



**Strathmore**  
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**The Effect of Stock Price Volatility on Bank Loan Dynamics: A Case of Kenya**

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DECLARATION

I declare that this work has not been previously submitted and approved for the award of a degree by this or any other University. To the best of my knowledge and belief, the Research Proposal contains no material previously published or written by another person except where due reference is made in the Research Proposal itself.

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## **List of Abbreviations**

NSE – Nairobi Securities Exchange

CBK – Central Bank of Kenya

KNBS – Kenya National Bureau of Statistics

AIC – Akaike Information Criteria

SC – Schwarz Criterion

VAR – Vector Autoregressive

CPI – Consumer Price Index

ILR – Interbank Lending Rates

EXC – Exchange Rates

## **ABSTRACT**

The study seeks to evaluate dynamic linkages between stock prices and bank lending behavior prevalent in Kenya. As such the focal variables are loans to the private sector and share prices. However, because of the existence of common macroeconomic cyclical factors that may drive both variables, the study also uses other control variables i.e. price level (CPI), exchange rates and interest rates (interbank lending rates). The study employs the use of a VAR model with monthly data collected from the year 2005 to 2016. A unit root test and a cointegration test to check for stationarity and cointegration among variables respectively are also used.

The findings are useful in explaining whether there is a causal relationship between adverse share price movement and bank lending in Kenya.

**KEY WORDS:** VAR model, Bank loans, Stock prices

## **CHAPTER 1: Introduction**

### **1.1.1 Background information**

The banking sector in Kenya dates back to 1896 when the bank of India was set up in Kenya. It is composed of the CBK, which acts as an oversight and regulatory authority and the commercial banks, non-bank financial institutions, microfinance institutions, money remittance providers and forex bureaus among other financial institutions as the regulated institutions. As at 2016, the number of licensed commercial banks was 42 and 1 mortgage finance company.

The banking sector is a very crucial driver in the whole economy as it is one of the financial intermediaries in open market operations initiated by the central bank. The main mechanism for bank's profitability is lending; a risky activity, though quite essential to both the bank and the economy.

The other crucial financial intermediary in any open market operation initiated by the CBK is the stock markets. In Kenya it is represented by the NSE. Emerging stock markets, like the NSE have been identified as being remotely integrated with the global capital markets. As a consequence, it has been argued that local macroeconomic variables rather than world risk factors are the primary source of equity return variation in these markets.

In turn if local macroeconomic variables explain equity returns then in efficient markets it would suffice that information from stock prices can as well be interpreted to explain the change in other macroeconomic variables. This being the case, stock prices (NSE 20 share index) can as well be used to explain bank lending behavior in the overall economy.

### **1.1.2 Stock Markets and Bank loans**

According to Chen, Roll and Ross (1986), no satisfactory theory can argue that the relation between financial markets and the macro economy move entirely in one direction. However, the paper mentioned that stock prices usually tend to be considered as dependent of external forces (even though they may also affect other variables as well).

Empirically, banks have been largely studied from the perspective of being monetary transmission mechanisms and their lending rates as variables affecting the pricing of stocks. On the other hand, their relations to the health of the financial markets have received limited attention (Ibrahim 2006).

Kim and Moreno (1994) is one of the studies that tried to evaluate the issue between bank loans and stock prices with specific attention to the case of Japan. Their study used monthly data from January 1970 to May 1993 and applied a vector autoregressive framework consisting of five variables (bank loans, industrial production, the call market rate, consumer prices and the Nikkei index). They found evidence of a positive relationship between changes in stock prices to bank lending.

This relationship was further evidenced in the 1997/1998 Asian crisis and recent 2007/2008 global financial crisis, both serving to indicate a linkage between the financial markets and the banking industry. Both of these involved increased exposure of banks to lending in speculative sectors and as a result, the inherent fragility of the banks' lending activities created a positive relation between the stock markets and the banking industry where if one was to collapse, the other would also be affected.

For the Asian crisis, the linkage between the collapsing stock markets and banking sector led to contraction in bank loans which vibrated to the real sector, ultimately affecting economic growth in the crisis-hit countries (Ibrahim 2006). In the 2007/2008 global financial crisis, the increased exposure by the banking sector to the real estate market backed by its traded mortgage based securities, created a linkage whereby failure in the banking industry affected the stock markets.

