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FINANCIAL INNOVATIONS AND BANK PERFORMANCE IN KENYA: EVIDENCE FROM BRANCHLESS BANKING MODELS

By

Moses Mwenda Muthinja[1]

Ph.D. Student in Finance

Student No.708260

In the

SCHOOL OF ECONOMIC AND BUSINESS SCIENCES

At the

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Supervisor: Prof. Chimwemwe Chipeta

Date of submission:

8th June, 2016

[1] Email: muthinjam@gmail.com. Cell Phone +254-721414959

DEDICATION

I dedicate this thesis to my parents Mr. Edward Muthinja and Mrs Marisella Nkirote Muthinja for their commitment to my education against all odds.

ACKNOWLEDGEMENTS

I would like to thank the Lord God Almighty, from whom all blessings flow and to my Lord and Saviour Jesus Christ, without him I would not have completed this thesis. In addition, I sincerely acknowledge the following:

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ABSTRACT

This study examines the relationship between financial innovation and financial performance of commercial banks in Kenya, as well as the drivers of financial innovations at both firm and macro levels. The financial innovations covered are the branchless banking models, which represent a departure from the traditional branch-based banking. More specifically, the financial innovations covered are: Mobile banking, agency banking, internet banking and Automated Teller Machines (ATMs). The study uses 10-year panel (secondary) data for the period spanning year 2004 to 2013. The study conducts an empirical analysis of the four types of financial innovations using three econometric models. The models have been specified using Koyck distributed lag models and estimated using dynamic panel estimation with System Generalised Method of Moments (GMM). The speed of adjustment of bank financial performance to financial innovation as well as the speed of adjustment of financial innovation to the financial innovation drivers has been tested using Koyck mean and median lags. The empirical results provide strong evidence of the link between financial innovations and bank financial performance with respect to Kenyan commercial banks.

The study makes a number of other findings. Firstly, financial innovations significantly contribute to firm financial performance and that firm-specific factors are more important to the firm's current financial performance than industry factors. Secondly, firm-specific variables significantly drive financial innovations at firm level with firm size being the most significant driver of financial innovation at firm level. The firm specific factors include firm size, transaction costs, agency costs, and technological infrastructure at firm level. Thirdly, macro level variables significantly drive financial innovation at firm level with regulation being the most important driver at macro level. The macro level drivers reviewed include: Regulation and taxes, incompleteness in financial markets, technological infrastructure at macro level and globalisation. Lastly, the existence of reverse causation between firm financial performance and firm financial innovation is established.

The speed of adjustment of firm financial performance to financial innovation has been determined. The results show that it takes on average 1.179 years for bank financial performance to adjust to the four financial innovations studied. Secondly, it takes less than a year (0.368 years) to accomplish 50% of the total change in firm performance following a unit-sustained change in

the financial innovations. Moreover, mobile banking has the shortest mean lag (2.849) while ATMs have the longest mean lag (4.926). Therefore, it takes approximately three years for mobile banking to adjust to financial innovation drivers at firm level and on average five years for ATMs to adjust to the financial innovation drivers. By and large, the speed of adjustment of financial innovations to macro level drivers is higher than the speed of adjustment of financial innovations to firm level drivers.

This study has made significant contribution to the body of knowledge in the field of financial innovations. The study has developed an econometric model which captures four financial innovations in a single study and empirically used the model to test their link to firm financial performance. The second and third econometric models have also captured the drivers of financial innovations at firm and macro levels. The reviewed literature observes that previous studies have largely focused on financial products in developed countries at the expense of emerging financial innovations in developing countries. In addition, previous studies have also largely ignored empirical approaches to the study of financial innovations. This study has empirically established the link between financial innovations and firm performance by modelling the four innovations in single model in a developing country (Kenya) context. One of the major contributions of this study is the establishment of the speed of adjustment of firm performance to financial innovations and the speed of adjustment of financial innovations to financial innovation drivers at both firm and macro levels. Lastly, the study has developed an original conceptual financial innovation value model (Fig. 6.1), which will be used in future financial innovation studies. This study has a number of managerial and policy implications which have been reviewed in the study.

Key words: Financial innovation, financial performance, industry adjusted ROE/ROA, branchless banking, financial innovation drivers, mean lag, median lag, speed of adjustment

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Declaration Regarding Plagiarism

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List of Abbreviations Used

Abbreviation	Meaning
ABTN	Number of Agency Banking Transactions
AML	Anti-money Laundering
ATM	Automated Teller Machine
BAG	Number of Agency Banking agents
BIS	Bank for International Settlements
CAK	Communications Authority of Kenya
CAR	Capital Adequacy Ratio
CBK	Central Bank of Kenya
CFT	Combating Financing of Terrorism
CMA	Capital Markets Authority
CSR	Corporate Social Responsibility/Responsiveness
DMU	Decision Making Unit
EBIT	Earnings Before Interest and Tax
EBK	Equity Bank of Kenya
EBT	Earnings Before Tax
ECM	Error Components Model
EVA	Economic Value Added
FATF	Financial Action Task Force
GAAP	Generally Accepted Accounting Principles
GMM	Generalized Method of Moments
IAS	International Accounting Standards
IFRS	International Financial Reporting Standards
IMF	International Monetary Fund
IRA	Insurance Regulatory Authority
ITU	International Telecommunications Union
IV	Instrumental Variables
KEPSS	Kenya Electronic Payment and Settlement System
Ksh	Kenya Shillings
LS	Least Squares
LSDV	Least Squares Dummy Variable
LYONS	Liquid Yield Option Notes

ML	Maximum Likelihood
NGO	Non-Governmental Organizations
NPL	Non-Performing Loans
POS	Point of Sale
RBA	Retirement Benefits Authority
RBV	Resource Based View
REM	Random Effect Model
ROA	Return on Assets
ROE	Return on Equity
ROI	Return on Investment
ROS	Return on Sales
TOE	Technology-Organization-Environment
VAMBTN	Value of Agency Banking Transactions
WB	World Bank
WG	Within Group

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CHAPTER ONE

BACKGROUND AND INTRODUCTION

1.0 Introduction

This study reviews four financial innovations in the form of branchless banking models and their link to financial performance of commercial banks in Kenya, for the ten year period (2004 to 2013). The four financial innovations which are the subject of this study include three branchless banking models in the banking sector and one model in the telecommunications sector. The three branchless banking models in the banking sector include: agency banking, internet banking and Automated Teller Machines (ATMs). The mobile banking component is the fourth branchless banking model referred to as Non-bank led model. Non-bank led models use information and communication technologies such as cell phones, prepaid cards and card readers for transmitting transaction details from either the customer or retail agent to the bank (Lyman, Ivatury, & Staschen, 2006). Lyman et al. (2006) observes that the non-bank firm designs financial products, engages retail agents either directly or through intermediaries and maintains the clients' electronic money accounts while electronically tracking customer account balances on their own data systems. Mobile banking only requires a customer to have a cell phone and an electronic money account with the mobile phone company. Mobile banking does not require the customer to have a bank account with a commercial bank. The branchless banking models provide a departure from the traditional banking models, which involve the use of physical bank branches to conduct banking business. The study covers 42 commercial banks operating in Kenya while incorporating the mobile banking component from mobile banking companies.

All the branchless banking models have been discussed in section 3.5 of this study. The study conducts an empirical analysis of the four financial innovations using three econometric models. The first econometric model tests the relationship between financial innovation and bank financial performance measured by industry adjusted return on equity and industry adjusted return on assets. Model two tests the drivers of financial innovations at firm level while model three tests the drivers of financial innovations at macro level. Lastly, the study tests the speed of adjustment of bank financial performance to financial innovations as well as the speed of adjustment of financial innovations to financial innovation drivers at both firm and macro levels. The speeds of adjustment have been measured using Koyck (1954) mean and median lags. The use of Koyck mean and median lags in the measurement of the mean and median lags is consistent with the approach used in recent studies (German-Soto & Flores, 2015).

1.1 Layout of this Chapter

The goal of this chapter is to provide the background of the study. The chapter is dividend as follows: 1.2 Background, 1.3 Financial innovations in Kenya, 1.4 The evolution of financial innovations in Kenya, 1.5 Motivation for the Study, 1.6 Why the choice of Kenya, 1.7 Problem statement, 1:8 Research objectives, and 1.9 Structure of the thesis.

1.2 Background

Financial innovation has been defined as "...the act of creating and then popularising new financial instruments as well as new financial technologies, institutions and markets..." (Tufano, 2003, p. 4). According to Tufano (2003), product innovations are evidenced by new financial instruments while process innovations embody innovative means of distributing the financial products, executing or pricing the transactions. Financial innovations, therefore, entail new products, new services, new production processes and new organisational forms (Frame & White, 2004). These financial innovations are seen as contributing to financial performance of firms.

The origin of economic thought which sees innovation as a determinant of economic performance is credited to Schumpeter (1934), whose study fronts innovation as its landmark initial contribution to economic literature. Schumpeter opines that the successful introduction of products, processes as well as organisational innovations, enables firms to supersede the existing industries as well as markets. These companies finally grow to attain significant market share at the expense of the less innovative firms. Innovation may be carried out by existing or new firms. However, new innovators are likely to penetrate a sector at the same time, a situation that would cause them to either grow or exit over time (Malerba & Orsenigo, 1997). This exit over time is explained in the later work of Schumpeter (1942, p. 83) as 'creative destruction,' which the author defines as the process of industrial mutation that continually revolutionises the economic structure from within, constantly destroying the old one and continuously creating a new one. In the context of innovations, Schumpeter (1942) argues that creative destruction refers to the incessant product and process innovation mechanism by which new production units replace outdated ones. Schumpeter contends that innovation enables a firm to build monopolistic rent, which tends to decline as new products and processes imitate the innovation.

Although it is broadly acknowledged that innovation and technological change are major drivers of economic growth, which gives competitive edge to firms, most literature has focused on innovation in

the manufacturing sector (Cainelli, Evangelista, & Savona, 2006). Consequently, innovation in services remain under-researched by innovation analysts (Hipp & Grupp, 2005; Tether, 2003). However, a number of studies have focused on the role of services innovation in general and financial services innovation in particular (Miles, 1993; Miles et al., 1995). These studies find considerable contribution of innovation in services to modern economies in relation to their employment output and inputs to other sectors of the economy. For example, Frame and White (2004) conclude that the adoption and spread of an innovation or its diffusion across an industry is important and that faster innovation diffusion leads to higher returns to the society associated with investments in the innovations. It would be expected, therefore, that firms which adopt and use financial innovations, would have better financial results or generally outperform the non-innovating as well as firms that do not adopt financial innovations.

Nevertheless, there is compelling evidence that financial innovations generate returns to innovators and can positively affect the entire economy (Lerner & Tufano, 2011). The benefits, according to the authors, are generated when households are able to have investment and consumption choices in addition to lowering the cost incurred in raising and deployment of funds. Consistent with Lerner and Tufano's (2011) findings, emerging financial innovations, especially in mobile money have propelled Kenya to the global limelight and aroused immense intellectual curiosity in the research community. In order to appreciate the context of this study these developments need to be put into proper perspective, to enable the distinctiveness of branchless banking models to be added to the proper theoretical lens.

The use of electronic card payments systems in Kenya has been there for decades. The most commonly used electronic card payments include credit cards, debit cards, prepaid cards, charge cards and Automated Teller Machine (ATM) cards. The electronic payment card market has been dominated by commercial banks and merchants for years. However, the introduction of mobile money in year 2007 in Kenya by the leading mobile phone service provider, Safaricom, has dramatically altered the electronic payment landscape in the country. Safaricom launched the world-acclaimed mobile money transfer service M-Pesa (meaning mobile money; 'Pesa' means money in Kiswahili, Kenya's national language), which has won numerous awards for its role in improving financial access and financial inclusion in the country. The model has been adopted by the other mobile phone service providers in the country and commercial banks, leading to an unprecedented mobile money transaction growth in Kenya.

The mobile money services sector in Kenya is one of the most advanced in the world (EIU, 2012). The financial innovation has significantly lowered the cost of money transfer in Kenya and increased the

degree of financial deepening and financial inclusion. The country has robust mobile money agent network and adequate regulatory support from the Central Bank of Kenya. According to Demirgüç-Kunt and Klapper (2012), Kenya is Sub-Saharan Africa's regional leader in mobile money. The emergence of mobile phones is seen as central to the development of many electronic payment innovations (Ingenico, 2012). Additionally, Al-Khouri (2014) observes that advancements in internet technology as well as mobile phones subscriptions have significantly fuelled the rise in electronic payments. These findings are consistent with Ingenico (2012) on the critical role the mobile phone technology has played in the development of electronic payments.

The low penetration of formal financial services coupled with high rate of mobile subscription has led to rapid growth in mobile payments (Capgemini & RBS, 2013). This development in mobile payments has resulted in a situation where the number of customers, number of transactions and the value of mobile payments have substantially dwarfed comparative figures for the combined usage of ATM cards, credit cards, charge cards, POS machines, prepaid cards and debit cards (CBK, 2015). Researchers outside Kenya might find the robustness of Kenya's agency banking startling, where banking is being conducted through third parties linked to commercial banks through point-of-sale terminals.

Importantly, with high-speed connection in Kenya, internet banking is now a common feature even in rural areas, where customers access their bank accounts online through cell phones. Innovations in mobile payments were introduced in Kenya in 2007 at a time commercial banks, *Western Union* and *MoneyGram* dominated the money transfer business. Mobile payments were dismissed as inconsequential by the existing players at the time. Eight years down the line, mobile payments are the dominant cash transfer options in the country (CBK, 2015).

Interestingly, although significant studies in the field of financial innovations are available, most of the studies have concentrated on financial products in developed countries (Frame & White, 2014; Lerner & Tufano, 2011; Tufano, 2003). Since innovations in mobile money and agency banking have not succeeded in developed countries (Ingenico, 2012), it is possible that researchers focusing on such economies have little understanding or appreciation of such financial innovations. In effect, emerging financial innovations widely used in developing countries in general and Kenya in particular have been given a wide berth. On the other hand, where they have been studied, the emphasis has been on providing descriptive statistics (See, Jepkorir, 2010). The reviewed studies on Kenya display lack of empirical or

quantitative approach to the study of financial innovations, which would afford the ease of replication in future or in other countries.

More importantly, although financial innovation studies based in Kenya describe the emerging innovations in branchless banking (Mwando, 2013), very little is known about what actually drives financial innovations at firm and macro levels. Secondly in view of the reviewed literature, very little is known about the link between financial innovations and firm performance. The implications of this state are that managerial actions and government policies are not guided by reliable and sufficient research. In view of this, the researcher opines that the existing knowledge on financial innovation does not adequately represent Kenya's financial innovation context especially with regard to branchless banking models.

Using dynamic panel analysis on 42 out of the total 43 commercial banks in Kenya, this study adopts an econometric approach to the study of financial innovations with the use of System GMM, proposed by Arellano and Bover (1995). Empirical tests on three hypotheses on the drivers of financial innovations at firm and macro levels as well as on the link between financial innovations and firm performance have been carried out in this study. The study applies frameworks largely used in the strategic management literature such as the Technological-Organisational-Environmental model (Tornatzky & Fleischer, 1990), Diffusion of Innovations (E. M. Rogers, 1962) and the Resource-Based View (Barney, 1991) to show the relationships between the variables used. These frameworks in aggregately form the theoretical framework upon which this study is grounded. Lastly, through the review of financial innovation literature and guided by the three frameworks, the financial innovation value model has been developed in the present study which can be used in future financial innovation studies. In the end, the contribution of the study to the knowledge gaps, methodological contribution and the managerial as well as policy implications of the study are discussed.

1.3 Financial Innovations in Kenya

Kenya has experienced phenomenal growth in financial innovations in the last ten years and some of these innovations have positioned the country as a global leader especially in mobile money innovations (Demirgüç-Kunt & Klapper, 2012; Kimenyi & Kibe, 2014). The country's Sub-Saharan Africa leadership in technological innovations has served to cement Kenya's leadership in the technologically driven and technology dependent financial innovations. The regulatory framework in the banking and

telecommunications sectors strongly supports these innovations. Three financial innovations in the form of branchless banking models are covered in this study. A detailed literature review on these models is provided in chapter three section 3.5.

1.4 The Evolution of Financial Innovations in Kenya

Kenya has experienced fast growth in mobile banking, agency banking, internet banking and ATMs over the study period. The following section reviews the evolution of these financial innovations over the study period.

1.4.1 Evolution of Mobile Banking

Mobile banking has been in operation for seven years over the study period ending 2013. This innovation has grown in quantum leaps since its introduction in 2007. For example, the growth in terms of the number of mobile phone agents, number of mobile money accounts and mobile banking transactions is discussed in Figures 1.1, 1.2 and 1.3 respectively. The compounded annual growth rates in a number of mobile banking aspects are also shown in Table 1.1.

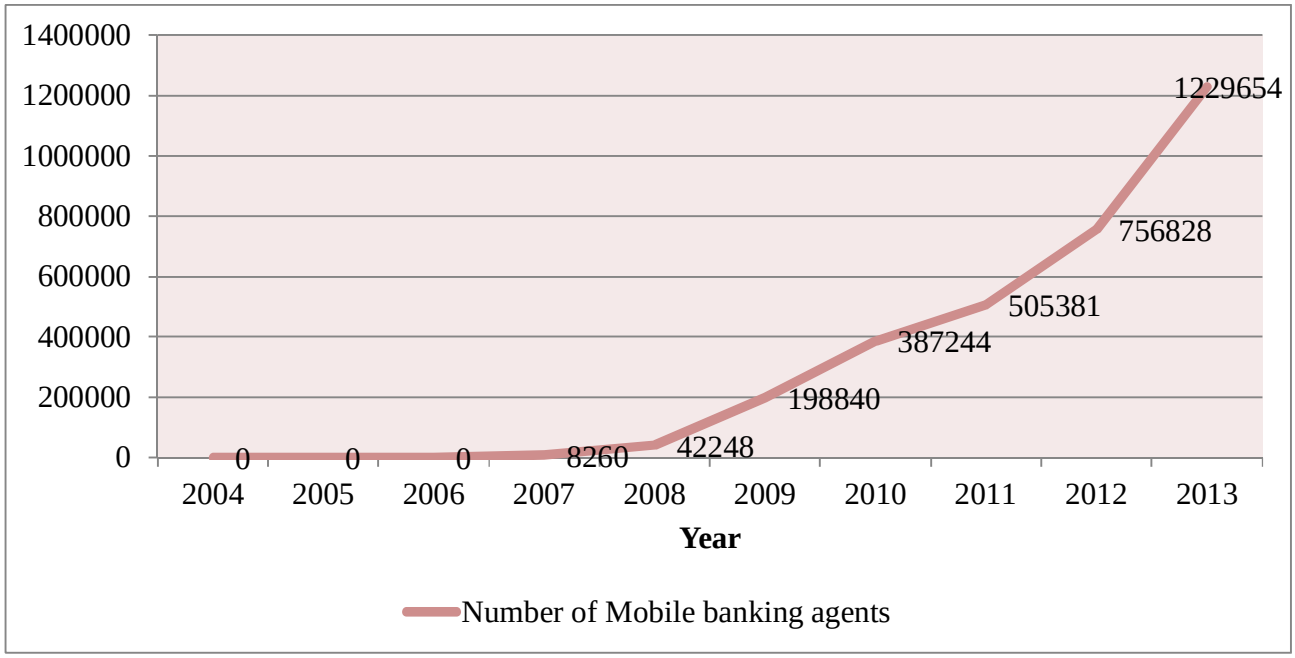


Fig. 1.1: Growth in Mobile banking agency

Source: Author's compilation using data obtained from the CBK

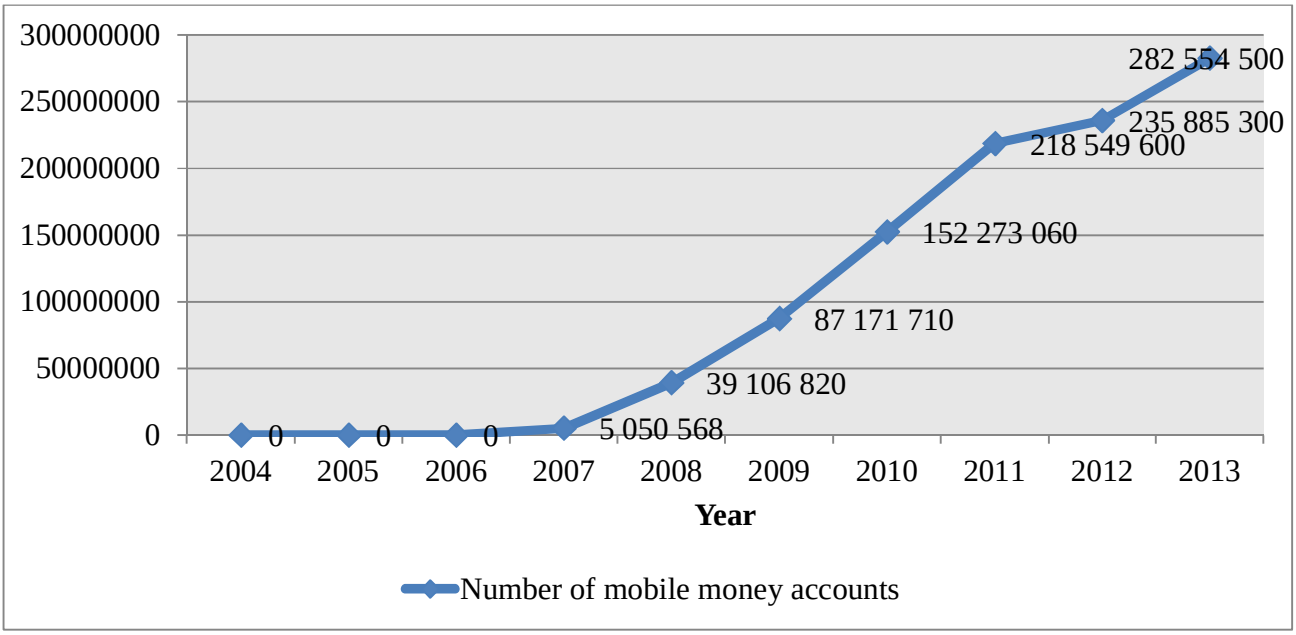


Fig. 1.2: Number of mobile money accounts

Source: Author's compilation using data obtained from the CBK

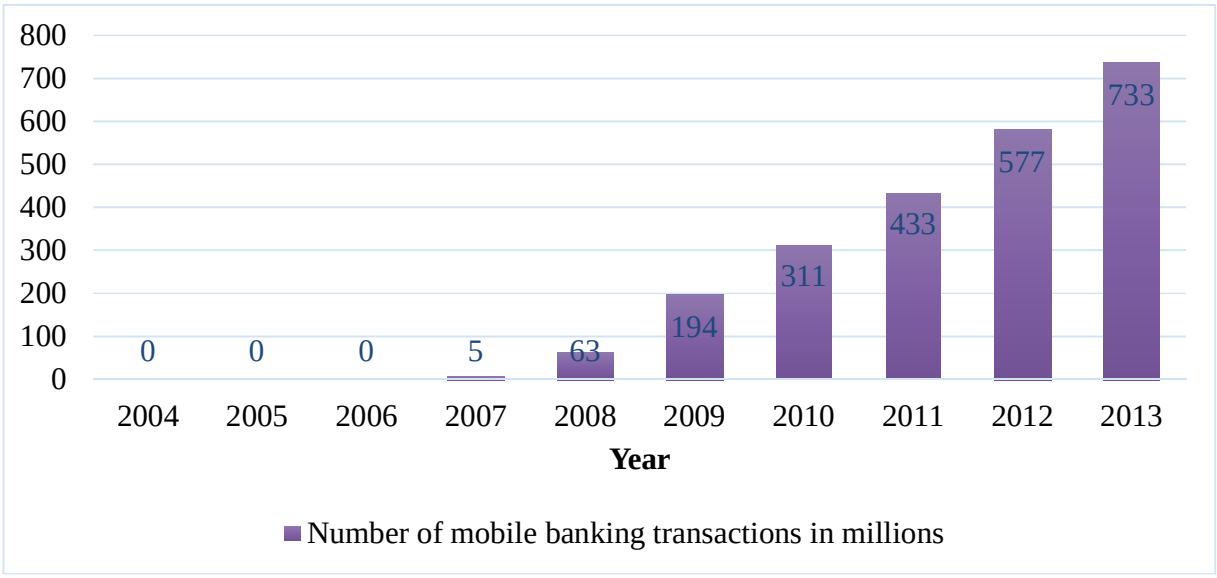


Fig. 1.3: Growth in Mobile banking Transactions

Source: Author's compilation using data obtained from the CBK

Fig. 1.1 shows that the number of mobile banking agents grew steadily from 8,260 in 2007 to 1, 229,654 at the close of 2013. This represents a compounded annual growth rate of 104.40% as shown in Table 1.1. The growth in mobile phone agents is vital since agents are the intermediaries between the customer and mobile phone companies in the distribution of mobile money services. The bigger the network of mobile agents the easier it is for users to access mobile money services in various locations. In addition, Fig. 1.2 shows the growth in the number of mobile money accounts, which represents the number of customers or users of mobile money services. The customer numbers grew from 5,050,568 in 2007 to 282,554,500, which represents a compounded annual growth rate of 77.70 % as shown in Table 1.1. Lastly, Fig 1.3 shows the growth in mobile banking transactions over the period, which grew from 5,470,349 to 732,597,100, representing a 101.30% compounded annual growth rate as shown in Table 1.1. These statistics highlight the exponential growth and popularity of mobile money in Kenya and sheds light on the importance customers attach to the financial innovation.

Table 1.1: Compounded annual growth in mobile banking

	2007	**2013**	****CAGR (%)**
Mobile banking agents	8,260	1,229,654	104.40
Number of accounts	5,050,568	282,554,500	77.70
Transactions	5,470,349	732,597,100	101.30
Value of Banking transactions (Ksh 'billions)	16,319	1,901,559	97.33

$$** CAGR = \left(\frac{Ending\ Value}{Beginning\ value}\right)^{\left[\frac{1}{number\ of\ years}\right]} - 1 \quad \text{…….....…….equation 1.1}$$

***CAGR= Compounded annual growth rate*

Source: Author's compilation using data obtained from the CBK

1.4.2 Evolution of Agency Banking

Agency banking has also grown remarkably since its introduction in 2010 as shown in figure 1.5. Agency banking has been in operation for four years over the study period, but annual data is available from 2011[2]. The evolution of agency banking is shown in figure 1.4.

[2] For a detailed review of Kenya's banking sector see chapter five of this study

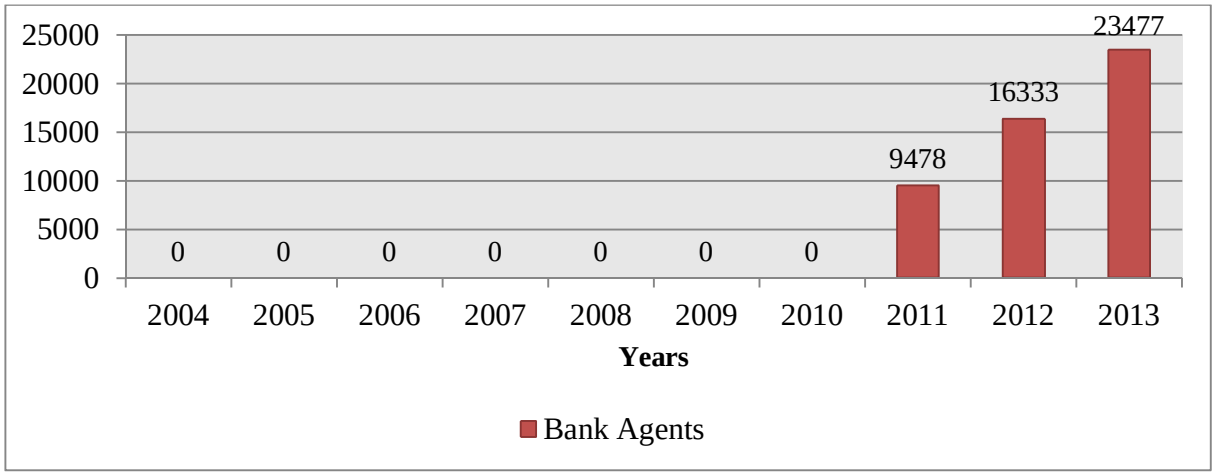


Fig. 1.4: Growth in Bank Agents

Source: Author's compilation using data obtained from the CBK

1.4.3 Evolution in Number of Bank Deposit Accounts and ATMs

The number of deposit accounts in the banking industry grew at a steady pace over the period, which served to increase financial access and reduce financial exclusion. The growth in ATMs in the industry grew from about 455 in 2004 to 2,487 in the industry as shown in Fig 1.5. However, the growth in ATMs and bank accounts has not been in tandem with the growth in mobile banking accounts.

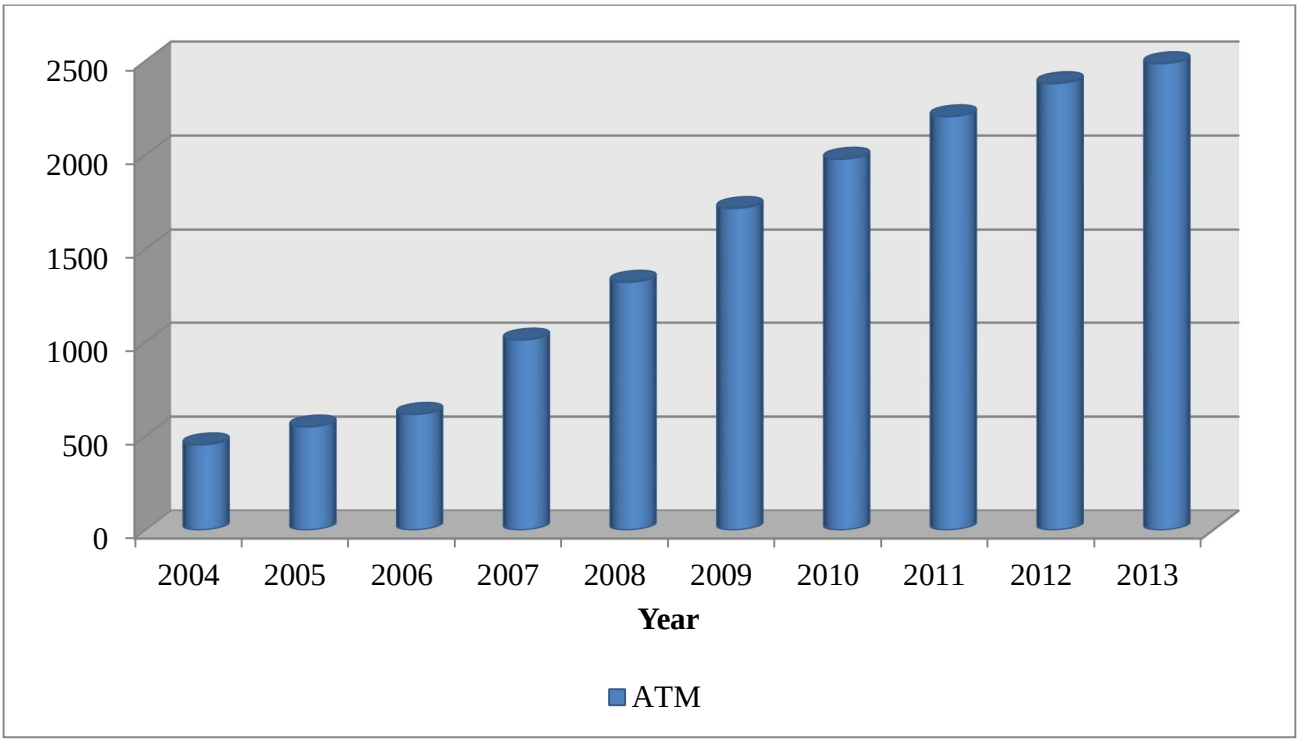


Fig. 1.5 ATM Growth

Source: Author's compilation using data obtained from the CBK

1.5 Motivation for the Study

This section focuses on the basis for carrying out the present study. Several grounds for undertaking the study, which include the importance of financial innovations, technological developments in recent times, financial innovation contribution to the National Payment System, and the global financial crisis are discussed. A brief case for the research focus on Kenya is also presented.

1.5.1 The Importance of Financial Innovations

There is growing interest in the study of financial innovations, which highlights the importance attached to this field. Considering finance drives almost all production as well as consumption activities, financial sector improvements has positive implications for the whole economy (Frame & White, 2014). The authors argue that financial innovations have indirect positive benefits to the economy, which include encouraging productive investment and savings decisions. Related to financial innovations is the research on financial deepening or financial inclusion and therefore, the interest in financial innovation, is

attributed to the perceived link to financial inclusion. Financial innovation has been the driver of financial deepening and economic development for many years (Laeven, Levine, & Michalopoulos, 2015). Financial deepening is synonymous to financial inclusion defined as "…a process that ensures the ease of access, availability and usage of the formal financial system for all members of an economy…" (Sarma, 2012, p. 3). If members of the community are financially excluded, they are unable to access the necessary financial services when needed. Therefore, appropriate financial innovation interventions would address the problem.

According to the Sarma (2012), index of financial inclusion, an inclusive financial system comprises three basic dimensions namely, banking penetration, availability of the banking services and usage of the banking system. The present study posits that an inclusive financial system should: 1) have a wide reach of users, implying wide penetration represented by the number of people having a bank account, 2) the banking services should be easily available to users as evidenced by the number of banking outlets such as ATMs and bank branches, and 3) the holders of the bank accounts should use the accounts widely. Although financial inclusion is not the basis of the present study, its link to financial innovations highlights the importance of studying financial innovations.

There is considerable literature linking financial innovations to a country's economic growth. Building on the Schumpeterian endogenous growth model in which entrepreneurs generate monopoly profits, Laeven et al. (2015) have developed a model of financial innovation and technological innovation. The model reflects individuals' profit maximising decisions in addition to exploring the implications to economic growth. The study concludes that financial innovation is necessary in order to sustain economic growth. The authors posits that unless financial institutions innovate, technological innovation and economic growth will eventually stop. Secondly, there is need for policy makers to place emphasis on the value of institutions, laws, regulations and policies that enable financial innovations.

The CBK (2015) data shows that mobile payments have overtaken all the electronic card payments combined in terms of the number of customers and the overall value of the payment transactions. Mobile payment platforms are being employed in every aspect of human life. These aspects include using mobile phone transfer money deposit accounts held in commercial banks, withdrawing cash from bank accounts to mobile money by use of mobile phone, use of mobile money in payment of insurance premiums, payment of utility bills, air ticket booking, retail outlets and many more. The many uses of mobile financial innovations underline the importance of research in financial innovations.

The use of third parties to transact banking business, commonly referred to as agency banking has grown substantially. This is in spite of the fact that it has been in operation in Kenya for only five years. Although CBK reports indicate that 90% of agency banking in Kenya is controlled by three commercial banks, the individual financial reports of the three banks confirm on average that 30% of the total revenue is accounted for by agency banking. Agency banking outlets are located in rural areas mostly in locations that would be practically impossible or unprofitable for the commercial banks to establish fully-fledged branches compliant with the strict CBK requirements. The wide network of bank agents carrying out agency banking appears to satisfy the banking penetration as well as the availability of the banking service dimensions of financial inclusion. Given the benefits derived from financial innovations, it is important for this study to identify the drivers of financial innovations in Kenya and the benefits that accrue to firms that do not only innovate but also adopt financial innovations.

1.5.2 Technological Developments in Recent Times

Technological innovations at firm and macro levels have been found to lead to financial innovations. Laeven et al. (2015) argue that new financial arrangements have historically emerged following the successful introduction of technological innovations. These financial arrangements, according to the authors, include new financial instruments, emergence of new financial institutions or application of new reporting techniques. The study findings are consistent with the earlier work of Frame and White (2014) which concludes that technological developments have significantly changed commercial banking business in the last 30 years. The authors argue that in general technological developments have contributed to the entrenchment of commercial banks in the network of global financial institutions undertaking a range of financial activities. In particular the study provides evidence that firstly, financial innovations have been catalysed by technological developments in the telecommunications sector. Secondly, financial innovations have altered not only bank products and services but also bank production processes. Recent technological innovations have led to the emergence of new financial innovations worldwide (Ingenico, 2012). The implication is that most of the studies in previous years largely carried out in the developed world have not kept pace with new financial innovations in developing countries. The dearth of research data on emerging financial innovations could partly be explained by the fact that the innovations such as mobile money and agency banking are not common in developed countries.

The new technological developments provide an imperative for carrying out the present study. For example, the emergence of new payment system namely (mobile money), which mainly uses cell phones to electronically transfer funds (electronic money). The evolution in mobile money has kept pace with the mobile subscriptions (see Fig 5.7a and Fig 5.7b). There has been phenomenal expansion in mobile subscriptions over the study period, which has dwarfed the fixed line subscriptions (see Fig 5.7a). The CBK (2015) payment statistics show that mobile payments have grown faster than the aggregate of all electronic plastic cards in the last five years (see Fig. 5.7 b). The plastic cards include debit cards, credit cards, charge cards, prepaid cards, POS machines and ATM cards.

1.5.3 The Global Financial Crisis

The aftermath of the infamous global financial crisis has made many investors and regulators sceptical of the value of financial innovations. This is evidenced by the statement of the former USA Federal Reserve Bank chairman: "…I wish that somebody would give a shred of neutral evidence about the relationship between financial innovations recently and the growth of the economy, just one shred of information…" (Volcker, 2009, p. 1).

There are a number of studies that appear to support Volcker's frustration with financial innovations. For instance, Henderson and Pearson (2011) argue that financial innovation enables investment banks and other banks to develop products that are capable of capitalising on investors' ignorance of financial markets. Financial innovations have widely been deceptively marketed as instruments of spreading risks and therefore, making investments safer. This argument is supported by Krugman (2007) study, which concludes that financial innovations such as CDOs have only succeeded in making innovators make more money, which they would not have to pay should the financial system collapse as a result of the innovations. The author observes that the resultant effect has been the diffusion of confusion, which misleads investors into taking more than their acceptable level of financial risks.

However, in response to criticism of financial innovation, Glenn Yago, the executive director of Milken Institute states, "…It's critical that we do not confuse real financial innovation with the intentionally opaque financial products, whose sole purpose was speculation and deception; real financial innovation was not the cause of the financial crisis, but it is surely needed to accelerate the recovery and fund our future needs…" (Milken, 2010, p. 1). Although sceptical of the value of financial innovations, Volcker (2009) acknowledges the ATM as the most important financial innovation seen in 20 years preceding

2009. On the other hand, F. Allen (2011) argues that to some extent, financial innovations have been developed to create complexity aimed at exploiting the purchaser. The study however finds that there have been many other financial crises in the past, which had nothing to do with financial innovations. In sum, Allen (2011) concludes that financial innovations have had substantial positive effects that outweigh the negative ones. The recent global financial crisis, therefore, has catalysed the counter debate on the value of financial innovations. This debate effectively provides a strong imperative for carrying out the present study to establish the value (or lack of it) of financial innovations in Kenya.

1.5.4 Financial Innovations' Contribution to the National Payment System

Financial innovations largely enhance account access and new payment methods in response to the consumers' demand for convenience and ease. The efficient operation of a country's payment system enables timely and safe completion of transactions, which contributes to the overall performance of the economy.

According to the Bank for International Settlements (BIS) a payment system is "…a set of instruments, banking procedures and typically interbank funds transfer systems that ensure the circulation of money…" (BIS, 2002, p. 38). A payment system is one of the financial systems infrastructure that enable financial transactions at both local and international financial markets (Allen, Christodoulou, & Millard, 2006). A payment system should not only enable local and international transactions but also lower the transaction costs of funds transfer. For instance, Demirgüç-Kunt and Klapper (2012) observe that the recent growth in mobile money branchless banking model has enabled millions of people execute financial transactions cheaply, securely and reliably. According to the study, these people had ordinarily been excluded from the formal financial system. The CBK data on national payment systems indicates that mobile payments have overtaken the combined payments made through all electronic plastic cards in the last seven years (CBK, 2015). The emergence of new payment system and its widespread usage provides the fourth imperative for undertaking the present research.

1.6 Why the Choice of Kenya?

Kenya is a member of the East African Community comprising Burundi, Kenya, Rwanda, Tanzania and Uganda. East Africa is moving fast towards regional integration with joint infrastructure projects being undertaken. The joint infrastructure projects include; the standard gauge railway from Mombasa city in Kenya connecting Uganda, Rwanda and South Sudan. Other infrastructure projects include road

networks and shared infrastructure. It is argued that the overall performance of the East African region will largely depend on developments taking place in Kenya (Kimenyi & Kibe, 2014). The authors demonstrate firstly, that the economy is the largest in the region, it is the most dynamic and its investment flows and trade are much better linked to other economies. Secondly, the human and capital bases in Kenya are more advanced; the economy is fairly diversified and the country is the regional leader in Information and Communication Technology (ICT). Thirdly, Kenya has a robust private sector compared to other East African states. The country's GDP accounts for 41% of the East African region's GDP (see Fig.1.7) and therefore the largest in the region (WB, 2015). According to the report, Uganda accounts for 19%, Tanzania 32%, Rwanda 6% and Burundi 2% of East Africa's GDP. Kenya is a financial and technological hub for East and Central Africa. According to Kimenyi and Kibe (2013) the country's economic leadership is accounted for by the advanced service sector, which has remained the largest contributor to the GDP growth since 2007.

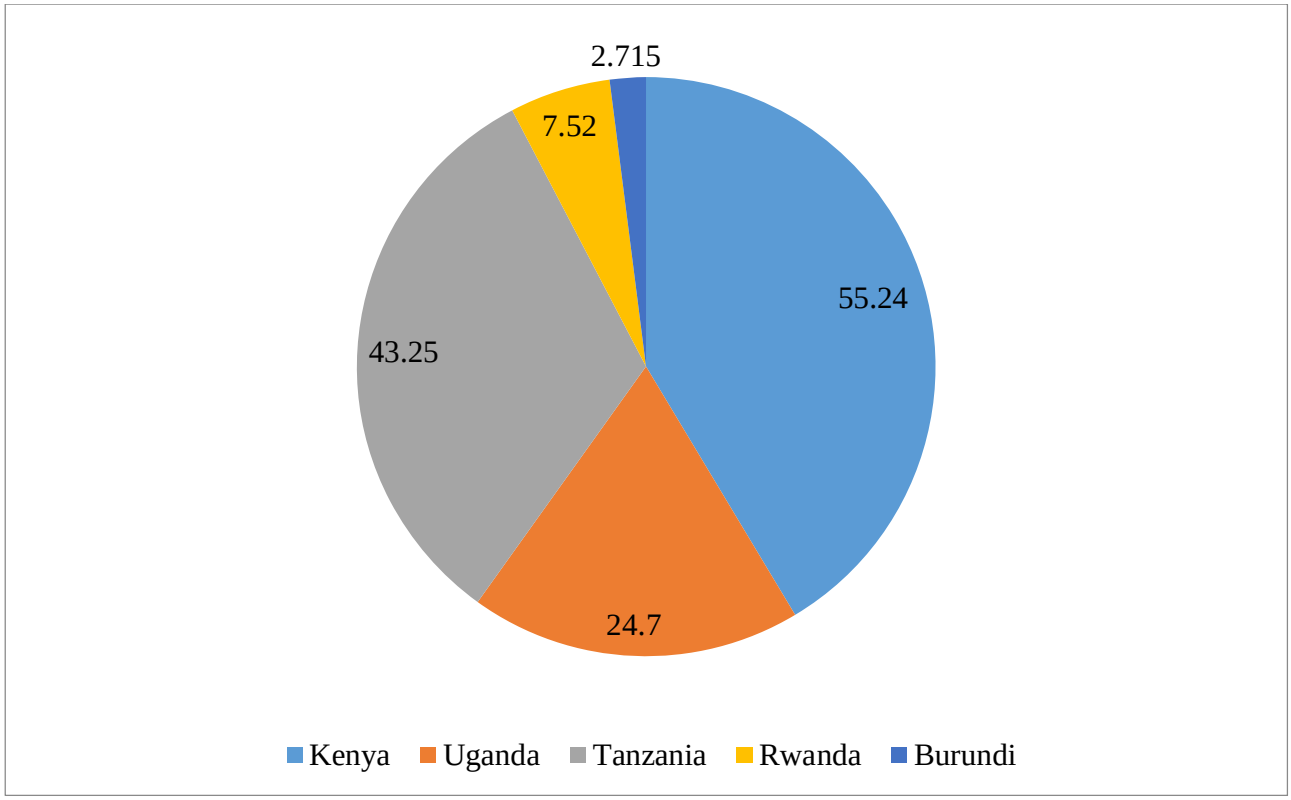


Fig 1.6: East African countries' 2013 GDP (current US$ Billions)

Source: Author's compilation using data obtained from the World Bank 2013 'World development indicators'

The mobile money services sector in Kenya is the most advanced in the world (Cracknell, 2012). The financial innovation has significantly lowered the cost of money transfer in Kenya and increased the degree of financial deepening and financial inclusion. The country has robust mobile money agent network and adequate regulatory support from the CBK. These innovations have attracted significant interest in the research community, leading to a number of studies in Kenya. For example, Demirgüç-Kunt and Klapper (2012) observe that Kenya is Sub-Saharan Africa's regional leader in mobile money. The study finds that 86% of all mobile phone users in Kenya use mobile money compared to 23% in the rest of Sub-Saharan Africa. Therefore, Kenya is at the focal point of financial innovations in the world. This is supported by Cracknell (2012) work, which classifies a Kenyan bank as Africa's most successful microfinance focused bank and a mobile phone service provider in Kenya as the world's leading provider of mobile payments. The Economist Intelligence Unit Global microfinance survey ranks Kenya at position five globally, the highest ranking in Africa (EIU, 2012). The study attributes Kenya's ranking to her global leadership and pioneering in mobile banking services.

In addition, Kenya has extensive secondary data from official sources. The Central Bank of Kenya has published substantial data relating to Kenya's banking sector, which includes individual banks (firm) data for Kenyan commercial banks. In addition, CBK regulations require Kenyan banks to publish their financial reports whether the commercial banks are listed or not. Data on Kenya's payment systems are also well published in the CBK website. Additional data relating to financial reports of all listed commercial banks are available at the Capital Markets Authority (CMA). Most importantly, Kenya was the first to introduce mobile money in the region, thus providing adequate time period to conduct rigorous empirical work on the country. Kenya's strategic geopolitical position, robust service and banking sector, regional leadership in financial and technological innovations as well as substantial availability of secondary data provides the fifth imperative for undertaking the present study.

1.7 Problem Statement

The central role and scope of financial innovation has made financial innovation a subject of significant research interest. For instance, Tufano (2003) asserts that "...the activity of financial innovation is large, but the literature on the topic is relatively small and spread out broadly among a number of fields. Unlike some other areas represented in this volume, where our profession had made a great deal of progress, the subject of financial innovation remains one in which our intellectual maps show vast uncharted – and potentially interesting – lands to be explored..." (p.37). Tufano's (2003) assertion puts into focus the

large scope of financial innovation and the constraints that researchers have to contend with in studying the subject.

Nevertheless, a number of studies have focused on the users of financial innovations with emphasis on three main areas. These areas include: The issuers of innovative securities, financial institutions, which adopt innovations and retail customers that use or adopt innovative payment technologies (Frame & White, 2004; Mahler & Rogers, 1999; Mas, 2009; Mas & Morawczynski, 2009). In spite of the numerous studies on financial innovations, Lerner and Tufano (2011) observe that the sources of financial innovations are not well known due to the absence of sufficient empirical evidence in spite of the their widely acknowledged economic importance.

Frame and White's (2004, 2014) extensive review of literature spanning a number of years paints a grim picture with regard to the paucity of empirical studies on financial innovation. For example, Frame and White (2004, p. 116) state that "... a striking feature of this literature, however, is the relative dearth of empirical studies that specifically test hypotheses or otherwise provide a quantitative analysis of financial innovation..." Therefore, it appears from these studies that the greatest challenge to empirical studies on financial innovations has been the deficiency of research data. Consequently, to remedy the data unavailability challenges, innovation studies have used patents as proxies for innovation in general.

However, Beck, Chen, Lin, and Song (2014) contend that financial services industry rarely uses patents as is the case with manufacturing and that in any case, patents are unavailable in most jurisdictions such as in the European Union. Accordingly, Beck et al. (2014) argue that majority of the current studies have taken a *case study* method, focusing on specific innovations. The studies adopting the case study approach include new forms of financial securities (Grinblatt & Longstaff, 2000; Henderson & Pearson, 2011), the introduction of credit scoring techniques (Akhavein, Frame, & White, 2005), internet-only banking (DeYoung, Lang, & Nolle, 2007) and lastly, firm innovation in emerging markets and the role of finance, governance, and competition (Ayyagari, Demirgüç-Kunt, & Maksimovic, 2012)

Many studies in developed countries have concentrated on financial innovation drivers in general. For example, Allen and Gale (1999) and Tufano (2003) provide evidence that financial innovations, particularly securities are largely driven by information asymmetries in financial markets. Other studies such as Merton (1989) as well as Madan and Soubra (1991) have linked the desire to reduce transaction

costs to the development of financial innovations[3]. Although these studies and others have made tremendous effort at establishing the drivers of financial innovations, their main focus has been on financial instruments or products in developed and emerging economies. However, the emergence of branchless banking models of financial innovations has shifted research focus to the developments in developing countries in general and Kenya in particular.

Historically, financial innovations have been described as "...one of the bedrocks of our financial system and the life blood of efficient and responsive capital markets..." (Horne, 1985, p. 621). The truth of this statement is underlined in Kenya's financial markets, where innovations in mobile money have propelled the country to position five globally and the highest ranking in Africa (EIU, 2012). The ranking by the Economist Intelligence Unit Global microfinance survey attributes Kenya's ranking to her global leadership and pioneering in mobile banking services. In addition to mobile banking innovations, Kenya has a robust network of agency banking agents contracted by a number of the leading commercial banks. Moreover, many banks have adopted internet banking and installed a number of ATMs across the country. In general, these innovations amount to a departure from the traditional branch-based banking commonly referred to as 'brick and mortar' banking. The country's leadership in mobile money innovations has stimulated research curiosity in the field of financial innovations. However, the research efforts appear fragmented in the sense that most studies focus on individual types of branchless banking such as mobile money, agency banking, internet banking and ATM banking.

The evolution of a number of branchless banking models has motivated research interest in Kenya's financial markets and a number of studies in the subject. However, most of the studies have focused on describing the existing financial innovations and the history pertaining to their introduction in Kenya. For instance, Hughes and Lonie (2007) provide a detailed history of the introduction of mobile money M-Pesa in Kenya and the regulatory challenges, which the mobile money platform had to contend with at the onset. Subsequent studies on the agency banking innovations in a number of countries, including Kenya, have also been done (Siedek, 2008). The author discusses the nature of agency banking in different countries and the different types of agents contracted. On the other hand, Jepkorir (2010) study focuses on the challenges faced by Kenyan commercial banks in adopting financial innovations.

[3] For a more detailed discussion on financial innovation drivers see section 3.2 of this study

All these studies have followed a consistent pattern of providing descriptive statistics on the financial innovations in Kenya but the studies fall short of empirical analysis. This lack of empirical rigour with regard to financial innovations is observed in other countries as well. Nevertheless, it is imperative that the value of financial innovation to the innovating firms be established if firms are to innovate in future. Frame and White (2004) contend, the adoption and spread of an innovation or its diffusion across an industry can generate positive returns to the firm. In addition, recent studies find that financial innovations have indirect positive benefits to the economy, which include encouraging productive investment and savings decisions (Frame & White, 2014).

To explain the link between financial innovations and firm performance, a number of studies have been carried out in Kenya. For example, Makini (2010) studies the relationship between financial innovation and financial performance of commercial banks in Kenya. The study uses descriptive survey with questionnaires used to collect data and reports descriptive statistics as the only results from the study. A similar approach has been used by Mwando (2013) in studying the contribution of agency banking to financial performance of nine commercial banks in Kenya. The study uses descriptive survey with questionnaires sent to 36 respondents in the banks under study and finds that firstly, regulation has contributed to the growth in agency banking. Secondly, agency banking has enabled commercial banks to reduce transaction costs. However, none of the reviewed studies has taken a holistic approach to the study of financial innovation and its impact on firm financial performance. These studies, and others discussed in the literature review, therefore, have left knowledge gaps in the field of financial innovations, especially in Kenya, which the present study seeks to address.

