International Journal of Economics, Commerce and Management
United Kingdom ISSN 2348 0386 Vol. VII, Issue 12, December 2019

http://ijecm.co.uk/

EFFECTS OF MONETARY POLICY ON INTEREST RATE SPREAD IN KENYA

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Abstract

Kenya's Vision 2030 indicates that the interest rate spread needs to be maintained at a sustainable level of about five to six per cent, to achieve the desired level of economic growth. Little empirical research has been done with respect to the effects of monetary policy on interest rate spread in Kenya. In addition, none of the studies has looked at the effects of monetary policy changes on interest rate spread by including the interest rate capping regime. The study therefore explored the effects of monetary policy on interest rate spread by including the first quarter of the interest rate capping regime, since its introduction. Average quarterly interest rate spread, lending rate and deposit rate were modeled against average quarterly central bank rate, credit reserve ratio, repo rate, interbank rate and Treasury bill rate. Secondary data from 2006 to 2016 was used. The auto regressive distributed lag model and Eviews were employed to analyze the data. The results revealed that the central bank rate and interbank rate had positive effect on interest rate spread, while cash reserve ratio, repo rate and Treasury bill rate had a negative effect on interest rate spread, in the long run. The cash reserve ratio, interbank rate, repo rate and Treasury bill rate were found to be significant monetary policy instruments and thus play an important role in explaining changes in the interest rate spread. The results also concluded that the lending rate was more elastic than deposit rate to changes in monetary policy instruments, in the long run.

Keywords: Interest rate spread; Monetary policy; Lending rate; Deposit rate; Banking sector; Kenya

INTRODUCTION

Background

The banking sector plays a fundamental role in the economy through the intermediation function. Banking business involves receiving funds from the public through demand, time and saving deposits, or borrowing from the public and other banks, and then using the funds wholly or partly for granting loans, advances and credit facilities and investing by other means (Chirwa, 2001). The process of accepting deposits and lending the funds takes place at an interest cost both to the depositor and the borrower.

The difference between the interest paid to the depositor and the interest charged on the borrower is what is called the interest rate spread (Tarus, Chekol and Mutwol, 2012). It is defined by market microstructure characteristics of the banking sector and the policy environment (Ngugi, 2001). A key indicator of banking sector financial performance, efficiency of financial intermediation and monetary policy impact is the interest rate spread.

Globally, the magnitude of interest rate spread varies across the world, which has been majorly attributed to the nature and efficiency of the financial sectors (Gatune and Gikera, 2015). It is inversely related to the degree of efficiency of the financial sector (Gatune and Gikera, 2015). Economies with weak financial sectors have much larger intermediation costs thus increased spread (Jayaraman and Sharma, 2003).

In developing economies, where capital markets are underdeveloped and commercial banks are greatly relied on for financing, the banking sectors play a crucial role in economic growth (Martinez and Mody, 2004). Tarus *et.al* (2012) noted that, it is therefore important that commercial banks provide financing services at the lowest possible cost. However, most countries in the sub Saharan Africa (SSA) still face high interest rate spreads, despite having undertaken structural adjustment reforms that resulted to liberalization of interest rates (Were and Wambua, 2014).

Researchers have ascribed the existence of high interest rate spread in developing countries to several factors which include high operating costs; financial repression; lack of competition among banks and market power of a few large dominant banks which enables them to manipulate industry variables such as lending and deposit rates and high inflation rates (Gatune and Gikera, 2015). A number of studies conducted on the factors influencing interest rate spread in Kenya identified credit risk, market structure, liquidity risk, operation cost, bank size, return on average assets, inflation, Treasury bill (Tbill) rate and central bank rate (CBR) as significant factors.

Since liberalization of the Kenyan banking sector in the early 1990s, the sector has experienced positive and encouraging growth, contributing towards making the sector the

financial hub of the East Africa region (Nyasha and Odhiambo, 2012). According to Financial Sector Deepening (FSD) Kenya (2015), the banking sector in Kenya has transformed significantly with increased depth, stability and access. Despite this, the sector has been a victim of challenges such as high cost of credit, high interest rate spread, comparatively high ratio of non-performing loans in some major banks, weak legal arrangements and slower transformation of local small privately owned banks (FSD Kenya, 2010; FSD Kenya, 2015).

Of concern is the high interest rate spread and its negative effects, which has attracted a lot of research and debate both in the private and public forums. Kenya's Vision 2030 indicates that the interest rate spread needs to be maintained at a sustainable level of about five to six percent to achieve the desired level of economic growth (Ondari, Murkas and Momanyi, 2016). Several reforms and monetary policy developments have taken place in a bid to tackle the issue of high interest rate spread.

In 2002, the Kenya African National Union (KANU) regime was replaced by a newly elected coalition government which pledged to uproot corruption among other vices in the economy (Gatune and Gikera, 2015). According to Market Intelligence (2003) as quoted by Gatune and Gikera (2015), the effect of this for the banking sector was the invoking of Section 44 of the Banking Act by the Finance minister during the 2003 budget. Gatune and Gikera (2015) stipulated that this and stricter supervision of banking activities by the Central Bank led to a decline in profits for the banking sector and a narrowing of interest rate spreads. Despite this, the interest rate spread stood at 13.36% which was still relatively high.

The central bank rate was then introduced in June 2006, in accordance with Section 36(4) of the Central Bank of Kenya (CBK) Act. Its purpose was to signal the stance of monetary policy so as to help regulate the high lending rates charged by banks and ultimately the high interest rate spread (Mwega, 2014). Before the introduction of the CBR, the bank rate being used since 2000 was three percent above the Tbill rate (Mwega, 2014). The effectiveness of the CBR in regulating the high lending rates however, has been weak in the last decade since its introduction, as the interest rate spread which stood at nine point zero eight percent, still remained relatively higher than the Kenya's Vision 2030 target of between five to six percent.

In August, 2016, a legislation of the Banking Act that capped lending rates at not more than four percent above the CBR and deposit rates at 70% of the CBR was approved; it came into effect on 14th September, 2016 (CBK, 2017). The Economic Survey (2017) stipulated that the amendment was aimed at protecting borrowers from high interest rates and reducing the high interest rate spread. This was not the first proposal of such an Act.

According to the Institute of Certified Public Accountants of Kenya (ICPAK) (2016), in 2000, there was an attempt by Hon. Joe Donde through the Donde bill, to amend the CBK Act

and cap lending rates at four percent above the 91-day Tbill rate and the deposit rate at four percent below the 91-day Tbill rate, bringing the spread to eight percent. In addition, in 2013, the Parliamentary Budget Office proposed the pegging of the deposit rates on lending rates (Cytonn, 2016). However, both of these attempts were futile. The interest rate capping has been successful in reducing cost of borrowing and the interest rate spread (CBK, 2017). However, the interest rate spread target as postulated by Kenya's Vision 2030 has yet to be achieved.

The role of the financial sector in promoting economic growth and development is well acknowledged in Kenya's vision 2030. Given the dominant role the banking sector plays in the financial sector through carrying out the intermediation function, an analysis of interest rate spread in the banking sector is central in understanding the financial intermediation process and the macroeconomic environment in which banks operate (Were and Wambua, 2014).

Interest rate spread in Kenya

The difference between the interest rates at which banks lend money to borrowers and the interest rates they pay to depositors is generally known as interest rate spread (Chelang'a, 2015). Interest rate spread is calculated as follows:

Interest rate spread = Interest rate on loans – Interest rate on deposits……..(1.1)

Kenya's Vision 2030 indicates that the interest rate spread needs to be maintained at a sustainable level of about five to six percent to achieve the desired level of economic growth (Ondari *et.al*, 2016). The country's banking sector however, has been recording higher spreads, which has been a source of policy concern.

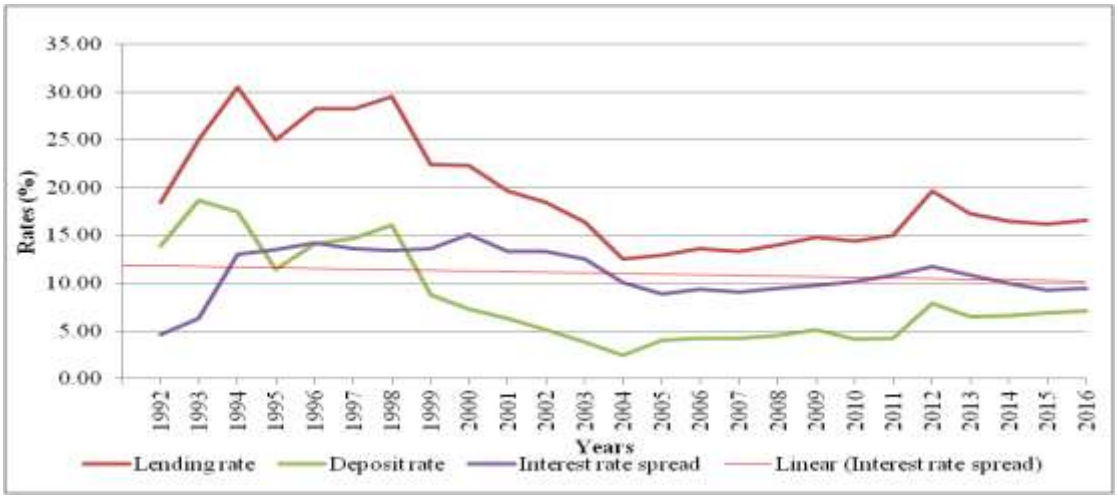

Figure 1: Weighted average commercial banks' lending rate, deposit rate and interest rate spread in Kenya: 1992-2016

Source: Central Bank of Kenya

Looking at Figure 1, a downward trend is seen in the interest rate spread following various financial reforms undertaken during the period. The abolishment of all charges and fees from the ceiling on commercial bank loan rates in early 1990s, brought about the spike in the average lending rates, which increased the interest rate spread between 1992 and 1994 (Nyasha and Odhiambo, 2012). Further amendments made on the Banking Act in 1995, aimed at increasing and strengthening the banking industry supervision, saw a further rise in the spread as a result of a significant drop in both the lending and the deposit rates (Beck *et.al*, 2010). The period after 1995 to 2003 saw a relatively stable interest rate spread, partly occasioned by the increased CBK's monetary autonomy through the amendment of the Central Bank Act in 1997, and the enhancement of capital requirements by the Central Bank in 1998 (Nyasha and Odhiambo, 2012; Beck *et.al*, 2010). A gradual decline in the spread followed between 2003 and 2005 largely because of the need of the banking sector to achieve the objective of narrowing high interest rate spreads set out in the Economic Recovery Strategy (ERS) paper on Wealth Creation and Employment among other requirements (Government of Kenya (GOK), 2003).

The introduction of the CBR in 2006 and the publication of Kenya's vision 2030 in 2007 as a long term development plan for the country, saw a relatively stable trend in the interest rate spread between 2006 and 2011 (GOK, 2007). A general downward trend in the spread was witnessed between 2012 and 2016 on account of the change of government following the elections held in 2012. The lowering of the CBR, interbank rate and repo rate in 2013 and the implementation of the interest rate capping law in mid-September 2016 also contributed to the downward trend in the spread.

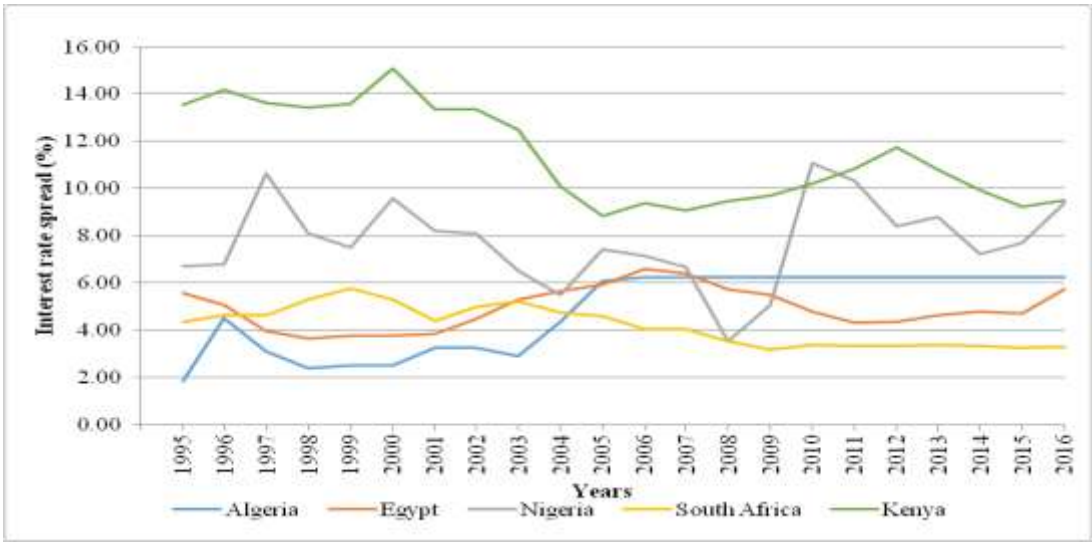

Figure 2: Comparison of interest rate spread between Kenya and the top economies in Africa: 1995-2016

Source: World Bank Indicators and Central Bank of Kenya

In comparison with the top four economies in Africa, figure 2 shows that the interest rate spread in Kenya has been way above that in Nigeria, South Africa, Egypt and Algeria. Algeria has the most stable interest rate spread having maintained it at six point two five percent for 10 years since 2006. South Africa has the lowest interest rate spread standing at three point two nine percent in 2016. While the trend has been declining in Kenya and South Africa, it has been rising in Algeria, Egypt and Nigeria between 1995 and 2016. South Africa's spread however, has been declining at a steadier rate compared to that of Kenya. The interest rate spread in Algeria, Egypt and South Africa has relatively been stable overtime as opposed to that of Kenya and Nigeria.

Evolution of the Monetary Policy in Kenya after liberalization

Central Bank of Kenya (2017) defines monetary policy as the decisions and actions taken by the Central Bank to ensure that the supply of money in the economy is consistent with growth and price objectives set by the government. The CBK has been mandated with the role of formulating and implementing monetary policy, and the Monetary Policy Committee (MPC) with the role of making monetary decisions in order to maintain price stability in the economy (CBK 2017). The instruments used by CBK are: the cash reserve ratio (CRR), central bank rate (CBR), discount window operations, open market operations (OMO), which involve the use of Tbills, Repos, Reverse Repos, Term Auction Deposits and Horizontal Repos, and foreign exchange market operations, which involve sale and purchase of foreign exchange to and from commercial banks (CBK, 2017).

The monetary policy in Kenya has gradually developed since its liberalization in the early 90s. 1990 to 1993 reflected a collapse of the monetary and fiscal policy, with the country experiencing the near-collapse of the shilling, the rapid growth of money supply reaching 34% in 1991, high inflation of close to 70% and the slowdown in economic growth to less than one percent in 1993 (Kinyua, 2001). In addition to this, the Central Bank Act allowed the override of CBK's Board of Directors decisions by the Minister of Finance, which in itself presented an anomaly. Hence the bank had only limited authority on the management of monetary policy (Ngugi, 2001).

