertainty. The Massachusetts Institute of Technology reintroduced Knight an distinction to help analyze the recent financial crisis and the underlying behaviors. Determining whether an innovation is subject largely to measurable risk or immeasurable uncertainty is not, in itself, an easy task. (Fagerberg and Verspagen, 2009). In many industries, innovations are released into or directed towards a relatively unchanging environment, aside from the effects of competitive innovation itself. For example, although there are certainly dynamic components to the pharmaceutical industry, the environment into which most pharmaceutical innovations are released – the human body – is fairly stable, if complex.

According to Greuning and Bratanovic (2009), effective risk management, especially for larger banks and for banks operating in deregulated and competitive markets, requires a formal process. In developing economies, especially those in transition, unstable, economically volatile, and shallow market environments significantly expand the range and magnitude of exposure to financial risk (Power, 2008). Such conditions render risk management even more complex and make the need for an effective risk management process even more acute. Advances in information technology, both hardware and software, and financial theory spurred a revolution in bank risk management over the past two decades. Two popular approaches to measuring and managing financial risks are stress-testing and value-at-risk. In either case, the idea is to identify the level of capital required for the bank to remain solvent in the face of unlikely adverse environments.

The management of risk has traditionally focused on capital. Equity capital is the cushion for absorbing risks of the institution (Saunders, Cornett and McGraw, 2006). This provides a good cushion because management does not need know what the source of the unanticipated loss is. They do not have to predict the source of loss, because equity protects the firm against all forms of risk; it is in that sense an all-purpose cushion and thus it is very attractive for managing risk. Equity capital also can be quite expensive for exactly that reason. One can formally employ theories of agency cost, taxation and so forth to supply reasons why equity financing can be expensive.

While the risk management effect in the study is larger for borrowers that are more likely to be actively traded in credit derivative markets, the researchers also provide evidence that the risk management benefits extend to firms that are unlikely to be traded in the credit derivative market. Risk management benefits are thus passed on to the entire portfolio of borrowers and not only the borrowers whose credit risk can be easily traded. This result suggests that active credit portfolio risk management reduces a bank's overall cost of risk-taking.

1.1.3 The Effect of Financial Innovation on Risk Management

Financial innovations have gained tremendous expansion in the recent past. While some institutions view these innovations as instrumental to the risk management function, others are adamant to adopt financial innovations. In the past decade, institutions have invested tremendously in public education in an effort to demystify unfounded concepts held by the less educated populations against some of the popular innovations (Frame and White, 2004). This has been so owing to the level of sophistication and the old age processes that the vast population here used to. The lack of hard copy evidence of

transaction has taken time for populations to embrace and especially in developing countries. Today, Automated Teller Machines, ATM's provide other services apart from cash withdrawals. However people would rather go to a physical banking hall and spend hours in the queue waiting for service than make a cheque deposit at the ATM's.

Financial innovations, while possibly beneficial under normal economic conditions, may amplify shocks in times of crisis. They are blamed for banks taking excessive risks and for a general erosion of lending standards leading to the financial crisis. The financial innovations improve economic performance by expanding opportunities for risk-sharing, risk-pooling and hedging inter temporal or spatial transfers of resources lowering transactions costs or increasing liquidity (Desai and Low, 1987). The recent financial innovations such as Real Time Gross Settlement, (RTGS) have widened opportunities for commercial banks while at the same time increasing the risk of exposure. The works undertaken by credit bureaus have further been made efficient due to integration of innovation. Thus obtaining credit information on a potential borrower has not been as difficult as it was in the past. This is seen to have a great impact on reducing the adverse selection risk substantially. Cross referencing has thus been made efficient thus reducing instances of fraud occasioned by adverse selection.

The nature of financial transactions possesses a great risk exposure to the concerned institutions. The paperless, online transactions have increased financial inclusion thus growing the loan book significantly. People are able to borrow considerable amounts without physical contact with lenders and perform so many other transactions. The argument has been that financial innovations have the capacity to spread risk through optimal shifting. Financial innovations have enabled availability of more risk

management tools which have outweighed the costs of new exposures it creates (Davila and Shelton, 2006)

1.1.4 The Banking Sector in Kenya

The financial sector in Kenya has undergone tremendous changes in the last two decades. A report by CBK (2011) shows that there are 43 commercial banks, 1 mortgage finance company, 6 deposit taking microfinance institutions, 2 credit reference bureaus and 124 foreign exchange bureaus. Studies such as Misati, Njoroge, Kamau and Ouma (2010) have shown that financial products have increased; activities and organizational forms have also improved. In addition commercial banks branch network has grown from 530 in 1999 to 1,102 branches by end of June 2011, ATMs increased from 262 to 2,021, number of deposit accounts from approximately one million with 16,673 staff to 12.8 million with 28,846 staff over the same period (CBK, 2011).

The financial infrastructure has slowly come into place, the market response has been swift and economic activity has supported growth. In the last 6 or so years, we have seen significant decline of barriers to entry to the financial sector, significant decline in cost of maintaining micro accounts, the introduction of new instruments targeting lower segments of the population and increased branch network of branches across the country (Njuguna, 2011). A report by Global Competitiveness Index (GCI) of 2011-2012 shows that Kenya was ranked 102 overall of the 142 countries ranked with an overall score of 3.8 out of the maximum of 7 putting Kenya among the bottom 50 in terms of competitiveness in the World.

1.2 Research Problem

According to Central Bank of Kenya (2011) the number of ATMs grew from 166 in 2001 to 2091 in 2010, debit cards increased from 160,000 in 2001 to over 6 million cards by the end of 2010 while mobile banking transactions increased from 48,000 per annum in 2007 to over 250,000 transactions per annum in 2010. Advances in technology and changing economic conditions have created impetus for this change. All these developments coupled with changes in the international financial environment and the increasing integration of domestic and international financial markets have led to rapid financial innovation. While these create new growth opportunities for commercial banks, new risk exposures also come along.

Despite the incontestable importance of financial innovation in the understanding of banking performance, the effect of innovation on risk management, is still misunderstood for two main reasons, first, there is inadequate understanding about the drivers of innovation and secondly innovations' impact on bank's risk management remains lowly untested. According to Lerner and Tufano (2009), the economics literature on financial innovation tends to concentrate on the diffusion of these innovations, the characteristics of adopters, and the consequences of innovation for firm profitability and social welfare; the external, rather than the internal, aspect of financial innovation seems to be emphasized in this type of literature.

The majority of studies have been done on areas of service excellence and customer satisfaction in the banking industry. However studies on relationship between financial innovation and risks management remain relatively unexplored. Beyani and Kasonde (2005) note that it is very important for institutions to have a futuristic view in

formulating risk management policies. This will thus enable institutions be better prepared for new risk exposures. A study by Maina (2011) holds that financial innovations can potentially reduce administrative costs leading to better credit risk management. Waweru (2012) on a similar study concludes that credit management and financial innovations are negatively correlated. Further, he recommends that banks engage in a more robust risk analysis processes. These studies clearly reveal inconsistencies, more so locally.

