

EFFECT OF MOBILE MONEY TRANSACTIONS ON INFLATION IN KENYA

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ABSTRACT

Sensitivity of the economy is a great concern for the government, policy makers, firms, individuals, financial markets, exporters and even importers. Therefore the primary aim of this research was to establish the link of inflation, mobile money transactions and amount of total value of mobile deposits. The study adopted an analytical research design to enable the researcher to analyze the impact of mobile transactions and value of monthly deposits on inflation individually. The study collected data from March 2007 to May 2016 when that mobile money was first introduced to enable the researcher to clearly establish any effect the mobile transactions have had in long term since their inception. The data collected was first assessed for suitability for the study and once ascertained graphs were drawn to show the graphical relationship between the variables. The data was further checked for linear relationship and the relationship was proved insignificant due to violation of CLM assumptions by the residuals in the model. Hence the researcher undertook autoregressive distributed lagged regression to assess the effect of total mobile transactions and total value of mobile transactions on inflation. Findings from the study indicated that both monthly mobile transactions and total value of monthly deposits have a lagged effect on inflation of up to one month. The study established that inflation has a lagged effect on itself up to four months and the lagged effect is highly significant. The study observed that the lagged effect of inflation on itself was more significant and influenced inflation in future more than the effect of mobile transaction had on inflation in future. The study therefore recommended that government policy should be aimed at targeting inflation triggers in the economy so as to better manage inflation and adopt the use of lagged effect of inflation on itself to estimate future inflation and curb inflation in Kenya. The study recommended that government take into consideration the effect of mobile transactions on inflation and on other macro variables in the economy.

Keywords: Total monthly transactions, total value of monthly deposits, mobile payments, Central Bank of Kenya.

DECLARATION

I declare that this dissertation is my original work and has not been previously published or submitted elsewhere for award of a degree. I also declare that this contains no material written or published by other people except where due reference is made and author duly acknowledged.

Kennedy Kimathi

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Sign.....

Date.....

SUPERVISOR

I do hereby confirm that I have examined the master's proposal of Kennedy Kimathi

Sign.....

Date.....

Dissertation Supervisor

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DEDICATION

I dedicate this research to my grandparents Mr. and Mrs. Julius Kaithuru for their encouragement and prayers.

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ABBREVIATIONS

CCK Communication Commission of Kenya

CBK Central Bank of Kenya

KBS Kenya Bureau of Statistics

GDP Gross Domestic Product

ATM Automatic Teller Machine

ICT Information Communication and Technology

DEFINITION OF TERMS

Interest rate	Refers to the commercial banks weighted average lending rate. This is the average rate at which commercial banks charge on new loans to customers denominated in local currency.
Inflation Rate	It is the weighted aggregate change in retail prices paid by customers for a given basket of goods and services for a specified period
Mobile money	Refers to all money deposited on mobile platform.

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

Inflation is the gradual and continued increase in price level of goods and services in the economy in a certain period of time. Price level increase causes each unit of currency to purchase smaller amount goods and lower quality services (Muthike & Sakwa, 2010). This causes the population to have a reduced amount of money to spend on the day to day operations (Grey, 2002). Therefore, inflation causes a lower purchasing power in the economy as the number of people able to spend money to satisfy their needs is reduced (Shoaib, 2005).

Kwon & Shin (2009) suggest that economists distinguish between two types of inflation based on the cause of price change into two categories namely: demand-Pull Inflation and cost-Push Inflation. These two types of inflation form the foundation for increase in the overall price level within an economy which can in affect the economy as a whole. Demand-pull inflation arises due to comprehensive demand for goods and services faster than the needs for these goods and services can be provided to the market (Aker & Jenny, 2008). A potential cause of this aggregate demand might come from a Central bank that quickly enhances the supply of money. The increase of funds in the market will increase demand for goods and services in the short run, businesses cannot greatly increase production and supply remains rigid (Garner& Alan, 2004).

Inflation is calculated by the consumer price index. The consumer price index (CPI) weighs changes in the price level of a market basket of consumer goods and services purchased by households (Ndungu, 2014). The CPI is a statistical estimate calculated using the prices of a sample of representative items whose prices are collected periodically. It is one of several price indices calculated by most national statistical agencies. The monthly percentage change in a CPI is used as a compute of inflation. A CPI can be used to index and

adjust for the effect of inflation to the real value of wages, salaries, pensions, regulating prices and for deflating monetary magnitudes to show changes in real values (Ginger, 2013).

Although there may be some economists who would argue that in the long run inflation does not matter, nonetheless, in reality, inflation is a serious concern for common people (Ouko, 2013). Shiller (1996) found that there was a stark difference between how common people and economists perceive inflation. Shiller (2006) found that among non-economists, the largest concern with inflation appears to be that it lowers people's standard of living. Another study by Easterly and Fischer (2001) confirmed that inflation concerns the poor more than the rich.

Coban (2013) argues that there are two ways to examine the effects of inflation on the relocation of income and wealth in the world. First, on the foundation of the change in the real value of such factor incomes as wages, salaries, rents, interest, dividends and profits. Secondly, on the basis of the size distribution of income over time as a result of inflation, whether the incomes of the wealthy have increased and that of the middle and poor classes have fallen with inflation. Inflation brings about change in the distribution of real income from those whose money incomes are relatively inflexible to those whose money incomes change over time due to market forces (Coban, 2013).

Inflation being a serious part of economic and clearly seen as a necessary sin can however become uncontrollable and become hazardous to the economy. Inflation can be caused by various economic factors such as money supply, interest rates, lending, employment, political upheavals, markets stability and even innovations and technology that are developed (Tracy, 2011).

Innovation can be described to be the process by which firms or individuals develop new products, ideas, methods, services, new production processes and technologies to better perform their operations and services (Tufano, 2002 and Lawrence 2010). In the financial

services industry, innovation is viewed as the act of creating and popularizing new financial instruments, technologies, institutions and markets, which facilitate access to information, trading and means of payment (Solans, 2003). Lerner (2002) puts forward that innovations are not just critical for firms in the financial services industry, but also influence other companies; for instance, enabling them to raise capital in larger amounts and at a lower cost than they could otherwise and that innovation is an important phenomenon in any sector of a modern economy.

Financial innovations crop up due to several factors for the growth of modern financial innovation as: reduction in costs, tax advantages, reduction in moral hazard, reduced regulatory costs, transparency, growth and customization. A highly turbulent atmosphere leads to successful innovation creating a unique competitive position and competitive advantage and lead to a superior performance in the market by providing better quality and product growth (Roberts and Amit, 2010). This can only be maintained by ceaseless innovation and improvement of the product and the process that a firm and individuals use in the delivery of their products to keep and win new markets (Porter, 2004).

In Kenya, the advent on mobile phone technology has clearly been well received and adopted widely in both rural and urban. With this adoption people in urban area have been able to transfer money to family and friends in rural areas and even different towns (Robinson, 2010). This has enabled liquidity to grow in the economy and money velocity has also increased. This has further been compounded by the entry into the money transfer sector by banks which are the back bone of the economy (Heikkinen & Korhonen 2006; Hamilton, Nigel & Adrian, 2007).

Payment solutions are key aspects of any financial or economic system, transactions with clients of businesses paying for goods and services at every point of purchase have to be done in order for the transaction to be complete. Thus, any solution relating to payment and

the handling of cash comes in handy for individual consumers and small businesses, retailers and wholesalers in the market place. M-Pesa is one of the payment solutions in the Kenyan market with many financial and communication companies wishing to include electronic payment solution to be part of their portfolio as a key aspect of their business model. The increase of these transactions in the economy can affect the economy and give rise to inflation in Kenya (Jack & Suri, 2011).

1.1.1 Mobile payment evolution and growth in Kenya

In Kenya, mobile money uptake has been very high, with the adoption of mobile payment, sending money and transfer of funds from one person to another. The mobile subscription registered 11.9% growth between April to May 2008 compared to 5.3% recorded in the same period 2007 as shown on table 1.1 below. The growth of subscribers was further enhanced by the roll out of mobile services by the two operators who entered the market during this period.

Table1.1: Mobile telephony subscription (Cumulative)

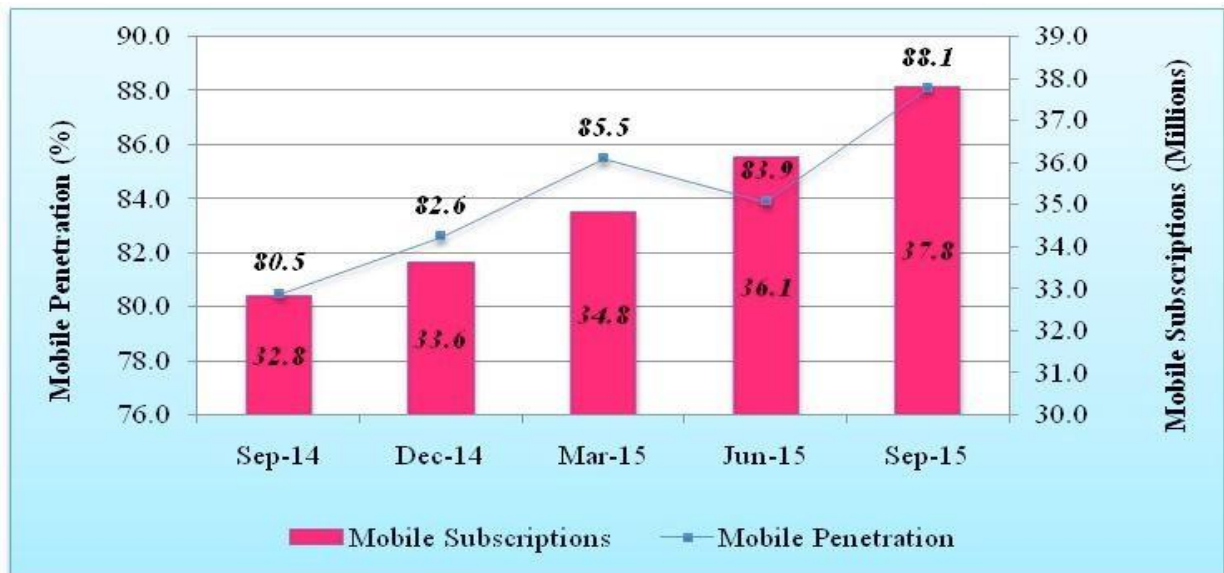
Indicator	Sept -07	Dec-07	Change	Sept-08	Dec-08	Change%
Number of subscribers	10,777,102	11,349,412	5.3%	14,503,964	16,233,833	11.9%
Mobile penetration (%)	28.97%	30.51%	5.3%	41.7%	43.64%	4.6%

Source: CCK Database (2008)

The mobile market in the country has maintained an upward trend with the quarter under review recording an increase of 4.7 percent in the number of mobile subscriptions to stand at 37.8 million up from 36.1 million subscriptions posted last quarter. Subsequently, mobile penetration grew from 83.9 percent recorded last quarter to 88.1 percent during the period under review.

FIGURE1.1 below illustrates the trends in mobile subscriptions and mobile penetration levels.

FIGURE1.1: Mobile Subscriptions and penetration



Source: CA, Operators Returns, Population figure used to compute for penetration is 43.0 million as per the Economic Survey 2015

Competition among service providers in the telecommunication industry has made it more open and lowering of prices has attracted more clients who find it more cost effective compared to other market prices in the money transfer market (Donner& Escobari, 2010).

Current mobile connectivity has become key in enabling the unbanked population to access banking services such as loans, savings and money transfer to and from banks. The banking sector has enhanced their services to include mobile payment solutions as part of their products. With 32.8 million users of mobile phone, access to the financial sector can be easily achieved and hence the growth in this sector due to convenience and security that has been enhanced to the user (Phillip, 2016).

Key to mobile money transfer and payment solution acceptance and all success in the industry is the wide use and access to mobile phone to all in the country. There has been

exponential growth in the industry since its inception and from a paltry 28% mobile penetration in Kenya in September 2007 to 88% mobile phone penetration in December 2015(CCK, 2011). This represents a wide growth and very elevated coverage rate in the country thus reflects on accessibility and acceptance of mobile phone use in Kenya (CCK, 2011).

This study hopes to merge the mobile money solutions and their effect on inflation that have been greatly accepted in Kenya. Since 2007 after the introduction of M-Pesa in Kenya and the continuous growth of industry mobile telecommunication companies have launched and develop many products ranging from money transfer, savings, deposits, payment for goods, services payments, loan facilities and payment options. Further innovation in the industry have been done and clients are able to use solution such as M-shwari, Lipa na M-Pesa, M-Kesho, Mcoopcash, Pesa pap all this convenient options make it easy and affordable to access and use mobile phone payment and analyze the possible effect of these innovations on inflation in Kenya (Jack, Suri & Townsend, 2015).

1.2 Statement of the Problem

Mutwiri (2010) suggested that mobile phone innovations such as M-Pesa, M-shwari, M-kesho, M-kopa and Airtel money have become popular and greatly accepted and embraced by the banked and the unbanked population: serving as a deposit account for the unbanked and the banked as well. Mutwiri (2010) further comments that, the service enables subscribers to use their mobile phones to carry out transactions such as: pay for goods, pay bills, send, receive money from friends, withdraw cash, top up airtime account or top up another account and control personal finances. Since the inception of M-Pesa many other money transfer companies have entered into the fray and this has been a key factor in money transfer and payment options in the country (CCK, 2015).

Muthike and Sakwa (2010) argue the technology adoption and its application in the economy can be a cause of development and growth in the economy. The rolling out of these technologies and their application can however cause unforeseen market forces and economic stagnation. Mobile phone solutions are technology innovations that have developed in past ten years due to the convenience and availability of mobile transfer options to the public. Mobile phones have evolved from the basic telecommunication gadgets to be more useful and help solve day to day problems. Far from the basic sending of text messages, multimedia messages and calling they have provided a platform for new and more innovative ways to transact and offer financial solutions. These financial solutions if unchecked can cause mass panic in the economy and make it difficult to curb such issues as money laundering and inflation (Berry et al, 2009).

Mwangi (2012) suggested that Mobile phones are easily and even more affordable currently than ever before making them the best option for both businesses and clients who are transacting to operate on. Suri (2005) found that the innovative use of this new technology has improved financial services in Kenya. Other notable academic research cited in the brief supports and amplifies their findings. The use of mobile payment technology needs rudimentary knowledge and information to operate. As a result, business operators in Kenya have adopted its use in their daily business operations and are registered users of M-Pesa (CCK, 2012). Consequently, individuals and businesses carry out various payments using their mobile phones for paying suppliers, paying bills, sending money, withdrawing cash and topping up talk time accounts (Haran, 2010). Mobile payment solutions enable one to know their balances and easily manage their accounts. The banked and the unbanked can also maintain account balances in their mobile phones which are perceived as deposits (Njenga, 2009).