Firstly, very little is specifically known with respect to what the drivers of financial innovations at both firm and macro levels in Kenya are. Additionally, there exists a dearth of studies focusing on emerging financial innovations in branchless banking models in Kenya. This has both managerial and policy implications. If the drivers of financial innovations at firm level are unknown to the management, it is impossible for the management to allocate resources to promote them. In addition, if the government is unaware of the drivers of financial innovations at macro level, government policies are likely to stifle financial innovations, with no appropriate feedback to inform policy.

Secondly, failure or inability to empirically assess the value of financial innovations to innovating firms, has managerial implications in the sense that, in the absence of empirical evidence linking financial

innovation to firm financial performance there is no incentive to innovate. Consequently, studies that have attempted to link financial innovations to firm performance have created a bypass around empirical approaches, consistent with Frame and White's (2004) findings. The implication of this state is that most of the findings are largely anecdotal owing to the subjective nature of the responses to questionnaires.

Thirdly, there is absence of studies on the speed of adjustment of financial innovation to financial innovation drivers. The implication is that if the speed of adjustment is unknown, the management and the research community lack empirical evidence on which of the financial innovation drivers (firm or macro level drivers) are more important in accelerating financial innovations. Moreover, there is lack of empirical evidence on the speed at which firm financial performance adjusts to financial innovation usage. In the absence of the knowledge on the speed of adjustment, it is difficult or impossible to know the time lag between the adoption and usage of financial innovation and the resultant effect on firm financial performance.

The present study addresses these research gaps in a number of ways. Firstly, the research covers financial innovations in two industries namely banking and telecommunications. The financial innovations in the banking industry covered in the study include; bank focused models and bank led models. Non-bank led models financial innovations are found in the telecommunications industry. To address the gap in knowledge on the sources of financial innovations, this study carries out an empirical analysis of the financial innovation drivers at both firm and macro levels. Secondly, the study seeks to determine the value of financial innovation in terms of its contribution to firms' financial performance. Lastly, the speed of adjustment of financial innovation to financial innovation drivers has been tested. In addition, the speed of adjustment of financial innovation to financial innovation drivers has been tested. The speed of adjustment has been tested using Koyck mean and median lag. The study uses a positivist research design with the help of dynamic panel estimation using 10-year firm data[4].

[4] For more details see chapter seven of this study

1.8 Research Objectives

The main objective of the study is to establish the link between financial innovations usage and bank performance in Kenya. The secondary objectives are to establish the:

- Firm level drivers of financial innovations usage Kenya.
- Macro level drivers of financial innovations usage in Kenya.
- Speed of adjustment of firm financial performance to financial innovations usage in Kenya.
- Speed of adjustment of financial innovations to financial innovation drivers in Kenya.

1.9 The structure of the thesis

Chapter one introduces Schumpeterian economic thought which attributes the successful introduction of products, processes as well as organisational innovations to superior firm performance. The chapter reviews the background of the study including the recent branchless banking financial innovations in Kenya. The financial innovations have positioned Kenya as the global leader in mobile money, making Kenya an appropriate unit of analysis for financial innovation studies. The motivation for the study, the problem statement and the research objectives have been discussed in the Chapter.

The rest of the thesis is structured as follows: Chapter two discusses the theoretical framework upon which this study is grounded. Chapter three provides the empirical literature on financial innovations. Chapter four discusses the empirical literature on firm performance. Chapter five deals with hypotheses development. Chapter six discusses the research methodology. Chapter seven discusses the empirical results. Chapter eight provides the conclusion of the study, contribution of the study and directions for future research.

CHAPTER TWO

THEORETICAL FRAMEWORK

2.0 Introduction

This chapter reviews the theoretical framework upon which this study is grounded. The study is grounded on the Technology-Organisation-Environment (TOE) framework, resource based theory/view (RBV) as well as innovation adoption and usage literature. The study uses the three frameworks to explain the value of financial innovation adoption and usage by firms. It is evident from the literature reviewed in chapter three that the four branchless banking models under review are largely technology driven and technology dependent. Since the financial innovations are technology driven and technology dependent, it is therefore appropriate to study the innovations using frameworks that have been widely used in the study of technological innovations. The chapter contains the following sections: 2.1 Adoption, diffusion and usage of innovations 2.2 Technology-Organisation-Environment (TOE) framework; 2.3 Resource Based View 2.4 Conclusion of the chapter.

2.1 Adoption, diffusion and usage of innovations

Innovation is an idea which an individual perceives as new, where the newness of the idea determines the individual's reaction to it (E. M. Rogers, 1995). Rogers argues that the idea need not be 'objectively' new to the individual considering the time elapsed since the first time it was discovered. Tushman and Nadler (1986, p. 75) Define innovation as "…the creation of any product, service or process which is new to a business unit..." Tushman and Nadler's study identifies two types of innovations: product and process innovations. According to the authors, product innovations refer to changes in a company's product or the service it renders while process innovation is the change in the way a product is made or the service is rendered. They further demonstrate three degrees of innovation within the product and process innovations namely; incremental, synthetic and discontinuous innovations. Branchless banking models are both product and process innovations but to a large extent they represent process innovations. Whereas mobile banking is a new product (therefore, product innovation) internet banking, ATMs and agency banking, are process innovations since they mark a change from the traditional ways of delivering banking services through bank branches.

According to Baker (2011), innovations producing incremental change bring in new elements or new versions of technologies currently existing. Baker (2011) contends that adopting organisations perceive

incremental innovations as representing the least level of risk and change and those generating synthetic change as a middle point of moderate change, enabling a better combination of existing technologies. The study concludes that innovations producing discontinuous change signify a major exit from existing technologies or processes. Radical innovations would be more challenging to implement than discontinuous innovations owing to natural human resistance to change. However, Ettlie, Bridges, and O'Keefe (1984) consider innovations producing discontinuous change as 'radical' (thus radical innovations), especially process innovations require a unique strategy and structure to implement.

The financial innovations covered in this study are in the three degrees of innovation. ATMs and internet banking would for example represent incremental innovations and therefore signify the least level of risk, since a bank can easily install ATMs without incurring substantial costs or change in management structure. In addition, internet banking does not require major changes in the bank's operations or cost structure. Agency banking, which entails the use of third parties would be classified as synthetic innovation since it requires a lot of investment and establishment of agency network fully equipped with POS terminals. These terminals give agents access to the customers' accounts held at the customers' banks. On the other hand, mobile banking embodies a radical or discontinuous innovations, which require a unique strategy and structure to implement. Mobile banking for example does not require the customer to have a bank account. The customer only needs an ordinary mobile phone and an e-money account with the mobile phone service provider, which they can open for free. No account maintenance fee and no need to visit the bank branch or the mobile phone company offices. Irrespective of the degree of financial innovation, the financial innovation will follow the process of adoption, diffusion and usage by a firm.

According to E. M. Rogers (1995, p. 21), adoption process is "…the process through which an individual (or other decision making unit) passes from first knowledge of an innovation to forming an attitude towards the innovation, to a decision to adopt or reject, to implementation of the new idea and to confirmation of this decision..." E. M. Rogers (1962) argues that in spite of the significant investments in developing and communicating innovations there are many time lags between the development of an innovation and the time of adoption of the innovations. The author contends that this is in spite of the significant investment in developing and communicating the innovations.

Advancements in ICT, emergence of a range of social media platforms as well as the rise in mobile phone subscriptions have made it easier for diffusion of internet and mobile phone dependent innovations. For

example, Toole, Cha, and González (2012) posit that innovation is largely influenced by social and mass media and that advertising through the mass media significantly influences innovation adoption compared to word of mouth. However, although there exists advanced mobile payment technologies, Schierz, Schilke, and Wirtz (2010) observe that adoption of mobile payments have not kept pace with the growth in mobile technologies. Their empirical study of the factors determining consumers' acceptance of mobile payment services concludes that compatibility, individual mobility, and subjective norm largely influence the adoption of mobile phone payments.

Variation in adoption of mobile payments varies across countries depending on the level of economic growth of each country. As discussed in section 2.4, network externalities and the effects of multisided markets largely affect the adoption and usage of electronic and mobile payments. Katz and Shapiro (1986) argue that network effect or externality occurs where the value of a product to one user is dependent on the number of other users of the same product. Mobile payments in developed countries have failed to attain a critical mass of users necessary for the success of the payment system. On the other hand mobile payments in developing countries have grown exponentially and are seen as serving a sizeable population hitherto excluded from the formal financial system due to poverty.

The adoption and usage of certain types of innovations is influenced by the human behaviour and individuals' perceptions with regard to the risk of adopting the innovations. For instance many users of internet banking fear that the limited interaction they have with banking staff exposes them to the risk of fraud involving the customers' bank accounts. In their study of adopters and non-adopters of internet banking, Patsiotis, Hughes, and Webber (2012) observe that majority place a premium on human interaction accorded by the bank staff and are concerned with risk inherent in internet banking and lack of pre-adoption trial. Additionally, a recent study by Martins, Oliveira, and Popovič (2014) buttresses Patsiotis (2012) work. Martins et al. (2014) posit that firstly, individual expectations with regard to expected performance, effort expectancy, perceived risks and social influence significantly explain usage of internet banking. Secondly, users' intentions, facilitating conditions are not significant in explaining the usage.

According to Frambach and Schillewaert (2002), adoption decisions take place between initiation and implementation stage. The authors argue that when an organisation gets to know about new innovations, it develops an attitude towards them and assesses the new products at the initiation stage. Once an

innovation has been evaluated, the organisation makes a decision on whether to adopt and use the innovation or not. Hence, innovation diffusion is considered a complex and multistage process which commences at adoption and later extends to usage and value creation to the firm (Cooper & Zmud, 1990; Fichman, 2000). As Frambach and Schillewaert (2002) posit, the innovation process becomes successful upon its acceptance and integration into the organisation and the demonstration of commitment through continued use of the innovation. This commitment is what E. M. Rogers (1995) sees as the decision to fully use the innovation as the only best available alternative.

The implication of the preceding studies is that the usage of innovations is more important than the innovation itself and more important than innovation adoption, since many firms fail to attain significant usage of innovations beyond initial adoption (Chatterjee, Grewal, & Sambamurthy, 2002). For instance, if an organisation innovates or adopts an innovation but does not use the innovation, such an innovation is of no value to the organisation. This argument would explain why a recent stream of literature has focused more on innovation usage as opposed to actual innovation and adoption of the innovations. Notably, although past studies have focused on adoption of e-business innovations, Zhu and Kraemer (2005) work has focused on post-adoption stages. The stages include the actual usage and value creation from e-business. The authors argue that these constitute critical stages with respect to the conduct of online business.

While past studies have shown that actual usage of ICT innovations is linked to ICT value, the link appears to be omitted in the literature (Devaraj & Kohli, 2003). This omission could be explained by the fact that a sizeable number of studies has focused on adoption versus non adoption and 'intent to adopt' (Zhu & Kraemer, 2005). Later work of Zhu, Kraemer, Gurbaxani, and Xu (2006) observes that promising innovations which fail to attain wide adoption, curtail the benefits that would accrue from their invention. The adoption and usage of innovations should generate value to a firm in terms of increase in firm profitability or rise in shareholder wealth represented by a surge in market prices of the company's shares. Nonetheless, Devaraj and Kohli (2003) study of diffusion of innovations argues that before an innovation can generate business value, it must be integrated into the corporate value chain. As to whether the usage of innovations in general and financial innovations in particular generates value to the firm adopting and using the innovations, the debate is inconclusive.

Most studies on financial innovations have focused on developed economies and appear to generalise the value generated from the use of financial innovations across all countries. Nevertheless a number of studies maintain that there is a need for the re-examination of theories developed in the context of mature markets and industrialised economies, owing to disparities in economic and regulatory environments (Austin, 1990; Zhu & Kraemer, 2005; Zhu, Kraemer, & Dedrick, 2004). This argument is consistent with Rosenzweig (1994) work that is critical of the notion of conceptual equivalence in management research across different cultures and economies. It is imperative, therefore, that the value from financial innovation usage be established if the firm or other firms are to use the innovations in future.

2.2 Technology-Organisation-Environment framework

The study of the adoption and usage of technological innovations can be done using the technology-organisation-environment framework (Tornatzky & Fleischer, 1990). According to Tornatzky and Fleischer, factors in the environmental and organisational context coupled with the technology itself fundamentally affect technological innovation adoption decisions. The TOE framework shows how the adoption and implementation of innovations is affected by the firm context (Baker, 2011). The TOE framework entails a threefold context for adopting and implementing technological innovations; technological, organisational and environmental contexts (Y.-M. Wang, Wang, & Yang, 2010)

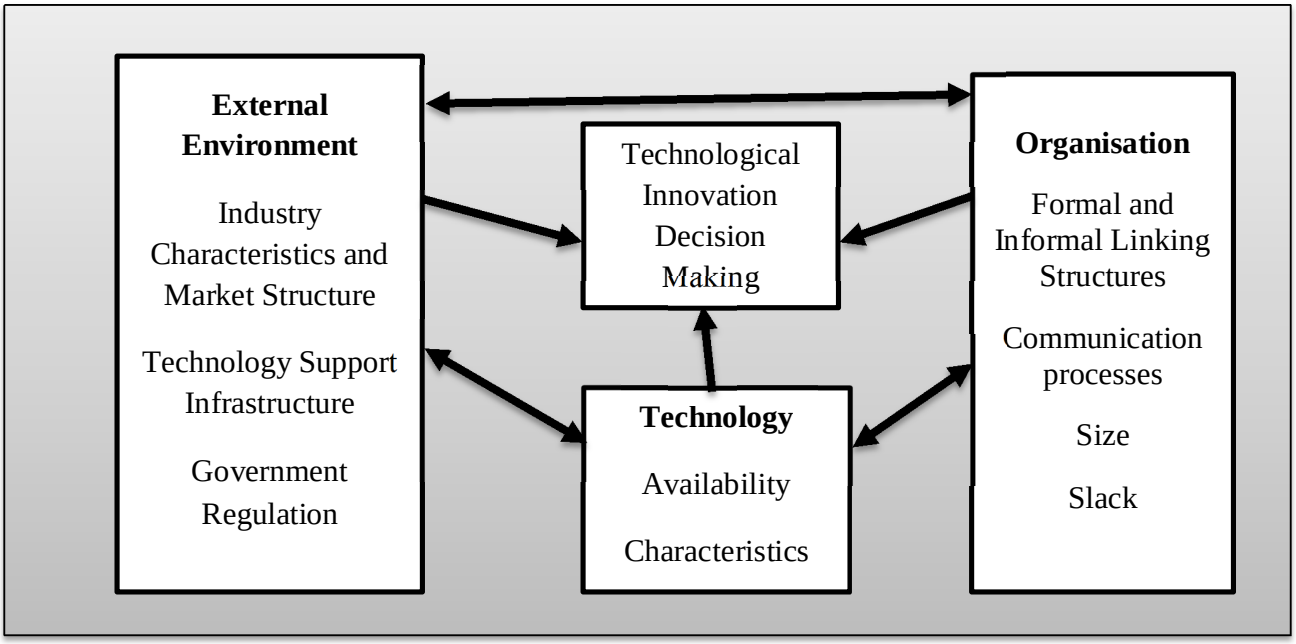


Fig 2.0: Technology-organisation-environment (TOE) framework (Tornatzky & Fleischer, 1990)

Technological Context

Technological context refers to technologies relevant to the firm including technologies already being used by the firm and the ones not in current use but available in the market (Baker, 2011). Advancement in electronic payments have led to the emergence of electronic money (e-money), which can be transferred through cell phones. For instance, Hughes and Lonie (2007) links the M-Pesa money transfer in Kenya to e-money technology. For a firm to be able to adopt and use new technologies, its current information and communication (ICT) infrastructure must have the ability and capacity to adopt and use the new innovations. A firm that possesses superior technologies will have an advantage over the firm that uses outdated hardware and software.

The speed of adoption between two firms may vary depending on the quality and quantity of the ICT infrastructure they use. According to Collins, Hage, and Hull (1988), technologies currently used by the firms are important in the adoption process since they define the limit on the scope and pace of a firm's technological change adopted. Technologies currently being used by the firm should be compatible with the new innovations for the firm to be able to fully exploit the potential of the new innovations. More importantly, technological context refers to not only the internal but also the applicable firm's external technologies (Oliveira & Martins, 2011).

Technological innovations are prone to network externalities, where the value of the product to one user is largely dependent on how many others are using similar product. The implication of network effects or externalities is that the firm should consider owning or using technologies that are widely used in the market. This is important because of service costs and replacement of parts. A firm needs to have not only hardware and software but also high speed and reliable internet connection to be able to connect to other firms. This is critical especially for a provider of financial innovation product such as online banking. Koellinger (2008) analysis of the link between the use of internet based technologies, innovation types and firm level performance finds that internet based technologies are critical in enabling the adoption of innovation.

Technological context should be considered at both firm and macro level. At macro level the role of the state in providing telecommunications infrastructure such as fibre optic cable network and licensing of 4G network, is critical in adoption of technological innovations in general and financial innovations in particular. The state also plays a critical role in providing regulatory and legal framework that guides the

usage and adoption of the innovations as well as the enforcement of (digital) contracts. Technologies available at macro level enable firms to create linkages which broaden the network adopting the innovations. As the network attains a critical mass, the value of the financial innovation to each individual firm increases with positive implications on the firm's financial performance.

Organisational Context

The context of an organisation or a firm to a large extent determines adoption and usage of innovations by the firm. Firms are generally heterogeneous in many respects. For example firms have different resource endowment in terms of assets, human capital, networks and surplus resources available for adoption of innovations. Organisational context relates to measures that describe a firm including the scope, firm size and the structure of management (Oliveira & Martins, 2011). Additionally, context includes characteristics and the resources a firm controls such as the linkages between employees, communications within the firm and the level or degree of a firm's slack resources (Baker, 2011). A number of studies have attempted to link firm size to innovation but the literature on innovation is divided on the role of firm size to innovation adoption and usage. E. M. Rogers (1995) opines that firm size is a "surrogate" measure of a number of dimensions which collectively lead to innovations; namely aggregate resources, technical expertise of employees and slack resources.

According to Baker (2011), size and slack are seen as the most studied factors affecting innovations in the organisational context. Slack is defined as "…the pool of resources in an organisation that is in excess of the minimum necessary to produce a given level of organisational output" (Nohria & Gulati, 1996, p. 1246). Although slack is helpful and desirable, Tornatzky and Fleischer (1990, p. 161) argue that it is "…neither necessary nor sufficient for innovation to occur". However, a firm with slack or surplus resources is able to take advantage of emerging new innovations by acquiring the infrastructure necessary for adopting and using the innovations. In addition, the firm has capacity for developing and using its own innovations. Large firms have resource advantages which enable them to initiate innovations and adoption (Damanpour, 1996; E. M. Rogers, 1995). Bhattacharyya and Nanda (2000) opine that investment banks with large market shares have high inclination towards financial innovation. They argue that larger firms invest more in process innovations, which reduce costs whereas small firms invest in new product development. These findings are consistent with Yin and Zuscovitch (1998) study which posits that large and small firms are guided by different investment incentives in determining whether to invest in process or product innovations. As firms expand and grow, the number of internal and external

linkages expand as well, creating a need for efficiency in operations. This would explain why large firms are more interested in process innovations. On the other hand, small firms are more interested in increasing their market share by developing innovative new products targeting a selected niche market.

Large firm size may not necessarily imply higher innovation adoption or usage. Larger firms are likely to have fragmented and incompatible systems which could increase complexity and cost of adoption (Zhu, Kraemer, & Xu, 2006). As firms expand their customer bases, increase the number of personnel, open new branches and enter into new mergers and partnerships, the linkages become more and more complex. Nevertheless, Tushman and Nadler (1986) observe that innovation is promoted by mechanisms that connect organisations' internal sub units or go beyond internal boundaries. Complex business processes, deep-rooted organisational structure and the hierarchy of decision making could further complicate the changes in structures and processes in large firms (Zhu, 2004). The end result of this complexity is slow decision making or sub-optimal decisions regarding investment in innovations. Notwithstanding the fact that the debate on the role of organisational context in the adoption and usage of innovations appear inconclusive, significant number of studies have found a link between firm context and innovations (Frame & White, 2004; Lerner & Tufano, 2011; Tufano, 2003). This study strongly links firm context in general and firm size in particular with adoption and usage of financial innovations in view of the reviewed literature.

Environmental Context

This is the stage where a firm does business, comprising its industry, competition and government dealings (Oliveira & Martins, 2011). Environmental context encompasses industry structure, availability or non-availability of technology service providers and the environment of government regulation (Baker, 2011). According to Baker, privacy laws requiring banks not to disclose their customer data could hinder banks from developing technologies which could enable customers access their accounts easily. Baker argues that government regulation could either increase or reduce the cost of innovations. The environment within which firms operates creates opportunities and threats to their innovation adoption and usage efforts. For example, as discussed later in chapter two, regulation and taxes deemed supportive of financial innovations at firm level are likely to spur innovation adoption and usage. The type of innovations a firm adopts must be compatible with the innovations or technologies in use by the industry. This is necessary because in the case of a bank which wants to adopt technologies for enabling

funds transfer, it must consider the compatibility of the system to the systems in use by the other banks, otherwise transfer transactions will not be executed.

Financial innovations literature has identified three main environmental factors encouraging the development of financial innovations namely: Regulation and taxes, globalisation, and risks and incompleteness in financial markets (Boyer, 2000; Calomiris, 2009; Tufano, 2003). Regulations and taxes have led to the development of financial innovations designed to sidestep regulatory restrictions on individuals' financial activities (Calomiris, 2009). Globalisation environment exposes firms to foreign exchange risks, interest rate risks, political risks and transaction exposure risks (Boyer, 2000). According to Lütz (1998), governments in the 1970s allowed financial innovations to increase through the elimination of foreign exchange controls.

The use of TOE in Innovation Research

The TOE framework has been applied to study different types of innovations (Oliveira & Martins, 2011). These studies include; electronic data interchange (EDI) (Kuan & Chau, 2001); open systems (Chau & Tam, 1997), e-business (H.-F. Lin & Lin, 2008; Salwani, Marthandan, Norzaidi, & Chong, 2009; Zhu & Kraemer, 2005), enterprise resource planning (ERP) (Pan & Jang, 2008), business to business (B2B) e-commerce (Teo, Ranganathan, & Dhaliwal, 2006), and knowledge management systems (KMS) (O.-K. Lee, Wang, Lim, & Peng, 2009). The studies show that the TOE model has wide applicability and is capable of explaining innovation adoption across a range of technological and industrial as well as national or cultural contexts (Baker, 2011). According to Baker, the empirical studies which test the TOE framework used fairly diverse factors to assess technological, organisational and environmental contexts. With this robust support, the TOE framework is adopted for the study of financial innovations in the present study.

2.3 Resource-Based View

According to RBV, firm performance is based on the unique resources which the firm controls and its ability to combine the resources to create value. RBV posits that firms create value by combining economically valuable resources that are hard to imitate (Barney, 1991; Peteraf, 1993). The resources include expert human capital, superior production technology, superior ICT infrastructure, patents, and other resources which are not sufficiently owned by competing firms. According to Barney (1991), RBV assumes that firms are heterogeneous or different in terms of the strategic resources they control and that

the resources are not freely perfectly mobile across firms. Ownership or control of unique resources may not by itself guarantee superior firm performance. As Salwani et al. (2009) posits, superior firm performance is attained when a firm not only acquires unique resources but also exploits the resources to give it superior competitive advantage. A firm's resources are valuable only and only if they lower the costs to the firm or increase the firm's revenues compared to what would have been the case in the absence of those resources by the firm (Barney, 1991). The RBV was developed to show how firms achieve sustainable competitive advantage (Caldeira & Ward, 2003). A firm is said to have competitive advantage when its current or potential competitors are unable to simultaneously implement a strategy currently being implemented by the firm (Barney, 1991). According to Barney, a firm enjoys sustained competitive advantage when other firms are unable to duplicate the benefits which give the firm competitive advantage. Superior firm performance and competitive advantage is achieved when a firm has attributes that are costly to imitate (Conner, 1991)

While RBV may be prone to limitations typical of other theoretical frameworks, the framework has been widely applied in a number of studies. For instance, Amit and Zott (2001) argue that each theoretical framework has weaknesses especially when applied in the context of highly interconnected electronic markets. Moreover, Priem and Butler (2001) argue that the value of the resources held by firms in the RBV framework is largely determined by the market environment in the course of opportunities and threats to the firm. They argue that in view of this, the resource values are determined by sources outside or exogenous to RBV so that in the event that product and customer factors vary, the resource values may vary as well. The study shows that such variations in resource values may lead to unpredictable changes in resource values causing indeterminate outcomes when carrying out resource based analysis.

However, Zhu (2004) uses the RBV framework to demonstrate that e-commerce capabilities coupled with ICT infrastructure create complementarities in resources that explain variations in performance across firms. The study concludes that the firm is more likely to develop unique capabilities from its main ICT infrastructure the more it uses ICT architecture. According to Zhu and Kraemer (2005), RBV model provides a theoretical foundation for linking the use of e-business and firm value, where firm value of IT depends on the degree to which a firm uses IT in the firm's value chain. This study suggests that firms with adequate resources develop and adopt financial innovations more than less endowed firms. It is also posited that the adoption and use of financial innovations can lead to significant firm

financial performance. Financial innovation is viewed in the present study as a valuable resource to the firm that can increase a firm's financial performance.

2.4 Conclusion of the Chapter

Chapter two has reviewed the theoretical framework upon which the study is grounded. From the literature reviewed, three frameworks have been discussed namely; 1) Adoption, Diffusion and Usage of Innovations 2) Technological-Organisation-Environment and 3) The Resource Based View. The adoption, diffusion and Usage of Innovations literature argues that although the adoption and diffusion of innovations is important, it is the usage of the innovations that ultimately adds value to the firm. This argument explains why the major emphasis of this study is on the usage of financial innovations as opposed to the adoption and diffusion of the innovations. The TOE framework provides an explanation on how the dependent and independent variables are linked and the appropriate approach to the study of innovations. According to the TOE framework, any study of technology dependent and technology driven innovation should focus on three aspects. These aspects relate to the technology in use at both the firm and macro levels, the characteristics of the organisation and the environment within which the organisation operates. Lastly, the RBV opines that firms with substantial resources outperform the firms with modest resources in terms of the adoption and usage of innovations in general. The implication of RBV is that firm size in general and firm characteristics in particular are critical drivers of financial innovations.

CHAPTER THREE

EMPIRICAL LITERATURE ON FINANCIAL INNOVATIONS

3.0 Introduction

The recent technological advancements in mobile telecommunications, coupled with advancements in data processing technologies have contributed to dramatic changes in the way banking business is conducted in Kenya. These changes have to a great extent led to a new generation of financial innovations in form of branchless banking that appear to redefine Kenya's banking business. For example, the ability to transfer money from mobile phone to another mobile phone, transfer money from mobile phone to a bank account, deposit and withdraw cash through automated teller machines, access bank accounts online, transfer cash from the bank account online to a mobile money account and transact a range of transactions through third parties (agency banking). More importantly, the financial innovations have grown rapidly making Kenya the global leader especially in mobile money with a number of implications for Kenya and global economy in general. Firstly, according to Merton (1992), a financial system should allocate and deploy economic resources spatially and over time, in an uncertain environment as its main function. The function of the financial system entails a payments system with a medium of exchange that enables the transfer of funds from savers to borrowers as well as savings accumulation (Frame & White, 2014). Secondly, Frame and White argue that finance is the main driver of both production and consumption activities and therefore developments in the financial sector have economy-wide ramifications.

As interest in financial innovations rises so is the intellectual curiosity regarding what exactly drives financial innovations at both firm and macro levels. Establishing these drivers at firm level would inform management decisions regarding resource allocation in support of financial innovations but on condition that the value of financial innovations at firm level is established. Determining the drivers of financial innovations at national level informs policy direction, which can for example result in regulatory actions to either support or curtail such innovations. If the value of financial innovations at firm level is established such as its link to firm financial performance, this has implications for the government in terms of revenue collections in form of corporate taxes. This chapter contributes to the emerging debate on the drivers, adoption, diffusion, usage and the value of financial innovations. The chapter introduces the empirical literature on financial innovations by reviewing studies on a number of topics in the field.

The breakdown of the chapter is as follows: Section 3.1 Definition of financial innovation; 3.2 The drivers of financial innovations; 3.3 The value of financial innovation; 3.4 Empirical studies on the diffusion and adoption of financial innovations; 3.5 Branchless banking models; and 3.6 Conclusion of the chapter.

3.1 Definition of Financial Innovation

Financial innovation is an area of financial economics that has attracted significant research interest in academic as well as corporate circles (Lerner, 2006; Lopez & Roberts, 2002). Tufano (2003) defines financial innovation in broad terms as "the act of creating and then popularising new financial instruments as well as new financial technologies, institutions and markets" p.4. According to the study, innovations can be categorised into *process* innovations and *product* innovations. The author opines that product innovations are signified by new financial instruments while process innovations are epitomised by innovative methods of distributing the financial products, dispensing transactions or pricing them.

The last few decades have witnessed an unprecedented increase in the number and types of financial innovations in both developed and developing countries. For example, M. H. Miller (1986) describes the developments in financial institutions and financial instruments used in the financial markets as a *revolution* but postulates that the wave of financial innovation was subsiding at the time of the study. This argument, however, is anecdotal and inconsistent with the recent financial innovation literature. For example the views of Merton (1986) are discounted by Tufano (2003), who proves that financial innovations shot up as evidenced by the significant number of new financial products and derivatives developed since Merton (1986) study. The author observes that though innovation fluctuates with some periods exhibiting high levels of innovations and others experiencing low levels of innovation, in the long run financial innovation is a distinct part of a growing economy.

Tufano's findings resonate well with the recent developments in a new generation of financial innovations in Kenya, namely branchless banking models. Whereas most financial innovation studies in developed countries have largely concentrated on financial products, the study of process innovations appears to have been given a wide berth especially in developing countries. The emphasis of the present study is on the process innovations used in delivering financial products. Most of the literature reviewed has discussed the drivers of financial innovations but with emphasis on the drivers of new financial products (Frame & White, 2004; Tufano, 2003). It is not clear whether the identified financial innovation

drivers can be generalised in the context of process innovations in general and branchless banking models in particular. The next section discusses the drivers of financial innovations in general.

3.2 The Drivers of Financial Innovations

There are many and varying explanations as to what the drivers of financial innovations are, but it appears there is no universal agreement. This study reviews a number of drivers which appear to represent a general consensus.

a) Incompleteness in Financial Markets

A complete market exists when "…every contingency in the world corresponds with a distinct marketable security" (Horne, 1985, p. 621). Horne posits that when the number and types of available securities does not cover these contingencies, incomplete markets will prevail. Where there is an incomplete market it is not possible to span all the possible states of nature, leading to a situation where players are unable to move the funds freely over time and space and are unable to manage risks (Tufano, 2003). For a marketable security to cover every contingency in the world, the market where the security is traded will need to be efficient. Basu (1977) argues that in an efficient capital market, security prices provide unbiased estimates of the underlying values by fully reflecting the available information in a rapid and unbiased manner. This is supported by Malkiel (2005), who finds that equity prices rapidly adjust to new information, denying investors any arbitrage opportunities of attaining above average returns without accepting above average risks. The implication is that security prices will rise in response to breaking good news and fall in response to breaking bad news consistent with the random walk theory.

However, Ball (2009) argues that the Efficient Market Hypothesis (EMH) does not mean that one should be able to predict future security prices as this would make the market inefficient for failure to reflect the information contained in the forecast. The EMH argues that it is not possible for an investor to make abnormal returns by using the information that the market already has, casting aspersions on the value of financial statement analysis. A market can operate at a weak, semi-strong or strong form efficient. Borges (2010) argues that in a weak form efficient market security prices traded in the market cannot be predicted by use of historical price information, implying that prices in such markets are largely uncorrelated. In a semi-strong efficient market, security prices reflect past and published information, while in a strong efficient market security prices reflect the past, published and private (inside or private) information.

Households in incomplete markets, borrow by only accepting a financial contract specifying a fixed repayment (Sheedy, 2013). Due to unavailability of credit from formal sources for low income earners or households, such borrowers are forced to borrow from informal lenders at borrowing rates far above the market rates. However, Sheedy concedes that the borrower is largely uncertain as to the source of income that will be used to repay the borrowed amount, which leads to inefficient distribution of risks. Inefficient distribution of risks could be due to the fact that financial market imperfections are characterised by information asymmetry, weak institutions for contract enforcement and high transaction costs (Guizar-Mateos, 2013). In addition, incompleteness in financial markets is caused by financial repression and/or imperfect information (Steel, Aryeetey, Hettige, & Nissanke, 1997) . According to Johansson and Wang (2011), financial repression or financial regulation is one of the main causes of structural imbalances especially in highly regulated countries. Structural imbalances in an economy are evidenced by fragmentation in financial markets.

According to Steel et al. (1997), financial markets are said to be fragmented when they contain weak linkages between segments and wide variations in risk adjusted returns occur. Financial innovations are vital especially in fragmented African financial markets. According to (Ntim, 2013), African financial markets have historically been fragmented into dualistic markets, namely formal and informal markets. The study observes that although African stock markets have experienced fast expansion, the markets remain "...highly fragmented, small, illiquid and technologically weak, severely affecting their informational efficiency…" (p.53). As world financial markets integrate, the effect of market fragmentation is likely to decline. For example, recent studies provide evidence of increased integration in global financial markets (Beck, Demirgüç-Kunt, & Levine, 2010). Beck et al argue that global financial markets integration has led to high income countries benefiting from international lending and bond issues while low income countries have become beneficiaries of higher remittance flows.

The cost of remittances or funds transfer in incomplete markets can be very punitive in view of the high transaction costs incurred in remitting cash through official channels (Gupta, Pattillo, & Wagh, 2009) Considering a sizeable proportion of households in such economies live on less than a US dollar a day, the high commissions on remittances and funds sent to poor rural based relatives erode the incomes that would otherwise be used to purchase foodstuffs. Consequently, any innovation that substantially reduces such transaction costs is likely to be embraced by masses within a short time leading to immediate gains for the innovators. Studies show that financial innovations are as a result of incompleteness in financial

markets and thus innovations arise to complete the markets by introducing securities markets for securities with no close substitutes so as to hedge against crucial risks (Duffie & Rahi, 1995b; Tufano, 2003). Although financial innovations are designed to reduce risks in incomplete markets, recent studies show that overconfidence with respect to risks of new financial products was central to the 2008 U.S.A credit crisis (Araujo, Kubler, & Schommer, 2012). Process financial innovations such as mobile money and agency banking arise to address inefficiencies in customer service, high costs of service delivery as well as the high costs of funds transfer in inefficient markets (Masila, Chepkulei, & Shibairo, 2015).

Owing to the high degree of information asymmetry and moral hazards in incomplete markets the cost of lending is exorbitant. Gathering credit information on micro borrowers and administering the loan once lending is done can be costly and risky for big lenders. However, with innovations in mobile money lending for micro loans such as airtime and micro loans significantly hedges against such lending risks. This is because mobile airtime loans do not require collateral as is the case with microfinance loans. Additionally, mobile phone based micro loans use customer data on past customers' mobile money transactions already in possession of the mobile phone company and the loans are disbursed electronically using mobile money. The implication of this is that the cost of gathering customer information for purposes of lending micro loans as well as the cost of disbursing the loans is significantly reduced.

Developing countries have a lion's share of unfulfilled needs in financial markets and some of the innovations such as mobile money that have failed to take off in developed countries have become an instant hit in developing countries (Ingenico, 2012). Secondly, the low penetration of formal financial services in addition to the high rate of mobile subscription has significantly contributed to the rise in mobile payments (Capgemini & RBS, 2013). Consequently, the number of customers, number transactions and the value of mobile payments have substantially dwarfed comparative figures for the combined usage of ATM cards, credit cards, charge cards, POS machines, prepaid cards and debit cards (CBK, 2015).

These developments buttress Horne (1985) assertion that an incomplete financial market pays financial intermediaries to exploit incompleteness by tailoring the security offerings to the unfulfilled needs of the investors. Horne contends that financial innovations arise to capitalise on profit opportunities arising from the incompleteness in financial markets and financial intermediation inefficiencies. Horne argues that in truly competitive financial markets, the profitability of the financial innovation to the initial

promoter will diminish over time. The study holds that promoters' profit margins decline as financial innovation grows culminating in increased benefits to the consumer due to the decline in promoters' profit margins. On the other hand, although Horne (1985) observes that promoters' profit margins per consumer decline over time, the innovations will have attracted a critical mass of users (Keser, Suleymanova, & Wey, 2012), which compensate for the reduced profit margin per consumer. More importantly, since innovation is a continuous process, as the initial innovations reach their full life cycle, new and more interesting financial innovations arise in response to the emerging and dynamic needs of consumers. In the long run financial innovations will continue to rise the more financial markets become incomplete and in tandem with the emerging needs of consumers.

b) Agency Problems and Information Asymmetry

Jensen and Meckling (1976, p. 308) define an agency relationship as "... a contract under which one or more persons (the principal(s)) engage another person (the agent) to perform some service on their behalf, which involves delegating some decision making authority to the agent..." The authors argue that agency cost is the aggregate of costs incurred by the principal to monitor the agent, bonding costs by the agent and the residual loss. The study posits that, firstly, monitoring costs entail budget restrictions, policies regarding compensation and rules of operation while residual loss is the cost arising from the agent's diversion of commitment from the principal's firm. Secondly, bonding costs are incurred by the principal to reward the agent to ensure that the agent does not engage in activities, which would amount to conflict of interest and to ensure that if the agent undertakes such acts, the principal will be adequately compensated by the agent. Thirdly, as managerial ownership decreases, agency costs increase. These findings are consistent with J. S. Ang, Cole, and Lin (2000) study, which posits that agency costs are higher among firms whose management owns less than 100 % shares and that as equity share of the owner declines, agency costs increase.

Agency problems arise even where the managing director (or management) controls 99% shareholding since the director or the management remains an agent or agents for the other one percent shareholders. In general, every employee is an agent of the shareholders and hence, failure or refusal of the employee to perform well would lead to agency problems. In the banking sector, agency problems arise where: The management fails either knowingly or unknowingly to carry out due diligence when appraising loan applicants leading to bad debts, frauds, poor customer service or low staff efficiency with regard to customer service rate per staff member. In such cases, banking halls get congested, customer

dissatisfaction grows, and staff morale goes down resulting in bank's poor financial performance in the long run. Poor staff performance could be related to the systems and processes in use at the bank. If the systems are user friendly and fast, this has positive implications in terms of efficiency score per staff, which is measured by the number of customers served by an employee over a given time period. However, an attempt by the management to resolve staff performance issues could lead to conflict of interest between the management and shareholders.

Berle and Means (1932) argue that conflicts of interest between owners and management may occur if management re-invests the company's profits to enlarge the management's power. According to the study, conflict of interest may arise if the management increases staff benefits above the competitive standards out of professional pride. The authors demonstrate that management may also improve labour quality above the level where stockholders would possibly generate optimum returns. Recent developments in global financial markets have put a spotlight on the role of agents in corporate governance. For instance, French et al. (2010) consider agency problem as one of the major causes of the global financial crisis experienced in 2007. This could be explained by the significant expenditures by executives of the top companies at heart of the financial crisis. Such expenditures include the purchase of executive jets, extreme executive salaries and bonuses even when the companies were at the risk of liquidation as well non-value adding mergers and acquisitions. French et al observe that conflicts of interest that cannot be easily addressed through contracts or markets may occur all over the economy and can harm the entire financial system.

Agency relationships may create costs associated with information asymmetry as far as the company's performance is concerned. This is because the management at any given time has information that is not available to outsiders in general and investors in particular (Boot & Thakor, 1997; Healy & Palepu, 2001; Oluwabiyi, 2014). Although the principal is the provider of capital, the agent holds superior information relative to the principal, which forces the principal to use incentive contracts to curtail transaction costs (Holmstrom, 1989). Morck and Yeung (2003) observe that agency problems exist even in family businesses in spite of the fact that in most economies family businesses are the dominant firms (Porta, Lopez-de-Silanes, & Shleifer, 1999). Morck and Yeung observe that in firms with wide ownership, the major concern is that professional agents or managers will fail to act in the owners' or public (owners)

best interest. They prove that family-owned firms' concern is that managers may choose to act in the best interest of the controlling family or families at the expense of other shareholders.

The problems associated with information asymmetry between a buyer and sellers of an investment product, commonly referred to as the 'lemons problem,' have been exemplified in a number of studies (Akerlof, 1970; Myers & Majluf, 1984; Zhang, 2014). According to Akerlof, information asymmetry leads to economic cost of dishonesty which comprises the sum by which the purchaser is cheated and the loss incurred from driving genuine firms out of businesses. This is consistent with F. Allen and Gale (1999) who show that participation of firms and investors in complex stock markets is hampered by the need for expensive information acquisition and analysis. According to Tufano (2003) the early history of development of securities shows that innovations were in response to information asymmetries. Tufano observes that certain innovations in the nineteenth century capitalised on the availability of more reliable and cheaper information. According to Akerlof (1970), developing countries take the lion's share of dishonesty in business and that credit markets in these countries strongly reflect the operations of the 'lemons principle'.

The 'lemons' problem in developing countries has been exemplified in later studies such as Anayiotos (1994), (Menkhoff, Neuberger, & Rungruxsirivorn, 2012) and (Mieno & Chaleunsinh, 2014). These findings have implications for financial innovations in developing countries in general and Kenya in particular. Firstly, high levels of information asymmetry increases agency costs and thus provides a higher incentive for development of financial innovation than in developed countries. Secondly, the needs of the households in developing countries are not homogeneous to those of developed countries owing to variations in the level of economic development. This means that agency problems in developing and developed economies are heterogeneous as well. Thirdly, the nature of financial innovations that appeal to the developed countries may not necessarily appeal to developing countries.

c) Transaction Costs

Financial innovations arise in order to minimise transaction costs (Merton, 1989) and maximise revenues while minimising marketing costs (Madan & Soubra, 1991) inherent in security design environment. Merton (1989) views are consistent with (Tufano, 2003) work, which demonstrates that the significant growth in ATMs and smart cards is propelled by the need to reduce transaction costs. The study concludes that ATMs have a potential to reduce transaction costs by a factor of 100. Innovation in payment systems

are in the process of replacing traditional paper based payments in a number of countries. According to (Humphrey, Kim, & Vale, 2001), electronic payments cost between one third and one half compared to paper-based non cash payments. Humphrey *et al.* contend that transaction type and the average value to a great extent determine which payment instrument a user will use and this varies from country to country. The study encapsulates the transactions as; POS payments, payments of bills, payroll payments and financial payments business to business dealings.

In the Kenyan context, these types of transactions have been significantly reduced since the advent of branchless banking models. More specifically the introduction of mobile money has substantially reduced the cost of electricity bill payments, rent payments and payroll disbursements costs among others. Secondly, it costs more for a customer to use the banking hall services than it does for using ATMs, internet banking or mobile banking. The use of agency banking or banking through third parties has materially reduced the customer traffic in the banking halls thereby increasing the efficiency score of the banking staff.

The introduction of agency banking means that most of the customers who used to be served in the banking halls can now be served by the wide network of bank agents distributed across the country, thereby reducing staff payroll costs. It is now possible to print bank statement online or through the ATMs for free and transfer funds to third parties online at minimal costs. Innovations in mobile payments were introduced in Kenya in 2007 at a time commercial banks, Western Union and MoneyGram dominated the money transfer business. Mobile payments were dismissed as inconsequential by the existing players at the time. Eight years down the line, mobile payments are the dominant cash transfer options in the country (CBK, 2015).

Mobile payments have revolutionised the money transfer industry in the recent past. The introduction of mobile payment system M-Pesa and other mobile payment platforms in Kenya has forced the established money transfer companies such as Western Union and MoneyGram to substantially reduce their money transfer charges (Mbiti & Weil, 2011). These examples provide evidence of practical reduction in transaction costs credited to the usage of different financial innovations

d) Regulations and Taxes

The debate on the role of regulations and taxes in driving financial innovations appears inconclusive. One stream of literature suggests that regulations have a positive link to financial innovations while the other suggests a negative link. It is argued that if a tax system applies different tax rates on different income streams or on different types of assets, the higher taxed parties will find ways of reducing the tax burden (Frame & White, 2004). The study finds that higher taxation levels will lead to larger flow of financial innovations and that, regulations may or may not inhibit financial innovations. For example where regulation prevents banks from owning insurance companies, any innovation that would arise from joint ownership will not occur. As far as the relationship between regulation and financial innovation is concerned, Frame and White state that "…it is impossible *a priori* to assign a positive or negative sign to the connection between the stringency of regulation (however measured) and the pace of financial innovation" (2004, p.121). The implication of Frame White's (2004) findings is that the impact of regulation on financial innovation depends on the intention of the regulation or the tax regime introduced by the state.

Consequently, at firm level, management actions will be to counter either the new regulation or develop innovations that are supported by the new regulation or the new tax. This is consistent with Calomiris (2009, p. 65) argument that "...financial innovations often respond to regulation by sidestepping regulatory restrictions that would otherwise limit activities in which people wish to engage..." Management actions in response to stiff regulations aimed at curtailing financial innovations may lead to the development of complex financial products and processes designed to sidestep the regulation. Whatever the case, new innovations will be developed whether the regulation is positive or not. For example Miller (1986) argues that the major catalysts to successful innovations for the twenty years preceding the study were regulation and taxes that induced the development of a range of financial products. Such products, according to Miller author, include zero coupon bonds and Eurodollar Eurobonds, which were developed to hedge against capital gains taxes. The growth of financial innovations in the 1970s is linked to the deregulation by governments through abolishment of exchange controls (Lütz, 1998).

Although significant studies link regulation to financial innovations, Frame and White (2004) argue that no hypothesis has been tested to support the broad literature. This argument is consistent with Silber (1983) and Cohen and Levin (1989) studies. Alderson and Fraser (1993) study of auction rate preference

stocks, considers new security innovations by issuing firms for the period 1980s to early 1990s to establish the characteristics of early issuers and the motivations behind early redemption of the preferred stocks. The study posits that banks and thrifts deemed risk takers are early issuers and that this special purpose vehicle is driven by tax benefits. The authors' assertion of tax benefits from use of the security, however, is not supported by any empirical test. However, Frame and White (2014) contend that regulation can curtail innovation and at the same time promote others, in an attempt to bypass the regulation. For example, according to the authors, "…regulatory capital arbitrage – or the ability to hold a particular risk in a different form and receive regulatory capital relief for doing so – has been a key driver of U.S. mortgage securitization activity for two decades. Finally, taxes can spur financial innovations to the extent that they create incentives to repackage (or re-label) specific income streams so as to reduce tax liability…" (p.6). Conversely, recent study observes that financial innovations are more likely to cause bank instability and drops in performance in times of financial crisis in countries with very stringent capital regulations (Beck et al., 2014).

These studies reveal a broad consensus on the fact that regulation and taxes have an impact on financial innovation although this is not backed by adequate empirical evidence. The implication is that the impact of regulation and taxes on financial innovation is positive but the speed and magnitude of innovation will vary depending on the nature of the regulation or tax. Secondly, the impact of regulation on financial innovation is positive but with a different time lags depending on the intention of the regulation. Thirdly, if the regulation is meant to stifle financial innovation, management counter actions aimed at side stepping the regulation will have a longer time lag than when the intention of the regulation is positive. Consequently, it will take a fairly longer time to design financial products and processes aimed at countering the regulation than the time it would take to develop products and processes promoted by the regulation. The risk of developing financial innovations to sidestep regulations and taxes is that further regulation or tax may be imposed which makes the new innovations redundant, unattractive or illegal.

e) Globalisation and Risk

Globalisation "…refer to a high (and increasing) degree of interdependency and interrelatedness among different and geographically dispersed actors…" (Archibugi & Iammarino, 2002, p. 99). The authors contend that the economic application of new ideas and knowledge is technical, organisational, managerial and institutional. This argument suggests that innovations have implications for technical application, organisational structures, managerial decisions and institutional designs. According to

Norris (2000), globalisation eliminates national boundaries, integrates national economies, technology, governance and cultures thereby generating complex relations of mutual interdependence. The integration of national financial systems has led to the emergence of an integrated financial system which presents opportunities, risks and threats to financial innovation development. For example, globalisation exposes firms to foreign exchange risks, interest rate risks, political risks and transaction exposure risks (Boyer, 2000). The actors in the global financial system are affected by different political, economic, social, cultural, religious and legal environments that affect the design and distribution of their financial products and processes.

Empirical Evidence on Globalisation and Financial Innovation

The global business environment presents opportunities and threats to financial innovation development. The opportunities include relaxation of foreign exchange controls and integration of stock markets in different countries enabling cross listing. For example, Lütz (1998) shows that governments in the 1970s allowed financial innovations to flourish through the abolition of foreign exchange controls. The governments also allowed foreigners to be members of the stock exchange thereby creating cross border capital flows (Rousseau & Sylla, 2003). Additionally, cross border integration is largely accounted for by the pace of financial innovations (Lane & Milesi-Ferretti, 2008). The study contends that sectoral trends such as the rise of hedge funds, securitisation, the use of special purpose vehicles by corporate and non-corporate entities has spread widely, accounting for the cross border financial ownerships in developed economies. It may not be easy to accurately measure globalisation and its impact on financial innovations due to the complexity of globalisation and its multidimensional nature.

Global integration of financial markets is closely interlinked with financial innovations and the two are largely partially driven by similar deregulatory changes in technology (Obay, 2014). Globalization, therefore, presents opportunities and threats for local firms in emerging markets to innovate so as to compete effectively (Gorodnichenko, Svejnar, & Terrell, 2010). For instance, Gorodnichenko et al. (2010) study of 27 emerging market economies estimates the effect of foreign competition and linkages with foreign firms on innovation by domestic firms. The study finds evidence of positive correlation between foreign competition and innovation. In addition, the study observes that the supply chain of multinational firms is important in driving innovation, but the link between innovation and globalisation does not significantly vary across the manufacturing and service sectors.

The global financial crisis experienced in 2007 to 2008 is seen as the side effect of the globalisation of financial innovations and has in effect generated significant research interest. For instance, Mendoza and Quadrini (2010) provide evidence of the role played by financial globalisation in the global financial crisis. Firstly, foreign lending accounted for over 50% of the increase in US non-financial sector net borrowings since 1980s. Secondly, global financial institutions and asset markets were adversely affected by the collapse of the US housing and mortgage-backed-securities. Lastly, financial integration causes a steep increase in net credit in the US and large spill overs in asset prices of country-specific shocks to bank capital. The implication of Mendoza and Quadrini (2010) study is that financial globalisation promotes cross border investment flows, which increases volatility in asset prices in response to events happening in other countries. However, Esqueda, Assefa, and Mollick (2012) examination of stock market volatility measured by either "beta-volatility" or by the standard deviation of stock returns over 1995–2007 does not support Mendoza and Quadrini's findings. Esqueda et al. (2012) conclude that an increase in financial integration reduces total stock return volatility for reviewed emerging markets, with nearly no effect for industrial economies. In addition, lower stock volatility occurs in more integrated financial markets but the low volatility is neither as strong as indicated by previous studies nor is it accompanied by increased turnover.

Globalisation of innovation is seen as synonymous to the growing international scope with regard to the generation and diffusion of technologies (Archibugi & Iammarino, 2002). Broadly speaking, globalisation has many facets and a wide scope and in effect a number of studies have concentrated on individual components of globalisation such as the economic variables (Rao, Tamazian, & Vadlamannati, 2011). On the other hand, many studies measure globalisation using a few economic variables, a practice that ignores its social and political dimensions (Rao et al., 2011). To address this gap, Dreher (2006) has developed a comprehensive index of globalisation incorporating political, economic and social dimensions for each country. The three dimensions are exemplified by Keohane and Nye (2000) as follows: 1) economic globalisation entails long distance flow of goods, capital services, and information and perceptions relating to market exchanges 2) political dimension is evidenced by diffusion of government policies, while 3) social dimension is epitomised by the spread of ideas, information, images and people. Certainly, bringing the three dimensions together to form a single multidimensional index for each of the countries is a monumental task most probably prone to measurement errors.