These two crises, though far apart geographically and in time, can be traced back to an argument by Kim and Moreno (1994) in which they explicitly stated that bank loans collateralized by such

assets as real property and shares, greatly exposed them to default risks as a result of falling share prices thereby adversely affecting a bank's loan supply behaviour.

Demirguc-Kunt and Levine (1996) also found that stock market indicators and banking sector developments are highly correlated. They found that development of the stock markets went hand in hand with that of the banking sector and that countries with banks and stock markets that performed relatively better tended to grow faster than predicted by individual firm characteristics. As such, stock prices should therefore reflect all the macroeconomic variables that indicate the current economic development. Therefore if stock prices reflect all macroeconomic variables, it would be a good tool to predict the future bank lending activities (Yartey, 2008).

### **1.1.3 Bank Lending behaviour**

Banks are in the business of lending out money. Banks issue out loans using the deposits that they have obtained from different savings, checking or money market accounts. According to Folawewo and Tennant (2008), if there is a large number of people applying for loans, banks charge higher interest rates and if the number reduces the interest rates reduce in order to attract more customers.

However a bank's decision to lend out money is not merely influenced by market demands. According to Moosa and Bhatti (2010), a bank's decision to lend out money is influenced by a variety of factors such as the volume of the bank's deposits, prestige and bank status recognition, level of their foreign and domestic investment, the liquidity ratio of the bank as well as prevailing interest rates among others.

The aim of this study will be to shed light on whether the performance of the NSE 20 share index has any bearing to bank lending behavior<sup>1</sup> and the direction of causality between the two in the overall economy.

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<sup>1</sup> Bank lending behavior refers to the amount of loans banks give out to the private sector.

## **1.2 Problem Statement**

An important factor in the economic development of any country is the availability of credit facilities to its population. This role is primarily that of the financial markets. According to Ambrose and Douglas Nyakundi (2013), well-developed financial markets play an important role in enabling economic agents to meet their liquidity needs as well as diversify their portfolios. Banks are a part of the financial markets and they play an important role in the economic growth of the country.

According to Becke and Hesse (2006), the banking sector should play its role well in order for any country to maintain their economic growth hence the reason why lending interest rates play a vital role in the contractionary and expansionary policies of central banks. It is also the reason why the central bank recognizes the efficiency of the banking sector as a precondition for macroeconomic stability and key in the execution of monetary policy.

Principally, banks earn their profit from the loans they give out hence lending interest rates are a key determinant of their profitability margins among other factors. Due to banks' increased profit appetite, bank lending rates have remained high and have become a macroeconomic problem threatening to hinder economic development.

This study sought to examine the relation between stock market performance and the bank loans to the private sector. This would significantly allow for forecasting of bank lending behavior to the private sector thereby enabling efficient monetary policy administration by the central bank in achieving economic growth.

### **1.3 Research Objectives**

#### **1.3.1 General Objective**

The main objective of this study is to determine the effect of stock price volatility on bank lending in Kenya.

#### **1.3.2 Specific Objectives**

- i. To determine how stock price fluctuations affect the amount of loans to the private sector.
- ii. To establish the causality relationship between stock prices and bank lending behaviour in Kenya.

### **1.4 Research Questions**

- i. Is there a relationship between stock price volatility and bank loans?

#### **Null hypothesis**

There is no significant relationship between stock prices and bank loans.

#### **Alternative hypothesis**

There is a significant causality relationship between stock prices and bank loans.

### **1.5 Scope of Study**

The study's time period under consideration will be between the years 2005 to 2015 based on the availability of data.

The study will use the NSE 20 share index as representative of share price volatility. Other variables that will be used include bank loans, the price level, exchange rates and interest rates. The last three factors are included to control for macroeconomic cyclical factors other than stock prices that may affect bank loans.

Bank loans will be represented by the amount of loans to the private sector. Price level will be represented respectively by the consumer price index (CPI) and exchange rates used will be the bilateral Kenyan Shilling rate vis a vis the US dollar. The interest rates used will be that of the interbank lending rates.