In an effort to remedy the deteriorating situation, the Central Bank Act was changed in 1996, expanding the role of CBK to that of maintaining of price stability, promoting liquidity and ensuring exchange rate and financial stability, with the ultimate goal of long term economic growth (Kinyua, 2001). Moreover, there was a shift from use of broad money (M3) to broader money (M3X and M3XT) in 1998. M3X is an aggregation of M3 and foreign currency deposits (FCDs) held by residents; and M3XT is defined as M3X plus government papers held by non-bank public (Kinyua, 2001). The reserve money, made up of the CBK bank reserves and

currency in circulation, served as an operating target. OMO, the cash ratio, the reserve requirement, rediscount facilities and lender of last resort facility were also implemented (Nyorekwa and Odhiambo, 2014).

Controlled monetary expansion ensured that growth in broad money (M3) remained low at two point eight percent in 1999. This helped in achieving the main objective of having money supply expand at the same pace with production of goods and services hence, maintaining low inflation (Kinyua, 2001). In 2001/02, the government pursued tight monetary policy aimed at containing inflation within the five percent target and stabilizing of the shilling and exchange rate. Controlled domestic borrowing by the government led to lowered Tbill rates (Kinyua, 2001).

The period between 2003 and 2016 saw the introduction of the CBR in 2006 and discount window in 2011, as a means of providing temporary liquidity to banks in extreme cases (CBK, 2017). In addition, a legislation of the Banking Act that capped lending rates at not more than four percent above the CBR, and deposit rates at 70% of the CBR, was approved in August 2016 and implemented in mid-September 2016 to protect borrowers from high interest rates and reduce the high interest rate spread (CBK, 2017; Economic Survey, 2017).

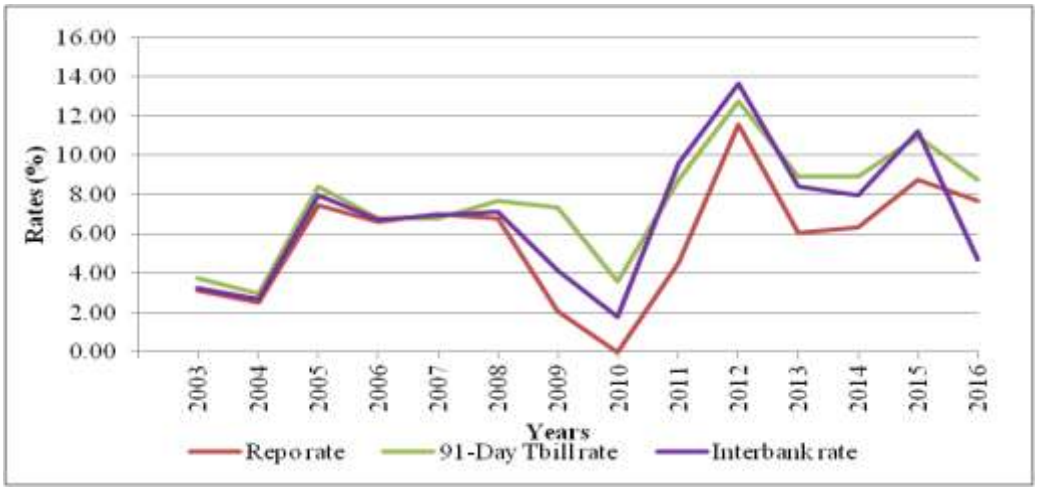

Figure 3: Average repo rate, 91-day Tbill rate and interbank rate in Kenya: 2003 - 2016

Source: Central Bank of Kenya

The figures 3 and 4 show the changes in the Kenya monetary policy from 2003 to 2016. Figure 3 shows cyclical movements of the average repo, 91-day Tbill and interbank rates. All the three rates sharply increased in 2005 due to improved liquidity conditions (Kenya Gazette, 2006). Relatively stable rates followed thereafter till 2008 occasioned partly by improved revenue collection and slower execution of budgeted expenditure (Kenya Gazette, 2006). This was followed by a sharp decline in 2010 majorly as a result of the economic slowdown which had

been caused by political instability; the economy needed some monetary stimulus hence an expansionary monetary policy (Economic Survey, 2010).

However, an acute rise of the rates was experienced in 2012, partly due to the upward adjustment of the CBR with a view of taming high inflation that was caused by a surge in the global commodity prices (Economic Survey, 2013). A decrease followed this phenomenon in 2013 due to the downward adjustment of the CBR for some monetary stimulus after the elections in 2012 (Economic Survey, 2013). Thereafter, the repo and 91-day Tbill rates steadily increased due to reduced pressure on domestic borrowing by the government brought about by the rationalization of expenditures (Monetary Policy Statement, 2016). The interbank rate on the other hand dipped in 2016.

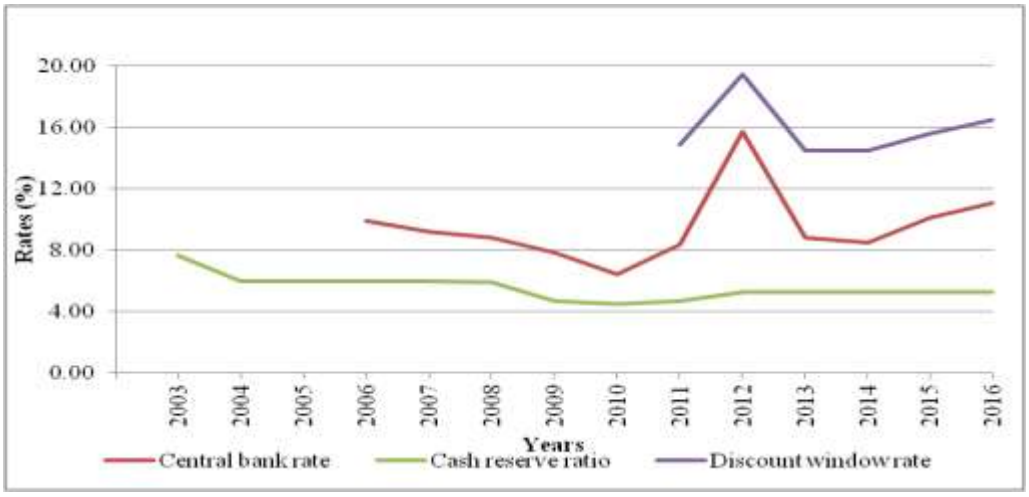

Figure 4: Average central bank rate, cash reserve ratio and discount window rate in Kenya: 2003 - 2016

Source: Central Bank of Kenya

Figure 4 shows that CRR reduced from seven point six seven percent in 2003 to six percent in 2004 and then to four point five percent in 2009, following largely the political instability (Economic Survey, 2010). The CBR also experience a decline till 2010 largely due to the economic slowdown which had been caused by political instability; the economy needed some monetary stimulus hence an expansionary monetary policy (Economic Survey, 2010). The CRR, CBR and discount window rate increased in 2012 by reason of reinforcing the gradual tightening of the monetary policy by the MPC, to curb inflationary pressures and achieve exchange rate stability (Economic Survey, 2012). There was a general decline in the CBR and the discount window rate from 2012 to 2014 followed by a rise in 2016 owing to MPC efforts to control the

incipient inflationary pressures and the exchange rate volatility (Economic Survey, 2016). The CRR was maintained at five point two five percent till 2016.

From the above, it is clear that CBK has over the years continuously refined its monetary policy operations and procedures so as to enhance the efficiency and effectiveness of delivery of its objectives in a changing financial and economic environment.

Monetary Policy and interest rate spread in Kenya

In a bid to ensure price stability, Central Banks adopt monetary policy instruments to control movements in interest rates in the economy. Generally, the Central Banks can undertake expansionary monetary policy or contractionary monetary policy. A contractionary monetary policy lowers bank reserves, deposits and loans and increases interest rates. This impacts the economy through an increase in the cost of borrowing, which then leads to a fall in investment and the general price level (Akhtar, 1995; Kelilume, 2014). The reverse situation applies with expansionary monetary policy but, this may not be the actual behavior of interest rate in practice (Kelilume, 2014).

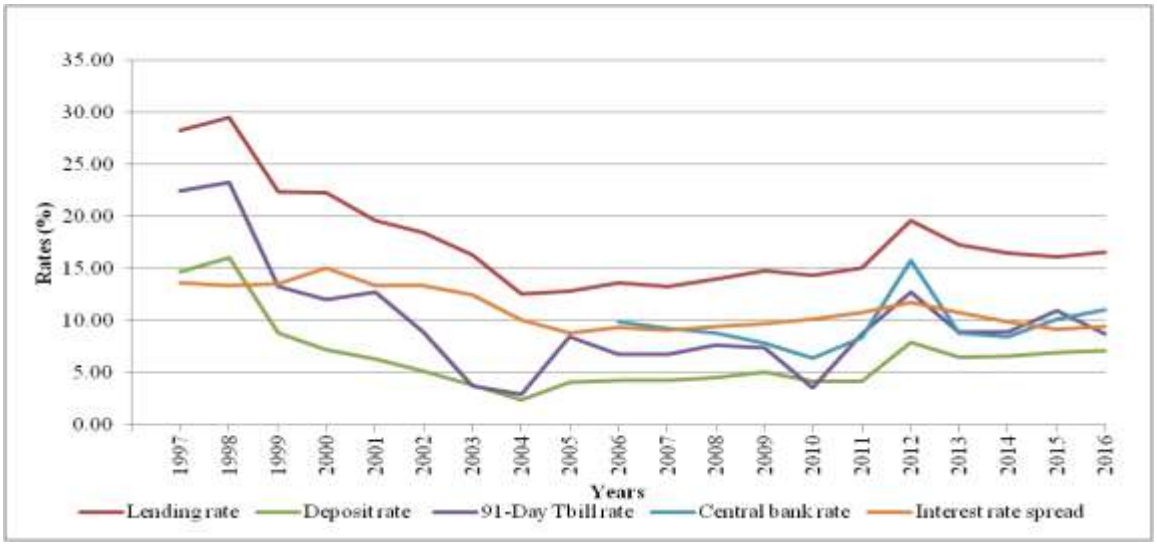

Figure 5: Average lending rate, deposit rate, 91-day Tbill rate, central bank rate and interest rate spread in Kenya: 1997 - 2016

Source: Central Bank of Kenya

Figure 5 shows the relationship between monetary policy and the interest rate spread in Kenya in the last two decades since 1997. The Tbill rate and the CBR have not been effective in regulation the lending and deposit rates and reducing the interest rate spread to levels consistent with Kenya's vision 2030 target. In the first decade, 1997 – 2006, the average Tbill

rate, lending rate and deposit rate are seen to gradually decline. However, the rate at which the lending and deposit rates were declining is not proportionate to the rate of decline in the Tbill rate. While the Tbill rate declined by approximately 70%, the lending rate and deposit rate declined by 52% and 71% respectively. As a result of this, the interest rate spread only dropped by roughly 31%.

During the second decade, 2007 – 2016, the rise and fall in the Tbill rate and CBR was not followed by same proportionate rise and fall in the lending and deposit rates. For instance, between 2009 and 2010, the average Tbill rate and CBR dropped by 3.78 and 1.46 points percentage respectively, while the lending and deposit rates only dropped by 0.45 and 0.93 percentage points respectively. This translated to a 0.48 percentage point drop in interest rate spread. Similarly, Tbill rate and CBR dropped by 3.83 and 6.92 percentage points between 2012 and 2013 while the lending rate only dropped by 2.34 percentage points, the deposit rate by 1.40 percentage points and the interest rate spread by 0.94 percentage points.

Credit growth and interest rate spread in Kenya

High interest rate spread hinders the access to credit by the private sector which is an impediment to economic growth (Rebei, 2014). In addition, Gatune and Gikera (2015) noted that high interest rate spreads are an impediment to financial intermediation, as they discourage potential savers due to low returns on deposits, and increase financing costs for borrowers, which lead to reduced investment and growth opportunities.

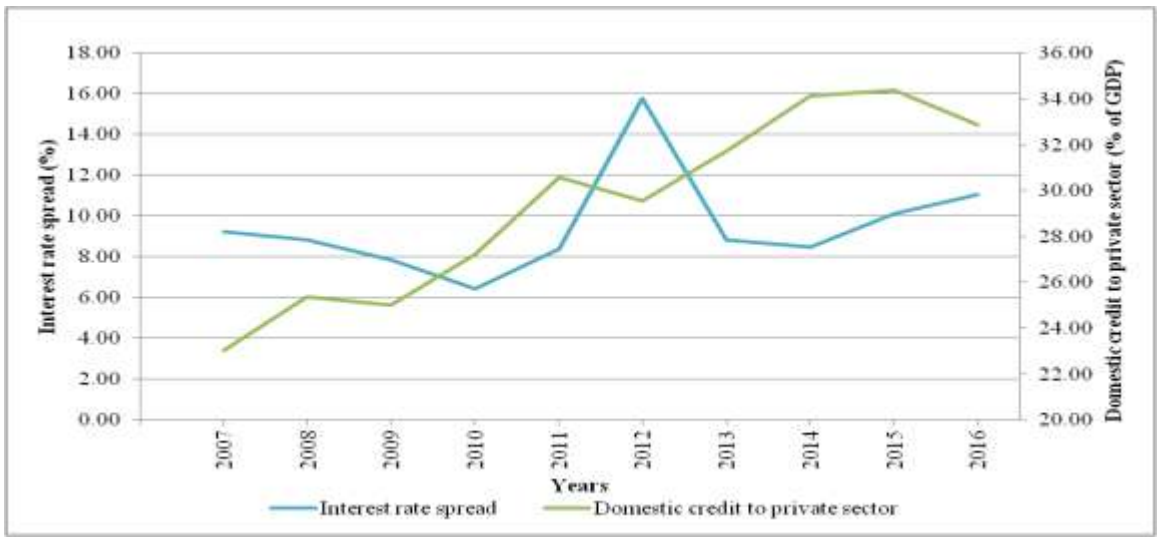

Figure 6: Interest rate spread and domestic credit to private sector in Kenya: 2007 - 2016

Source: Central Bank of Kenya

Kenya's banking sector has in the last decade recorded an expansion in the private sector credit as shown in figure 6. The figure shows that generally, domestic credit to private sector in Kenya has had a negative relationship with interest rate spread in the decade. The period 2010/11 presented an exemption where the increase of the interest rate spread saw an expansion in private sector credit on cause of the prevailing monetary policy regime at the time (CBK, 2011). Due to high interest rate spread, contracted deposits reduce the supply of the bank loans which increase the loan rate and thus the cost of borrowing becomes higher (Wambugu, 2014). Banks are therefore expected to carry out intermediation at the lowest cost possible with a view to promote investment opportunities and overall economic growth (Tarus *et.al*, 2012).

The statement of the problem

The banking sector in Kenya has been shown to exhibit significant and persistent high interest rate spread, compared to those in more developed African countries. High interest rate spread hinders the access to credit by the private sector, which is an impediment to economic growth. In addition, it discourages the deepening of financial intermediation which limits financing for potential borrowers due to increased financing costs.