The subject of financial innovations is quite dynamic and while the effects of it seem to have settled in developed countries, it is not quite same with developing countries. Indeed in Kenya emergence of new technologies, products, processes, markets and competitor banks places demand on any commercial bank to apply any skills necessary to remain competitive and achieve competitive advantage. However international studies seem to point to a very precautionary direction. The question therefore is what is the effect of financial innovations on risk management by commercial banks in Kenya?

1.3 Research Objective

To establish the effect of financial innovations on risk management of commercial banks in Kenya.

1.4 Value of the Study

It should be noted that financial innovation is more than a business action taken by private enterprises. In fact, it can exert influence on monetary policy taken by central bank or monetary authorities. The study's findings can help banks in evaluating the importance of financial innovation on their performance in terms of bolstering profitability. Banks, especially commercial ones, are swiftly becoming more aware of the

importance of financial innovation in this era and this study adds impetus to knowledge on the link between innovation and performance.

Financial innovation simultaneously raises concerns. Most notably, it has a direct impact on monetary policy set by central bank. Financial innovation influences the structure of financial markets, the financial behavior of economic agents and the types of financial products traded. It therefore influences the entire monetary transmission mechanism, and adds uncertainty to the financial environment in which central bank conducts monetary operations. As a result, the industries players are able to utilize the findings from this study to understand the sector and adjust where necessary.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter reviewed both the existing theories of financial innovations and documented studies on the topic.

2.2 Theoretical Review

This section reviewed theories that are relevant to the topic of study. The Schumpeter theory of innovation, constraint induced financial innovation theory and finally the Modern Portfolio Theory (MPT).

2.2.1 Schumpeter Theory of Innovation

This theory is associated with one of the 20th century's great economic and political thinkers, Schumpeter, who is well known for his theory explaining the activities that lead to economic growth in capitalist economies (Toivonen and Tuominen, 2009). His theory centers on entrepreneurial innovations and their role as the key driver of economic growth. Schumpeter argues that competition among market participants leads to a desire to seek out new ways to improve technology, new ways to do business and other types of advantages that would increase profit margins and directly impact the entrepreneur's standard of living (Fagerberg and Verspagen, 2009). Schumpeter describes the act of new innovations replacing old innovations as "creative destruction." This process is driven by the inevitable copying of new innovations, which causes profit margins to become low and creates a new incentive to seek out new innovations.

Schumpeter argued that anyone seeking profits must innovate. That will cause the different employment of economic system's existing supplies of productive means

(Schumpeter, 1942). Schumpeter believed that innovation is considered as an essential driver of competitiveness and economic dynamics (Hanush and Pyka, 2007). He also believed that innovation is the center of economic change causing gales of “creative destruction”, which a term is created by Schumpeter in *Capitalism, Socialism and Democracy*. According to Schumpeter innovation is a "process of industrial mutation that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one". Thus for institutions to remain competitive in all areas including risk management, they must innovate.

2.2.2 Constraint-Induced Financial Innovation Theory

American economist Silber (1983) advanced constraint-induced financial innovation theory. This theory argues that the purpose of profit maximization of financial institution is the key reason of financial innovation. There are some restrictions including external handicaps such as policy and internal handicaps such as organizational management in the process of pursuing profit maximization. Though these restrictions not only guarantee the stability of management, they reduce the efficiency of financial institution, so financial institutions strive toward casting them off. Constraint-induced innovation theory discussed the financial innovation from microeconomics, so it is originated and representative. But it emphasized “innovation in adversity” excessively. So it cannot express the phenomenon of financial innovation increasing in the trend of liberal finance commendably.

Because financial industry is special, it has the stricter regulations. Financial institutions deal with the status such as the reduction of profit and the failure of management induced by government regulations in order to reduce the potential loss to the minimum.

Therefore, financial innovation is mostly induced by the purpose of earning profit and circumventing government regulations (Scylla 1982). It comes true through the game between government and microcosmic economic unity. Financial innovation connects with social regulation closely, and it is a regulation transformation which has mutual influence and is mutual causality with economic regulation.

Miller (1986) and Merton (1992) considered financial innovation as an engine of growth.' It may in fact be considered as a 'general purpose technology, as Lerner and Tufano (2011) establish from the work of other authors, which has the potential to change the entire economic system. In a new model of economic growth, Michalopoulos, Laeven, and Levine (2010) argue that growth is not only a consequence of profit-maximizing entrepreneurs willing to introduce new technologies, but of financial entrepreneurs who find novel ways to finance the technologists. Not all outcomes are necessarily positive in the short term; Gubler (2011) argues the result of the modern financial innovation process is increased product and institutional complexity, and increased market fragility. Though the lack of empirical evidence on the impact of financial innovation on the economy should make one cautious about the potential consequences of it, it is nonetheless acknowledged that financial innovation has a clear incidence on highly-financially-dependent economies.

2.2.3 Modern Portfolio Theory

This theory was developed by Markowitz (1952) and is all about establishing the balance between maximizing return and minimizing risk. Thus this calls for careful selection of investments composition in a manner that diversifies risk without necessarily reducing the expected return. The central premise of this theory is that investments in a portfolio

must not be selected based on individual merits but rather the effect of changes in price of an investment on another in the portfolio must be considered. Essentially it is all about establishing a tradeoff between risk and expected return. Generally, the higher the risk of an asset, the higher the return that an investor must demand, thus riskier assets are associated with higher returns. The assumption is that investors are risk averse thus will always prefer less risky portfolios given two investments offering equal returns.

The ideal portfolio should be composed of assets that are not strongly correlated so as to minimize volatilities caused by market movements. According to the theory, return is defined as the weighted expected return of each asset in a given portfolio. Risk on the other hand is measured by average deviation from the mean. MPT holds that, for each individual investment, two types of risks exist; systematic and unsystematic risks. Systematic risk refers to undiversifiable market risks such as interest rate fluctuations, foreign exchange fluctuations and economic recessions. According to Markowitz (1952) unsystematic risk on the other hand refers to that part of risk that's particular to an investment and thus diversifiable through increasing number of investments in the portfolio which are not strongly correlated. Well diversified portfolios, offer the lowest possible risk and the highest level of return. MPT thus holds that investors who make most out of the market are those willing to assume higher risks.