Data is collected from major databases such as those of the Central Bank of Kenya, the Kenya National Bureau of Statistics (KNBS), the Nairobi Stock Exchange and the World Bank.

## **1.6 Value of the Study**

The study will be beneficial to the Central Bank of Kenya (CBK) as the regulator of lending rates in all the commercial banks in Kenya. The study will give CBK an insight on how a change in the stock prices may affect bank's lending behaviour, thereby enabling them to structure their policies based on this. It will also help to indicate whether any shocks in the financial markets can significantly affect banks.

The study also serves to critique the causality relationship between stock prices and bank's lending behaviour. It has been widely considered that bank lending rates have an effect on stock prices. Our study will try to form a new dimension to this old adage and subsequently illuminate the direction of the causality relationship. In illuminating the causality of the two variables, the study will also be testing on the efficiency of the Kenyan stock market.

The management of commercial banks will also find the study useful as any indication of causality of a bank's lending rate by the stock price will therefore mean that a bank's lending activities can be predicted in the event of a possible drastic fall in the stock market.

The study's findings will also provide a benchmark upon which other studies may be done on the field.

## **Chapter 2: Literature Review**

### **2.1 Introduction**

This chapter presents and explains the framework that guides the study. In understanding the relationship between bank lending and stock price volatility, the study reviews the relationship between the equity market and the money market as well as the various theories relevant and applicable to the study.

### **2.2 Theoretical Review**

This section has reviewed theory that is relevant and applicable to the study.

#### **2.2.1 The Abstinence theories**

The basic idea behind the theory of abstinence is that interest is created from a capitalist's need to be compensated for choosing to use his wealth from a time-consuming process rather than using it in the present. Nassau Senior (1872), is given credit as the originator of the abstinence theory. His use of the term abstinence implied an act of self-denial or sacrifice on the part of the capitalist. This abstinence was included among the costs of production as a third original factor besides labor and land.

He acknowledged that capital had a positive relation to labor productivity such that if a person was to sacrifice his capital to pay productive workers, it would then suffice that he would expect to be paid back part of the produce as compensation for the discomfort during the period in addition to the original capital he had lent out.

Boehm Barwerk criticised this theory on the basis that capitalists often earn interest without any pain incurred on their part. In part, he stated his criticism did not necessarily invalidate the abstinence theory but rather invalidated the naïve argument of compensating the capitalist for the 'pain' of his abstinence.

Alfred Marshall added to the abstinence theory but through the replacement of the term 'sacrifice' with waiting. In doing so, he was able to explain clearly the concept of interest by ascribing value creation of the capital on the premise of time i.e. for one to lend now and forgo consumption in the present, they must be ascertained of a future value that will be greater than the amount being lent out now. This amount that they receive factors the amount of waiting time

they endure and hence the need for some form of inducement which Marshall identified as interest.

### **2.2.2 Efficient market hypothesis**

An efficient market according to Fama (1970) is one where all securities accurately reflect available information in the market. It would therefore be impossible to outperform the market consistently as there are many competitors each with similar access to the same information.

The theory is classified under three levels; the weak form, semi-strong form and strong form. The weak form describes a market in which historical data on price movements and volume do not affect the present prices of securities hence technical analysis can't be used in achieving superior returns. Semi-strong form efficient, describes a market in which all public information is incorporated into the share price hence both fundamental and technical analysis can't be used in achieving superior returns. Strong form market refers to one where both public and private information is incorporated in the stock price therefore however much the amount of information investors have they can't be able to outperform the market.

### **2.2.3 Interest rate parity condition**

Interest rate as defined by Keynes is the reward an individual gets for parting with liquidity for a specified period of time. They are a key determinant in the money market and hence the need to study them.

Interest rate parity condition was developed by Keynes (1923) in explaining why it is impossible for a monetary institution to set their real interest rate in relation to an international one. International capital inflows were set as the main reason for this, as they resulted in dynamic linkages between exchange rates, interest rates and inflation.

### **2.2.4 Behavioural finance theory**

In the EMH, the core assumption is that investors are rational. In behavioral economics, markets are not perfect and investors are not rational but driven by emotions. Accordingly, this theory assumes that most investors are driven by their own gut instincts which help them focus on broader issues.