Kenya's Vision 2030 indicates that the interest rate spread needs to be maintained at a sustainable level of about five to six percent to achieve the desired level of economic growth. Despite the ongoing financial sector reforms aimed at enhancing competition, and the monetary policy developments aimed at reducing the interest rate spread through the regulation of lending and deposit rates over the years, such as the introduction of the CBR and the implementation of the interest rate capping, the spread still remains relatively higher than the stipulated target.

In an attempt to understand how to tackle the high interest rate spread problem, various studies have been conducted on the factors that influence interest rate spread in Kenya. Despite having a large number of studies done on the determinants of interest rate spread, little empirical research has been done with respect to the effects monetary policy has on interest rate spread. In addition, none of the studies have looked at the effects of the changes in monetary policy instruments on interest rate spread by including the interest rate capping regime. Therefore, the contribution of this study was to investigate the effects of monetary policy on interest rate spread in the banking sector in Kenya, by including the first quarter of the interest rate capping regime since its introduction.

Research questions

i. How do changes in the monetary policy instruments influence the interest rate spread in Kenya's banking sector?

ii. What is the difference in the elasticity of lending rate and deposit rate to changes in monetary policy instruments in Kenya's banking sector?

Objective of the study

The general objective of this study was to deepen the understanding on the effects of monetary policy on interest rate spread in Kenya.

Specific objectives

i. To examine how changes in monetary policy instruments influence the interest rate spread in Kenya's banking sector.
ii. To establish the difference in the elasticity of lending rate and deposit rate to changes in monetary policy instruments in Kenya's banking sector.

Significance of the study

In the Kenya vision 2030, one of the stipulated constraints the financial services sector has to overcome is to lower the interest rate spread. The understanding of the effects monetary policy has on interest rate spread would help the CBK to come up with monetary policy reforms aimed at achieving the interest rate spread target stipulated in the vision 2030. This would encourage financial deepening through savings and credit expansion, and a safe, sound competitive and efficient banking system.

The results of the study would also be of great value to the various stakeholders, as understanding the relationship between monetary policy and interest rate spread would provide them with an insight into making more informed choices on borrowing, lending and saving. This would in turn help in short term and long term financial and strategic decision making.

The research would also be beneficial to researchers and scholars, through its contribution to the pool of knowledge on the effects of monetary policy on interest rate spread in Kenya and hence form a basis for further research and use as an academic reference material.

Scope of the study

The study focused on the effects of monetary policy on interest rate spread in Kenya from the third quarter of 2006 to the fourth quarter of 2016. The period of the study is critical because it reflects a decade of the operation of the central bank rate since its introduction in 2006. Quarterly data is also used to capture more accurately, any monetary policy changes and the corresponding effects on interest rate spread, lending rate and deposit rate. The monetary

policy instruments included are the five most commonly used by CBK which were the central bank rate, credit reserve ratio, interbank rate, repo rate and 91-day Treasury bill rate.

LITERATURE REVIEW

Theoretical literature

Keynesian liquidity preference theory of interest rate determination

The theory was put forward by Keynes (1936) and stated that interest rate is determined by the desire to hold money and the supply of money. Keynes (1936) defined interest rate as the price which equilibrates the desire to hold cash with the available quantity of cash. Keynes (1936) therefore viewed money as the liquid asset and the rate of interest as the payment for the loss of that liquidity.

Demand for money arises from three motives; transactions, precautionary and speculative. Under transactions motive, people desire to hold money for carrying out normal transactions of business and exchange; precautionary motive of money demand entails holding money for unseen contingencies that may require sudden expenditure; and speculative motive is the desire to hold money in order to gain profit through changes in prices in future (Stephanson, 1950). The supply for money is considered to be fixed by the state policy in the short run and Keynes treated it as a discretionary factor. Short term interest rate is therefore determined at the point of equilibrium between demand for money and the supply of money and is therefore viewed as a monetary phenomenon.

The role of interest rate as a reward of parting with liquidity makes interest rate a viable tool for government intervention through the monetary authority in the financial market to manage the economy in the short term. This theory therefore, forms the basis of interest rate channel of monetary policy which is fundamental to this study. This theory however, failed to adequately explain the role of commercial banks in monetary policy transmission under imperfect market conditions and is therefore considered as incomplete. The theory is criticized for assuming interest rates as monetary phenomena and ignoring the effect of savings and investments on interest rates.

The loanable funds theory of interest rate determination

The theory was developed by Robertson (1937) and later revised in greater detail by Halm (1946). This theory depicted that the rate of interest is determined by the interaction of the demand and supply of loanable funds. The origin and magnitude of interest rate is determined by the equilibrium of demand and supply of loanable funds, with the demand being governed by

profit expectations and the supply by present and future income and interest rates (Stephanson, 1950).

Halm (1946) defined loanable funds as the sum of money supplied and demanded in the credit market. The demand for loanable funds consists of consumer demand, which was reflected in the purchase of durable goods, producer demand and partly included cash balances (Halm, 1946). Stephanson (1950) indicated that an increasing number of producers were willing to use increasing amounts of loanable funds at a decreasing interest cost. Hence the demand curve is downward sloping. The assumption made about the supply of loanable funds is that people tend to save and hoard more at a higher rate of interest and thus the supply curve is upward sloping (Halm, 1946).

The theory links to the study by linking the determination of deposit rate and lending rates to the interaction of the demand and supply of loanable funds, in this case, deposits and loans. If the lending rate differs from deposit rate there exists a difference which is the interest rate spread. The theory is criticized for assuming that interest rate is determined by time preference.

Post Keynesian structuralist theory

The theory held that money supply is endogenous and emphasized on bank lending activity (Pollin, 1991). Palley (2001) asserted that bank credit leads to creation of deposits and ultimately increases money supply. The theory prescribed that commercial banks respond to changes in the market by taking positions that maximize their profits. This means that commercial banks react to monetary policy changes by revisiting their portfolios of assets and liabilities (Palley, 2001). The structuralists argued that commercial banks are profit seeking firms that continually create new financial instruments to economize on reserves, evade interest rate controls or move assets off their balance sheet.

Commercial banks interaction with Central Bank depends on the commercial banks liquidity position which means that, it is not always necessary for commercial banks to approach Central Bank for liquidity provision every time monetary policy changes (Pollin, 1991). Essentially, the theory claims that Central Bank has control over money supply only to the extent that changes in monetary policy affect the cost structure of commercial banks, compelling the banks to adjust their assets and liability positions. This then leads to a change in the commercial banks' ability to extend loans to their customers and ultimately changes money supply. The theory is important to this study because it appraises the credit channel of monetary transmission which focuses on bank behavior. This study accepts this approach as it explains monetary transmission in the presence of market information and information asymmetry.

Monti-Klein imperfect competition framework

This framework assumes that a commercial bank is confronted by a downward sloping demand for loans and an upward sloping supply of deposits. The bank seeks to maximize its profits, and its decision variables are the amount of loans and deposits (Freixas and Rochet, 1997). The model states that if the policy rate given by the Central Bank is fixed, then the bank's profits are given by the sum of intermediation margins on loans and deposits, less management costs. The higher the market power of a bank, the higher the intermediation margin (Freixas and Rochet, 1997). Market power will lead banks to quote lower deposit rates and higher loan rates leading to a high interest rate spread.

One implication of this framework is that, when management costs are assumed to be additive the bank's decision problem is separable; which means that the optimal deposit rate is independent of the characteristics of the loans market and the optimal loan rate is independent of the characteristics of the deposit market (Freixas and Rochet, 1997). In addition, under the same assumption, the sensitivity of optimal deposit rate and loan rate to changes in the policy rate depends on the number of banks in the banking sector. As the number of banks grows, the optimal loan rate decreases and the optimal deposit rate increases.

Empirical literature

A dynamic panel regression analysis by Folawewo and Tennant (2008) on 33 SSA countries from 1988 to 2005 and guided by the work of Demirguc-Kunt and Huizinga (1999), found the central bank's discount rate and reserve requirement to be statistically significant and positively related to interest rate spread. This study also concluded that Tbill rate has a negative and statistically significant effect on interest rate spread. Diagnostic tests carried out in the study included; the multicollinearity test by using the correction matrix and the unit root test for stationarity of data.

Mohsin (2011) studied the impact of monetary policy on lending and deposit rates in Pakistan by use of panel data analysis on monthly bank data for the period November 2001 to March 2011. The study applied the Philip and Loretan (1991) method which is an extension of Engle and Granger (1987). The study concluded that lending rate was co-integrated while deposit rate was not co-integrated with the central bank discount rate in the long run. In addition, it concluded that only 0.2 and 0.16 of the impact of a change in the discount rate is passed to the lending rate and deposit rate respectively.

Aress (2012) conducted a multiple regression analysis to determine the effect of monetary policy on interest rates in Kenya. The study, which was anchored on the loanable funds and Keynesian theories, found the Tbill rate and repo rate to have a positive effect on

lending rate while CBR had negative effect on lending rate in Kenya. Tbill and CBR were statistically significant while Repo rate was non-significant.

Makambi (2012) applied the Auto Regressive Distributed Lag (ARDL) estimation, Error Correction Model (ECM) and Augmented Dickey-Fuller (ADF) stationarity test to find out the nature and dynamics of adjustments of commercial banks' retail rates to monetary policy changes in Kenya. The study, which was anchored on the Post Keynesian structuralist theory and Monti-Klein profit maximization model, found that the interbank rate, repo rate and Tbill rate had a positive effect on both the lending rate and deposit rate. The study also found that lending rates were rigid upwards as they adjusted faster to decreases in monetary policy rates relative to increase in monetary policy rates. In contrast, deposit rates were found to be rigid downwards as they adjusted faster to increase in monetary policy rates compared to decreases in monetary policy rates. Diagnostic tests conducted by the study were; the Durbin Watson and Breusch-Godfrey LM test for autocorrelation, ARCH LM test for heteroskedasticity and F statistics for the stability of the models.

Oduori (2012), based on the theoretical work of Ho and Saunders (1981), used generalized least square regression analysis on monthly data between 2007 and 2011 to analyze the factors affecting interest rate spread amongst commercial banks in Kenya. The study found the 91-day Tbill rate to be negative and significant, CBR to be positive and significant and interbank rate and CRR to be negative and non-significant. The diagnostic tests carried out by the study were the Shapiro-Wilk normality test and autocorrelation test using the Auto Correlation Factor Plot (ACF). Nonetheless, the period covered by the study was relatively short which rendered it insufficient to draw inferences over the long run.

Garr and Coleman (2013), by use of panel data regression on time series data from 1990 to 2010 and guided by the works of Demirguc-Kunt and Huizinga (1998), Moore and Craigwell (2000) and Sologoub (2006), concluded that required reserve, Tbill rate and the discount rate were found to have no relationship with interest rate spread in Ghana. The study carried out the test for multicollinearity using the correlation matrix and the ADF Unit root test to test for stationarity of the data.

Nampewo (2013) found Tbill rate and CBR to have a positive and statistically significant effect on interest rate spread in Uganda; a study which was based on McKinnon and Shaw (1973) paradigm. The study employed the Engle and Granger (1987) two-step procedure and the ECM on quarterly data for the period 1995 to 2010. The study also tested for data stationarity using the ADF unit root test, for autocorrelation using the Durbin-Watson Statistic, for model specification using the Ramsey RESET test and for serial correlation using the Breusch-Godfrey Serial Correlation LM test.

A study by Kelilume (2014) on the effects of the monetary policy rate on interest rates in Nigeria, found that after first differencing, the monetary policy rate had a positive impact on deposit rate and prime lending rate. The study also found that the interest rate pass-through from monetary policy rate into prime lending rate was complete and significant while the pass-through to deposit rate was incomplete and non-significant on the basis of the traditional t-test. The study was based on the Monti-Klein framework and the marginal cost pricing model, also referred to as monetary policy approach (de Bondt, 2005) and adopted the Vector Autoregressive (VAR) methodology. The ADF unit root test was used to test for stationarity. The study however used a short time span of 2007 – 2012.

Rebei (2014), by use of the pooled estimated generalized least square method of estimation on panel data from 2009 Q1 to 2013 Q3, also found that policy interest rate proxied by Tbill rate, known as Bokolo bill rate, had a positively and statistically significant effect on interest rate spread in Solomon Islands. However the length and size of the sample used could not conduct analysis on individual banks.

Were and Wambua (2014) applied panel data regression analysis and tested for multicollinearity on annual data for the period 2002–2011 to empirically investigate the factors that drive interest rate spread of commercial banks in Kenya. It was anchored on the bank dealership model by Ho and Saunders (1981). The study found the effect of monetary policy, proxied by the CBR, on interest rate spread to be positive but not highly significant. Nevertheless the study used a simple measure of spread which is affected by the composition of lending of individual banks.

Ondari *et.al* (2016) used panel data regression on annual data between years 2002 to 2011 to analyze the determinants of interest rate spread in Kenya. The study was based on the model by Ghosh (2008) and the dealership model of Ho and Saunders (1981). Diagnostic tests carried out were; the unit root test, normality test, tests for fixed and random effects and tests for multicollinearity, autocorrelation and heteroskedasticity. The findings revealed Tbill rate to be positive and significant and CRR to be negative and non-significant in determining interest rate spread. The study however, did not include all the banks in study.

Overview of literature

The theoretical literature review discussed loanable funds theory of interest rate determination, Keynesian liquidity preference theory of interest rate determination, post Keynesian structuralist theory and Monti-Klein imperfect competition framework. Various studies carried out on how monetary policy influences interest rate spreads, deposit rates and lending rates were presented in the empirical literature review.

Empirical literature review showed that results varied for various studies and in different countries. While Folawewo and Tennant (2008) and Oduori (2012) concluded that Tbill rate had a negative effect on interest rate spread, Nampewo (2013) and Ondari *et.al* (2016) concluded that Tbill rate had a positive effect on interest rate spread. Similarly, while the results by Kelilume (2014) concluded that the monetary policy rate had a positive impact on deposit rate and prime lending rate, Mohsin (2011) concluded that lending rate was co-integrated while deposit rate was not co-integrated with the central bank discount rate in the long run. In addition, different models of estimation were used by different studies such as panel data regression, pooled generalized least square method, ECM, ARDL model and multiple regression among others.

Most studies used the Tbill rate, CBR and reserve requirement as the main proxies for monetary policy. The other monetary instruments have been under researched. In addition, none of the studies reviewed in Kenya has looked at the effect of monetary policy instruments on interest rate spread by including the interest rate capping regime. This in itself posed a research gap. There was therefore a need to extend investigations to accommodate the interest rate capping period.

As a result, the study was anchored on post Keynesian structuralist theory and Monti-Klein imperfect competition framework because Kenya's banking sector is characterized by commercial banks seeking to maximize their profits in the presence of information asymmetry and imperfect competition. In addition, Aress (2012) and Oduori (2012) guided the choice of independent variables and Makambi (2012) guided the use of ARDL estimation models by the study. ARDL model was chosen because it eliminates the problem of serial correlation in error term, it is fairly straightforward to determine the optimal number of lags to be included in an ARDL model and the model is valuable in testing for the presence of long run relationships between economic time series.

Diagnostic tests carried out by the study were: the stationarity test, multicollimearity test, heteroskedasticity test, serial correlation test, model specification and model significance and reliability, as in the studies: Folawewo and Tennant (2008), Makambi (2012), Garr and Coleman (2013), Nampewo (2013), Were and Wambua (2014) and Ondari *et. al* (2016).