Increased mobile phone innovation being accepted have not only enabled more people to access banking services through the short code services provided by the banks but also telecommunication companies have set up loan facilities and even deposit taking accounts such as M-shwari and M-kesho (Kigume, 2011).

However, there is no existing study that analyzes the influence of using these mobile money transactions on inflation in Kenya. This study hopes to establish the link between the progressive use of mobile money such as deposit and savings, payment option, money transfer and other conveniences brought about by adoption of mobile based money solution and the effect they have had on inflation in Kenya since March 2007.

1.3 Research Objectives

1.3.1 General objective

The overall objective of the study was to analyze the distributed effect of mobile money transactions on inflation in Kenya.

1.3.2 Specific objectives

The specific objectives of the study were;

1. To analyze the effect of the amount of mobile deposits on inflation in Kenya.
2. To analyze the effect of the number of mobile money transactions on inflation in Kenya.

1.4 Research questions

In the view of the above stated objectives;

1. What is the effect of the amount of mobile deposits on inflation in Kenya?
2. What is the effect of the number of mobile transactions on inflation in Kenya?

1.5 Significance of the study

The study was intended to analyze the effect of mobile money transactions on inflation over the past eight years in Kenya. Since the inception of mobile money transfer in March 2007 they have taken a key role in the transfer and payment system in the economy. The study findings can help government and central bank in guiding the policy and management of inflation in Kenya. Inflation is a key economic factor and the government has keen interest as the regulator. Hence the study can also give a clear picture of the relationship between mobile money transaction and inflation.

1.6 Scope of the Study

The study is limited to the national impact of number of mobile transactions and total value of deposits on inflation. Secondary data was used as the sources of mobile transaction data which is gathered by the service providers to the government and regulators. Further, data was collected from the Central Bank of Kenya.

1.7 Limitations of the study

Time and resources were the major constrain which restricted the study; this limited the sample as the researcher only focused on inflation arising from mobile money transactions use of payment, savings, deposits and payment solutions which have been established in the past years. There was also a limitation on the sources of data collected whereby the researcher only used secondary data due to the difficulty of obtaining primary information on number of customers using the mobile payment thus data was sourced from the Central Bank of Kenya.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter reviews literature on mobile payment platforms and inflation. It discusses the key theories underlying mobile payment innovations, develops a conceptual framework and expounds on the research gaps of bank innovations and financial performance.

2.1 Theoretical Review

2.1.1 Keynesian Theory

Maynard (1930) proposes that Keynesian economic theory says that changes in money supply do not openly affect prices, and that evident inflation is the consequence of pressure in the economy expressing themselves in prices.

Demand-pull theory states that inflation rate accelerates due to aggregate demand increased above the potential of the economy to produce and meet the needs of the market. Thus, any factor that increases aggregate demand can cause inflation. O'Sullivan and Sheffrin (2003) suggested that eventually, aggregate demand may be lower than productive capacity resulting from increasing the quantity of currency in circulation faster than the real growth rate of the economy. Gordon (1988) offers that demand inflation is advantageous to a rapid economic enlargement in view of the fact that the excess demand and favorable market conditions will stimulate investment and expansion.

Increase in access to financial services in Kenya has been growing since its inception. Expansion in the financial market has greatly been impacted by financial penetration as 80 percent of the population has access to financial services through the mobile handsets. Mutwiri (2010) suggests that mobile penetration has enabled access to both mobile transfer services and credit services. Further, financial integration of people who would not access

financial services due to distance from financial institutions such as banks has been remedied by the large number of mobile service agents.

Blanchard and Galí (2007) put asserts that some level of inflation possibly will be painstakingly desirable in order to restrain joblessness. Modern macroeconomics describes inflation using a Phillips curve that shifts because of such matters as supply shocks and inflation becoming built into the normal workings of the economy. Blanchard and Galí (2007) suggest that the Phillips curve shows only the demand-pull component of the triangle model. Coe (1984) addresses another concept called the potential output, which is a level of GDP, where the economy is at maximum level of production. Where the GDP over shoots potential, the theory suggests that inflation will accelerate as suppliers raise their prices and built-in inflation rises.

Aggregate demand can be directly affected by money circulation in the economy, when demand for goods and services in the economy increases so does the inflation rate (Maynard, 1930). Research by Titus (2003) has demonstrated that money velocity coupled with innovations in the economy can be counterproductive due to increased access to money through high lending with little leveraging on debt. Mobile access to finances through credit and transfer of funds can trigger money circulation in the economy and thus enhance demand in market.

Mobile money growth in Kenya has enhanced the aggregate demand due to increased cash flow to the economy. Mobile money transfer, loans, credit, payments solutions and enhanced access to finances can be a trigger to inflation in the economy. With mobile transactions growth enhancing access to finances, government and economist are keen to understand the relationship between mobile money transactions in Kenya and inflation.

2.1.2 Monetarist Theory

Monetarists presume velocity of money is unaffected by monetary policy, the real value of output is unyielding in the long run by the productive power of the economy. Mankiw (2002) recommended that under this assumption, the primary cause of the change in general price level is changes in money supply. With growth velocity, the money supply determines the value of nominal output.

Paul (2000) argues, the most significant factor affecting inflation is how rapid money supply increases or shrinks. Consider fiscal policy, government spending and taxation, as fruitless in controlling inflation. Monetarists assert that history shows that inflation has always been a monetary trend. The quantity theory of money, simply stated, that any change for money in a system will change the price level. Paul (2000) reckons that increased access to financial sector in the economy enhances the ability of credit in the economy and this can spur growth and integration. Money velocity caused by the mobile technology has further been seen to increase money velocity and enhanced credit and financial integration in Kenya. It is notable that over 30 million Kenyans have access to mobile phones and banking services which access money in circulation.

In Kenya, money velocity has been increased as a result of mobile money transactions. This increased money exchange and ease of access of finances can affect inflation and the economic growth. There is a critical need to understand the relationship between money velocity and inflation in Kenya.

Monetarist economists could easily relate the effect of mobile phone technology and the effect this has on inflation due to increase in money velocity due to high transfer, payment options and savings which are readily available. Mobile money transfer gives the economy high liquidity and thus can affect inflation.

Money velocity and interest rate in Kenya have an impact on the inflation rate in the economy. With growth in the economy rising from the increase in money velocity can cause a change in inflation rate and if uncontrolled will cause a spike in inflation. Technology is being used in the economic activities in Kenya and roping in a large population which were not before able to access financing and banking services (Moses, 2000).

2.1.3 Innovation Diffusion Theory

According to Dillon and Morris (1996): Rogers (1983 & 2003), the factors which influence the diffusion of an innovation include; relative advantage (the extent to which a technology offers improvements over currently available tools), compatibility (its consistency with social practices and norms among its users), complexity (its ease of use or learning), trial ability (the opportunity to try an innovation before committing to use it), observability (the extent to which the technology's outputs and its gains are clear to see). These elements are not mutually exclusive thus unable to predict either the extent or the rate of innovation diffusion (Ngumi, 2013).

Mobile technology has since its onset onto the financial market and its use in money transfer, savings and credit been accepted in Kenya and taken up to be utilized in all sectors of the economy. Access to financial sector in the economy is closely linked to inflation even as access to finance is seen to enhance economic growth (Mwangangi, 2012).

Moore and Benbasat (1991) built on the work of Roger (1983), amongst others Tornatsky and Klein (1982) and Brancheau and Wetherbe (1990) argue that: relative advantage, compatibility, and trial ability are key and critical for any technology to be adopted and established in the market. It is worth noting that both relative advantage and ease of use are skewed characteristics since they can be perceived differently depending on an individual's perceptions. In Kenya mobile technology has been easy to access and has been understood by the majority of population. Ease of access to this mobile phone, compatibility

and trial ability has attracted more and more Kenyans to use mobile phones to save, store and transact using mobile money.

Fishbein and Ajzen (1980) concur, attitudes towards an object and attitudes regarding a particular behavior relating to that object can frequently differ. Moore and Benbasat (1991) also derived three further characteristics. While Rogers (1983) included image as an internal component of relative advantage, Moore and Benbasat (1991) found it to be an independent predictor of adoption.

Mobile money innovations in Kenya have grown and various telecommunication companies in Kenya have been setting up highly innovative mobile money products. M-pesa, Mkesho, Airtel money, Orange money are all products that have been established and largely adopted. These innovations have created a new avenue to send money, pay for goods, utility payments and savings of money creating a significant money flow channel in the economy.

2.2 Empirical Review

2.2.1 Mobile phone deposits and savings

Mobile deposits and saving in the mobile money industry have been growing in Kenya since the Launch of M-pesa in March 2007. In January 2010 there was a total deposit of 25.27 billion for M-pesa alone and a savings of over 4 billion Kenya shillings (Safaricom, 2010). Further, growth of monthly deposits has been increasing since the setting up of M-pesa. At the end of January 2011, the total deposits for the month was 45.2 billion Kenya shillings this representing a growth of over 90 percent over the same period the previous year. These deposits and savings represent a significant money supply that can in the long run influence inflation in Kenya (Safaricom, 2011).

Market confidence had been seen to drive further the demand to access this industry and the general acceptance in the market by end users. Small businesses and major national

and multinational organizations have been at the fore front of access to the mobile payment solutions as they continue to accept mobile payments for services and goods that they offer to the market. This continuous access and liquidity had a great impact on inflation rate and financial liquidity in the market (Howard, Philip & Mazaheri, 2009).

Suri (2011) describes Mpesa as an innovation that obviously dominates all other transfer modes that were in the market before its inception. Users say it is faster, cheaper, more reliable, and safer, and a very large majority report that they would suffer significant negative consequences if it were to be shut down (Jack & Suri, 2011).

However, the clear-cut source of these benefits, the specific economic impacts of M-Pesa and Airtel are not easy to calculate. M-Pesa enhances the safe storage and transfer of money. It has provided an easier way for people to pay for goods and services, electricity bills, for instance, can be paid with a push of a few buttons instead of traveling to a distant office and waiting in a long line with a fistful of cash (Jack & Suri, 2011).

As of January 2016 the mobile phone platform in Kenya has had mobile deposits totaling to above 125 billion which have a high influence in the market liquidity and can affect inflation in Kenya (CBK, 2016). This high level of deposits coupled with the savings on mobile phone platform make it important for the industry supervisors to take an interest on the impact of mobile phone solution and the effect on inflation in Kenya (CCK, 2016).

According to Van Hove (2001) which also Mallat (2007) argues that consumer decision to adopt a payment system is significantly affected by the amount of other consumer's traders using it. Failure to create a significant mass has contributed to stoppage of several previous payment systems (Szmigin and Bourne, 1999). Therefore a critical accomplishment factor for the M-Pesa mobile payment source to reach a wide base. The coverage area of the M-Pesa mobile payments is spread throughout the country with over six million registered subscribers. The growth of mobile money in Kenya has

been a key component to economic empowerment in the Kenyan populace and has enhanced money supply in the economy. Inflation can be influenced by money access in the economy and this access to finances and help to spur inflation in the long run (Barry, 2013).

In Kenya, accessibility of mobile money and other mobile payment solutions and options to the population has been the key dynamic force of the economic acceptance and inclusion in the economic activities. Accessibility and availability of agents throughout the country, where agents are more wide spread in the markets as compared to banks in Kenya leads to a high confidence in the mobile money service. It is offering competitive pricing system instituted by the service providers being at the helm of the operation such as Safaricom, Airtel, Orange and Equitel who give support to the local agents who are at the tip of the operation (Mwangangi, 2012).

A number of qualitative studies such as Morawczynski and Pickens (2009) and Mas and Morawczynski (2009) explored the economic and social impacts of M-Pesa in Kenya. Morawczynski et al (2009) found proof that M-Pesa has changed the savings behavior, remittances and has increased rural livelihoods. These studies provide indicative support of the impacts of M-Pesa, generally unable to quantify the effects of the system and are limited by their small sample sizes. The inflation rate in Kenya can be influenced by these small consistent and numerous transfers that occur on a daily basis within the population (Mwangi, 2015).

On the other hand micro and macro level evidence suggested that mobile phones can improve consumer and producer welfare in developing countries (Klonner & Nolen 2009). The result of mobile phones on changes in GDP and growth, especially Africa, is still relatively unknown. Roller and Waverman (2001) assessed the impact of mobile infrastructure on economic development and found that a 10 percent increase in the mobile penetration rate increased economic growth by 1.5 percent. This can be a significant impact on the economic

growth and thus this use of mobile money can lead to inflation in the economy as currency circulation, transfer of funds, credit of loans and payments of goods and services has been highly accepted and is seen as a more acceptable and convenient form of payment in the country (Musicho, 2011).

Waverman, Meshi and Fuss (2006) conducted similar analysis in developing countries; discovery that 10 percent swell in mobile technology levels was associated with a 0.6 percent increase in growth rates. While these studies grant some evidence of the positive relationship connecting mobile phones and economic growth, it is greatly important for the relationship between the uses of mobile phone technology and inflation especially with the growth of mobile money and payment systems in Kenya (Diana, 2016).

Money transfer users need to access this fund at convenient locations and within all areas they operate. Thus the need for the agents to be widely distributed all over the country to enable customers to reach them and conduct transactions every time they need to transact. Over the last quarter of 2015 the number of money transfer subscription grew by 3 per cent to stand at 28.7 million during the quarter up from the 27.7 million number of clients posted the previous year (CCK, 2015.) The acceptance of this form of payment, due to conveniences has had a boost and had a big impact of inflation in Kenya and can increase the money velocity as each and every transfer in the economy can inflate inflation (Moni, 2012).

While convention or earlier money transfer mechanisms used to be quite cumbersome and expensive M-Pesa has changed the pricing structure and thus enhanced competition in the money transfer sector. To deposit money a user only has to be registered with M-Pesa using the procedure outlined early at an agent location and only requires identification documents. Recipients of money need not be registered on M-Pesa however registration gives one cheaper rates at the point of withdrawal. This is because there is a higher charge for sender and

receiver who are not registered, while registration is free which encourages all to be registered (Njoroge, 20012).

Further due to the widespread network of agents in the country standing at over 135,000, convenience is a principal factor and the clients are never too far away from an agent at whatever time in the process of depositing and or withdrawing money (CCK, 2015). The transaction costs of sending money through the mobile payment technology are lower than those of banks and money transfer companies (Omwansa, 2009).