## **2.3 The linkage between the stock market and interest rates**

Stock markets play an important role in accelerating economic growth through their provision of saving and investment facilities. As such share prices act as a leading economic indicator. Due to this relation, investor's usually value stocks by checking on macroeconomic variables among other factors.

According to Fama (1981), there is a negative correlation between expected inflation and real activity. Real activity is in turn positively related to returns in the stock market. Therefore, stock market returns are negatively correlated to expected inflation whose proxy is usually the short term interest rate.

Lobo (2000) also argued that interest rates are inversely related to share prices. Increase in interest rates causes a decrease in stock prices because the required rate of return on stock prices leads to a decrease in the stock prices.

### **2.3.1 How stock prices may affect bank lending**

Kim and Moreno (1994) showed that stock prices can influence bank lending in two ways; through signaling changes in economic activity and by affecting the capital position of banks.

According to finance theory, stock prices usually reflect investor expectations of future real activity. Hence changes in share prices signal changes in economic activities thereby affecting loan demand. For example a decline in share prices can indicate contractionary measures thereby lowering loan demands.

On the other hand share price fluctuations can affect loan supply by affecting the capital position of banks through the market value of bank equity. For example, a bank with substantial unrealized capital gains may lend more freely as this will allow them to write off larger amounts of losses by realizing the gains. Conversely a drop in share prices will make banks reluctant in lending out. Therefore when banks hold shares, it would suffice that there exists a positive relation between stock prices and bank lending.

## **2.4 An Empirical Review**

Kim and Moreno (1994) examined stock prices and bank lending behavior in Japan. Their study also sought to examine the effect of regulatory developments that were likely to have strengthened the relationship between the two variables. The study found out that prior to the Basel accord, the regulatory environment weakened any relation between stock prices and bank lending. This was mainly due to government interference in cushioning banks from adverse shocks related to government sanctioned debts and the lack of laws subjecting banks to capital adequacy requirements. The study concluded that changes in the regulatory regimes led stock prices to influence the lending behaviour of banks.

Demirguc-Kunt and Levine (1996) revealed that improved functionality of the stock market led to a higher debt-equity ratio in firms. One would expect that a better functioning capital market would imply that firms would be willing to take out more equity capital; however the study showed that a better functioning capital market greatly increased the use of bank finance as well. It therefore implied that stock markets and banks are not substitutes for each other, but actually stock market developments increase the amount of bank loans.

Ross and Zervos (1998) studied the empirical relationship between various measures of stock market development, bank development and long run economic growth for 47 countries from 1976 to 1993. The results indicated that stock market liquidity and bank developments had a positive relationship with contemporaneous future rates of economic growth, capital accumulation and production rates. The results also suggested that stock markets and banks provided different financial services.

Das (2005) on the other hand argued that if we were to know that two markets were linked through a common cyclical pattern then it would be possible for one to forecast the change in stock prices from a change in bank interest rates. The efficient market hypothesis suggests that all current information in a strong market is reflected in the share prices; therefore if bank's interest rates were reflected in the share prices then movements in the share prices could also forecast movements in bank lending rates.

Ibrahim (2006) examined the relationship between stock prices and bank loan dynamics in Malaysia over the period 1978-1998. The study employed time-series techniques of cointegration, vector auto regression and impulse response functions on a six variable framework

that included; loans to the private sector, stock prices, real output, interest rates, exchange rates and the price level.

The results from the study indicated that there was a positive response of bank loans to share price increase. It also showed that a drastic fall in share prices precedes contractionary measures in bank lending activities in line with Kim and Moreno (1994) for the case of Japan. The reason for the contractionary measures was that a precipitous fall in share prices greatly increased banks' exposure to default risk. Hence banks were least likely to give out loans following a drop in the stock market. The study also indicated that there was no causal relation from bank loans to stock prices.

Almutair (2015) studied the relation between bank loans and stock prices in Saudi Arabia from the period 1998 to 2013. The study found a positive relationship between the stock prices and bank loans. This laid credence to economic theory that as stock prices rise; the supply and demand for bank loans also increases. The results also indicated that total bank loans reacted positively to increase in stock prices and not the other way round. This thereby indicated that there existed a causal relation from stock prices to bank loans; a characteristic conclusion quite similar to that of Ibrahim (2006) for the case of Malaysia.