Globalisation and Financial Innovations in Kenya

In the last few decades, a number of global developments with significant implications for financial innovations in Kenya have taken place. Firstly, telecommunication sectors in most countries were liberalised paving the way for the participation of the private sector in the ownership and management of telecommunication companies. Liberalisation was largely influenced by the Bretton Woods and multilateral lenders, namely the World Bank and the IMF. Secondly, most public institutions such as banks, which were essentially controlled by the states were also privatised. Thirdly, the rapid growth in mobile telecommunications in developing countries has emerged to meet the huge demand for telecommunication services, which the governments were unable or unwilling to meet before liberalisation.

The rise in mobile phones uptake in developing countries, including Kenya, has spurred mobile phone based financial innovations. Additionally, liberalisation of the banking sector has encouraged banks to enter into regional and local expansion drives coupled with the development of financial innovations to anchor and drive the expansion. More importantly, based on the Central Bank of Kenya reports, locally-owned banks have outperformed foreign-owned banks in terms of customer numbers, profitability and total assets (CBK, 2013). Moreover, globalisation has enabled the sharing of the global ATM network infrastructure, which means that commercial banks no longer need to develop their own ATM networks. Lastly, the increased movement of human capital across national borders has led to the need for remittances back home and the need to access bank accounts online as opposed to visiting the branch. Consequently, financial innovations in form of branchless banking models have been developed in response to the emerging needs impelled by globalisation.

f) Technological Developments

There is a strong link between technological developments or innovations and financial innovations. This is explained by the fact that most of the financial innovations, especially the ones that are the subject of the present study, are both technology dependent and technology driven. For example, electronic payment systems mainly rely on the use of computer networks, internet and digital stored value systems, which in sum exchange value online and offline through a process of debits and credits (Al-Khouri, 2014). Considerable reduction in costs arise from use of electronic payments since most electronic

payments cost approximately a third of paper based non cash payments (Humphrey et al., 2001). The reduction is as a result of the use of technological innovations.

Mobile payments refer to a variety of financial transactions initiated with a mobile device (Flood, West, & Wheadon, 2013). Mobile payments use electronic money and largely rely on mobile devices especially mobile phones. The success of the mobile money is dependent on technological linkages with other financial institutions and individuals. For instance, Pennings and Harianto (1992) find a strong correlation between a firm's commitment to technological networking and the firm's ability to innovate, suggesting a strong effect on the level of technological linkages. The study argues that the importance of networking in technology in all the regression models studied validate the hypothesis that inter-firm linkages is a vital pre requisite for innovation. The authors argue that banks inclined towards networking with information technology firms have a higher probability of adopting innovations such as video banking. The study observes a positive relationship between early adoptions of video banking, information technology accumulated experience and technological linkages. In addition, Hughes and Lonie (2007) link M-Pesa money transfer, which allows payment of utility bills using mobile electronic money in Kenya by a mobile telecommunications company to e-money technology. The implications of these studies is that technological development at firm level and macro level is a necessary prerequisite for financial innovation developments. The technologies enable not only the adoption but also the usage of financial innovations.

g) Firm Size

There is considerable literature linking or attempting to link firm size to innovation in general and financial innovation in particular. The RBV argues that firms with sufficient resources are more likely to innovate than firms that are not well endowed. Consequently, firm size is critical since financial innovations require substantial investment in research and development and ICT infrastructure which may not be within the reach of small firms. For instance, Bhattacharyya and Nanda (2000) show that investment banks with large market share have high inclination towards financial innovation whereas it is more likely for smaller banks to share their innovations with larger banks. The importance of firm size in the development of financial innovations is observed by other studies that establish the existence of reverse causality between firm size and financial innovations. For example, Tufano (1989) finds a strong positive relationship between firm size as measured by market share and financial innovation, whereby the largest banks innovate and become larger in the process.

Innovative activities occur within industries and technologies in different ways so that in some cases, innovative activities are as a result of five major innovators while in other cases innovative activities are distributed among larger firms (Malerba & Orsenigo, 1997). The authors observe that large firms account for the bulk of innovative activities in certain technologies while small firms are fairly active in others. Large firms account for the lion's share of innovations even in the period of financial crisis. For instance, Alvarez, Benavente, and Crespi (2010) study of Chilean manufacturing firms' responses to the 1998 financial crisis observe a positive link between firm size and the firm's innovations.

A number of other studies examine the relationship between firm size and financial innovations in different countries (Akhavein et al., 2005; Ayyagari et al., 2012; D'Este, Iammarino, Savona, & von Tunzelmann, 2012). These studies attribute most of the financial innovations to large firms, and the results are consistent across different countries. For example, Akhavein et al. (2005) study on the diffusion of financial innovations examines the adoption of small business credit scoring by large banking organizations in the USA. The study finds that large banks and those found in New York Federal reserve district were front runners in adopting business credit scoring, which was largely influenced by the size of their branch network. In addition, Ayyagari et al. (2012) study of over 19,000 firms across 47 countries investigates the characteristics of firms associated with innovation. The authors observe that large firms account for more innovations compared to smaller firms and that the aggregate indicators also confirm that large firms innovate more than smaller firms. The TOE framework discussed in chapter one of the present study provides further explanation of the role of organisation context of firm size in the development of financial innovations.

Firm Constraints

This refers to limitations imposed on the firms both internally and externally and which constrain the firm from optimising its performance. According to Silber (1983), firms develop innovations in financial instruments and practices to lessen financial constraints imposed on them. Additionally, Tufano (2003) argues that firms most restricted and troubled by imperfections are more likely to innovate. This is consistent with Silber (1983) study which demonstrates that constraint based innovations account for significant new bank products between 1952 and 1970 and 60 per cent of financial innovations between 1970 and 1982. According to Tufano (2003), the smallest, weakest firms exposed to major constraints are more likely to innovate perhaps so as to appeal to potential investors, unlike large firms who have already passed initial imperfection stage and are now pre-occupied with capital structuring efforts and

financial innovations. One of the constraints faced by small firms is a regulatory requirement to maintain minimum capital such as Basel (2010) minimum capital adequacy requirements and asset quality. This requirement presents an external constraint for commercial banks. Secondly, according to Hottenrott and Peters (2012), external constraints would entail financing restrictions imposed by lenders through debt covenants requiring the firm to always maintain a certain current ratio. Capital Adequacy Ratio (CAR) is a measure of a bank's capital expressed as a percentage of risk weighted credit exposure of a bank.

$$CAR = \frac{Tier\ one\ capital + Tier\ two\ capital}{Risk\ Weighted\ Assets}$$ .....equation 3.1

The ratio is used to cover depositors in order to promote the stability and efficiency of the global financial systems. The ratio measures both tier one and tier two capital. Tier one capital is meant to absorb losses without necessarily winding up the bank while tier two capital can absorb losses in the event of the bank ceasing operation, providing depositors with a lesser degree of protection (Basel, 2010).

The importance of capital to a business, especially commercial banks cannot be ignored for a number of reasons. Firstly, Athanasoglou, Brissimis, and Delis (2008) argue that capital is the available amount of own funds that supports the bank while providing buffer in the event of adverse business position. Secondly, capital is also a buffer against distress and run on accounts, a situation where bank depositors rush to withdraw money held in the accounts at once (Diamond & Rajan, 2000). Importantly, Dang (2011) opines that capital adequacy ratio as a measure provides a basis for judging a bank's adequacy of capital and indicates the bank's internal ability to withstand losses in crisis times. Nevertheless, the regulatory requirement to maintain minimum capital can be a major constraint to small banks since they have to retain capital, which would otherwise be advanced as loans. Considering loans to customers significantly contribute to bank's revenue and profitability, small banks are more constrained by this requirement than large banks.

3.3 The Value of Financial Innovation

As discussed in chapter one of this study and in the preceding section, financial innovation plays an important role not only to the innovating firms but also to the whole economy. Finance drives both production and consumption and as a result, financial innovation enhances this function. Financial innovation encourages productive investments by enabling the transfer of investment funds. Conversely, financial innovations have been lauded as the drivers of growth of the economy and at the same time blamed as the main cause of financial crises in the global economy (Lerner & Tufano, 2011). The study,

however, contends that financial innovations generate returns to innovators and can affect the entire economy. According to the author, this, occurs when households are able to have investment and consumption choices in addition to lowering the cost incurred in raising and deployment of funds. Notably, Silber (1983) observes that the ability to bear risks in relation to futures markets has been improved as a result of innovations in financial institutions and practices. Silber argues that these innovations have also lowered transaction costs through the introduction of automated teller machines enabling firms to circumvent regulations such as the money market regulation Q in the USA. Financial innovation enables banks to undertake more risks, enabling them provide valuable credit and diversification of risks for firms as well as households effectively enhancing efficiency in the allocation of capital and economic growth (Beck et al., 2014).

A financial product is not considered innovative just because it is new to the market. The product must either enable the investor generate high returns on investments or enable hedging against financial risks. In view of this, Finnerty (1988) argues that firstly, a new security is deemed innovative if it enables an investor to earn higher after tax risk adjusted rates of return without any negative after tax cost of funds on the issuer. Secondly, the issuer should realise after tax cost of funds without negatively impacting him/her more than he was impacted prior to introduction of the security.

The value generated from financial innovation may depend on timing of the adoption and usage of the innovations. Some firms are early adopters while others are laggards, who prefer late adoption and usage of financial innovations. For instance, Lopez and Roberts (2002) use historical methods to analyse the effects of order of market entry on market share in the financial services sector. The authors find that early entrants to financial innovations in pension funds, credit cards and debit cards enjoy market share advantages. According to the study, a baseline model that regresses 'share' against order of market 'entry' explains 70% of the variability in performance. The findings show that the second entrant is likely to capture 78% of the eventual market share of the pioneer, tenth entrant captures on average 11% consistent with findings in other industries.

The value of financial innovations has been a subject of research interest for decades. A number of studies have focused on the value of innovation as well as value of imitation. In other words, does it pay more to innovate or to imitate? In response to this question, Tufano (1989) reviews 58 financial innovations for the period 1974-1986 to examine the rewards that accrue to investment banks for their decision to invest in financial innovations. The study finds that at the initial stage of the launch of new products,

banks do not charge higher prices and even in the long run the same banks charge lower prices than those charged by their imitators. Tufano posits that banks gain a larger market share with financial innovations than with imitated products since innovators become infra marginal rivals rewarded with lower trading, marketing and underwriting costs. Other studies such as Carow (1999) have used a sample of 2,370 public security offerings, including 64 financial security innovations and four conventional securities to examine how investment banks are rewarded for developing new products. The study posits that as innovation is broadly implemented and competition enters the stage, underwriting fees decline, suggesting innovators are compensated for additional underwriting costs associated with new products. In addition, financial innovations in electronic payments help reduce payment costs by between one third and one half compared to paper based non cash payments (Humphrey et al., 2001).

Recent studies have also focused on the value of financial innovation at macro level. For instance, Laeven et al. (2015) study develops a model to predict the relationship between financial innovation and economic growth. The model predicts that failure by financiers to innovate leads to ultimate end of technological innovation and economic growth. Therefore, this underlines the value of innovation at the national level. Economic growth may be catalysed by the role of financial innovations in enabling firms have access to debt capital. For instance, According to Blair (2010), access to debt-like instruments by all types of firms, especially financial institutions, has been enabled by the multiple financial innovations developed in the past few years.

In the case of Kenya, mobile money enables micro savers to save their money in mobile phone-based accounts further highlighting the role of financial innovation. Nevertheless, Lerner and Tufano (2011, p. 12) contend that the "…particular challenge associated with assessing the social impact of financial innovation lies in the fact that so many of its consequences are in the form of externalities…". The implication of this finding is that the value generated by financial innovation may be either negative or positive. The impact of financial innovation is sometimes driven by factors beyond the control of the innovators or the users of the innovations. In sum, financial innovation is seen as an essential component of any financial system activity and is critical for investors, in their search for financial instruments to address market inefficiencies and imperfections (Delimatsis, 2012).

3.4 Empirical Studies on the Adoption, Diffusion and Usage of Financial Innovations

Innovation adoption is an individual's decision to make use of an innovation while diffusion of innovation refers to the accumulated level of users of an innovation in a given market (E. M. Rogers, 1995, 2010). A number of researchers have studied the adoption and diffusion of financial innovations aimed at identifying which organisations adopt innovations and their speed of adoption. For example, Ben-Horim and Silber (1977) conducts empirical tests on financial innovations in the context of linear programming model of the behaviour of commercial banks, with emphasis on new product category. The study opines that financial innovations such as certificates of deposit (CD) occur so as to reduce or remove financial limitations imposed on firms. According to the study, the restrictions include regulation requiring banks not to lend more than what is demanded by the bank's customers. Other constraints include lack of capital to ensure that total assets equal the sum of capital and liabilities. The study finds that adversity arising due to 1952 to 1972 regulations contributed to innovations by banks and that innovations were catalysed by decrease in utility or profitability due to regulations. According to the study, this is because regulations give rise to shadow prices, which provide opportunity for increased profitability through financial innovations.

Lerner (2002) empirically examines patents for financial formulas and methods, whose patentability is confirmed in the litigation between State Street Bank and Trust and Signature Financial Group. The author also reviews the diffusion of financial innovations across firms and evidence that finance patents significantly increased following the State Street's judicial ruling allowing patenting of business methods. The study finds evidence that big companies take a lion's share of finance patents with minimal patents attributable to universities. These findings are inconsistent with the earlier work of Horne (1985), which posit that academic research fundamentally contribute to diffusion of financial innovations. There is considerable literature on the financial institutions and commercial banks adoption of new technologies (Akhavein et al., 2005; Frame & White, 2004). According to anecdotal evidence reported in Frame and White (2004), banks are not generally known to be early adopters of innovative technologies although they still adopt in the long run. A number of studies[5] have reviewed the relationship between firm size innovative activity and highlighted the strong link between the two (Akhavein et al., 2005; Ayyagari et al., 2012; D'Este et al., 2012).

[5] See section 3.2 (g) for a detailed discussion

The role of the mass media in the adoption and diffusion of innovations is vital. For instance, Toole et al. (2012) work on the impact of social network structure on innovation observes than the mass media play a critical role in the adoption, diffusion and usage of innovations. The mass media may play a big role in changing negative cultural practices that negatively impact on innovation adoption, diffusion and usage. A cross country study by J. B. Ang and Kumar (2014) of financial development and barriers to the cross-border diffusion of financial innovations analyses cross-sectional data collected in 123 countries. The study provides evidence that the further away a country is from the country leading in a given technology, the lesser the financial development of that country. In addition, cultural barriers, which inhibit the diffusion of financial technology across national borders, negatively affect financial development. The negative influence according to the authors occurs when cultural barriers negatively influence the ability of the follower countries to adopt innovations from across the borders.

3.5 Network Effects or Externalities, Multisided Markets and Financial Innovations

The adoption and use of electronic payments is prone to both network externalities and the effects of multisided markets. A network effect or externality arises when the value of a product to a single user is dependent on the number of other users of similar product (Katz & Shapiro, 1986). Technologies prone to network effects have a tendency to show long lead time followed by rapid growth (Shapiro, Varian, & Becker, 1999). The study argues that as existing customers return positive feedback, the customer base grows making the adoption of the product worthwhile for many more users; eventually the product achieves a critical mass and takes over the market. Katz and Shapiro (1986) argue that there are products for which the utility derived from their consumption rises with the rise in the number of agents consuming the product. The consumption externalities according to the study are due to various factors namely: 1) the direct physical effect that the quality of the product has on the number of consumers of the product, and 2) Indirect benefits from consumption of the product, for example, number of other individuals purchasing similar products.

Baddeley (2004) argues that electronic payment systems are network goods whose value or utility is dependent on their ability to be accessed within a network of other users. Although technologies may be differentiated, the value of differentiation to users is subordinate to the users' preference for compatible technologies (Keser et al., 2012). The study opines that technologies subject to network effects must attain a 'critical mass,' defined as the minimum number of users needed to make the choice of technology

the best choice for any remaining user. The implications of these findings are that electronic payments must either attain a critical mass by widening their coverage or be rendered obsolete.

Kazan and Damsgaard (2013) argue that owing to the complexity of payment card systems, the systems need both cardholders and merchants so as to create viable platforms. Payment cards exhibit an indirect network effect. This is because the adoption of one card by a cardholder does not necessarily lead to a direct benefit on another user since the receivers of payment cards are merchants and not the other users. Rochet and Jean (2006, p. 645) refer to these markets as two sided markets or 'multi sided markets.' The authors argue that two sided markets are markets "…in which one or several platforms enable interactions between end users and try to get the two (or multiple) sides 'on board' by appropriately charging each side…" (p. 645). According to Filistrucchi, Geradin, Van Damme, and Affeldt (2014) two sided markets arise in markets for payment cards where companies sell the use of cards while shops buy Point of Sale terminals. According to the study, two sided markets experience both usage externalities and membership externalities. The authors observe that firms can be seen as platforms that need to consider the two sides in order to succeed in business.

If there are more members on one side of the multisided platforms, each member of the platform can expect to derive more value (Evans, 2013). The study finds that the increase in value is as a result of the ability of each member to find new trading partners, which in turn increases trading volumes. Evans posits that multisided payment platforms experience problems with attaining dynamic growth since their success is tied to their ability to attain a critical mass on both sides. Critical mass creates value, which brings in new members on each side. Network effect compels firms to not only seek to achieve production side economies of scale but also to attain demand side economies of scale (Shapiro et al., 1999). Once the firm has enough customer bases, Shapiro argues, the market will grow by itself.

Therefore, it follows that network externalities as well as multisided market effects, significantly explain variations in adoption and usage of electronic payments. The popularity of mobile payments according to Aker and Mbiti (2010) is largely as a result of sharing of mobile phones in low-income communities. The study provides evidence of sharing of mobile phones in Bangladesh villages among 70 people. The sharing of mobile phones makes the customer base bigger than the normal customer base. Most customers are reluctant, therefore, to join a provider of electronic payment services if the provider's network is narrow. Saloner and Shepard (1992) tests for network effects on the adoption by banks' ATMs. The authors find that a bank with many geographically dispersed ATMs from where customers

can access their accounts increases the value of the ATM network and is preferable to a bank with a small ATM network. According to the authors, a bank can increase the size of its network by increasing ATM locations in its own system and by networking its ATMs with other banks.

Innovation adoption, diffusion and usage is of paramount importance in the study of financial innovations. At the firm level, financial innovation adoption is the starting point since a decision has to be made to use the innovation at firm level. Once a decision is reached to adopt financial innovation, the financial innovation must be diffused to ensure that the accumulated number of users of the innovation in a given market is as big as possible. The speed with which financial innovation is diffused or spread will to a large extent be affected by mass media efforts to promote or discourage the innovation, the network effect, multisided markets effect and the organisational as well as individual cultural practices. The cultural practices may or may not promote the speed of financial innovations adoption, diffusion and usage. In the end, it is the continued usage of the financial innovation by a firm that generates value to the firm, since a firm may adopt a financial innovation but fail or refuse to have continued use of the innovation.

3.6 The Speed and Magnitude of Innovation

Innovation speed shows how fast relative to other firms in the industry a firm adopts either process or product innovation (Gopalakrishnan, 2000). Innovation speed can also be defined as the time taken between initial product development and introduction of the product to the market (Kessler & Chakrabarti, 1996; Vesey, 1991). Innovation speed may explain the variations in the magnitude of innovation usage across firms. This is because Rogers (1983) argues that innovation speed is an indicator of a firm's quickness in adopting a product or process innovation relative to its competitors in the industry. Although the speed of innovation has a positive link to firm financial performance, studies show that the link is bi-directional. For example, Gopalakrishnan (2000) study of innovation speed relative to other firms operating in the industry observes reverse causality between the speed of innovation and financial performance as measured by ROA. In addition, the study finds that higher profitability in an earlier time period facilitates speedy innovation while speedy innovation leads to higher financial performance in the current time period.

In order to increase innovation speed, firms need to make proper use of market intelligence and assign the responsibility of promoting the innovation to an influential person in the company. This is because

fast response to market intelligence achieves the greatest impact with regard to innovation speed and new product performance (Carbonell & Rodríguez Escudero, 2010). In addition, the influential champion should promote the usage of the innovations since the champion is seen as the only significant positive factor necessary for faster innovation speed (Allocca & Kessler, 2006). Nevertheless, such a champion would only optimise performance where there is top management support, clarity of goals and speed-based rewards (Carbonell & Rodríguez-Escudero, 2009). The authors see these as central in building conditions that increase innovation speed, especially in an environment of high technological instability.

The magnitude of innovation refers to the quantity of innovations of any type adopted by a firm within a period of time (Gopalakrishnan, 2000). Magnitude of innovation is represented by the number of new products or newly developed processes by a firm. According to Gopalakrishnan (2000) to determine the magnitude of innovation, one needs to aggregate the total number of new products, processes and practices adopted by a firm as a proportion of total innovations. The study finds that increased firm performance in form of profitability is linked to a high magnitude of innovation score and that the scores increase with increased focus on innovation magnitude.

A number of empirical studies have focused on the speed of innovation and its impact on firm financial performance. For instance, Allocca and Kessler (2006) study of 158 projects in a number of technology-related industries, apply a conceptual model of innovation speed for SMEs. The study finds that with respect to organisational capability and staffing-related factors, the only statistically significant positive factor for innovation speed is an influential champion of the innovation. Allocca and Kessler (2006) findings are supported by Carbonell and Rodríguez-Escudero (2009) work on 183 new product projects, which shows that the support of the top management coupled with the clarity of goals are critical for innovation speed.

Innovation speed has been operationalised using five variables, which reflect the firm's quickness in generating novel ideas, launch of new products, new processes, new product development and new ways of solving problems relative to competition (Liao, Wang, Chuang, Shih, & Liu, 2010; Z. Wang & Wang, 2012). Using these five variables, Wang and Wang (2012) examine the effects of innovation speed on both operational performance and financial performance. The empirical hypotheses tests confirm that innovation speed is positively linked to both firm operational performance and firm financial performance. The implication of these studies is that although innovation generally leads to firm financial

performance, firm financial performance is moderated by the speed and magnitude of innovation. The role of management is seen as critical in determining the speed of innovation.

3.7 Branchless Banking Models

Branchless banking refers to the delivery of banking services to customers without the use of traditional 'brick and mortar' branches. The delivery of services is done from remote locations such as mobile phones of clients, online services, ATMs and through third parties representing the bank; commonly referred to as agency banking. The fact that this model does not require the bank branch has made it earn a name 'branchless model.' However, Alexandre, Mas, and Radcliffe (2011) argue that the use of the term branchless banking is potentially misleading since it assumes that bank branches are not useful. The study contends that this situation would make the bank fail to control its destiny, preferring to use the term "banking beyond bank branches." Most financial innovation studies refer to the model as branchless banking model and so the present study refers to the models as such. A review of financial innovation studies has identified three models of branchless banking, namely: Bank led model, Bank focused model and Non-bank led model (Laukkanen, 2007; Lyman et al., 2006; Mwando, 2013; Siedek, 2008). These studies identify agency banking and mobile banking as the two models of branchless banking conducted through retail agents.

Bank focused model entails the use of ATMs and internet banking Siedek (2008). The bank focused model as well as other branchless banking models are in operation in a number of countries. For instance, Lyman et al. (2006) study finds evidence of the existence of branchless banking in the five countries studied namely: Brazil, India, Kenya, Philippines and South Africa. According to the Lyman et al. study, state and privately-owned banks in Brazil offer financial services by use of agents who include post offices, lottery kiosks, pharmacies and small supermarkets (A. Kumar, 2006, p. 27). According to Lyman et al (2006) India Reserve Bank has permitted banks to use specialised micro finance institutions, post offices, Non-Governmental Organisations (NGOs), co-operative societies, and limited companies as agents. On the other hand, South Africa does not permit banks to offer branchless banking through non-bank institutions. Kumar observes that mobile companies wishing to offer branchless banking in South Africa have entered into joint ventures to offer cell phone banking through licensed banks.

3.7.1 Bank Focused Models

Bank focused models use ATM and internet as access tool to a bank account, which makes them a mere extension of the conventional branch based banking (Mwando, 2013; Siedek, 2008). A number of studies on the diffusion of ATMs and the characteristics of banks that adopt them have encapsulated various findings (Frame & White, 2004; Hannan & McDowell, 1984, 1987; Olatokun & Igbinedion, 2009; Saloner & Shepard, 1992; Sinha & Chandrashekaran, 1992). Hannan and McDowell (1984) work covering about 4,000 USA banks for the period 1971-1979 find that larger banks and those operating in concentrated local markets have a higher probability of ATM adoption. They find that the probability of adoption is affected by other factors with regulatory environment within which the bank operates largely shaping its adoption decisions. These factors include: Bank's product mix, location in urban areas, banking restrictions of the bank's branch, holding company affiliation of the bank and the wage rate of the households in that area.

Hannan and McDowell (1987) later examined the nature of banks' reactions to the preceding adoption processes of their rivals with regard to ATM adoption. Consistent with their 1984 results, they find that adoption of ATM by rivals increases the conditional probability that a rival will make a decision to adopt the innovation. They also find evidence that firms located in less concentrated markets more strongly react to rival precedence than those in concentrated markets. However, Frame and White (2004) contend that although they used the same data, Hannan and McDowell (1987) failed to include two significant variables included in their 1984 work, which invalidates their results. The two variable include product mix and location variables. Although the use of ATMs has been popular in most African countries, there has been concerns with regard to ATM related frauds (Jegede, 2014; Ogbuji, Onuoha, & Izogo, 2012). Nevertheless, bank focused models are seen as crucial e-commerce enablers especially the use of internet (M.-C. Lee, 2009; Roy, Kesharwani, & Singh Bisht, 2012).

3.7.2 Bank Led Models

In this model, banks develop the financial products and services but handle all or most of the customer interactions through agents who also distribute the products while customer accounts are held at the banks. This means the bank is the ultimate provider of the financial products (Lyman et al., 2006). According to the authors, agents make use of POS terminals, which read bank cards and occasionally banks contract management firms to help them in identifying, contracting, equipping and monitoring bank agents on their behalf. According to Mwando (2013) the management agents may sometimes be

held liable for the negligence of the agents they recruit but in most cases the bank as principal is held accountable for the negligence of the agents.

Agency banking is in operation in a number of countries although there are variations in terms of how it is practiced. For example, Laukkanen (2007), Siedek (2008) and Mwando (2013) observe that agency banking can assume many forms such as use of post offices in Australia, corner stores in France, lottery outlets in Brazil and other forms in Kenya as banking agents. Additionally, Tarazi and Breloff (2011) find that many countries allow a wide range of legal entities and individuals to be bank agents while other countries only allow legal entities to be eligible bank agents. Even though agency banking assumes different forms in different countries, the type of services offered to customers appear homogenous. For instance, A. Kumar (2006) argues that banks use agency banking to reduce costs of financial services delivery and to reduce the volume of customers at the branches and establish new market presence. According to Kumar, agency banking in Brazil and India is used for meeting regulatory requirements for distributing credit to low-income and marginalised regions which would be unprofitably served by conventional banking through branches. Like other financial innovations, the form agency banking assumes and the uses to which agency banking is put evolves over time. This highlights the dynamic nature of financial innovations.

3.7.3 Non-bank Led Models

According to Lyman et al. (2006) these models use ICTs such as cell phones, prepaid cards and card readers for transmitting transaction details from either the customer or retail agent to the bank. In non-bank led models the bank's role is limited to that of safe keeping of funds for the non-bank entity and therefore customers neither maintain bank accounts nor deal with banks (Tomášková, 2010). According to Lyman et al. (2006), customers deal with non-bank companies such as mobile phone service providers or prepaid card issuers with retail agents acting as the customers' point of contact. However, Lyman et al (2006) posit that customers' money is held in virtual e-money held at non-banks' servers that are not linked to the bank account in customers' names.

The mobile phone company (non-bank) designs financial products, engages the bank agents either through intermediaries or directly and maintains the clients' electronic money accounts while electronically tracking customers account balances on their own data base systems (Hughes & Lonie, 2007; Lyman et al., 2006). Hughes and Lonie (2007) suggest that M-Pesa adoption rate in Kenya is 'excellent,' implying that the product meets market needs. The authors attribute this success to the fact

that mobile phone banking clients are able to carry out transactions where there is non-bank mobile provider's network coverage by visiting the agents for depositing or withdrawing cash. The transactions are enabled through virtual accounts to large groups of people, which extends financial services to majority of people (Owens & Bantug-Herrera, 2006). Although mobile phone companies charge little amounts in transaction costs, the companies seeks to have a large customer base. For instance, mobile banking aims to achieve greater revenue per customer through text messages and transaction charges; generate interest from e-money balances held in commercial banks and enhance customer loyalty (INFODEV, 2006).

The provision of financial services by mobile phone companies increases customer loyalty and exit costs to existing customers. Consequently, A. Kumar (2006) argues that e-money account holders are unlikely to switch service providers and that new customers are likely to join because of the benefit from the service. The study finds that deploying financial services over mobile networks is technically feasible, profitable and is backed by significantly high demand. The success of mobile payments in Kenya is aided by the acceptance of new and non-bank financial services providers (Aduda & Kalunda, 2012; Beck, Cull, et al., 2010). Mobile banking has grown in quantum leaps since its introduction in 2007 and the growth has been in tandem with growth in mobile subscriptions as shown in Fig 3.0.

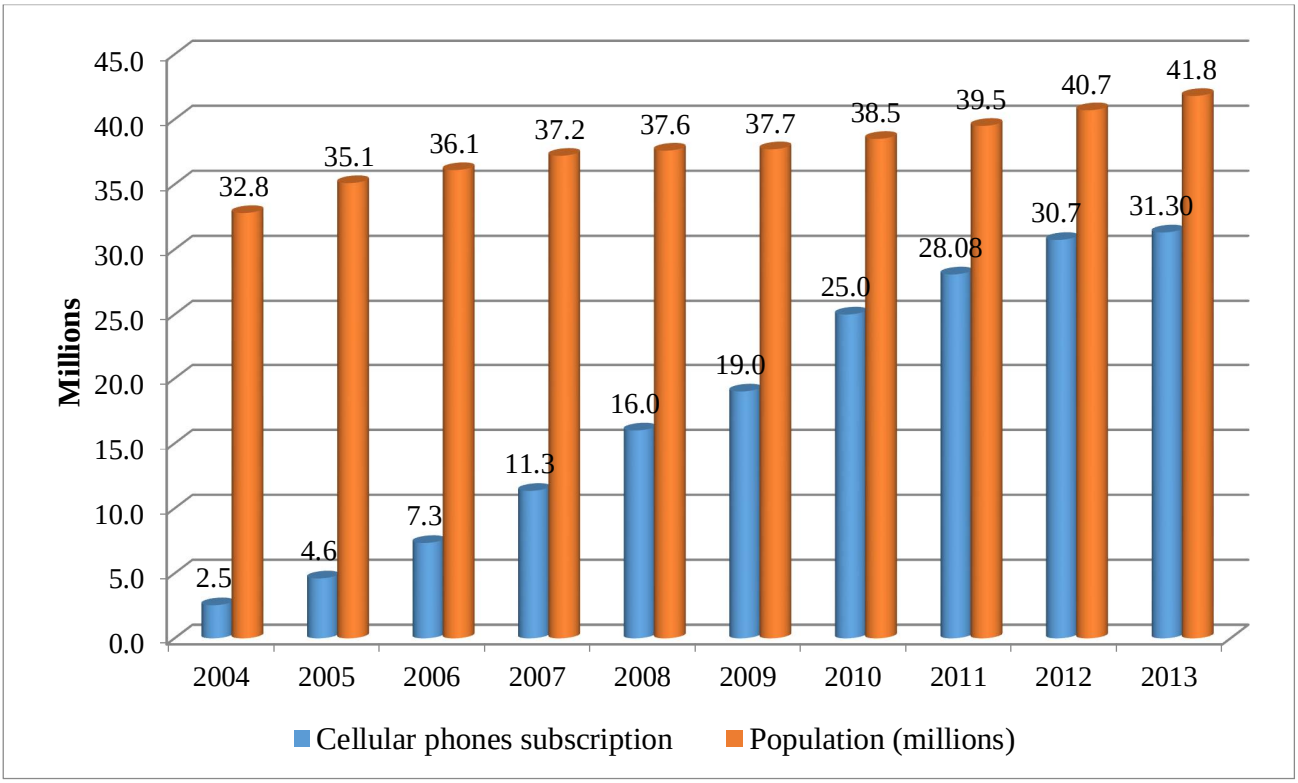


Fig 3.0: Cellular phones subscription in Kenya vs population growth

Source: Author's computation with data obtained from ITU and World Bank

Fig 3.0 shows that cellular subscription as a percentage of the whole Kenyan population has grown from 7.6% in 2004 to 74.9% in 2013. Considering that in most localities mobile phones are shared (WB, 2001), the scope of mobile money coverage is much higher than the 74.9%. The fixed lines subscription as a percentage of total population declined from 0.9% in 2004 to 0.5 % in 2013. Although, fixed lines subscriptions in developed countries as a percentage of total population is significant in most developing countries but mobile subscriptions take the lead (Demirgüç-Kunt & Klapper, 2012; EIU, 2012; Ingenico, 2012). This could also explain the preference for mobile payments as opposed to electronic payments in developing countries. Table 2.1 provides as summary of the three models discussed including the key differences between them.

Table 3.1 Branchless Banking Models Comparisons

Features	Bank focused model	Bank led model	Non-bank led model
Means of access to financial services	ATMs Internet	Bank agents	Mobile phones Mobile phone agents
Type of banking	Internet banking ATM banking	Agency banking	Mobile banking
Custodian of customer deposits	The bank	The bank	The bank
Regulator	CBK	CBK	CBK & CAK
Any need for actual bank account?	Yes	Yes	No
Type of money transacted	Actual/physical money Electronic money	Actual/Physical	Electronic money/mobile money
Who develops the financial products?	The bank	The bank	The non-bank institution/mobile phone company
Who distributes the financial products?	The bank	Bank agents	Mobile phone company's agents
Who bears the risk of the money transferred?	The bank	The bank	The non-bank institution/mobile phone company
Any need for a mobile phone?	No	No	Yes

Source: Author

The preceding subsections have focused on the theory of financial innovations, effectively revealing emerging patterns in the field. For example, although there is evidence of substantial literature on financial innovation, the focus has been on financial products in developed countries. However, emerging literature appears to be putting emphasis on new types of financial innovations in the form of branchless banking models. A review of the drivers of financial innovations in general finds that such drivers drive branchless banking as well, albeit with minor differences. For example, the drivers of mobile banking in developing countries have not succeeded in driving mobile banking in developed countries.

Mobile banking is seen as meeting unique needs of the unbanked populations in developing countries. The growth in mobile banking has been in tandem with the rapid mobile phone subscriptions in a number of developing countries. Importantly, agency banking, which entails the provision of banking services through licensed third parties has been embraced. Agency banking has assumed different forms in different countries and the types of services offered through the innovation are evolving over time. Lastly, the literature suggests that although the adoption and diffusion of financial innovation is critical, it is the usage of financial innovation that ultimately pays off in terms of value creation to the users of financial innovations. This is because a firm may adopt an innovation but fail to use it over time. Consequently, this explains the focus of the present study on the usage of financial innovations as opposed to adoption and diffusion of the innovations. The value generated may be in the form of market share expansion, operational efficiency and firm financial performance, among others. The magnitude of financial performance value generated from financial innovations is moderated by the speed and the magnitude of financial innovations implying that fast adopters and users of financial innovations get more value than laggards.

3.8 Conclusion of the Chapter

This chapter has introduced innovation in general and financial innovation in particular. The literature on the drivers of financial innovations at firm and macro level has been reviewed. Although the literature shows a number financial innovation drivers, it has not identified any dominant driver of financial innovation at either firm or macro level. Secondly there is evidence in the literature to suggest the existence of a link between firm level and macro level variables to financial innovations. The chapter discusses the value or benefits that accrue to firms from financial innovation adoption and usage. The chapter finds evidence confirming Frame and White (2004) findings that most financial innovation studies have approached the studies from a phenomenological perspective. The increase in financial

innovation studies that use qualitative approach at the expense of quantitative approach highlights the importance of the present study. At the end of the chapter, a review of the three models of branchless banking finds that the models have been widely used in a number of countries including Kenya, Philippines, South Africa, India and Brazil. Since financial innovation is a driver of firm financial performance, the next chapter discusses the theory of firm performance.

CHAPTER FOUR

EMPIRICAL LITERATURE ON FIRM PERFORMANCE

4.0 Introduction

This chapter reviews the theoretical and empirical literature on firm performance by analysing different perspectives of firm performance. The main objective of the study is to establish the link between bank financial performance and financial innovations. This chapter contributes to the main objective by reviewing and identifying the appropriate proxies for firm financial performance. The chapter contains the following sections: 4.1Conceptual framework and meaning of firm performance; 4.2 Dimensionality of firm performance; 4.3 Measures of firm performance; 4.4 Firm factors, industry structure and firm financial performance; 4.5 Innovations and firm financial performance; and 4.6 Conclusion of the chapter.

4.1 Conceptual Framework and Meaning of Firm Performance

One of the main challenges facing research in organisational performance is the lack of consensus on the definition of organisational performance and the measurement of the organisational performance construct. Most studies have broadly defined organisational performance as the outcome of social and economic factors emanating from the interaction between organisations' attributes, actions and the environment (Combs, Crook, & Shook, 2005). While this definition helps us appreciate the general meaning of performance, the definition lends itself to multiple interpretation and performance measurement problem. It is imperative that any study on firm performance clearly explains the author's conceptualisation of the term 'performance' to avoid ambiguity in its definition and measurement. According to Mueller (2004) conceptualisation is giving theoretical meaning to concepts, a process which usually entails defining the concepts abstractly in theoretical terms. Mueller argues that firstly, in order to describe a social phenomenon and to test hypothesis, the concept or construct being studied should be operationalised. Secondly, by operationalising a concept the researcher moves from the abstract level to the empirical level, where the focus of the study is the variables rather than concepts. Nevertheless, the broad definition of firm performance and failure to specify the dimensions and boundaries of performance has effectively led researchers to varying and conflicting findings that they are unable to interpret (Boyd, Gove, & Hitt, 2005).

In order to understand the firm or organisational performance construct there is need to understand its measure validation (Combs et al., 2005). According to Combs et al "...measure validation involves establishing content, convergent and discriminant validity. Content validity is present when experts agree that measures fall within the construct's domain. Convergent validity is present when there is a high degree of agreement among two or more different measures of the same construct while discriminant validity is present when measures of different constructs do not converge…" (p. 261).

Simply put, convergent validity tests whether constructs that should be related, are related while discriminant validity tests whether constructs believed to be unrelated are, in fact, unrelated. By successfully evaluating discriminant validity, a researcher is able to show that a test of a concept is not highly correlated with other tests designed to theoretically measure different concepts (Campbell & Fiske, 1959). There are a number implications of these findings for the present study. Firstly, since performance means different things to different researchers, there are many definitions of the term 'performance.' Secondly, the definition of performance largely determines the measure of performance to be used. Thirdly, the measure of performance used should be acceptable in other studies that have studied performance. Lastly, to ensure convergent validity is present, a high degree of agreement among two or more different measures of performance should exist.

The growing interest in firm performance research is informed by the need to explain variations across firms (Hoopes, Madsen, & Walker, 2003). Performance metrics have been used to measure the performance of decision-making units as well as the performance of decision makers in an organisation. Combs et al. (2005) point out the existence of a wide consensus on the importance of organisational performance and concludes that it is probably the most important construct in management research. Firm performance is viewed as a multifaceted construct comprising a number of aspects such as the effectiveness of operations, corporate reputation, and the survival of the organisation (Richard, Devinney, Yip, & Johnson, 2009). The fact that firm performance is multifaceted has led to multiple definition of the same performance construct.

Extant literature centred on corporate financial performance does not expressly define financial performance. The studies largely define financial performance in terms of its two dimensions, namely, short term profitability and market evaluation of future profits (Inoue & Lee, 2011). Venkatraman and Ramanujam (1986, p. 803) define firm financial performance as "...the use of simple outcome based financial indicators that are assumed to reflect the fulfilment of economic goals of the firm." The authors

argue that irrespective of whatever proxy is used to represent firms' performance, the orientation of the approach still remains financial. The study contends that this practice assumes the legitimacy and superiority of financial goals among all the firms' goals. Firm performance has been defined in a number ways: "maximising profits or more accurately present value" (Jensen & Meckling, 1976, p. 307); "High returns over longer periods of time" (Wernerfelt, 1984, p. 172); "Rate of return on assets" (Rumelt, 1991, p. 167); "Fulfilment of economic goals of the firm" (Venkatraman & Ramanujam, 1986, p. 803); "The value that an organisation creates using its productive assets [in comparison] with the value that the owners of the assets expect to obtain" (Barney, 1991, p. 26). Although the definitions appear similar, the differences are largely in terms of the type of returns, time period, stability of expected returns and their emphasis on absolute returns, expected returns and relative returns (C. C. Miller, Washburn, & Glick, 2013). According to the study, this explains the existence of confusion with regard to firm performance. This study defines firm performance as the return on firm's assets and return on shareholders' equity.

The persistent use of performance as a dependent variable in most management studies reflects its significance as the critical evaluative criterion (Richard et al., 2009). A number of researchers have attempted to establish the extent to which performance construct has been studied. For example, March and Sutton (1997) find 23% of 439 articles in four leading journals over a three-year period include some measure of performance as dependent variables. However, in spite of the significant research interest in organisational performance, Richard et al. (2009) observe that minimal effort has been made by researchers in determining what performance is and how it should be measured. Notably, the extensive study of performance has made it so common in management that its composition and definition are seldom conclusively justified (March & Sutton, 1997; Richard et al., 2009). These studies find that the appropriateness of performance irrespective of the form it takes has been unquestionably assumed.

According to Richard et al. (2009) organisational performance entails three specific areas of firm outcomes, namely: product market performance, financial performance and shareholder return. The authors argue that organisational performance is neither a one-dimensional theoretical construct nor should it be represented by a single operational measure. Most studies have used performance measures, which are largely unrelated and faced challenges with the definition and measurement of performance (Maltz, Shenhar, & Reilly, 2003). Although Boyd et al. (2005) argue that the use of more than one indicator for firm performance reduces measurement error, the argument is inconsistent with Combs et

al study. Combs contends that a construct's validity will become dubious where multiple measures of the same construct are used.

Firm performance theory should not only explain variations in firm performance but also predict future performance based on the current performance drivers under study. This argument is consistent with Bacharach (1989) work, which opines that the usefulness of a theory emanates from its ability to both explain and predict. Such an explanation according to Bacharach grounds the meaning of constructs, variables and the linkages between them, while prediction tests the meaning by relating it to empirical evidence.

Conceptualising performance as a multidimensional or multifaceted construct, is central to any firm performance research. For example, Dess and Robinson (1984) argue that any research on organisational performance must consider two fundamental issues; selecting the conceptual framework from which to define organisational performance and identifying accurate available measures for operationalising performance. The authors contend that regardless of the framework for operationalising organisational performance, organisational performance is complex and multidimensional, making its operationalisation naturally difficult. Even when the focus is on economic dimensions, the authors opine that researchers have faced many challenges in finding accurate measures, especially when dealing with privately-owned and multi industry firms. Since firm performance is multidimensional, the definition of performance is largely influenced by the dimension assumed by the individual defining the term. Consequently, the measure of performance depends on the definition of performance assumed by the researcher. The multidimensionality aspect of performance is accepted in accounting (Callen, 1991), Finance (Henri, 2004) and management literature (Venkatraman & Ramanujam, 1986). Although performance is multidimensional, meaning it encompasses various empirical and theoretical components, the individual components may or may not be related (Devinney, Yip, & Johnson, 2010).

When attempting to measure performance, a decision has to be made as to whether one is studying an individual's performance (e.g. CEO), unit performance (e.g. branch or division), team performance or organisation as a whole. Richard et al. (2009) sum up the three sources of organisational performance multidimensionality as: 1) The stakeholders interested in the performance measure; 2) the landscape of performance determination and 3) the relevant time frame in measuring performance.

4.2 The Dimensionality of Firm Performance

According to Richard et al. (2009), when measuring performance three sources of dimensionality must be considered. This section reviews the three dimensions.

Dimensionality one: Stakeholders

Stakeholders refer to entities that have a stake in the continued existence of the operations of the firm. The stakeholders are multiple and almost infinite, meaning it is not possible for the management at any given time to establish the actual number of stakeholders. In addition, the stakeholders have multiple needs, some of which cannot be quantified in monetary terms. According to Devinney et al. (2010) stakeholders include employees, suppliers or distributors, customers, shareholders and the state. Consideration of stakeholders in measuring performance largely determines the performance metric to be used. Consequently, the performance metric should be consistent with the need(s) of the target stakeholder(s). Divisional heads are more likely to be appraised based on the accounting performance measures of the divisional performance and on the measures of shareholders returns (Merchant, 2006; Otley, 2007).

In practice the management of a firm relates with multiple stakeholders at both firm and national level, which entails a trade-off of multi stakeholder interests (Richard et al., 2009). The authors argue that the trade-off of multi stakeholder interest has implications for the applicability of performance measures. Van der, Van Ees, and Witteloostuijin (2008) find no relationship between firm performance as measured by ROA and EPS and the attainment of the interest of secondary stakeholders. It follows from Van der et al study that whereas the interests of the secondary stakeholders have not influenced the choice of firm performance measures, primary stakeholders' interests must have been factored in. However, later work of Richard et al. (2009) find evidence linking firm social performance and financial performance. These studies in general confirm that the choice of performance measures and the definition of performance for a given firm will largely depend on who the management of the firm considers as the key or primary stakeholders. If the key stakeholders are shareholders, it is natural to expect that profitability and stock market performance measures will be the basis of the periodical reports. For non-profit making entities, qualitative performance measures such as efficiency scores through the use of data envelopment analysis (DEA) will to a great extent form the basis of periodic reporting and performance appraisal.

Dimensionality two: Heterogeneity-resources and Environment

Heterogeneity or variations in performance of firms has been intensively studied in strategic management literature. It is mainly grounded in the resource-based view (RBV). The main research question which RBV seeks to answer is "... why do firms in the same industry vary systematically in performance over time…" (Hoopes et al., 2003, p. 889). The study observes that a number of studies have associated RBV to industry conditions and to the environment. The implication according to the study is that researchers have positioned RBV as the dominant explainer of inter-firm performance variations. In addition, Y. Lin and Wu (2014) argue that from the perspective of internal organisation of the firm, RBV sees the firm as a bundle of resources. These resources give the firm a competitive edge if they are valuable, rare, inimitable and non-substitutable (Peteraf, 1993; Wernerfelt, 1984). Heterogeneity is also seen to arise from differences in the industries where firms operate and the business environment. The variations in resources each firm controls lead to heterogeneity in firm performance as well. It is expected, therefore, that firm size significantly explain the variations in performance across firms[6].

Dimensionality three: The Measurement Time Frame

When defining and measuring performance, duration or time frame for which performance is being studied should be considered. If short-term performance or long term performance is being measured, the performance metric should factor in this, otherwise the results would be inappropriate. In view of this, McGahan and Porter (2003) find that performance changes occur at different stages for industry and firm level. The firm driven performance persists at a slower rate compared to industry driven factors. The earlier work of McGahan and Porter (1999) find that 76.6% to 81.8 % persistence of the industry driven performance compared to 47.9 to 65.5% persistence in firm specific factors. In view of these findings, Richard et al. (2009) suggest that firstly, the context within which research is being done i.e. firm level or industry level should be considered. Secondly, the selected time frame for any study should be consistent with the phenomenon being studied. Thirdly, performance measures are time dependent. Fourthly, the dependence of performance measures on time is attributed to reputation effects that link

[6] For a more detailed review of RBV see chapter 2, section 2.3 of this study.

past performance to future performance. The linkage between past and present performance effectively provides feedback mechanism within the dimensionality of performance (Roberts & Dowling, 2002).

Devinney et al. (2010) work focusing on 3,000 global firms in 38 industries concludes that a minimum of three dimensions of performance is required to characterise firm performance and the firm performance fundamental aspects. Performance measures are motivating factors encouraging managers to make optimal inter temporal decisions (Abernethy, Bouwens, & Lent, 2013). However, this is achieved when short and long term managerial actions on firm value are fully reflected in performance measures (Lambert, 2001). The time frame dimensionality of performance is critical, especially in financial reporting under the Generally Accepted Accounting Principles (GAAP). GAAP refers to the rules for the preparation of financial statements, designed to ensure stakeholders compare and evaluate firms and their results based on similar information and format. The GAAP time period concept requires accounting for the firm to be taken over specific time period known as the accounting period or fiscal period. The accounting periods are of equal lengths, usually one year. The implication of this requirement is that, whereas a researcher may want to study accounting firm performance over a long period, the performance will be divided in years in line with GAAP. As to which is the most appropriate time period for estimating firm performance, the debate is inconclusive and the opinion divided.

It is argued that when measuring performance, consideration of the relationship between the time series properties, which links firm activity to performance should be made (Richard et al., 2009). The author argues that this can be achieved by observing changes in performance from the well-selected short time periods over a longer period of time. Secondly, using longitudinal data in this way helps the researcher focus attention on changes in performance as opposed to absolute performance level, which effectively controls for time invariant error. The use of longitudinal data helps correct the fixed effects specific to the different firms (Boulding, 1990). It is also possible to test and account for shifting model parameters in addition to those associated with the time series itself, using pooled data methods collected over multiple time period (H. P. Bowen & Wiersema, 1999). Although the debate on the most appropriate time period for longitudinal performance data to use is inconclusive, Kirby (2005) finds wide consensus that ten years period is the most appropriate time frame for studying firm performance. The author argues that over a period of ten years, most companies will have been led by more than one CEO. In addition, over that period, a number of structural breaks may have occurred, which can help the researcher study the individual firms' response to the structural breaks.

4.3 Measures of Firm Performance

The multidimensional nature of firm performance and its multiple definitions make it more challenging to adequately measure performance. For instance, "…the challenge of measuring companies relative performance across industries and eras, declaring the top performers and finding the common drivers of their success is so daunting that it might seem a fool's errand to attempt" (Kirby, 2005, p. 30). Assessing the performance of firms operating in multiple industries is even more complex due to the problem of allocating balance sheet and income statement items such as sales and asset items among the many industries within which they operate (Dess & Robinson, 1984). According to the study, making accurate estimates through survey techniques is a difficult task. This according to the authors, therefore, represents a major source of measurement error, due to confidential nature of the data and application of different accounting policies and procedures among firms. The study shows that assessing the performance in single industry, privately held firms is even more difficulty.

Dess and Robinson (1984) suggest that using published data is inappropriate for investigating individual firm's performance due to variations in accounting treatments and procedures among firms, which raises the risks of errors. The challenge of measurement is also compounded by lack of universally agreed single performance measure, which has led to the use of multiple assessment metrics (Masa'deh, Tayeh, Al-Jarrah, & Tarhini, 2015). To determine the commonly used performance measures or the meaning of performance irrespective of the dependent or independent variables used, Kiviluoto, Brännback, and Carsrud (2011) review 118 articles published in five top tier peer-reviewed journals. The journals include two in entrepreneurship journals and two in general management journals. The study finds that 'growth,' 'profitability' and combination of growth and profitability are used as proxies or meaning of performance. Secondly, most studies use the measures of 'firm success' as synonyms for firm performance measures. Thirdly, 39.8% of articles consider sales growth as a performance measure while 65.8 % of articles use both growth and profitability as the performance measures. Fourthly, the most widely used performance measure is sales or revenue growth (61%) followed by profitability or accounting based measure (58.8 %).