Transaction expenses are small making the total cost of the transaction affordable and attractive to the clients in the market. The cost of the mobile payments must be inexpensive to most of the businesses and far below what banks charge for their bank transactions. There are many different mobile handsets which are easy to operate and have the functionalities required for the mobile payment technology (Jack & Suri, 2007).

Morawczynski (2009) says that M-Pesa became the dominant money transfer in 1 years of its inception. Hillary (2011) suggests that M-Pesa's popularity has been driven by its speed, safety, reliability, extensive network of outlets, and its price relative to the alternatives. Prior to the introduction of M-Pesa, Kabbucho et al (2003) document that the cost of immediately sending US\$110 through normal channels ranged between US\$13 (Money Gram) US\$22 bank wire, while the cost for slower modes were from \$3 (bus companies) to \$8 (postal money order). Comparing to these options M-Pesa offered a significantly cheaper method of instantly transferring funds (Safaricom, 2008).

In Kenya mobile money transactions have been on the rise, with a large portion of the populace having registered as users. At the end on 2015 there were over 30.2 million users of mobile payment solutions in Kenya and in December of 2015, the total deposits amounted to over 150 billion over the same month. These transaction can increase liquidity in the market

and enhance money velocity consequently increase purchasing power in the economy all which can result in inflation due to demand pull in the market.

2.2.2 Mobile money transfer and payment growth

Mobile transfer in Kenya has grown and is being used to send money to friends, family and for payments for goods and services. In November 2011 there were over 60.511 billion Kenya shillings in transfer and 7.442 billion in payments through mobile money (Safaricom 2011). Growth in transfer of funds has grown over time with transfer at 72.312 billion in January 2013 and payments of up to 16.8 billion in the same month (Safaricom, 2013).

The number of mobile money transfer subscriptions and active agents as shown in table 2.1

Table2.1: Mobile Money Transfer Service

	Sep-15		Jun-15		%
	Agents	Subscriptions	Agents	Subscriptions	Subscriptions
<i>MPesa</i>	91,246	22,127,622	87,119	21,338,328	3.7
<i>AirtelMoney</i>	9,986	3,114,956	9,857	3,119,812	-0.2
<i>Orang</i>	16,734	191,300	15,984		-0.6
<i>EquitelM</i>	-	1,085,869	-	873,643	24.3
<i>Mobikash</i>	16,162	1,754,117	14,801	1,714,170	2.3
<i>Tangaza*</i>	1,596	503,556	1,596	503,556	0.0
Total	135,724	28,777,420	129,357	27,742,040	3.0

Source: CCK 2015

The total number of mobile money transfer subscriptions grew by 3.0 per cent to stand at 28.7 million during the quarter under review up from 27.7 million subscriptions posted in the previous quarter. The net gainers within the quarter were M-Pesa, Equitel Money and Mobikash by 3.7, 24.3 and 2.3 percent respectively. Airtel Money and Orange Money lost by 0.2 percent and 0.6 percent respectively. The total number of active mobile money transfer

agents stood at 135,724 during the quarter up from 129,357 active agents reported during the last quarter.

This innovation and eventual adoption by the population in Kenya has seen this become the most used channel of money transfer and with far reach to all individuals. The presence of money transfer agents all over the nation has been significant to the growth of the money transfer platform. The banking industry has also seen the impact of this innovation and have been trying to catch up with mobile money innovation, banks have all set up mobile money transfer option to ensure customer retention and have had to play second fiddle to the more connected telecommunication company's who have a direct link to the customer base through the handsets (Gleni, 2013).

From a macroeconomic point of view: authors like Röller and Waverman (2001) and Nadiri and Nandi (2003) based their investigation on the impact of mobile infrastructure on economic growth and argue that mobile infrastructure can generate a significant gain on the growth of developing countries (Aker and Mbiti, 2010). Other studies focusing on a micro point of view; Jensen (2007) also found evidence of a positive impact of the mobile phone on the fish market efficiency in the Kerala State, in India, by reducing transaction costs and improving the information on the market.

The story of mobile phones' spreading out as a backdrop, the intensification of M-Pesa is amazing. Within eight months of its setting up in March 2007, over 1.2 million Kenyans had registered to use M-Pesa, and over US\$88 million had been transferred over the system (Safaricom, 2007). By September 2009, over 8.55 million Kenyans had registered to use the service and US\$3.8 billion (equal to 10 percent of Kenya's GDP) transferred over the system since inauguration (Safaricom, 2009).

With business practices being universal and integration of small businesses with global trends all changes in business payment solutions have been transferred to all parts of

the planet. Kenya has however not been left out with adoption and innovation of payment solutions in the economy to boast customer satisfaction and cash management. Further with competition and growth being inevitable and changes in the modes of payment the Kenyan market has come to be at the helm of mobile money adoption with products which are unique to the Kenyan market and are being adopted worldwide (Albert, 2013).

The telecommunications sector is slowly gaining momentum as one of Kenya's profitable sectors despite the fact that its contribution to the gross domestic product is still low, at below 5%. The future however looks promising, in the first quarter of the financial year 2014/15, 522,435 new customers were added to mobile network subscription which saw mobile phone penetration increase to 80.5 percent. This therefore means that of the 40 million Kenyans, 32.8 million are subscribed to a mobile network from 32.2 recorded during the previous quarter (Aker & Mbiti, 2015).

The explosive increase was also mirrored in the growth of M-Pesa agents, which grew to over 18,100 locations by April 2010, from a base of approximately 450 in 2007. In contrast, Kenya has only 501 bank branches (Mas and Ng'weno, 2009). Despite the fact that the mobile telephone is within view of being a major business, e-money services like M-Pesa are still in their early days and are constantly evolving in response to aggressive pressures and customer needs. Despite all the awareness M-Pesa has received, there is no quantitative evidence on its economic and social impacts (Isaac & David, 2011).

Morawczynski and Pickens (2009) observed that clients sent smaller but regular remittances, resulting to overall larger remittances to rural. Researchers have also noted the potential of M-Pesa to influence savings. Morawczynski and Pickens (2009) observe clients often keep a balance on their M-Pesa accounts; thereby using the system as an elementary bank account despite the fact that interest is not given. In addition, Vaughn (2007) notes that some individuals stored money in M-Pesa due to safety considerations, especially when travelling

across the country. Using ethnographic methods in three communities, Plyer et al. (2010) observe that M-Pesa has enable small business to increase and grow and has also increased the movement of money.

Proceeding the invention and eventual adoption of M-Pesa in Kenya people still sent money using both formal and informal channels to transfer funds especially to family members in rural and urban areas. Various companies offered dispatch rider services which could be used as money transfer services with bus companies offering this to individuals who sending money over long distances. In other cases people sent money disguised in packages as some companies were unwilling to carry hard cash in the parcels and loss of money using this mode was inevitable (Kabbucho et al., 2003 & Morawczynski, 2009).

Mobile connectivity growth and widespread reach of agents in Kenya and the highly accepted mobile money acceptance has given the country a high financial liquidity due to the money transfer within the economy. With business growth and competition comes the need for more innovative products and ideas which can enhance customer retention and profitability over the long run. Key to this innovation is the payment solution and the introduction of Information Communication and Technology (ICT) products which have revolutionized the industry in Kenya. Customer satisfaction, confidence, accessibility and wide spread acceptance of this mode of payment have led to the boom of this form of payment: which has been helmed as innovative, less cumbersome and convenient to both businesses in Kenya and users of product and services (Mas & Rotman, 2008).

Payment solutions which are available to businesses in the economy all have their pros and cons and both businesses and customers take into consideration their impact on their bottom lines. Cash handling costs which are incurred due to handling physical hard currency are slowly being less and less preferred over less costly and convenient forms of payment

such as mobile money, bank transfers, card payment such as visa and master card (Aker & Mbiti, 2010).

The mobile phones are key product that products that have affected business practices. Payments via mobile phones are a recent progress in Kenya and enhanced how business is done. Industries have embraced the use of mobile payment technology in their operations. This mode of payment is an easier form of cash delivery to their suppliers and business partners, a system which is relatively affordable (Anurag, Tyagi and Raddi, 2009). With appeal and convenience of mobile banking and mobile payment services from corner to corner the country as there are probably more people with mobile handsets than with bank accounts (Porteous, 2006).

2.2.3 Mobile credit

Mobile phone networks in Kenya such as Safaricom, Airtel, Orange, Equity and other are now offering credit to their loyal customers. These lines of credit are all extended on the basis of customer loyalty and length of device use (Mugambi, 2014). Credit that is offered to customer comes in different types such as airtime or mobile money such as M-Pesa or Airtel money which can be withdrawn at the nearest agent (Otieno, 2016).

While all customers are able to request for credit which is advanced to them and is paid with an interest after duration of time, this credit is limited to small amounts depending on customer loyalty. Customer who prove to be reliable and pay on time, receive a higher credit rating which gives them more limit to borrow in subsequent request. On the other hand anyone who does not pay on time is given a lower credit score and can be denied future borrowing (Kariuki, 2015).

Companies in the banking sector such as Kenya Commercial Bank of Kenya, Cooperative Bank, Family Bank are also using mobile hand set and in conjunction with

telecommunication companies in the industry to provide credit and loans through the short code services (Kariuki, 2015). These codes ensure customers of banks are able to access their finances and bank balances. Customers who wish to withdraw money from their bank accounts are able to do it at the comfort of their homes (Maluku, 2012).

The banking and telecommunication sectors in Kenya have witnessed growth amidst competition that has gripped the sectors. Companies in these sectors have seen completion grow amongst each other in the sector with all having a taste of the mobile based customer base of over 35 million Kenyans. The customer base has also been treated to lower prices and innovative products such as Mshwari, Pesa pap, and coopcash among others all in a bid to outdo and keep the lucrative industry (Moses, 2016).

Since 2007, mobile money financial payment modes of payments have emerged in variety of forms in Kenya. The systems typically engage a set of applications that facilitate a range of financial transactions via mobile phone to send airtime, pay bills and transfer money between individuals (Hinz, Rudolph, Antolin, & Yermo, 2010). Currently a few systems in developing countries allow international money transfers. Diverse institutional and business models provide these services; some are presented entirely by banks, others entirely by telecommunications providers (Porteous, 2006).

The majority Mobile payment systems let the customer to store value in an account accessible by the handset, stored value account, transfer value between customers by using text messages, command and personal identification numbers. A “pseudo account” can be established by purchasing “electronic money” (emoney) from the agents, usually a third party or someone who works for the mobile phone operator or bank. The user can then send e-money to another recipient with a phone, who then withdraws the e-money from their local transfer agent (Hinz, Rudolph, Antolin & Yermo, 2010).

Suri (2013) argues that M-Pesa has been touted to be “banking the unbanked”, on average, M-Pesa users are wealthier, educated and urban. Additionally, the data imply that most transfers are happening within urban areas. M-Pesa and other m-money systems have of late transitioned from purely money transfer system to a payment platform that enables governmental organizations, schools, hospitals and firms to send and receive payments (Suria, 2013).

It has been found that mobile phones can advance consumer and producer welfare in developing countries, Jensen (2007), Aker (2008), Klonner and Nolen (2009). Waverman, Meshi and Fuss (2006) conducted a similar analysis in developing countries; found that 11 percent increase in mobile dispersion levels was linked with a 0.6 percent increase in growth rates. These studies offer some evidence of the affirmative relationship between mobile phones and economic growth (Aderonke & Charles, 2010).

Pagani (2004) stated that accessibility is a major requirement of mobile payment services to work for. Small and micro businesses are among the best beneficiaries of using M-Pesa mobile payment. By 1st March, 2009, there were 8,650 M-Pesa agents spread throughout the country offering the mobile payments service. The business operators visit the bank less often and spend more time managing their businesses. Equally, unbanked Kenyans can now receive or send money wherever they are in the country (Omwansa, 2009). Bulk of the business operators are familiar with the use of the mobile payment services as they are easy to use and require no formal training before use.

Njenga (2009) states that even though the mobile phone balances may seem low, the fact that there are balances proves that there is storage which can be perceived as acceptance of deposits. It is also a significant indication of the high value placed on the convenience associated with the use of the mobile payment services. Omwansa (2009) argues that a lost or stolen mobile phone does not mean catastrophe as no one can access an M-Pesa account

without a correct personal identification number. In addition it explains that in a country where majority of population are unbanked, M-Pesa gives handiness in addition to security (Siau et al., 2004; Mallat, 2007).

Safety and security in transactions is key to the primary concerns for users (Nam, Yi, Lee and Lim, 2005). Funds security is principle to depositor or else it would be difficult persuading anyone to store or send money. Mobile transfers cause no delays, no transaction incompleteness and no personal information leak during payment transactions (Aderonke and Charles, 2010). The use of the pin and secret code for the M-Pesa transactions enhances the security and privacy issues. Key necessities for financial transaction in an electronic environment should include confidentiality, authentication, data integrity and non-repudiation (Shon and Swatman, 1998).

2.3 Research Gap

Mwangi (2012) suggested that Mobile phones are easily and even more affordable currently than ever before making them the best option to send money. Suri (2005) found out that the innovative use of this new technology has improved financial services in Kenya. Other notable academic research cited in the brief supports and amplifies their findings and suggested that widely accepted innovation can cause market disruption (Mark, 2001).

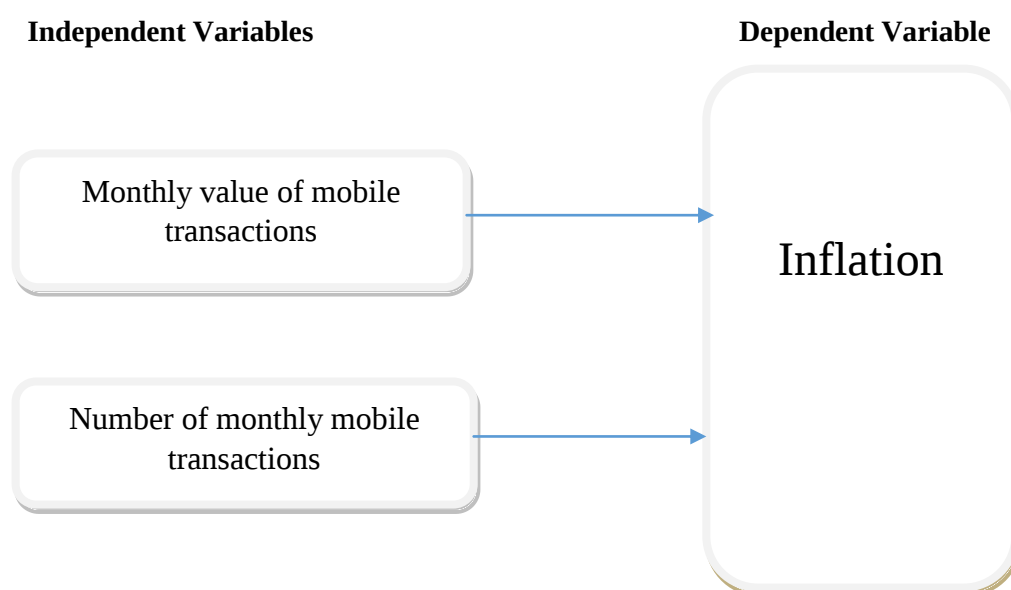
The use of mobile payment technology requires little knowledge to operate. In consequence, business operators in Kenya have embraced its use in their each day business operations and are registered users (Morgan, 2012). Consequently, Haran (2011) found that individuals and businesses carry out diverse transactions using their mobile phones within and around their business surroundings; such as paying suppliers for goods and services, paying bills, sending money to friends and relatives, withdrawing cash and topping up airtime accounts (Haran, 2010).