Ologunde et al (2006) did a study on stock market capitalization and interest rates in Nigeria. They found out that the share market ensures long term real capital to the economy hence the level of efficiency in the stock markets is quite important for all market players in it who have a role in ensuring long term real capital in the economy. From the point of view of a lender, the interest rate is the fee charged for lending out money. Therefore if lending rates increase then deposit rates will also increase. Hence considering that investors always intend to invest in efficient markets, an increase in deposit rates will influence them to keep their money in banks rather than having them in the stock markets. Thus leading to reduced share prices.

Chirchir (2012) studied the relationship between share prices and interest rates in Kenya. He used the weighted average lending rate of commercial banks in Kenya and the NSE 20 share index as a proxy for stock prices between October 2002 and October 2012. The study employed the Toda Yamamoto (1995) method. The results indicated that there existed no significant causal relationship between interest rates and share prices. The study also found negative causality existed in both directions albeit insignificant, as had been proposed by Fama (1981).

Nyasha and Odhiambo (2015) studied the dynamic causal relationship between bank-based financial development, stock market development and economic growth in Kenya from 1980 to 2012. The results indicated that there existed no causality between market based financial developments and bank based financial developments in Kenya. Thereby concluding that Kenya's banking sector is largely driven by the real sector.

## **Chapter 3: Methodology**

### **3.1 Introduction**

This chapter presents the study's research design, population sampling, procedure for data collection and data analysis.

### **3.1 Research design**

The study will use an empirical design where secondary data will be collected, analyzed and research hypothesis tested. The focal variables of the study will be stock prices and bank loans. However, because of the existence of common macroeconomic cyclical factors that may drive both variables, the study also uses other control variables i.e. the price level and interest rates.

According to Kim and Moreno (1994) these factors are added in order to capture macroeconomic cyclical factors that may influence bank lending behavior. We also include exchange rates as an additional factor. Exchange rate depreciation is an initiating factor that contributes to a drastic fall in share prices and subsequently bank loans. Its effect on bank loans and share prices necessitates its inclusion as a control factor.

The study will also employ tests of causality on the focal variables i.e. stock prices and bank loan dynamics.

### **3.2 Population size and sample**

Bank loans will be represented by the amount of loans to the private sector. Price level will be represented by the consumer price index (CPI). The interest rates used will be that of the interbank lending rates. Lastly, the exchange rate used will be the bilateral Kenyan Shilling rate against the US dollar.

### 3.3 Data analysis and presentation

The study will use time series techniques in its estimation methodology. It will therefore follow the following steps in its estimation;

- (i) A unit root test
- (ii) Cointegration test
- (iii) Specification and estimation of the model
- (iv) Impulse response functions

The unit root tests (integration) and Cointegration tests are important in proper specification of the VAR model to be used.

#### 3.3.1 Unit root test

We apply the Augmented Dickey Fuller (ADF) test and Phillips-Perron unit root test in order to determine the stationarity of the variables and their order of integration.

##### Augmented Dickey-Fuller (ADF) test

The ADF test does not directly test on the stationarity but indirectly through the existence (or absence) of a unit root.

The test is based on the estimates of the following regression;

$$\Delta y_t = \alpha + \beta_t + \gamma y_{t-1} + \delta_1 \Delta y_{t-1} + \dots + \delta_{p-1} \Delta y_{t-p+1} + \varepsilon_t$$

Where;

$y_t$  is the variable tested for unit root,  $\alpha$  the constant term,  $\beta_t$  the coefficient on a time trend,  $\Delta$  is the first difference operator and  $p$  is the selected number of lag lengths.

The test statistic value is calculated as;

$$\tau = \frac{\hat{\gamma}}{\sigma_{\hat{\gamma}}}$$

Where;  $\hat{\gamma}$  is the estimated coefficient and  $\sigma_{\hat{\gamma}}$  is the standard error in the coefficient estimate.