It is important that performance be correctly measured to enable users of companies' annual reports make relevant, reliable and timely decisions. However, performance measurement is not an easy or straightforward task owing to a number of reasons. As discussed in the preceding literature, performance is multidimensional and hence any performance measurement should capture the three main dimensions.

Performance measurement cuts across many different industries and sectors, which lead to variations in definition and measurement. The implication is that there is no uniformity in how performance is measured across industries and sectors making comparison quite daunting.

Additionally, assessing data from privately-owned firms is a big challenge especially considering such firms are under no obligation to publish financial performance results. In most cases private firms have different financial reports depending on the objective of the reports. For example, it is not uncommon to find private firms with three financial reports for the same period where one report is for submission to the bank for funding and therefore has 'higher' financial performance, the second report is for the tax authority, where the report has recorded a trading loss and of course the actual report. In such a case it becomes difficult for an outsider to make or infer meaning from whatever report is availed for performance analysis. Even where the accounts or performance reports are not manipulated, there exist variations in accounting policies and treatment of estimates that require subjective estimation.

Performance is measured in multiple disciplines such as engineering, medical, military, corporate world, among others. In all these disciplines, the understanding of what performance entails is different and so is the performance metrics used. Although the disciplines are different their main point of intersection is the financial aspect since money is spent irrespective of the objectives of the entity. Therefore, this study places more emphasis on the financial performance in general and the accounting performance measures in particular. A review of the other financial performance measures is also provided. There are four widely used firm performance measures identified in the literature, namely, accounting based, stock-market based, mixed accounting, and subjective measures (Richard et al., 2009; Rowe & Morrow, 1999). The four performance measures are discussed in details in the next sections.

i. Accounting Based Performance Measures

The preference for accounting performance measures is to a large extent based on their ability to measure economic value generated by specified firm resources, which makes them reasonable and appropriate proxies for a firm's value creation (Anthony & Govindarajan, 2004). This finding is consistent with Abernethy et al. (2013) study which finds that the benefits derived from accounting returns is due to two reasons. Firstly, accounting returns explicitly relate firms' earnings to the assets that generate the earnings by combining financial statement information. Secondly, in practice, the accounting performance measures are used in conjunction with the estimate of firms' cost of capital. The authors

argue that "…these estimates manifest themselves as 'hurdle rates' and their inclusion in accounting return measures reinforces incentives for business unit managers to consider the longer-term effect of their actions. Managers know these 'hurdle rates' apply now and in the future and this prompts them to consider how their decisions affect future measured performance…" (p. 928). The implication of consideration of longer-term effect of management actions would positively impact on both the present and future firm performance. However, Dobbs and Koller (2005) argue that accounting results and rise in share prices do not necessarily show whether a company is able to sustain current performance and generate future profits. This they argue is because companies can manipulate earnings per share through acquisitions or share repurchase. Richard et al. (2009) note that not only the wide usage of accounting-based measures but also a link between accounting-based measures and economic returns. The high correlation (above 0.75) between accounting and economic rates of return, buttresses the wide acceptance of accounting returns in the organisational performance literature and therefore consistent with Abernethy et al. (2013) work.

The review of preceding studies reveals a mixed opinion on the relationship between accounting performance measures and performance. It may not be appropriate to link firm performance to the choice of performance measure used by the firm since the relationship or correlation may be spurious. Although the relationship may not necessarily exist or, where it does, it may not be strong enough; the role of accounting performance measures cannot be ignored. The performance metrics are supposed to show how a company has performed as opposed to causing the company to perform. It is the management responsibility to use performance results to monitor its performance and improve where necessary and for the stakeholders to determine how best to use performance results presented by the firm's management.

Accounting reports are prepared according to GAAP, whose application and practices vary across firms with regard to the treatment of certain items in financial statements. The items include, provision for depreciation on non-current assets, provision for non-performing loans, inventory valuation as well as revenue and expenditure recognition. According to GAAP, once a firm has adopted a method of treating items in the financial statements, the method should be consistently applied over the years to enable comparison across firms.

The GAAP requirement notwithstanding, accounting performance measures have been criticised for their lack of comparability and their propensity to manipulation compared to other performance measures. On

the other hand, Delen, Kuzey, and Uyar (2013) observe that the use of accounting financial ratios has been extensively used and are considered powerful tools for management decision making. This argument is supported by Devinney et al. (2010) study, which argues that financial performance measures are central to the understanding of performance of firms. Moreover, Ross, Westerfield, and Jordan (2008) observe that financial ratios have a number of merits, which include: 1) Appraisal of management performance for rewards purposes; 2) Measuring performance of departments within companies; 3) Prediction of future performance; 4) Providing information to creditors and suppliers; 5) Measuring the performance of rivals; and 6) Determining the performance of target companies for purposes of acquisitions.

A number of recent studies have used accounting ratios to predict bankruptcy by classifying good or bad performing companies with their probable values (P. R. Kumar & Ravi, 2007). Other studies have used accounting ROE ratio with the help of machine learning-based models to predict bankruptcy (Martín-Oliver & Vicente Salas-Fumás, 2012; Olson, Delen, & Meng, 2012). Additionally, Barton, Hansen, and Pownall (2010) study on performance measures, most valued by investors worldwide, has entirely used accounting performance measures. Barton et al concludes that for purpose of equity valuation, research and accounting standard setters should focus more on the underlying attributes considered most relevant by investors as opposed to emphasis on looking for the best performance measure. The implication of these findings is that the choice of the performance measure in general and accounting performance measures in particular largely depends on the intended use of the performance results. Some accounting performance measures are intended for internal use i.e. within the organisation while other accounting measures are for external use.

There are many financial performance measures provided by accounting systems, which consider costs, turnover and profits that can be computed at both the branch and organisational levels (Datar, Kulp, & Lambert, 2001). Some studies use growth in sales as a performance measure whereas others use it as an explanatory measure (Capon, Farley, & Hoenig, 1990). According to Venkatraman and Ramanujam (1987) sales growth, net income growth and Return on Investments (ROI) are some of the main measures of business economic performance. Abernethy et al. (2013) observe that accounting return measures provide measures of economic value generated from identifiable resources. From the literature reviewed in this study, a number of accounting measures have been identified. Each method has its strengths and shortcomings and is applied in different scenarios depending on the objective of the analysis. Some of

the accounting measures such as the return on equity can be broken further into other smaller ratios and therefore the present study will restrict itself to the most widely used accounting performance measures, consistent with existing literature. The next section reviews the most widely used accounting performance measures.

a) Return on Investments (ROI)

Return on Investments is defined as a ratio of net income to total assets (Jacobson, 1987). ROI is widely considered a simple and effective measure of division's or profit centre's efficiency in utilising the capital entrusted to it (Solomons, 1965). On the other hand some departments dealing with service delivery in companies such as the human resources have expressed their dissatisfaction with ROI. For example Phillips (1997) argue that the human resource departments are in most cases unable to quantify the return on their investment in training and development. However, Reece and Cool (1978) observe that ROI is viewed as the most useful measure of a division's performance. According to the authors ROI has many advantages which would account for its wide usage, namely: 1) as a ratio it enables one to compare companies of differing sizes; 2) as a percentage return measurement, ROI is consistent with company's cost of capital measurement; and 3) the ratio can be used by parties outside the company to make intercompany comparisons of economic performance.

Since the gain from investment is expressed in current values or prices while the invested capital is not, ROI can be affected by inflation as a result of increasing gain from investment. This would distort the true ROI resulting in misleading results. Jacobson (1987) examines the validity of ROI as a measure of economic rate of return by studying the relationship between ROI and stock returns seen as widely accepted measure of firm performance. The results suggest that ROI is a useful and most probably the best available business performance indicator. It also finds significant association between information found in ROI and stock returns. However, recent studies show that where ROI is used to appraise decision-making units (DMUs), there is the risk that managers may select only those projects which are equal to or exceed the DMU's current ROI (Venanzi, 2012). This, according to Venazi, is irrespective of the value created by the DMU in the long term. If this happens, it can lead to sub-optimisation, where DMUs (subsystems) work to optimise their goals at the expense of the goals of the whole organisation (system). In addition, this would buttress Solomons (1965) earlier argument that where ROI is used to make corporate decisions involving a division such as new investment, emphasis should be on success or failure of the venture as opposed to the success or failure of the management. According to Touny and

Shusha (2014), ROI measures the efficiency and effectiveness of a firm's financial performance by showing how efficiently a firm is utilising invested capital to generate income.

According to Andru & Botchkarev (2011:202),

$$\text{ROI} = \frac{\text{Gain from Investment} - \text{Cost of Investment}}{Cost\ of\ Investment} \quad \text{.....equation 4.1}$$

Andru & Botchkarev study show that the approaches to ROI computation vary across companies and conclude therefore ROI must be accompanied by credible explanations of terms and conditions, assumptions as well as numeric features of the business cycle. The authors argue, shed light on the context of firm decisions.

The variations in the computation of ROI across firms would make inter firm comparison difficult and the explanation of terms and conditions of the business cycle would lead to biased and subjective interpretation. This attempt would affect the credibility and reliability of ROI in management decision-making. The credibility of ROI should be protected since Botchkarev and Andru (2011) opine that ROI performance measure is one of the most widely used metrics in business analysis. The authors observe that analysts have over time used non-rigorous and amorphous combinations of approaches prone to inaccuracies and biased judgments. Although Nwude (2012) argues that ROI can be used in investment appraisal decisions involving new investments, Information system managers encounter challenges in evaluating ICT projects (Kleist, 2012). The central problem according to Kleist is whether to rely on the ICT vendor in predicting the ROI before undertaking ICT projects, coupled with the insufficiency of relevant information to make the decision.

Notwithstanding the fact that ROI has been widely used in measuring firm performance, numerous studies have highlighted its glaring weaknesses. For example, Jacobson (1987) demonstrates the failure of ROI to relate the profit streams to the investment which produced it. This Jacobson argues, is because the earnings are as a result of past investment decisions while assets are likely to have effect on the past, current and future earnings. These weaknesses according to Jacobson have made ROI subject to criticism as "…..being so seriously flawed that it bears so little if any, resemblance to the crucial concept of internal or economic rate of return" (1987, p.470). Recent studies have validated Jacobson's dismissal of ROI. For instance, Meng and Berger (2012) find that the predictive ability of ROI is impaired by its

failure to include non-financial performance indicators. The other criticism of ROI is its failure to recognise the capitalisation of research and development expenditure.

Solomons (1965) suggests that one of the most serious shortcomings of ROI computation is its inclusion of only tangible investments, ignoring capitalisation of research and development expenditure even when they result in patents. Research and development (R&D) expenditure has implications on the firm's present and future performance. Although R&D expenditure is felt in the current year (or the years it was incurred) the benefits from the expenditure are felt in the long term. In the event that the outcome of R&D turns out to be positive, the profitability of the firm will rise in future years and if the R&D expenditure outcome is negative, the losses will be in future as well. Patenting of research and development expenditure does not necessarily lead to innovation or increase in firm performance since not every patent will eventually benefit the firm.

Consequently, R&D expenditure should not be merely recognised in ROI computation on grounds that the R&D expenditure led to patents unless there is evidence of its direct link to firm performance now or in future. Meng and Berger (2012) argue that the accounting approaches used in ROI computation have cast aspersions on the accuracy of ROI. The study attributes this to the failure to include non-financial performance indicators in the profit computation, which has eroded its predictive power. Lastly, some studies contend that other accounting performance measures incorporate the time value of money, a factor ignored by ROI (Abernethy et al., 2013). The reviewed shortcomings of ROI have informed the decision not to use it as proxy for firm financial performance in this study.

Return on Sales (ROS)

Return on Sales is one of the measures of a firm's profitability. It is calculated as a ratio of net profit after taxes (excluding extra ordinary items) divided by net sales (Palepu, 1985). ROS is easier to calculate compared to other profitability measures since the data required for its calculation is available in any income statement. Carey, Post, and Sharpe (1998) have used ROS to measure firm performance owing to availability of data and unavailability of data necessary to compute ROA. A number of studies find a strong correlation between ROA and ROS and evidence that the two ratios generate similar results (Hitt, Hoskisson, & Kim, 1997). Since there is strong correlation between ROA and ROS, the two ratios should not be used in the regression model to avoid repetition.

Return on Equity (ROE)

Return on equity is one of the most widely used profitability ratios in the banking industry. According to (Moussu & Petit-Romec, 2014) ROE has been used by the banking industry in the allocation of capital within and across divisions. The study observes that ROE is a central performance measure in the banking and the choice of the ratio is as a result of risk management approach to banking. This approach the authors argue, places emphasis on the regulation of bank capital due to a belief in the banking industry that equity should be minimised to reduce capital costs. This is consistent with the earlier work of Simpson and Kohers (2002) which finds ROE as a performance measure most broadly accepted in the banking industry. ROE is the ratio of net income to firm's total assets book value (Mehran, 1995). ROE is expressed as: earnings before tax divided by equity (EBT/Equity) (Jose, Lancaster, & Stevens, 1996). The rationale behind the use of ROE is that shareholders' return should be maximised since they are the owners of the firm.

Consequently, the owners bear the maximum risks compared to other stakeholders in the company (A. Kumar, 2006). Although Monteiro (2006) argues that ROE is probably the most important ratio an investor can use; the author contends that its use has a number of shortcomings. For instance, Rappaport (1983) finds that the asset turnover component of ROE is affected by inflation, which may make it increase even when the assets are not well utilised. The use of accounting policies and conventions which can be changed by the management and are not uniformly applied across different firms is another weakness of ROE (Reimann, 1989). In addition, Finegan (1991) contends that ROE ignores the timing of cash flows and is a short term measure of performance. This short term focus can make the management lose sight of the long term performance, thereby eroding shareholder value (Copeland Thomas, Koller, & Murrin, 1996, p. 105).

A number of studies have used ROE in their theoretical models (Ohlson, 1995) and empirical valuation models (Frankel & Lee, 1998). The wide use of ROE has confirmed its superiority over other performance measures. Brown and Marcus (2009) argue that although ROA and ROE are conceptually similar, ROE is relatively better since it measures operating performance from the point of view of the shareholder. According to the authors, this is because ROE eliminates interest expense from the earnings used in its computation. Recent studies have also found ROE as an appropriate performance measure. Quaadgras, Weill, and Ross (2014) preference for ROE is based on the belief that ROE is a measure of a company's efficiency or the amount of profit generated in view of the resources provided by the owners.

Dehning, Richardson, Smith, and Zmud (2014) have used ROE and ROA to describe the link between some specific process measures and firm performance. The study concludes that ROE is the best measure of overall performance owing to its link with a firm's market value measures. With this robust support and wide acceptance especially in the banking industry, ROE is adopted as a proxy for firm financial performance albeit with adjustment for industry effects. A recent doctoral thesis has used the ratio to measure corporate governance and financial performance of selected firms at the Johannesburg Stock exchange (Mans-Kemp, 2014)

Return on Assets (ROA)

Most of the studies which use ROE have also used ROA as the complimentary performance measure. This is because whereas ROE emphasis is on returns generated by the owner's investment or equity in the firm, ROA emphasises on returns generated by the firm's assets. ROA measures the success of a firm in generating earnings using assets in the absence of financing of those assets (Selling & Stickney, 1989). Return on Assets (ROA) is the net income in year x dividend by the total assets as at the beginning of year x

The preference for ROA over ROE in the measurement of operational efficiency is consistent with White *et al*. (1994) who propose the use of both ROA and ROE to separate asset management and financing influences on profitability. McGuire, Sundgren, and Schneeweis (1988) study on Corporate Social Responsibility (CSR) and financial performance find ROA measure as better predictor of CSR than market measures. This according to the authors is because perceptions of social responsibility are unsystematic or firm specific and hence accounting measures should be more sensitive to them as opposed stock market measures, which show systematic market trends. Secondly, ROA is calculated using data prepared by the management who can manipulate it leading to its stability. Thirdly stock market measures are more variable over time since they mainly respond to unexpected changes in information. According to Jose *et al*. (1996), the EBIT measure used to calculate ROA is free of interest payments as a result of firm financing and is not prone to tax legislation and tax accounting over the study period.

ROA indicates the amount of revenue earned on each dollar of asset, meaning a high ROA value is an indicator of a high profitable business. The ratio should be used to compare companies in the same industry since some industries are more asset sensitive than others (Selling & Stickney, 1989). Some

industries will need heavier outlay than others, which would lower their ROA. Therefore, an increasing ROA trend is an indicator of the company's increasing profitability and vice versa. The wide acceptance of ROA and the fact that the firms in this study are in the same banking industry is a strong imperative for the use of the ratio as the second proxy for firm performance. The ratio is adjusted for industry effects.

Industry Adjusted ROE and ROA

When using a firms' ROE and/or ROA, it is possible to find unusually high or unusually low values for either of these ratios. Recent studies have used industry adjusted ROE and ROA to mitigate this effect (Kayanga, 2008). The industry adjusted ROE is calculated by subtracting the average industry ROE from the ROE of the firm and dividing the result by the standard deviation of in the industry ROE (Cannella & Lubatkin, 1993). According to the study, the industry adjusted ROA is calculated by subtracting the average industry ROA from the ROA of the firm and dividing the result by the standard deviation in the industry ROA. The industry adjusted ROE and ROA, gives us relative performance.

Yeh, Lee, and Woidtke (2001) have used industry adjusted ROE and ROA to measure firm performance. The study finds similar results for industry adjusted ROE and industry adjusted ROA and therefore reports on industry adjusted ROA results for brevity sake. In order to control for potential endogeneity problem, Brown and Marcus (2009) have included lagged values of the mean industry adjusted ROE and ROA in their regression models. Other recent studies have also adjusted ROE to the industry mean ROE (Li & Qian, 2013). Since industry adjusted ROE and ROA is strongly grounded in the literature, this study uses industry adjusted ROE and ROA values in the regression model.

ii. Stock Market Based Performance Measures

A firm's market performance reflects investors' perception of its value as opposed to its fundamental value. This assertion is supported by Stickney, Brown, and Wahlen (2007, pp. 969-970), who state: "...the market price for a share of common equity is a very special and informative number because it reflects the aggregate expectations of all of the market participants following that particular stock. The market price reflects the result of the market's trading activity in that stock. It summarises the aggregate information the market participants have about the firm, and the aggregate expectations for the firm's future profitability and growth…" It assumed that share prices reflect all the information (past and published) about a listed company. According to Richard et al. (2009) shareholder return is the most widely used market based performance measure in management, economics, strategy and finance

research. The study opines that market based performance measures are able to incorporate intangible assets such as goodwill more effectively than accounting data.

However, market based performance measures are prone to market inefficiencies and speculation in stock markets especially in developing economies where stock markets are poorly developed (Masa'deh et al., 2015). Share prices embody the wealth of the shareholders and since these shares (for listed companies) can easily be sold in the stock market, shareholders are able to easily realise their gains.

It appears that it would not be easy for a shareholder to ascertain the accuracy of financial accounting reports prepared by the management. However, in practice controls do exist to ensure reliability of accounting data provided by the management. These controls include the requirement for company accounts to be audited by an independent auditor and the audit report presented to shareholders directly in the annual general meeting (AGM). Although market based performance measures capture intangible assets such as goodwill, the goodwill gets impaired in the event the company is placed under receivership or liquidation.

iii. Mixed Accounting and Stock market-based Measures

Studies on firm financial performance have largely used both accounting and stock market measures. According to Conyon and Lerong (2014), accounting and stock market measures are widely used in evaluating CEO performance. The authors observe that stock market measures are mainly preferred by stockholders because of their ability to show how their wealth has grown. The accounting-based measures of profitability include ROA, ROE, ROS among others while stock market-based measures include market return on stocks (Combs et al., 2005; Hult et al., 2008). The mixed accounting and financial measures combine both accounting and financial market measures so as to balance the risk which is largely ignored by accounting measures (Richard et al., 2009). The ratio of the market value of a firm's assets to their replacement cost is one of the most widely used mixed accounting and market-based performance measures. The ratio developed by James Tobin is referred to as Tobin Q (Tobin, 1969). Since it is not always easy or possible to measure a company's replacement cost of noncurrent assets, most studies have used the closest proxy namely book value of assets. This approach has been criticised for failure to capture the value of intangible assets, which is a general weakness inherent in accounting performance measures.

As an alternative to Tobin's Q, Economic Value Added (EVA^{TM}) has been widely used as a mixed performance measure (Stern, Stewart, & Chew, 1995). According to S. Chen and Dodd (1997, p. 318) EVA[7] is the difference between a company's after tax net operating income and its cost of capital expressed as:

$$EVA = (Return\ on\ capital - cost\ of\ capital) total\ capital \quad \text{..... equation 4.2}$$

(Chen and Dodd, 1997; p.320)

Where: total capital is the sum of total equity and interest bearing debt, while cost of capital is the weighted average cost of these two components of capital. The proponents of EVA argue that it leads to high stock returns. This led to its fast adoption by the leading USA corporations such as Coca-Cola, and AT&T, among others and as a result hailed as the panacea for high stock returns. In addition, the EVA supporters contend that EVA is the only performance measure which is directly linked to stock's intrinsic value (Stewart, 1991). Their argument according to Stewart is that at the end of the day, a shareholder is only interested in share value gains. Secondly, share value (or EVA) of a company increases if it (the company): 1) increases operating profits without the need for further capital, 2) uses less capital for the same operation level and 3) invests in projects which generate returns higher than the cost of capital (Chen & Dodd 1997).

A number of recent empirical studies have questioned the validity of the claims made by Stern Stewart Management services regarding the value of EVA as well as the literature supporting it. The gist of the matter is that the value of EVA has been exaggerated simply because top corporates were the early adopters of the performance measure and the same corporate CEOs have unreservedly endorsed its adoption albeit with anecdotal evidence. For example Ray (2001, p. 67) has bluntly dismissed the performance measure "…EVA may be nothing more than a clever way of repackaging of some very old business principles…" The implication of Ray's statement is that EVA is just the well-known accounting performance measures rebranded and patented. More specifically it is a repackaged residual income accounting (RI) measure.

Recent empirical studies observe that instead of equity market value, EVA uses a company's book value of debt and ROA in place of shareholder returns (Fernandez, 2001, 2013). The author argues that

[7] EVA is a trademark of Stern Stewart Management Services

irrespective of whatever adjustments the accounting data may be subjected to, EVA has nothing to do with shareholder value creation. This argument is consistent with efficient market hypothesis, which argues that it is not possible to consistently beat the market by using the information which the market already has. Linking share prices to a performance measure would amount to attempting to beat the market with information already known by the market. It appears from this discussion that an attempt to move away from accounting performance measures in favour of EVA has ended up generating rebranded accounting performance measures in the name of EVA. This would serve to cement the importance of accounting-based performance measures. In addition, attempting to combine accounting and stock market based measures does not generate better results. Although there is a wide agreement on the validity of both accounting and market-based performance measures the relationship and strength of the two has not been conclusively established (Gentry & Shen, 2010; Rowe & Morrow, 1999).

According to Bhargava, Dubelaar, and Ramaswami (1994) multiple performance measures exist and are applied in research. The study however, concedes that the use of multiple measures is problematic since the measures have been found to be unrelated leading to varying outcomes depending on the measures used. The lack of a clear evidence on the relationship between accounting and market based performance measures would explain the reservations, which most studies have with regard to combining the two performance measures. As a result, most studies have used either accounting-based or market-based performance measures but not both.

Some studies support the case for combined accounting and market performance measures. On the other hand, Gentry and Shen (2010) opine that it would not be appropriate to combine market and accounting performance measures into one financial performance measure. According to the study, firstly, accounting profitability and market performance represent unique performance dimensions with minimal overlap, since performance is a multidimensional construct and not unidimensional. Secondly, the stock market value of a firm reflects its future performance while accounting performance measures reflects its past performance. Despite the fact that the two have the potential to be related, Gentry and Shen contend that the logic and philosophy they represent are different and cannot be assumed to overlap.

Thirdly, researchers should clearly define the construct or specific firm performance aspect they wish to study first and then use it as a guide to the theory and development of hypothesis. Accounting measures mainly capture historical and short term performance while market based performance measures reflects future and long term performance of firms (Hoskisson, Hitt, Wan, & Yiu, 1999). Gentry and Shen (2010)

find the absence of evidence in research literature on the relationship between long term and short term performance. The implication of these findings is that if one wishes to study a firm's financial performance, the study must first clearly define what financial performance is (or represents), the time frame of that performance and then use the concept consistently in the development of theory and hypothesis. Once the timeframe dimensionality is determined the researcher can be able to determine whether to use long-term or short-term performance measures.

iv. Subjective Performance Measures

These measures use neither accounting nor market based performance measures. They entail the opinion of the top management and/or knowledgeable employees within an organisation who possess significant knowledge of the subject under study. This approach has been used by Dess and Robinson (1984), where the top management was asked to provide a subjective assessment of their firm's performance. Later study by Cannella and Hambrick (1993) interviewed executives and security analysts to obtain data on pre and post-acquisition performance for a study on executive succession in acquired firms.

Most studies have historically been sceptical of the use of subjective performance measures. The scepticism arises from the high propensity for human error arising from imperfections in human cognition (Gilovich, Griffin, & Kahneman, 2002). The weaknesses of subjective or non-financial measures notwithstanding, Richard et al. (2009) find that the increased focus on subjective performance is largely driven by the widening theoretical and normative aspect of firm performance. The authors observe that the emergence of assessments, which focus on the multidimensional aspect of firm performance (such as economic, social and environmental) supports the need for subjective measures. The subjective assessments include corporate social performance (CSP) and Fortune Reputation Surveys.

A number of studies have reviewed the non-financial measures of firm performance, their predictive ability and value relevance (Amir & Lev, 1996; Ittner & Larcker, 1997). Ittner and Larcker's use of customer satisfaction and business data finds evidence linking customer satisfaction with accounting performance measures. Conversely, Amir and Lev (1996) posit that earnings, cash flows and book values financial information are irrelevant for valuation of securities when looked at on standalone basis, but earnings provide explanation of prices when combined with non-financial information. The study contends that non-financial measures may not be objective and are subject to subjective interpretations. However, Dess and Robinson (1984) argue that the use of accurate objective performance measures

should be strongly encouraged and used if they are available. In addition, Eccles (1990) suggests that financial data cannot be the only indicator of firm performance and that relying on the accounting department to predict the company's future leaves the company "hopelessly mired in the past" p.131. The study finds increasing number of managers using their company's system of measurement to monitor non-financial measures to strengthen their competitive strategies.

Other subjective measures in use include product quality, market share and customer satisfaction; among others. These measures are increasingly being used in measurement of performance reward schemes (Banker, Potter, & Srinivasan, 2000). This is consistent with Ittner and Larcker (1997), who observe an increase in the use of non-financial performance measures such as market share and customer satisfaction in performance evaluations. In times of financial distress, earnings could be deemed an unreliable indicator of firm performance. This is due to high propensity of the management to manipulate accounting policies so as to increase accounting income to protect their jobs, earn huge pay and avoid debt default (Gilson & Vetsuypens, 1993). Most non-financial or subjective performance measures are not within the control of the management and are therefore not prone to manipulation by the management. In times of financial distress, such measures may be a better reflection of the reality on the ground with respect to the performance of the firm. According to Abernethy et al. (2013) the main advantage of nonfinancial performance measures is their ability to improve contracting efficiency which motivates managers to undertake managerial actions with long term implications. The authors argue that this attribute of nonfinancial performance measures can be a lead indicator of future performance. Secondly, the measures can be custom-made to measure specific firm activities deemed by the management to be more critical in the long term.

4.4 Firm Factors, Industry Factors and Firm Financial Performance

There is substantial research on factors that contribute to firm financial performance. These factors or determinants are at both firm and industry/macro levels.

Firm and Industry Factors

The financial performance of firms could be explained by firm-specific factors or by the structure of the industry in which the firms operate. According to the industrial organisation view industry factors are the key determinants of firm performance. On the other hand RBV posits that firm specific variables are the primary firm performance drivers. A number of studies have attempted to establish which of these

have significant impact on firm financial performance. For example, Kamasak (2011) argues that performance differences among firms can be explained by Industrial Organization (I/O) economic theory and RBV. The I/O theory according to Kamasak, states that firm performance variations can be explained by the structural features of the sectors in the industry where the firm operates. The implication of this view is that there exists a direct relationship between industry performance and firm performance. If this was the case heterogeneity among firms would be immaterial since the performance of the firm would mainly depend on the performance of the industry where it operates.

RBV contends that the performance variations among firms are mainly accounted for by the resources that the individual firms control (Galbreath & Galvin, 2008). Galbreath and Galvin (2008) argue that the debate on firm resources versus industry contribution to firm performance has critical managerial implications. Firstly, the authors suggest that if research finds that firm specific factors are more important, then management will question the importance of the industry structure. Secondly, if industry structure is found to be the major determinant of firm performance, management will have to decide the level of attention to be accorded to the firm specific factors. The authors find that firm specific factors generally have higher effect on performance than industry structural effects. A number of studies link variations in firm performance to firm-specific factors and are therefore consistent with RBV (Boyd, Bergh, & Ketchen, 2010; Galbreath & Galvin, 2008; Kamasak, 2011).

Variations in performance of firms within an industry will depend on the speed with which the firms evolve within an industry. According to Hawawini, Subramanian, and Verdin (2003) organizations within an industry evolve differently, have different organizational formation or structure and employ different strategies. These formations or structures and strategies in the end make individual firms have distinct capabilities that distinguish them within the industry (Nelson, 1991). A number of empirical studies on firm and industry effect on firm performance find firm attributes more important than industry factors. For instance, Schmalensee (1985) empirical analysis of industry contribution to firm profitability using market share as the proxy for firm size, has shed more light on the issue.

Using data from the year 1975 Federal Trade Commission (FTC) business data and return on assets as proxies for firm performance, the study makes important findings. Firstly, the study observes that 20% of the observed variance in firms' returns is explained by the industry where the firms operate. Secondly, firm attributes of market share have no significant contribution to firm performance. However, the study offers no reasonable explanation for the 80% of aggregate variance in firms' returns. Nevertheless,

building on Schmalensee (1985) work, Rumelt (1991) attempts to explain the 80% variance unexplained by Schumalensee' study. Rumelt includes other terms to measure inter-temporal persistence in industry effects from interactions with the industry. The study finds that industry membership accounts for 9% of the business unit variance in returns. Secondly 44 % of variance in business unit returns is explained by firm specific factors.

A number of studies in the services industries using methodologies identical to Rumelt (1991) have validated Rumelt's findings (Brush & Bromiley, 1997; Mauri & Michaels, 1998; McGahan & Porter, 1997; Ruefli & Wiggins, 2003). Conversely, Kamasak (2011) argues that the literature on performance variability among and within firms is inconclusive as to whether industry factors or firm specific factors account for the performance variability. On the other hand, Hawawini et al. (2003) find that the performance of dominant (leading) firms as well as small firms (losers) in a given industry is significantly driven by firm specific resources. Industry effect according to the study is more important for the firms, which are neither leaders nor losers in a given industry. Hawawini et al. (2003) findings are consistent with the resource, based view which links firm performance to the resources the firm controls.

Although numerous studies have been done on firm and industry characteristics and their link to firm performance, no conclusive results appear to have been found even from the recent studies. For instance, Y.-M. Chen (2010) study seeks to establish what explains the variations in performance of firms with identical industry structure, leverage and competencies in the same ICT industry. The empirical results show that firm factors have greater impact on performance than industry factors in both Taiwan and South Korea. On the other hand, Karabag and Berggren (2014) argue that firm specific factors such as competitive strategies have no significant impact on firm performance but the industry structure is the strongest determinant of firm performance. The lack of universally agreed performance metrics as well as consensus with regard to the definition of 'firm performance' means that researchers may not generate homogenous results after all. Consequently, the results of each study should be interpreted in the context in which it was done in view of the variables studied and what the researchers consider to be the appropriate proxy for firm performance.

All the same, the relative importance of the effects of the industry structure and firm performance could be very significantly different in emerging markets (Khanna & Rivkin, 2001). The study, however, offers no conceivable justification for this variation across markets. It is possible that variations in financial market development between developed and emerging markets could explain the differences in the

effects of industry structure and firm performance. In less developed markets, most industries experience market concentration where very few large firms account for the lion's share of the whole industry performance. For example 52.39% market share of the Kenya's banking sector is controlled by six commercial banks out of a total of 43 banks (CBK, 2013).

Although it may be difficult to attain normal distribution of market share even in developed economies, the standard deviation is much higher in developing or emerging economies than is the case in developed economies. In addition the research on industry and firm factors does not offer any evidence on the drivers of firm performance (McGahan & Porter, 2005). In sum, the preceding review of literature provides strong evidence that firm-specific factors significantly drive firm performance, which in effect buttresses the resource based view. More importantly for this study and to contribute to the preceding debate, firm size and industry ROE and ROA performance measures are included in our model as control variables. The model tests the relationship between financial innovations and firm performance.

4.5 Innovations and Firm Financial Performance

A number of studies have reviewed the relationship between firm financial performance and innovation in manufacturing as well as innovation in services. For instance, Rosenbusch, Jan, and Andreas (2011) meta-analysis of previous research on the relationship between innovation and firm performance aims at establishing the direction and strength the relationship has on the performance of small and medium enterprises. The study makes a number of findings. Firstly, a positive relationship between innovation and performance is established. Secondly, fostering innovation orientation has a stronger positive relationship with performance than generating innovation process output such as products and services. Thirdly, investment in process innovation leads to higher firm performance than investment in product innovations. The findings are largely equivocal as to what explains the variation in returns from investment in process and product innovations. Laforet (2013) considers innovation orientation as a pre-requisite for innovation. According to the study, innovation orientation entails risk taking attitude, deemed the main feature of innovative companies.

According to Laforet (2013), few companies have empirically examined innovation outcomes at firm level or the link between firm's innovation and firm performance. However, the author does not provide a plausible explanation for shortage of the empirical studies. On the other hand, Artz, Norman, Hatfield, and Cardinal (2010) study 272 firms derived from 35 industries over 19 years to establish the firms'

ability to generate benefits from their inventions and innovation as well as the effect of the innovation on firm financial performance. The study observes a negative relationship between patents and performance as measured by both ROA and sales growth. However, the negative link between innovation and firm financial performance observed in Artz et al. (2010) could be as a result of the use of an inappropriate proxy for innovation, namely patents. This is because patents may not necessarily result to innovation.

F. E. Bowen, Rostami, and Steel (2010) argue that although there is a positive link between innovation and future performance, the link between innovation and past performance is unclear. For instance, R.-J. Lin, Tan, and Geng (2013) empirical study of four leading Vietnamese motorcycle manufacturers show a positive correlation between green product innovation and firm performance. Conversely, Aas and Pedersen (2011) empirical analysis of 3575 Norwegian manufacturing firms finds that firms investment in service innovation generate significantly higher performance in operating results that their counterparts.

It appears from the literature that most of the studies on firm performance and innovation have been carried out in developed countries. However, critical success factors for innovation may not be replicable across geographical regions and markets due to cultural differences (Al-Ansari, Pervan, & Xu, 2013; Laforet & Tann, 2006). Consequently, more studies are needed across geographical regions for purposes of comparison. Using ROI, ROA, ROS and Overall profitability as proxies for firm performance with data from a wide range of US industries, Calantone, Cavusgil, and Zhao (2002) find that a firm's innovativeness is strongly positively related to firm performance.

The link between firm performance and innovation is complex necessitating further research (Jiménez-Jiménez & Sanz-Valle, 2011). The study, however, finds a positive relationship between innovation and firm performance. The authors argue that the strength of the relationship between innovation and firm performance is higher for bigger and older firms in the manufacturing sector. The respondents to the questionnaires used in the study were asked about the evolution of their firm's performance over the preceding three years. The findings of this study, however, may not be replicated in other studies in view of the subjective nature of the performance measures used.

Aduda and Kingoo (2012) study of the relationship between electronic banking and financial performance of Commercial banks in Kenya finds a strong positive relationship between bank

performance and e-banking innovations. Using ROA as proxy for bank performance and number of ATMs and debit cards as proxy for e-banking, the authors find that innovation contributes to performance of large firms as well as small and medium enterprises. Additionally, Rosenbusch, Brinckmann, and Bausch (2011) argue that innovative products enable SMEs compete with large and established firms. According to the authors, innovative products enable small firms avoid price competition and also create new demands that contributes to the firm's growth.

Cainelli et al. (2006) assess the impact of innovation on the service firms' economic performance by conceptually and empirically exploring the bi-relationship between innovation and firm level economic performance in services. The authors attempt to establish the existence of virtuous circle between innovation and firm level economic performance. The study generates important findings. Firstly, the study finds a strong positive relationship between innovation and firm's economic performance. Secondly, innovating firms perform better than non-innovating firms in terms of economic growth and productivity. Thirdly, the study observes reverse or circular relationship between innovation and firm performance evidenced by the higher propensity for better performing firms to innovate and commit their capital to innovation. The findings indicate that firms with high turnover as evidenced by high sales growth show above average innovation expenditure in ICT encompassing both hardware and software. These findings are consistent with earlier work of Gopalakrishnan (2000) on the reverse causality between innovation and financial performance.

Firms adopt innovations so as to contribute to performance or effectiveness of the organization (Damanpour, 1991). Innovation is critical for any firm to operate and remain alive especially in a strongly competitive business environment. Hult, Hurley, and Knight (2004) findings confirm that a firm's innovativeness is an important determinant of business performance irrespective of the hostile market environment within which the firm operates. Using new product development as proxy for innovation to explore retail bank performance, Eric Reidenbach and Moak (1986) study finds strong evidence linking bank performance to the development of new products. The authors, nevertheless, are unable to identify the nature of the relationship. This they argue is because performance could be affected by other factors such as better management decisions regarding the development of the new products.

DeYoung et al. (2007) have studied 424 community banks comprising the earliest adopters of internet banking in USA. The study compares the change in the banks' year 1999-2001 financial performance with that of 5,175 community banks using branch-only banking. The authors find an improvement in the

profitability of the early adopters of internet banking among community banks associated with internet banking. The authors largely attribute this profitability to revenues from deposits and service charges. According to the study, internet banking is used as a complement for physical branch use as opposed to being a substitute for it.

The studies reviewed in the preceding section provide evidence of existence of a link between innovation and firm performance in different setups. From the reviewed studies, there is evidence linking innovation to firm financial performance for both small and large firms. Product and process innovation helps the firms in improving performance as well as enabling small firms compete with large firms. Small firms use innovation to create niche markets for their new products and to avoid price competition with large firms. The relationship between innovation and firm performance is two way, meaning there is a reverse causation between the two. Innovation enables small firms to become big enough to afford huge expenditures in innovation and associated research and development.

4.6 Conclusion of the Chapter

Chapter three has dealt with the empirical literature on firm performance in general and firm financial performance in particular. The review of literature indicates a considerable effort at attempting to define the term performance and a lack of consensus on what the term actually embodies. The difficulties in defining performance emanates from variations in conceptualisation of the term and the multidimensional nature of performance. Performance is seen to have three dimensionalities namely; *stakeholder* dimensionality, *heterogeneity-resources and environment* dimensionality and *measurement time frame* dimensionality. These dimensions need to be considered when defining or measuring performance. Stakeholders are entities that have a stake in the continued existence of the operations of the firm.

These entities determine or influence the performance measures to be used. For example whether accounting measures or stock market based performance measures. Each stakeholder has vested interests in the firm but it is difficult to address the needs of all the stakeholders. Heterogeneity dimension is the variations in performance of firms as a result of differences in the quality and quantity of the resources that each firm possesses. The duration or time frame for which performance is being studied should be considered when defining and measuring performance. This implies that when measuring short term performance, one should use short term performance measures and vice versa.

The chapter discusses the measurement of performance in details with a review of four main performance measures. These performance measures include; accounting based performance measures, stock market based performance measures, mixed accounting and stock market measures and subjective performance measures. ROE and ROA are adopted as proxies for firm financial performance albeit with adjustment for industry effects. ROE and ROA have been used extensively in studies on the banking sector. The study finds that when using firms' ROE and/or ROA, it is possible to find unusually high or unusually low values for either of these ratios and that recent studies have used industry adjusted ROE and ROA to mitigate this effect. The chapter reviews two theories explaining the role of firm attributes versus industry structure on firm performance. These theories include the industrial organization view which argues that industry factors are the key determinants of firm performance and resource based view which posits that firm specific variables are the primary firm performance drivers. The chapter finds evidence in favour of firm resources in driving firm performance, which is consistent with the resource based view. Lastly, the critical role played by innovation in driving firm performance is discussed. The next chapter reviews the banking sector in Kenya.

CHAPTER FIVE

KENYA'S BANKING SECTOR REVIEW (2004-2013)

5.0 Introduction

The goal of the chapter is to review the context within which the present research is carried out. A review of the banking sector performance for the 10 years' study period starts with the summary of the structure of the sector. The chapter discusses financial regulations which touch on financial innovations. Although not every banking regulation has a bearing on financial innovations the regulations have a bearing on the financial sector. The variables used in studying firm data and their relationships are summarised with the help of descriptive statistics. The chapter is dividend as follows: Section 5.1 structure of the banking sector. 5.2 Business environment. 5.3 Performance of the banking sector

5.1 The Structure of Kenya's Banking Sector

According to the CBK the banking sector in Kenya comprises; The Central Bank of Kenya (CBK), which is the sector regulator, 44 banks (43 commercial banks and one mortgage finance company-MFC), seven representative offices of foreign banks, nine microfinance banks (MFBs), two credit reference bureaus (CRBs), one money remittance provider (MRP) and 101 forex bureaus (FXBs). According to CBK, out of the 44 banks, 30 are locally owned, including three publicly held banks, while 14 are foreign owned (CBK, 2013). All the foreign exchange bureaus, microfinance banks and credit reference bureaus are privately held. The structure of the banking sector as at December 2013 is shown in figure 5.1.

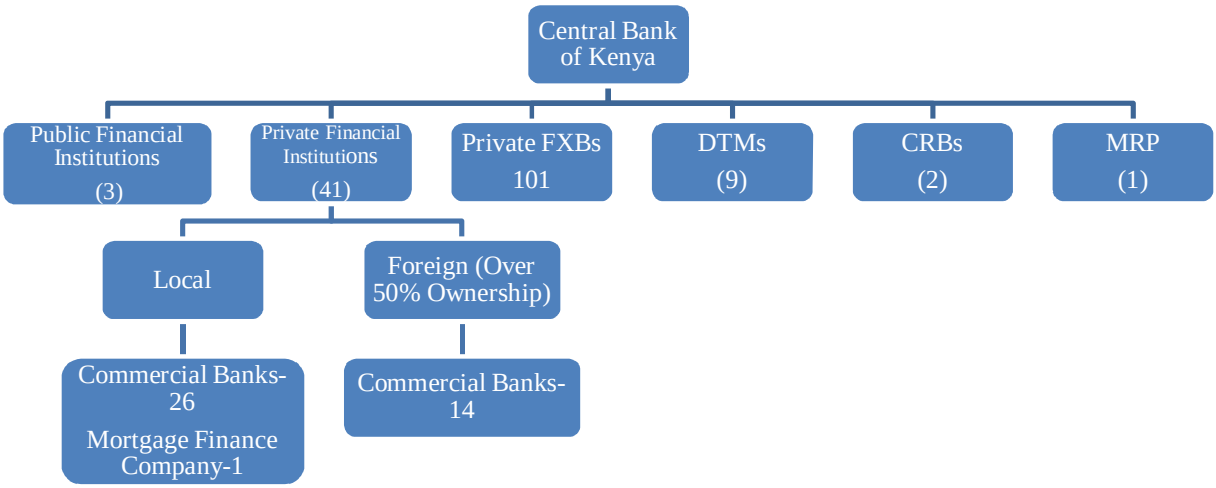


Fig 5.1 Structure of the Banking Sector- December 2013

Source: Central Bank of Kenya Annual Supervision Report (2013, p. 1)

Regulations and Legislations in the Banking Sector

Kenya's banking sector has evolved over time as a result regulations and guidelines of the CBK and amendments to the Banking Act following recommendations of the CBK. CBK proposed a number of amendments to the banking legislation in 2004 aimed at harmonising the supervisory powers of the Bank with international practice (CBK, 2004). According to the report it was expected that the proposals would strengthen the bank supervision to ensure compliance with the Basel Core principles for effective bank supervision and other requirements for corporate governance. According to CBK three areas of the Banking Act were amended to include; 1) Provision for the creation of a Monetary Policy Advisory Committee; 2) Section 36 (4) dealing with Central Bank Rate; and 3) deletion of Sections 39 and 39 (a) on the regulation of interest rates. The CBK has been vigilant to ensure compliance to the new regulations. Consequently, the Central Bank penalised many commercial banks for breaching the banking Act and prudential regulations (CBK, 2005). These breaches entailed the failure to make sufficient provisions for bad and doubtful debts, lending in excess of allowed limits, loans misclassification as well as submitting returns that were not accurate to the Central Bank.

In order to ensure stability of the financial system in general and banking sector in particular, the CBK, Ministry of Finance and the other players spearheaded the supervisory and regulatory reforms in 2007 (CBK, 2007). The major changes in the year entailed the operationalisation of the Finance Act, the Banking (Amendment) Act 2006 and the publication of the proceeds of crime and Anti-Money Laundering Bill 2007, which was tabled in parliament in the same year. The year 2007 saw the approval of mobile money transfer commonly referred as mobile banking with the introduction of M-Pesa. M-Pesa is a mobile money product of the leading telecommunications company-Safaricom. M-Pesa means mobile money (where 'M' stands for mobile and 'Pesa' is a Kiswahili language word meaning 'money'). This marked a significant development in the financial services sector with regulatory support from the CBK.

In 2008, a number of legal and supervisory developments took place, which has long-term implications for the banking sector. The Banking Act 2008 was amended through the Finance Act 2008 to progressively raise the minimum core capital for banks to one billion Kenya Shillings (Ksh) by the end of 2012 up from Ksh250 million ("Finance Act," 2008). The CBK published the Banking (Credit Reference Bureaus) Regulations 2008 in July 2008, which empower the regulator to license and monitor Credit Reference Bureaus and assemble credit information from commercial banks (CBK, 2008). The CBK envisioned that the sharing of credit information would boost access to affordable credit and permit collection of credit information on Kenyans working in the informal sector enabling appraisal of credit risks by banks.

Kenya's efforts at streamlining the banking sector from a regulatory approach were extended to the East African community. The member states of the EA community signed a Memorandum of Understanding in 2008, which aid the sharing of information and supervisory co-operation for the banks operating in the region (CBK, 2008). According to the CBK, a similar memorandum is expected between Retirement Benefit Authority (RBA), Insurance Regulatory Authority (IRA) and Capital Markets Authority (CMA). The banks regulator contends that regional and domestic information sharing is in response to lessons learnt from the global financial crisis, which stresses the need for co-ordination among domestic and foreign regulators. A Memorandum of Understanding (MOU) was signed between CBK, CMA, IRA and RBA to facilitate information sharing and supervisory co-ordination between participating domestic regulators (CBK, 2009). According to CBK, the MOU will largely check the activities of large conglomerates in the financial sector that may want to benefit from regulatory arbitrage.

The year 2009 saw the commencement of Central Bank proposals, which eventually led to the introduction of Agency banking in Kenya ("Finance Act," 2009). Agency banking entails the use of CBK approved third parties by commercial banks, which enables the banks to extend their outreach. Agency banking services include cash deposits, withdrawals, bill payments and account balance enquiry. The CBK issued guidelines to agency banking in May 2010, which requires banks to seek the approval of CBK for their agent network in addition to approval for specific agents. The regulations also require commercial banks to specify the services to be provided by agents in addition to vetting their respective agents (CBK, 2010). The CBK argues that the model is aimed at enabling banks to provide banking services in a cost effective manner and fostering financial inclusion.

5.2 Business Environment

The Kenyan economy has experienced a number of shocks over the 10-year study period. The worst shock was experienced in 2008 emanating from the post-election violence over the disputed 2007 general election results. The country's GDP has fluctuated over the period of study as shown in fig 4.2.

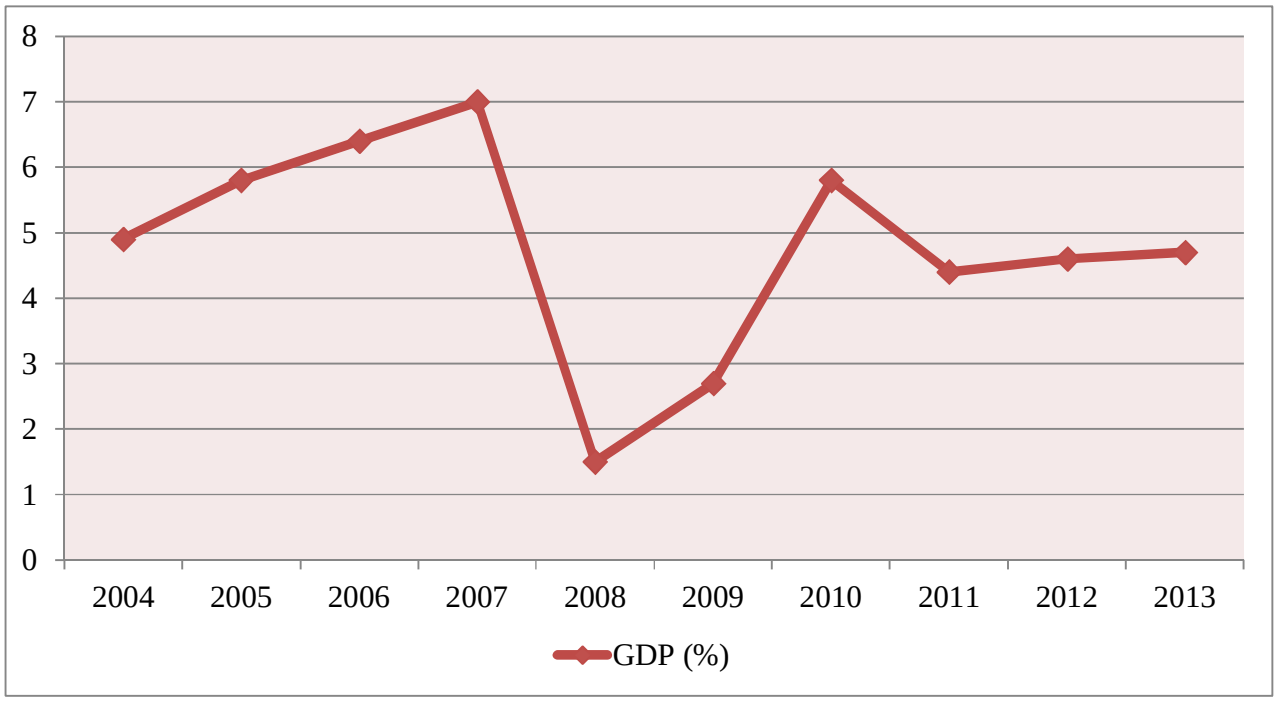


Fig. 5.2: Gross Domestic Product (GDP) Growth

Source: Author's compilation using data obtained from the World Bank's World Development Indicators.

In 2004, Kenya's GDP expanded by 4.3%, the highest growth since 1994. The improved economic environment and strong macro-economic fundamentals largely resulted in positive growth in all sectors of the economy (CBK, 2004). For instance, the gross non-performing loans to total assets ratio sharply declined as a result of the settlement of non-performing loans in one leading state controlled bank and a number of recoveries and write offs in a number of banks. The decline in nonperforming loans over the study period is illustrated in fig. 5.3.