METHODOLOGY

Research design

The study adopted the experimental research design which is often used where there is time priority in a causal relationship; in other words, the cause precedes the effect. The dependent variables used were the average interest rate spread, lending rate and deposit rate. The

independent variables used were the average central bank rate (CBR), cash reserve ratio (CRR), interbank rate, repo rate and 91-day Tbill rate.

Theoretical framework

The methodology adopted was anchored on the post Keynesian structuralist theory and Monti-Klein imperfect competition framework because Kenya's banking sector is characterized by commercial banks seeking to maximize their profits in the presence of information asymmetry and imperfect competition. This in turn leads to the determination of the lending and deposit rates and ultimately, interest rate spread.

Effects of changes in monetary policy on interest rate spread

In order to meet the first objective, this study adopted the Monti-Klein imperfect competition model developed by Freixas and Rochet (1997). The model held that banks face a downward sloping aggregate demand for loans and an upward sloping aggregate supply of deposits, that is, there is imperfect competition in the market for banks (Spahn, 2008). D is assumed to represent deposits, L represents loans, r_D represents return on deposits and r_L represents the price on loans (Spahn, 2008). Further the model assumes that technology is given which implies that the cost of handling deposits and loans is represented by C (D, L) (Spahn, 2008). The model also assumes that there are N banks (n = 1, 2,…, N) which use the same technology (Spahn, 2008).

Bank n's balance sheet is represented as: $D_n = L_n + M_n$……....(3.1)

Where; *Dn* are deposits (liability), *Ln* are loans (asset) and *Mn* are the interbank balances (asset). *Mn* is the net position of bank n on the interbank market where the interest rate m, is exogenous to the bank (Spahn, 2008).

Spahn (2008) showed that the profit of bank n is given by:

$$\pi_n = r_L(L_n + \sum_{m \neq n} L_m^*)L_n + mM_n - r_D(D_n + \sum_{m \neq n} D_m^*)D_n - C_n(D_n, L_n) \quad \text{……(3.2)}$$

Freixas and Rochet (1997) showed that equation 3.2 using equation 3.1, can be rewritten as the sum of the intermediation margins on loans and deposits minus costs as follows:

$$\pi_n = \{r_L(L_n + \sum_{m \neq n} L_m^*) - m\}L_n + \{m - r_D(D_n + \sum_{m \neq n} D_m^*)\}D_n - C_n(D_n, L_n) \quad \text{……(3.3)}$$

The unique Cournot equilibrium of the banking sector is characterized by an N-tuple vector (D_n^*, L_n^*) n = 1, 2,…, N and has each bank setting D_n^* = D^*/N and L_n^* = L^*/N (Freixas and Rochet, 1997).

The first order conditions are therefore given by:

$$\frac{\partial \pi_n}{\partial L_n} = r_L^{'}(L^*)\frac{L^*}{N} + r_L(L^*) - m - C_L^{'}(D,L) = 0 \quad \text{.....(3.4)}$$

$$\frac{\partial \pi_n}{\partial D_n} = -r_D^{'}(D^*)\frac{D^*}{N} + m - r_D(D^*) - C_D^{'}(D,L) = 0 \quad \text{.....(3.5)}$$

Assuming a linear cost function, $C_n(D_n, L_n) = \omega_D D + \omega_L L$, solving for the optimal deposit and loan rates from equations 3.4 and 3.5 gives:

$$r_L^* = -r_L^{'}(L^*)\frac{L^*}{N} + m + \omega_L \quad \text{.....(3.6)}$$

$$r_D^* = -r_D^{'}(D^*)\frac{D^*}{N} + m - \omega_D \quad \text{.....(3.7)}$$

From equation 3.6 and 3.7, it can be seen that in perfect competition where N → ∞, the deposit and loan intermediation margins are equal to their respective marginal costs (Spahn, 2008). With oligopoly, N becomes smaller and the loan intermediation margin increases since $r_L^{'} < 0$, whereas the deposit intermediation margin decreases since $r_D^{'} > 0$ (Lim, 2001).

Rewriting equations 3.6 and 3.7 obtains:

$$r_L^* = \omega_1 + \beta_1 m \quad \text{.....(3.8)}$$

$$r_D^* = \omega_2 + \beta_2 m \quad \text{.....(3.9)}$$

Where; $\omega_1 = \omega_L - r_L^{'}(L^*)\frac{L^*}{N}$ and $\omega_2 = -\omega_D - r_D^{'}(D^*)\frac{D^*}{N}$

ω_1 and ω_2 are constant loan and deposit intermediation margins while β_1 and β_2 measure the effect of a change in market rate on the loan and deposit rates (Spahn, 2008). Equations 3.8 and 3.9 form the basis of the study's empirical investigation.

One result that follows from this model is that, when management costs are assumed to be additive the bank's decision problem is separable; which means that the optimal deposit rate is independent of the characteristics of the loans market and the optimal loan rate is independent of the characteristics of the deposit market (Freixas and Rochet, 1997). This rather important assumption is employed in literature to justify the use of two separate equations of lending and deposit rate determination.

Let $r_L^* = L_t$ be the commercial banks lending rate, $r_D^* = D_t$ be the commercial banks deposit rate and $m = MP_t$ be the proxy for monetary policy rate at time *t*. Equations 3.8 and 3.9 can therefore be rewritten as equations 3.10 and 3.11.

$L_t = \beta_0 + \beta_1 MP_t$.....(3.10)

$D_t = \lambda_0 + \lambda_1 MP_t$……..……..(3.11)

Since both the lending rate and deposit rate are functions of monetary policy, it implies that interest rate spread is also a function of monetary policy and can be represented as:

$IRS_t = \theta_0 + \theta_1 MP_t$……..……..(3.12)

Where $IRS_t = L_t - D_t$ is the commercial banks interest rate spread at time *t*.

Difference in the elasticity of lending rate and deposit rate to changes in monetary policy

The methodology adopted to meet the second objective of the study borrows from the theoretical framework. The Monti-Klein imperfect competition model developed by Freixas and Rochet (1997) was used to yield equations 3.10 and 3.11. These two equations formed the basis of the empirical investigation of the second objective, which is to establish the difference in the elasticity of lending rate and deposit rate to changes in monetary policy.

Model specification

Given the scope and objectives of this study, three empirical Autoregressive Distributed Lag (ARDL) models were derived. The first ARDL model would help in analyzing the first objective while the other two ARDL models would analyze the second objective. The study adopted the ARDL model because the use of Akaike Information Criteria (AIC) to determine the appropriate number of lags absorb serial correlation and correctly specifies the consequent ARDL model (Greene, 2003).

The effects of changes in monetary policy on interest rate spread

Equation 3.12 presents the long run relationship between interest rate spread and the monetary policy rates. The interest rate spread – monetary policy rate ARDL (p,q) model in period *t* is:

$$IRS_t = \theta_0 + \sum_{i=1}^{p} \theta_i IRS_{t-i} + \sum_{i=0}^{q} \alpha_i MP_{t-i} + \varepsilon_t \quad \text{……..……..(3.13)}$$

Where:

IRS_t is the average quarterly interest rate spread in period *t*

IRS_{t-i} is the average quarterly interest rate spread in period *t – i*

MP_{t-i} is the average quarterly monetary policy rate in period *t – i*

θ_i are the coefficients for short run relationship

α_i are the coefficients for long run relationship

p and *q* are the number of lag for quarters

ε_t is the error term in period *t,* normally distributed about the mean of zero

To examine the long run effects of changes in monetary policy instruments on interest rate spread, equation 3.13 was estimated as follows:

$$IRS_t = \Omega_0 + \Omega_1 CB_t + \Omega_2 CR_t + \Omega_3 IB_t + \Omega_4 RP_t + \Omega_5 TB_t \quad \text{.....(3.14)}$$

Where:

IRS_t is the average quarterly interest rate spread in period *t*

CB_t is the average quarterly CBR at time *t*

CR_t is the average quarterly CRR at time *t*

IB_t is the average quarterly interbank rate at time *t*

RP_t is the average quarterly repo rate at time *t*

TB_t is the average quarterly 91-day Tbill rate at time *t*

Ω_i are the coefficients for long run relationship for *i* = 1,2,3,4,5

The difference in the elasticity of lending rate and deposit rate to changes in monetary policy

Equation 3.10 presents the long run relationship between the lending rate and the monetary policy rates, while equation 3.11 presents the long run relationship between the deposit rate and monetary policy rates. To meet the second objective, the study sought to derive two ARDL models; one showing the long run relationship between lending rate and monetary policy rates and the other showing the long run relationship between to the deposit rate and monetary policy rates. The study then analyzed the difference between corresponding coefficients in both models. The lending rate – monetary policy rate and deposit rate – monetary policy rate ARDL (p,q) models in period *t* were therefore given as:

$$L_t = \beta_0 + \sum_{i=1}^{p} \beta_i L_{t-i} + \sum_{i=0}^{q} \pi_i MP_{t-i} + \mu_t \quad \text{.....(3.15)}$$

$$D_t = \lambda_0 + \sum_{i=1}^{p} \lambda_i D_{t-i} + \sum_{i=0}^{q} \gamma_i MP_{t-i} + \eta_t \quad \text{.....(3.16)}$$

Where:

L_t is the average quarterly lending rate in period *t*

L_{t-i} is the average quarterly lending rate in period *t – i*

D_t is the average quarterly deposit rate in period *t*

D_{t-i} is the average quarterly deposit rate in period *t – i*

MP_{t-i} is the average quarterly monetary policy rate in period *t – i*

β_i and λ_i are the coefficients for short run relationship

π_i and γ_i are the coefficients for long run relationship

p and *q* are the number of lag for quarters

μ_t and η_t are the error term in period *t,* normally distributed about the mean of zero

In order to examine the difference in the elasticity of lending rate and deposit rate to changes in monetary policy instruments in the long run, equations 3.15 and 3.16 were estimated as follows:

$$L_t = \varphi_0 + \varphi_1 CB_t + \varphi_2 CR_t + \varphi_3 IB_t + \varphi_4 RP_t + \varphi_5 TB_t \quad \text{.....(3.17)}$$

$$D_t = \psi_0 + \psi_1 CB_t + \psi_2 CR_t + \psi_3 IB_t + \psi_4 RP_t + \psi_5 TB_t \quad \text{.....(3.18)}$$

Where:

L_t is the average quarterly lending rate in period *t*

D_t is the average quarterly deposit rate in period *t*

CB_t is the average quarterly CBR at time *t*

CR_t is the average quarterly CRR at time *t*

IB_t is the average quarterly interbank rate at time *t*

RP_t is the average quarterly repo rate at time *t*

TB_t is the average quarterly 91-day Tbill rate at time *t*

φ_i and ψ_i are the coefficients for long run relationship *i* = 1,2,3,4,5

Definition and measurement of variables

Table 1: Definition and measurement of variables

Type	Variable	Measure	Description
Dependent variables	Interest rate spread (*IRS)*	Percentage	The difference between commercial bank's lending rate and deposit rate. It is calculated as the difference between the average quarterly lending rates and average quarterly deposit rates of commercial banks in Kenya.
	Lending rate (*L*)	Percentage	The interest rate charged by financial institutions to borrowers for the principal amount of loans. It is expressed as the average quarterly lending rate of commercial banks in Kenya.

Table 1…

	Deposit rate (*D*)	Percentage	The interest rate paid by financial institutions to deposit account holders. It is expressed as the average quarterly deposit rate of commercial banks in Kenya.
Independent variables	Central bank rate (*CB*)	Percentage	The lowest rate- of interest Central Bank charges on loans to commercial banks. It is expressed as the average quarterly central bank rate in Kenya.
	Cash reserve ratio (*CR*)	Percentage	A specified percentage of total deposits commercial banks should keep in cash as reserve in case of mass withdrawals by customers. It is expressed as the average quarterly cash reserve ratio in Kenya.
	Interbank rate (*IB*)	Percentage	The rate of interest charged on short-term loans between banks. It is expressed as the average quarterly interbank rate in Kenya.
	Repo rate (*RP*)	Percentage	The rate at which eligible government securities by the Central Bank are auctioned in the market to commercial banks. It is expressed as the average quarterly repo rate in Kenya.
	Tbill rate (*TB*)	Percentage	The return on Treasury bills which are secure short term investments. It is expressed as the average quarterly 91-day Treasury bill rate in Kenya.

Data type and source

The study used secondary data on the interest rate spread, lending rate, deposit rate, CRR, CBR, interbank rate, repo rate and the 91-day Tbill rate. Average quarterly time series data was used ranging from the third quarter of 2006 to the fourth quarter of 2016. The data was obtained from the Statistical Bulletins published on CBK's website.

Data analysis approach

The first objective examined how changes in monetary policy instruments influence the interest rate spread in Kenya's banking sector. The long run ARDL equation 3.14 was modeled with the dependent variable being interest rate spread and the independent variables being the monetary policy rates namely central bank rate, cash reserve ratio, interbank rate, repo rate and 91-day Tbill rate.

Since the study used time series data, each variable was subjected to a unit root test using the Augmented Dickey-Fuller (ADF) test and the Phillip Perron (PP) test, to determine stationarity and order of integration. PP test is a superior criterion because it takes care of serial

auto correction and structural breaks. If the variables were found to be integrated at level I(0) and stationary, then the study proceeded to estimate the ARDL model. If the variables were found to be non stationary at levels, then the study carried out the first differencing and repeated the ADF and PP tests. To proceed to estimate the ARDL model, data must be integrated at level I(0) or after the first differencing I(1). This test was guided by Garr and Coleman (2013) and Kelilume (2014).

A cointegration analysis was also carried out using Johansen cointegration test. Trace and Eigen values were used to determine the number of cointegrating vectors. If the test found that there was at least one cointegrating vector equation among the variables and rejected the null hypothesis, then the study proceeded to estimate the ARDL model. Estimation of the ARDL model was done using the Eviews software.

After estimating the ARDL model, tests for multicollinearity, heteskedasticity, serial correlation, model specification and model significance and reliability were carried out. A test for multicollinearity was performed by carrying out a correlation analysis for each pair of independent variables to yield a correlation matrix. Multicollinearity occurs when one independent variable can be used to predict another independent variable because of very high inter-association. A correlation coefficient of 0.8 and above implies severe multicollinearity. Folawewo and Tennant (2008) guided the use of this test.

A heteroskedasticity test was carried out using the Breusch-Pagan-Godfrey test. The null hypothesis of no heteroskedasticity was assumed and tested at five percent level of significance The Breusch-Pagan-Godfrey test concludes that heteroskedasticity exists when the p value is less than five percent level of significance. The Breusch-Godfrey Serial Correlation LM test was conducted to test for serial correlation on the residuals. The null hypothesis of no serial correlation was assumed and tested at five percent level of significance. The Breusch-Godfrey test concludes that serial correlation exists when the p value is less than five percent level of significance. These tests were guided by Makambi (2012) and Nampewo (2013).