The null hypothesis for the test will be;

$H_0: \gamma = 0$  i.e. has unit root hence the data needs to be differenced to make it stationary

and alternative hypothesis is

$H_1: \gamma < 0$  i.e. does not have unit root hence the data is stationary and doesn't need to be differenced.

### **Phillips-Perron unit root test**

The ADF unit root test suffers majorly from serial correlation. As a result, the study also employs the use of Phillips-Perron unit root test as it disregards any form of serial correlation in the variables.

The null and alternative hypotheses for the PP test for variables in their level form are;

$H_0: \alpha = 0$  ( $Y_t$  has unit root/non-stationary)

$H_1: \alpha < 0$  ( $Y_t$  has no unit root/ stationary)

In this case, the result should be non-stationary in the level form of the test. The null hypothesis formed, i.e. there is a unit root should not be rejected at the significance level of 90%, 95% and 99%. That being said, the test statistics should have an  $\alpha$  larger than 0.1, 0.05 and 0.01 in each significance level respectively. In other words, the larger the  $\alpha$  of the test-statistics, the higher is the probability that the null hypothesis will not be rejected.

On the other hand, the null and alternative hypotheses for variables at the first differences should be:

$H_0$  Unit roots of I(2)

$H_1$  There is a unit root/non-stationary

In the first difference, the intended result is to obtain 1 unit root. This means that the null hypothesis needs to be rejected at the significance level of 90%, 95% and 99%. That being said, the test-statistics should have an  $\alpha$  smaller than 0.1, 0.05 and 0.01 in each significance level respectively. In other words, the smaller the  $\alpha$  of the test-statistics, the higher is the probability that the null hypothesis will be rejected.

### 3.3.2 Cointegration test

Nelson and Plosser (1982) established that time series data for macroeconomic variables are typically non-stationary. Granger and Newbold (1974) showed that spurious regression may result when traditional regression analysis is used on two non-stationary data; hence the need for cointegration tests to check on whether you are using empirically meaningful relationships. This method will estimate the number of cointegration relationships and the parameters involved. If a cointegration relationship exists between the variables then it implies a long run relationship between them. If no cointegration is found, it is necessary to continue working with the variables in difference form. The study will use the Johansen and Juselius test (1990).

Johansen and Juselius (JJ) test

The methodology of the JJ test starts from a VAR model of order p which can be represented as;

$$\mathbf{y}_t = \mathbf{A}_0 + \mathbf{A}_1\mathbf{y}_{t-1} + \dots + \mathbf{A}_p\mathbf{y}_{t-p} + \boldsymbol{\varepsilon}_t \quad (1)$$

Where;  $\mathbf{y}_t$  is  $(n * 1)$  vector of variables,  $\mathbf{A}_0$  is  $(n * 1)$  vector of constant terms and  $\boldsymbol{\varepsilon}_t$  is  $(n * 1)$  vector of error terms.

The equation (2) can then be rewritten in the form;

$$\Delta\mathbf{y}_t = \mathbf{A}_0 + \sum_{i=1}^{p-1} \boldsymbol{\Gamma}_i \Delta\mathbf{y}_{t-1} + \boldsymbol{\Pi}\mathbf{y}_{t-1} + \boldsymbol{\varepsilon}_t \quad (2)$$

Where;

$$\boldsymbol{\Pi} = \sum_{i=1}^p \mathbf{A}_i - \mathbf{I} \quad \text{and} \quad \boldsymbol{\Gamma}_i = - \sum_{j=i+1}^p \mathbf{A}_j \quad (3)$$

If the coefficient matrix  $\boldsymbol{\Pi}$  has a reduced rank  $r < k$ , it suffices that there must exist  $k * r$  matrices  $\boldsymbol{\alpha}$  and  $\boldsymbol{\beta}$  each with rank  $r$  such that  $\boldsymbol{\pi} = \boldsymbol{\alpha}\boldsymbol{\beta}' + \boldsymbol{\beta}\mathbf{y}_t$  is stationary. Where  $r$  is defined as the number of cointegrating relationships,  $\boldsymbol{\alpha}$ 's elements are defined as adjustment parameters and each column of  $\boldsymbol{\beta}$  is a cointegrating vector.