2.3 Determinants of Risk Management

A number of risks, key among them, liquidity risk, operational risk and credit risk, faces commercial banks. The determinants of risk management can be broadly categorized in to those based on market imperfections and those based on managerial risk aversion. The market imperfections are mainly the observable imperfections such as taxes, financial

distress costs and investment opportunities. These factors explain the rationale behind risk management by firms. According to Modigliani and Miller, (1963) risk management is irrelevant as any strategy implemented by a firm is replicable by individual investors. In reality however, markets are not perfect and thus risks exist.

2.3.1 Size of the Firm

Ideally, large firms possess more negotiating power thus lower financing costs on average (Stulz, 1996). This thus reduces the need to hedge risks for large firms. However, a majority of signs reveal that it is actually the large firms that diversify as opposed to small ones. On another direction however, the firm size is considered a large determinant of a firm's ability to exploit varied methods of diversifying risks such as professional consultation fees, software and qualified personnel

2.3.2 Investment Possibilities

Investment possibilities require financing which can be either internal or external. The type of financing has an impact on the extent of risk exposure and thus the need for hedging. Firms concentrate more on having steady internal earnings so as to minimize the need for external financing. External financing exposes firms to asymmetric information and consequently asymmetric risk (Froot, Scharfstein and Stein, 1993). Internal funding is considered as one other way of hedging against risks. Investment opportunities are measured by acquisition and exploration activities.

2.3.3 Taxation

This entails the nature of taxation laws governing a particular country. Generally, the tax structure is convex in nature and hedging to cover risks may result in to reduction of

taxes through reduced earnings (Graham and Smith, 1999). The pre-tax value of a firm is reduced significantly through hedging. If the hedging benefits outweigh associated costs, the post-tax value of a firm is increased. According to Smith and Stulz, (1985), the tax advantage of a firm increases as the tax function becomes more convex.

2.3.4 Financial Distress Costs

Firms that are more financially constrained may consider hedging tools to reduce the constraint burden. Financial distress costs are a probable reason why firms manage risks, (Smith and Stulz, 1985). Firms can use hedging to reduce financial distress costs. As a risk management tool, hedging potentially increases shareholders wealth due to reducing expected bankruptcy costs. In this model, small firms should hedge more because hedging costs are directly proportional to the value of the firm.

2.3.5 Managerial Risk Aversion

According to Stultz, (1984) management compensation is supposed to be a constant percentage of the firm's value at any given time. This should thus change with fluctuations in the value of the firm. All managers will prefer reducing the mean variance of a firm's value without creating additional costs for shareholders. Managers will hedge less if their expected utility is a convex function of a firm's value. The introduction of option shares is meant to create a convex relationship between the value of the firm and managers utility. It is expected that managers with higher holdings to be less risk averse hence hedge less and seek riskier investments unlike those with less or no holdings. Therefore, option compensation is leads to more risk seeking

2.4 Empirical Review

A number of studies have been conducted both locally and internationally on the subject of capital structure. While some are quite similar, some are not directly related.

2.4.1 International Evidence

Beyani and Kasonde (2005) on financial innovation and the importance of modern risk management systems concluded that it is important for firms to adopt modern risk management systems. They note that it is paramount for banks to have a futuristic view when formulating risk measurement systems, bearing in mind the rapid technological changes and rapid growth of markets. The study also reveal that institutional, process and product innovations will always present heightened risk levels owing to the level of unfamiliarity at first although this is expected to reduce over time. In addition, innovations may possess risks, which may remain hidden and only surface in times of stress.

Financial innovations in addition to opening new opportunities, has led to increased market players Ignazio (2007). Therefore, the developments have increased the available financing and investment opportunities. Additionally these also have led to speedy channels of monetary policy transmission policy in an economy thus financial markets becoming more liquid and complete. Effectively this affects the cost of investments and returns on savings depending on market movements.

Mathews and Thompson (2008) observe that financial innovations relating to new products and processes also open doors to a myriad of new risks. Financial institutions must thus appreciate this fact and any innovation should be subjected to efficacy

assessments. A match must be made between financial innovations and risk management policies and structure lest they span out of control. This way risk management function will be ready for challenges posed by new innovations.

Wang, Gui and Ma (2009) research on risks of Chinese commercial banks independent innovation. The study notes that financial innovations increase circulation of capital safety of assets through higher profitability and liquidity. Financial institutions existing in high dynamic environments can adopt new technologies in order to counter emerging problems. Additionally the study notes that the major challenge with financial innovations is that they are not balanced. This is to say that more innovations relate to debts compared to those for assets and the innovations lag behind economic development in China. There is also a mismatch between information technology and financial innovation with the latter lagging behind. This has been attributed to the fact that there are few external pressures. However, the study cautions against blindly adopting financial innovations as they result into new risk exposures.

According to studies by Piazza (2010), financial innovations have offered more opportunities for diversification and at the same time reduced investment costs. However they have not lowered the relative cost of symmetric investment opportunities. Potential investors have the option to either use low quality, less costly public information or utilize high quality, more costly information private information so as to avoid excessively risky investments. However in the advent of financial innovation, the incentives for private information are much lower while that for public information is completely eradicated. Effectively, the state should invest in very costly and risky technology so as to remain relevant.

2.4.2 Local Evidence

Mwangi (2007) did a study on the factors affecting financial innovations in the Kenyan Securities market. A sample of 48 listed companies was selected for study for which primary data was collected and analyzed. The Kenyan laws on investor protection were identified as the major determinant of financial innovation. The second factor was the fluctuations in exchange rate among other market factors. In addition, the lack of an automated trading system was found to have a negative impact on financial innovations. The other factors identified were; global financial competition and integration of financial systems.

Ngugi et al (2010) conducted a study on the influence of innovativeness on growth of SME's in Kenya. The study utilized primary data collected by use of questionnaires and regression model for analyzing data. The findings revealed that indeed innovativeness does have an impact on growth of SME's. The study notes that managers who are open to innovation, support creative ideas and experimentation, mostly excel. Thus results into new products and processes which have a significant positive influence on growth and performance.

Maina (2011) in his study, the effect of financial innovation on credit risk management of commercial banks concluded that financial innovations have a positive effect on credit risk management. The study analyzed secondary data for all the 43 commercial banks collected for a period of 10 years, 2003-2013. Notably the findings reveal that consumers are open to new financial innovation and thus the success of the same. Financial innovations have the potential to significantly reduce administrative costs associated with loan recovery more effectively compared to traditional methods.

A similar study was conducted by Waweru (2012). In his study, he sampled 18 commercial banks for which he collected secondary data from financial product reports, risk manuals and audited financial accounts. Despite banks operating in a risk environment for the period under study, investing in secure transfer platforms such as RTGS's, and internet banking helped mitigate the risks. Therefore a negative correlation exists between financial innovations and risk management. The study concluded that financial innovations expose commercial banks to the following types of risks; credit risk, strategic risk, liquidity risk, country risk and reputational risk. It thus recommended that commercial banks engage in a more comprehensive risk mitigation policies so that a realistic risk index factor is evident at any given time.