The Ramsey RESET was conducted to test for model specification. The null hypothesis of correct model specification was assumed and tested at five percent level of significance. RESET concludes that a model is correctly specified when the p value is less than 0.05 level of significance. Nampewo (2013) guided the use of this test. Further, F statistics and R-squared were used to evaluate the significance and reliability of the model. Significance of individual coefficients was tested using the t statistics and corresponding p values at five percent level of significance.

The second objective established the difference in the elasticity of lending rate and deposit rate to changes in monetary policy instruments in Kenya’s banking sector. The ARDL

equations 3.17 and 3.18 were modeled with the dependent variables being lending rate and deposit rate and the independent variables being the monetary policy rates namely central bank rate, cash reserve ratio, interbank rate, repo rate and 91-day Tbill rate.

A similar procedure as that in objective one was followed. First, a stationarity test was carried out on all the variables in each model using the ADF and PP tests. Secondly, a cointegration analysis was carried out to find out whether there was at least one cointegrating vector equation among the variables. Thirdly, long run lending rate – monetary policy and deposit rate – monetary policy ARDL models were estimated. Then, the post estimation diagnostic tests for multicollinearity, heteroskedasticity, serial correlation, model specification and model significance and reliability were carried out. Lastly, the long run coefficients of the lending rate – monetary policy rates and deposit rate – monetary policy rates ARDL models were compared and used to explain the difference in the elasticity of lending rate and deposit rate to changes in monetary policy instruments as follows:

$$\text{Difference in elasticity} = \begin{Bmatrix} \text{Lending rate } (L_t) \text{ is more elastic than Deposit rate } (D_t) \text{ if } |\varphi_i| > |\psi_i|, \text{ for } i = 1, 2, 3, 4, 5 \\ \text{Lending rate } (L_t) \text{ is less elastic than Deposit rate } (D_t) \text{ if } |\varphi_i| < |\psi_i|, \text{ for } i = 1, 2, 3, 4, 5 \\ \text{Lending rate } (L_t) \text{ is equally elastic as Deposit rate } (D_t) \text{ if } |\varphi_i| = |\psi_i|, \text{ for } i = 1, 2, 3, 4, 5 \end{Bmatrix} \quad ...(3.19)$$

FINDINGS

Descriptive statistics

This section presented descriptive statistics for commercial banks' interest rate spread, lending rate, deposit rate and monetary policy rates – central bank rate (CBR), cash reserve ratio (CRR), interbank rate, repo rate and Tbill rate. Quarterly weighted averages of the interest rate spread, lending rate and deposit rate, and quarterly averages of the CBR, CRR, interbank rate, repo rate and Tbill rate, from the third quarter of 2006 to the fourth quarter of 2016 were used. The results in table A.1 in the appendices show that the interest rate spread, lending rate and deposit rate during the time of study had means of 10.0238, 15.6802 and 5.6571, medians of 9.8450, 14.9000 and 5.5150 and standard deviations of 1.0871, 1.9942 and 1.4329 respectively. From these results, the lending rate had a higher variation than the deposit rate. The results further indicated that the CRR had the least mean (5.2440), median (5.2500) and standard deviation (0.4993) among all the monetary policy rates used in this study. The CBR had the highest mean of 9.4840 and the interbank rate had the highest standard deviation of 4.5804, among all the monetary policy rates.

Time series properties

The study used quarterly time series data. As a result, stationarity tests and cointegration analysis were carried out.

Test for Stationarity

Stationarity test is conducted to determine the stationarity of time series and order of integration of the variables. This ensures that the times series has a constant mean and variance and as a result, the time series yields meaningful regression results. The study employed the Augmented Dickey-Fuller (ADF) test and the Phillip-Perron (PP) test. The hypothesis tested was:

H_0: The time series data is not stationary; unit root exists

Ha: The time series data is stationary; unit root does not exist

The results were presented in table A.2 in the appendices. The ADF results show that the interest rate spread was non-stationary at level, with intercept only and trend and intercept, for all levels of significance. However, it was found stationary after first difference and integrated of order one I(1), with intercept only, at 10% level of significance. On the other hand, ADF statistics concluded that lending rate, deposit rate, CBR, CRR, interbank rate, repo rate and Tbill rate were stationary at level and integrated of order zero I(0), at respective levels of significance.

By use of PP statistics, none of the variables was stationary at level and I(0). However after the first difference, the interest rate spread, lending rate and deposit rate were found to be stationary and I(1), with intercept only; while the CBR, CRR, interbank rate, repo rate and Tbill rate were found to be stationary and I(1), with intercept only and trend and intercept, at respective levels of significance.

Cointegration analysis

Johansen cointegration test was applied in examining the number of cointegrating vectors in the model where the Trace and Eigen values were used to determine the number of cointegrating vectors. Johansen's technique was used because it licenses for more than one cointegrating relationship unlike the Engle– Granger technique.

The cointegration analysis for the interest rate spread – monetary policy model, derived to examine the first objective of the study, was presented in table 2.

Table 2: Cointegration results for interest rate spread – monetary policy model

Sample (adjusted): 2007Q1 2016Q4				
Included observations: 40 after adjustments				
Trend assumption: Linear deterministic trend				
Series: *IRS CB CR IB RP TB*				
Lags interval (in first differences): 1 to 1				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.6049	96.6664	95.7537	0.0463
At most 1	0.3934	57.5244	69.8189	0.7407
At most 2	0.3080	27.5291	47.8561	0.8335
At most 3	0.1638	12.8031	29.7971	0.9003
At most 4	0.1197	5.6482	15.4947	0.7366
At most 5	0.0136	0.5469	3.8415	0.4596
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.6049	42.1420	40.0776	0.0133
At most 1	0.3934	19.9954	33.8769	0.7570
At most 2	0.3080	14.7260	27.5843	0.7695
At most 3	0.1638	7.1549	21.1316	0.9476
At most 4	0.1197	5.1013	14.2646	0.7290
At most 5	0.0136	0.5469	3.8415	0.4596
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Table 2 shows that the results from both unrestricted cointegration rank test (Trance) and unrestricted cointegration rank test (Maximum Eigenvalue) concluded that there was one cointegrating vector equation among the variables (interest rate spread, CBR, CRR, interbank rate, repo rate and Tbill rate), at the 0.05 level of significance. That is, the null hypothesis was rejected because the p values, 0.0463 and 0.0133, were less than 0.05.

Cointegration analyses on variables used to achieve the second objective of the study were presented in tables 3 and 4. The cointegration analysis on the lending rate – monetary policy model was presented in table 3, while that of the deposit rate – monetary policy model was presented in table 4.

Table 3: Cointegration results for lending rate – monetary policy model

Sample (adjusted): 2007Q1 2016Q4				
Included observations: 40 after adjustments				
Trend assumption: Linear deterministic trend				
Series: *L CB CR IB RP TB*				
Lags interval (in first differences): 1 to 1				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.6672	96.5628	95.7537	0.0302
At most 1	0.4146	50.5543	69.8189	0.6135
At most 2	0.3150	29.1361	47.8561	0.7618
At most 3	0.1650	14.0022	29.7971	0.8405
At most 4	0.1211	6.7909	15.4947	0.6021
At most 5	0.0398	1.6254	3.8415	0.2023
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.6672	44.0085	40.0776	0.0171
At most 1	0.4146	21.4182	33.8769	0.6525
At most 2	0.3150	15.1340	27.5843	0.7375
At most 3	0.1650	7.2113	21.1316	0.9451
At most 4	0.1211	5.1654	14.2646	0.7208
At most 5	0.0398	1.6254	3.8415	0.2023
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Table 3 shows that the results from both unrestricted cointegration rank test (Trance) and unrestricted cointegration rank test (Maximum Eigenvalue) concluded that there was one cointegrating vector equation among the variables (lending rate, CBR, CRR, interbank rate, repo rate and Tbill rate), at the 0.05 level of significance. That is, the null hypothesis was rejected because the p values, 0.0302 and 0.0171, were less than 0.05.

Table 4: Cointegration results for deposit rate – monetary policy model

Sample (adjusted): 2007Q1 2016Q4				
Included observations: 40 after adjustments				
Trend assumption: Linear deterministic trend				
Series: *D CB CR IB RP TB*				
Lags interval (in first differences): 1 to 1				
Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.6512	95.8226	95.7537	0.0495
At most 1	0.4330	53.6895	69.8189	0.4750
At most 2	0.3240	30.9910	47.8561	0.6670
At most 3	0.1966	15.3302	29.7971	0.7583
At most 4	0.1243	6.5745	15.4947	0.6276
At most 5	0.0312	1.2659	3.8415	0.2605
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.6512	42.1331	40.0776	0.0289
At most 1	0.4330	22.6985	33.8769	0.5536
At most 2	0.3240	15.6608	27.5843	0.6944
At most 3	0.1966	8.7557	21.1316	0.8516
At most 4	0.1243	5.3086	14.2646	0.7025
At most 5	0.0312	1.2659	3.8415	0.2605
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

The Trance and Max-Eigen test statistics in table 4 concluded that there was one cointegrating vector equation among the variables (deposit rate, CBR, CRR, interbank rate, repo rate and Tbill rate), at the 0.05 level of significance. That is, the null hypothesis was rejected because the p values, 0.0495 and 0.0289 were less than 0.05. As a result of the cointegrating test results in tables 2, 3 and 4, the relationships between the variables could be described by ARDL model.

Regression results and interpretation

The effects of changes in monetary policy on interest rate spread

The first objective of the study was to examine how changes in monetary policy instruments influence the interest rate spread in Kenya's banking sector. The objective was achieved by running an ARDL model on average quarterly interest rate spread (*IRS*), alongside average quarterly CBR (*CB*), CRR (*CR*), interbank rate (*IB*), repo rate (*RP*) and Tbill rate (*TB*) as described in equation 3.13. Optimal lags selected using the Akaike's Information Criterion (AIC) were (4, 4, 0, 0, 1, 1). The ARDL results were presented in table A.3 in the appendices.

From the table, the value of R-squared shows that, variations in the CBR, CRR, interbank rate, repo rate and Tbill rate jointly explain 98.79 per cent of the variations in the interest rate spread, holding other factors constant. The remaining 1.21 per cent is explained by other variables not included in the model. The p value of 0.0001 of F-statistic indicates that the overall model was statistically significant in explaining the relationship between average quarterly interest rate spread and average quarterly CBR, CRR, interbank rate, repo rate and Tbill rate. This further shows that there was cointegration among the set of I(0) and I(1) variables used in the model.

As a result, the study performed long run estimation, as guided by equation 3.14 and presented the results in table 5.

Table 5: ARDL long run form results for interest rate spread – monetary policy model

Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Central bank rate	0.1211	0.1036	1.1690	0.2761
Cash reserve ratio	-1.5235	0.1981	-7.6890	0.0001
Interbank rate	0.6959	0.0974	7.1431	0.0001
Repo rate	-0.1752	0.0545	-3.2129	0.0124
Tbill rate	-0.6351	0.1309	-4.8506	0.0013
Constant	17.8772	1.4495	12.3337	0.0000

The results in table 5 yielded the following long run equation:

$$IRS_t = 17.8772 + 0.1211CB_t - 1.5235CR_t + 0.6959IB_t - 0.1752RP_t - 0.6351TB_t \quad ..(4.1)$$

Equation 4.1 shows that the CBR and interbank rate have positive effect on interest rate spread, while CRR, repo rate and Tbill rate have a negative effect on interest rate spread in the long run. A percentage increase in CBR led to a 0.1211 percentage increase in the interest rate spread, ceteris paribus; a percentage increase in CRR led to a 1.5235 percentage decrease in the interest rate spread, ceteris paribus; a percentage increase in interbank rate led to a 0.6959 percentage increase in the interest rate spread, ceteris paribus; a percentage increase in repo rate led to a 0.1752 percentage decrease in the interest rate spread, ceteris paribus; and a percentage increase in Tbill rate led to a 0.6351 percentage decrease in the interest rate spread, ceteris paribus.

Table 5 also shows that the CRR, interbank rate, repo rate and Tbill rate were significant at the five per cent level of significance. That is, the null hypothesis was rejected at 0.05 level of significance because the p values, 0.0001, 0.001, 0.0124 and 0.0013, were less than 0.05. CBR was found to be non significant at 0.05 level of significance as the p value of 0.2761 was greater than 0.05.

These results support Oduori, (2012), which found a positive relationship between central bank's discount rate and interbank rate, and interest rate spread and Folawewo and Tennant (2008), which found that Tbill rate had negative effect on interest rate spread. The results also support Oduori (2012) and Ondari *et.al* (2016) conclusions that CRR negatively affects interest rate spread.

The difference in the elasticity of lending rate and deposit rate to changes in monetary policy

The second objective of the study was to establish the difference in the elasticity of lending rate and deposit rate to changes in monetary policy in Kenya's banking sector. This objective was achieved by running two ARDL models and then comparing the corresponding coefficients in both models. The first model was run on average quarterly lending rate (*L*), alongside average quarterly CBR (*CB*), CRR (*CR*), interbank rate (*IB*), repo rate (*RP*) and Tbill rate (*TB*) as described in equation 3.15.

The other was run on average quarterly deposit rate (*D*), alongside average quarterly CBR (*CB*), CRR (*CR*), interbank rate (*IB*), repo rate (*RP*) and Tbill rate (*TB*) as described in equation 3.16. Optimal lags selected using the Akaike's Information Criterion (AIC) for equation

3.15 were (2, 4, 0, 4, 2, 4), and for equation 3.16 were (3, 4, 2, 0, 3, 2). The ARDL results for the two models were presented in tables A.4 and A.5 in the appendices, respectively.

From table A.4, the value of R-squared shows that, variations in the CBR, CRR, interbank rate, repo rate and Tbill rate jointly explain 99.77 per cent of the variations in the lending rate, holding other factors constant. The remaining 0.23 per cent is explained by other variables not included in the model. The p value of 0.0000 of F-statistic indicates that the overall model was statistically significant in explaining the relationship between average quarterly lending rate and average quarterly CBR, CRR, interbank rate, repo rate and Tbill rate. This further shows that there was cointegration among the set of I(0) and I(1) variables used in the model.

From table A.5, the value of R-squared shows that, variations in the CBR, CRR, interbank rate, repo rate and Tbill rate jointly explain 99.43 per cent of the variations in the deposit rate, holding other factors constant. The remaining 0.57 per cent is explained by other variables not included in the model. The p value of 0.0000 of F-statistic indicates that the overall model was statistically significant in explaining the relationship between average quarterly deposit rate and average quarterly CBR, CRR, interbank rate, repo rate and Tbill rate. This further shows that there was cointegration among the set of I(0) and I(1) variables used in the model.

As a result of this, the study performed long run estimations for both lending rate – monetary policy model and deposit rate – monetary policy model, as guided by equations 3.17 and 3.18. The results were presented in tables 6 and 7.