This research was to bridge the knowledge gap on the impact of this new technology which just seems to be peaking up. In Kenya mobile technology has been greatly adopted and has been heralded as an easy and affordable way of connecting business and customers. Payments have been simplified and security has been enhanced in the day to day financial sector with business adopting the payment systems and government seems to be playing catch up as all these new applications seems to be unregulated in the existing laws. With the relation of the factors in this research being established it shall provide a platform to further understand and manage the inflation caused by mobile money transactions.

2.4 Conceptualization

The study was looking at the effect of number of mobile transaction and total value of monthly transactions had on inflation in Kenya. The figure below shows the conceptual framework explaining the relationship between inflation (dependent variable) and number of monthly mobile transactions and value of monthly mobile transactions (independent variables).

FIGURE 2.1 Conceptual framework



2.4.1 Definition and Measurement of Variables

The study analyzed the effect of mobile money transaction on the national inflation in the long run. The data was collected on a monthly basis from March 2007 to April 2016. The researcher evaluated the relationship between the dependent and independent variables with an aim of better understanding how these relationship can be utilized to control inflation.

Table 2.2 Definition and Measurement of Variables

Variable	Abbreviation	Definition	Measurement	Calculated as
Value of total mobile transactions	DS	The amount of funds that are deposited in to mobile phones through agents.	Total mobile money deposits to mobile monthly basis.	Log (Monthly deposits and savings)
Number of mobile transactions	MT	The number of total number of individual transactions done using mobile money platforms	Total monthly transactions.	Log (total transactions)
Inflation	INF	Constant raise in the broad price level of goods and services	Measured using the consumer price index on a monthly basis.	CPI Monthly

The study used logs of the independent variables to simplify the data which is expected to be in huge amounts and running into billions of Kenya shillings. Mark and Chowdhury (2001) suggest that researchers can adopt logs to make the data linear, for plotting proposes and normalize outliers in a data set.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the methodology used to conduct the study. It specifies the research design, data collection and data analysis.

3.2 Research Design

The study used an analytical research design. The analytical research design helped the researcher to better understand the relationship between mobile innovations and inflation. An analytical research design seeks to identify and quantify association existing between variables, test hypothesis, identify causes and effects and draw statistical conclusions (Seen, 2012). Analytical research design enabled the study to clearly scrutinize the significance of the effect of mobile transactions on inflation in Kenya.

3.3 Data collection

The study collected data on a monthly basis. This data was collected beginning from March 2007 to May 2016; which constitutes 111 months and thus 111 observations for each of the variables in the research data. This is because the mobile money innovations in Kenya were first introduced in March 2007 when M-Pesa was launched by Safaricom. The data was collected from the Central Bank of Kenya which is the regulator of financial industry in Kenya. The research used a data collection work sheet to gather data as shown in Appendix 1.

3.4 Data Analysis Procedures

First the data was examined and cleaned using Excel to assess if the data is representative of the variables in the study and all the variables were captured fully. Next, the study then used descriptive analysis performed as follows;

3.5 Descriptive Analysis

3.5.1 Linear regression

The study fitted a multiple regression analysis as follows:

$$y_t = \beta_0 + \beta_1 DS_t + \beta_2 MT_t + \varepsilon_t \dots \dots \dots \text{Equation 1}$$

Where:

Y Is the dependent variable inflation t Monthly time period

β_0 Represents the constant term β_1 is the correlation coefficients

DS Represents the total value of money deposits and savings

MT Represents total monthly transactions

After fitting the model, the following residual analysis was performed;

3.5.2 Residual Analysis

The study conducted a linear regression analysis to assess the relationship between inflation and monthly mobile transaction and total monthly value of deposits. The following tests were also conducted to assess if classical linear models assumptions are violated, a histogram for residuals to test normality of distribution of residuals, a scatter plot to test for patterns in the residuals, a test for heteroskedasticity to assess the distribution of the variance, an omitted variable test to clarify if any variable are missing from the residual and lastly a multicollinearity test to establish the extent of relationship between the independent variables. Due to violation of some of the classical linear models assumptions the study employed an autoregressive distribute lagged regression model to investigate the effect each of the independent variables have on the dependent variable.

3.5.3 Regression with Lagged Explanatory variables

Using the lagged explanatory variables the study was able to analyze distributed effect of the independent variable on the dependent variable. Model specification was adopted as follows:

1. Deposits and savings

$$y_t = \beta_0 + \beta_1 DS_t + \beta_2 DS_{t-1} + \dots + \beta_q DS_{t-q} + \varepsilon_t \dots \dots \dots \text{Equation 2}$$

Where: y_t Is inflation

DS Is deposits and savings t is time (monthly)

Next the study chose the maximum lag length for the models 1 and 2 above, the following steps: Where $X = DS$ or MT

Step 1

Choose the maximum possible lag length q maximum that is seen to be reasonable for the data used in the research (say 2 months or 3 months).

Step 2

Estimate the model
$$Y_t = \beta_0 + \beta_1 X_t + \beta_1 X_{t-1} + \dots + \beta_{q_{max}} X_{t-q_{max}} + \varepsilon_t$$

If the P-value for testing $\beta_{q_{max}}=0$ is less than the significance level chosen (0.05) then go no further. Use q_{max} as lag length. Otherwise go on to the next step.

Step 3

Estimate the model:
$$Y_t = \beta_0 + \beta_1 X_t + \beta_1 X_{t-1} + \dots + \beta_{q_{max}-1} X_{q_{max}+1} + \varepsilon_t$$

If the P-value for testing $\beta_{q_{max}-1}=0$ is less than the significance level chosen (0.05) then go no further. Use $q_{max}-1$ as lag length. Otherwise go on to the next step.

Step 4

Estimate the model: $Y_t = \beta_0 + \beta_1 X_t + \beta_1 X_{t-1} + \dots + \beta_{q_{\max}-2} X_{q_{\max}+2} + \varepsilon_t$

If the P-value for testing $\beta_{q_{\max}-2}=0$ is less than the significance level chosen (0.05) then go no further. Use $q_{\max}-2$ as lag length. Otherwise go on to the next step, etc.

In summary, the number of observations used in the model with lagged explanatory variables is equal to the original number of observations, T , minus the maximum lag length. Distributed lag models have the dependent variable depending on an explanatory variable and lags of the explanatory variable. If the variables in the distributed lag model are stationary, then OLS estimates are reliable and the statistical techniques of multiple regressions (looking at P-values or confidence intervals) can be used in a straightforward manner. The lag length in the distributed lag model can be selected by sequentially using t-tests beginning with a reasonably large lag length.

CHAPTER FOUR

DATA ANALYSIS AND FINDINGS

4.1 Introduction

This chapter presents the results of comprehensive data analysis but as a preliminary, the characteristics of data under consideration were first checked. The results were presented using visual aids which include graphs and also using descriptive statistics.

4.2 Descriptive Statistics

Table 4.1: Descriptive statistics of the variables

Variable	Inflation	Log of transactions	Log of value
Observations	111	111	111
Mean	8.506486	7.357522	10.77222
Std. Dev	4.91001	0.7343227	0.7134174
Minimum	1.85	4.33674	7.808822
Maximum	19.72	8.088313	11.44395
Skewness	0.9879508	-1.868097	-1.841312
Kurtosis	2.766785	6.448443	6.40673

The descriptive statistics are shown in Table 4.1. The data was collected over 111 months from March 2007 to May 2016. The minimum transaction was observed in March 2007 when the mobile transfers were first introduced in Kenya while the highest observed number of transactions of 8.0888 was observed in May 2016 which marks the last date the data was collected. This shows a clear growth of the number of transactions in the market and acceptance of the mobile transfers in the economy. The mean of number of transactions was 7.35 which was very high and shows a high number of transactions are occurring on a daily basis.

Monthly transactions in value were also of an upward trajectory, the minimum number of transactions being recorded on the first month mobile transfer inception of 7.808 while the highest number of deposits of 11.44 was recorded on May 2016 showing an increased growth from the initial deposits. Inflation has a minimum of 1.85 recorded in April 2007 while the highest inflation rate was in November 2011 standing at 19.72 % this can be attributed to demand pull by the market caused by, a significant loss in value of the Kenyan and thus the reduction imports from foreign markets leading to more money circulating in the economy. Further, reduction in the lending rates had influenced the market to have surplus liquidity and thus leading to increased money supply in the economy. Inflation had a mean of 8.0506% showing that it had no significant trend but fluctuated due to market forces (Njoroge, 2012).

Next, the trend analysis of the variables was conducted and the graphs were used to depict the trend of the variables over the time under study.

4.3 Trend analysis

FIGURE 4.1: Trend of monthly inflation

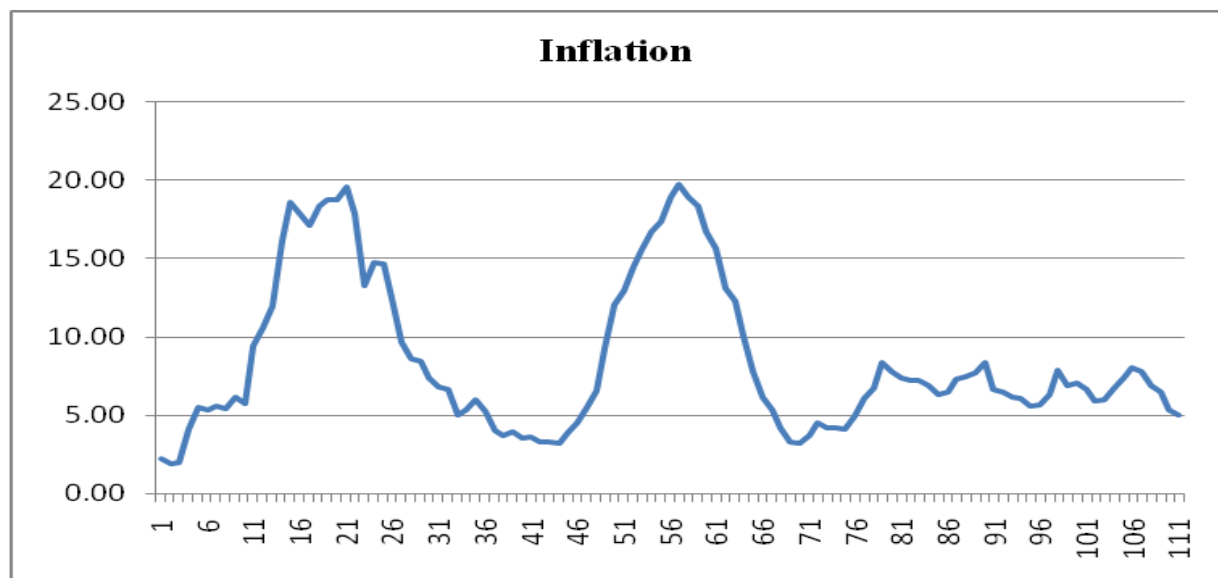


FIGURE 4.2: Trend of number of transaction

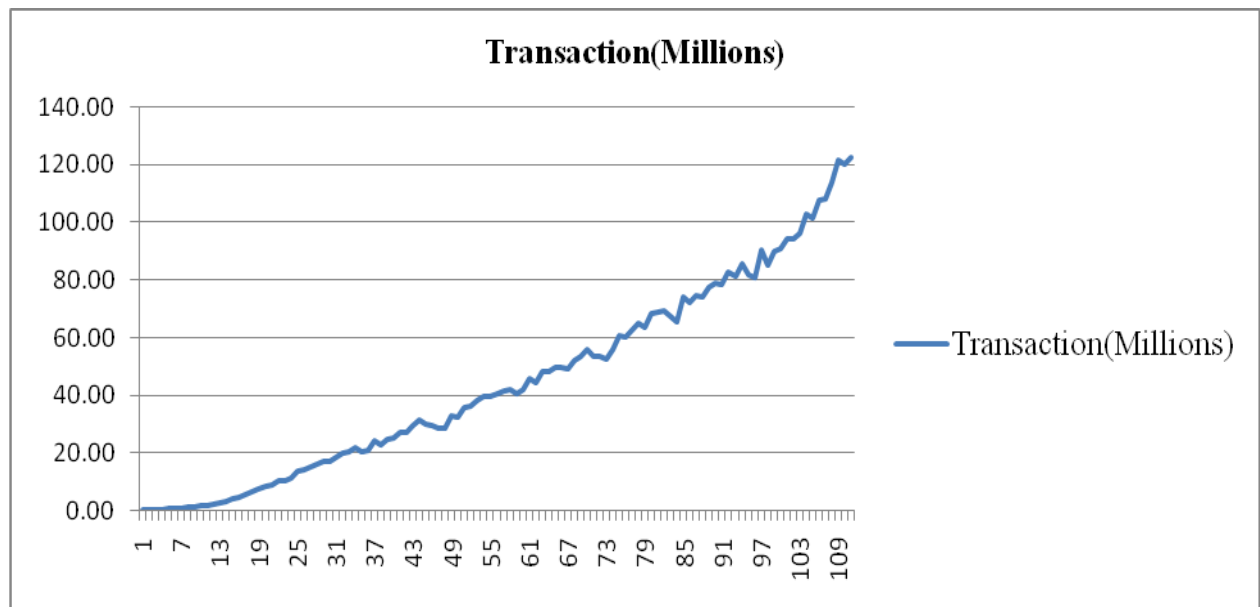


Figure 4.1 above illustrated that inflation has a pattern or trend and seasonality. Inflation has a peak of 19.72 and a trough of 1.85. Figure 4.2 illustrates that the transactions of mobile money have a trend and seasonality and a growing rate from the inception of mobile money transactions in March 2007.