Ndungu (2013) also did a similar study on non- financial institutions in Kenya and obtained data from 39 non-financial firms listed at the NSE. One of the major financial innovations identified by the study is derivative instruments. The major risks facing these institutions are interest rate risk, foreign exchange risk and commodity price risks. It reveals that derivatives are used for hedging, liquidity and risk management functions in these institutions. A strong level of significance was established between financial innovation strategies and risk management. Technology support stood at a 10% significance level in explaining variations in the use of derivatives. Finally the study recommends the use of derivatives as a risk management tool.

2.5 Summary of Literature Review

The central premise of the theories on financial innovation reviewed is that the objective of a firm is maximization of profits. Both constraint-induced financial innovation and Schumpeter theories advocate financial innovation as competitive tool seeking firms must innovate. This view emphasized by the MPT that holds that riskier investments offer increased returns. The international empirical evidence has greatly mirrored financial innovation as a two hedged sword; it provides opportunities and at the same time possesses new challenges in terms of risk exposure. Mathews and Thompson (2008) note that financial innovations must be subject to thorough assessments lest the much unfamiliar risks span out of control. The number of studies done locally on financial innovations is quite few. One by Maina (2011) held that financial innovations have a positive relationship with credit risk management. This position has been affirmed by Ngugi (2010). The subject of financial innovations is quite dynamic and while the effects of it seem to have settled in developed countries, it is not quite same with developing countries. This subject of financial innovations thus requires further research as new innovations enter the market owing to unique macro-economic factors existent in developing countries.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

In the section, the researcher looked at how the research was undertaken. In particular it discusses the research design, target population, sample, data collection, data analysis, analytical model for data analysis and tests of significance.

3.2 Research Design

Kothari (2004) describes a research design as a plan, structure and strategy of investigation to obtain answers to research questions and control variance. Additionally, a study design is the plan of action the researcher adopts for answering the research questions and it sets up the framework for study or is the blueprint of the researcher. A descriptive research design was used in this study. The main aim of descriptive research is to provide an accurate and valid representation of the factors or variables that are relevant to the research question (Joshi et al., 2010).

3.3 Target Population

Creswell (2003) defines population as the total collection of elements about which the researcher wishes to make some inferences. A population refers to any group of institutions, people or objects that have common characteristics. The target population for this study constituted all the commercial banks in Kenya, a total of 43 in number, (Appendix I)

3.4 Data Collection

Secondary data was collected from official documentation with commercial banks for a period of 10 years from 2004 - 2014. These included product performance reports and

risk manuals for all the 43 commercial banks. The data collected was annual risk index factors for the dependent variable. The product performance reports provided data for value transacted through new channels, institutions and loan products. The use of secondary data eliminated cases of low response rate associated with primary data and also expedited the data collection process.

3.5 Data Analysis

The multiple linear regression model was used to determine the relationship between the dependent variables and independent variables. The nature of relationship was defined by the coefficient of correlation and coefficient of determination. Quantitative secondary data was coded and entered into the computer for computation of descriptive statistics. The Statistical Package for Social Sciences (SPSS version 22.0) was used for the regression model.

3.5.1 Analytical Model

The multiple linear regression model was as follows;

$$Y = a + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \varepsilon$$

Where; Y was risk management measured by the annual value at risk. This index majorly integrates operational risk, liquidity risk, credit risk, compliance risk, legal risk, market risk and reputational risk. a is the constant term that measures risk management when all the other variables are zero. X_1 was the value of additional loan products, X_2 value transacted through new channels, E-banking, mobile banking, cheque clearing system X_3 value transacted through new institutional banking such as agency banking, X_4 the

inflation rate and X_5 the interest rates. The comparison is made to the base year, 2004. In the model, $\beta_1, \beta_2, \beta_3, \beta_4$ and β_5 represent the changes in the variables X_1, X_2, X_3, X_4 and X_5 because of changes in Y , ε is the error term. The correlation coefficient was used to measure the nature of relationship between the dependent and each of the independent variables. A positive relationship has a correlation coefficient ranging between 0 to +1 while a negative one will range between 0 to -1.

Table 3.1: Operationalization of the variables

Variable	Indicator of Variable	Measurement of the variable	Data collection method	Level of Analysis
Y	Risk Management	Value at Risk	Secondary source	Descriptive
X_1	Agency Banking	Natural log of Volume transacted	Secondary source	Descriptive
X_2	Inflation	Consumer price Index (CPI)	Secondary source	Descriptive
X_3	Mobile Banking	Natural log of Volume transacted	Secondary source	Descriptive
X_4	ATM Cards Transactions	Natural log of Value of ATM Cards Transactions	Secondary source	Descriptive
X_5	Interest Rates	Lending Rates	Secondary source	Descriptive

Source: Researcher

3.5.2 Test of Significance

A test of significance is aimed to reveal whether the result of the study were by mere chance or otherwise. T-test was used to determine whether a linear relationship exists between the dependent and independent variables with a 95% level of confidence. A p-value was computed that indicated how likely the results of the study were gotten by chance.

CHAPTER FOUR: DATA ANALYSIS RESULTS AND INTERPRETATION

4.1 Introduction

The study objective was to establish the effect of financial innovations on risk management of commercial banks in Kenya from 2004 to 2014. The analysis, presentations and the findings of this study are as discussed in the subsequent sections of this chapter.

4.2: Descriptive Statistics

In order to understand the data used for the analysis, the researchers conducted a descriptive analysis so as to understand the distribution of data. The measures used here included minimum, maximum, mean and standard deviation. The findings are illustrated in the Table 4.1 below:

Table 4.1: Descriptive statistics

Variables	Minimum	Maximum	Mean	Std. Deviation
ATMs Cards	12.18	14.24	13.3353	0.77832
Agency Banking	4.00	5.00	4.6667	0.57735
Mobile Transfers	6.16	7.55	6.9426	0.56499
Loan/Equity ratio	.47	.73	.6069	0.09278
Inflation rates	3.98	13.98	8.5417	3.87591
Interest rates	13.00	14.00	13.4000	0.54772

Source: Research Findings

From the descriptive statistics results in Table 4.1, the loan to equity ratio had a minimum of 0.47 and a maximum of 0.73. The ratio had a mean of 0.6069 with a standard deviation of 0.09278. The value of money transacted through agency banking had a minimum of 4.00 and a maximum of 5.00. The mean for this value was 4.6667 with a standard

deviation of 0.57735. Atm cards value of money transacted had a minimum value of 12.18, a maximum of 14.24 with a mean of 13.33353 and a standard deviation of 0.77832. Value of money transacted through mobile transfers had a minimum of 6.16 and a standard deviation of 7.55, the mean was 6.9426 with a standard deviation of 0.56499. Inflation rates in the study period had a minimum annual average of 3.98 and a maximum of 13.98. This rate had a mean of 8.5417 with a standard deviation of 3.87591. Lastly, the inflation rates had a minimum of 13.00 with 14.00 as the maximum annual average. The mean was 13.4000 with a standard deviation of 0.54772.