Table 6: ARDL long run form results for lending rate – monetary policy model

Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Central bank rate	1.0365	0.0701	1.0205	0.3316
Cash reserve ratio	-2.5975	0.2166	-11.9916	0.0000
Interbank rate	0.7904	0.1182	6.6852	0.0001
Repo rate	-0.4656	0.0553	-0.9310	0.3738
Tbill rate	-0.3384	0.1555	-2.1758	0.0546
Constant	25.7861	1.4487	17.7996	0.0000

The results in table 6 yielded the following long run equation:

$$L_t = 25.7861 + 1.0365CB_t - 2.5975CR_t + 0.7904IB_t - 0.4656RP_t - 0.3384TB_t \quad ..(4.2)$$

Equation 4.2 shows that the CBR and interbank rate have a positive effect on lending rate, while CRR, repo rate and Tbill rate have a negative effect on lending rate. A percentage increase in CBR led to a 1.0365 percentage increase in the lending rate, ceteris paribus; a percentage increase in CRR led to a 2.5975 percentage decrease in the lending rate, ceteris paribus; a percentage increase in interbank rate led to a 0.7904 percentage increase in the lending rate, ceteris paribus; a percentage increase in repo rate led to a 0.4656 percentage decrease in the lending rate, ceteris paribus; and a percentage increase in Tbill rate led to a 0.3384 percentage decrease in the lending rate, ceteris paribus.

The results were similar to Aress (2012), which found the relationship between CRR and the lending rate negative. The results were however contrary to Makambi (2012), which found that the repo rate and Tbill rate had a positive effect on the lending rate.

The results in table 6 show that the CRR and interbank rate were significant at 0.05 level of significance which means that the null hypothesis was rejected at 0.05 level of significance because the p values, 0.0000 and 0.0001, were less than 0.05. On the contrary, CBR, repo rate and Tbill rate were found to be non significant at 0.05 level of significance as the p values, 0.3316, 0.3738 and 0.0546 were greater than 0.05.

Table 7: ARDL long run form results for deposit rate – monetary policy model

Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Central bank rate	0.0715	0.2355	4.4010	0.0005
Cash reserve ratio	-1.8636	0.4513	-4.1297	0.0009
Interbank rate	0.4335	0.1345	3.2231	0.0057
Repo rate	0.0515	0.1322	3.5215	0.0031
Tbill rate	0.2728	0.1506	1.8118	0.0901
Constant	-8.6321	3.6103	-4.6069	0.0003

The results in table 7 yielded the following long run equation:

$$D_t = -8.6321 + 0.0715CB_t - 1.8636CR_t + 0.4335IB_t + 0.0515RP_t + 0.2728TB_t \quad ..(4.3)$$

Equation 4.3 shows that CBR, interbank rate, repo rate and Tbill rate have a positive effect on deposit rate, while CRR has a negative effect on deposit rate. A percentage increase in CBR led to a 0.0715 percentage increase in the deposit rate, ceteris paribus; a percentage increase in CRR led to a 1.8636 percentage decrease in the deposit rate, ceteris paribus; a percentage increase in interbank rate led to a 0.4335 percentage increase in the deposit rate, ceteris

paribus; a percentage increase in repo rate led to a 0.0515 percentage increase in the deposit rate, ceteris paribus; and a percentage increase in Tbill rate led to a 0.2728 percentage increase in the deposit rate, ceteris paribus. The results were similar to Makambi (2012), which found that the interbank rate, repo rate and Tbill rate had a positive effect on the deposit rate.

Table 7 shows that the CBR, CRR, interbank rate and repo rate were significant at 0.05 level of significance. That is, the null hypothesis was rejected at 0.05 level of significance because the p values, 0.0005, 0.0009, 0.0057 and 0.0031 were less than 0.05. Tbill rate however, was found to be non significant at 0.05 level of significance because the p value, 0.0901 was greater than 0.05. By looking at the absolute values of the coefficients in equations 4.2 and 4.3, a percentage increase in CBR, holding all other factors constant, led to an increase in lending rate by 1.0365 and an increase in deposit rate by 0.0715, which means that the effect on the lending rate was relatively higher than that on the deposit rate, by 0.9649 percentage points. A percentage increase in CRR, holding all other factors constant, led to a decrease in lending rate by 2.5975 and a decrease in deposit rate by 1.8636, which means that the effect on the lending rate was relatively higher than that on the deposit rate, by 0.7339 percentage points.

A percentage increase in interbank, holding all other factors constant, led to an increase in the lending rate by 0.7904 and an increase in deposit rate by 0.4335, which means that the effect on the lending rate was relatively higher than that on the deposit rate by 0.3569 percentage points. An increase in repo rate by one per cent led to a decrease in the lending rate by 0.4656 and an increase in the deposit rate by 0.0515, which means that the effect on the lending rate was relatively higher than that of the deposit rate by 0.4141 percentage points.

Similarly, a percentage increase in Tbill rate, holding all other factors constant, led to a decrease in the lending rate by 0.3384 and an increase in the deposit rate by 0.2728, which means that the effect on the lending rate was relatively higher than that on the deposit rate by 0.0656 percentage points. Hence in summary and following equation 3.19, the elasticity of the lending rate to changes in monetary policy is relatively higher than the elasticity of the deposit rate to changes in monetary policy.

Post estimation diagnostics

A series of diagnostic tests were carried out to determine the statistical soundness of the models and whether they are appropriate for forecasting.

Test for Multicollinearity

Multicollinearity test was carried out to determine the level of inter-association among the independent variables used in the study. To affirm the absence of severe multicollinearity, the

correlation coefficient between variables should be less than 0.8 (Gujarati, 2004). A correlation analysis for each pair of independent variables was carried out to yield correlation matrix given by table A.6 in the appendices. The results indicate that the correlation coefficients between independent variables were less than 0.8 and hence there was no severe multicollinearity.

Test for Heteroskedasticity

Heteroskedasticity transpires when the variance of the residuals in a model is not constant. A heteroskedasticity test on the three models was carried out using the Breusch-Pagan-Godfrey test. The hypothesis tested was:

H_0: Heteroskedasticity is not present

Ha: Heteroskedasticity is present

The Breusch-Pagan-Godfrey test for the three models; interest rate spread – monetary policy model, lending rate – monetary policy model and deposit – monetary policy model; yielded the results on tables A.7, A.8 and A.9 in the appendices. The results in all the three tables failed to reject the null hypothesis because the Chi-square p values of observed R-squared, 0.1899, 0.3975 and 0.4979, were greater than five per cent level of significance. As a result, the study concluded that there was no heteroskedasticity.

Test for Serial correlation

Serial correlation is present if residuals of one period are related to the residuals of the previous period. Breusch-Godfrey Serial Correlation LM test was employed in the study to test for the presence of serial correlation. The hypothesis tested was:

H_0: Serial correlation is not present

Ha: Serial correlation is present

The Breusch- Godfrey Serial Correlation LM test for the three models yielded the results on tables A.10, A.11 and A.12 in the appendices. The results in all the three tables confirmed that there was no evidence of serial correlation because the p values of the observed R-squared, 0.1406, 0.1223 and 0.1601, were greater than 0.05. Therefore, the study failed to reject the null hypothesis at 0.05 level of significance.

Test for Model specification

The Ramsey Regression Specification Error Test (RESET) was proposed by Ramsey (1969) to detect general functional form misspecification of a linear regression model. It is a diagnostic test for correctness of functional form. The hypothesis tested was:

H_0: The model is correctly specified Ha: The model is not correctly specified

The Ramsey RESET for the three models yielded the results on tables A.13, A.14 and A.15 in the appendices. The results in all the three tables failed to reject the null hypothesis because the p values of the F statistic, 0.1036, 0.1710 and 0.9224 were greater than 0.05 level of significance. As a result, the study concluded that the linear functional form of the three ARDL models was correctly specified and appropriate for estimation.

Summary of the findings

The results show that a percentage increase in CBR led to a 0.1211 percentage increase in the interest rate spread, ceteris paribus; a percentage increase in CRR led to a 1.5235 percentage decrease in the interest rate spread, ceteris paribus; a percentage increase in interbank rate led to a 0.6959 percentage increase in the interest rate spread, ceteris paribus; a percentage increase in repo rate led to a 0.1752 percentage decrease in the interest rate spread, ceteris paribus; and a percentage increase in Tbill rate led to a 0.6351 percentage decrease in the interest rate spread, ceteris paribus. The CRR, interbank rate, repo rate and Tbill rate were found to be significant at the five per cent level of significance.

In addition to this, the effect on the lending rate was relatively higher than that on the deposit rate, by 0.9649 percentage points, as a result of a percentage increase in the CBR, ceteris paribus; the effect on the lending rate was relatively higher than that on the deposit rate, by 0.7339 percentage points, as a result of a percentage increase in the CRR, ceteris paribus; the effect on the lending rate was relatively higher than that on the deposit rate by 0.3569 percentage points, as a result of a percentage increase in the interbank rate, ceteris paribus; the effect on the lending rate was relatively higher than that of the deposit rate by 0.4141 percentage points, as a result of a percentage increase in the repo rate, ceteris paribus; and the effect on the lending rate was relatively higher than that on the deposit rate by 0.0656 percentage points, as a result of a percentage increase in the Tbill rate, ceteris paribus.

CONCLUSIONS

The study was structured to investigate two specific objectives. The first objective was to examine how changes in monetary policy instruments influence the interest rate spread in Kenya's banking sector. The findings of the study show that there was long run cointegration between the interest rate spread and monetary policy rates - CBR, CRR, interbank rate, repo rate and Tbill rate. The results concluded that the CBR and interbank rate had positive effect on interest rate spread, while CRR, repo rate and Tbill rate had a negative effect on interest rate spread in the long run. The CRR, interbank rate, repo rate and Tbill rate were found to be

significant monetary policy instruments and thus play an important role in explaining changes in the interest rate spread.

The second objective was to establish the difference in the elasticity of lending rate and deposit rate to changes in monetary policy instruments in Kenya's banking sector. The findings of the study show that there was long run cointegration between the lending rate and monetary policy rates - CBR, CRR, interbank rate, repo rate and Tbill rate; and deposit rate and monetary policy rates - CBR, CRR, interbank rate, repo rate and Tbill rate. The results also show that the changes in CBR, CRR, interbank rate, repo rate and Tbill rate yielded a higher effect on the lending rate compared to the deposit rate. The study therefore concluded that the lending rate was more elastic than deposit rate to long run to changes in monetary policy instruments.

POLICY IMPLICATIONS

In light of the findings of this study, a number of policy implications were drawn. First the Central Bank should work toward gradually reducing and maintaining the central bank rate at a level that is in line with Kenya's vision 2030 interest rate spread target, of about five to six percent. Second, the Central Bank should also work towards gradually raising and maintaining the cash reserve ratio at a level that is in line with Kenya's vision 2030 interest rate spread target. Third, Central Bank should consider having policies that gradually increase Tbill rate and repo rate accordingly, in line with Kenya's vision 2030 interest rate spread target. The high responsiveness of interest rate spread to Tbill rate and repo rate also suggest that deregulation must eventually take place and thus this will permit the interest rate spread to narrow. Fourth, the Central Bank should concentrate on policies that work towards gradually increasing or reducing monetary policy instruments that correspondingly lower the lending rate, which in turn will allow the interest rate spread to decrease.

AREAS FOR FURTHER RESEARCH

The study explored the effects of monetary policy on interest rate spread in Kenya. The study was restricted to data on commercial banks in Kenya's banking sector. However, non-bank financial institutions play an important role in the banking sector in Kenya. Therefore, a possible area for further research is to expand the scope of the effects of monetary policy on interest rate spread to include non-bank financial institutions in Kenya. This would enable a holistic and in-depth understanding of how interest rate spread responds to changes in monetary policy in Kenya's banking sector.

REFERENCES

Akhtar, M. (1995). Monetary policy and long-term interest rates: A survey of empirical literature. Contemporary Economic Policy, 13(3), pp. 110-130.

Aress, A. (2012). The effect of monetary policy on interest rates in Kenya. Postgraduate. UON.

Beck, T., Cull, R., Fuchs, M., Getenga, J., Gatere, P., Randa, J. and Trandafir, M. (2010). Banking sector stability, efficiency and outreach in Kenya. World Bank Policy Research, Working Paper 5442.

Bernanke, B. and Gertler, M. (1995). Inside the black box: The credit channel of monetary policy transmission. Journal of Economic Perspective, 9(4), pp. 27-48.

Bertocco, G. (2006). Some observations about the endogenous money theory. (online) Available at: http://eco.uninsubria.it/dipeco/quaderni/files/QF2006_2.pdf

CBK, (2011). Kenya Financial Sector Stability report. (online) Available at: https://www.centralbank.go.ke/reports/financial-sector-stability-reports/

CBK, (2016). Monetary Policy Statement. (online) Available at: https://www.centralbank.go.ke/reports/monetary-policy-reports/

CBK, (2017). CBK Reports and Financial Statements. (online) Available at: https://www.centralbank.go.ke/reports/cbk-reports-and-financial-statements/

CBK, (2017). Central Bank of Kenya official website. (online) Available at: https://www.centralbank.go.ke/

Chelang'a, K. (2015). The determinants of interest rates spreads among commercial banks Kenya. Postgraduate. UON.

Chirwa, E. (2001). Market structure, liberalization and performance in the Malawian banking industry. AERC, Study 108.

Cytonn, (2016). The impact of capping interest rates on the Kenyan economy. (online) Available at: https://www.cytonn.com/download/The%20Impact%20of%20Capping%20Interest%20Rates%20on%20the%20Kenyan%20Economy%20vFFinal.pdf

Freixas, X. and Rochet, J. (1997). Microeconomics of banking. London: MIT Press.

FSD Kenya (2010). Impact Assessment Summary Report. Nairobi.

FSD Kenya (2015). Kenya's Financial Transformation in the 21st Century. Nairobi.

Folawewol, A. and Tennant, D. (2008). Determinants of interest rate spread in sub-Saharan African countries: a dynamic panel analysis. In: The 13th Annual African Econometrics Society Conference. 9–11 July 2008, Pretoria.

Garcia, P., Guevara, J. and Maudos, J. (2017). Interest rates and Net Interest Margins:

The impact of monetary policy. In Chesini, G., Giaretta, E., Paltrinieri, A. (Eds), The Business of Banking: Models, Risk and Regulation. London: Palgrave McMillan.

Garr, D. and Coleman, A. (2013). Macroeconomic and Industry determinants of interest rate spread - Empirical evidence. Developing Country Studies, 3(12).

Gatune, E. and Gikera, G. (2015). Factors influencing interest rate spread among commercial banks in Kenya. The Strategic Journal of Business and Change Management, 2(74), pp. 816-853.

GOK, (2003). Economic Recovery Strategy 2003-2007. Nairobi: Government Printer.

GOK, (2007). Kenya's Vision 2030. Nairobi: Ministry of State for Planning, National Development and Vision 2030.

Greene, W. (2003). Econometric Analysis, (5th ed.). New Jersey. Prentice Hall.

Gujarati, D. (2004). Basic Econometrics, (4th ed.). New York. The McGraw-Hill Companies.

Halm, G. (1946). Monetary Theory. Philadelphia: The Blackiston company.

Howels P. and Baikin, S. (2007). Financial markets and institutions. 5th edition. Edinburgh: Pearson Ed. Limited.

ICPAK, (2016). Capping interest rates: - bad economics or a necessary intervention. (online) Available at: https://www.icpak.com/wp-content/uploads/2015/09/Capping-Interest-Rates.pdf

Ireland, P. (2010). Monetary policy transmission mechanism. In Stephen, N. and Lawrence, E., Monetary Economics. London: Palgrave McMillan.