FIGURE 4.3: Trend of inflation and number of transactions

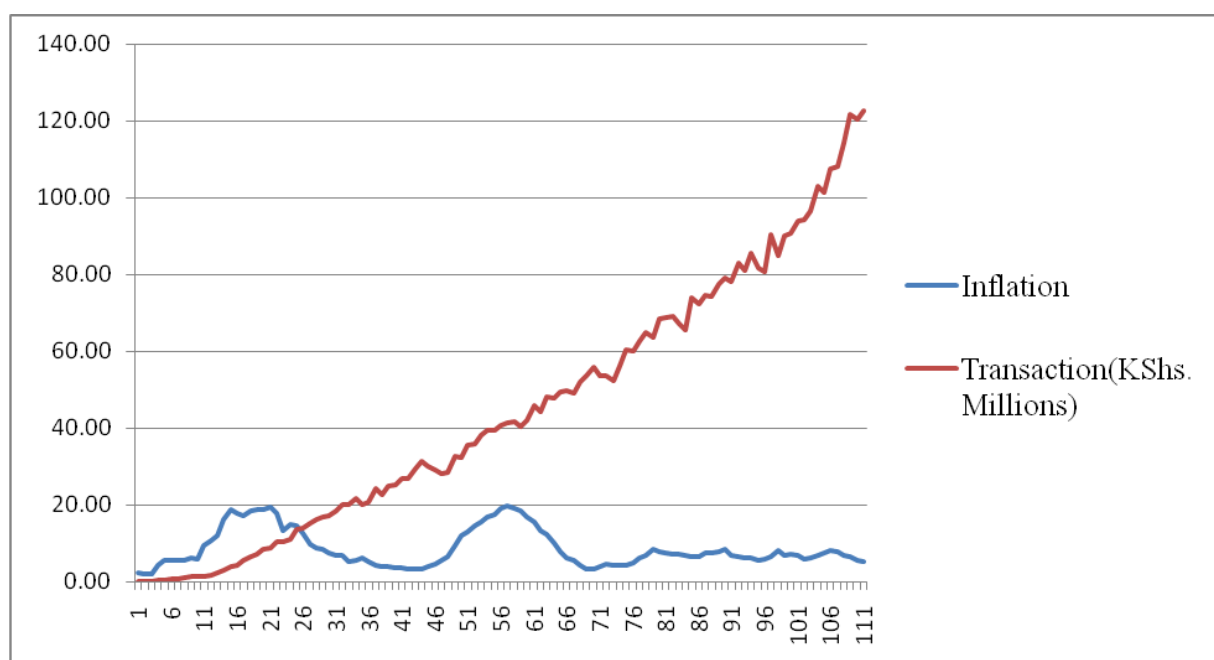
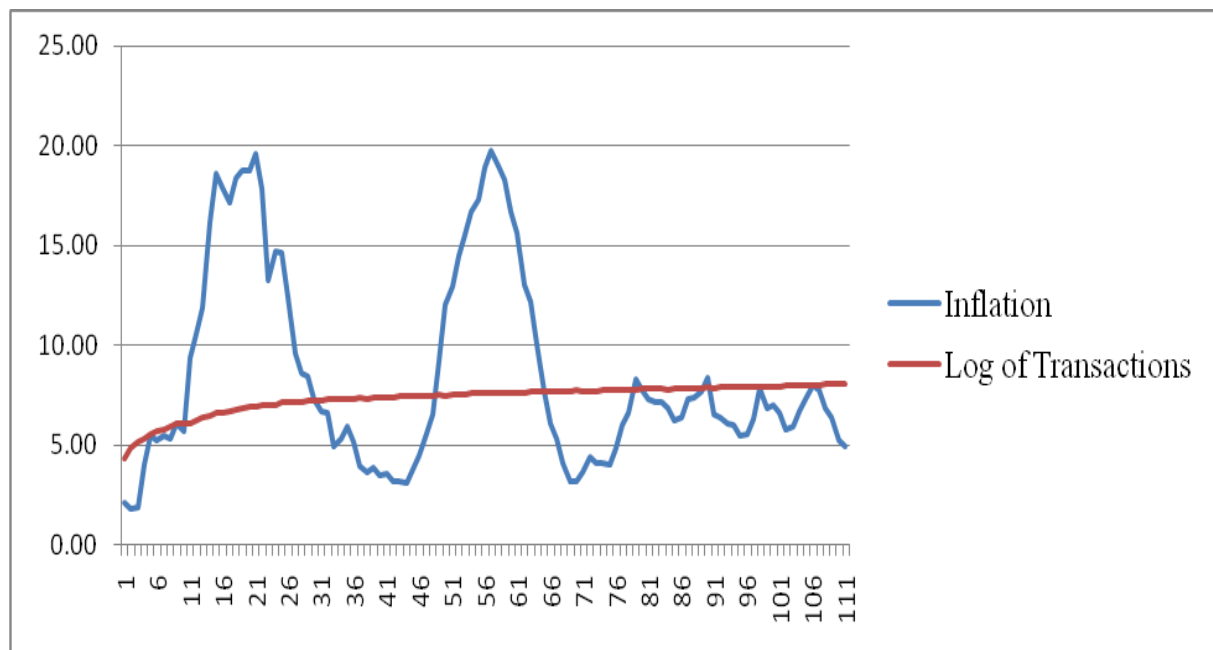


Figure 4.3 further shows that the observations for number of transactions had observed to exhibit signs of containing a trend and seasonality which were much more frequent than that of inflation. The growth rate and consistent increase of mobile transactions indicates that transactions have a clear trend that is observable from the graphical representation. The graphical line representation of inflation is represented above and shows the distortion due to the trend observed in the total number of monthly transactions, thus the researcher choose to user the log of number of transactions transaction so as to linearize the number of transactions.

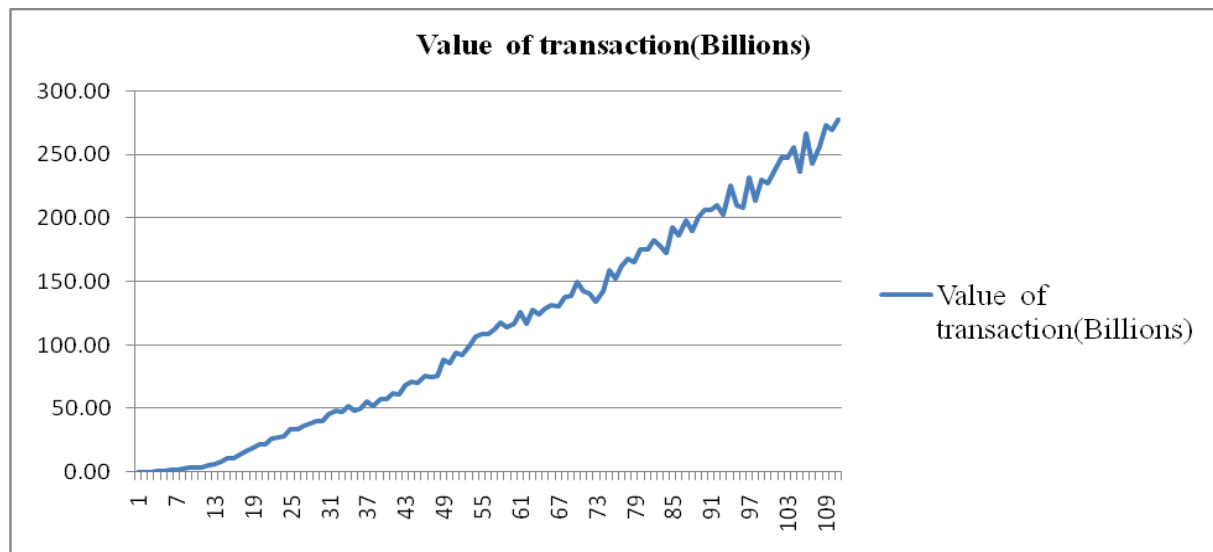
FIGURE 4.4: Trend of inflation and log of number of transaction



As represented in figure 4.4 above, the data illustrates a negative relationship between the increase of inflation and number of transactions. The research found out that an increase in inflation leads to a decrease in the number of transactions on the mobile money networks in Kenya. In April 2009 a decrease in inflation from 12.42 percent to 9.61 percent lead to and increase on mobile money transactions from 13,779,600 to 15,048,800 in the month of May.

As illustrated in figure 4.4 above, the higher and growing rate of transfers and use of mobile payments increase money velocity in the economy making finance more accessible to a larger number of people in the population. Increase in money velocity is generally related to inflation growth and is a key aspect of demand pull inflation in Kenya.

FIGURE 4.5: Trend of value total monthly transactions



The study collected data of 111 months and it indicated a consistent growth of value of mobile deposits since the setting up of Mpesa and even the entrance of other service providers such as Airtel and Equitel. Further the researcher observed that there was a larger increase in value of mobile transactions when inflation reduced causing the liquidity to increase in the market. Inflation reduction allows for more disposable income to the populace and this may at times be counterproductive as more circulation could lead to higher demand and further spur inflation to increase.

Figure 4.5 illustrates there is a trend and seasonality in the value of deposits. The trend in value of deposits shows that mobile deposits have been accepted and the innovation of this technology has been accepted. Figure 4.6 shows a clear relationship of inflation and value of deposits. The data illustrates that inflation went to a maximum of 19.72% while the deposits are increasing on a monthly basis and show seasonality month to month.

FIGURE 4.6: Trend of inflation and value of transactions

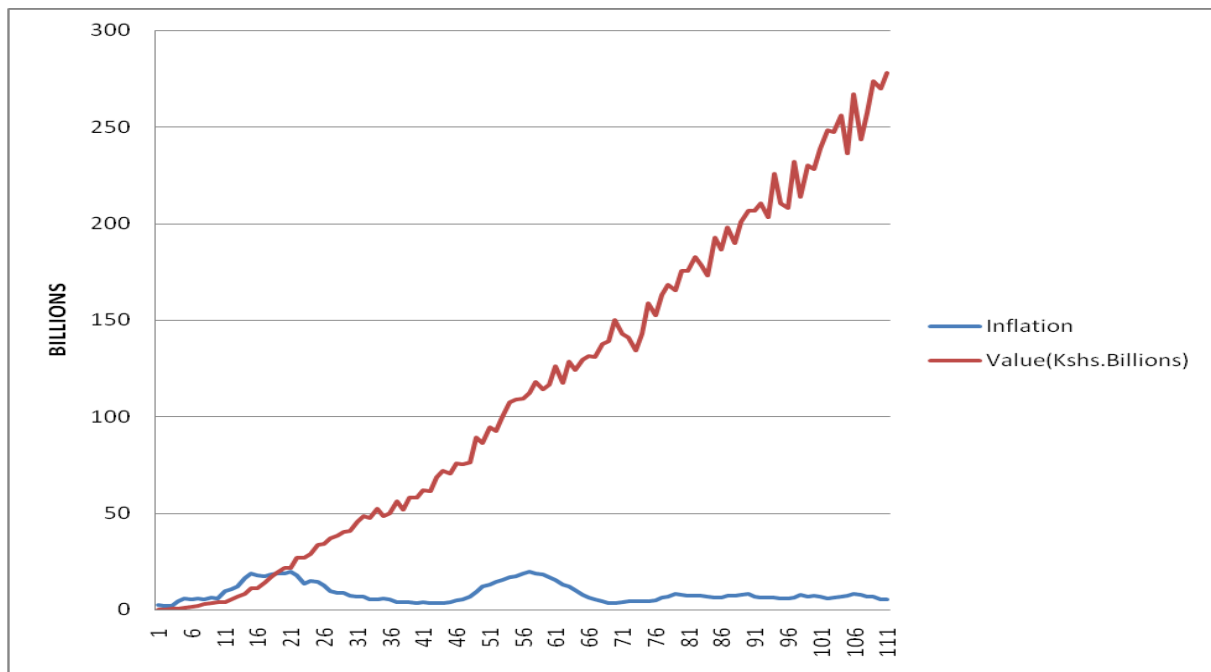


FIGURE 4.7: Trend of inflation and log of value of transactions

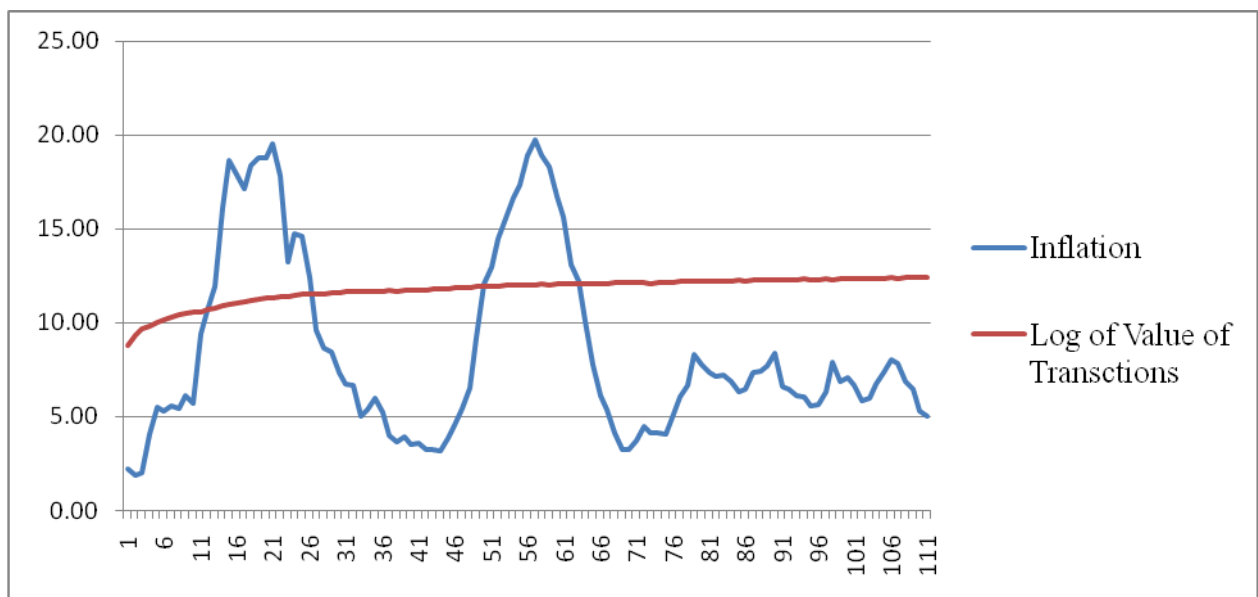


Figure 4.7 illustrates the relationship of inflation the log of value of monthly transaction. The graph shows the use of logs to linearize the value of monthly transactions. The economic effect of growth in deposits shows that there is high money circulation in the

economy which is a precursor for higher inflation rates. The study then conducted linear regression analysis to investigate the effect of the number of monthly transactions and total value of monthly mobile deposits on inflation in Kenya.