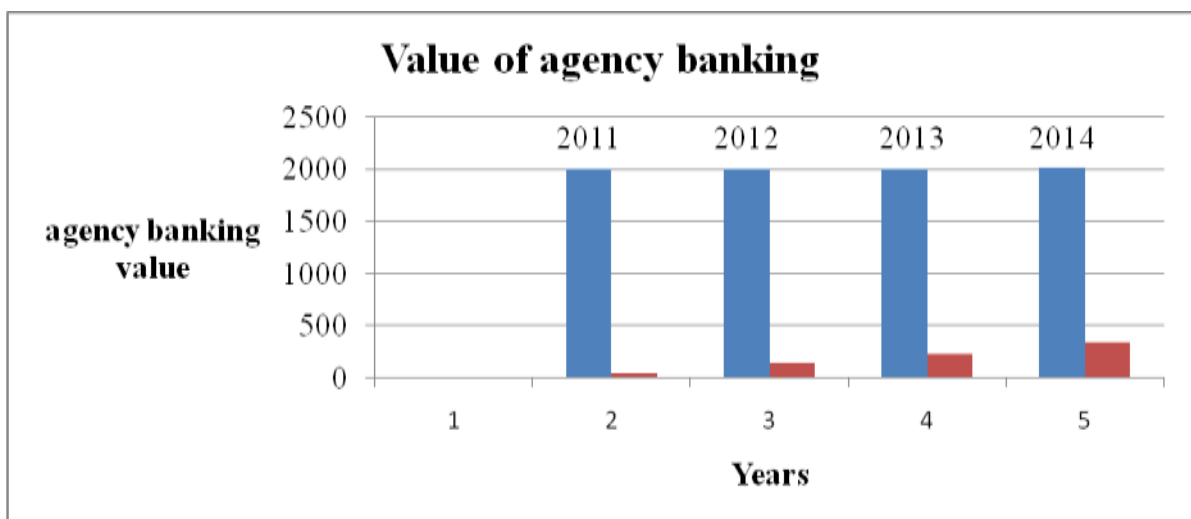
4.3 Graphical Representations

The study presented graphical illustrations of the data as shown below:

4.3.1 Value of Agency Banking

This section presents graphical representation of the agency banking over the study period

Figure 4.1: Agency Banking



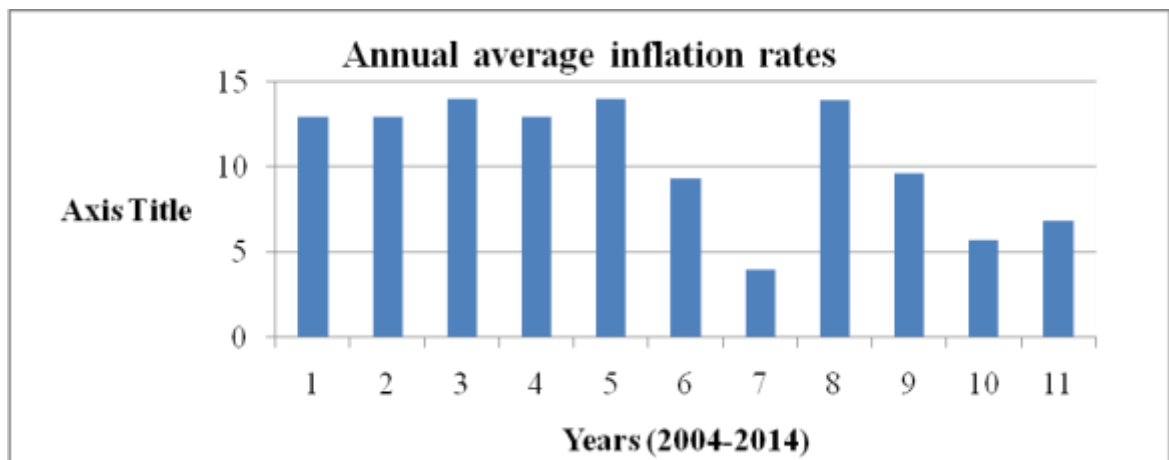
Source: Research Findings

The value transacted in agency banking has been increasing over time whereby a low of 44 billion in transactions were recorded in 2011 and a high of 345 billion in transactions were recorded in the year 2014.

4.3.2 Inflation Rates

This section presents graphical representation of the inflation rates over the study period

Figure 4.2: Inflation Rates



Source: Research Findings

The plotted graph in Figure 4.2 depicts the trend in the average annual inflation rates in the study period of 2004-2014. From the graph, it's clearly evident that the inflation rates were lowest in the year 2013 with an annual average of 5.733. The inflation rates were however highest in the years 2006 and 2008. This could be directly attributed to the election turmoil in the year 2007.

4.3.3 Interest rates

The study presented the interest rates graphically as shown in the figure 4.3 below:

Figure 4.3 Interest Rates



Source: Research Findings

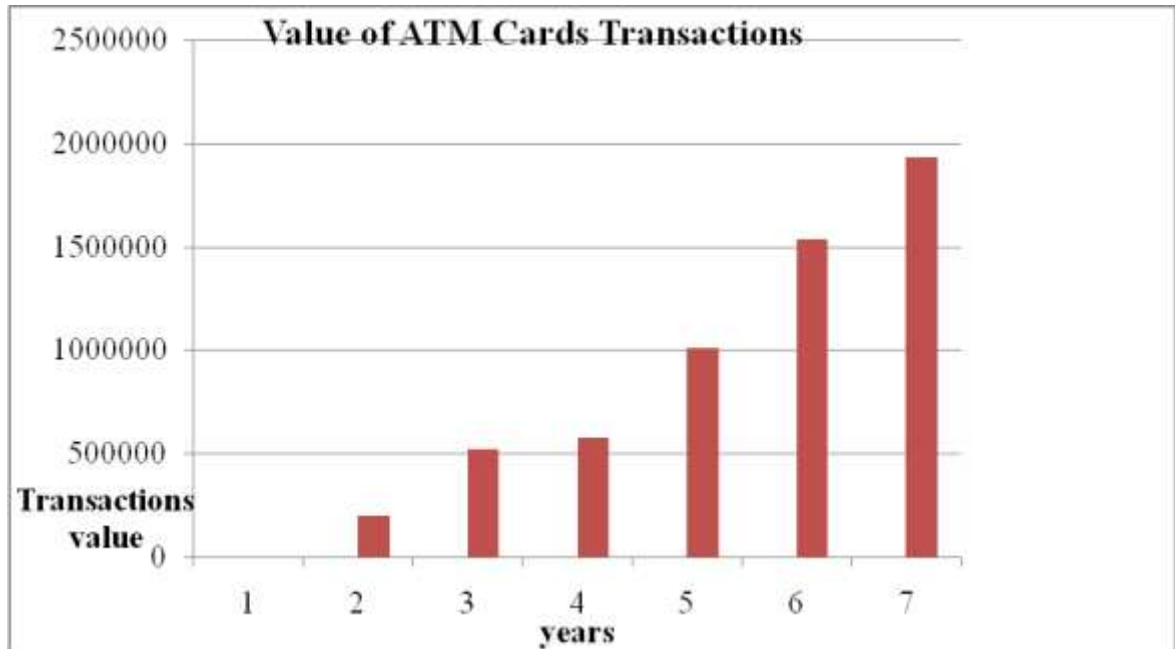
The interest rates plotted graph shows that the rate has been generally oscillating around 15 with the lowest annual average interest rate at 13 in the years 2004, 2005 and 2007.