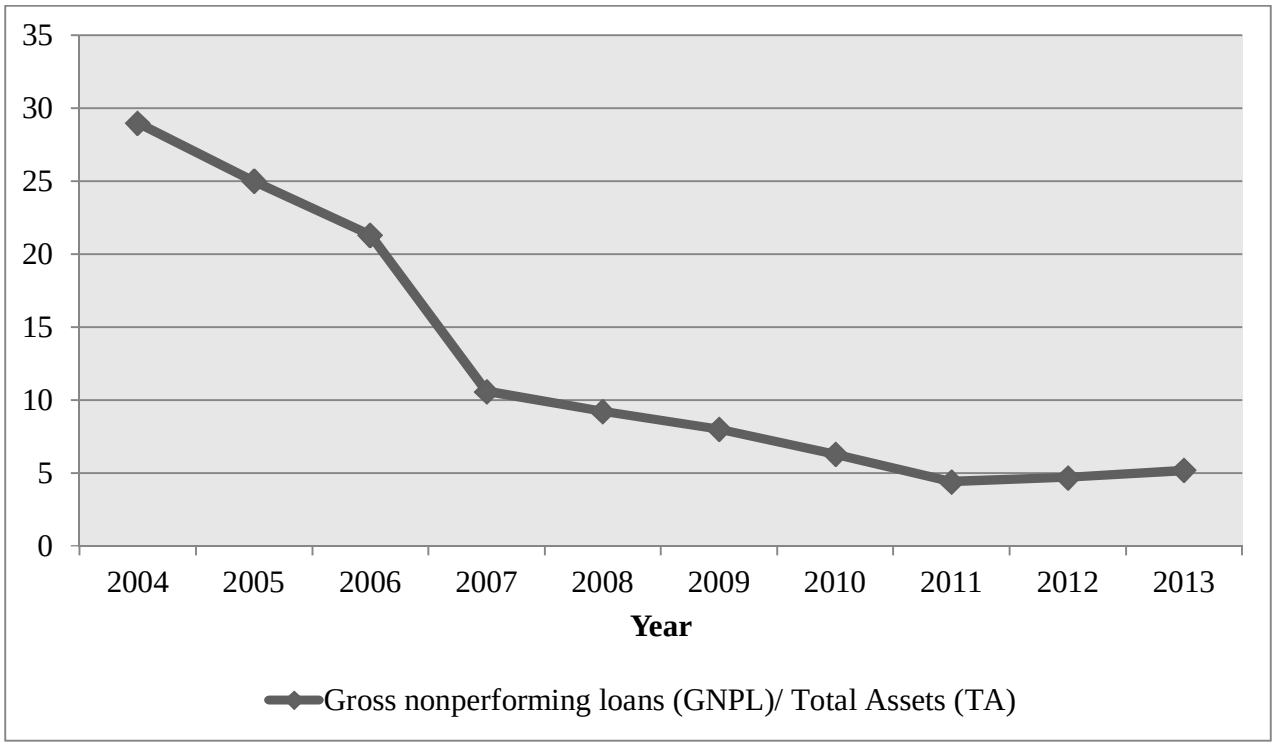


Fig. 5.3: Banking Sector Non-performing Loans

Source: Author's compilation using data obtained from CBK

Although 2008 coincided with the global financial crisis, the CBK contends that Kenya's financial sector was not affected owing to its lack of exposure to sub-prime mortgage at the centre of the crisis (CBK, 2008). According to the CBK report, Kenya's financial system was affected by the lag effects of the crisis as it spread from USA to the rest of the World. The disputed general elections held in December, 2007 led to the outbreak of post-election violence ending in early 2008. In spite of the post-election crisis and the global financial crisis, the financial sector registered robust performance in all key performance

indicators as evidenced by the growth in total assets from Ksh951 billion in 2007 to Ksh1.18 trillion in 2008 (CBK, 2008).

To mitigate the effects of the global financial crisis, CBK increased its surveillance of the banking sector with an emphasis on capital adequacy, asset quality, foreign exchange exposures and liquidity management. Liquidity in the banking sector is measured by the ratio of liquid assets to total deposits. It is considered a reflection of the bank's ability to meet its obligations as when they fall due (CBK, 2008). According to CBK, Basel I deals with capital adequacy framework, which seeks to align the banks' capital to their risk profiles whereas Basel II is a modification of the Basel I framework. Basel I framework only factored credit and market risks facing banks for purposes of capital adequacy.

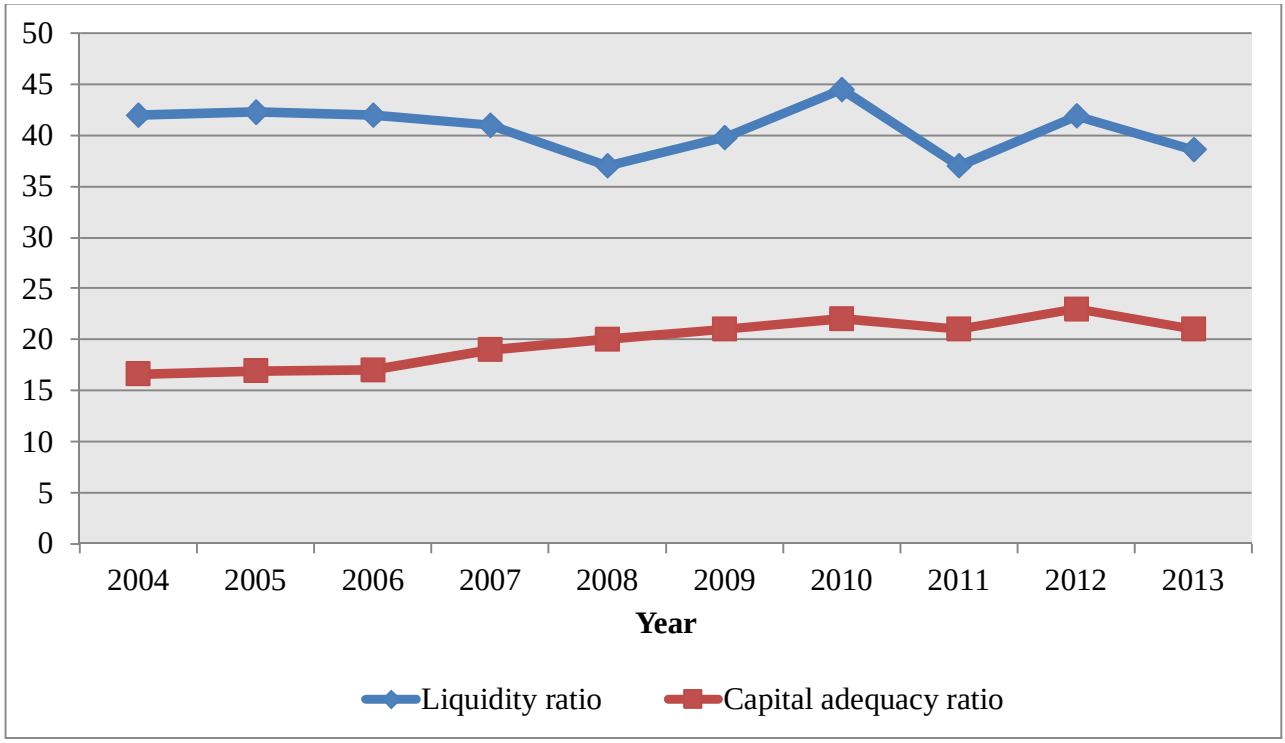


Fig. 5.4: Banking sector Liquidity and Capital Adequacy

Source: Author's compilation with data obtained from the CBK

Fig. 5.4 provides evidence that the liquidity as well as the capital adequacy position has consistently remained stable and above the mandatory regulatory requirement. The minimum required capital adequacy ratio is 12% whereas the minimum required liquidity ratio has been 20 % over the period of study. A number of Kenyan banks have aggressively embarked on regional expansion in the East African

region comprising Southern Sudan, Rwanda, Uganda, Tanzania and Burundi. The momentum for regional expansion is growing largely driven by large banks. The impact of the regional expansion will most likely be felt in the long term once the foreign operations begin recording profits from their operations.

5.3 Developments in ICT (Electronic Banking)

The banking sector has generally embraced technology over the period. In 2005, CBK introduced Real Time Gross Settlement (RTGS) system referred to as Kenya Electronic Payment and Settlement System (KEPSS) (CBK, 2005, p. 4). According to CBK, the system is aimed at, firstly, curtailing the use of cash as a financial instrument in the payment system. Secondly, the system reduces risks arising from payment exposure and promotes the efficiency and safety of exchange in value between parties. Consequently, this provides an online system enabling individuals and banks to electronically transfer funds on real time basis. Banks have significantly leveraged on technology to entice new customers thereby cross-selling their products to existing ones (CBK, 2009).

These systems according to CBK are incessant innovations by banks driven by globalisation and accessibility to electronic products and service delivery channels. The introduction of internet and mobile banking services is attributed to advancements in ICT platforms which enable online viewing of bank statements, cheque book requests, notification on account activities, funds transfer and online payment of utility bills and integration of customer information. Banks have also leveraged on developments in ICT and telecommunication companies to create convenience to customers while reducing cost of service delivery. ICT applications largely affect the strategies adopted by banks in the delivery of products and services to their customers (CBK, 2010). These capabilities also determine the type of products and services that can be offered by the banks as well as the efficiency of the offering to customers.

The banking sector in Kenya has ICT platforms that are supported by the key banking systems. According to CBK, the capabilities of the banking systems and other integrated systems have largely driven the banks' strategies. The main bank systems in current use by banks include: *Bankers realm, Flex-cube, T24* and *Pinnacle*. The new systems being adopted by banks enable the centralisation of staff and support new technology driven products such as internet, agency banking and mobile banking. The application of ICT has significantly affected the banking sector efficiency score as measured by the ratio of number of staff to the number of customers (CBK, 2013). The growth in efficiency score is illustrated in fig. 5.5.

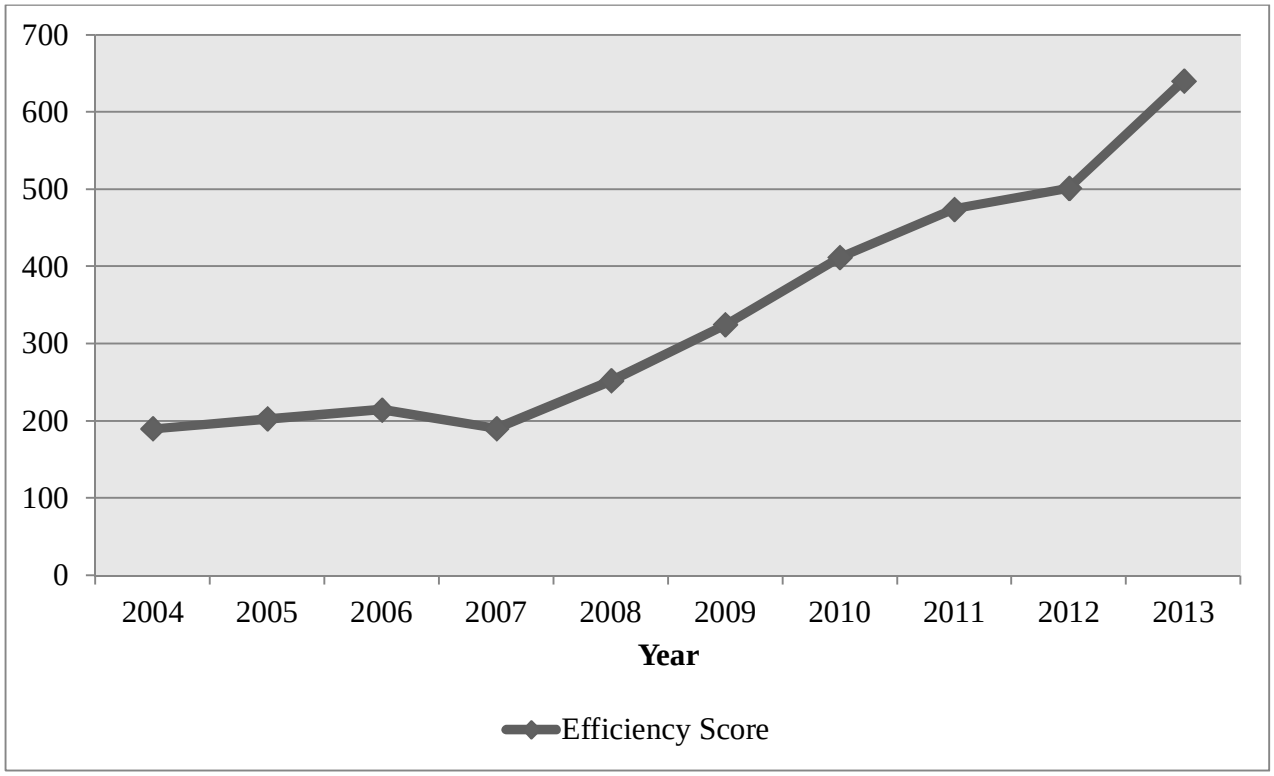


Fig. 5.5: Growth in Efficiency Score

Source: Author's compilation using data obtained from the CBK

$$Efficiency\ Score = \frac{Total\ number\ of\ deposit\ accounts}{Total\ number\ of\ Staff} \quad \text{.....equation 5.1}$$

The implication of the increase in efficiency score is that the growth in number of bank customers is not in tandem with the employment of new banks staff. An efficiency score of 200 means that one employee can serve 200 customers in a day. With the increased use of ICT platforms such as mobile banking, ATMs, online banking and agency banking many customers are being served in locations away from the traditional bank branches. Therefore, it is evident that banks are benefiting from the use of financial innovations in their operations. To mitigate the risks inherent in ICT-based banking, the CBK has placed the responsibility of risk management on the senior management of the relevant banking institutions (CBK, 2013). The CBK expects that the adequate Internal Control Systems (ICS) in this regard will increase customer confidence with respect to issues of confidentiality, integrity and timely delivery of services by the banks.

5.4 Employment in the Sector

The banking sector experienced rapid expansion as evidenced by the rise in branch numbers resulting in the increase in overall employment from 10,884 in 2002 to 34, 059 in 2013 (CBK, 2013). Even though employment figures generally increased to 2013, the employment of support staff significantly declined a decline CBK attributes to the preference for outsourcing by most banks. Fig 5.6 illustrates the evolution in employment in the banking sector over the 10-year study period.

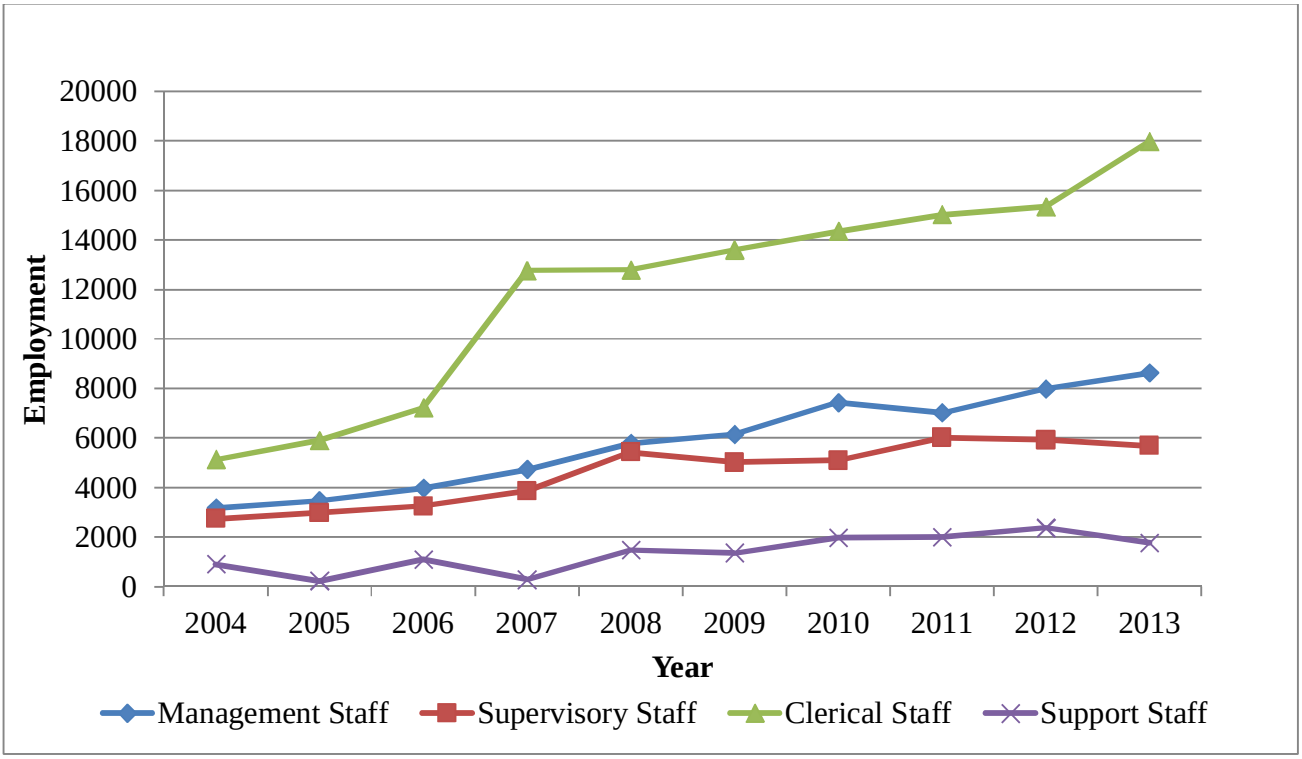


Fig 5.6: Employment in the Banking Sector

Source: Author's compilation with data obtained from the CBK

5.5 National Payment System

Kenya's national payment system has experienced the emergence of new payment system namely mobile money. The payment system mainly uses cell phones to transfer funds in the form of electronic money (e-money). The growth in mobile money has grown in tandem with the growth in mobile subscriptions as shown in Fig 5.7 (a) and Fig 5.7 (b). The growth in mobile subscriptions over the 10- year period has been phenomenal and appears to render fixed lines subscriptions obsolete as shown in Fig 5.7 (a).

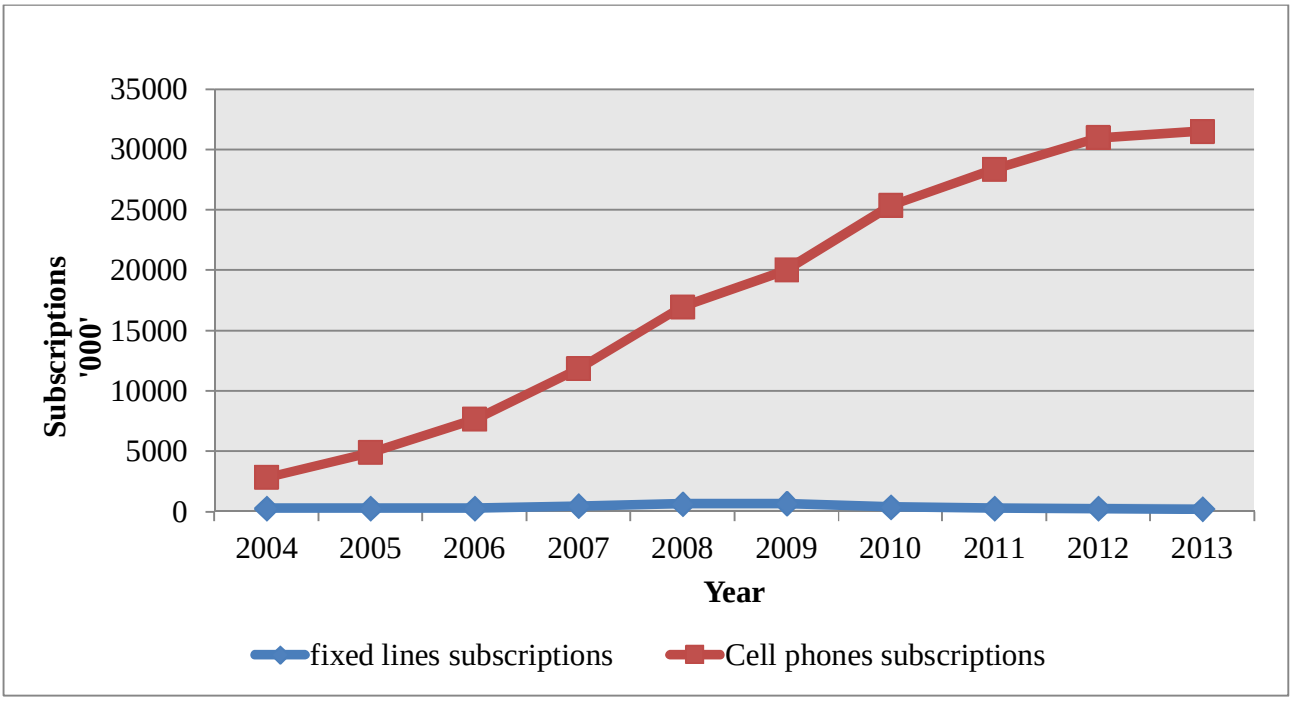


Fig. 5.7(a): Evolution of mobile and fixed line subscriptions

Source: Author's compilation with data obtained from the ITU

Using data from the CBK the Fig. 5.7 b shows that mobile payments have overtaken the combined payments made through all electronic plastic cards in the last five years. The plastic cards included under "other electronic systems" include: Credit cards, debit cards, prepaid cards, charge cards, POS machines and ATM cards.

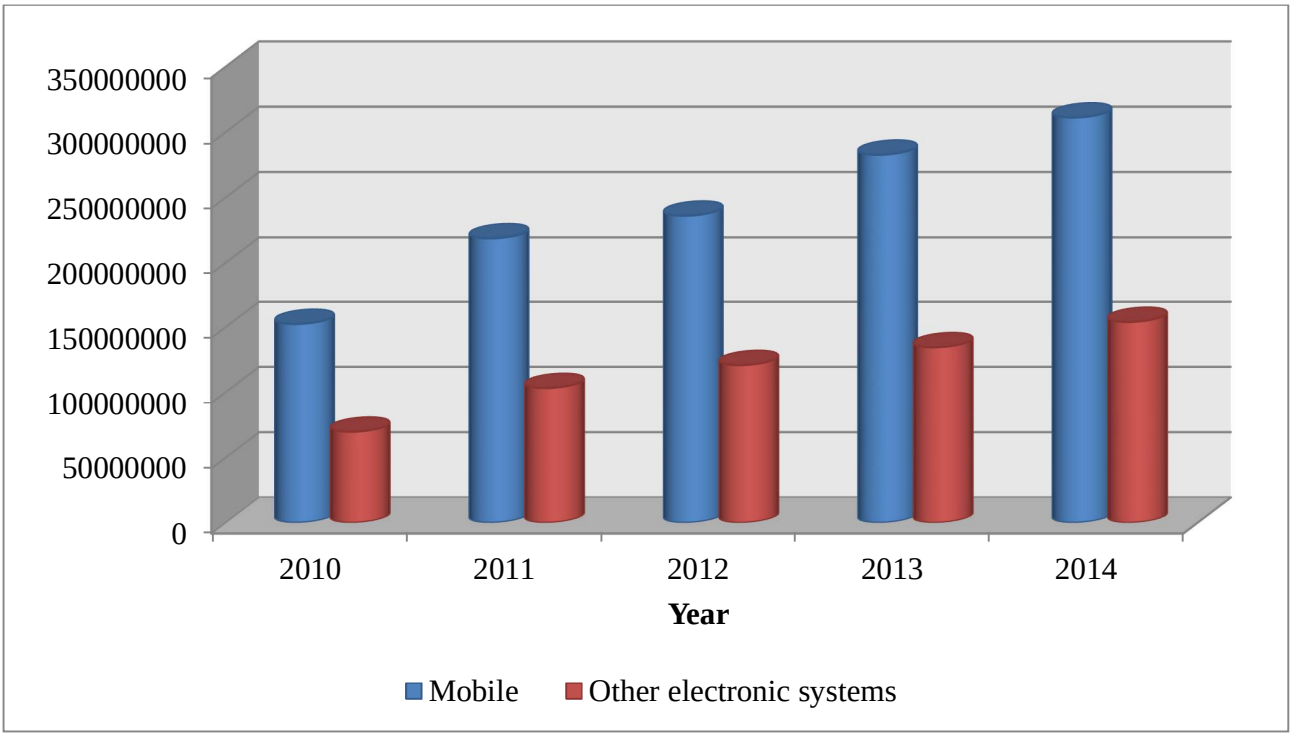


Fig. 5.7(b) Number of electronic payment customers

Source: Author's compilation from data obtained from the CBK

The number and value of transactions from mobile platforms has significantly overtaken the number and value of all the other electronic payment platforms. The implication is that emerging payment innovations in the telecommunications sector are outpacing the traditional banking innovations like ATM cards. Since mobile payment innovations are anchored in the banking sector, the two innovations may not necessarily be in conflict. The complementary nature of the innovations in the banking sector implies the two sectors will continue with their interdependence and symbiotic relationship. Fig. 5.8 (a) and 5.8 (b) illustrate the growth in both number and value of transactions conducted through mobile platforms and other systems.

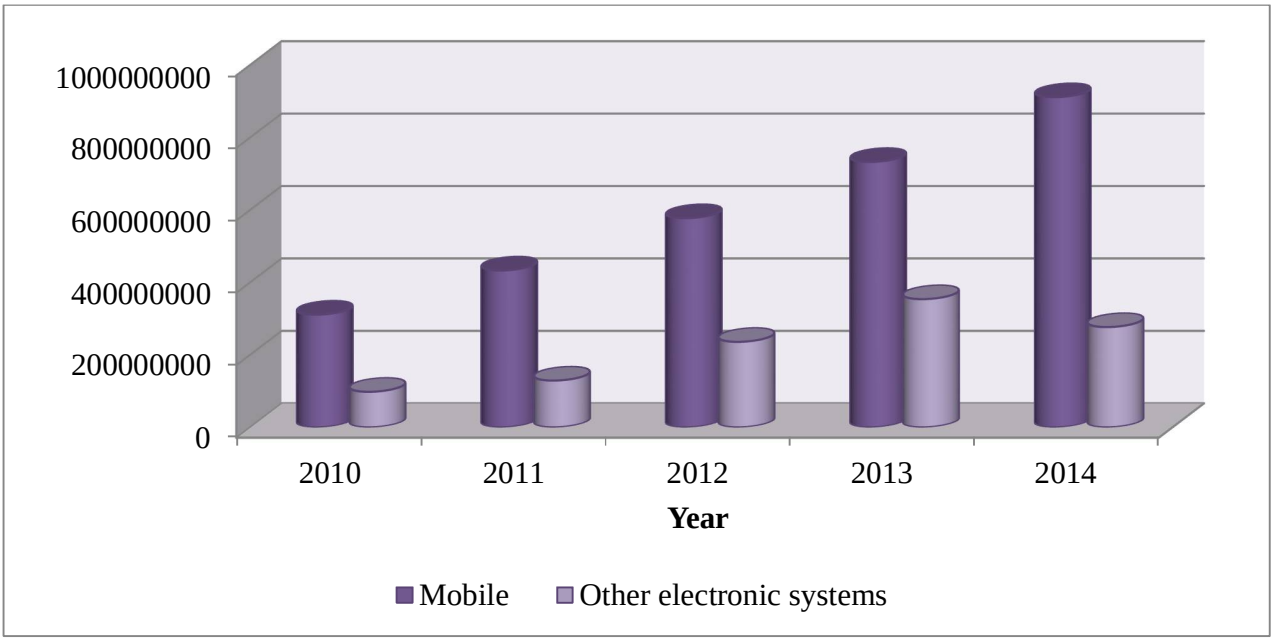


Fig. 5.8(a) Number of payment transactions

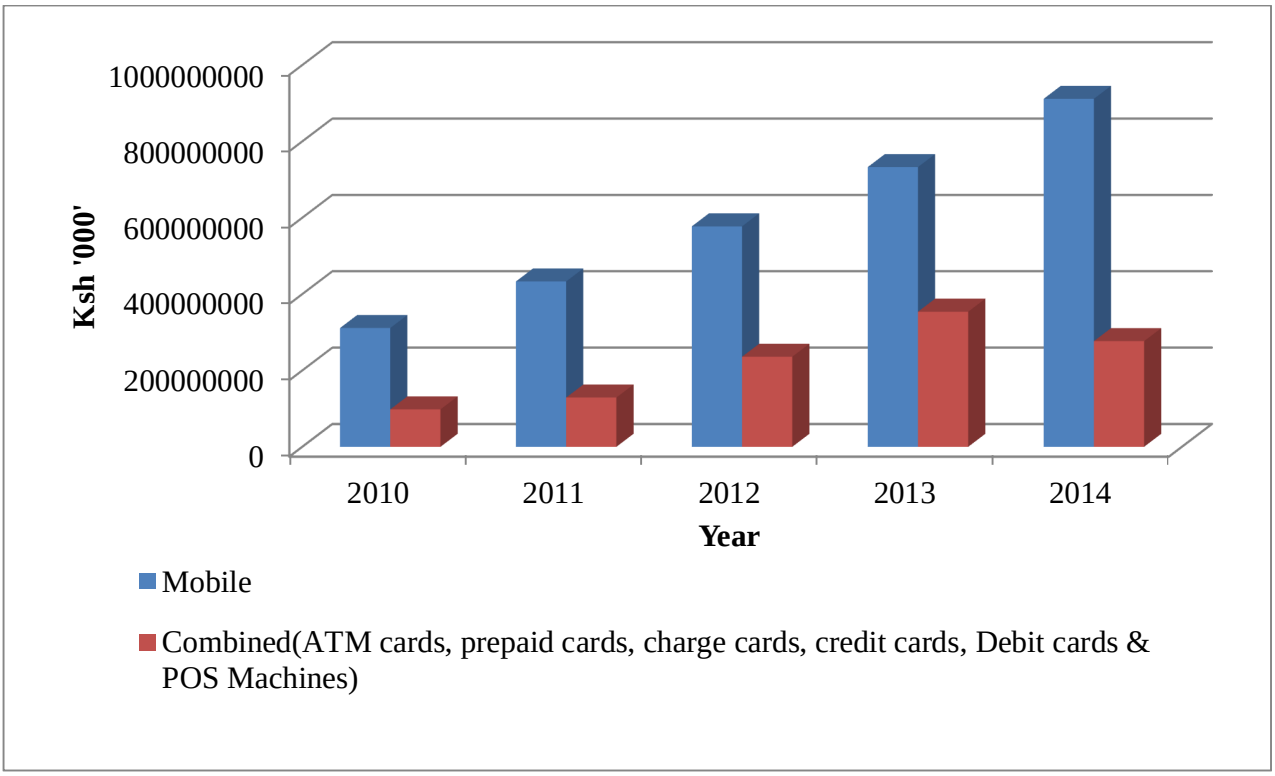


Fig. 5.8(b) Value of electronic payments

Source: Author's compilation with data obtained from the CBK

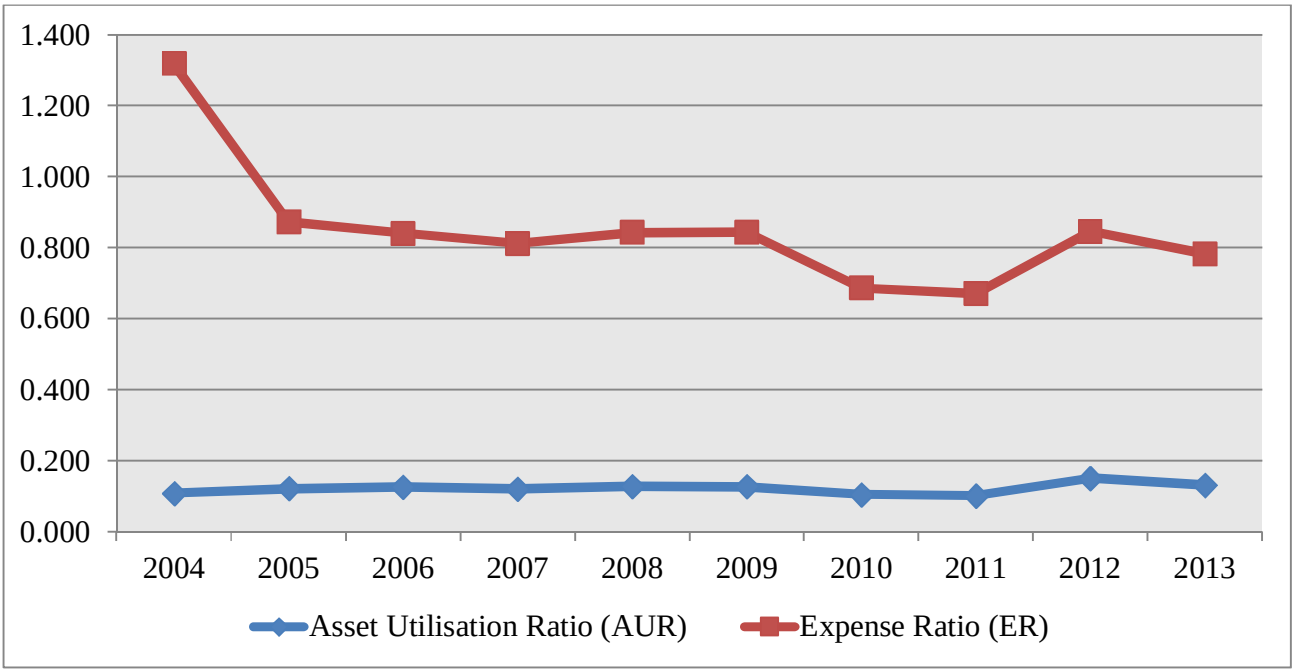


Fig 5.9 (a): Agency costs in the banking sector

Source: Author's computation with data obtained from the CBK

5.6 Agency Banking in the Banking Sector

Banks have contracted supermarkets, security companies, pharmacies, post offices and other entities as agents. However, 90% of agency banking is controlled by three large banks. The commercial banks adopting agency banking continue to register positive financial performance attributed to agency banking usage. For example, one of the leading locally-owned bank's agents as at the end of 2012 stood at 6,344, which was a 96% growth from year 2011. These transactions accounted for 30% of all transactions by the bank in the year (EBK, 2012)

Table 5.1: Number and Values of Transactions undertaken through Agent Banking		
Type of Transactions	Number of transactions	Value of transactions (Ksh 'Millions')
Cash Deposits	3,575,502	28,293
Cash Withdrawals	2,960,692	15,319
Payment of Bills	43,398	113
Transfer of Funds	5	0.000320
Balance enquiries	1,197,164	N/A
Mini statement requests	6,413	N/A
Collection of account opening application forms	978,529	N/A
TOTAL	8,761,703	43,612

Source: CBK Annual Supervision Report (2011, p. 14)

The number, types and value of transactions conducted through agency banking has grown significantly since 2010, as illustrated in Tables 5.2 and 5.3. The data in these tables show a growing preference for agency banking, considering that the types of transactions conducted through agents are similar to those conducted at the bank branches. However, compared to the mobile platforms, agency banking lags behind in terms of number and value of transactions as well as the number of agents over the four-year period (2010-2014). The dominance of mobile banking over agency banking could be explained by the fact that users of agency banking must have (in most cases) a formal bank account with a bank. Considering majority of Kenyans have no access to a bank account, mobile banking appears to be addressing the banking needs of the unbanked.

Table 5.2: Type and number of transactions undertaken through agent banking				
Type of Transaction	Number of Transactions			
	Year 2012	Year 2013	% change	Cumulative*
Account balance enquiries	4,770,829	5,771,490	21%	11,739,483
Cash deposits	12,554,299	18,531,811	48%	34,661,612
Cash withdrawals	11,862,412	6,981,903	43%	31,805,007
Collection of account opening application forms	176,218	158,781	-10%	1,313,528
Collection of debit and credit card application forms	52,212	57,245	10%	109,457
Collection of debit and credit cards	31,321	19,673	-37%	50,994
Mini-statement requests	43,376	30,776	-29%	80,565
Payment of bills	142,046	113,429	-20%	298,873
Payment of retirement and social benefits	303,455	387,454	28%	690,909
Transfer of funds	944	3,292	249%	4,241
Total	29,937,112	42,055,854	40%	80,754,669
Number of agents	16,333	23,477	44%	
				*Year 2010-2013
Source: CBK Annual Supervision Report (2013, p.16)				

Table 5.3: Type and value of transactions undertaken through agent banking-December 2013				
Type of transaction	**Value of transactions (Ksh. Millions)**			
	2012	2013	% Change	Cumulative
Cash deposits	101,171	160,790	59%	290,254
Cash withdrawals	49,610	73,894	49%	138,822
Payment of bills	239	251	5%	603
Payment of Retirement and Social Benefits	1,064	1,254	18%	2,318
Transfer of funds	14	27	91%	41
Total	**152,097**	**236,216**	**55%**	**432,038**
Source: CBK Annual Supervision Report (2013, p.17)				

5.7 Performance of the Banking Sector

Kenya's banking sector has grown remarkably in terms of total assets, total deposits and other parameters over the 10-years study period. The sector performed well in spite of the post-election and global financial crises shocks as well as changes in political regimes over the period. The banking sector is largely concentrated in favour of (six) large banks, which take a lions' share of the banking sector performance. The CBK grouped banks into 'peer groups' based on total assets whereby banks were classified as 'large' if their total assets were above Ksh15 billion, as 'Medium' if their total assets were between Ksh5 billion and Ksh15 billion and as 'small' if total assets were less than Ksh 5 billion. Some banks have moved from lower classification to higher ones and vice versa. Although large banks account for bigger share of the sector performance, generally the banking sector has been on upward trajectory in terms growth as illustrated in Fig. 5.9 (a).

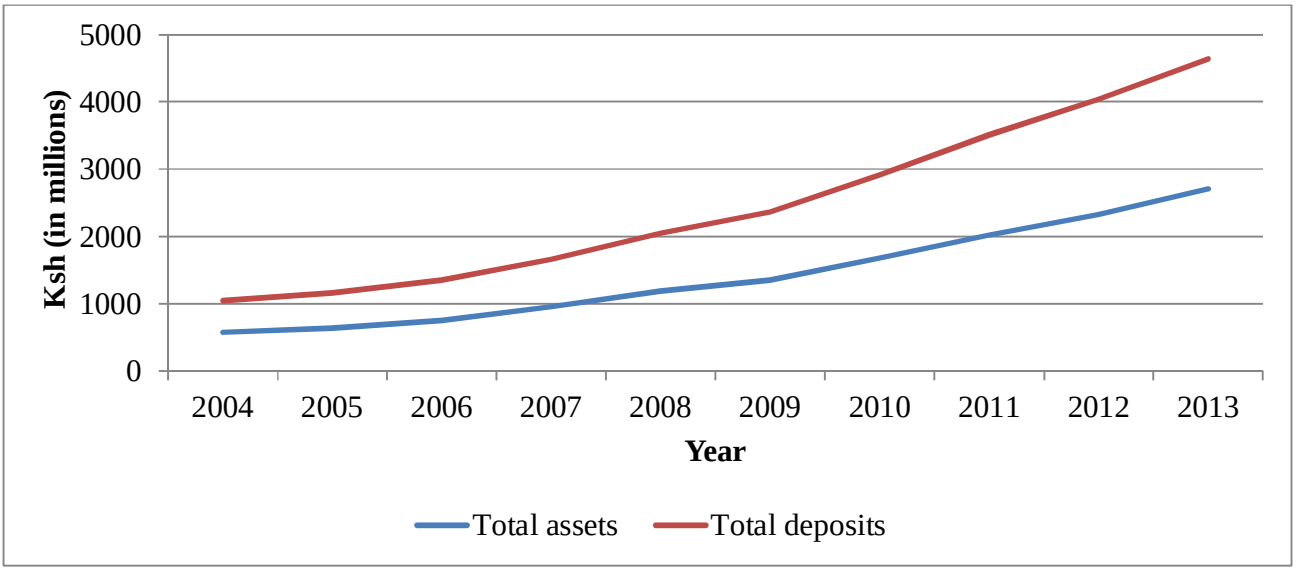


Fig. 5.9 (b): Growth in total deposits and total assets

Source: Author's compilation with data obtained from the CBK

The peer group classification led to over 50% of the banks being classified as 'big' in the 2010 necessitating a revision of the grouping criteria (CBK, 2010). The classification of banks into three peer groups since 2010 has been based on the weighted composite index which comprises: total assets, deposits, capital size, number of deposit accounts and loan accounts (CBK, 2011). As at December 2013, six banks were classified as large, 15 as medium and 23 as small. The six large banks account for 52.39 % of the (weighted) market size, medium banks account for 37.95 % and the 23 small banks control a paltry 9.66% of the market.

Consequently, these statistics provide evidence of high concentration in the banking sector, which is likely to reduce small banks to mere followers and imitators of the financial innovations developed by large banks. The dominance of large banks in terms of total assets and total deposits implies that large banks have sufficient resources to develop financial innovations. Fig 5.9 (b & c) illustrates the performance of the peer groups since year 2006 although the composition of the individual peer groups has varied over time. The apparent decline in total assets for all peer groups in year 2010 is as a result of the change in classification criteria for the peer groups.

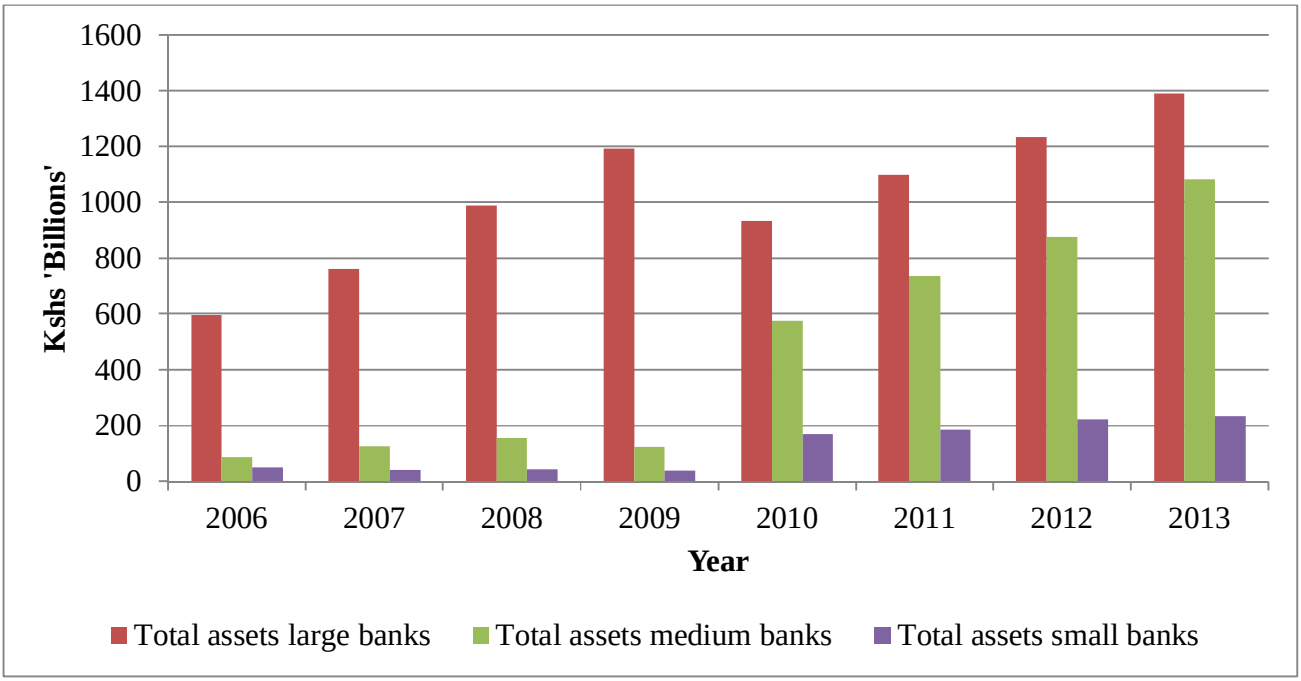


Fig. 5.9 (c): Growth in peer groups' total assets

Source: Author's compilation with data obtained from the CBK

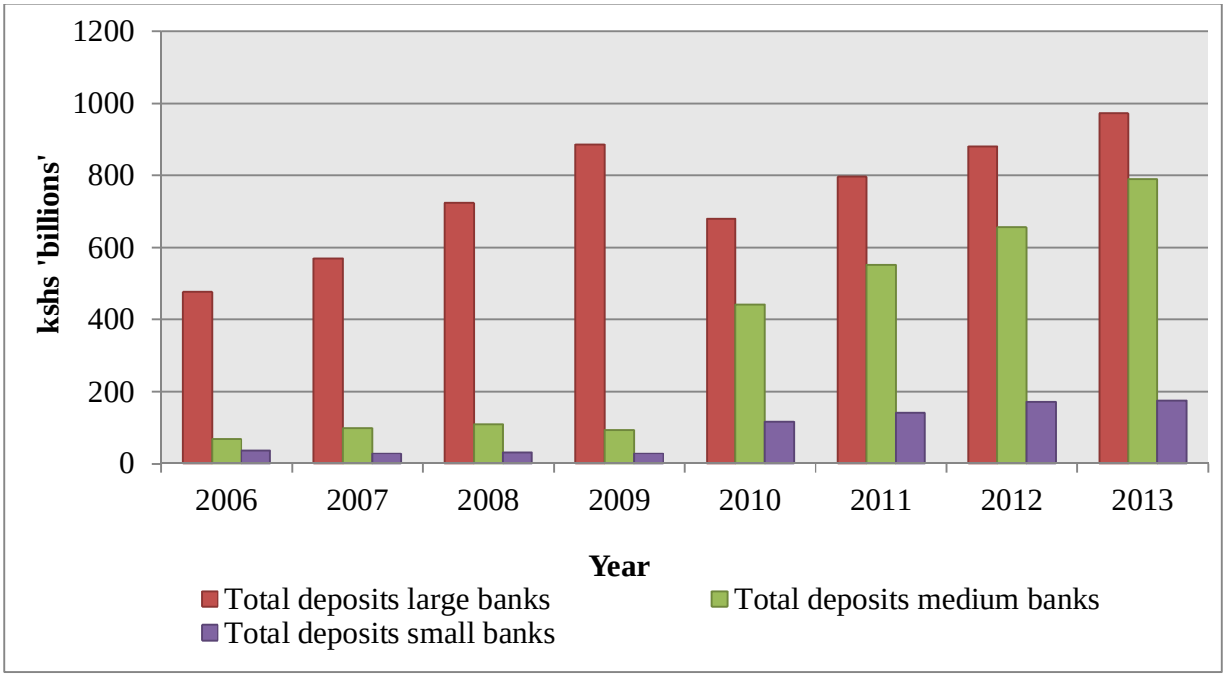


Fig 5.9 (d): Growth in total deposits

Source: Author's compilation with data obtained from the CBK

CHAPTER SIX

HYPOTHESES DEVELOPMENT

6.0 Introduction

The preceding chapters have underlined the empirical literature on financial innovations, empirical literature on firm performance and reviewed Kenya's banking sector over the ten year study period. The aim of this chapter is to formulate testable hypotheses based on the theoretical framework and empirical issues discussed in the foregoing chapters. A review of the research philosophies, research approaches and strategies used to achieve the objectives of the study as discussed in chapter one of this study and a justification of the choices for the current study is provided. The chapter describes research hypotheses to be tested. The foundation for development of testable hypotheses emanates from the debate the foregoing chapters present.

6.1 Chapter Layout

This chapter is organised as follows: Section 6.2 Financial Innovation Value Model 6.3 Is the development of hypotheses supported by the literature reviewed in the preceding chapters. Section 6.4 Is the conclusion of the chapter.

6.2 Financial Innovation Value Model

The Financial innovation value model in Fig. 6.1 maps out the variables to be used in the development of hypotheses and their relationship to one another. The conceptual model is developed with reference to the TOE framework discussed in Chapter two; empirical literature on financial innovations discussed in chapter three and the empirical literature on firm performance discussed in chapter four. At the technological and organisational context, the literature has identified nine drivers of financial innovation. These include; technological developments at firm level, agency problems and information asymmetry; transaction costs, firm size and firm constraints; incomplete financial markets, regulation and taxes; globalisation and risk and technological developments at macro level. The literature on the drivers and their respective proxies are encapsulated in this subsection.

As discussed in chapter two, TOE provides the theoretical framework for explaining the value of financial innovation adoption and usage by firms. A combination of technological, environmental and

organisational factors significantly affect technological innovation adoption and usage decisions at firm level. The TOE framework thus entails a three contexts for adopting and introducing technological innovations; technological, organisational and environmental contexts (Y.-M. Wang et al., 2010). In order to determine the value of financial innovation, firms need to establish the drivers of financial innovation at both firm and macro levels. Once financial innovation drivers are established the management will need to allocate resources towards the development of those drivers. Importantly, the firm needs to establish which financial innovations best suits the context within which the firm does business. This is critical since as discussed in the preceding chapters some financial innovations such as mobile money have not succeeded in the context of developed countries. This is despite the fact that they have been adopted at an exponential rate in some developing countries such as Kenya.

The financial innovation value model encapsulates the drivers of the three financial innovations in the form of branchless banking models. The three models are discussed in more details in section 3.5. The branchless models include; bank-focused model, bank-led model and non-bank-led model. The models enable customers enjoy banking services from remote locations without having to visit physical bank branches. For example, bank focused model enables the use of ATMs and internet banking for cash deposits, cash withdrawals, bank statements among other services. Secondly, bank led models use third parties or licensed bank agents to serve customers with the help of point of sale terminals. The bank agents are paid commissions for services offered to the bank customers but are not employees of the bank. Lastly, non-bank led models use mobile phone technologies and electronic money (e-money) to carry out an array of banking services without requiring a customer to have a bank account with a commercial bank.

The adoption and usage of financial innovation generates value to the firm in the form of an increase in firm financial performance. The value generated from the usage of financial innovations may depend on the speed with which firm financial performance adjusts to financial innovations. Secondly, the value generated is associated with the speed with which financial innovation responds to financial innovation drivers. For instance, some firms are early adopters while others are laggards or late adopters. The speed of adjustment or adoption shows how fast relative to other firms in the industry a firm adopts either process or product innovations. Although adoption of innovation is critical in generating value to a firm, it is the usage of the financial innovations that ultimately pays. The hypotheses developed in this chapter are in reference to the objectives of the study highlighted in Chapter one.

An extensive analysis and practical justification for each of the hypotheses is provided in this section. The analysis of the financial innovation drivers at both micro and macro level is consistent with the Technology-Organisation-Environment (TOE) framework reviewed in the literature.

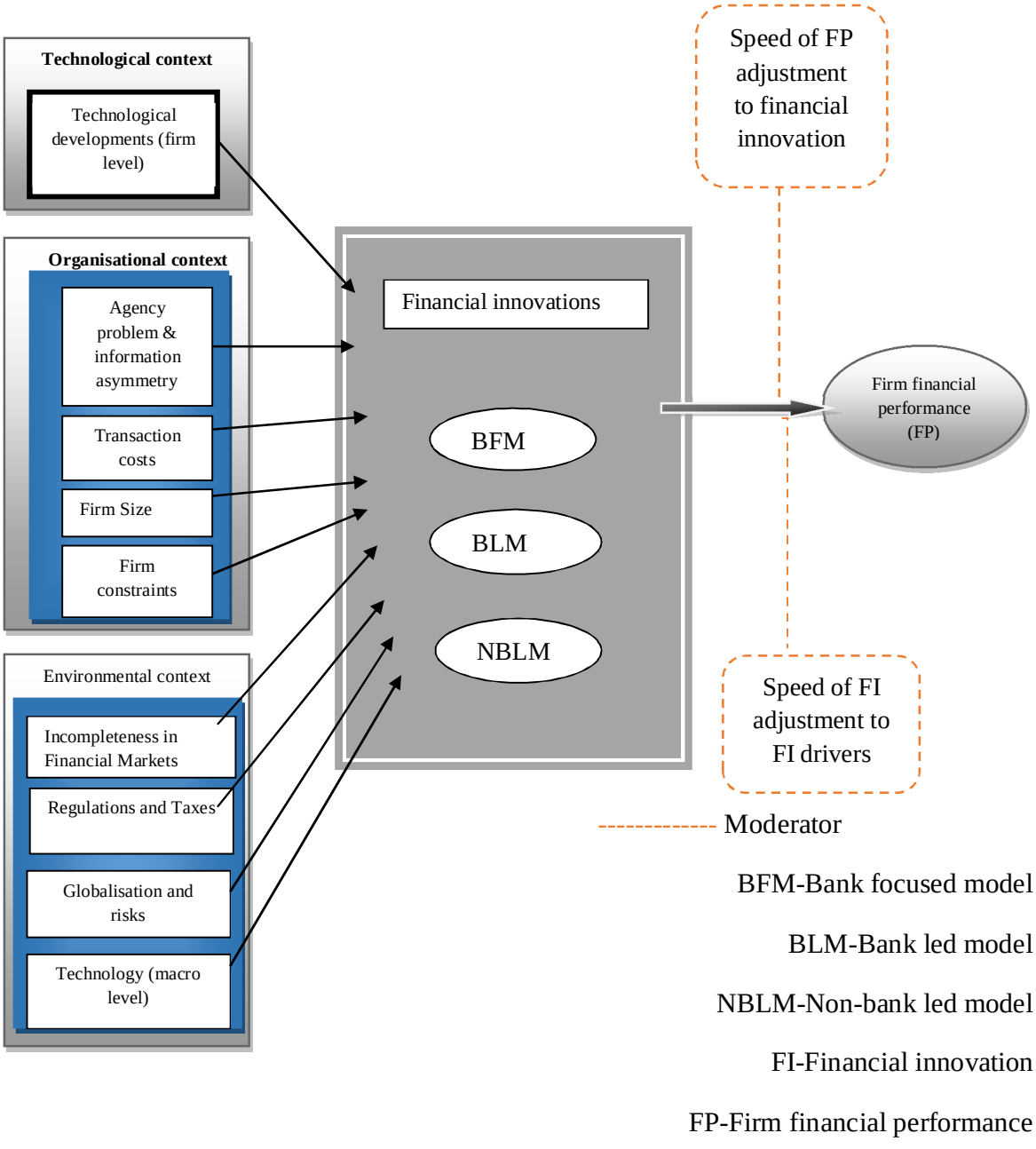


Fig 6.1: Financial Innovation value model

Source: Author

6.3 Development of hypotheses one to three

This section discusses the formulation of the three research hypotheses to be tested.