4.4 Linear Regression Analysis

Table 4.2: Linear Regression of Log of number of mobile transactions and deposits

Dependent Variable: Monthly Inflation	
Log of Monthly Mobile Transaction	-41.36204 *** (17.19029)
Log of Monthly total mobile Deposits in Ksh.	42.48127 *** (17.69401)
Constant	-144.7892 ** (64.3771)
F	2.90
Prob> F	0.0593
R-Squared	0.0510

(***, **, * significant at the 1%, 5%, and 10% levels, respectively)

The linear regression analysis in Table 4.2 above, indicates that an increase of 1% of number of mobile transactions cause inflation to decrease by 41%. The increase in number of total transactions is seen to reduce inflation owing to increase in money velocity which is evenly distributed among all individuals and reduce purchasing power thus impacting on inflation (Minges, 2010).

The linear regression in Table 4.2 above also suggests that, increase of total value of monthly mobile by 1% will result in an increase of inflation by 42%. The increase in mobile transaction value is an indication of increases in purchasing power of the population. While increase in deposits is not the only factor that can increase inflation it can contribute partially as there is an increase in demand in goods and services due to currency circulation and money velocity (CBK, 2007).

The R-squared indicates that only 5.1% of inflation is explained by the number of total mobile transaction and total value of monthly mobile transactions in the economy. This shows that the model is inadequate as it does not explain the 94.9% of the factors affecting inflation in Kenya. The Probability>F is 0.0593 which is above 0.05 and thus the linear regression model is insignificant.

Next, residual analysis was performed to check if the classical linear model assumptions were observed by the residuals of the model and hence determine its suitability to explain the relationship of the variables.

4.4.1: Normality test

FIGURE 4.8: Histogram for Residuals

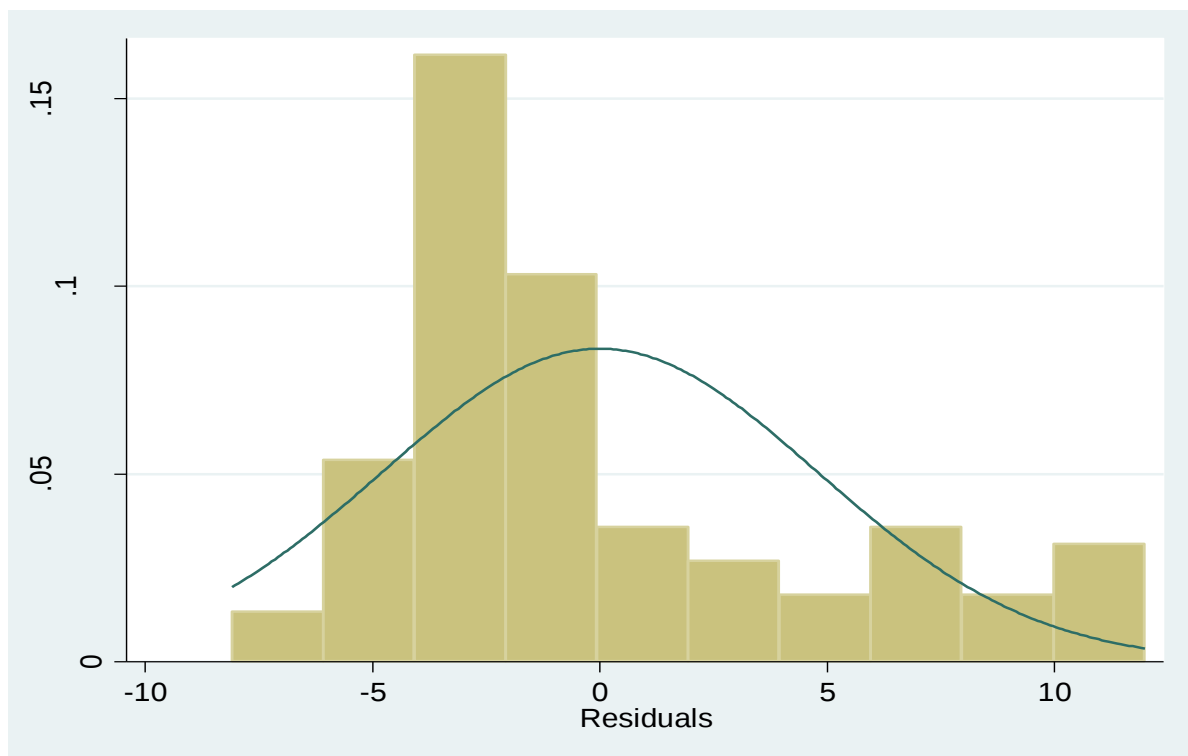


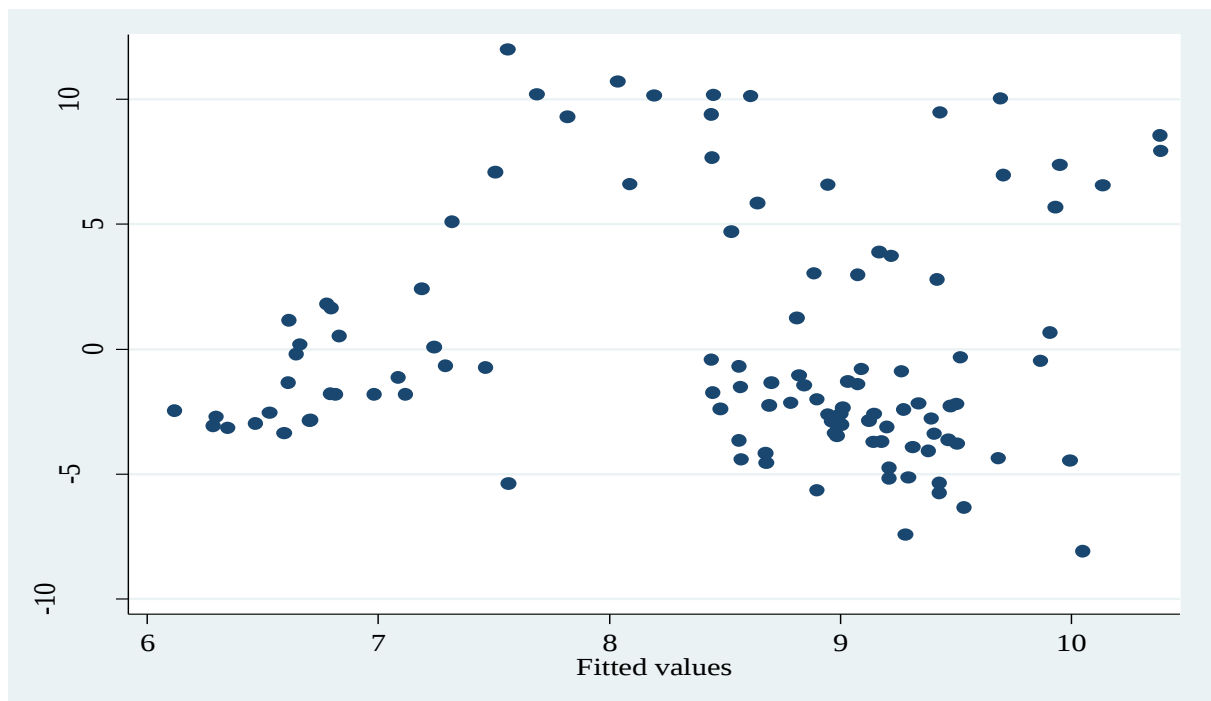
FIGURE 4.9: Skewness/Kurtosis

Skewness/Kurtosis tests for Normality					
Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	—— joint ——	
				adj chi2(2)	Prob>chi2
resid	111	0.0002	0.8454	11.68	0.0029

The histogram on Figure 4.8 shows that the residuals have a skew and thus the normality assumption was violated. The normality test showed that the residuals were not normally distributed and therefore the classical linear model assumption of normality was violated.

4.4.2 Scatter plot for residuals

FIGURE 4.1.0: Scatter plot for residuals



The residuals plot in Figure 4.1.0 above shows that the plot does not have a pattern implying that the residuals were independent.

4.4.3: Testing for Heteroskedasticity

FIGURE 4.1.1: Breusch-pagan test

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of Inflation

chi2(1)      =      2.64
Prob > chi2   =    0.1041
```

The existence of heteroskedasticity is a chief concern in the application of regression analysis, as well as the analysis of variance (Morgan, 2000). The residuals variance was not constant. The probability value of the Breusch-Pagan test for heteroskedasticity as show above is above 0.05 and thus the variance of the residuals is not constant.

4.4.4 Omitted Variables Test

The researcher used the omitted variable test to check for omitted variables in the regression.

FIGURE 4.1.2: Omitted variables test