The annual rate was however highest at 19.64 in the year 2012. The rate was also high at 19.31 for the year 2013. This is partly due to election jitters in the subsequent general elections.

4.3.4 : Value of ATM Cards Transactions

This section presents graphical representation of the value of ATM cards transactions over the study period

Figure 4.4: Value Transacted through ATM Cards



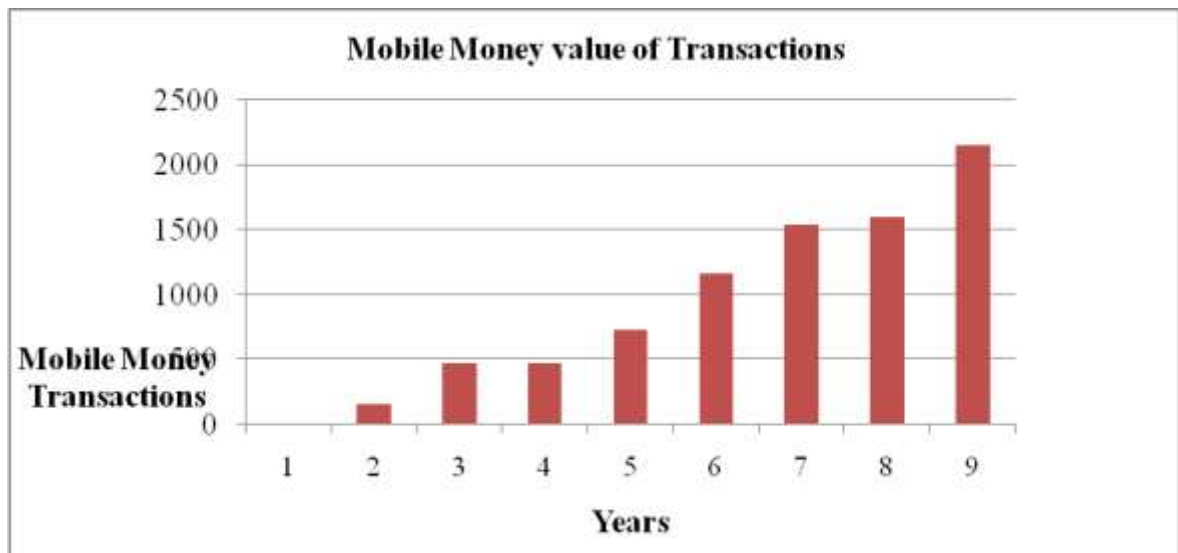
Source: Research Findings

The value in ATM Cards Transactions has been increasing over time as shown in Figure 4.4. In year 2009, the least amount in transactions at Ksh 195,280 was realized whereas the year 2014 had the highest amount in terms of the transactions at Ksh 1,928,723. This increment has been increasing almost exponentially over time due to the wide adoption of E-banking.

4.3.5 Mobile Money Value of Transactions

This section presents graphical representation of the mobile money value of transactions over the study period

Figure 4.5: Mobile Money Value of Transactions



Source: Research Findings

The value of money transacted through mobile platforms has been increasing over the years as shown in Figure 4.5. The year 2013 had the highest value in terms of mobile transfers at 2159 billion. This has been made possible due to the high number of mobile users in the country especially after mobile phones became very affordable. In the year 2007, the value transacted was only 157 billion but as seen in Figure 4.5, this amount has increased tremendously over the recent past.

4.4 Inferential Statistics

In order to arrive at the conclusion regarding the relationship between the dependent and independent variables, the study conducted several tests including Persons Moment of Correlation and multiple regression analysis

4.4.1 Correlation Analysis

Pearson’s correlations analysis was conducted at 95% confidence interval so as to establish the relationship between the risk management and the independent variable of the study that is interest rates, inflation rates, agency banking, ATM cards value transactions and mobile money transactions.

Table 4.2: Correlation Analysis

		Risk	Inflation Rates	Interest Rates	Agency	ATM
Risk	Pearson Correlation	1				
	Sig. (2-tailed)					
Inflation rates	Pearson Correlation	.594	1			
	Sig. (2-tailed)	.004				
Interest Rates	Pearson Correlation	.423	.095	1		
	Sig. (2-tailed)	.0012	.426			
Agency	Pearson Correlation	.668	.293	.918	1	
	Sig. (2-tailed)	.0032	.707	.082		
ATM	Pearson Correlation	.452	.914*	.972**	.976*	1
	Sig. (2-tailed)	.0036	.011	.001	.024	

Source: Research Findings

From table 4.13, there is a positive correlation between the risk management and the factors (interest rates, inflation rates, agency banking, ATM cards value transactions and mobile money transactions) of magnitude 0.594 with inflation rates, 0.423 with interest rates, 0.668 with agency banking, 0.369 with the ATM cards value transactions and a magnitude of 0.757 with mobile money transactions. The independent variables also had a positive significant correlation relationship with P-values of 0.004, 0.0012, .0032, .0036

and 0.003 respectively. The study dropped mobile banking from the correlation analysis because it exhibited high level of multicollinearity with risk management.

4.4.2 Regression Analysis

The researcher also conducted a regression analysis whereby the findings are as discussed in the subsequent sections.

Table 4.3: Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.7968	0.6348	0.6024	0.99846

Predictors: (Constant), Interest rates, Inflation rates, Agency Banking, ATM Cards Value Transactions, Mobile Money Transactions

Source: Research Findings

The model summary results in Table 4.2 indicate that the value of R was 0.7968, the R square value was 0.6348, adjusted R square after error was 0.6024 and the standard error of the estimate was 0.99846. This implied that 60.24% of the changes in the dependent variable were attributed to the study variables. Nevertheless, the other factors not studied in this study contributed the remaining 39.76% of the changes in the loan equity ratio.