6.3.1 Development of Hypothesis one: Financial Innovation and Firm Performance

Financial Innovation Usage

Hypothesis one is developed to test the relationship between the usage of financial innovation in form of branchless banking models and firm performance. A number of studies reviewed in the preceding chapters have linked financial innovations usage to firm financial performance (Cainelli et al., 2006; Gopalakrishnan & Damanpour, 2000). The value of financial innovation is felt irrespective of the business environment the firm operates in. For instance, Hult et al. (2004) argue that innovation can contribute to firm financial performance irrespective of the hostile environment in which the firm operates.

DeYoung et al. (2007) study of 424 community banks comprising the earliest adopters of internet banking in USA explains the implication of financial innovation adoption. The study compares the change in the banks' 1999-2001 financial performance with that of 5,175 community banks using *branch only banking*. They find an improvement in the profitability of the early adopters of internet banking among community banks associated with internet banking. In addition, Hernando and Nieto (2007) provide a quantitative analysis of the impact of internet banking and the financial performance of banks. Using 72 commercial banks in Spain for the 1994-2002 years of operation, the study finds that the reduction in transaction costs leads to an expansion in the banks' profitability. This profitability is represented by Return on Assets (ROA) and Return on Equity (ROE). These findings are consistent with Damanpour (1991) study, which provides evidence linking the adoption of innovations and performance or effectiveness of the organisation. A number of other studies such as A. Kumar (2006) and Mwando (2013) find evidence linking banks' adoption of agency banking to; reduction in costs of financial services delivery, reduction in the volume of customers at the branches and establishment of new market presence. The reduction in customer volumes at the branches increases the efficiency score of the bank staff. Efficiency score is the ratio of total deposit accounts to number of staff. These studies provide evidence that as banks use agency banking, the reduction in costs will significantly increase the bank's profitability. Therefore, it follows from this review that adoption and usage of financial innovations such

as internet banking, agency banking and others leads to increase in firm financial performance in terms of profitability.

Measures of Firm Performance

A number of proxies are used in measuring firm performance. A comprehensive review of these measures appears in chapter four section 4.3 of this study. Firm performance in this study means either industry adjusted ROE or industry adjusted ROA. The justification for the use industry adjusted ROE and industry adjusted ROA is provided in section 4.3. This study posits that as innovations in ATMs, Internet banking, agency banking and mobile banking increase, financial performance of the firms (banks) increase as well. This implies a direct relationship between financial innovation usage and firm financial performance. The review provides the basis for testing hypothesis one to establish the relationship between the usage of financial innovations and firms' financial performance. The industry adjusted ROE is calculated by subtracting the average industry ROE from the ROE of the firm and dividing the result by the standard deviation of the industry ROE (Cannella & Lubatkin, 1993). According to the study, the industry adjusted ROA is calculated by subtracting the industry ROA from the ROA of the firm and dividing the result by the standard deviation of the industry ROA.

$$Industry\ adjusted\ ROE = \frac{(Firm\ ROE - Averange\ industry\ ROE)}{Standard\ deviation\ of\ the\ industry\ ROE} \quad \text{.....equation 6.1}$$

$$Industry\ adjusted\ ROA = \frac{(Firm\ ROA - Averange\ industry\ ROA)}{Standard\ deviation\ of\ the\ industry\ ROA} \quad \text{.....equation 6.2}$$

Table 6.1: The banking industry extracts

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Industry ROE (%)	23	24	28	28	27	25	28	31	30	29
Mean industry ROE (%)	27.30									
Std deviation in ROE (%)	2.45									
Industry ROA (%)	2	2	2	3	3	3	4	4	5	5
Mean industry ROA (%)	3.30									
Std deviation in ROA (%)	1.10									

Table 6.1 shows extracts from the financial performance reports of the banking sector obtained from the CBK annual supervision reports. The table shows that industry ROE has remained substantially higher than industry ROA over the 10-year period. A number of factors would explain this variation in ROE and ROA values. Firstly, according to Haldane (2009, p. 2), ROE can be decomposed as:

$$ROE = ROA * Leverage$$ .....equation 6.3

It follows, therefore, that ROE is affected by the company's leverage level. Secondly, a further decomposition of ROE ratio produces three other ratios namely: profitability, asset turnover and financial leverage as shown in equation 6.4 (De Wet & Du Toit, 2007, p. 2)

$$ROE = \frac{Earnings}{Sales} x \frac{Sales}{Assets} x \frac{Assets}{Equity}$$ .....equation 6.4

Therefore, the authors argue that ROE can be propped up by increasing profitability, by efficient use of assets and by increasing financial leverage. Moreover, Haldane argues that ROA is a measure of the management skill in generating profits using the pool of assets owned by the company while ROE is a measure of the managements' luck in gearing up those assets. The author observes that the rise in leverage has accounted for the increase in banks' ROE in the United Kingdom over years. The banking sector is different from other sectors with regard to the use of leverage, meaning the sector has substantially higher leverage than other sectors. This is because in addition to the loans, which banks take from traditional lenders, customer deposits comprise loans extended to the banks and which are repayable at any time. Banks use customer deposits to give out loans, which substantially increase the banking sector's growth and in effect enhance its ROE.

Hypothesis One

H_0: The usage of financial innovations does not significantly explain the variation in firm financial performance in Kenya.

H_1: The usage of financial innovations significantly explains the variation in firm financial performance in Kenya.

6.3.2 Development of Hypothesis Two: Drivers of Financial Innovations at Firm Level

Hypothesis two is developed to test the drivers of financial innovations at firm level using the variables identified in the literature.

Technological Developments

A number of studies have identified technological development as a driver of financial innovation adoption and usage. Technological developments refer to technologies relevant to the firm, including technologies already being used by the firm and the ones not in current use but available in the market (Baker 2011). These technologies define the limit on the scope and pace of a firm's technological change adopted (Collins et al, 1988). Technological resources include infrastructure, human capital and knowledge, which would make a firm technologically competent (Salwani *et* al., 2009). The infrastructure provides the platform for development of financial innovations. For example, mobile money payments in non-bank led models are enabled through electronic money (Hughes & Lonie, 2007). This study uses ICT infrastructure plus ICT personnel costs at the firm level as the proxy for technological development at firm level. To compute the cost of ICT infrastructure at firm level, the study uses balance sheet figures for ICT infrastructure and income statement figures for personnel salaries expenditure. ICT infrastructure includes computers, servers and other ICT equipment. It is expected that if the amount of ICT infrastructure and expenditure on personnel is high for a given firm, the amount of financial innovation will also be high.

Agency Problems and Information Asymmetry

According to Jensen and Meckling (1976), agency costs is the sum of: Cost incurred by the principal to monitor the agent, the bonding costs by the agent and the residual loss. Jensen and Meckling argue that monitoring costs entail budget restrictions, policies regarding compensation and rules of operation. Residual loss according to the authors is the cost arising from the agent's diversion of commitment from the principal's firm. Diversion of attention by the agent would for example entail doing private businesses during working hours. Jensen and Meckling opine that bonding costs are incurred by the principal to reward the agent to ensure that the agent does not engage in activities which would amount to conflict of interest. In addition bonding costs ensure that if the agent undertakes such acts, the principal will be adequately compensated by the agent. Nevertheless, J. S. Ang et al. (2000) have found that the actual measurement of agency costs whether in absolute or relative terms in most studies has been minimal. According to Ang *et al.,* expense ratio and asset utilization ratio are widely used in financial economics and accounting. The expense ratio decreases with increase in financial innovations. The ratio is a measure of the efficiency of management in controlling operating costs, which include expenditure on perquisites and other direct agency costs.

$$Expense\ ratio\ (ER) = \frac{Operating\ Expenses}{Annual\ Sales} \quad \text{.....equation 6.5 (a)}$$

The asset utilisation ratio is a measure of the management's effectiveness in deploying assets. Agency costs are inversely related to asset utilisation ratio

$$Asset\ utilisation\ ratio\ (AUR) = \frac{Annual\ Sales}{Total\ Assets}$$ ……..…….....……equation 6.5 (b)

Since financial innovations are intended to reduce agency costs, there should be an inverse relationship between financial innovations and the two ratios. This implies that as financial innovations increase, both ER and AUR should decline.

Transaction Costs

The need to reduce transaction costs is one of the drivers of financial innovations in Kenya's banking sector. Humphrey et al. (2001) contend that innovations in electronic payments have helped reduce payment costs to a level within the range of one third and one half of paper based non cash payments. This is consistent with Merton (1989, p. 271) study, which finds that financial innovations arise in order to minimise transaction costs.

Tufano (2003) observes that the significant growth in ATMs and smart cards is motivated by the need to reduce transaction costs. The study finds that ATMs have a potential to reduce transaction costs by a factor of 10. This study uses the proportion of net fees and commissions to total income as proxy for bank transaction costs. The net fees and commissions are incurred largely in money transfer as bank transaction charges. Although net fees and commissions comprise income on the part of the bank, banks aim to generate the bulk of their revenues from other sources. The CBK carries out regular surveys of all banks showing the charges in form of fees and commissions which banks charge their customers.

The objective of the survey is to discourage banks from charging exorbitant fees and commissions to their customers. The implication of this practice is that although banks still have to charge fees and commissions for the services they render to their customers, the proportion of net fees and commissions to total income declines in the long term as banks adopt innovations to reduce the charges so as to remain competitive. It is expected that as the number of financial innovations increase the bank's relative transaction costs represented by the proportion of net fees and commissions to total income will decline.

Firm Size

The size of a firm largely determines its ability to develop and adopt new financial innovations due to resources needed for innovation development. Malerba and Orsenigo (1997) posit that the bulk of

innovations could be accounted for by a group of few large firms or the largest firm. The study is consistent with Akhavein et al (2005) work, which find evidence linking large banks to the adoption of small credit scoring technology in the United States. The large banks adopting the technology were largely influenced by the large size of their branch network. According to Tufano (1989) there is a strong positive relationship between firm size as measured by market share and financial innovation whereby largest banks innovate and become larger in the process. Empirical studies in finance and accounting have used total assets, total sales, book value of equity and market value of equity as proxies for firm size (Al-Khazali & Zoubi, 2005). These studies use proxies for firm size as: total assets (Daley, 1984; Lougee & Marquardt, 2004), total sales (Shehata, 1991), book value of equity (Kasznik & McNichols, 2002), market value of equity (Charitou, Clubb, & Andreou, 2001; Kousenidis, Negakis, & Floropoulos, 2000). Pagano and Schivardi (2003) use employee size as the proxy for firm size. The study argues that sales would be an inappropriate measure of firm size since sales volume is dependent on the intensity of intermediate inputs. `

These intermediate inputs would include sales and distribution costs such as advertising and sales commissions paid to sales people. The use of book value and market value for equity would be appropriate if all the firms under study are listed. Considering that majority of the firms in this study are not listed, the study uses total assets as proxies for firm size. The use of total assets is consistent with RBV, which posits that firms create value by combining economically valuable resources, which are hard to imitate (Barney, 1991; Peteraf 1993). This study argues that a significant number of financial innovations are accounted for by large firms under study. The implication is that banks with higher total assets account for the bulk of the financial innovations.

Firm Constraints

Firm constraint refers to limitations imposed on the firms both internally and externally and which constrain the firm from optimising its performance. Silber (1983) work demonstrates that constraint based innovations accounted for significant new bank products between the 1952 and 1970 and 60 per cent of financial innovations between 1970 and 1982. In addition, Tufano (2003) argues that the smallest, weakest firms exposed to major constraints are more likely to innovate perhaps so as to appeal to potential investors, unlike large firms, which have already passed initial imperfection stage and are now pre-occupied with capital structuring efforts and financial innovations. Silber (1983) contends that government regulations comprise one of the biggest constraints imposed on firms. The Basel (2010)

specifies the minimum capital adequacy requirements and asset quality ratio, which present external constraints for banks.

Hottenrott and Peters (2012) show that external constraints would entail financing restrictions imposed by lenders through debt covenants requiring the borrower to always maintain a certain ratio. This study uses capital adequacy ratio (CAR) as a proxy for firm constraints. A low CAR is an indicator of firm constraints in the variables measured by the ratio implying such firms should have higher levels of financial innovations. Capital Adequacy Ratio (CAR) is a measure of a bank's capital expressed as a percentage of a bank's risk weighted credit exposure.

Capital Adequacy Ratio (CAR)

$$CAR = \frac{\text{Tier one capital+Tier two capital}}{Risk\ weighted\ Assets} \quad \text{.....equation 6.6}$$

The ratio is used to cover depositors in order to promote the stability and efficiency of the global financial system. The ratio measures both tier one and tier two capital. Tier one capital is meant to absorb bank losses without necessarily winding up the bank while tier two capital can absorb losses in the event of the bank ceasing operation, providing depositors with a lesser degree of protection (Basel, 2010). Therefore, capital is very critical for the survival and smooth running of any business entity. For instance, Athanasoglou et al. (2008) argue that capital is the available amount of own funds which supports the bank while providing buffer in the event of adverse business position. In addition, it provides a buffer against distress and run on accounts, a situation where bank depositors rush to withdraw money held in the accounts at once (Diamond & Rajan, 2000).

The CBK regulations require all commercial banks in Kenya to maintain minimum capital as measured by CAR and consistent with Basel one requirements. As Dang (2011) observes, capital adequacy ratio as a measure provides a basis for judging a bank's adequacy of capital and indicates the bank's internal ability to withstand losses in crisis times. However, in an effort to maintain minimum CAR, small banks are forced to retain own capital with a number of negative implications and constraints. For example, Meh and Moran (2010) study finds that capital constraints could expose banks to shocks such as technology shock, which in effect lowers the profitability of bank lending effectively, making it difficult for banks to secure loanable funds. In the words of the authors "...banks must therefore finance a larger share of entrepreneur projects from their own net worth (their capital), which requires an increase in their

capital-to-loan (or capital adequacy) ratio. Since bank capital mostly consists of retained earnings, it cannot adjust immediately and bank lending falls..." (p.555).

Secondly, according to Peek and Rosengren (1996) the decline in the capitalisation of Japanese commercial banks in the late 1980s resulted in reduction of economic activities in countries such as USA where the banks had notable presence. Thirdly, Van den Heuvel (2008) contends that the less capitalised U.S.A banks are more prone to monetary policy shocks since capital requirements such as CAR limit the ability of banks to create liquidity making it costly for banks. Fourthly, Kishan and Opiela (2000) study using bank level data finds compelling evidence that bank capital and bank size differentiate a credit channel, such that the smallest and least-capitalised commercial banks are most responsive to monetary policies. The authors contend that poorly capitalised banks react to monetary policies by significantly reducing lending in response to monetary policies.

Consequently, CAR is a constraint for small banks and therefore, faced with capital challenges and constraints, the banks are likely to develop financial innovations in response to the constraints as discussed in the literature. On the other hand, constraints based innovation is inconsistent with RBV since firms need resources including capital to innovate as argued by RBV. The debate on the role of constraints in driving financial innovation appears inconclusive in view of the apparent conflict between RBV and constraint based innovation literature. It is possible that constraints may drive financial innovations but the innovations may not be statistically significant since innovation by small firms, constrained by resources is aimed at serving a given niche market. Innovation by small firms may target a market that is largely ignored by large banks. Such innovations rarely attract large players and therefore become statistically insignificant in the long run.

Hypothesis Two

H_0: Firm (organisational) level context does not significantly drive financial innovations usage at firm level in Kenya.

H_1: Firm (organisational) level context significantly drives financial innovations usage at firm level in Kenya.

6.3.3 Development of Hypothesis Three: Macro-level Financial Innovation Drivers

Hypothesis two was developed to test the drivers of financial innovations at firm level. The literature reviewed provides evidence that innovation is driven by both firm-specific and macro level variables. Hypothesis three is developed to test the drivers of financial innovation at macro level. A number of financial innovation drivers at macro level were discussed in chapter two of this study. The section below provides a brief discussion of the role of macro level factors in driving financial innovations at firm level.

Incompleteness in Financial Markets

According to Horne (1985) an incomplete financial market pays financial intermediaries to exploit incompleteness by tailoring the security offerings to the unfulfilled needs of the investors. A number of studies have linked financial innovations to incompleteness in financial markets. The studies find evidence to suggest that innovations arise to complete the markets by introducing securities markets for securities with no close substitutes (Duffie & Rahi, 1995b; Grinblatt & Longstaff, 2000; Tufano, 2003).

This study uses the stock market development index (SMINDEX)[8] developed by Demirgiic-Kunt and Levine (1996) and further extended by Mahonye (2014) as the proxy for completeness in stock market. This study computes the Stock market development index using the principal component analysis (PCA) approach developed by Mahonye (2014). The PCA approach is considered more robust than Demirgiic-Kunt and Levine since it recognises that the individual components of the index have different weights. For instance, the PCA carried out by Mahonye finds that 0.61, 0.56 and 0.56 of variations in overall measure of the stock markets development are accounted for by the value of shares traded, market capitalisation and turnover ratio respectively.

This finding contrasts with Demirgiic-Kunt and Levine (1996) treatment of the measures as if they are of equal weight. This study computes the stock market development index using data from the World Bank stock market development indicators for Kenya over the 10-year period. The index is considered ideal because it captures stock market size, liquidity, concentration, volatility, asset pricing as well as regulatory and institutional indicators of stock market development. The higher the index, the more developed stock market is in a given year and therefore the more efficient or complete the market is assumed to be. Ideally, it is expected that as the stock market develops and therefore becomes more

[8] SMINDEX comprises number of listed companies, market capitalisation, value of shares traded and turnover ratio. For details on the construction of this indicator, see Mahonye (2014, p.100-102)

complete, financial innovations will decrease. This is because as Horne (1985) finds, an incomplete financial market pays financial intermediaries to exploit the incompleteness by tailoring the security offerings to the unfulfilled needs of the investors.
Principally, the implication of this finding is that as markets develop the opportunity to make gains associated with information asymmetry is eroded. In the wake of erosion of opportunities for making gains due to information asymmetry, intermediaries develop less and less financial innovations leading to decline in aggregate financial innovations over time. However in the absence of empirical studies linking branchless banking models to incompleteness in financial markets, it is not clear whether these findings should be generalised to branchless banking models as well.

From the literature reviewed in the present study, there is a dearth in studies that find conclusive evidence linking the development of branchless banking models of financial innovations to incompleteness in financial markets. However, recent innovation adoption research suggests that the earlier findings on the relationship may not apply to branchless banking models in general and internet banking in particular. For example, Patsiotis et al. (2012) study of the adopters and non-adopters of internet banking find that most bank customers prefer human interaction accorded by the bank staff. Their preference for human interaction is influenced by their concern on the risk inherent in internet banking and lack of pre adoption trial. Additionally, Martins et al. (2014) study finds individual expectations with regard to expected performance, effort expectancy, perceived risks and social influence significantly explain usage of internet banking.

The implication of these recent studies is that as the markets become complete or approach completeness, the level of information asymmetry declines. As the degree of information asymmetry declines, the need for human interaction between customer and bank staff is minimised increasing the preference for branchless banking. However, it may, take considerable time before incomplete markets can become complete, which may span beyond the study period making the effect unobservable in the regression output. In view of these recent findings, this study posits that as financial markets develop, innovations in branchless banking models decrease and vice versa.

Regulation and Taxes

A number of studies find a link between regulation and financial innovations. These studies provide evidence that the nature of the relationship has largely depended on the nature and intention of the regulation. According to Frame and White (2004), regulations may or may not inhibit financial innovations. The implication is that if a regulation is seen as supportive by the firms, new financial innovations will move in the direction intended by the regulation. Calomiris (2009) contends that in most cases financial innovations are developed to sidestep regulations deemed restrictive to individual firm's activities. Although several studies link regulation to financial innovations, these findings are not supported by empirical evidence (Frame & white, 2004). Frame and White opine that, if a tax system applies different tax rates on different income streams or on different types of assets, the higher taxed parties will find ways of reducing the tax burden. Higher taxation levels will lead to larger flow of financial innovations but it is not possible to quantitatively predict the relationship between the stringency of regulation and the pace of financial innovation (Frame & white, 2004).

A dummy variable for the effect(s) of regulation is added with '1' indicating introduction of regulation (s) and '0' indicating no new regulation in a given year. The impact of any regulation in any given year will also be tested. The focus of this study is on the regulations, which affect any or all of the four financial innovations. The impact of financial regulation on the development of financial innovation is in most cases time lagged since firms initially take time before responding to the new regulation. The study posits that if a regulation supports financial innovations the quantity of financial innovations increases and vice versa.

Globalisation and Risks

There is compelling evidence linking globalisation to firms' exposure to foreign exchange risks, interest rate risks, political risks and transaction exposure risks (Boyer, 2000). However, Lutz (1998) observes that abolition of foreign exchange controls can lead to increase in financial innovations. Government regulation allowing foreign participation and listing in the stock exchange creates cross border capital flows (Rousseu and Sylla, 2003). Globalisation can be measured using globalisation index. Using data from the World Bank for the variables in the index, Dreher (2006) has developed a comprehensive index of globalisation incorporating political, economic and social dimensions for each country. Dreher (2006) work is consistent with the earlier work of Keohane and Nye (2000). Individuals and firms are attracted

to financial innovations in different countries for a number of reasons. For example, Lane and Milesi-Ferretti (2008) find that the desire to gain exposure to new asset classes makes investors attracted to financial innovations in another country. The study finds a strong positive relationship between financial innovation and financial globalisation. Moreover, Lane and Milesi-Ferretti argue that the relationship between the two arise in an effort to arbitrage between asset prices, taxes and regulatory regimes.

The level of a country's economic development and financial depth is important in the adoption and usage of branchless banking. The level of a country's economic development determines the quality of life that its citizens lead. It also has implications on the disposable incomes and purchasing power of households. Financial deepening is synonymous to financial inclusion defined "…as a process that ensures the ease of access, availability and usage of the formal financial system for all members of an economy…" (Sarma, 2012, p. 3). If the members of the community are financially excluded, they are unable to access the necessary financial services when needed and therefore appropriate e-payment interventions would address the problem.

According to Ben, Molico, and Stuber (2014) the global adoption of e-money has progressed at slower pace than expected. The authors opine that the speed of e-money adoption is high in cash intensive economies where e-money is seen as addressing specific needs thereby creating a niche market. The study is consistent with Flood et al. (2013) work, which observes faster adoption of mobile payments in developing countries than the adoption in developed countries. The authors find that variations in adoption are explained by the fact that individuals in developed economies already have access to formal financial services. In addition, Ingenico (2012) observes that extreme growth in mobile payments is mainly driven by developing countries where a sizeable population own mobile phones but have no access to bank accounts.

Although there has been a general worldwide increase in electronic payments, the growth in mobile payments has outpaced the growth in plastic cards payments in developing countries. The low penetration of formal financial services, coupled with high rate of mobile subscription has led to rapid growth in mobile payments (Capgemini & RBS, 2013). However, the report observes limited acceptance of electronic cards outside the main cities and tourist areas in developing countries. Mobile payments are seen as addressing specific needs in developing economies where majority of the population have limited or no access to formal financial services. The study finds that since mobile payments rely on prepayments, there is no need for providing collateral or providing credit history to the mobile service

provider in order to make mobile payments. Conversely, to obtain a credit card one has to go through a rigorous process of credit appraisal and provide collateral for use of the credit card.

Additionally, to obtain a debit card, one has to have a formal bank account and in most cases maintain a minimum balance in addition to paying regular ledger fees. The limited acceptance of electronic cards in Kenya is evident from the Central Bank of Kenya data, which shows that mobile payments have significantly overtaken electronic payments cards. Agency banking is an attempt to increase financial access to the large population of the unbanked and to solve the problem, which is not common in developed countries. This study posits that as globalisation evidenced by high globalisation index increases, financial innovations will rise in response. This, therefore, implies a direct relationship between globalisation and financial innovations.

Technological Developments at Macro Level

Technological linkages between firms have a large impact on firms' ability to innovate (Pennings & Harianto, 1992). Empirical results from the study validate the hypothesis that interfirm linkages are an important pre-requisite for innovation. For example, according to the study, banks inclined towards networking with information technology firms have a higher probability of adopting video banking innovations. Financial innovations are largely dependent on ICT and are prone to network externalities. The more the users of the financial innovations the greater the value of the financial innovation to a single user. Interfirm linkages help broaden the network and the value of the innovations.

The ability of firms to link with other firms largely depends on the infrastructure available at macro level. Infrastructure at macro level enable connectivity and access, especially internet access and internet connection speed. UNCTAD (2003) has developed a measure of each country's technological profile using aggregated index of ICT diffusion. The components of this index are; connectivity, access and government policies. The study finds that connectivity and access as well as competitive telecommunications policy and connectivity have strong positive correlations. The study posits that the index is a measure of central measures of technological development. On the other hand the International Telecommunications Union has developed an index referred to as the ICT development index (IDI) (ITU, 2014). The components of IDI is ICT access, ICT use and ICT skills at macro level.

ICT development index (IDI)[9] is an aggregate of 11 indicators with respect to three categories of ICT: access, use and skills whereby the first two are weighted by 40 % and the third by 20 %. The comprehensive index by ITU (2009) has been used to compare ICT developments globally. The index is considered the most appropriate for this study due to its robustness in including a number of ICT developments at macro level. Secondly, recent studies such as Dobrota, Jeremic, and Markovic (2012) have used the same indicators, synthesising them into one value effectively enabling them to establish the critical variables in the measurement of ICT development levels across countries. This study, therefore, uses IDI as the proxy for technological developments at macro level. It is expected that a high index of technological development leads to a high aggregate financial innovations at firm level for all the branchless banking models (financial innovations).

Hypothesis Three

H_0: The (environmental) macro level context does not significantly drive financial innovations usage at firm level in Kenya.

H_1: The (environmental) macro level context significantly drives financial Innovations usage at firm level in Kenya.

6.4 Conclusion of the Chapter

The chapter has introduced the conceptual financial innovation value model which demonstrates the relationship between the dependent and independent variables. The basis for the formulation of the three hypotheses is discussed. Lastly the three hypotheses is have been formulated based on the reviewed literature.

[9] Refer to Appendix 3: ICT development index (IDI)-weighting of indicators

CHAPTER SEVEN

RESEARCH METHODOLOGY

7.0 Introduction

The chapter describes the research methods, which include: the data collection, research instruments, procedures followed, research hypotheses to be tested as well as the statistical data analysis techniques adopted for the study. Research methodology refers to selections made by a researcher with respect to cases to be studied, data collection methods and procedures for data analysis when planning and conducting the research (Silverman, 2006). Research methodology, therefore, raises philosophical questions regarding the validity of the assertions made by the researcher with respect to what the researcher wants to know (Hawashe, 2014). According to Eriksson and Kovalainen (2008) the main objective of the research methodology is to describe how a given problem or issue can be studied. Research methods "...refer only to the various means by which data can be collected and/or analysed…" (Hussey & Hussey, 1997, p. 54). Saunders et al (2003:2) refer to 'methods' as "...tools and techniques used to obtain and analyse data." Lastly Jankowicz (2000, p. 209) defines 'methods' as "...a systematic and orderly approach taken towards the collection and analysis of data that information can be obtained from those data...." There are a number of research methodologies that can be employed to achieve the aims and objectives of a study. The research methodologies adopted are subject to the research paradigm chosen by the researcher.

A research paradigm or philosophy is defined as the "...progress of scientific practice based on people's philosophies and assumptions about the world and the nature of knowledge…" (Hussey & Hussey, 1997, p. 47). According research literature, there are two main research paradigms used in research, namely positivist and phenomenological research paradigms (Collis & Hussey, 2013). The positivist paradigm is "...an approach to social research, which seeks to apply the natural science model of research to investigations of the social world" (Denscombe, 2007, p. 332). According to Hussey & Hussey the positivist paradigm is considered as quantitative, objectivist, scientific, experimentalist and traditionalist. On the other hand, phenomenological paradigm is "...a fact or occurrence that appears or is perceived, especially one of which is the cause in question…" (Allan, 1991, p. 893). The phenomenological paradigm is considered as qualitative, subjectivist, humanistic and interpretivist (Hussey & Hussey, 1997).

The positivist approach includes: experimental studies, cross-sectional studies and survey while phenomenological approach includes case studies, action research, feminist perspective, ethnography, grounded theory, among others (Hawashe, 2014). According to Collins & Hussey, depending on the assumptions made by the researcher, several methodologies may be adopted under either positivist or phenomenological paradigms. In sum, Hussey and Hussey (1997) observe that the methodology precisely addresses such questions as; why did the researcher collect certain data? Which data was collected? Where did the researcher collect the data from? When did the researcher collect the data? How did the researcher collect the data and, finally, how will the researcher analyse the data. In general, the nature and purpose of the research determines which methods and methodologies would be most appropriate in achieving the aims and objectives of the study (Hawashe, 2014).

The rest of the chapter is organised as follows: Section 7.1 Research philosophy or paradigm. 7.2 Estimation technique. 7.3 Specification and Estimation of the Three Models. 7.4 Testing for the speed of adjustment in the regression models one, two and three. 7.5 Control Variables. 7.6 Formal tests of specification in panel data. 7.7 Robustness of the models and results. 7.8 Data Collection and Sample size. 7.9 Conclusion of the chapter.

7.1 Research Philosophy or Paradigm

This study adopts a positivist research philosophy or paradigm by following a deductive reasoning approach to conducting the study. The study identifies functional relationships or causal effects and tests pre-existing financial innovation and firm performance theories. The positivist paradigm has distinctive features that make it ideal for the present study. These include: It mainly produces quantitative data, uses large samples, is concerned with hypotheses, deals with highly precise and specific data, has a high reliability and mainly generalises from sample to population (Collis & Hussey, 2013). Therefore, the paradigm is consistent with the data used and the objectives of this study. More importantly, the distinctive features of positivist paradigm and the use of secondary firm data buttress the use of quantitative research approach as opposed to a qualitative one.

7.2 Estimation technique

The study adopts a dynamic model specification for a number of reasons. Firstly, the past literature has observed that firm performance shows persistent effects meaning past performance affects present

performance. Secondly, firm performance is not only influenced by the present financial innovation but also past financial innovation. Formally, the model is specified as follows:

$$Y_{i,t} = \alpha_i + \beta_0 X_{i,t} + ...\beta_k X_{i,t-k} + \theta Z_{i,t} + \mu_{i,t} \quad \text{.....equation 7.1}$$

A priori, the optimal lag in equation 7.1 is unknown. However, if we assumed that the effect of past financial innovation decay overtime as argued by Koyck (1954) then equation 7.1 can transform using Koyck transformation. The resulting equation through the transformation process is given as follows:

Koyck (1954) distributed lag equation:

$$Y_{i,t} = \alpha_i(1-\lambda) + \lambda Y_{i.t-1} + \beta_0 X_{i,t} + \theta Z_{i,t} + \mu_{1,t} \quad \text{.....equation 7.2}$$

Estimating the model above using OLS, fixed or random effect models gives rise to a number of econometric issues such as autocorrelation and heteroscedasticity. However, the dynamic GMM developed by Arellano and Bond (1991) help address these challenges. In addition, the model has been found to be robust to measurement errors, addresses some endogeneity and it is well suitable where we have small t and large n. Given the structure of the panel data of this study, where t=10 and n= 42 dynamic GMM is therefore the most suitable estimation technique.

The dynamic Koyck distributed lag model is estimated using Generalised Method of Moments (GMM) (Arellano & Bond, 1991; Arellano & Bover, 1995; Blundell & Bond, 1998). According to these studies the model is ideal for analysing and estimating data with small time periods, data which is replete with measurement errors and for models whose independent variables are likely to be endogenous. Hansen (1982) demonstrates the consistency results for the Generalized Method of Moment (GMM) estimator under a number of assumptions regarding the form of the econometric model. In addition, Baum et al (2003) demonstrate the popularity of the application of GMM in recent studies, where researchers have been faced with the problem of heteroscedasticity of unknown form.

According to Chausse (2010), GMM estimation procedures have been largely used in both economics and finance studies. The study contends that firstly, GMM is seen as a generalisation of a number of other estimation techniques such as Instrumental Variables (IV), Least Squares (LS) and Maximum Likelihood (ML). Secondly, GMM only requires some assumptions regarding moment conditions making it more flexible.

The study concludes that the fact that GMM imposes no restrictions on data distribution has made it more popular. This popularity according to the author has led most of the major statistical packages such as Matlab, Gauss or Stata to provide for tool boxes to enable the use of GMM procedure.

Consequently, the implication from these studies is that dynamic panel estimation technique is the most appropriate for the present study for a number of reasons. Firstly, the presence of lagged dependent variable $Y_{i,t}$ in our model leads to autocorrelation. Secondly, most of the financial innovation variables have small time periods. For example agency banking innovation has been in use in Kenya for only three years (2010-2013), mobile money for seven years (2007-2013) and internet banking data is available for a five-year period (2009-2013). Thirdly, the nature of accounting data used to generate accounting returns (ROE and ROA) is prone to measurement errors due to variations in accounting policies across firms with regard to the treatment of a number of items in financial statements. Fourthly, the panel data set time dimension is short (t=10) and has a larger country (firm) dimension (n=42). In this study, we apply the Systems GMM estimator which assumes that the first differences of the instruments are not correlated with the fixed effects parameters which then increase the number of probable instruments which would be used in estimating the model parameters (Arellano & Bover, 1995; Blundell & Bond, 1998; Fowowe & Babatunde, 2013). Robustness is achieved across each of the two financial performance measures namely adjusted return on equity and adjusted Return on assets. For robustness purposes and in order to control for potential endogeneity problem this study includes lagged values of the mean industry adjusted ROE and ROA in the regression models.

7.3 Specification and Estimation of the Three Models

This section discusses the specification and estimation of the three models. The three models are specified using distributed lag models in general and Koyck (1954) distributed lag model in particular. Distributed lag models are appropriate for specifying models where the effect of the independent variables on the dependent variable is time lagged and where the lagged effect of the dependent variable affects the dependent variable in future. The models are estimated using two-step system GMM.

7.3.1 Model One Specification

The present study uses a dynamic panel data distributed lag model to estimate the relationship between financial innovations and firm financial performance. This is because the lagged values of the dependent variable (firm performance) are included among the explanatory (financial innovation) variables (see

Gujarati, 2003, p.656). The independent variables are also lagged since it takes time before the investment in financial innovations can have significant impact on firm performance. A number of reasons would account for the lags in financial innovation impact on firm performance.

Firstly, according to Griliches (1967) the decision to invest in research and development (R&D) expenditure and its ultimate payoff in terms of productivity involves not only considerable lag but also several lags. Since investment in financial innovations usually involves considerable R&D expenditure, it takes time before the investment in R&D as well as the capital cost of the ICT infrastructure can be recouped.

Secondly, the adoption and use of electronic payments is prone to both network externalities and the effects of multisided markets. A network effect or externality arises when the value of a product to one user depends on the number of other users of the same product (Katz & Shapiro, 1986). Technologies prone to network effects have a tendency to show long lead time followed by rapid growth (Shapiro et al., 1999). The study argues that as existing customers return positive feedback, the customer base grows making the adoption of the product worthwhile for many more users; eventually the product achieves a critical mass and takes over the market.

Thirdly, individuals are naturally resistant to change, especially culture change because of the discomfort that change offers. In most cases customers adopt a wait and see attitude and therefore adopt the innovations at a later date. Such customers are referred to as 'laggards,' possibly because of their lagged response to the introduction of new products and innovations. The resistance to change in favour of adoption and usage of financial innovations may also be attributed to risk factors.

The risk factors include fear of money laundering and the risk of fraud associated with the use of third parties to access personal accounts under agency banking. In view of these observations, the study uses a general distributed lag model expressed as:

$$Y_{i,t} = \alpha_i + \beta_0 X_{i,t} + ...\beta_k X_{i,t-k} + \theta Z_{i,t} + \mu_{i,t} \quad \text{..... equation 7.3 [10]}$$

[10] The independent variables measure financial innovation usage and have been scaled down using industry usage of the financial innovations. As discussed in Chapter 2 (Theoretical framework) Frambach and Schillewaert (2002, p. 164) contends that the innovation process becomes successful upon its acceptance and integration into the organisation and the demonstration

To estimate the distributed lag model, we use the Koyck transformation distributed lag model (Koyck, 1954). The Koyck model is expressed as:

$$Y_{i,t} = \alpha_i(1-\lambda) + \lambda Y_{i.t-1} + \beta_0 X_{i,t} + \theta Z_{i,t} + \mu_{i,t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\text{equation 7.4}$$

Where[11]

$\mu_{i,t}$ = ($u_t - \lambda u_{t-1}$), a moving average of u_t and u_{t-1}, = error terms

u_t= time t error term

u_{t-1} = time $t-1$ error term

$Y_{i,t}$= Firm performance represented by industry adjusted ROE and industry adjusted ROA for firm i over time t

$Y_{i,t-1}$= $Lagged\ values\ of\ Y_{i,t}$

$X_{i,t}$= Lagged values of financial innovation variables (X_1 , X_2 , X_3 X_4**)** for firm i over time t where

$$X_1 = \frac{Number\ of\ firm\ i\ ATMs\ over\ time\ t}{Number\ of\ industry\ ATMs\ over\ time\ t}$$

$$X_2 = \frac{Number\ of\ firm\ i\ internet\ accounts\ over\ time\ t}{Number\ of\ industry\ internet\ accounts\ over\ time\ t}$$

$$X_3 = \frac{Number\ of\ firm\ i\ agency\ banking\ agents\ over\ time\ t}{Number\ of\ industry\ agency\ banking\ agents\ over\ time\ t}$$

$Number\ of\ Internet\ accounts\ is\ represented\ by\ the\ number\ deposit\ accounts$

$X_4 = Log\ of\ Mobile\ banking\ number\ of\ transactions\ (MBTN)\ over\ time\ t$

$Z_{i,t} = Vector\ of\ control\ variables$[12] $for\ firm\ i\ over\ time\ t$

of commitment through continued use of the product innovation. According to E. M. Rogers (1995, p. 21) this commitment entails the decision to make full use of an innovation as the only best available course of action.

[11] Refer to appendix 2: variables and their measurement and section 6.3.1: Financial innovation and firm performance
[12] Refer section to section 7.5 for a discussion on the control variables

$Z_{i,t} = f(industry\ ROE\ or\ ROA, \log of\ total\ assets\ for\ firm\ i\ over\ time\ t,\ GDP\ growth\ rate)$

β_0, , θ are coefficients of $X_{i,t}$, $Y_{i,t-1}$, and $Z_{i,t}$ respectively and α is a constant

Hypothesis one is separately tested with adjusted ROE and adjusted ROA as the dependent variables in the model.

7.3.2 Model Two Specification

The impact of financial innovation drivers on financial innovation is assumed to be lagged. For example the decisions of the management (agents) to invest in R & D relating to financial innovations has significant implications in later years. Secondly, with respect to firm size, as a firm grows it is able to marshal resources necessary to invest in financial innovation. However, growth itself is a function of time. The study uses a general distributed lag model expressed as:

$$Y_{i,t} = \alpha_i + \beta_0 X_{i,t} + ...\beta_k X_{i,t-k} + \theta Z_{i,t} + \mu_{i,t} \quad \text{..... equation 7.5}$$

To estimate the distributed lag model, we use the Koyck transformation distributed lag model (Koyck, 1954). The Koyck model is expressed as:

$$Y_{i,t} = \alpha_i(1-\lambda) + \lambda Y_{i.t-1} + \beta_0 X_{i,t} + \theta Z_{i,t} + \mu_{i,t} \quad \text{.....equation 7.6}$$

Where[13]

$\mu_{i,t}$ = ($u_t - \lambda u_{t-1}$), a moving average of u_t and u_{t-1}, = error terms

u_t= time t error term

u_{t-1} = time $t-1$ error term

$Y_{i,t}$= Financial innovation[14] for firm i over time t

[13] Refer to appendix 2: variables and their measurement and section 6.3.2: Drivers of financial innovation at firm level

[14] For details on financial innovations for firm i over time t see model 1 specification and section 3.5: Branchless banking models

$X_{i,t}$= Lagged values of financial innovation drivers variables (X_1 , X_2 , X_3 X_4**)** for firm i over time t where

$$X_1 = \frac{\text{Technological developments at firm level (Tdf) for } firm\ i\ over\ time\ t}{Total\ assets\ for\ firm\ i\ over\ time\ t}$$

$$\text{Tdf} = \text{f}(ICT\ infrastructure\ +\ personnel\ salaries)$$

$$X_2 = Agency\ Costs\ (AC)$$

$$AC = f(Expense\ Ratio, Asset\ utilisation\ ratio)$$

$$X_3 = \frac{\text{Transaction costs (TC) for } firm\ i\ over\ time\ t}{Total\ income\ for\ firm\ i\ over\ time\ t}$$

$$\text{TC} = \text{f}(\frac{\text{Net fees \& } commissions\ for\ firm\ i\ over\ time\ t}{Total\ income\ for\ firm\ i\ over\ time\ t})$$

$$X_4 = Log\ of\ firm\ size\ (FS)\ for\ firm\ i\ over\ time\ t$$

$$FS = Total\ assets$$

$Y_{i,t-1}$= $Lagged\ values\ of\ Y_{i,t}$

$Z_{i,t}$ = $Vector\ of\ control\ variables$[15] $for\ firm\ i\ over\ time\ t$

$$Z_{i,t} = f(GDP\ growth\ rate, Globalisation\ index)$$

β_0, θ are coefficients of $X_{i,t}$, $Y_{i,t-1}$, and $Z_{i,t}$ respectively and α is a constant

Hypothesis two is separately tested with ATMs, internet banking, mobile banking and agency banking as the dependent variables in the model.

7.3.3 Model Three Specification

The study uses a general distributed lag model expressed as:

$$Y_{i,t} = \alpha_i + \beta_0 X_{i,t} + ...\beta_k X_{i,t-k} + \theta Z_{i,t} + \mu_{i,t}$$ …….……..…..…… equation 7.7

[15] Refer section to section 7.5 for a discussion on the control variables

To estimate the distributed lag model, we use the Koyck transformation distributed lag model (Koyck, 1954). The Koyck model is expressed as:

$$Y_{i,t} = \alpha_i(1-\lambda) + \lambda Y_{i.t-1} + \beta_0 X_{i,t} + \theta Z_{i,t} + \mu_{i,t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\text{equation 7.8}$$

Where[16]

$\mu_{i,t}$ = ($u_t - \lambda u_{t-1}$), a moving average of u_t and u_{t-1}, = error terms

u_t= time t error term

u_{t-1} = time $t-1$ error term

$Y_{i,t}$= Financial innovations[17] for firm i over time t

$X_{i,t}$= Lagged values of financial innovation drivers variables (X_1, X_2 , X_3 X_4 , $Z_{i,t}$ **)** for firm i over time t where

$X_1 = Incompleteness\ in\ financial\ markets\ (Ifm)$

Ifm is represented by stock market development index (Mahonye, 2014, p. 102)

Tdf = f($ICT\ infrastructure\ +\ personnel\ salaries$)

$X_2 = Regulation\ and\ taxes\ (Rt)$

$Rt\ is\ a\ dummy\ variable\ which\ assumes\ 1\ for\ regulation\ and\ 0\ for\ absence\ of\ regulation$

$X_3 = Globalisation\ and\ risk\ (Gr)$

$Gr\ is\ represented\ by\ Globalisation\ index\ (GI)$

$X_4 = Technological\ developments\ at\ macro\ level\ (Tdm)$

$Tdm = ICT\ development\ index\ IDI$

[16] Refer to appendix 2: variables and their measurement and section 6.3.3: Macro level financial innovation drivers

[17] For details on financial innovations for firm i over time t see model 1 specification for this study

$Y_{i,t-1}$= $Lagged\ values\ of\ Y_{i,t}$

$Z_{i,t}$ = $Vector\ of\ control\ variables\ for\ firm\ i\ over\ time\ t$

$Z_{i,t}$ = $f(GDP\ growth\ rate, firm\ size)$

β_0, θ are coefficients of $X_{i,t}$, $Y_{i,t-1}$, and $Z_{i,t}$ respectively and α is a constant

Hypothesis three is separately tested with ATMs, Internet banking, mobile banking and Agency banking as the dependent variables in the model

7.4 Testing for the Speed of Adjustment in the Regression Models One, Two and Three

This section tests the speed of adjustment of the dependent variables in models one, two and three to the independent variables in the models. Since financial innovation is driven by firm-level and macro-level drivers, the speed with which financial innovation adjusts to the drivers is expected to affect financial innovation usage. Consequently, the speed with which firm performance adjusts to financial innovation usage will affect the value a firm gets from financial innovation usage. The relationship between financial innovation drivers, financial innovation and firm financial performance is illustrated in the financial innovation value model in fig 6.1.

Model one, two and three of this study have been estimated using Koyck distributed lag model expressed as:

$$Y_{i,t} = \alpha_i(1-\lambda) + \lambda Y_{i.t-1} + \beta_0 X_{i,t} + \theta Z_{i,t} + \mu_{i,t}$$

Where

$V_{i,t}$= ($u_t - \lambda u_{t-1}$), a moving average of u_t and u_{t-1}, = error terms

u_t= time t error term

u_{t-1} = time $t-1$ error term

$Y_{i,t}$= dependent variable for firm i over time t

$X_{i,t}$= independent variables for firm i over time t

$Y_{i,t-1}$= $Lagged\ values\ of\ Y_{i,t}$

$Z_{i,t}$ = $Vector\ of\ control\ variables$[18] $for\ firm\ i\ over\ time\ t$

β_0, θ are coefficients of $X_{i,t}$, $Y_{i,t-1}$, and $Z_{i,t}$ respectively and α is a constant

According to Koyck model, the mean and the median lags serve as a measure of the speed with which Y responds to X. Therefore, the mean and median lags would represent the speed with which $Y_{i,t}$ (Financial innovation) responds to $X_{i,t}$ ($financial\ innovation\ drivers$). Secondly, the mean and the median lags can show the speed with which firm financial performance responds to financial innovations usage.

$The\ Koyck\ model\ mean\ lag$ = $\frac{\lambda}{1-\lambda}$……..……Equation 7.9a

Thus if $\lambda = \frac{1}{2}$, the mean lag is 1

The median lag is the time required to accomplish 50% of the total change in Y following a unit sustained change in X.

$The\ Koyck\ model\ median\ lag$ = $-\frac{log\ 2}{log\ \lambda}$ ……Equation 7.9b

If the median lag is 0.4, the implication is that it takes less than half the period to accomplish 50% of the total change in Y. If the median is 3.3, it implies that it takes more than three periods to accomplish 50 % change in Y. The higher the value of $\boldsymbol{\lambda}$ the lower the speed of $Y_{i,t}$ adjustment and the lower the speed of $\boldsymbol{\lambda}$ the higher the speed of adjustment of $Y_{i,t}$.

Therefore the $mean\ lag = \frac{\lambda}{1-\lambda}$ and the $median\ lag = -\frac{log\ 2}{log\ \lambda}$ can be used to measure the speed of financial innovations adjustment with respect financial innovation drivers as well as the speed of adjustment of firm financial performance to financial innovation.

[18] Refer section to section 7.5 for a discussion on the control variables

7.5 Control Variables

This section discusses the control variables used in the three regression models. The purpose of the control variables is to control for any other factors that may affect the dependent variables other than the main independent variables. This ensures the robustness of the final results.

Industry Factors

The industrial organisation view contends that industry factors are the key determinants financial performance of firms. Hence, firm performance may be affected by the structure of the industry in which the firms operate. For example, Kamasak (2011) argues that performance differences among firms can be explained by Industrial Organization (I/O) economic theory and RBV. The I/O theory according to Kamasak, states that firm performance variations can be explained by the structural features of the sectors in the industry where the firm operates. This implies a direct relationship between industry performance and firm performance. The banking industry ROE and ROA, therefore, are included in model one as a control variable. Since the structure of the industry affects firm performance, the peer grouping of the Kenyan banks is also factored in the regression models as a control variable. The banks are grouped into three peer groups i.e. large, medium and small[19].

Past Firm and Industry Performance[20]

The past firm and/or industry financial performance may affect current or future financial performance. This is encapsulated in McGahan and Porter (2003) study which observes that firm driven performance persists at a slower rate compared to industry driven factors. In their earlier work, McGahan and Porter (1999) find 76.6% to 81.8 % persistence of the industry driven performance compared to 47.9 to 65.5% persistence in firm specific factors. The implication of these findings is that past firm and industry performance may affect present or future performance but the past industry performance may have a bigger effect. According to Richard et al. (2009) the dependence of performance measures on time is attributed to the reputation effects which link past performance to future performance. The linkage between past and present performance in effect provides a feedback mechanism within the dimensionality of performance (Roberts & Dowling, 2002). Past firm and industry performance is included in the regression models as control variables. Past firm performance is represented by the lag

[19] See section 5.4 Performance of the banking sector and Table 8.4 dummy variables and proxies
[20] See section 4.2 The dimensionality of firm performance, for a more detailed discussion

of industry adjusted ROE for each firm while past industry performance is represented by the lag of industry ROE.

Ownership Structure of Firms

A number of studies find that foreign owned firms perform better than locally owned firms, and therefore foreign ownership has a positive impact on firm performance (Aydin, Sayim, & Yalama, 2007). These findings are consistent with Goethals and Ooghe (1997) study of 75 Belgian firms, which find foreign owned firms perform better than the locally owned firms. In view of these findings and other related studies, it is expected that the ownership of the firms is likely to influence the results of this study. Ownership of the firms is included in the regression models, as ownership dummies where 1 represents locally owned firms and 0 represents foreign owned firms.

Listing

Out of the 42 commercial banks studied, 10 are listed at the Nairobi Securities Exchange. Due to the possibility that the listing may influence the results, a listing dummy is included in the regression with a listing dummy of 1, and 0 for unlisted banks.

Economic Performance

The performance of the economy where firms operates affects their financial performance (Dollar, Hallward-Driemeier, & Taye, 2005). As the economy grows, the economic environment where the firms operate becomes more conducive. For example, banks loan uptake increases due to increased economic activities in addition to reduced default on loans. To control for the effect of economic performance on the firm performance, GDP growth rates are used as control variables in the regression models.