```
. ovtest

Ramsey RESET test using powers of the fitted values of Inflation
Ho: model has no omitted variables
      F(3, 105) =      13.03
      Prob > F   =      0.0000
```

The omitted variables test exhibited a Prob>F of less than 0.05 thus revealing that the model had omitted variables and therefore cannot be adequately used to explain the relationship between the variables.

4.4.5 Multicolliniarity test

FIGURE 4.1.3 Variance inflation test

. vif

Variable	VIF	1/VIF
LogofDepos~s	752.17	0.001329
LogofTrans~s	752.17	0.001329
Mean VIF	752.17	

Testing for correlation of the residuals was done using a variance inflation factor test and this showed a mean greater than 0.05. Because of the high correlation and violation of normality assumptions the study uses distributed lagged regression models to analyze the effect of number of monthly transactions and total value of monthly deposits on inflation in Kenya.

4.5 Lagged Regression Analysis

4.5.1 Choosing lag length of inflation and number of monthly transactions

Table 4.3: Choosing lag length of inflation and number of monthly transactions

Variables	Distributed Lagged regression	Autoregressive Distributed Lagged Regression
Inflation	L1	1.261541 *** (0.081)
	L2	-3.425048 ** (0.159)
	L3	0.2723345 (0.160)
	L4	-0.0871815 (0.158)
	L5	-0.1879029 (0.096)
Log of Transaction	L0 -7.682188 (16.37783)	
	L1 -15.28527 (23.15942)	
	L2 19.9519 * (11.68117)	
Constant	31.78974 (10.173)	0.7023882 (0.221)
F	2.01	547.36
Prob> F	0.1178	0.0000
R-Squared	0.0542	0.9555

(***, **, * significant at the 1%, 5%, and 10% levels, respectively)

As shown in Table 4.3, the study undertook distributed lagged regression analysis to establish the appropriate lag length for the effect of monthly transaction on inflation in Kenya. The study established that monthly transactions have a significant lagged effect on inflation

for up to one month. It was also established that inflation has a significant lag effect on itself for up to four months as shown in the table above.

4.5.2 Lagged regression of inflation and log number of monthly transactions

Table 4.4: Lagged regression of inflation and Log of monthly transactions

Variables	Distributed Lagged regression	Autoregressive Distributed Lagged Regression	Autoregressive Distributed Lagged Regression
Inflation	L1	1.332195 *** (0.919)	1.312408 *** (0.939)
	L2	-0.4199963 *** (0.155)	-0.410756 *** (0.156)
	L3	0.3548078 ** (0.155)	0.3372396 ** (0.157)
	L4	-0.3388094 *** (0.916)	-0.5028482 *** (0.092)
Log of Transaction	L0 -24.14876 ** (11.826)		-0.5028482 (3.905)
	L1 21.85002 ** (10.919)		-0.2578568 (3.79)
Constant	26.2852 (8.581)	0.6040548 (0.214)	3.681755 (2.659838)
F	2.01	547.36	310.27
Prob> F	0.1178	0.0000	0.0000
R-Squared	0.0542	0.9555	0.9564

(***, **, * significant at the 1%, 5%, and 10% levels, respectively)

The study as illustrated in Table 4.4 showed that lagged regression analyses of lagged relationship of inflation and number of mobile transactions in Kenya. The first model of analysis model was a distributed lagged regressed of the number of mobile transactions on inflation. The model suggested that a 1% increase in number of transactions in the current month resulted in a decrease cause inflation to fall by up to 24.14%. Further it was established a 1% increase in number of monthly transaction in the previous month would result in increase of inflation in this month by 21.85%. This distributed lagged regression model however only explains the relationship of number of transactions and inflation at only 5.42%

and the Prob>F is greater than 0.005 thus making this model to be insufficient to explain the relationship of number of mobile transactions and inflation.

The research further undertook autoregressive distributed lagged regression model of inflation of itself to establish the impact of inflation in past months to inflation in this current month as indicated in Table 4.4 above. The data exhibits that 1% increase in inflation in the previous month results in a 1.3% increase in inflation in the current month. Consequently, the model revealed that 1% increase in number of mobile transactions in lag two cause inflation to decrease by 0.41% in this month. The third lag of number of transactions on inflation revealed that a 1% increase in number of mobile transaction results into an increases inflation by 0.35%. The fourth lag number inflation revealed that a 1% increase in inflation causes inflation to decrease by 0.33% in the current month. The autoregressive distributed lagged regression of inflation on itself has a reliability of 95.55% and this shows that the model explains the effect of inflation of itself by 95.55%. The Prob>F was 0.0000 indicating a high significance of the model because it was less than 0.05.

Last the study undertook autoregressive distributed lagged regression and included the lags of inflation and lag of number of transactions to establish the significance of lagged inflation and lagged number of transactions. This model exhibited a Prob>F of 0.0000 showing the model is highly significant and an R-squared of 95.64% indicating that the relationship is explained up to 95.64%.

The final autoregressive model shows that inflation has a lagged effect on itself, the model shows that a 1% increase in inflation in lag one cause inflation in the current month to increase by 1.31%. Where inflation is lagged by one month a 1% increases in inflation causes inflation in the current month to reduce by 0.41%. This model further revealed that a 1% increase in lag three will cause inflation in the current month to increase by 0.33%. An increase in inflation by 1% lagged to four months will cause inflation in the current month to

decrease by 0.5%. Further, the autoregressive distributed lagged regression revealed that a 1% increase in number of monthly transaction cause inflation to decline by 0.5% while the distributed lagged of number of monthly transactions of one month caused inflation to decline by 0.25%.

4.5.3 Choosing the lag length of inflation and log of deposits

Table 4.5: Choosing lag length of inflation and log of deposits

Variables	Distributed Lagged regression	Autoregressive Distributed Lagged Regression
Inflation	L1	1.332195 (0.0919054)
	L2	-0.4194963 (0.1557772)
	L3	0.3548078 (0.1559777)
	L4	-0.3388094 (0.0916327)
	L5	-0.1879029 (0.096)
Log of Deposits	L0 -11.07477 (14.616)	
	L1 -10.00641 (19.457)	
	L2 18.01404 (10.255)	
Constant	42.4339 (14.686)	0.6040548 (0.214983)
F	1.98	547.36
Prob> F	0.1219	0.0000
R-Squared	0.0397	0.9555

(***, **, * significant at the 1%, 5%, and 10% levels, respectively)

Figure 4.5 above shows, the study undertook lagged regression of total monthly deposits on inflation in Kenya and found out that the value of deposits have a one month lagged effect on inflation in the economy. The autoregressive distributed lagged regression of inflation on itself found out that inflation has a significant lag of four months.

4.5.4 Autoregressive lagged regression of inflation and log of total monthly deposits

Table4.6: Autoregressive lagged regression of inflation and log of total monthly deposits

Variables	Distributed Lagged regression	Autoregressive Distributed Lagged Regression	Autoregressive Distributed Lagged Regression
Inflation	L1	1.332195 *** (0.919)	1.313599*** (0.939)
	L2	-0.4199963 *** (0.155)	-0.4108567*** (0.156)
	L3	0.3548078 ** (0.155)	0.3556896** (0.157)
	L4	-0.3388094 *** (0.916)	-0.3328238*** (0.923)
Log of Deposits	L0 -22.12634 ** (10.90159)		-0.1058706 (3.669)
	L1 19.98496 ** (10.0426)		-0.1124308 (3.487)
Constant	32.34956 (12.07726)	0.6040548 (0.214)	3.000068 (2.924)
F	2.21	547.36	362.87
Prob> f	0.1148	0.0000	0.0000
R2	0.0397	0.9555	0.9561

(***, **, * significant at the 1%, 5%, and 10% levels, respectively)

The study used distributed lagged regression to establish the lagged relationship of inflation and value of total monthly deposits. The data reveals that a 1% increased in value of deposits in the current month will reduce inflation by 22.12% while a lag of one month a 1% increase in the past month will result in increase inflation by 19.98% in the current month. This indicates that inflation is both influenced positively and negatively if value of monthly

transactions is lagged. However, this model of distributed lagged regression only explains 3.975% of the relationship between inflation and total monthly deposits and subsequently the model has a Prob>F of 0.1148 which is greater than 0.05 which makes the model irrelevant.

Prompted by this result, the study undertook autoregressive distributed lagged regression of inflation on itself to establish the lagged effect of inflation on itself. The study still established that lagged inflation has a significant lag of four months as seen in the results of monthly transactions above.

Finally, autoregressive distributed lagged regression was conducted on inflation and value of total monthly deposits and established that current month's value of mobile transactions increase by 1% will cause inflation to increase by 0.10%. Additionally it was established that the one month lagged effect of value of deposits increase by 1% will affect the current month's inflation by negative 0.11%. The autoregressive lagged regression established that inflation has a lagged effect on itself of up to four months. A 1% increase in inflation in lag one resulted in an increase of 1.3% of inflation in the current month. Secondly it was observed that a 1% increase in inflation in lag two would yield a decrease in inflation in the current month by up to 0.41%. Further, it was recorded that a 1% increase in inflation in lag three would result in an increase of inflation in the current month by 0.35%. Lastly, the model revealed that a 1% increase in inflation in the final lag would produce a reduction in inflation rate in the current month by 0.33%. This model has a Prob>F of 0.00 which shows a high significance of the model and an R-Squared of 95.61% which showed that the autoregressive distributed lagged regression explained the effect of deposits by up to 95.61%.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary and conclusions based on the findings in the previous chapter. It further made recommendations given the findings and highlight areas of further research.

5.2 Summary of the findings and discussion

The study focused on its main objective which was to assess the impact of mobile transactions on inflation. Further the researcher sort to establish the distributed long term effect of monthly transaction on inflation and the effect of total value of mobile money transaction in the economy on inflation. The research sought to understand the impact of this new use of mobile money, transactions, payments and the economic impact it could have in the long run on inflation in the economy.

To the best of the knowledge of the study this was the first of such a study undertaken anywhere in the world and specifically in Africa to assess the distributed effect of mobile money transactions and its subsequent adoption on inflation. It was also important to note that Kenya is the first country to have mobile payment solution that have been widely accepted and utilized by most of the people in doing day to day transactions. This study hoped to draw a link between the inflation in Kenya and the adoption of mobile technology in Kenya.

The study established that inflation rate had a mean of 8.5%, a minimum of 1.85% and a maximum 19.72% and that the fluctuations were due to a myriad of factors such as interest rates in the market and currency fluctuations at the international market. The research also found that the total monthly transactions had a minimum of 21,714 in the first month of introduction of mobile money and a maximum of 122 million transactions in the month of

May 2016, this indicating a trend in the growth of number of total transactions since introduction of the mobile money transfer and payment services. Subsequently, the total number of deposits value grew from 64 million to 227.94 billion in the month of May 2016. The study established that the number of transactions have been growing in volume and value in Kenya due to more people using this as a store of value and a payment option in their daily life.

To achieve the above objectives monthly data was collected of the variables inflation, total monthly mobile transactions and total value of monthly transactions in Kenya. The data collected was time series and was first examined using Microsoft Excel to ensure the variables were all present. The study applied a linear regression to assess the linear relationship of the variables. However the residuals in the linear regression model violated classical linear regression assumptions and the researcher undertook an autoregressive distributed lagged regression to establish the relationship of the variables.

The research established that the monthly mobile transactions had a lagged effect on inflation of one month while the effect of value of deposits of mobile money had a lagged effect on inflation of one month as well. With the variables affecting inflation independently the research choose to use an autoregressive distributed lagged regression model to explain the relationship of both independent variables on the dependent variable significantly.

The autoregressive distributed lagged regression on total monthly transactions showed that a 1% increase in monthly transactions caused a 0.5% decrease in inflation in the current month and a lagged effect of one month resulted in a decrease of inflation by 0.25%. Inflation was also decreased by -0.10% due to an increase in total value of monthly transactions by 1% and a one month lag of total value of mobile transactions would cause a decrease in inflation by 0.11%. The study hoped to explain the relationship of money circulation through the

mobile platforms in the economy and the effect the transaction and value of deposits on inflation.

5.3 Conclusion

The study intended to analyze the effect of mobile money transactions on inflation over the past eight years in Kenya. Since inception of mobile money transfer in March 2007 they have taken a key role in the transfer and payment system in the economy. The study findings can help government and central bank in guiding the policy and management of inflation in Kenya. Inflation is a key economic factor and the government has keen interest as the regulator. Hence the study also gives a clear picture of the relationship between mobile money transaction and inflation.

The study points out the effect of mobile money on inflation, growth of inflation and how it can be regulated and measured. The study found out that an increase in mobile transaction in Kenya and deposit levels also could affect inflation both positively and negatively in the current month while the lagged effect of both variable results in increase in inflation.

The study undertook autoregressive distributed lagged regression model of inflation of itself to establish the impact of inflation in past months to inflation in this current month as indicated in Table 4.4 and Table 4.5. The data exhibits that 1% increase in inflation in the previous month results in a 1.3% increase in inflation in the current month. Consequently, the model revealed that 1% increase in number of mobile transactions in lag two cause inflation to decrease by 0.41% in this month. The third lag of number of transactions on inflation revealed that a 1% increase in number of mobile transaction results into an increases inflation by 0.35%. The fourth lag of inflation on itself shows that a 1% increase in inflation causes inflation to decrease by 0.33%. The autoregressive distributed lagged regression of inflation on itself has a reliability of 95.55% and this shows that the model explains the effect of

inflation of itself by 95.55%. The Prob>F was 0.0000 indicating a high significance of the model because it was less than 0.05.

The study also conducted autoregressive distributed regression on inflation and number of monthly transaction and established that a 1% increase in monthly transactions in the current month would result in a decrease in inflation by 0.10% while a decrease in monthly transactions lagged to one month would result in a decrease in inflation in the current month. The study established that the inflation rate is also significantly affected by the previous month's inflation up to a lag of four months. The study established that the autoregressive distributed lagged regression of total monthly transactions had a lagged effect of inflation on itself as well. The lag of inflation in lag one showed that a 1% increase in inflation in the previous month results in an increase in inflation in the current month by up to 1.3%.

Secondly, the lag two of inflation on itself revealed that a 1% in inflation would result in decrease in inflation in the current month by 0.41%. Lag three revealed that a 1% increase inflation results in an increase in inflation by 0.33%. Lastly, the fourth lag revealed that a 1% increase inflation results in a decrease in inflation in the current by 0.33%.

The study established that inflation has a more significant impact on itself as established by the results of autoregressive distributed lagged regression. The results revealed that the impact of inflation on itself is more significant in explaining the results future and current inflation rates in the economy. Inflation was established have a lagged effect of up to four lags on itself as compared to the single lagged effect of number of monthly transactions and a single lag for the value of deposits on a monthly basis. The study concluded that the most significant model to explain inflation in the study was the autoregressive distributed lagged regression of inflation on itself as it indicates a high reliability as shown by the Prob>F

of 0.0000, and an R-Squared value of 95.55% meaning the relationship of inflation on itself is explained up to 95.55%.

5.4 Recommendations of the study

The findings of the study demonstrated that in deed mobile transactions have an effect on the inflation in Kenya. The results of the study further show that the numbers of monthly transactions have a lagged effect on inflation. Also the research found out that inflation is also affected by lagged effect of total monthly mobile transactions.

To sum up, various central banks and governments in the world during the last few years acknowledged the importance of keeping low level of inflation due to its positive effect on economic growth. To reduce inflation to one digit level and maintain it there. This study convincingly supports such initiatives and finds the level of inflation must be maintained at a low and manageable level.

The study went out to outline the effect of the relationship of mobile transaction in the economy and inflation. The study established that inflation is affected negatively by increase in money circulation in the economy. The results of the study can be used by the government to examine the effect of fiscal and monetary policy used by the government and central bank. The desired effect by the government to have a stable economy with fewer shocks and instability can be monitored and assessed through the movement of finances in the mobile platforms and assess the effect inflation has on growth and development of the economy.

Monetary economist suggest that money is the principle factor affecting and influencing the inflation rate and there is little other factors can do without the regulation of liquidity in the economy. The study established that inflation is going up or down in relation to the change in money supply in the economy, money supply is seen to increase due to

changes in interest rates that increase borrowing and the changes in currency strength or balance of payment.

In Kenya, the general acceptance of mobile money solutions have been highly accepted and adopted to be present in most spheres of financial transactions. In Kenya over 30 million people have access to financial services and payment solutions through their gadgets or handset. Access to financial services is a key goal to government as this penetration is linked to other social economic benefits within Kenya. Even as this development is attributed to mobile transactions there can be negative effects that may be a result of increased use of these services such as inflation which need to be monitored and controlled by the authorities.

5.5 Limitation of the study

Time was the major constrain of the research and this impeded further analysis of the variable in the research. Secondly, the research employed the use of secondary data and thus the reliability of the data is not guaranteed by the researcher due to use of secondary data. The study also had a difficulty in accessing a breakdown of the data relating to the mobile transactions such as the ages, sex and demographics of users of mobile money in Kenya. Lastly cost of undertaking the research were an impediment in undertaking the research.

5.6 Recommendation for further research

The study found that the relationship between inflation and mobile money has only been undertaken using lagged regression and thus recommends that it be explored using other data analysis techniques to build a wealth of information. The researcher further recommends that the impact of mobile transactions and the adoption of mobile money into the economy of Kenya had a growing effect on the cost of doing business. The research was conducted using the monthly variable while this relationship can be tested using daily variable to assess the same relationships.

This study only assessed the single impact of mobile transactions on inflation only and thus further research ought to be done to seek the growing impact of inflation on cost of doing business, lending, credit, employment, development, growth and social impact.

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APPENDIX I: Data Collection Work Sheet

Date	Value of monthly transactions (Ksh)	Inflation	Number of mobile transactions
03.2007			
04. 2007			
05.2007			
06.2007			
07.2007			
08.2007			
09.2007			
10.2007			
11.2007			
12.2007			

APPENDIX II: Regression Analysis

```
. regress Inflation LogofTransactions LogofDeposits
```

Source	SS	df	MS	Number of obs =	111
Model	135.14622	2	67.57311	F(2, 108) =	2.90
Residual	2516.75551	108	23.3032918	Prob > F =	0.0593
				R-squared =	0.0510
				Adj R-squared =	0.0334
Total	2651.90173	110	24.1081975	Root MSE =	4.8273

Inflation	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
LogofTransactions	-41.36204	17.19029	-2.41	0.018	-75.43617 -7.28791
LogofDeposits	42.48127	17.69401	2.40	0.018	7.408664 77.55388
_cons	-144.7892	64.3771	-2.25	0.027	-272.3957 -17.18257

```
. reg Inflation LogofTransactions l1.LogofTransactions l2.LogofTransactions
```

Source	SS	df	MS	Number of obs =	109
Model	139.040239	3	46.3467462	F(3, 105) =	2.01
Residual	2427.11066	105	23.1153396	Prob > F =	0.1178
				R-squared =	0.0542
				Adj R-squared =	0.0272
Total	2566.1509	108	23.7606565	Root MSE =	4.8078

Inflation	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
LogofTransactions					
--.	-7.682188	16.37783	-0.47	0.640	-40.1564 24.79202
L1.	-15.28527	23.15942	-0.66	0.511	-61.20612 30.63558
L2.	19.95189	11.68117	1.71	0.091	-3.209711 43.11349
_cons	31.78974	10.17384	3.12	0.002	11.61689 51.96259

```
. reg Inflation LogofTransactions l1.LogofTransactions
```

Source	SS	df	MS	Number of obs =	110
Model	107.434204	2	53.7171022	F(2, 107) =	2.30
Residual	2504.20681	107	23.403802	Prob > F =	0.1057
				R-squared =	0.0411
				Adj R-squared =	0.0232
Total	2611.64102	109	23.9600093	Root MSE =	4.8377

Inflation	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
LogofTransactions					
--.	-24.14876	11.82684	-2.04	0.044	-47.59409 -.7034194
L1.	21.85002	10.91987	2.00	0.048	.2026543 43.4974
_cons	26.2852	8.581027	3.06	0.003	9.274311 43.29608