4.4.3 Analysis of Variance (ANOVA)

This section presents the Analysis of Variance (ANOVA) which explains the strength of the model in explaining the fitness of the model

Table 4.4: ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	.8934	4	.22335	30.5373	0.005
Residual	.256	35	.007314		
Total	.919	39			

a. Dependent Variable: Loan equity ratio

b. Predictors: (Constant), Interest rates, Inflation rates, Agency Banking, ATM Cards Value Transactions, Mobile Money Transactions

Source: Research Findings

The ANOVA findings in Table 4.3 showed that the value of calculated f or the f statistic was 30.5373. The F critical value at 0.05 significance level with numerator degrees of freedom 4 and 35 denominator degrees of freedom was 2.49. Since the f calculated value was greater than the f critical ($30.5373 > 2.49$), the regression model was thus significant in showing the relationship between the loan equity ratio and the independent variable of the study that is interest rates, inflation rates, agency banking, ATM cards value transactions and mobile money transactions. The regression significance was 0.005 which was less than 0.05 thus showing that the regression model was indeed significant.

Table 4.5: Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-.1372	.0126	3.316	10.213	.005
Inflation rate	.0483	.1236	-1.848	12.036	.012
Interest rate	.3301	.0326	1.471	8.269	.036
Agency banking	.5436	.2136	0.698	9.369	.042
ATM cards	.2364	.0014	1.165	2.361	0.06
Mobile money	.3694	.2369	0.369	2.725	0.09

Dependent Variable: Risk Management

Source: (Research Findings, 2015)

The regression model became;

$$Y = - 0.1372 + 0.0483 X_1 + 0.3301X_2 + 0.5436 X_3 + 0.2364 X_4 + 0.3694 X_5.$$

The co-efficient results in Table 4.4 showed that holding all the independent variables constant at zero decreased the loan equity ratio by 0.1372. A unit increment in inflation rate increased the ratio by 0.0483. On the contrary, a unit increase in the interest rates

increased the ratio by 0.3301. Additional unit increment in value transacted via agency banking increased the ratio by 0.5436. A unit increase in value transacted via ATM Cards increased the ratio by 0.2364 and a unit increase in mobile money transactions increased the ratio by 0.3694. A positive relationship was noted between inflation rates, interest rates and value of money transacted through agency banking. Money transacted through agency banking and via mobile transactions had the greatest influence on the equity loan ratio.

The inflation rates, interest rates and agency banking transactions value were significant since their significance values were less than 0.05. However, ATM Cards and mobile money value of transactions were not significant since their significance values were greater than 0.05.

4.5 Interpretation of the Findings

The research findings revealed that money transacted through agency banking and via mobile transactions had the greatest influence on the risk management. A positive relationship was noted between inflation rates, interest rates and value of money transacted through agency banking. It is evident that the studied financial innovations had an impact on the firm`s risks due to general uncertainties and fear of change by the clientele. People will generally be skeptical about new innovations but will slowly adopt them after they realize their benefits. This therefore presents the firms with risks due to the amount of money they invest in new and uncertain financial innovations. For firms to remain profitable, they should properly assess underlying risks that accompany any new and intended innovation. The study revealed that financial innovations had an impact on risks and uncertainties faced by firms in the retail industry. The findings concur with

Mathews and Thompson (2008) who observed that financial innovations relating to new products and processes opens doors to a myriad of new risks for the firms.

Firms need to properly weigh the anticipated benefits against the underlying risks so as to remain profitable for the foreseeable future. Optimal scrutiny of the intended innovations will definitely reduce any underlying risks. These remarks concur with Maina (2011) who concluded that effective financial innovation management has a positive impact on credit risk management. The lack of innovations reduces risk as noted by the negative coefficient. This finding concurs with Waweru (2012) that a negative correlation exists between financial innovations and risk management. Based on the above research findings, effective financial innovation management reduces risk exposure by firms. This is in agreement with Maina (2011) that financial innovations have a positive relationship with credit risk management.

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The study aimed at establishing the effect of financial innovations on risk management of commercial banks in Kenya. The study concentrated on the period 2004 to 2014. This chapter showcases the summary, conclusions and recommendations based on the research findings.

5.2 Summary

The research findings showed that financial innovations positively influenced risks faced by commercial banks in Kenya. Financial innovations should therefore be accompanied by sound management practices so as to effectively foresee the successful adoption and implementation of those innovations. However, banks should readily conduct adequate feasibility studies before rolling out their innovations so as to detect flaws that may hinder their successful implementation. A positive relationship was observed between inflation rates, interest rates and amounts transacted through agency banking. Based on the research findings, effective financial innovation management reduces risk exposure by firms. Firms need to properly weigh the anticipated benefits against the underlying risks so as to remain profitable for the foreseeable future. Optimal scrutiny of the intended innovations will definitely reduce any underlying risks. The research findings revealed that money transacted through agency banking and via mobile transactions had the greatest influence on the equity loan ratio. It is evident that the studied financial innovations had an impact on the firm's risks due to general uncertainties and fear of change by the clientele. People will generally be skeptical about new innovations but will

slowly adopt them after they realize their benefits. This therefore presents the firms with risks due to the amount of money they invest in new and uncertain financial innovations.

5.3 Conclusions

The researcher concluded indeed banks in Kenya operate in a risky environment, however, they have managed to mitigate risks through investments in more secure money transfers for instance internet banking and mobile banking. The F statistic value being greater than the critical value implied that the model was significant in establishing the effects of financial innovation on risk management by commercial banks in Kenya. The study was only able to capture the effects of the five independent variables on the dependent variables. The other innovations that affect risk management were not addressed by this study. It can be concluded that based on the research findings, bank financial innovations have a positive impact on risk management by commercial banks. In addition, adoption of financial innovations positively influences financial performance by commercial banks thus better proceeds to the company`s shareholders.

It is important to note that banks in Kenya have continuously performed well even though other sectors have shown slow performance. Banks have been at the forefront in financial innovations and this has enabled them get more income.

5.4 Recommendations for Policy and Practice

Kenyan commercial banks should therefore continue to invest in financial innovations so that they can be able to control administrative costs. The Kenyan government should promptly provide incentives towards research and development so that banks can continue to come up with more financial innovations. Government should also pursue

strategies so as to provide incentives in technology transfer to less developed economies so as to promote the adoption and implementation of world class innovations.

The adoptions of the internet and mobile phones have been found to enhance the delivery of self driven technology banking services. The researcher strongly recommended that Kenyan commercial banks should continue to make sustainable industry linkages with service providers in the mobile phones industry not forgetting internet service providers. Therefore, banks should monitor and effect loan repayments bearing in mind convenience to their customers.