Firm Size

The context of an organisation or a firm to a large extent determines adoption and usage of innovations by the firm. The TOE literature suggests that the organisational context such as the scope, firm size and the structure of management has implications on financial innovation (Oliveira & Martins, 2011). A number of studies have attempted to link firm size to innovation adoption and usage. For example, E. M. Rogers (1995) argues that firm size is a proxy for a number of dimensions which collectively lead to innovations; namely aggregate resources, technical expertise of employees and slack resources. Although firm size is an independent variable in model two, which tests the drivers of financial innovation at firm level, it is a control variable in model one and three. Firm size is represented by the log of total assets

7.6 Formal Tests of Specification in Panel Data

This section discusses a number of important tests that were be carried out in this study. The tests include; Sargan test (Sargan, 1958), test for lack of first and second order autocorrelation (Arellano and Bond, 1991), Wald test of joint significance, multicollinearity test and test for endogeneity and reverse causation

7.6.1 Sargan Test

Sargan test is a test of over identifying restrictions used for testing the validity of instrumental variables (Sargan, 1958). It is assumed that exogenous variables are actually exogenous and therefore the null hypothesis being tested is that residuals are uncorrelated with the exogenous variables. A higher p-value shows better instrument validity and therefore if the null hypothesis accepted statistically, therefore the instruments are valid.

7.6.2 Test for Lack of First and Second Order Autocorrelation

The study tests for lack of first and second order correlation as well as Arellano and Bond (1991) test for zero autocorrelation in the residuals. It is expected that there is no autocorrelation in the residuals if the null hypothesis of zero autocorrelation is not rejected in favour of the alternative hypothesis.

7.6.3 Wald Test for Joint Significance

Wald test is carried out in this study to test for the significance of the independent variables in the regression models. The null hypothesis is that the coefficient of all the independent variables are equal to zero while the alternative hypothesis is that the coefficients are not equal to zero. The variables will be included in the model if the wald results are significant otherwise the variables should be omitted.

7.6.4 Multicollinearity Test

Multicollinearity arises when a multiple regression contains two or more highly correlated predictor variables. In such a case one predictor variable can be accurately linearly predicted from the others. The presence of multicollinearity may lead spurious correlations. The study uses correlation matrix to identify the variables that show evidence of multicollinearity.

7.6.5 Test for Heteroscedasticity

Heteroscedasticity arises when a set of random variables contain sub-populations with different standard deviations from others. According to Berry and Feldman (1985), heteroscedasticity occurs when: 1) errors increase with increase in the value of instrumental variables (IV), 2) errors increase as the values of an IV move to extreme in either direction such as extreme negative to extreme positive; 3) there are measurement errors, 4) there are differences in sub-populations or some other interaction effects; and 5) the model is mis-specified e.g. instead of using Y instead of log of Y. The presence of heteroscedasticity leads to biased standard errors, which results in biased test statistics and confidence intervals. In order to detect heteroscedasticity the study uses Breusch-Pagan/Cook-Weisberg test for heteroscedasticity (Breusch & Pagan, 1979). This test detects any form of linear form of heteroscedasticity. According to Breusch-Pagan/Cook-Weisberg test the null hypothesis is that the error variances are all equal while the alternative hypothesis is that the error variances are not equal (or are multiplicative of one or more variables). The Breusch Pagan results presented in Appendix five confirm the existence of heteroscedasticity in the regression models. To deal with the heteroscedasticity, this study uses two stage GMM.

7.6.6 Tests for Endogeneity and Reverse Causation

The present study sought to establish the drivers of financial innovations at both firm and macro levels. Secondly the study sought to establish the functional relationship between financial innovations and corporate financial performance. The reviewed literature suggests that financial innovations can lead to significant financial performance. The assumption here is that financial innovation leads to high financial performance but high financial performance does not lead to financial innovations**.** However, a number of studies have observed the existence of reverse causality between financial innovation and financial performance (Gopalakrishnan, 2000). According to Blundell et al (1999) when ‘market share ‘is used as a proxy for performance there is evidence that firms which innovate end up growing eventually acquiring a bigger market share, which implies reverse causality. Additionally, the unidirectional link between innovation in technology and performance is no yet established (Koellinger, 2008). The study finds that well performing firms have easier access to funds for financing more investments and innovations.

To address the problem of endogeneity, this study uses instrumental variables approach, which uses the lagged values of the endogenous variables as instruments (Coles, Daniel, & Naveen, 2008; Himmelberg,

Hubbard, & Palia, 1999; Linck, Netter, & Yang, 2008; Semykina & Wooldridge, 2010). Consistent with these studies, in the analysis, all the four financial innovations in model one and the drivers of financial innovations in model two and three, as well as the control variables in each model are treated as endogenous using two stage GMM.

Rationale for Using Panel Data

The use of panel data econometrics has robust support and generally has numerous benefits over the use pure cross sectional or pure time series data (Gujarati, 2003). In reference to Gujarati (2003) and specifically for this study, panel data takes heterogeneity into account by allowing individual bank variables. Secondly, panel data is more informative, has more variability and lower level of collinearity among variables. Thirdly, panel data combines time series and cross sectional observations allowing for more degrees of freedom and therefore ideal for studying dynamic change. Fourthly, Effects that cannot be observed either by pure cross sectional or pure time series data can be detected and measured by panel data. Lastly, panel data helps minimise bias by using large volume of data. The bias would arise if firms are aggregated into broad aggregates. In sum, Gujarati (2003) work encapsulates the benefits of panel data, concluding that it enriches empirical analysis in ways that would be impossible if only cross sectional or time series data is used.

Dealing with Outliers in the Panel Data

An outlier refers to an observation which is located at an abnormal distance from the rest of the observations in a random sample (Gladwell, 2008). According to (Aguinis, Gottfredson, & Joo, 2013), "...outliers usually exert disproportionate influence on substantive conclusions regarding relationships among variables..." (p.2). Although a number of studies have a pervasive view of outliers, whereby outliers are considered as problems which need to be 'fixed' or 'cleaned,' Aguinis *et. al.,* (2013) have argued against such contextual generalisations. This is because firstly, previous studies suggest that automatic treatment of any outlying data point as harmful is not necessarily a good practice (Hawawini *et. al*., 2003). Secondly, removing outliers may lead to artificial range restrictions just because the outliers have been defined in a negative way (McNamara, Aime, & Vaaler, 2005). Lastly, recent study provides a strong evidence that elimination of outliers so as to achieve normality of individual performance can result in mis-specified theories as well as misleading practices (O'Boyler Jr & Aguinis, 2012). In view

of these studies, this study has ensured that outliers are not eliminated without due regard to the context and implications of the actions.

This study covers a financial innovations over a 10-year period, spanning year 2004 to 2013. Out of the four financial innovations covered, only ATMs have been in place for the entire 10-year period. The other financial innovations have been in operation as follows; mobile banking-seven years (2007-2013), agency banking-three years (2011-2013), internet banking[21]-five years (2009-2013). The implication of this is that some years have missing data on account of there being no such innovations. In addition, whereas some banks have respective financial innovations such as agency banking, other banks do not have some of the financial innovations. It, follows, therefore, that although some banks have a large number of financial innovations, other banks may have zero figures.

To mitigate the risk of such outliers, the study uses the approaches encapsulated in a number of studies (Bohrnstedt & Knoke, 1994; Fox, 1991; Hamilton, 1992; Pindyck & Rubinfeld, 1998; Rousseeuw & Leroy, 2005; Williams, 2015). Specifically, with reference to these studies, a number of actions are taken to deal with outliers in this study. Firstly, we check to ensure there are no coding errors such as addition of extra zero to the outlying case. Secondly, we run the regression with both the missing data and without the missing data and find no significantly different results. Thirdly, we carry out log transformation of explanatory variables with extreme values such as the mobile banking number and value of transactions as well as the total assets. Financial innovation values are also scaled down by total assets or industry values in addition to the use log transformation. Fourthly, large outliers are accounted for by adding more explanatory and control variables. Lastly, to eliminate outliers relating to ROE and ROA firm financial performance measures, the study uses industry adjusted ROE and ROA.

7.7 Robustness of the Models and Results

This study has ensured that the models and the results are robust in a number of ways. Firstly, the study uses industry adjusted ROA and industry adjusted ROE. The use of two performance measures ensures that the results are robust to alternative performance specification measures. For instance, the four financial innovations studied have largely shown statistically significant positive relationship with each of the performance measures. More importantly, the use of four different financial innovations under branchless banking models ensures that the results are robust to alternative financial innovation

[21] Internet banking data (deposit accounts) was not available for 2004 to 2008

specifications. The study covers four financial innovations in the form of branchless banking models namely mobile banking, agency banking, internet banking and ATMs. Each of the four financial innovations have been included as a dependent variable with firm level and macro level financial innovation drivers as the independent variables. In most of the regression models, the null hypotheses regarding financial innovation drivers, link to financial innovation at firm and macro levels, have been rejected in favour of the alternative hypotheses at all conventional significant levels.

Secondly, to test the relationship between financial innovations and firm performance, the study uses industry adjusted ROE and industry adjusted ROA as the firm performance measures instead of the normal ROE and ROA. The use of industry adjusted ROE and ROA mitigates the possibility of unusually high or unusually low values of either ROE or ROA ratios (Kayanga, 2008). In addition, He and Sommer (2011) observe that the use of industry adjusted ROA and ROE performance measures controls for the industry-wide effects in each year which are beyond the control of the firms. Moreover, the use of industry adjusted performance measures accounts for the variations in market opportunities, impacting on managerial activities and industry-specific constraints affecting firm performance (De Massis, Kotlar, Campopiano, & Cassia, 2013). Importantly, the use of industry adjusted performance measures is consistent with a number of recent studies (Beisland & Mersland, 2013; Dehning et al., 2014; Kim, Mauldin, & Patro, 2014; Quaadgras et al., 2014). The adjusted values of ROE and ROA also control for potential endogeneity problem. This is buttressed by Brown and Marcus (2009) study, which has included lagged values of the main industry adjusted ROE and ROA in the regression models.

Thirdly, the study has controlled for a number of factors that would affect the results in all the three models. These factors include; ownership of the banks (local or foreign ownership), peer grouping (large, medium or small) and listing (whether the firm is listed at the Nairobi Securities Exchange or not). Other control variables[22] such as performance of the economy (GDP growth), past firm performance, industry performance, past financial innovations have been factored into the regression models.

Fourthly, since innovation is a dynamic process and the financial innovations are dynamic as well, the study uses a dynamic panel estimation technique. The study adopts Arellano-Bover/ Blundell Bond System GMM estimation. According to the literature reviewed in chapter five, system GMM is ideal for analysis and estimation of data with small time periods, data which is replete with measurement errors

[22] See section 7.5: Control variables, for a robust discussion on the control variables used in the study

and for models whose independent variables are likely to be endogenous. Since the presence of lagged dependent variable $Y_{i,t}$ in our models leads to autocorrelation, and most of the financial innovation variables have small time periods, System GMM is more ideal and therefore, has been used in this study. In addition, ROE and ROA accounting performance measures are likely to have measurement errors due human errors in estimation and variations in accounting policies across firms. The study uses industry adjusted ROE and ROA to address their measurement errors. The industry adjusted performance measures control for firm ROA and ROE outliers arising from industry wide effects which are out of firm's control and which weigh heavily on firms' performance. In addition, the use of GMM addresses the ROE and ROA measurement problem. Lastly, the panel data set time dimension is short (t=10) and has a larger country (firm) dimension (n=42).The study uses of system GMM when the regressing data with these characteristics. Additionally, the use of GMM addresses the other shortcomings of the data reviewed in this section.

In sum, the use of the industry adjusted performance measures, the inclusion of a range of control variables in each model, and the use of the System GMM in the study makes the models and the results more robust. In addition, robustness is achieved by use of alternative performance measures and four alternative model specifications. The alternative model specifications are used in model two and three with each branchless banking financial innovation having individual model specification.

7.8 Data Collection and Sample size

The study uses secondary quantitative data mainly obtained from the financial statements of the firms under study. The financial statements are downloaded from online databases namely *Bankscope*[23] Other sources of the secondary data include; individual company websites, Capital Markets Authority (Kenya), Central Bank of Kenya Bank supervision reports and CBK annual reports, The World Bank, Kenya National Bureau of Statistics, Financial Sector Deepening (FSD) in Kenya, Communication Authority of Kenya (CAK), World Bank Development Indicators and International Telecommunications Union (ITU). The population of the study comprises all locally and foreign owned commercial banks in Kenya that are not under statutory management. The sample size comprises 42 banks out of the 43 commercial banks (see Appendix one). The sample comprises all commercial banks except one, which is under statutory management as at the end of the study period. The study is conducted by use of statistical

[23] Licensed to the University of the Witwatersrand

econometric modelling technique namely dynamic panel estimation. The study uses quantitative research design.

7.9 Conclusion of the Chapter

Chapter five discusses the development of the hypotheses and the research methodology used. The three hypotheses used in the study and the resultant econometric models are also explained. These models use the Koyck distributed lag model since the effect of financial innovation on firm performance is time lagged. In addition, the impact of financial innovations drivers on financial innovation is time lagged as well. The reasons for the time lag are also discussed in the chapter. Hypothesis one is developed to test the relationship between the usage of branchless banking models financial innovation and firm performance. Hypothesis two is developed to test the drivers of financial innovation at firm level. Hypothesis three is developed to test the drivers of financial innovation at macro level. Each of the variables in the three models and the proxies for each variable have been detailed. The chapter has focused on the unresolved issues with regard to the drivers of financial innovations and relationship between financial innovation usage and firm performance.

A model of financial innovation value is designed with supporting literature for ease of understanding of the relationship between different variables in the study. The hypotheses are developed to carry out analyses at both firm level and macro level. Firm performance is measured in terms of industry adjusted Return on Assets and industry adjusted Return on Equity. Although most banks that have agency banking also have Automated Teller Machines, not every bank has agency banking. The chapter discusses the Fixed Effects, Dynamic feedback and GMM Estimators providing justification or the use of system GMM as well as panel data. A discussion on the control variables used in the study is provided. A number of formal tests of specification in panel data have also been reviewed. The chapter discusses the robustness of both the models and the results and concludes that the robustness elements have been incorporated in the performance measures used and that the models are robust to alternative specifications for both financial innovation drivers and firm performance measures. Finally, the chapter discusses the research design to be used, population of study and the sample size as well as the expected sources of secondary data.

CHAPTER EIGHT

EMPIRICAL RESULTS

8.0 Introduction

The preceding chapter developed the hypotheses and three econometric models to test the research objectives. The chapter also discussed the research methodology and the system GMM estimation. The results generated from the estimated models are presented in this chapter. The main goal of this chapter is to report and discuss the results of the study in line with the objectives of the study.

8.1 Layout of the Chapter

The layout of the chapter is as follows: 8.2 Basic tests and summary statistics. 8.3 Correlational matrices for all the variables in each model. 8.4 Regression outputs. 8.5 Presentation of outputs. 8.6 Robustness of the models and results. 8.7 Contribution of the study. 8.8 Limitation of the study and suggestions for future research. 8.9 Conclusion of the chapter.

8.2 Basic tests and Summary Statistics

This section summarises the relationships between the variables used in the study of the banking firms in Kenya. The statistics are presented in Tables 8.1 and 8.2. Table 8.3 shows the summary statistics with regard to the comparable industry variables. The statistics show observations relating to the industry variables over the 10-year period. Mobile banking has been in operation for only seven years while agency banking has operated for only four years. Consequently, the minimum values for a number of financial innovation variables over the ten year period is 0. This shows that not all financial innovations have been in existence for the whole study period. The mean industry ROE is 27.25 % and ranges between 22.5% and 30.9 % over the study period. The mean industry financial performance shows that the banking sector generally performed well over the study period. The good industry performance was in spite of the drop in GDP to a minimum of 1.5 % in 2008 as a result of post-election violence arising from the December 2007 general elections.

Table 8.1 Summary statistics – industry analysis

Variable	Obs	Mean	Std.	Min	Max
ROE	10	27.25	2.721621	22.5	30.9
GDP	10	4.78	1.663864	1.5	7
ATM	10	1472.8	785.9509	455	2487
ES	10	376.1648	158.0289	190.3972	640.0821
DEPACS	10	1.08E+07	6375934	3329616	2.18E+07
MBAG	10	312845.5	415381.1	0	1229654
VMBTN	10	600403.8	711235	0	1901559
MBAC	10	1.02E+08	1.11E+08	0	2.83E+08
VABTN	10	4.32E+10	8.31E+10	0	2.36E+11
BAG	10	4928.8	8594.819	0	23477
ABTN	10	8075485	1.52E+07	0	4.21E+07

Table 8.2 shows correlations matrix for the industry variables which correspond with the main firm variables in the econometric model. The correlational matrix shows strong positive correlation between all four financial innovation proxies and industry ROE, implying that the reviewed financial innovations positively drive industry financial performance.

Table 8.2: Correlational matrix - industry analysis

	ROE	ATM	ES	CAR	NPL	GDP	BAG	ABTN	DEP.ACS	T.EMP
ROE	1									
ATM	0.4479	1								
ES	0.554	0.9366	1							
CAR	0.228	0.8882	0.6969	1						
NPL	-0.0131	-0.1467	-0.1344	0.0645	1					
GDP	0.4379	-0.2483	-0.1004	-0.3166	0.6337	1				
BAG	0.6174	0.7647	0.8923	0.476	-0.2417	-0.0117	1			
ABTN	0.5254	0.7216	0.8558	0.4662	-0.152	-0.0027	0.9843	1		
DEPACS	0.5356	0.9421	0.9955	0.7102	-0.164	-0.1193	0.9048	0.8736	1	
T.EMP	0.3736	0.978	0.8974	0.8828	-0.228	-0.3234	0.743	0.7099	0.9203	1

Table 8.3 provides a summary statistics for all the dependent and independent variables. The observations range between 294 and 420 which shows that the panel data is unbalanced. The financial innovations were introduced in different years and most banks have taken time before adopting and using the

innovations. Most of the financial innovations were introduced during the study period and over the second half of the period. It is therefore not helpful to have a longer study period.

Table 8.3: Summary statistics for all the dependent and independent variables

Variable	Obs	Mean	Std. Dev.	Min	Max
indadjroe	395	-4.077494	7.099692	-49.95	9.26
indadjroa	397	-.8036177	2.647438	-18.8818	6.45455
lnmbtn	420	16.47961	10.88276	0	25.01373
atmindatm	420	.0323281	.107043	0	1.12088
depacinddepac	420	.0145586	.059812	1.20E-07	0.501807
bagindag	420	.0071342	.0450916	0	0.399437
gdp	420	4.78	1.580363	1.5	7
lnta	397	23.37778	1.342892	20.6464	26.5019
er	405	118.2064	1371.078	0	27600
car	397	26.93914	18.98079	8.9	270.39
tdfta	420	.059306	.1943405	2.70E-11	1.70154
nfcti	405	13.52306	9.540893	0	94.25
gi	420	46.79875	.7713691	46.0392	48.79
idi	294	2.14	.4343949	1.62	2.79
rt	420	.2	.400477	0	1
smindex	420	-7.90e-07	1.551575	-1.79757	3.13667
indroe	420	27.3	2.454454	23	31
indroa	420	3.3	1.101312	2	5
ownership	420	.6666667	.4719667	0	1

Notes: *indadjroe* is the industry adjusted ROE, *indadjroa* is the industry adjusted ROA, *Ln* is the Logarithm. *MBTN* is the number of mobile banking transactions. *atmindatm* is the ratio of number of firm i ATMs to number of ATMs in the Industry. *depacinddepac* is the ratio of number of firm i internet accounts (deposits accounts) to the number of internet accounts (deposit accounts) in the industry. *bagindag* is the ratio of number of firm i agency banking agents to the number of agency banking agents in the industry. *gdp* is Gross Domestic Product. *lnta* is the logarithm of total assets. *er* is the expense ratio. *aur* is asset utilisation ratio. *car* is the capital adequacy ratio. *tdfta* is the ratio of technological developments at firm level to the firm's total assets. *nfcti* is the ratio of firm i net fees and commissions to total income. *gi* is globalisation index. *idi* is ICT development index. *rt* is regulations and taxes. *Smindex* is stock market development index. *indroa* is industry ROA. *indroe* is industry ROE.

Table 8.4: Summary Statistics for the Dummy Variables

Regulation and taxes			
	Frequency	Percent	Cumulative
0	336	80	80
1	84	20	100
Total	420	100	
Ownership			
	Frequency	Percent	Cumulative
0	140	33	33
1	280	64	100
Total	420	100	
Listing			
	Frequency	Percent	Cumulative
0	320	76	76
1	100	24	100
Total	420	100	

Dummy_Large			
	Frequency	Percent	Cumulative
0	360	86	86
1	60	14	100
Total	420	100	
Dummy_Medium			
	Frequency	Percent	Cumulative
0	280	67	67
1	140	33	100
Total	420	100	

The Dummy Variables

Four dummy variables have been used in this study namely: regulations and taxes (rt), ownership, listing and peer group dummies (large, medium and small with small banks as the reference group). rt is one of the main variables for model three, which tests the drivers of financial innovation at macro level. These dummies are represented by 0 and 1 as summarised below.

Table 8.5: Dummy Variables and Proxies

Dummy	Proxy
Regulation affecting financial innovation in time t	1
Absence of Regulation affecting financial innovation in time t	0
Locally owned banks	1
Majority foreign ownership in the banks	0
Bank listed at the Nairobi Securities Exchange	1

Bank not listed at the Nairobi Securities Exchange[24]	0
The bank belongs to the large peer group (dummy_large)	1
The bank does not belong to the large peer group (dummy_large)	0
The bank belongs to the medium peer group (dummy_medium)	1
The bank does not belong to the medium peer group (dummy_medium)	0
Reference bank peer group is small banks	

The summary statistics for the dummy variables indicates:

1. There were two regulations directly affecting financial innovations under study, which fell on two time periods (or 20% of the study period).
2. The banks are grouped into three peer groups (large, medium and small) by the Central Bank of Kenya based on the market size index (CBK, 2013). The market size index comprises weighted average of net assets (0.33), total deposits (0.33), total capital (0.33), total number of deposit accounts (0.005) and total number of loan accounts (0.005). Of the 42 banks studied, six banks are large; 14 are medium while 22 are small.
3. Ten commercial banks are listed at the Nairobi Securities Exchange while 32 banks are not listed.
4. Majority of the commercial banks (28) are locally owned while the rest (14) are foreign owned.

These control variables are included to ensure their effect (if any) on firm performance and/or financial innovation is controlled for and to ensure robustness of the model and results.

8.3 Correlational Matrices for all the Variables in Each Model

Table 8.6 provides the correlation matrix for all variables used to predict firm performance and financial innovation drivers. The relationship between industry adjusted ROA and industry adjusted ROE is strong at 0.83. This is because the two ratios are measures of firm performance although the components of each of the ratios are different. Owing to the strong correlation, the two variables are not used in the same regression equations. Industry performance (both indroe and indroa) has a positive correlation with both

[24] The listing dummy has no effect on all the results in the regressions and has therefore omitted in the regression outputs

firm performance and all financial innovation except ATMs. Ownership structure is also having a positive relationship with both firm performance and financial innovations.

The results confirm the literature on the relationship between financial innovations (represented by ATMs, number of deposit accounts, agency banking agents and mobile banking transactions) and firm performance represented by industry adjusted ROA and industry adjusted ROE. The firm size control variable has the strongest relationship to firm performance and financial innovation. This is consistent with Blundell et al (1999) and Gopalakrishnan (2000) studies which confirm the existence of reverse causation between financial innovations and firm performance. The studies observe that large firms have the resources to develop and adopt innovations. The adoption or usage of innovations eventually enable larger firms to attain a bigger market share. The strong relationship between firm size and financial performance is also consistent with the resource-based view (RBV), which argues that the resources controlled by a firm to a large extent affect its performance.

According to Zhu (2004) a firms innovation capabilities coupled with information technology (IT) infrastructure create complementarities in resources that explain variations in performance across firms. The expense ratio (er) has a negative relationship with financial innovation implying that as financial innovations increase agency costs decline. Firm constraint as represented by car has a negative relationship with three out of four financial innovations studied. Firm constraints has a negative correlation with mobile banking. However, mobile banking is not an innovation of the banking sector. Mobile banking is an innovation of the mobile phone companies but all the cash transferred is held in the banking sector. The stock market development index, a proxy for completeness in financial market has a negative relationship with all financial innovations except ATMs. This is consistent with literature which argues that financial innovations arise to complete the markets. This explains why financial innovations increase as stock market development index falls.

Stock market development appears to have no correlation with firm performance as evidenced by correlation of 0.00 with industry adjusted ROA and 0.04 with industry adjusted ROE. The result agrees with the literature with regard to the relationship between firm constraints and financial innovations. Tufano (2003) posits that the smallest, weakest firms exposed to major constraints are more likely to innovate in order to appeal to potential investors. The author finds that small firms are more likely to innovate unlike large firms which have already passed initial imperfection stage and are now pre-occupied with capital structuring efforts and financial innovations. The correlation matrix shows that as

firm constraints, measured by the decline in capital adequacy ratio increase, the quantity of financial innovations increase. This finding is consistent with Silber (1983) study which finds that constraint based innovations account for significant new bank products between 1952 and 1970 and 60 percent of financial innovations between 1970 and 1982. However, increased innovations by small banks are likely to be an attempt to catch up with the large banks, which account for the bulk of the innovations. Firm size has the strongest relationship with all the proxies of financial innovations consistent with the resource-based view.

Table 8.6: Correlational matrices for all the variables in the three models

	iaroe	iaroa	lnmbtn	atmia	depac	Biag	gdp	lnta	er	car	tdfta	nfcti	gi	idi	rt	Sm index	Ind roe	Ind roa	ows
iaroe	1.00																		
iaroa	0.83*	1.00																	
lnmbtn	0.11	0.15*	1.00																
atmia	0.17*	0.13*	-0.07	1.00															
depac	0.18*	0.25*	0.14*	0.31*	1.00														
Biag	0.14*	0.18*	0.12	0.31*	0.58*	1.00													
gdp	0.06	0.06	-0.41*	0.03	-0.03	-0.02	1.00												
lnta	0.52*	0.49*	0.31*	0.42*	0.37*	0.32*	-0.08*	1.00											
er	-0.30*	-0.38*	0.01	-0.02	-0.01	-0.01	0.07	-0.15*	1.00										
car	-0.23*	-0.28*	0.04	-0.12	0.01	-0.04	-0.04	-0.37*	0.17*	1.00									
tdfta	-0.03	-0.10	-0.23*	-0.03	-0.03	-0.03	0.09	0.00	0.10	0.03	1.00								
nfcti	0.01	-0.02	-0.20*	0.38	0.07	0.03	0.04	0.14*	-0.06	-0.11	0.11	1.00							
gi	0.09	0.11	0.43*	-0.03	0.06	0.06	-0.02	0.18*	0.00	-0.02	-0.11	-0.08	1.00						
idi	0.03	0.10	0.81*	-0.01	0.08	0.18	0.22	0.24*	-0.08	-0.03	-0.14	-0.17	0.34*	1.00					
rt	0.09	0.10	0.26*	-0.02	0.02	-0.08	0.51	0.01	0.10	0.00	-0.03	-0.02	0.16*	-0.27*	1.0				
sminde x	0.05	-0.02	-0.42*	0.03	-0.07	-0.14	0.43	-0.18	0.06	-0.06	0.09	0.10	-0.25*	-0.57*	0.35*	1.00			

indroe	0.14*	0.17*	0.64*	-0.05	0.13*	0.17*	0.08	0.28	0.01	-0.01	-0.18*	-0.18*	0.14*	0.64*	0.14*	-0.01	1.00	
indroa	0.10	0.17*	0.83*	-0.06	0.15*	0.20*	-0.15*	0.35	-0.02	0.01	-0.20*	-0.23*	0.46*	0.99*	0.09	-0.52*	0.75*	1.00
ows	-0.03	0.03	0.00	0.09	0.12	0.11	0.00	-0.14	-0.08	-0.06	-0.16*	0.04	0.00	0.00	0.00	0.00	0.00	0.00	1.00

Standard errors in parentheses. ***$P<0.01$

Notes: *iaroe* is the industry adjusted ROE, *iaroa* is the industry adjusted ROA. *Ln* is the Logarithm. *MBTN* is the number of mobile banking transactions. *atmia* is the ratio of number of firm i ATMs to number of ATMs in the Industry. *depac* is the ratio of number of firm i internet accounts (deposits accounts) to the number of internet accounts (deposit accounts) in the industry. $biag$ is the ratio of number of firm i agency banking agents to the number of agency banking agents in the industry. *gdp* is Gross Domestic Product. *lnta* is the logarithm of total assets. *er* is the expense ratio. *aur* is asset utilisation ratio. *car* is the capital adequacy ratio. *tdfta* is the ratio of technological developments at firm level to the firm's total assets. *nfcti* is the ratio of firm i net fees and commissions to total income. *gi* is globalisation index. *idi* is ICT development index. *rt* is regulations and taxes. *Smindex* is stock market development index. *indroa* is industry ROA. *indroe* is industry ROE. Ows is ownership.

8.4 Regression Outputs

This section presents regression the regression outputs of the three models

8.4.1 Model one, Results: Financial Innovation and Firm Performance

This section provides the regression results from the model one presented in Table 8.7. The model tests the relationship between financial innovations and firm financial performance. Financial performance is measured by industry adjusted ROE and industry adjusted ROA. Each of the performance measures has been included as the dependent variable in the model. In each case, both Arellano-Bond test for zero autocorrelation in first-difference errors (AR 2 test) and Sargan test of over identifying restrictions are carried out. The two tests confirm no autocorrelation and that over identifying restrictions are valid in the regression models. Additionally, Wald test for joint significance of the independent variables confirms that the independent variables are jointly significant at one percent level of significance in driving firm financial performance. Therefore, the model is appropriate for testing the relationship between financial innovation and firm performance. Since industry adjusted ROE and industry adjusted ROA have a strong correlation and ROE has been considered superior to ROA, we largely report on the results of industry adjusted ROE (Yeh et al., 2001).

Model one results provide evidence that ATMs, agency banking and mobile banking, financial innovations significantly lead to firm financial performance at the five percent level of significance for both ATMs and agency banking. The results indicate that mobile banking significantly affects firm performance at one per cent level of significance. These results are also economically significant in view of the size of the effect that the independent variables have on the dependent variable (firm performance). The size of the effect the independent variables have on firm performance is measured by the size of the coefficients of the independent variables. According to the results in Table 8.7, the coefficients are significantly above zero at 31.79, 18.72 and 0.0635 for ATMs, agency banking and mobile banking proxies respectively. Importantly, the coefficients have positive signs as expected, providing evidence that the financial innovations significantly and positively drive firm performance. Although the effect of internet banking on firm performance is not statistically significant at all conventional levels of significance, the effect is positive as evidenced by a positive co-efficient of 4.094.

These results confirm the dominance of mobile banking (non-bank led model) over the other two branchless banking models. This can be explained by a number of observations made in the study.

Firstly, the dominance of mobile payments, customer numbers over the other electronic payments as evidenced in figure 5.7 (b), is an indication of the popularity of mobile banking in Kenya. Secondly, Figure 1.3 shows the growth in mobile banking transactions for the period between 2007 and 2013. The Figure demonstrates that since the introduction of mobile banking in 2007, mobile banking transactions have grown significantly over the period, which confirms the link between mobile banking and firm performance. Although the contribution of agency banking to firm performance is significant at the five percent level of significance, agency banking was in operation for only three years over the 10-year study period. The implication is that the impact of agency banking is likely to be felt more in the future, considering the fact that the impact of financial innovation on firm performance is time lagged. In addition, agency banking has been adopted by 13 out of 42 commercial banks and therefore the innovation is yet to be widely felt.

The contribution of ATMs to firm performance is significant at the five percent level of significance in spite of the fact that a number of banks (including multinationals) in Kenya have not installed their own ATMs. These banks have linked their customers to the shared platform referred to as *Kenswitch*[25]. Moreover, *Visa* and *Master card* branded ATMs enable the sharing of the ATM network globally implying that individual firms sharing the ATM platforms may not necessarily have the incentive to install many ATMs in view of the huge installation cost per ATM machine. Nevertheless, ATM usage has significant impact on firm financial performance. The results in table 8.7 show that internet banking positively affects firm performance, but the contribution is insignificant. Past performance and industry performance are included as control variables in the model. A firm's past performance has a statistically significant positive impact at the one per cent level of significance, while the industry's impact on firm financial performance is negative and insignificant when industry ROE is used. However, when industry ROA is used, the impact of the industry on firm performance is negative, but statistically significant at all conventional levels. It appears that industry performance is generally not a major driver of individual bank's firm performance in Kenya.

When industry adjusted ROA is used in the regression, a firm's size significantly and positively affects firm performance while the effect of firm size is insignificant when industry adjusted ROE is used. This could be explained by the fact that total assets used as the proxy for firm size, comprise the resources

[25] *Kenswitch* is a shared financial switch comprising a consortium of over twenty Kenyan commercial banks which enable the round the clock delivery of electronic banking services through the use of a range of delivery channels. It was established with the key objective of "creating a common switch and ATM network between various small and medium sized banks in Kenya" (LTS, 2015)

controlled by the firm, which have been found to drive firm performance. The impact of firm size on firm performance buttresses the resource based view which holds that performance variation among firms is mainly dependent on the resources which individual firms control (Galbreath & Galvin, 2008). However, these findings are not consistent with the industrial/organisation economic theory, which holds that firm performance variations can be explained by the structural features of the sectors in the industry where the firm operates (Kamasak, 2011). The ownership structure of the banks has been used as a control variable in the regression. The null hypothesis is that ownership structure of the banks does not significantly affect firm financial performance. The results find that ownership structure has a statistically significant positive impact on firm performance. The size of the coefficient is big (at 2.525) and is positive as expected. This shows that locally-owned banks are the main drivers of financial innovations. For example as observed in the review of the banking sector performance, locally owned banks (three commercial banks) account for more than 90% of agency banking in Kenya.

Lastly, GDP is included in the regression as a control variable. Consequently, this study finds a significant positive relationship between performance of the economy as measured by GDP growth, and firm financial performance. Secondly, the size of the coefficient is big (at 0.336) and positive as expected. The implication of this finding is that the economic environment where commercial banks operate is critical in driving their financial performance. This is because when the economy is performing well, the uptake of development loans increases and default rates on such loans fall with positive implications on profitability.

In sum, the study results presented in table 8.7 provide evidence that mobile banking, ATMs and agency banking significantly explain the variation in firm financial performance in Kenya. Therefore, we reject the null hypothesis in favour of the alternative hypothesis at one per cent level significance for mobile banking and five per cent level of significance for both ATMs and agency banking. Lastly, internet banking has no significant effect on firm financial performance. Consequently, we do not reject the null hypothesis. It appears that internet banking may need to attain a critical mass of users capable of driving bank's profitability, which is a function of time.

Table 8.7: Model one – System GMM Results – financial innovation and firm financial performance

	(1)	(2)
	indadjroe	indadjroa
L.indadjroe	0.152***	
	(0.0113)	
indroe	-0.0550	
	(0.0437)	
ownership	2.525**	1.049***
	(1.108)	(0.326)
L.indroe	-0.241***	
	(0.0531)	
depacinddepac	4.094	2.841
	(10.58)	(2.517)
L.depacinddepac	-9.905	
	(15.53)	
lnta	1.680	0.570***
	(1.798)	(0.0746)
L.lnta	-1.080	
	(1.722)	
atmindatm	31.79**	1.744
	(12.44)	(2.771)
bagindag	18.72**	0.461
	(7.751)	(0.980)
lnmbtn	0.0635***	0.0300***
	(0.0155)	(0.00256)
gdp	0.336***	0.169***
	(0.0563)	(0.0156)
Dummy_large	0.837	
	(0.510)	
Dummy_medium	0.492	
	(0.349)	
L.indadjroa		0.254***
		(0.00788)
indroa		-0.164***
		(0.0451)
_cons	-15.11**	-15.42***
	(6.581)	(1.733)
N	308	355
AR (2) test	Z = .31726	Z = -1.6547
Sargan test	chi2(130)= 28.31586	chi2(175) = 35.76437
Wald	chi2(15) = 1685.43***	chi2(9) = 3067.28***

Standard errors in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: L.indadjroe is lag industry adjusted ROE. L.indadjroa is lag industry adjusted ROA. L.indroe is lag industry ROE. L.depacinddepac is lag of the ratio of number of internet banking accounts (deposit accounts) to the number of industry internet accounts (deposit accounts).

8.4.2 Model two Results: Firm Level Financial Innovation Drivers

This model tests the drivers of financial innovations at firm level based on the reviewed literature. In the model, financial innovation is the dependent variable while the drivers of financial innovations are the independent variables. Each of the four financial innovations has been included as the dependent variable in the model. In each case, both Arellano-Bond test for zero autocorrelation in first-difference errors (AR 2 test) and Sargan test of over identifying restrictions are carried out. The two tests confirm no autocorrelation and that over identifying restrictions are valid in the regression models. The model is therefore appropriate for testing the drivers of financial innovation at firm level.

What Drives Financial Innovation at Firm Level?

Chapter three and chapter six have discussed in detail the drivers of financial innovation at firm level and the appropriate proxies for each of the drivers. This section discusses the results from the empirical analysis of the drivers presented in table 8.8. The main drivers of financial innovation at firm level are; firm size, technological developments at firm level, agency costs and firm constraints.

Table 8.8: Model two – System GMM Results – Drivers of financial innovation at firm level

	(1)	(2)	(3)	(4)
	lnmbtn	bagindag	atmindatm	depacinddepac
L.lnmbtn	0.649***			
	(0.00455)			
aur	-0.211***	-0.000301***		
	(0.0211)	(0.0000461)		
indadjroe	0.0348**	0.0000474***	0.000130***	
	(0.0158)	(0.0000117)	(0.00000923)	
car	0.0168***	0.0000111***	0.0000216***	-0.0000550***
	(0.00284)	(0.00000376)	(0.00000245)	(0.0000123)
tdfta	31.32***	0.105***	0.0831***	0.711***
	(11.02)	(0.0248)	(0.00198)	(0.0472)
nfcti	-0.0910***	-0.000249***	0.000300***	0.000203***
	(0.0178)	(0.0000346)	(0.00000972)	(0.0000391)
lnta	2.434***	0.00793***	0.00502***	0.0233***
	(0.144)	(0.000564)	(0.0000694)	(0.00156)
Dummy_large	-0.303			
	(0.386)			

Dummy_medium	0.379**			
	(0.156)			
L.bagindag		0.753***		
		(0.00672)		
ownership		0.0121***		0.0317***
		(0.00196)		(0.00382)
L.atmindatm			0.797***	
			(0.00520)	
er			0.00000241***	-0.0000403***
			(0.000000262)	(0.00000981)
L.lnta				-0.0163***
				(0.00154)
lagdepacinddepac				0.779***
				(0.0199)
indadjroa				0.000832***
				(0.000178)
_cons	-45.99***	-0.186***	-0.119***	-0.199***
	(3.726)	(0.0125)	(0.00166)	(0.0195)
N	358	358	358	355
AR (2) test	Z= -1.3781	Z= -.46869	Z= .90103	Z= .85437
Sargan	chi2(187) = 41.76186	chi2(178) = 33.13132	chi2(227)=39.34686	chi2(163) = 35.41554
Wald	chi2(9) = 107816.61***	chi2(8) = 29267.08***	chi2(7) = 1.60e+06***	chi2(8) = 2.01e+06***

Standard errors in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Notes: L.lnmbtn is lag of the logarithm of mobile banking transactions. L.bagindag is the lag of the ratio of number of firm *i* agents to the total number of agency banking agents in the industry. L.atmindatm is the lag of the ratio of number of firm *i* ATMs to the total number of ATMs in the industry. L.lnta is the lag of the logarithm of total assets. Lagdepacinddepac is the lag of the ratio of number of firm *i* internet accounts (deposit accounts) to the total number of internet accounts (deposit accounts) in the industry.

Firm Size

According to the reviewed literature, firm size positively drives financial innovations at firm level. Secondly, RBV literature contends that the resources a firm controls give it a competitive edge over its competitors. The null hypothesis is that firm size as measured by the log of the firm's total assets, does

not significantly explain variations in financial innovations across firms. This study finds evidence that firm size significantly drives the four financial innovations studied at one per cent level of significance. Secondly, consistent with the literature, the co-efficients of the four financial innovation proxies are positive and the size of the co-efficients is large as well. For example the coefficients are 2.434, 0.00793, 0.00502 and 0.0233 for mobile banking, agency banking, ATMs and internet banking respectively. The results suggest that firm size is a key driver of financial innovations, which buttresses previous studies. For instance, the findings are consistent with the resource-based view which holds that firms with sufficient resources are more likely to innovate than firms with modest resources. The plausible explanation for this finding is that since financial innovations require substantial investment in research and development as well as ICT infrastructure, large firms have an upper hand in developing and adopting financial innovations compared to small firms. The results also support Akhavein et al. (2005) as well as Malerba and Orsenigo (1997) studies which find large firms accounting for the bulk of financial innovations. In view of these results we reject the null hypothesis in favour of the alternative hypothesis at one percent level of significance for all the four financial innovations studied.

Agency Costs

Agency costs are significant drivers of financial innovations in Kenya's banking firms. The results in table 8.8 show that the asset utilisation ratio (aur) and the expense ratio (er) used as proxies for agency costs in the regression models are statistically significant at the one percent level of significance for all the four financial innovations. However, the size of the coefficients is very small (close to zero) for all the financial innovation save for mobile banking (at -0.211). The results suggest that mobile banking reduces agency costs more than agency banking, ATMs and internet banking. It is expected that the relationship between financial innovations and agency costs is inverse since the literature argues that financial innovations arise to reduce agency costs (Tufano, 2003). In addition, according to J. S. Ang et al. (2000) expense ratio and asset utilization ratio, widely used in financial economics and accounting decline with increase in financial innovations. The results indicate that the two ratios have a significant and an inverse relationship with mobile banking, agency banking and internet banking. The implication of these findings is that the reduction in transaction costs with increase in financial innovations usage is an incentive for firms to not only innovate but also adopt and use the innovations.

On the other hand, although the expense ratio and asset utilisation ratio are significant at one per cent level of significance for ATMs, the results indicate that ATMs do not necessarily reduce agency costs in

Kenya's banking sector. Although the effect of agency costs is statistically significant at one per cent level of significance, the size of the coefficient (at 0.00000241) is not economically significant. The possible explanation for the positive relationship between agency costs and ATMs may rest in the ATM installation costs and the management discretion in approving the expenditure. ATMs involve substantial installation costs and the management or agents are at liberty to approve the expenditure. Consequently, the management may install substantially expensive machines increasing the overall capital expenditure.

All in all, in view of these findings the null hypothesis is rejected in favour of the alternative hypothesis at one per cent significant level. This study confirms that mobile banking, internet banking and agency banking significantly reduce agency costs at one per cent level of significance, consistent with the reviewed literature. Therefore, agency cost is a driver of financial innovation at firm level.

Transaction Costs

A number of studies have linked financial innovation to the need to reduce transaction costs. For example, Merton (1989) argues that financial innovations arise to curtail transaction costs. In addition, as discussed in chapter five, other studies find that innovations in electronic payments have helped reduce payment costs to a level within the range of one third and one half of paper based non cash payments (Humphrey et al., 2001). Moreover, according to Tufano (2003) fast growth in ATMs and smart cards is informed by the need to reduce transaction costs. Transaction costs are represented by the ratio of net fees and commissions to total income (nfcti) as shown in table 8.8. Consistent with this literature, the present study finds that mobile banking and agency banking financial innovations are associated with significant reduction in transaction costs at one per cent level of significance. The sign of the coefficients is negative as expected. Additionally, the coefficient transaction cost (proxy) with respect to mobile banking is both negative and the size is bigger (at -0.0910) than other financial innovations, suggesting that mobile banking reduces transaction costs more than the other financial innovations. The size of the coefficients of the transaction costs with respect to other financial innovations is very small, implying that the effect of the financial innovations in reducing transaction costs is very minimal. The results suggest that the desire to reduce transaction costs has minimal impact on the usage of agency banking, ATMs and internet banking. In addition, although the impact of ATMs and internet banking financial innovations on transaction costs is significant, the results indicate that ATMs and internet banking have not succeeded in reducing transaction costs over the study period. The two innovations will need to reach a critical mass where their adoption and usage can significantly reduce transaction costs.

It should also be noted that as the study observes, a number of banks (including multinationals) in Kenya have no ATMs of their own. The banks with no ATMs have linked their customers to *Kenswitch*. Additionally, ATMs are shared worldwide for example *Visa* and *MasterCard* branded ATMs. The implication of these ATM sharing platforms is that individual firms may not reap immediate benefits by introducing new and more ATMs. Internet banking requires not only internet access but also knowledge of the internet applications so as to easily navigate the online banking platforms. Conversely, considering the low internet penetration in the country and the high digital divide in Kenya, it will take time before internet banking effect on transaction costs can be significantly felt by Kenyan banks. These findings, therefore, provide a justification for the rejection of the null hypothesis in favour of the alternative hypothesis at one per cent level of significance.

Technological Developments at Firm Level

The financial innovation literature suggests that technologies in use at firm level define the limit on the scope and pace of a firm's technological change adopted (Collins et al, 1988). The technological resources include infrastructure, human capital and knowledge, which enable a firm to be technologically competent (Salwani *et* al., 2009). These infrastructure provides the platform for the development of financial innovations. Consequently, firms which have more ICT infrastructure and personnel are expected to innovate more, suggesting a positive relationship between the amount of technological resources and financial innovation. Technological developments at firm level are represented by the proportion of technological infrastructure and ICT personnel to the firm's total assets (tdfta).

The results from this study are consistent with the literature linking technological developments at firm level to financial innovations. As expected, technological developments at firm level significantly and positively drive the four financial innovations at one per cent level of significance. The effect of technological developments at firm level on firm's financial innovations is also economically significant. This is evidenced by the large size of the coefficients of the proxies of technological developments at firm level with respect to the four financial innovations. The coefficients have positive signs as expected i.e. 31.32 (mobile banking), 0.105 (agency banking), 0.0831 ATMs and 0.711 for internet banking. The role of technological resources in driving financial innovations at firm level, therefore, is consistent across the four financial innovations studied.

These results are also consistent with the RBV and the TOE frameworks. The TOE framework involves a threefold context for adopting and implementing technological innovations; technological,

organisational, and environmental contexts (Y.-M. Wang et al., 2010). The organisational context discussed under the TOE framework is therefore relevant in explaining financial innovation drivers at firm level. According to TOE[26], firm context affects the adoption and implementation of innovations (Baker, 2011). As discussed in chapter two, Tornatzky and Fleischer (1990) argue that factors in the environmental and organisational context coupled with the technology itself materially affect technological innovation adoption. The results presented in table 8.8 show that technological infrastructure and ICT personnel owned or controlled by an organisation significantly drives financial innovations at firm or organisational level. The results suggests that firms with more ICT infrastructure and more ICT personnel are associated with an increase in financial innovations, consistent with RBV and TOE literature. Therefore, we reject the null hypothesis at all conventional levels of significance in favour of the alternative hypothesis.

Firm Constraints

It is argued in the literature that small firms exposed to constraints are more likely to innovate so as to appeal to potential investors (Tufano, 2003). If this finding applies to Kenyan banks, the firm constraint proxy would have a positive correlation with all the financial innovations studied. The results of this study presented in table 8.7 find that as expected, firm constraints have a statistically significant positive relationship with mobile banking, agency banking and ATMs but a significant negative link to internet banking at all conventional levels of significance. The size of the coefficients of the independent variable (car) is very small except for mobile banking. For instance the coefficients are 0.0168 (mobile banking), 0.0000111 (agency banking), 0.0000216 (ATMs) and -0.0000550 for internet banking. These results suggest that undercapitalisation (as a firm constraint) of commercial banks is associated with the increase in mobile banking, agency banking and ATMs but the size of the impact has been fairly small save for mobile banking. The amount of investment required to set up internet banking is not significant compared to other branchless banking models and therefore any bank can adopt and use it irrespective of the constraints faced. This study observes that all the banks studied have consistently met the minimum capital adequacy requirement set by the CBK. We, therefore, reject the null hypothesis in favour of the alternative hypothesis at one percent level of significance.

[26] See Chapter 2: Theoretical framework for a detailed discussion on TOE and RBV

8.4.3 Model Three: Macro Level (environment) Financial Innovation Drivers

This model tests the macro or environmental level drivers of firms' financial innovations based on the reviewed literature. Each of the financial innovation drivers at macro level has been included as the dependent variable in the model. The Wald test for joint significance confirms that the independent variables are jointly significant in driving macro level financial innovations at one per cent level of significance. In each case both Arellano-Bond test for zero autocorrelation in first-differenced errors (AR 2 test) and Sargan test of over identifying restrictions are carried out. The two tests confirm no autocorrelation and that over identifying restrictions are valid in the regression models. The model is therefore appropriate for testing the macro level drivers of financial innovation at firm level.

Table 8.9a: Model three – System GMM results – The macro level drivers of financial innovations

	(1)	(2)	(3)	(4)
	lnmbtn	bagindag	atmindatm	depacinddepac
L.lnmbtn	0.121***			
	(0.0000385)			
lnta	0.0232***	0.0200***	-0.00261***	0.0145***
	(0.000252)	(0.000321)	(0.000195)	(0.000199)
gi	-0.0178***	-0.000113***	-0.000734***	-0.00144***
	(0.0000519)	(0.0000157)	(0.0000169)	(0.0000370)
idi	1.111***	-0.0157***	-0.0122***	-0.00930***
	(0.000495)	(0.000271)	(0.000484)	(0.000196)
rt	0.254***	0.0408***	0.000955***	0.00320***
	(0.000193)	(0.000645)	(0.000122)	(0.0000831)
smindex	-0.270***	-0.0170***	0.00227***	-0.000163**
	(0.000135)	(0.000293)	(0.0000603)	(0.0000737)
indadjroa	0.00869***			
	(0.0000496)			
L.bagindag		0.639***		
		(0.00458)		
gdp		-0.00410***		
		(0.0000781)		
L.gdp		0.00850***		
		(0.000139)		
indadjroe		0.000333***	0.000101***	-0.000124***
		(0.0000159)	(0.00000846)	(0.00000781)
L.atmindatm			0.579***	
			(0.00507)	
L.lnta			0.0290***	-0.00126***
			(0.000846)	(0.000331)
ownership			0.00950	0.0327***

			(0.00797)	(0.00469)
L.depacinddepac				0.870***
				(0.00266)
_cons	18.87***	-0.465***	-0.553***	-0.246***
	(0.00712)	(0.00748)	(0.0184)	(0.00718)
N	286	284	279	279
AR (2) test	Z= -2.9255	Z= -.47689	Z= 1.071	Z= .85673
Sargan test	chi2(46)= 41.99726	chi2(55) = 41.31087	chi2(78)= 38.8968	chi2(64)= 40.12379
Wald	chi2(7) = 3.87e+08***	chi2(9) = 302215.63***	chi2(9) = 119555.61***	chi2(9) = 3.60e+06***

Standard errors in parentheses
* p < 0.1, ** p < 0.05, *** p < 0.01

Notes: L.lnmbtn is lag of the logarithm of mobile banking transactions. L.bagindag is the lag of the ratio of number of firm *i* agents to the total number of agency banking agents in the industry. L.atmindatm is the lag of the ratio of number of firm *i* ATMs to the total number of ATMs in the industry. L.lnta is the lag of the logarithm of total assets. Lagdepacinddepac is the lag of the ratio of number of firm *i* internet accounts (deposit accounts) to the total number of internet accounts (deposit accounts) in the industry. L.gdp is lag of GDP.

What Drives Financial Innovation at Macro Level?

Chapter two and chapter five discuss in detail the drivers of financial innovation at macro level and the appropriate proxies for each of the drivers. This section discusses the results from the empirical analysis of the drivers presented in table 8.9a. The main drivers of financial innovation at macro level are globalisation and risk (gi), technological developments at macro level (idi), regulations and taxes (rt) and incompleteness in financial markets (smindex). This section discusses results of the regressions presented in table 8.9.

Globalisation and Risk

This study uses annual globalisation index (gi) as the proxy for globalisation. According to the reviewed literature, governments' actions with regard to globalisation have either encouraged or discouraged the development of financial innovations through the abolition or introduction of foreign exchange controls (Lütz, 1998). Government actions include the authorisation of foreigners to be members of the stock exchange thereby promoting cross border capital flows (Rousseau & Sylla, 2003, p. 373). In addition, there is compelling evidence that cross border integration is largely accounted for by the pace of financial innovations (Lane & Milesi-Ferretti, 2008). The study opines that sectoral trends such as the rise of hedge

funds, securitisation, the use of special purpose vehicles by corporate and non-corporate entities, explain the cross border financial ownerships in developed economies.