Jayaraman, T. and Sharma, R. (2003). Why is interest rate spread high in Fiji? Results from a preliminary study. Fijian Studies, 1(1).

Kelilume, I. (2014). Effects of the monetary policy rate on interest rates in Nigeria. The International Journal of Business and Finance Research, 8(1).

Kenya National Bureau of Statistics, (2010 - 2017). Economic surveys. Nairobi: Government Printer.

Keynes J. (1936). The general theory of employment, interest and money. Cambridge: Harcourt, Brace and Company.

Kinyua, J. (2001). Monetary policy in Kenya: Evolution and current framework. CBK Working Paper.

Lim, G. (2001). Bank interest rate adjustments: Are they asymmetric?. Economic Record, 77(237), pp. 135-147.

Makambi, S. (2012). Nature and dynamics of adjustment of commercial banks' retail rates to monetary policy changes in Kenya. Postgraduate. Kenyatta University.

Martinez, P. and Mody, A. (2004). How foreign participation and market concentration impact bank spreads: Evidence from Latin America. Journal of Money, Credit and Banking, 36 (3), pp. 511-537.

Mohsin, H. (2011). The Impact of Monetary Policy on Lending and Deposit Rates in Pakistan: Panel Data Analysis. The Lahore Journal of Economics, 16, pp. 199-213.

Moore, J. (1998). An optimising model for monetary policy analysis: can habit formation help?. Reserve Bank of Australia.

Mwega, F. (2014). Bank rate and the transmission mechanisms of monetary policy in Kenya. CBK Working Paper.

Nampewo, D. (2013). What drives interest rate spreads in Uganda's banking sector?. International Journal of Economics and Finance, 5(1), pp.76-85.

Ngugi, R. (2001). An empirical analysis of interest rate spread in Kenya. AERC, Study 106.

Nyasha, S. and Odhiambo, N. (2012). Banking sector reforms in Kenya: progress and challenges. Corporate Ownership and Control, 10 (1).

Nyorekwa, E. and Odhiambo, N. (2014). Monetary policy regimes and economic performance in Kenya. In: Macroeconomic processes and regional economies management: Problems and Perspectives in Management. Business perspective, 12(4).

Oduori, P. (2012). Determinants of interest rate spreads amongst commercial banks in Kenya. Postgraduate. UON.

Ondari, C., Mukras, M. and Momanyi, G. (2016). The Determinants of Interest Rates Spread in Kenya. International Journal of Economics, 1(1), pp. 12-30.

Palley, T. (2001). Endogenous Money: What is it and why does it matter. Public Policy Department.

Pollin, R (1991). Two theories of Money supply endogeneity: some empirical evidence. Journal of Post Keynesian economics, 13(3), pp. 366-395.

Ramsey, J. (1969). Tests for Specification Errors in Classical Linear Least Squares Regression Analysis. Journal of the Royal Statistical Society, 31(2), pp.350-371.

Rebei, N. (2014). Determinants of Interest Rate Spreads in Solomon Islands. IMF Working Paper 14/105.

Republic of Kenya, (2006). The Kenya Gazette. Nairobi: Government Printer.

Robertson, D. (1937). Alternative theories of the rate of interest. The Economic Journal, 47, pp. 428-436.

Spahn, S. (2008). The pass-through from market interest rates to retail bank rates in Germany. Doctor of Philosophy. University of Nottingham.

Stephanson, E. (1950). Analysis of the liquidity preference theory of interest. Postgraduate. The University of Montana.

Tarus, D., Chekol, Y. and Mutwol, M. (2012). Determinants of Net Interest Margins of Commercial Banks in Kenya: A Panel Study. The 2nd Annual International Conference on Accounting and Finance (AF 2012). 25-27 May, Colombo.

Wambugu, B. (2014). The effect of loan size on interest rate spread in commercial banks in Kenya. Postgraduate. UON.

Were, M. and Wambua, J. (2014). What factors drive interest rate spread of commercial banks? Empirical evidence from Kenya. CBK Working paper.

World Bank, (2017). World Development Indicators. (online) Available at: https://data.worldbank.org/data-catalog/world-development-indicators

APPENDICES

Table A.1: Descriptive statistics results

Variable	Obs	Mean	Std. Dev.	Min	Max	Median
Interest rate spread	42	10.0238	1.0871	6.0900	12.1700	9.8450
Lending rate	42	15.6802	1.9942	13.0700	20.2100	14.9000
Deposit rate	42	5.6571	1.4329	3.4400	8.4500	5.5150
Central bank rate	42	9.4840	2.8169	5.8300	18.0000	8.7900
Cash reserve ratio	42	5.2440	0.4993	4.5000	6.0000	5.2500
Interbank rate	42	7.4948	4.5804	1.0600	21.8700	7.0150
Repo rate	42	6.0007	3.8686	0.0000	16.6800	6.8050
Tbill rate	42	8.3202	3.2748	1.8200	19.3500	8.1250

Table A.2: Test for stationarity results

Variable	Type of test	Form of test	Test statistics	Conclusion
Interest rate spread (Level)	ADF	Intercept	-1.7398	Non-Stationary
		Trend and Intercept	-1.3433	
	PP	Intercept	-1.3707	Non-Stationary
		Trend and Intercept	-0.9198	
Interest rate spread (First difference)	ADF	Intercept	-2.6952*	Stationary
		Trend and Intercept	-2.8180	Non-Stationary
	PP	Intercept	-2.7529*	Stationary
		Trend and Intercept	-2.6792	Non-Stationary
Lending rate (Level)	ADF	Intercept	-2.7642*	Stationary
		Trend and Intercept	-2.7149	Non-Stationary
	PP	Intercept	-1.5367	Non-Stationary
		Trend and Intercept	-0.9699	
Lending rate (First difference)	PP	Intercept	-2.7013*	Stationary
		Trend and Intercept	-2.6478	Non-Stationary
Deposit rate (Level)	ADF	Intercept	-2.1136	Non-Stationary
		Trend and Intercept	-4.1433**	Stationary
	PP	Intercept	-1.1022	Non-Stationary
		Trend and Intercept	-1.9477	
Deposit rate (First difference)	PP	Intercept	-2.6168*	Stationary
		Trend and Intercept	-3.1946	Non-Stationary
Central bank rate (Level)	ADF	Intercept	-3.5161**	Stationary
		Trend and Intercept	-3.6251**	
	PP	Intercept	-1.9808	Non-Stationary
		Trend and Intercept	-2.0399	
Central bank rate (First difference)	PP	Intercept	-3.5539**	Stationary
		Trend and Intercept	-3.4857*	
Cash reserve ratio (Level)	ADF	Intercept	-2.5435	Non-Stationary
		Trend and Intercept	-10.5798***	Stationary
	PP	Intercept	-1.8303	Non-Stationary
		Trend and Intercept	-1.5313	
Cash reserve ratio (First difference)	ADF	Intercept	-2.9389*	Stationary
		Trend and Intercept	-2.6300	Non-Stationary
	PP	Intercept	-3.3358**	Stationary
		Trend and Intercept	-3.3513*	
Interbank rate (Level)	ADF	Intercept	-3.5187**	Stationary
		Trend and Intercept	-3.5655**	
	PP	Intercept	-2.4749	Non-Stationary
		Trend and Intercept	-2.4439	
Interbank rate (First difference)	PP	Intercept	-4.6977***	Stationary
		Trend and Intercept	-4.5799***	
Repo rate (Level)	ADF	Intercept	-2.6355*	Stationary
		Trend and Intercept	-2.6872	Non-Stationary
	PP	Intercept	-2.4361	Non-Stationary
		Trend and Intercept	-2.4344	
Repo rate (First difference)	PP	Intercept	-8.6653***	Stationary
		Trend and Intercept	-8.5576***	
Tbill rate (Level)	ADF	Intercept	-3.7599***	Stationary
		Trend and Intercept	-4.1557**	
	PP	Intercept	-2.6012	Non-Stationary
		Trend and Intercept	-2.7063	
Tbill rate (First difference)	PP	Intercept	-3.836***	Stationary
		Trend and Intercept	-3.735**	
Critical values	**Intercept only**	**Trend and Intercept**		
1% significance	-3.6329	-4.2436	*** Stationarity at 1% level of signifcance	
5% significance	-2.9484	-3.5443	** Stationarity at 5% level of signifcance	
10% signifcance	-2.6129	-3.2047	* Stationarity at 10% level of signifcance	

Table A.3: ARDL results for interest rate spread – monetary policy model

Sample (adjusted): 2007Q3 2016Q4					
Included observations: 38 after adjustments					
Maximum dependent lags: 4 (Automatic selection)					
Model selection method: Akaike info criterion (AIC)					
Dynamic regressors (4 lags, automatic): *CB CR IB RP TB*					
Fixed regressors: C					
Number of models evalulated: 12500					
Selected Model: ARDL(4, 4, 0, 1, 1, 0)					
Variable		Coefficient	Std. Error	t-Statistic	Prob.*
Interest rate spread					
	IRS(-1)	-0.0591	0.4429	-0.1334	0.8972
	IRS(-2)	0.5581	0.2604	2.1431	0.0645
	IRS(-3)	-0.3718	0.1882	-1.9757	0.0836
	IRS(-4)	-0.5421	0.2144	-2.5289	0.0353
Central bank rate					
	CB	0.1619	0.1984	0.8164	0.4379
	CB(-1)	-0.2777	0.1361	-2.0412	0.0755
	CB(-2)	-0.0873	0.1810	-0.4821	0.6427
	CB(-3)	-0.1195	0.2584	-0.4625	0.6561
	CB(-4)	0.4938	0.1488	3.3190	0.0106
Cash reserve ratio					
	CR	-1.4455	0.4575	-3.1595	0.0134
Interbank rate					
	IB	0.0484	0.0707	0.6841	0.5132
	IB(-1)	0.2633	0.0532	4.9458	0.0011
Repo rate					
	RP	-0.0215	0.0571	-0.3766	0.7163
	RP(-1)	-0.1694	0.0396	-4.2733	0.0027
Tbill rate					
	TB	-0.2332	0.0848	-2.7481	0.0251
	C	25.2938	3.8893	6.5034	0.0002
R-squared		0.9879	Mean dependent var		10.0838
Adjusted R-squared		0.9439	S.D. dependent var		1.1254
S.E. of regression		0.2666	Akaike info criterion		0.2150
Sum squared resid		0.5688	Schwarz criterion		1.5078
Log likelihood		25.9156	Hannan-Quinn criter.		0.6750
F-statistic		22.4524	Durbin-Watson stat		3.1211
Prob(F-statistic)		0.0001			
*Note: p-values at the 0.05 level					

Table A.4: ARDL results for lending rate – monetary policy model

Sample (adjusted): 2007Q3 2016Q4					
Included observations: 38 after adjustments					
Maximum dependent lags: 4 (Automatic selection)					
Model selection method: Akaike info criterion (AIC)					
Dynamic regressors (4 lags, automatic): *CB CR IB RP TB*					
Fixed regressors: C					
Number of models evalulated: 12500					
Selected Model: ARDL(2, 4, 0, 4, 2, 4)					
Variable		Coefficient	Std. Error	t-Statistic	Prob.*
Lending rate					
	L(-1)	-0.2910	0.2562	-1.1358	0.2825
	L(-2)	0.4948	0.1893	2.6137	0.0259
Central bank rate					
	CB	0.4662	0.0889	5.2447	0.0004
	CB(-1)	-0.2885	0.0993	-2.9045	0.0157
	CB(-2)	-0.0233	0.1078	-0.2160	0.8334
	CB(-3)	-0.5012	0.1290	-3.8854	0.0030
	CB(-4)	0.4037	0.0750	5.3834	0.0003
Cash reserve ratio					
	CR	-1.1275	0.2998	-3.7607	0.0037
Interbank rate					
	IB	-0.1047	0.0305	-3.4310	0.0064
	IB(-1)	0.1956	0.0339	5.7725	0.0002
	IB(-2)	0.0627	0.0446	1.4071	0.1897
	IB(-3)	0.3265	0.0453	7.2020	0.0000
	IB(-4)	0.1493	0.0604	2.4733	0.0329
Repo rate					
	RP	-0.0279	0.0321	-0.8706	0.4044
	RP(-1)	-0.0484	0.0241	-2.0080	0.0724
	RP(-2)	-0.0655	0.0289	-2.2693	0.0466
Tbill rate					
	TB	0.0040	0.0542	0.0731	0.9432
	TB(-1)	0.0771	0.0687	1.1227	0.2878
	TB(-2)	-0.0302	0.0687	-0.4396	0.6696
	TB(-3)	-0.0302	0.0606	-0.4982	0.6291
	TB(-4)	-0.2901	0.0519	-5.5930	0.0002
	C	20.5315	2.5238	8.1352	0.0000
R-squared		0.9977	Mean dependent var		15.8976
Adjusted R-squared		0.9914	S.D. dependent var		1.9733
S.E. of regression		0.1835	Akaike info criterion		-0.4143
Sum squared resid		0.3368	Schwarz criterion		0.7923
Log likelihood		35.8717	Hannan-Quinn criter.		0.0150
F-statistic		158.0694	Durbin-Watson stat		3.0924
Prob(F-statistic)		0.0000			
*Note: p-values at the 0.05 level					

Table A.5: ARDL results for deposit rate – monetary policy model

Sample (adjusted): 2007Q3 2016Q4					
Included observations: 38 after adjustments					
Maximum dependent lags: 4 (Automatic selection)					
Model selection method: Akaike info criterion (AIC)					
Dynamic regressors (4 lags, automatic): *CB CR IB RP TB*					
Fixed regressors: C					
Number of models evaluated: 12500					
Selected Model: ARDL(3, 4, 2, 0, 3, 2)					
Variable		Coefficient	Std. Error	t-Statistic	Prob.*
Deposit rate					
	D(-1)	1.3989	0.2198	6.3638	0.0000
	D(-2)	0.4313	0.2260	1.9082	0.0757
	D(-3)	-0.4873	0.2294	-2.1247	0.0506
Central bank rate					
	CB	0.3569	0.0706	5.0588	0.0001
	CB(-1)	-0.1107	0.0751	-1.4732	0.1614
	CB(-2)	0.0698	0.0706	0.9889	0.3384
	CB(-3)	-0.0947	0.0685	-1.3814	0.1874
	CB(-4)	0.1340	0.0488	2.7448	0.0150
Cash reserve ratio					
	CR	-0.3099	0.2686	-1.1540	0.2666
	CR(-1)	0.2477	0.4490	0.5517	0.5893
	CR(-2)	1.1570	0.4676	2.4744	0.0258
Interbank rate					
	IB	-0.0936	0.0278	-3.3641	0.0043
Repo rate					
	RP	-0.0496	0.0189	-2.6306	0.0189
	RP(-1)	0.0281	0.0211	1.3307	0.2032
	RP(-2)	-0.0444	0.0238	-1.8692	0.0813
	RP(-3)	-0.0937	0.0199	-4.7073	0.0003
	TB	0.1816	0.0434	4.1817	0.0008
	TB(-1)	-0.0874	0.0554	-1.5788	0.1352
	TB(-2)	-0.1877	0.0571	-3.2855	0.0050
Tbill rate					
	C	-5.7028	1.0341	-5.5147	0.0001
R-squared		0.9943	Mean dependent var		5.8139
Adjusted R-squared		0.9860	S.D. dependent var		1.4176
S.E. of regression		0.1676	Akaike info criterion		-0.4531
Sum squared resid		0.4215	Schwarz criterion		0.5381
Log likelihood		31.6081	Hannan-Quinn criter.		-0.1004
F-statistic		119.5932	Durbin-Watson stat		2.2362
Prob(F-statistic)		0.0000			
*Note: p-values at the 0.05 level					