```
. reg Inflation L1.Inflation L2.Inflation L3.Inflation L4.Inflation L5.Inflation
```

Source	SS	df	MS	Number of obs =	106
Model	2382.02297	5	476.404595	F(5, 100) =	444.80
Residual	107.105012	100	1.07105012	Prob > F =	0.0000
				R-squared =	0.9570
				Adj R-squared =	0.9548
Total	2489.12799	105	23.7059808	Root MSE =	1.0349

Inflation	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
Inflation					
L1.	1.261541	.0981464	12.85	0.000	1.066821 1.456261
L2.	-.3425048	.1597565	-2.14	0.034	-.6594571 -.0255524
L3.	.2723345	.1602136	1.70	0.092	-.0455248 .5901937
L4.	-.0871815	.1586919	-0.55	0.584	-.4020217 .2276586
L5.	-.1879029	.0968429	-1.94	0.055	-.3800364 .0042306
_cons	.7023882	.2218415	3.17	0.002	.2622609 1.142516

```
. reg Inflation L1.Inflation L2.Inflation L3.Inflation L4.Inflation
```

Source	SS	df	MS	Number of obs =	107
Model	2388.51765	4	597.129412	F(4, 102) =	547.36
Residual	111.274938	102	1.09093076	Prob > F =	0.0000
				R-squared =	0.9555
				Adj R-squared =	0.9537
Total	2499.79259	106	23.5829489	Root MSE =	1.0445

Inflation	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
Inflation						
L1.	1.332195	.0919054	14.50	0.000	1.149901	1.514489
L2.	-.4194963	.1557772	-2.69	0.008	-.7284797	-.1105129
L3.	.3548078	.1559777	2.27	0.025	.0454269	.6641888
L4.	-.3388094	.0916327	-3.70	0.000	-.5205625	-.1570564
_cons	.6040548	.214983	2.81	0.006	.177637	1.030473

```
. reg Inflation L1.Inflation L2.Inflation L3.Inflation L4.Inflation LogofTransactions L1.LogofTransactions
```

Source	SS	df	MS	Number of obs =	107
Model	2390.20498	6	398.367497	F(6, 100) =	363.52
Residual	109.587601	100	1.09587601	Prob > F =	0.0000
				R-squared =	0.9562
				Adj R-squared =	0.9535
Total	2499.79259	106	23.5829489	Root MSE =	1.0468

Inflation	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
Inflation						
L1.	1.312408	.0939286	13.97	0.000	1.126057	1.49876
L2.	-.4110756	.156716	-2.62	0.010	-.7219957	-.1001554
L3.	.3572396	.1570365	2.27	0.025	.0456836	.6687955
L4.	-.3335112	.0928836	-3.59	0.001	-.5177895	-.1492329
LogofTransactions						
--.	-.5028482	3.905365	-0.13	0.898	-8.250982	7.245286
L1.	.2578568	3.709664	0.07	0.945	-7.10201	7.617724
_cons	2.46813	2.096555	1.18	0.242	-1.691376	6.627636

```
. reg Inflation LogofDeposits L1.LogofDeposits L2.LogofDeposits
```

Source	SS	df	MS	Number of obs =	109
Model	137.206483	3	45.7354944	F(3, 105) =	1.98
Residual	2428.94441	105	23.1328039	Prob > F =	0.1219
				R-squared =	0.0535
				Adj R-squared =	0.0264
Total	2566.1509	108	23.7606565	Root MSE =	4.8097

Inflation	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
LogofDeposits						
--.	-11.07477	14.6164	-0.76	0.450	-40.05638	17.90685
L1.	-10.00641	19.45735	-0.51	0.608	-48.58674	28.57392
L2.	18.01404	10.2558	1.76	0.082	-2.321304	38.34939
_cons	42.64339	14.68677	2.90	0.004	13.52224	71.76454

```
. reg Inflation LogofDeposits L1.LogofDeposits
```

Source	SS	df	MS	Number of obs =	110
Model	103.568129	2	51.7840645	F(2, 107) =	2.21
Residual	2508.07289	107	23.4399336	Prob > F =	0.1148
				R-squared =	0.0397
				Adj R-squared =	0.0217
Total	2611.64102	109	23.9600093	Root MSE =	4.8415

Inflation	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
LogofDeposits						
--.	-22.12634	10.90159	-2.03	0.045	-43.73747	-.5152174
L1.	19.98496	10.0426	1.99	0.049	.0766656	39.89325
_cons	32.34956	12.07726	2.68	0.009	8.407788	56.29133

```
. reg Inflation L1.Inflation L2.Inflation L3.Inflation L4.Inflation LogofDeposits L1.LogofDeposits
```

Source	SS	df	MS	Number of obs =	107
Model	2390.01962	6	398.336603	F(6, 100) =	362.87
Residual	109.77297	100	1.0977297	Prob > F =	0.0000
				R-squared =	0.9561
				Adj R-squared =	0.9535
Total	2499.79259	106	23.5829489	Root MSE =	1.0477

Inflation	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
Inflation						
L1.	1.313599	.0939535	13.98	0.000	1.127198	1.5
L2.	-.4108567	.1569833	-2.62	0.010	-.722307	-.0994064
L3.	.3556896	.157243	2.26	0.026	.0437239	.6676553
L4.	-.3328238	.0929374	-3.58	0.001	-.517209	-.1484386
LogofDeposits						
--.	-.1058706	3.669536	-0.03	0.977	-7.386125	7.174384
L1.	-.1124308	3.487446	-0.03	0.974	-7.031424	6.806562
_cons	3.000068	2.924836	1.03	0.307	-2.802723	8.802859

APPENDIX III: Work plan

Activity	Timeframe	Output
Development of Proposal	March 2016	Proposal
Presentation and Approval	June 2016	Authority
Data collection and Analysis	August 2016	Draft Report
Report submission	September 2016	Final Report

APPENDIX IV: Data collected

Date	Inflation	Transaction	Log of Transactions	value in ksh	Log of Deposits
Mar, 2007	2.19	21,714	4.34	64,390,500	7.81
Apr, 2007	1.85	70,000	4.85	220,896,000	8.34
May, 2007	1.96	150,000	5.18	483,709,000	8.68
Jun, 2007	4.07	233,661	5.37	720,102,000	8.86
Jul, 2007	5.48	354,298	5.55	1,065,370,000	9.03
Aug, 2007	5.30	516,239	5.71	1,579,910,000	9.20
Sep, 2007	5.53	669,689	5.83	2,069,690,000	9.32
Oct, 2007	5.38	958,908	5.98	2,829,550,000	9.45
Nov, 2007	6.08	1,221,740	6.09	3,514,950,000	9.55
Dec, 2007	5.70	1,274,100	6.11	3,770,270,000	9.58
Jan, 2008	9.40	1,346,830	6.13	4,059,040,000	9.61
Feb, 2008	10.58	1,739,900	6.24	5,219,790,000	9.72
Mar, 2008	11.90	2,397,500	6.38	6,747,450,000	9.83
Apr, 2008	16.12	3,072,890	6.49	8,389,640,000	9.92
May, 2008	18.61	4,021,270	6.60	10,904,200,000	10.04
Jun, 2008	17.87	4,201,440	6.62	10,917,200,000	10.04
Jul, 2008	17.12	5,391,080	6.73	14,017,100,000	10.15
Aug, 2008	18.33	6,342,410	6.80	16,756,300,000	10.22
Sep, 2008	18.73	7,151,910	6.85	19,269,900,000	10.28
Oct, 2008	18.74	8,303,650	6.92	21,600,700,000	10.33
Nov, 2008	19.54	8,566,810	6.93	21,700,000,000	10.34
Dec, 2008	17.83	10,205,100	7.01	26,990,000,000	10.43
Jan, 2009	13.22	10,190,600	7.01	27,074,900,000	10.43
Feb, 2009	14.69	11,079,300	7.04	28,686,300,000	10.46
Mar, 2009	14.60	13,554,100	7.13	33,820,200,000	10.53
Apr, 2009	12.42	13,779,600	7.14	34,020,100,000	10.53
May, 2009	9.61	15,048,800	7.18	36,806,200,000	10.57
Jun, 2009	8.60	15,984,600	7.20	38,175,600,000	10.58
Jul, 2009	8.44	16,898,600	7.23	40,337,400,000	10.61
Aug, 2009	7.36	17,010,400	7.23	40,678,700,000	10.61
Sep, 2009	6.74	18,370,300	7.26	45,368,300,000	10.66
Oct, 2009	6.62	19,920,000	7.30	48,636,500,000	10.69
Nov, 2009	5.00	19,975,000	7.30	47,465,600,000	10.68
Dec, 2009	5.32	21,689,100	7.34	52,341,700,000	10.72
Jan, 2010	5.95	20,076,700	7.30	48,462,500,000	10.69

Feb, 2010	5.18	20,808,700	7.32	49,905,500,000	10.70
Mar, 2010	3.97	24,075,800	7.38	56,116,700,000	10.75
Apr, 2010	3.66	22,693,300	7.36	51,813,600,000	10.71
May, 2010	3.88	24,698,400	7.39	58,079,500,000	10.76
Jun, 2010	3.49	25,033,800	7.40	58,099,300,000	10.76
Jul, 2010	3.57	26,915,000	7.43	61,772,800,000	10.79
Aug, 2010	3.22	26,823,300	7.43	61,531,000,000	10.79
Sep, 2010	3.21	29,445,700	7.47	68,506,200,000	10.84
Oct, 2010	3.18	31,318,600	7.50	71,794,700,000	10.86
Nov, 2010	3.84	30,038,600	7.48	70,272,700,000	10.85
Dec, 2010	4.51	29,118,300	7.46	75,865,400,000	10.88
Jan, 2011	5.42	28,204,700	7.45	75,432,800,000	10.88
Feb, 2011	6.54	28,546,200	7.46	76,336,600,000	10.88
Mar, 2011	9.19	32,730,100	7.51	88,996,600,000	10.95
Apr, 2011	12.05	32,425,400	7.51	86,087,700,000	10.93
May, 2011	12.95	35,345,700	7.55	94,372,400,000	10.97
Jun, 2011	14.48	35,822,200	7.55	92,643,700,000	10.97
Jul, 2011	15.53	37,976,300	7.58	99,710,400,000	11.00
Aug, 2011	16.67	39,299,300	7.59	107,424,000,000	11.03
Sep, 2011	17.32	39,213,900	7.59	108,615,000,000	11.04
Oct, 2011	18.91	40,550,000	7.61	109,119,000,000	11.04
Nov, 2011	19.72	41,176,900	7.61	112,332,000,000	11.05
Dec, 2011	18.93	41,707,500	7.62	118,080,000,000	11.07
Jan, 2012	18.31	40,244,900	7.60	114,060,000,000	11.06
Feb, 2012	16.69	41,780,500	7.62	116,691,000,000	11.07
Mar, 2012	15.61	45,757,000	7.66	126,093,000,000	11.10
Apr, 2012	13.06	44,350,000	7.65	117,360,000,000	11.07
May, 2012	12.22	47,965,500	7.68	128,403,000,000	11.11
Jun, 2012	10.05	47,876,300	7.68	124,020,000,000	11.09
Jul, 2012	7.74	49,350,000	7.69	129,280,000,000	11.11
Aug, 2012	6.09	49,700,000	7.70	131,380,000,000	11.12
Sep, 2012	5.32	48,940,000	7.69	130,690,000,000	11.12
Oct, 2012	4.14	51,890,000	7.72	137,680,000,000	11.14
Nov, 2012	3.25	53,560,000	7.73	138,990,000,000	11.14
Dec, 2012	3.20	55,960,000	7.75	150,160,000,000	11.18
Jan, 2013	3.67	53,406,800	7.73	142,653,000,000	11.15
Feb, 2013	4.45	53,468,300	7.73	141,126,000,000	11.15

Mar, 2013	4.11	52,394,900	7.72	134,446,000,000	11.13
Apr, 2013	4.14	55,999,300	7.75	142,609,000,000	11.15
May, 2013	4.05	60,340,000	7.78	158,770,000,000	11.20
Jun, 2013	4.91	60,030,000	7.78	152,500,000,000	11.18
Jul, 2013	6.03	62,710,000	7.80	162,760,000,000	11.21
Aug, 2013	6.67	64,710,000	7.81	168,100,000,000	11.23
Sep, 2013	8.29	63,430,000	7.80	165,590,000,000	11.22
Oct, 2013	7.76	68,270,000	7.83	175,290,000,000	11.24
Nov, 2013	7.36	68,700,000	7.84	175,220,000,000	11.24
Dec, 2013	7.15	69,137,800	7.84	182,495,000,000	11.26
Jan, 2014	7.21	67,051,900	7.83	178,478,000,000	11.25
Feb, 2014	6.86	65,593,400	7.82	172,797,000,000	11.24
Mar, 2014	6.27	73,981,700	7.87	192,695,000,000	11.28
Apr, 2014	6.41	72,095,500	7.86	186,664,000,000	11.27
May, 2014	7.30	74,547,200	7.87	198,131,000,000	11.30
Jun, 2014	7.39	74,028,800	7.87	189,911,000,000	11.28
Jul, 2014	7.67	77,465,100	7.89	200,992,000,000	11.30
Aug, 2014	8.36	78,898,700	7.90	206,720,000,000	11.32
Sep, 2014	6.60	78,174,800	7.89	206,341,000,000	11.31
Oct, 2014	6.43	82,892,500	7.92	210,277,000,000	11.32
Nov, 2014	6.09	80,998,400	7.91	203,239,000,000	11.31
Dec, 2014	6.02	85,607,100	7.93	225,549,000,000	11.35
Jan, 2015	5.53	81,653,400	7.91	210,540,000,000	11.32
Feb, 2015	5.61	80,740,500	7.91	208,132,000,000	11.32
Mar, 2015	6.31	90,347,700	7.96	231,836,000,000	11.37
Apr, 2015	7.87	84,905,600	7.93	213,746,000,000	11.33
May, 2015	6.87	89,902,400	7.95	230,152,000,000	11.36
Jun, 2015	7.03	90,668,600	7.96	227,921,000,000	11.36
Jul, 2015	6.62	93,998,500	7.97	238,864,000,000	11.38
Aug, 2015	5.84	94,120,000	7.97	248,154,000,000	11.39
Sep, 2015	5.97	96,320,000	7.98	247,506,000,000	11.39
Oct, 2015	6.72	102,750,000	8.01	255,808,000,000	11.41
Nov, 2015	7.32	101,330,000	8.01	236,372,000,000	11.37
Dec, 2015	8.01	107,440,000	8.03	267,068,000,000	11.43
Jan, 2016	7.78	108,130,000	8.03	243,370,000,000	11.39
Feb, 2016	6.84	114,136,000	8.06	257,185,000,000	11.41
Mar, 2016	6.45	121,716,000	8.09	273,585,000,000	11.44

Apr, 2016	5.27	120,230,000	8.08	269,820,000,000	11.43
May, 2016	5.00	122,550,000	8.09	277,940,000,000	11.44