5.5 Limitations of the Study

The researcher used secondary data which was collected from The Central Bank of Kenya website. In this regard, the veracity of the research findings was in essence affected by the reliability and accuracy of the reported information by the CBK.

The study focused on financial innovation on risk management by commercial banks. However, other factors exist which in one way or another contribute to risk management by commercial banks which were disregarded in this study. The researcher only used five independent variables in the study and only concentrated on financial innovations effects. The effects of other variables on risk management were not addressed by this study.

The study was faced with challenges in getting detailed data since some services were only introduced recently for instance agency banking. Data availability for these variables proved difficult leading to less data observations compared to the other variables under study.

5.6 Suggestions for Further Research

This study only addressed a few bank innovations thus further assessments are recommended for other innovations like credit guarantees and securitization on their effects on risk management by commercial banks. A thorough assessment ought to be done so as to establish if adoption of financial innovation indeed contributes to financial deepening.

The researcher recommends similar studies to be carried out on micro finance institutions. In recent times, micro finance institutions have grabbed the attention of mobile money service providers and commercial banks thus this sector has experienced significant transformation. These institutions should therefore adopt innovations in order to go beyond the provision of micro loans thus consequently making this sector more viable. This will enhance comparisons of research findings in both the banking and micro finance sector thus coming up with recommendations that are applicable to relevant sectors in the country.

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APPENDICES

APPENDIX I: LIST OF COMMERCIAL BANKS IN KENYA AS AT 31ST DECEMBER 2014

1. Bank of Africa
2. Bank of Baroda
3. Bank of India
4. Barclays Bank
5. Brighton Kalekye Bank
6. CFC Stanbic Bank
7. Chase Bank (Kenya)
8. Citibank
9. Commercial Bank of Africa
10. Consolidated Bank of Kenya
11. Cooperative Bank of Kenya
12. Credit Bank
13. Development Bank of Kenya
14. Diamond Trust Bank
15. Dubai Bank Kenya
16. Ecobank
17. Equatorial Commercial Bank
18. Equity Bank
19. Family Bank
20. Fidelity Commercial Bank Limited
21. Fina Bank
22. First Community Bank
23. Giro Commercial Bank
24. Guardian Bank
25. Gulf African Bank
26. Habib Bank
27. Habib Bank AG Zurich
28. IandM Bank
29. Imperial Bank Kenya
30. Jamii Bora Bank
31. Kenya Commercial Bank
32. K-Rep Bank
33. Middle East Bank Kenya
34. National Bank of Kenya
35. NIC Bank
36. Oriental Commercial Bank
37. Paramount Universal Bank
38. Prime Bank (Kenya)
39. Standard Chartered Kenya
40. Trans National Bank Kenya
41. United Bank for Africa
42. Victoria Commercial Bank
43. ABC-Bank (Kenya)

Source: (CBK Website)

APPENDIX II: MOBILE BANKING TRANSACTIONS DATA FROM 2007-2014

Year	Agents	Customers in 000'	Transactions	Value of transactions (Billions)
2007	1,582	505	5,470,349	16
2008	6,104	3,911	62,740,790	167
2009	23,012	8,717	193,500,400	473
2010	39,449	15,227	311,046,200	732
2011	50,471	21,855	432,998,200	1,169
2012	76,912	23,589	577,374,200	1,545
2013	113,130	28,255	732,597,100	1,902
2014	127,340			2,159

Source: Central Bank of Kenya, 2015

APPENDIX III: ATM CARDS VALUE OF TRANSACTIONS FROM 2009-2014

Year	ATMs	Total Cards	Value of Transactions '000000s	No of transactions
2009	1,827	4,858,802	195,820	39,612,431
2010	2,091	7,672,695	517,324	92,484,489
2011	2,205	10,132,799	577,852	122,389,203
2012	2,381	10,730,604	1,009,760	224,575,358
2013	2,487	11,484,600	1,532,779	338,067,117
2014	2,359	15,235,468	1,928,723	568,369,026

Source: Central Bank of Kenya, 2015.

APPENDIX IV: AGENCY BANKING DATA FROM 2007-2014

Year	Value of transactions in Billions	No of transactions	Bank Agents
2011	44	8,761,703	9,748
2012	152	30,007,652	16,333
2013	236	42,055,000	23,477
2014	345	52,361,536	32,428

Source: Central Bank of Kenya, 2015.

APPENDIX IV: INFLATION DATA FROM 2009-2014

	2009	2010	2011	2012	2013	2014
Jan	13.2	6.0	5.4	18.3	3.7	7.2
Feb	14.7	5.2	6.5	16.7	4.5	6.9
March	14.6	4.0	9.2	15.6	4.1	6.3
April	12.4	3.7	12.1	13.1	4.1	6.4
May	9.6	3.9	13.0	12.2	4.1	7.3
June	8.6	3.5	14.5	10.1	4.9	7.4
July	8.4	3.6	15.5	7.7	6.0	7.7
Aug	7.4	3.2	16.7	6.1	6.7	8.4
Sep	6.7	3.2	17.3	5.3	8.3	6.6
Oct	6.6	3.2	18.9	4.1	7.8	6.4
Nov	5.0	3.8	19.7	3.3	7.4	6.1
Dec	5.3	4.5	18.9	3.2	7.2	6.0

Source: Central Bank of Kenya, 2015.

APPENDIX VI: INTEREST RATES DATA FROM 2004-2014

Years	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
January	13.48	12.12	13.20	13.78	13.78	14.78	14.98	14.03	19.54	18.13	17.03
February	13.01	12.35	13.27	13.64	13.84	14.67	14.98	13.92	20.28	17.84	17.06
March	13.12	12.84	13.33	13.56	14.06	14.87	14.8	13.92	20.34	17.73	16.91
April	12.67	13.12	13.51	13.33	13.91	14.71	14.58	13.92	20.22	17.87	16.7
May	12.55	13.11	13.95	13.38	14.01	14.85	14.46	13.88	20.12	17.45	16.97
June	12.17	13.09	13.79	13.14	14.06	15.09	14.39	13.91	20.3	16.97	16.36
July	12.31	13.09	13.72	13.29	13.90	14.79	14.29	14.14	20.15	17.02	16.91
August	12.19	13.03	13.64	13.04	13.66	14.76	14.18	14.32	20.13	16.96	16.26
September	12.27	12.83	13.54	12.87	13.66	14.74	13.98	14.79	19.73	16.86	16.04
October	12.39	12.97	14.01	13.24	14.12	14.78	13.85	15.21	19.04	17	16
November	11.97	12.93	13.93	13.39	14.33	14.85	13.95	18.51	17.78	16.89	15.94
December	12.25	13.16	13.74	13.32	14.87	14.76	13.87	20.04	18.15	16.99	15.99

Source: Central Bank of Kenya, 2015.