Table A.6: Multicollinearity test results

	Central bank rate	Cash reserve ratio	Interbank rate	Repo rate	Tbill rate
Central bank rate	1.0000				
Cash reserve ratio	0.2760	1.0000			
Interbank rate	0.7728	0.2209	1.0000		
Repo rate	0.7995	0.4967	0.7320	1.0000	
Tbill rate	0.7886	0.1376	0.7840	0.6683	1.0000

Table A.7: Heteroskedasticity results for interest rate spread – monetary policy model

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	1.6545	Prob. F(19,18)	0.1455
Obs*R-squared	24.1640	Prob. Chi-Square(19)	0.1899
Scaled explained SS	7.0432	Prob. Chi-Square(19)	0.9940

Table A.8: Heteroskedasticity results for lending rate – monetary policy model

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	1.0749	Prob. F(27,10)	0.4783
Obs*R-squared	28.2623	Prob. Chi-Square(27)	0.3975
Scaled explained SS	1.0995	Prob. Chi-Square(27)	1.0000

Table A.9: Heteroskedasticity results for deposit rate – monetary policy model

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.8764	Prob. F(22,15)	0.6202
Obs*R-squared	21.3721	Prob. Chi-Square(22)	0.4979
Scaled explained SS	3.3062	Prob. Chi-Square(22)	1.0000

Table A.10: Serial correlation test results for interest rate spread – monetary policy model

Breusch-Godfrey Serial Correlation LM Test			
F-statistic	0.9211	Prob. F(2,16)	0.4182
Obs*R-squared	3.9233	Prob. Chi-Square(2)	0.1406

Table A.11: Serial correlation test results for lending rate – monetary policy model

Breusch-Godfrey Serial Correlation LM Test			
F-statistic	3.7171	Prob. F(2,8)	0.2098
Obs*R-squared	8.0476	Prob. Chi-Square(2)	0.1223

Table A.12: Serial correlation test results for deposit rate – monetary policy model

Breusch-Godfrey Serial Correlation LM Test			
F-statistic	2.4794	Prob. F(2,13)	0.3112
Obs*R-squared	6.9698	Prob. Chi-Square(2)	0.1601

Table A.13: Ramsey RESET results for interest rate spread – monetary policy model

	Test statistic		Conclusion
Dependent variable	F-statistic	Prob. (F-stat)	No misspecification error evidence in the model
Interest rate spread	2.3421	0.1036	

Table A.14: Ramsey RESET results for lending rate – monetary policy model

	Test statistic		Conclusion
Dependent variable	F-statistic	Prob. (F-stat)	No misspecification error evidence in the model
Lending rate	0.5156	0.1710	

Table A.15: Ramsey RESET results for deposit rate – monetary policy model

	Test statistic		Conclusion
Dependent variable	F-statistic	Prob. (F-stat)	No misspecification error evidence in the model
Deposit rate	0.0099	0.9224	

Table A.16: Weighted average commercial banks' lending rate, deposit rate and interest rate spread in Kenya: 1992-2016

	%		
Year	Lending rate	Deposit rate	Interest rate spread
1992	18.4733	13.8667	4.6067
1993	24.9917	18.6558	6.3358
1994	30.5467	17.5175	13.0292
1995	25.0283	11.4642	13.5642
1996	28.2392	14.0658	14.1733
1997	28.2975	14.6858	13.6117
1998	29.4900	16.0692	13.4208
1999	22.3800	8.8000	13.5800
2000	22.3367	7.2650	15.0717
2001	19.6667	6.3250	13.3417
2002	18.5050	5.1408	13.3642
2003	16.3650	3.8625	12.5025
2004	12.5317	2.4325	10.0992
2005	12.8867	4.0592	8.8275
2006	13.6358	4.2583	9.3775
2007	13.3317	4.2567	9.0750
2008	14.0167	4.5600	9.4567
2009	14.8042	5.0900	9.7142
2010	14.3592	4.1650	10.1942
2011	15.0492	4.2225	10.8267
2012	19.6483	7.9075	11.7408
2013	17.3092	6.5083	10.8008
2014	16.5142	6.5917	9.9225
2015	16.1558	6.9333	9.2225
2016	16.5750	7.0950	9.4800

Source: Central Bank of Kenya

Table A.17: Comparison of interest rate spread between Kenya and the top economies in Africa: 1995 - 2016

	Interest rate spread (%)				
Year	Algeria	Egypt	Nigeria	South Africa	Kenya
1995	1.8333	5.5542	6.7025	4.3542	13.5642
1996	4.5000	5.0417	6.7775	4.6125	14.1733
1997	3.1042	3.9563	10.6258	4.6250	13.6117
1998	2.3750	3.6542	8.0758	5.2958	13.4208
1999	2.5000	3.7475	7.4792	5.7592	13.5800
2000	2.5000	3.7592	9.5833	5.3042	15.0717
2001	3.2500	3.8333	8.1825	4.4000	13.3417
2002	3.2500	4.4583	8.1008	4.9758	13.3642
2003	2.8750	5.3083	6.4967	5.1983	12.5025
2004	4.3542	5.6500	5.4825	4.7383	10.0992
2005	6.0625	5.9167	7.4158	4.5825	8.8275
2006	6.2500	6.5833	7.1575	4.0283	9.3775
2007	6.2500	6.4083	6.6508	4.0142	9.0750
2008	6.2500	5.7417	3.5090	3.5125	9.4567
2009	6.2500	5.4833	5.0650	3.1717	9.7142
2010	6.2500	4.7750	11.0642	3.3683	10.1942
2011	6.2500	4.2917	10.3175	3.3275	10.8267
2012	6.2500	4.3583	8.3850	3.3133	11.7408
2013	6.2500	4.6083	8.7775	3.3475	10.8008
2014	6.2500	4.7917	7.2092	3.3242	9.9225
2015	6.2500	4.7167	7.7005	3.2633	9.2225
2016	6.2500	5.7417	9.3703	3.2867	9.4800

Source: World Bank Indicators and Central Bank of Kenya

Table A.18: Average repo rate, 91-Day Tbill rate, interbank rate, central bank rate, cash reserve ratio and discount window rate in Kenya: 2003 – 2016

	(%)					
Year	Repo rate	91-Day Tbill rate	Interbank rate	Central bank rate	Cash reserve ratio	Discount window rate
2003	3.1300	3.7308	3.2617	-	7.6667	-
2004	2.5400	2.9592	2.6875	-	6.0000	-
2005	7.4792	8.4375	7.9717	-	6.0000	-
2006	6.6392	6.8125	6.7117	9.9286	6.0000	-
2007	7.0250	6.8000	6.9700	9.2292	6.0000	-
2008	6.7742	7.7033	7.1075	8.8542	5.9167	-
2009	2.0858	7.3767	4.1525	7.8750	4.7083	-
2010	0.0000	3.5992	1.7850	6.4167	4.5000	-
2011	4.5208	8.7308	9.6200	8.3958	4.6875	14.9040
2012	11.5425	12.7558	13.6383	15.7500	5.2500	19.5000
2013	6.0517	8.9250	8.4150	8.8333	5.2500	14.5000
2014	6.3650	8.9308	7.9408	8.5000	5.2500	14.5000
2015	8.7467	10.9275	11.2383	10.1250	5.2500	15.6250
2016	7.6957	8.7414	4.7186	11.0714	5.2500	16.5000

Source: Central Bank of Kenya

Table A.19: Average lending rate, deposit rate, 91-Day Tbill rate, central bank rate and interest rate spread in Kenya: 1997 - 2016

	(%)				
Year	**Lending rate**	**Deposit rate**	**91-Day Tbill rate**	**Central bank rate**	**Interest rate spread**
1997	28.2975	14.6858	22.4925	-	13.6117
1998	29.4900	16.0692	23.3233	-	13.4208
1999	22.3800	8.8000	13.2850	-	13.5800
2000	22.3367	7.2650	12.0650	-	15.0717
2001	19.6667	6.3250	12.7300	-	13.3417
2002	18.5050	5.1408	8.9425	-	13.3642
2003	16.3650	3.8625	3.7308	-	12.5025
2004	12.5317	2.4325	2.9592	-	10.0992
2005	12.8867	4.0592	8.4375	-	8.8275
2006	13.6358	4.2583	6.8125	9.9286	9.3775
2007	13.3317	4.2567	6.8000	9.2292	9.0750
2008	14.0167	4.5600	7.7033	8.8542	9.4567
2009	14.8042	5.0900	7.3767	7.8750	9.7142
2010	14.3592	4.1650	3.5992	6.4167	10.1942
2011	15.0492	4.2225	8.7308	8.3958	10.8267
2012	19.6483	7.9075	12.7558	15.7500	11.7408
2013	17.3092	6.5083	8.9250	8.8333	10.8008
2014	16.5142	6.5917	8.9308	8.5000	9.9225
2015	16.1558	6.9333	10.9275	10.1250	9.2225
2016	16.5750	7.0950	8.7414	11.0714	9.4800

Source: Central Bank of Kenya

Table A.20: Domestic credit to private sector and interest rate spread in Kenya

Year	**Domestic credit to private sector (% of GDP)**	**Interest rate spread (%)**
2007	23.0450	9.2292
2008	25.3806	8.8542
2009	25.0216	7.8750
2010	27.2284	6.4167
2011	30.5726	8.3958
2012	29.5362	15.7500
2013	31.7127	8.8333
2014	34.1352	8.5000
2015	34.3752	10.1250
2016	32.8542	11.0714

Source: World Bank Indicators and Central Bank of Kenya

Table A.21: Average interest rate spread, lending rate, deposit rate, central bank rate, cash reserve ratio, interbank rate, repo rate and Tbill rate

		(%)							
Years	Quarters	Interest rate spread	Lending rate	Deposit rate	Central bank rate	Cash reserve ratio	Interbank rate	Repo rate	Tbill rate
2006	Q3	9.4900	13.6333	4.1433	9.9167	6.0000	5.8067	5.9433	6.1000
	Q4	9.7700	13.8933	4.1233	10.0000	6.0000	6.2000	6.3000	6.3233
2007	Q1	9.4100	13.6600	4.2500	10.0000	6.0000	6.5000	6.6267	6.1800
	Q2	9.1400	13.2833	4.1433	9.5000	6.0000	6.9667	6.9800	6.6500
	Q3	8.7400	13.0667	4.3267	8.6667	6.0000	7.3467	7.4967	7.0567
	Q4	9.0100	13.3167	4.3067	8.7500	6.0000	7.0667	6.9967	7.3133
2008	Q1	9.5033	13.8933	4.3900	8.7500	6.0000	7.0633	7.0367	7.0433
	Q2	9.5467	13.9933	4.4467	8.8333	6.0000	7.3667	7.2333	7.6133
	Q3	9.1367	13.7400	4.6033	9.0000	6.0000	7.2300	6.6067	7.9133
	Q4	9.6400	14.4400	4.8000	8.8333	5.6667	6.7700	6.2200	8.2433
2009	Q1	9.6033	14.7733	5.1700	8.4167	5.0000	5.6700	4.9333	7.7733
	Q2	9.7167	14.8833	5.1667	8.0833	4.8333	4.8133	3.4100	7.3733
	Q3	9.7167	14.7633	5.0467	7.7500	4.5000	3.2500	0.0000	7.2600
	Q4	9.8200	14.7967	4.9767	7.2500	4.5000	2.8767	0.0000	7.1000
2010	Q1	10.0433	14.9200	4.8767	6.9167	4.5000	2.7633	0.0000	6.2500
	Q2	9.9700	14.4767	4.5067	6.7500	4.5000	1.9233	0.0000	4.1200
	Q3	10.4433	14.1500	3.7067	6.0000	4.5000	1.3967	0.0000	1.8233
	Q4	10.3200	13.8900	3.5700	6.0000	4.5000	1.0567	0.0000	2.2033
2011	Q1	10.5200	13.9567	3.4367	5.8333	4.5000	1.2033	0.5533	2.6067
	Q2	10.3500	13.9033	3.5533	6.0833	4.5833	5.2900	5.3167	5.8533
	Q3	10.3733	14.4167	4.0433	6.5000	4.7500	10.1200	0.0000	10.0500
	Q4	12.0633	17.9200	5.8567	15.1667	4.9167	21.8667	12.2133	16.4133
2012	Q1	12.1600	20.0533	7.8933	18.0000	5.2500	20.4800	10.5533	19.3533
	Q2	11.7667	20.2133	8.4467	18.0000	5.2500	16.8000	16.6800	12.4267
	Q3	12.1700	20.0033	7.8333	15.3333	5.2500	9.9000	10.7933	10.2167
	Q4	10.8667	18.3233	7.4567	11.6667	5.2500	7.3733	8.1433	9.0267
2013	Q1	11.4533	17.9000	6.4467	9.5000	5.2500	8.0133	8.3500	8.7800
	Q2	10.9067	17.4300	6.5233	8.8333	5.2500	7.4000	8.3433	8.6833
	Q3	10.4467	16.9467	6.5000	8.5000	5.2500	8.1100	4.8633	8.5100
	Q4	10.3967	16.9600	6.5633	8.5000	5.2500	10.1367	2.6500	9.7267
2014	Q1	10.4233	17.0000	6.5767	8.5000	5.2500	8.5767	2.3067	9.1333
	Q2	10.1900	16.6767	6.4867	8.5000	5.2500	7.2533	7.7567	9.1433
	Q3	9.8233	16.4033	6.5800	8.5000	5.2500	9.1000	7.1133	8.8167
	Q4	9.2533	15.9767	6.7233	8.5000	5.2500	6.8333	8.2833	8.6300
2015	Q1	8.9667	15.6200	6.6533	8.5000	5.2500	6.9133	8.0133	8.5567
	Q2	8.9767	15.5733	6.5967	9.0000	5.2500	10.5733	8.8600	8.3133
	Q3	9.2500	16.0833	6.8333	11.5000	5.2500	17.1800	11.2033	12.2400
	Q4	9.6967	17.3467	7.6500	11.5000	5.2500	10.2867	10.3650	14.6000
2016	Q1	10.5167	17.9267	7.4100	11.5000	5.2500	4.9833	7.6133	10.2367
	Q2	11.4433	18.1467	6.7033	10.8333	5.2500	4.1433	7.0900	8.1067
	Q3	9.8733	16.5400	6.6667	10.1667	5.2500	5.1300	5.6667	7.5667
	Q4	6.0867	13.6867	7.6000	10.0000	5.2500	5.0500	3.5250	8.1400

Source: Central Bank of Kenya

Table A.22: Commercial Banks in Kenya

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

Source: Central Bank of Kenya