The null hypothesis is that globalisation does not explain variations in financial innovations in Kenya. The implications of these studies is that the impact of globalisation on financial innovations can be either positive or negative and largely depends on governments' actions or inactions. Studies on the impact of globalisation on financial innovations in developing economies in general and the impact on branchless banking models in particular are largely unavailable. In the absence of credible studies which explain the relationship between globalisation and branchless banking financial innovations, this study explains the relationship based on the empirical results provided in table 8.9a. The empirical results find a significant negative relationship at one percent level of significance between globalisation and all the branchless banking financial innovations studied. The size of the effect of globalisation (as evidenced by the size of correlation coefficients) on mobile banking is fairly big while the effect on the other three financial is small.

The implication of these findings is that globalisation does not lead to increase in financial innovations in Kenya with regard to branchless banking models. The global arena comprises countries which are at different levels of economic development and financial depth. These two factors would explain the variations in responses to globalisation between branchless banking models and other types of financial innovations. Although studies have linked globalisation to increase in financial innovations in developed countries, the results of this study provide evidence that the findings may not be generalised with respect to branchless banking in developing countries. This is because the needs of developing countries are not necessarily homogenous to the needs of developed countries. For instance, the majority of individuals in developed countries have access to formal financial services and have available credit history, which largely lacks in developing economies. Based on the results of this study, we do not reject the null hypothesis at all conventional statistical levels of significance.

Technological Developments at Macro level

The ICT development index (idi) for Kenya, developed by ITU has been used as the proxy for technological developments at macro level. The literature suggests that technological developments at the firm and macro levels drive financial innovations. The empirical results discussed under model two (see summary of results in table 8.8) show that technological developments at firm level significantly

and positively drive financial innovations at firm level for all the four financial innovations. However, empirical results presented in table 8.8 show that at the macro level, the role of technological developments in driving financial innovations is different with respect to each of the four financial innovations. The results indicate that technological developments significantly drive mobile banking at one per cent level of significance. The magnitude of the effect of technological developments at macro level on financial innovation based on the size of the coefficient is also large. However, although the IDI coefficient is statistically significant at all conventional levels for all financial innovations, its relationship with agency banking, ATMs and internet banking is negative.

These results could be explained by the fact that mobile banking innovation is not an innovation of commercial banks. Although mobile banking is an innovation of the telecommunications sector, the mobile banking infrastructure has been adopted and used by commercial banks. Additionally, the mobile banking infrastructure is significant enough to drive financial innovations. Moreover, this could be due to the small size of the ICT infrastructure, which supports agency banking, ATM and internet banking. The implication is that technological infrastructure at firm level are more important in driving the firm's financial innovations than the ICT infrastructure at the macro level. We, therefore, reject the null hypothesis with respect to mobile banking in favour of the alternative hypothesis at one percent level of significance. On the other hand, we fail to reject the null hypothesis with respect to agency banking, internet banking and ATM usage at all conventional levels of significance.

Regulation and Taxes

The relationship between regulation and financial innovation is largely dependent on whether the regulation is supportive or stifles financial innovation. According to Miller (1986) regulation and taxes significantly contribute to the development of a range of innovations in financial products. In addition, Calomiris (2009) contends that regulations may lead to development of financial innovations geared towards bypassing the new regulation, if the regulation is seen as limiting the activities that individuals would like to engage in. Whatever the case, new innovations will be developed whether the regulation is positive or not. The null hypothesis in this study is that regulation and taxes does not significantly explain variations in financial innovations usage across firms in Kenya. This study provides evidence that the financial regulations in Kenya have been supportive of all the financial innovations. The dummy variable for regulation is significant at one percent level of significance and the coefficient is positive for all the four innovations. The size of the effect of regulation on the financial innovation is big as evidenced by

the following coefficients; 0.254 (mobile banking), 0.0408 (agency banking), 0.000955 ATMs and 0.00320 for internet banking. The effect of regulation is felt more by mobile banking and agency banking. This confirms that financial regulation in Kenya significantly drives firm financial innovations. Therefore, we reject the null hypothesis in favour of the alternative hypothesis at all conventional levels of significance.

As discussed in chapter two of this study, the difference between the effect of negative and positive regulation is the speed and magnitude of the innovation. Secondly, the length of the time lag between the introduction of the regulation and the development of innovations in response to the regulation will also vary. The management may require more time to respond to negative regulation than positive regulation.

Incompleteness in Financial Markets

A number of the studies opine that incompleteness in financial markets drives financial innovations by introducing products with no close substitutes aimed at completing the markets (Duffie & Rahi, 1995a; Grinblatt & Longstaff, 2000; Tufano, 2003). For example, as discussed in chapter two, mobile money and agency banking innovations arise to address inefficiencies in customer service, high costs of service delivery as well as the high costs of funds transfer in inefficient markets. The implication of these studies is that as financial markets develop and become complete, financial innovations decrease and therefore the relationship between stock market development and financial innovations is inverse. The null hypothesis is that incompleteness in financial markets does not significantly explain the variations in financial innovation usage at firm level.

The results presented in table 8.9a are consistent with the reviewed literature. Using the stock market development index as the proxy for stock market development or completeness, the empirical results show that the incompleteness in financial markets significantly drives financial innovation at all conventional significant levels of significance for mobile banking and agency banking. In addition, incomplete financial markets significantly drive financial innovations at five percent level of significance. Moreover, the results show that the relationship is inverse for three out of the four financial innovations consistent the reviewed literature. The size of the coefficients of the independent variable show that the effect of incompleteness in financial markets on financial innovations is economically significant. Conversely, ATMs have been extensively used in developed financial markets and therefore the relationship between ATMs and financial markets development or completeness is direct and

significant at one percent significant level. Thus, we reject the null hypothesis in favour of the alternative hypothesis at one percent for mobile banking and agency banking and five percent for ATMs. Secondly, we do not reject the null hypothesis with respect to ATMs usage at one percent level of significance.

8.5.0: Results of the Speed of Adjustment in Model One to Three

As discussed in chapter seven, according to Koyck model, the mean and the median lags measure the speed with which Y responds to X. For instance, the mean and median lags would represent the speed with which $Y_{i,t}$ (firm financial performance) responds to $X_{i,t}$ $(financial\ innovation)$. This is encapsulated in the literature as "… the median lag is the time required for the first or 50% of the total change in Y following a unit sustained change in X…" (Gujarati, 2003 p.668)

Table 8.9b Speed of adjustments in model one, two and three

Model	$Y_{i,t}$	Dependent variable[27]	λ	log λ	log 2	Mean lag	Median lag
	Lag indadjroe	Firm performance	0.152	-0.818	0.301	1.179	0.368
Model 1	Lag indadjroa	Firm performance	0.254	-0.595	0.301	1.340	0.506
	Lag lnmbtn	Mobile banking	0.649	-0.188	0.301	2.849	1.603
	Lag bagindag	Agency banking	0.753	-0.123	0.301	4.049	2.443
	Lag atmindatm	ATMs	0.797	-0.099	0.301	4.926	3.055
Model 2	lag depacinddepac	Internet banking	0.779	-0.108	0.301	4.525	2.775
	Lag lnmbtn	Mobile banking	0.121	-0.917	0.301	1.138	0.328
	Lag bagindag	Agency banking	0.639	-0.194	0.301	2.770	1.548
	Lag atmindatm	ATMs	0.579	-0.237	0.301	2.375	1.268
Model 3	Lag depacinddepac	Internet banking	0.87	-0.060	0.301	7.692	4.977

8.5.1: Firm Financial Performance: Speed of Adjustment to Financial Innovations

This section reports on the tests on the speed of adjustments of the dependent variables to independent variables in models one to three, which are summarised in Table 8.9b. The results are also shown in Fig.

[27] Refer to Tables 8.7, 8.8, 8.9a

8.1. Firm financial performance has been measured by the industry adjusted ROE and industry adjusted ROA. The industry adjusted ROE has a mean lag of 1.179 and a median lag of 0.368. This means that it takes on average 1.179 years for firm performance as measured by industry adjusted ROE to adjust to the four financial innovations studied. Secondly, it takes less than a year (0.368 years) to accomplish 50% of the total change in firm performance following a unit-sustained change in the financial innovations. The industry adjusted ROA has a mean lag 1.340 and a median lag of 0.506. This means, it takes on average 1.34 years for financial performance as measured by industry adjusted ROA to adjust to financial innovations. Additionally, it takes more than a half a year (0.506 years) to accomplish 50% of the total change in firm performance following a unit-sustained change in financial innovations, when firm financial performance is measured by industry adjusted ROA. The speed of adjustment is illustrated in Fig. 8.1. According to the results, it takes a shorter period for firm financial performance to adjust to financial innovations than it takes financial innovation to respond to financial innovation drivers at firm level. The implication of these findings is that although it may take longer for a firm to adopt and use financial innovations, once the innovations are adopted and used, firm value will be achieved in a shorter period. This firm value is in form of increase in financial performance represented by the increase in industry adjusted ROE and ROA.

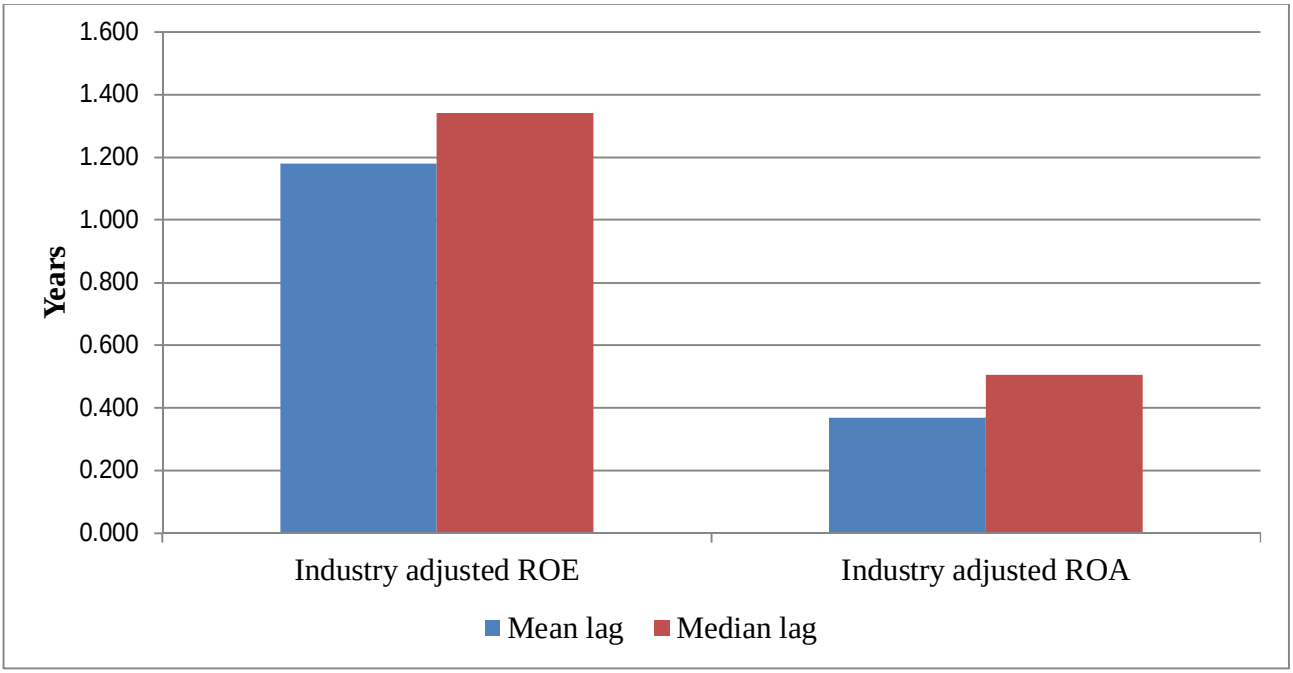


Fig 8.1: Firm financial performance speed of adjustment to financial innovation

Source: Author

8.5.2: The speed of Financial Innovation Adjustment to Financial Innovation Drivers at Firm Level

This section discusses the speed of adjustment of financial innovations to firm level financial innovation drivers. Firm level financial innovation drivers are summarised in the model two results presented in Table 8.7. The results of the speed of adjustment of the dependent variable (financial innovation) to independent variables (firm level financial innovation drivers) in model two are presented in Table 8.9. The results presented in Table 8.9 show that mobile banking has the shortest mean lag (2.849) while ATMs have the longest mean lag (4.926). These results, therefore, indicate that it takes on average about three years for mobile banking to adjust to firm level financial innovation drivers and on average about five years for ATMs to adjust to the financial innovation drivers. Consequently, mobile banking has the shortest median lag (1.603) while ATMs have the longest median lag (3.055). It therefore takes more than a year, i.e. 1.6 years and 3.055 years to achieve 50% of the total change in mobile banking and ATMs respectively. The speed of adjustment is illustrated in Fig. 6.2. The implications of these findings is that the effect of firm level financial innovation drivers on different financial innovations is time lagged, with the length of the lags ranging on average between 1.6 years and 3.055 years for the four financial innovations.

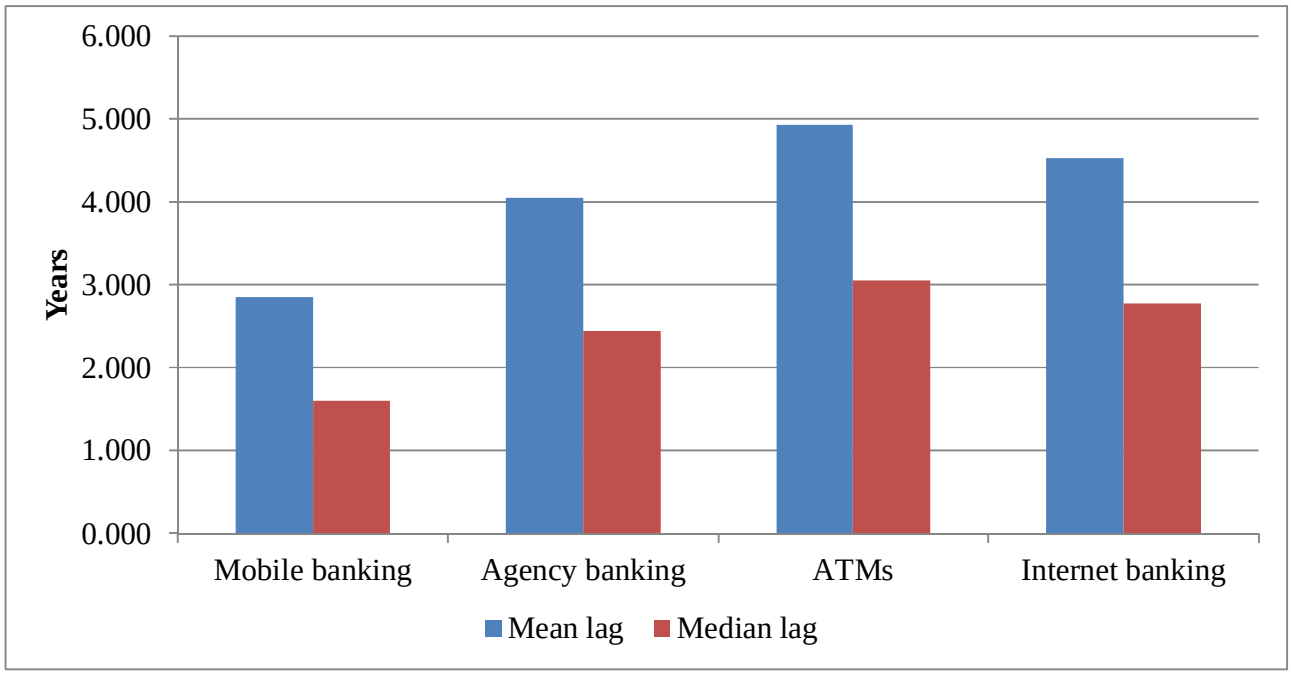


Fig. 8.2: Financial innovation speed of adjustment to firm level drivers

Source: Author

8.5.3: The Speed of Financial Innovation Adjustment to Financial Innovation Drivers at Macro Level

This section discusses the speed of adjustment of financial innovations to macro level financial innovation drivers. Macro level financial innovation drivers are summarised in the model three results presented in Table 8.9a. The results of the speed of adjustment of financial innovation to macro level financial innovation drivers are presented in Table 8.9b and Fig. 8.3.

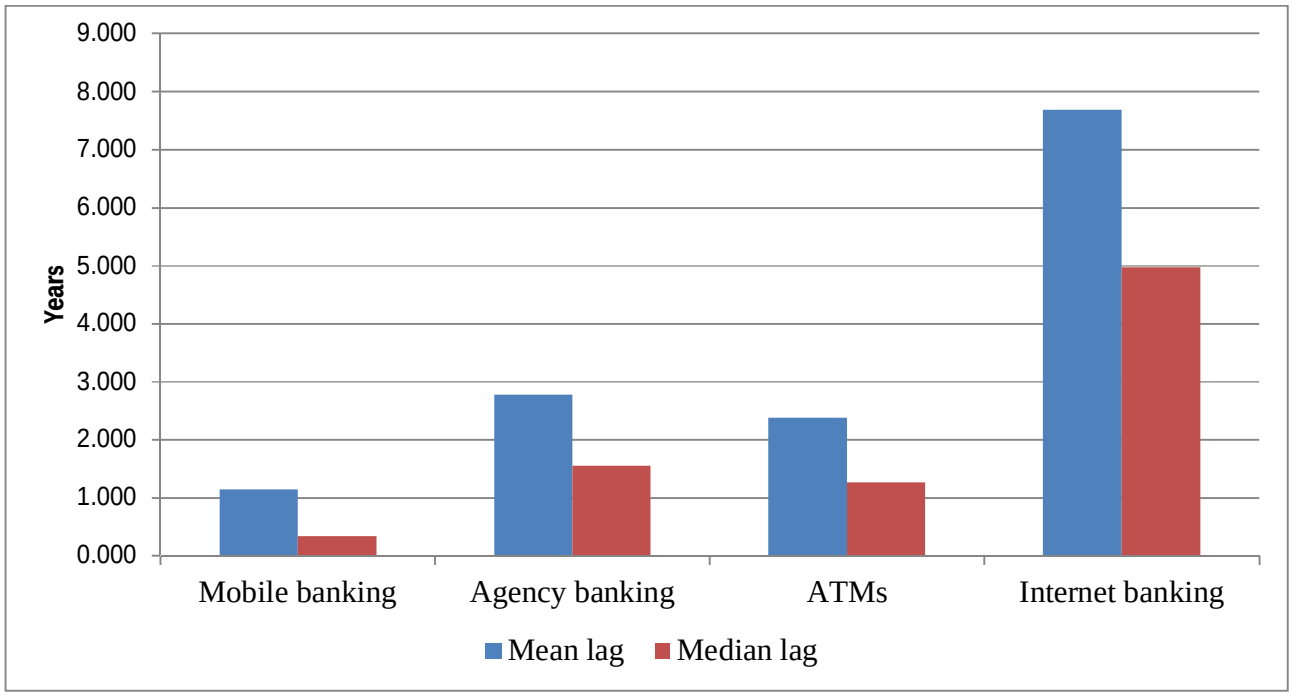


Fig 8.3: Financial innovation speed of adjustment to macro level drivers

The objective of this study is to establish the link between financial innovation and firm financial performance and to establish the firm and macro drivers of financial innovation at firm level. The present study also aims to establish the speed of adjustment of firm financial performance to financial innovation and the speed of adjustment of financial innovations to the respective financial innovation drivers. The results show that mobile banking has the shortest mean lag (1.138 years) and the shortest median lag (0.328 years) while internet banking has the longest mean lag (7.692 years) and the longest median lag (4.977 years). Overall, the speed of adjustment of financial innovations to macro level drivers is higher than the speed of adjustment of financial innovations to firm level drivers. However, the speed of adjustment of internet banking to macro level drivers is very low since it takes on average, 7.7 years for internet banking to respond to macro level drivers. Generally, the speed of adjustment of financial

innovation to financial innovation drivers and the speed of adjustment of firm financial performance to financial innovation may depend on the innovation speed in a given firm.

Innovation speed has been operationalised in a number of studies as the firm's quickness in generating new ideas, launching new products, development of new products, new processes and new ways of solving problems relative to competitors (M.-J. Chen & Hambrick, 1995; Liao et al., 2010). According to Z. Wang and Wang (2012), innovation speed is critical for attainment of superior firm performance and can enable the firm to effectively compete in the market. This is consistent with the previous studies which empirically confirm a positive link between speed-to-market and the whole success of the new product (Carbonell & Rodríguez-Escudero, 2009; Carbonell & Rodríguez Escudero, 2010). Moreover, rapid technological developments in the marketplace, increased competition as well as shortened product lifecycles have put pressure on companies to innovate at a faster rate (Heirman & Clarysse, 2007; Lynn, 2008). The implications of these studies, coupled with the findings from this study are that the macro-economic environment where firms operate is critical for the speedy adoption and usage of financial innovations. Secondly, although firms may have a fast response to macro-economic opportunities, bureaucracies inherent at firm level may slow the response to the usage of financial innovation.

The results of the present study indicate that the speed of adjustment of financial innovation to financial innovation drivers at firm level is lower than the speed of adjustment of financial innovation to financial innovation drivers at macro level. This could be explained by the degree of complexity characteristic in most organisations. According to E. Rogers (2003), complexity refers to the extent to which the adopting unit perceives an innovation as relatively hard to understand and use. For example, the need for new knowledge to make use of the newly introduced innovation may disrupt the existing knowledge leading to resistance to change (Armstrong & Hardgrave, 2007). In addition, since the adopting units may have insufficient information about the new innovation, the risk of error in decision-making increases, compounding the degree of complexity (Liu, Ghorpade, Tu, & Zhang, 2012).

8.6 Conclusion of the Chapter

The chapter has presented the results of the empirical studies carried in line with the objectives of the study and the stated research hypotheses. The chapter commences with the basic tests and the summary statistics. A number of control and dummy variables have been included in the regression models to ensure that other factors outside the key variables that would affect the results are considered.

A list of the dummy variables and summary statistics for the dummies is provided to shed more light on their characteristics. The chapter provides correlational matrices for all the variables used in the study to provide an overview of the relationships between the variables and the direction of the relationships.

A detailed discussion of the regression outputs followed by a discussion of results and the supporting literature is provided. The chapter provides evidence that the results from the regression outputs are not only largely statistically significant but also consistent with the literature reviewed in the preceding chapters. A test of the speed of adjustment of financial innovation to financial innovation drivers shows that mobile banking adjusts faster than the other three financial innovations. In addition, a test of the speed of adjustment of firm financial performance to financial innovations finds that it takes on average 1.179 years for firm performance as measured by industry adjusted ROE to adjust to the four financial innovations studied. Additionally, it takes less than a year (0.368 years) to accomplish 50% of the total change in firm performance following a unit-sustained change in the financial innovations. More importantly, the tests of the speed of adjustment of financial innovation to financial innovation drivers, find that financial innovation adjusts faster to macro level drivers than firm level drivers.

CHAPTER NINE

CONCLUSION OF THE THESIS AND DIRECTIONS FOR FUTURE RESEARCH

9.0 Introduction

This study has reviewed financial innovations in the form of branchless banking models in Kenya and their link to firm financial performance. The scope of the study covers 42 out of the 43 commercial banks operating in Kenya and regulated by the Central Bank of Kenya. A detailed background of the study is provided in chapter one. The background sheds light on the Kenyan context in which the research was carried out with emphasis on the evolution of financial innovations in Kenya. The motivation for the study details five imperatives for carrying out the research, namely the importance of financial innovations, technological developments in recent times, the recent global financial crisis, financial innovations contribution to the national payment system and the unique Kenyan context.

The reviewed literature exposes the existing knowledge gaps in a number of areas. Firstly, the study observes deficiency of empirical studies on financial innovations such as branchless banking models. Secondly, previous studies largely lack a holistic approach to the study of financial innovations. This has led to fragmented studies that address individual or specific aspects of financial innovations. Lastly, very little is known about what drives financial innovations at firm and macro levels as well as the link between financial innovation usage and firm financial performance. This study fills the knowledge gaps by conducting a robust empirical analysis of four types of financial innovations in a single study using four econometric models. The theoretical framework upon which the study is grounded is reviewed, including the innovation adoption, diffusion and usage theories as well as the TOE and RBV frameworks largely used in strategic management literature. This study has extended the use of these frameworks to the study of financial innovations.

A detailed review of literature covers the empirical literature on financial innovations, empirical literature on firm performance and the Kenya's banking sector over the study period. The empirical studies on financial innovations and firm financial performance provide evidence of the link between the two. Nevertheless, most of the previous studies have concentrated on financial innovations in the form of financial products in developed countries. Although there are multiple meanings of 'firm performance' as well as diverse ways in which performance construct is operationalised in the literature, the focus of this study is on firm financial performance as measured by the industry adjusted ROE and ROA.

Three hypotheses have been tested and the research methodology outlined and a number of formal tests of specifications in the panel data have been carried out. A presentation of the empirical results of the regressions is presented starting with the basic tests and summary statistics and correlation matrices for all the variables used in the study. The empirical results provide strong evidence of the link between financial innovations and firm performance with respect to Kenyan commercial banks. In addition, the study provides strong empirical evidence of the drivers of financial innovations at both firm and macro levels. The identified financial innovation drivers at firm level include firm size, transaction costs, agency costs and technological infrastructure at firm level. Conversely, at macro level financial innovation in Kenya is mainly driven by regulation as well as incompleteness in financial markets.

To ensure robustness of the models and the results, a number of steps have been taken. Firstly, the study uses industry adjusted ROA and ROE which ensures that externalities arising from industry effects, beyond the control of the individual firms are mitigated. Secondly, to ensure the results are robust to alternative specification measures, the study uses two different firm financial performance measures as well as four different financial innovations. We find that the results are robust to the respective alternative specification measures. Thirdly, a host of control variables are included in the econometric models. In view of the dynamic nature of financial innovations, the study uses dynamic panel estimation technique with the help of Arellano-Bover/Blundell Bond System GMM. More importantly, the contribution of the study to the body of knowledge as well as the managerial and policy implications of the study are discussed. Lastly, a recommendation for future research is made in view of the limitations experienced in the study with respect to availability of data. These constraints curtailed the ability to carry out a cross-country comparative study.

9.1 Summary of Results and Presentation of Hypotheses

In view of the preceding discussions in this chapter summarising the results in the regression outputs, this section summarises the responses to the three main hypotheses of the study as follows:

Hypothesis One

H_0: The usage of financial innovations does not significantly explain the variation in firm financial performance in Kenya.

H_1: The usage of financial innovations significantly explains the variation in firm financial performance in Kenya.

The study results presented in table 8.7 provide evidence that mobile banking, ATMs and agency banking significantly explain the variation in firm financial performance in Kenya. Hence, we reject the null hypothesis in favour of the alternative hypothesis at all conventional levels of significance for mobile banking and five per cent level of significance for both ATMs and agency banking. In addition, we do not reject the null hypothesis with respect to internet banking.

Hypothesis Two

H_0: Firm (organisational) level context does not significantly drive financial Innovations at firm level in Kenya.

H_1: Firm (organisational) level context significantly drives financial Innovations at firm level in Kenya.

The study results presented in table 8.8 provide evidence that organisational or firm context represented by agency costs, transaction costs, firm constraints, firm size and technological developments at firm level significantly drives financial innovation at the firm level. The null hypothesis, therefore, is rejected in favour of the alternative hypothesis at one per cent level of significance for all the four financial innovations.

Hypothesis Three

H_0: The (environmental) Macro level context does not significantly explain the variation in Financial Innovations usage in Kenya.

H_1: The (environmental) Macro level context significantly explains the variation in Financial Innovations usage in Kenya.

The study results presented in table 8.9a provide evidence that the environmental context represented by globalisation, technological developments at the macro level, regulations and taxes and incompleteness in financial markets significantly drives financial innovations at firm level. Therefore, we reject the null hypothesis in favour of the alternative hypothesis at one per cent level of significance with respect to regulation and taxes and incompleteness in financial markets, globalisation and risk and the four financial

innovations. Secondly, we reject the null hypothesis at one per cent level of significance with respect to technological developments at macro level and mobile banking.

9.2 Contribution of the study

Although the subject of financial innovation has been widely studied, most of the studies have concentrated on financial products in developed countries. Consequently, emerging financial innovations widely used in developing countries in general and Kenya in particular have been largely ignored or where they have been studied, the emphasis has been on qualitative study. Secondly, most of the studies have focused on one of the financial innovations at a time, such as small business credit scoring (Akhavein et al., 2005, p. 593). Studies focusing on Kenya have largely followed the same approach. For example the history of M-Pesa mobile money in Kenya (Hughes & Lonie, 2007) and the study of agency banking in a number of countries, including Kenya (Siedek, 2008). The researcher is not aware of any other research that has studied the four branchless banking models in all the commercial banks in Kenya using a comparative quantitative approach.

There has been significant interest in the research community in establishing the relationship between innovation in general (and financial innovation in particular) and firm financial performance. However, Laforet (2013) contends that few studies have empirically examined innovation outcomes at firm level or the link between firm's innovation and firm performance. This study provides empirical evidence that firstly, ATMs, agency banking and mobile banking financial innovations significantly lead to firm financial performance at five percent level of significance for both ATMs and agency banking. In addition, mobile banking significantly affects firm performance at one per cent level of significance. Moreover, the results are economically significant in view of the size of the effect that the independent variables have on the dependent variable (firm performance). Most financial innovation studies cover financial products and processes with minimal empirical rigour. This study fills the gap in literature by providing empirical evidence with regard to the link between financial innovation and performance as well as the drivers of financial innovation at firm and macro levels. Lastly, the study uses the approach used in German-Soto and Flores (2015) to provide empirical evidence of the speed of adjustment of firm financial performance to financial innovations as well as the speed of adjustment of financial innovation to financial innovation drivers. The author has not come across any other financial innovation study that has tested the respective speeds of adjustment in Kenya or elsewhere.

According to Dubin (1978) study on theory development, there are three critical elements of a complete theory namely what, how and why. These three elements are encapsulated in Whetten (1989, p.491) study as "…What and How describe; only Why explains. What and how provide a framework for interpreting patterns, discrepancies, in our empirical observations. This is an important distinction because data whether qualitative or quantitative, characterise; theory supplies the explanation for the characteristics. Therefore, we must make sure that what is passing as good theory includes a plausible cogent explanation for why we should expect certain relationships in our data. Together these three elements provide the essential ingredients of a simple theory: description and explanation" (p. 491). The author contends that after a researcher has identified several factors, there is need to show how the factors are related. This according to the study involves the use of arrows and boxes, a step that provides an orderly conceptualisation by explicit delineation of patterns. Secondly, the delineated patterns introduce causality among the identified factors.

The study applies frameworks used in the strategic management literature such as the Technological-Organisational-Environmental (Tornatzky & Fleischer, 1990) and the Resource Based View (Barney, 1991) to explain the relationships between the variables used. These frameworks also form the theoretical framework upon which this study is grounded. Consequently, through the review of financial innovation literature and guided by these two frameworks, the financial innovation value model shown in figure 6.1, chapter six has been developed in this study. The conceptual model can be used to explain the relationship between financial innovation drivers at firm and macro level, financial innovation and the link between financial innovation and firm performance. The 'arrows' and 'boxes' delineate patterns and causal relationships used in the regression models. More importantly, the financial innovation value model is, therefore, a contribution of this study to the body of knowledge in the field of financial innovations.

The methodological approach used in this study is grounded on Technology-Organisation-Environment (TOE) framework (Tornatzky & Fleischer, 1990) and the subsequent extensions to the framework. Tornatzky and Fleischer argue that factors in the environmental and organisational context as well as the technology itself significantly affect technological innovation adoption decisions. The TOE framework encompasses a threefold context for adopting and implementing technological innovations; Technological, Organisational and environmental contexts (Y.-M. Wang et al., 2010).

Using the TOE framework, Zhu and Kraemer (2005, p. 66) develop *an integrated model of E-business use and value* to study post adoption variations in usage and value of E-business by organisations.

Although Zhu and Kraemer work represents a major step in the study of E-business innovations, the weaknesses[28] of the model are identified and corrected by Salwani et al. (2009). The authors integrate the TOE framework with E-commerce usage and link them to business performance. The study graphically demonstrates how TOE affects E-commerce usage and how E-commerce usage leads to business performance. Salwani et al. refer to their framework as *E-Value model* highlighting the value a business generates from the use of E-commerce. According to the model, the business performance arising from E-commerce usage is moderated by E-commerce experience.

Building on Tornatzky and Fleischer (1990) TOE model, Zhu and Kraemer (2005) 'integrated model of E-business use and value' and Salwani et al. (2009) 'E-Value model' this study develops 'Financial innovation value model' (see Fig. 6.1). Financial innovation value model shows the value a firm generates from the continued use of financial innovations. The value is in the form of increased financial performance represented by ROE and ROA. Based on the reviewed literature financial innovation is driven by factors at both firm and environmental (macro) levels. It is, therefore, plausible to study the drivers using the TOE framework. The financial innovation value model links financial innovation drivers at firm level to financial innovation and financial innovation is linked to firm financial performance. The model shows that financial innovation leads to firm financial performance but the extent of the financial performance is moderated by the speed with which financial performance adjusts to financial innovation usage. The development of financial innovation value model therefore represents key original extension of methodologies used in the study of financial innovations. Although the model has been contextualised to Kenya, it can be used in the study of different financial innovations in other countries, especially with regard to financial innovations which are technology driven.

[28] The details of the weaknesses of the Zhu and Kraemer (2005) model are extensively discussed in Salwani et. al., (2009, p. 172). This study focuses on the linkages in the two models as opposed to details of the study of E-business and E-commerce. The link between TOE, E-commerce usage and business performance encapsulated in the two studies provide valuable insights for the development of the *financial innovation value* model in this study. This is especially so since E-business, E-commerce and branchless banking financial innovation models are largely technology driven and technology dependent.

One of the major contributions of this study is on the methodological approach to the study of financial innovations. The study which appears close to this research is by Makini (2010), which studies the relationship between financial innovation and financial performance of commercial banks in Kenya.

The study, however, uses descriptive survey with questionnaires used to collect the survey data and descriptive statistics as the only results from the study. Whereas this is a positive effort, it is difficult to replicate the study in view of the subjective approach used in the study. Notably, in their detailed review of financial innovation literature, Frame and White (2004, p. 116) make critical findings with implications for future research "…a striking feature of this literature, however, is the relative dearth of empirical studies that specifically test hypotheses or otherwise provide a quantitative analysis of financial innovation...". In response to Frame and White finding, this study has conducted a detailed empirical analysis of the drivers of financial innovations at both firm and macro level. The same approach has been adopted in studying the link between financial innovations and firm financial performance. The analysis is not only quantitative but also uses system GMM with robustness approaches being incorporated in the regression models. To the best of the author's knowledge as guided by the reviewed literature, no other study has been carried out before, with the level of analytical rigour, in Kenya or elsewhere in the field of financial innovations.

Managerial and Policy Implications of the Study

This study has a number of managerial and policy implications. Firstly, the drivers of financial innovations at firm and macro level have been identified as well as the link between financial innovations and firm financial performance. Management efforts should be geared towards finding the drivers of financial innovations in their respective firms and in the development, adoption and usage of the financial innovations covered in this study. The financial innovation drivers at firm level include firm size, transaction costs, agency costs and technological infrastructure at firm level. On the other hand, at macro level, firms' financial innovation is mainly driven by regulation and taxes, incompleteness in financial markets and technological developments at national or macro level.

Management efforts at driving financial innovation should be consistent with the recent global trends. For example, a study of 246 CEOs from PwC's Global CEO panel, comprising multinational companies across all sectors, company sizes from developed and emerging economies, makes important findings (PWC, 2013). According to the study "...CEOs are now taking personal responsibility for directing and

inspiring innovation as it becomes an ever more vital element of business survival and success..." (p.3). The implication of the PWC research and this study is that the management should recognise that innovation in general and financial innovation in particular generates financial value and contributes to the success of the firm. Moreover, financial innovation is seen as encouraging banks to take on more risks, providing valuable credit as well as firms' risk diversification services (Beck et al., 2014).

This study has established the speed of adjustment of firm financial performance to financial innovations and the speed of adjustment of financial innovation to various financial innovation drivers. The management should ensure fast response to market intelligence to achieve the greatest impact with regard to innovation speed and new product performance (Carbonell & Rodríguez Escudero, 2010). It is critical that the management identifies an influential champion to promote the usage of the innovations since the champion is the only significant positive factor needed for faster innovation speed (Allocca & Kessler, 2006). Nevertheless, although an influential innovation champion is critical for innovation speed, such a champion can only succeed where the management is supportive of the innovation and rewards innovative activities. For instance, Carbonell and Rodríguez-Escudero (2009) study of 183 new product innovations confirms that top management support, clarity of goals and speed-based rewards are crucial in building conditions which hasten innovation speed, especially in an environment of high technological turbulence.

The present study provides empirical evidence that firm specific factors are more important drivers of both firm performance and firm's adoption and usage of financial innovations than industry and macroeconomic variables. Relying on the industry structure to drive firm performance or to drive the firm's financial innovation adoption and usage is to the disadvantage of the Kenya's banking firms. This is because firm-specific factors such as firm size and technological infrastructure at firm level significantly drive financial innovations compared to macro level drivers such as globalisation which does not. At policy level, government efforts should be concentrated at providing an appropriate regulatory framework that is supportive of financial innovations. However, Borrás and Edquist (2013) contend that on their own, policy instruments are not systemic unless joined into mixes which address the complex and habitual multi-dimensional nature of innovation. The authors argue that the design of innovation policy must entail clarifying the main objectives, converting them into direct objectives and, on this account, ascertaining problems that are not addressed by private firms. More importantly, the "...actions to strengthen regulation should not stifle the creativity and dynamism of financial markets…"

(IMF, 2007, p. 126). Lastly, the government of Kenya and other governments, especially in developing economies should promote linkages between mobile phone companies and commercial banks that encourages other companies to not only share infrastructure but also promote the diffusion of innovations across sectors.

9.1 Limitations of the Study and Suggestions for Future Research

The problem of getting comparable data for other countries has made it difficult to carry out a comparative cross country study. This is also explained by the fact that the financial innovations studied are relatively new and not widely used in other countries. Kenya was the pioneer in the adoption of some of the financial innovations such as mobile banking before other African countries, thus making comparison difficult. As the diffusion of innovations continues and the innovations are adopted in other countries, future studies could carry out such comparative studies. There is an emerging debate on whether the speed of financial innovation is preferable to the speed of imitation of financial innovations. In other words, should firms invest in financial innovation or wait for their peers to innovate and then imitate their innovations? The author contends that these issues present interesting avenues for future research. Beyond firm performance, future studies could focus on the link between financial innovations and inclusive finance. Such a study may be necessary in order to spur financial market development and economic growth. More studies could be carried to establish the link between financial innovations in the form of branchless banking models and financial inclusion. Lastly, future studies could review other drivers of financial innovations which are not covered in this study. These drivers include sophistication among customers, competition and changing global pattern of financial wealth. Since this study adopts a positivist research paradigm, these drivers of financial innovations were not included due to their qualitative nature.

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APPENDIX

Appendix one: Kenya commercial banks covered in the study

Tables 1: Commercial Banks in Kenya

	Bank Name	Size (Large/medium/small)
1.	Africa Banking Corporation Ltd	Small
2.	Bank of Africa Kenya Ltd	Medium
3.	Bank of Baroda (k) Ltd	Medium
4.	Bank of India	Medium
5.	Barclays Bank of Kenya Ltd	Large
6.	CFC Stanbic Bank Ltd	Large
7.	Chase Bank (K) Ltd	Medium
8.	Citibank N. A Kenya	Medium
9.	Commercial Bank of Africa Ltd	Medium
10.	Consolidated Bank of Kenya Ltd	Small
11.	Co-operative Bank of Kenya Ltd	Large
12.	Credit Bank Ltd	Small
13.	Diamond Trust Kenya Ltd	Medium
14.	Dubai Bank Kenya Ltd	Small
15.	Ecobank Kenya Ltd	Medium
16.	Equatorial Commercial Bank Ltd	Small
17.	Equity Bank Ltd	Large
18.	Fidelity Commercial Bank Ltd	Small
19.	Fina Bank Ltd	Small
20.	Giro Commercial Bank Ltd	Small

21.	Guardian Bank Ltd	Medium
22.	Habib Bank A.G Zurich	Small
23.	Habib Bank Ltd	Small
24.	Imperial Bank Ltd	Medium
25.	I & M Bank Ltd	Medium
26.	Kenya Commercial Bank Ltd	Large
27.	K-Rep Bank Ltd	Small
28.	Middle East Bank (K) Ltd	Small
29.	National Bank Of Kenya Ltd	Medium
30.	NIC Bank Ltd	Medium
31.	Oriental Commercial Bank Ltd	Small
32.	Paramount Universal Bank Ltd	Small
33.	Prime Bank Ltd	Medium
34.	Standard Chartered Bank Kenya Ltd	Large
35.	Trans- National Bank Ltd	Small
36.	Victoria Commercial Bank Ltd	Small
37.	Family bank Ltd	Medium
38.	Ecobank Ltd	Medium
39.	Gulf Africa Bank Ltd	Small
40.	Jamii Bora Bank Ltd	Small
41.	First Community Bank Ltd	Small
42.	UBA Kenya Bank Ltd	Small

Source: Central Bank of Kenya

Appendix two: Variables and their measurement

	Variable	Measurement	Expected sign	Sources
1	Technological developments at firm level	Infrastructure, human capital and knowledge which would make a firm technologically competent. Balance sheet figures for ICT infrastructure as proxy for infrastructure. Personnel salaries expenditure in the income statement as proxy for personnel.	+	Mata, Fuerst & Barney (1995:491); Bharadwaj (2000:172); Salwani *et* al., (2009:173)
2	Agency problems and information asymmetry	Expense ratio and Asset utilization ratio	-	Ang, Cole and Lin (2000:81)
3	Transaction costs	Net fees and commissions as proxy for banks transaction costs. E-money transfer commissions as proxy for transaction costs in Non Bank led models	-	Tufano (2003:14) Humphrey, Kim and Vale (2001:216)

4	Firm size (Fs)	Total Assets	+	Daley (1984:184), Lougee and Marquardt (2004:778), Shehata (1991:773), Gopalakrishnan (2000:146)
5	Firm constraints	Capital Adequacy Ratio (CAR),	+	Chava & Roberts (2008:2090 Dang (2011:17), Hottenrott and Peters (2012:1127)
6	Incompleteness in financial markets	Stock market development index	-	Demirgiic-Kunt and Levine (1996:293), Mahonye (2014)
7	Regulation and taxes	A dummy variable for the effect (s) of regulation is added with '1' indicating introduction of regulation (s) and '0' indicating no regulation in a given year	+ or -	Frame and White (2004:121), Calomiris (2009:65)
8	Globalization and Risks	The index of globalization incorporating political, economic and social dimensions for each country.	+ or -	Boyer (2000:294). Lutz (1998:154) Rousseu and Sylla (2003:373). Dreher (2006:1094) Keohane and Nye (2000:4).

9	Technological developments at Macro Level	International Telecomunications ICT Development Index (IDI)	+	Pennings & Harianto (1992:34) UNCTAD (2003:34)
10	Financial Innovation	Number of ATMs per bank. Number of deposit accounts per bank. Number of agents per bank Number of deposit accounts Number of E-money agents	+	DeYoung, Lang and Nolle (2007:1033) Hernando and Nieto (2007:1081) Kumar (2006:27) Mwando (2013:28) Siedek, 2008:2) Hannan and McDowell, (1984:329, 1987:157) Sinha and Chandrashekaran (1992:117) Saloner and Shepard (1992:481) Frame and White (2004:577) Olatokun and Igbinedion, (2009:374). Lyman *et al*. (2006:4).
11	Firm performance	Adjusted Return on Assets Adjusted Return on Equity	+	Ramanujam and Varadarajan (1989:540), Hall and st. John (1994:155), Griffin and Mahon (1997:11), Hitt, Hoskisson and Kim (1997:778), DeYoung and Rice (2004:39), McGuire,

				Sundgren and Schneeweis (1988:868), McKee, Rajan and Pride (1989:26), Woo, Willard and Daellenbach, (1992:439) and Preston and O'bannon, 1997:425)

Appendix three: ICT development index (idi)-weighting of indicators

ICT Development index-weighting of indicators				
ICT access	Ref. Value	%	Weight	
1. Fixed telephone lines per 100 inhabitants	60	20		**ICT development index**
2. Mobile cellular telephone subscriptions per 100 inhabitants	150	20		
3. International Internet bandwidth (bit/s) per Internet user	100000*	20		
4. Proportion of households with a computer	100	20		
5. Proportion of households with Internet access at home	100	20	**40**	
ICT use	Ref. Value	%	Weight	
6. Internet users per 100 inhabitants	100	33		
7. Fixed broadband Internet subscribers per 100 inhabitants	60	33		
8. Mobile broadband subscribers per 100 inhabitants	100	33	**40**	
ICT skills	Ref. Value	%	Weight	
9. Adult literacy rate	100	33		
10. Secondary gross enrolment ratio	100	33		
11. Tertiary gross enrolment ratio	100	33	**20**	
* This corresponds to a log value of 5, which was used in the normalization step.				
Source: International Telecommunications Union (2009, p.18				

Appendix four: List of Equations

Equation Number	Equation
1.1	$CAGR = \left(\frac{Ending\ Value}{Beginning\ value}\right)^{\left[\frac{1}{number\ of\ years}\right]} - 1$
3.1	$CAR = \frac{Tier\ one\ capital + Tier\ two\ capital}{Risk\ Weighted\ Assets}$
4.1	$\text{ROI} = \frac{\text{Gain from Investment} - \text{Cost of Investment}}{Cost\ of\ Investment}$
4.2	$EVA = (Return\ on\ capital - cost\ of\ capital) total\ capital$
5.1	$Efficiency\ Score = \frac{Total\ number\ of\ deposit\ accounts}{Total\ number\ of\ Staff}$
6.1	$Industry\ adjusted\ ROE = \frac{(Firm\ ROE - Averange\ industry\ ROE)}{Standard\ deviation\ of\ the\ industry\ ROE}$
6.2	$Industry\ adjusted\ ROA = \frac{(Firm\ ROA - Averange\ industry\ ROA)}{Standard\ deviation\ of\ the\ industry\ ROA}$
6.3	$ROE = ROA * Leverage$
6.4	$ROE = \frac{Earnings}{Sales}\ x\ \frac{Sales}{Assets}\ x\ \frac{Assets}{Equity}$
6.5 (a)	$Expense\ ratio\ (ER) = \frac{Operating\ Expenses}{Annual\ Sales}$
6.5 (b)	$Asset\ utilisation\ ratio\ (AUR) = \frac{Annual\ Sales}{Total\ Assets}$

6.6	$\text{CAR} = \dfrac{\text{Tier one capital + Tier two capital}}{Risk\ weighted\ Assets}$
7.1	$Y_{i,t} = \alpha_i + \beta_0 X_{i,t} + \ldots \beta_k X_{i,t-k} + \theta Z_{i,t} + \mu_{i,t}$
7.2	$Y_{i,t} = \alpha_i (1-\lambda) + \lambda Y_{i.t-1} + \beta_0 X_{i,t} + \theta Z_{i,t} + \mu_{1,t}$
7.3	$Y_{i,t} = \alpha_i + \beta_0 X_{i,t} + \ldots \beta_k X_{i,t-k} + \theta Z_{i,t} + \mu_{i,t}$
7.4	$Y_{i,t} = \alpha_i (1-\lambda) + \lambda Y_{i.t-1} + \beta_0 X_{i,t} + \theta Z_{i,t} + \mu_{i,t}$
7.5	$Y_{i,t} = \alpha_i + \beta_0 X_{i,t} + \ldots \beta_k X_{i,t-k} + \theta Z_{i,t} + \mu_{i,t}$
7.6	$Y_{i,t} = \alpha_i (1-\lambda) + \lambda Y_{i.t-1} + \beta_0 X_{i,t} + \theta Z_{i,t} + \mu_{i,t}$
7.7	$Y_{i,t} = \alpha_i + \beta_0 X_{i,t} + \ldots \beta_k X_{i,t-k} + \theta Z_{i,t} + \mu_{i,t}$
7.8	$Y_{i,t} = \alpha_i (1-\lambda) + \lambda Y_{i.t-1} + \beta_0 X_{i,t} + \theta Z_{i,t} + \mu_{i,t}$
7.9 (a)	$Mean\ lag = \dfrac{\lambda}{1-\lambda}$
7.9 (b)	$median\ lag = -\dfrac{log\ 2}{log\ \lambda}$

Appendix five: Breusch-pagan test

a) ATM Banking

	FE	RE	OLS
	atmindatm	atmindatm	atmindatm
latmindatm	0.758***	0.832***	0.837***
	0.0163)	-0.00883	-0.00808
er	0.918	-0.00000433	-0.00000583
	(0.0000116)	-0.0000107	-0.0000107
car	0.631	0.0000138	0.0000134
	(0.0000660)	-0.000049	-0.0000468
tdfta	-0.0926	0.083	0.0907*
	-0.1	-0.0552	-0.0516
nfcti	0.000183	0.000228*	0.000218*
	(0.0000180)	-0.000119	-0.000112
lnta	0.0000807	0.00317***	0.00298***
	(0.00173)	-0.000822	-0.000772
indadjroe	0.135	0.0000349	0.0000311
	000176)	-0.000146	-0.000142
_cons	-0.0131	-0.0757***	-0.0715***
	(0.0431)	-0.0199	-0.0187
N	358	358	358
adj. R-sq	0.865		0.978
Breusch-pagan test			3288.72***
Standard errors in parentheses * p<0.10, ** p< 0.05, *** p<0.01			

b) Internet Banking

	FE	RE	OLS
	depacindde~c	depacindde~c	depacindde~c
lagdepacin~c	0.580***	0.974***	0.974***
	-0.0632	-0.0206	-0.0206
gi	-0.0013	-0.00081	-0.000806
	-0.00154	-0.00161	-0.00161
idi	0.00249	-0.00611	-0.00611
	-0.00607	-0.00384	-0.00384
rt	0.00477	0.00511	0.00511
	-0.00379	-0.00393	-0.00393
smindex	-0.00260*	-0.002	-0.002
	-0.00152	-0.00155	-0.00155
indadjroe	-6.1E-05	-0.00013	-0.000127
	-0.00028	-0.00021	-0.000205
lnta	-0.00103	0.00279**	0.00279**
	-0.00643	-0.00124	-0.00124
ownership	0	0.00288	0.00288
	(.)	-0.00276	-0.00276
_cons	0.0873	-0.0169	-0.0169
	-0.158	-0.0797	-0.0797
N	284	284	284
adj. R-sq	0.186		0.909
Breusch-pagan test			1111.93***
Standard errors in parentheses		** p<0.10, ** p<0.05, *** p<0.1*	

c) Mobile banking

	FE	RE	OLS
	lnmbtn	lnmbtn	lnmbtn
lmbtn	0.588***	0.719***	0.719***
	(0.0457)	(0.03)	(0.03)
aur	0.00158	0.0788	0.0788
	(0.18)	(0.0994)	(0.0994)
car	0.0243	0.0125	0.0125
	(0.0272)	(0.0178)	(0.0178)
tdfta	-26.61	-12.96	-12.96
	(40.47)	(20.04)	(20.04)
nfcti	-0.0121	-0.0202	-0.0202
	(0.0717)	(0.0404)	(0.0404)
lnta	3.419***	0.293	0.293
	(1.006)	(0.292)	(0.292)
indadjroe	0.081	0.0115	0.0115
	(0.0704)	(0.0535)	(0.0535)
_cons	-70.53***	-0.427	-0.427
	(24.04)	(7.154)	(7.154)
N	358	358	358
adj. R-sq	0.66		0.691
Breusch-pagan test			367.66***
*Standard errors in parentheses * p<0.10, ** p< 0.05, *** p<0.01*			