In order to identify the number of cointegrating vectors, the JJ test uses two test statistics; the trace test and maximum Eigen value test.

#### Trace test

The test statistic for the trace test is;

$$Trace = -T \sum_{i=r+1}^n \ln(1 - \hat{\lambda}_i)$$

The null hypothesis for the test will be  $H_0: r = 0$

Versus the alternative hypothesis of

$$H_1: r > 0$$

### Maximum Eigen value test

The test statistic of the maximum Eigen value test is given by;

$$\lambda_{max} = -T \ln(1 - \hat{\lambda}_{r+1})$$

This test, tests for the null hypothesis of r cointegrating vectors against the alternative hypothesis of (r+1) cointegrating vectors.

### 3.3.3 Specification and estimation of the model

In order for proper specification of the model, integration and cointegration tests are necessary. If the variables are non-stationary, the results from such a specification will be spurious. If the variables are changed to their first differences in order to render them stationary, cointegration of the variables may also lead to mis-specification of the model.

If the results show that the variables are non-stationary and not cointegrated, they suggest the use of VAR in first differences. If the variables happen to be cointegrated, then a vector error correction model (VECM) needs to be used. Ibrahim (2006) also argued that since a VECM model can be reparameterized to form an equivalent of a VAR model, then the validity of non-stationary variables requires the presence of cointegration. It is also worth mentioning that whether VAR in levels or a VECM for modeling cointegrated series is a better approach is still a debatable fact (Ibrahim, 2006).

One of the advantages of level VAR over VECM is the economic interpretation obtained from the impulse-response functions. Level VAR allows for history to decide on whether the effects of the shock are permanent or not whereas in VECM, their implied explanation is that the impact of certain shocks are permanent.

## The VAR model

The VAR model was introduced by Sims (1980) as an alternative to the macro econometric models that were there. It has been adopted over time due to its ease of use and flexibility when analyzing multivariate time series data.

The VAR model with p lags that the study will use is specified as;

$$Y_t = c + \psi_1 Y_{t-1} + \psi_2 Y_{t-2} + \dots + \psi_p Y_{t-p} + \varepsilon_t, \quad t=1 \dots T$$

Where;  $Y_t = (y_{1t}, y_{2t}, \dots, y_{5t})'$  denoting a  $(5 * 1)$  vector of time series variables.

$y_{1t} = \text{Bank loans to the private sector}$

$y_{2t} = \text{NSE 20 share index}$

$y_{3t} = \text{CPI index}$

$y_{4t} = \text{Exchange rate}$

$y_{5t} = \text{interbank lending rate}$

;  $\psi_i$  is a  $(5 * 5)$  coefficient matrix,

;  $\varepsilon_t$  is a  $(5 * 1)$  unobservable zero mean white noise vector process and

; c is a  $(5 * 1)$  vector of constants.

The lag length of the auto regression is an important factor in the VAR model, the more the lags there are the less the degrees of freedom. In choosing the number of lags, we will determine the one with minimum AIC and SC value. If both the AIC and SC are not minimized using the model, we will apply a Likelihood ratio (LR) test of Johansen (1995). The LR test is specified as;

$$LR = -2(\log L_k - \log L_{k+1}) \sim \chi^2(n^2)$$

Where; k is the lag order, n is the number of variables and L is the maximum likelihood of the model.

If  $\leq \chi_a^2$  we do not reject the null hypothesis that all the elements in the coefficient matrix are zero. Then we can reduce the lag order until the null hypothesis is rejected.

### **3.3.4 Impulse response functions**

Impulse response identifies the responsiveness of the dependent variables when a shock is put on the error term. From the estimated model, we will simulate impulse response functions as a basis for our inferences.

This test provides information about the relative importance of each variable affecting share prices and bank loans. Furthermore, this test attempts to detect the positive and negative shocks that flow from share prices to bank loans and vice versa.

Graphical method is used in this test to observe the relationship between the independent and dependent variables.

## Chapter 4: Data and Results

### 4.1 Introduction

This chapter presents the data analysis, presentation and interpretation of the study. The study analyzed the relationship between bank loans to the private sector (LPS), stock prices (NSE), price level (CPI), interest rates (ILR) and the exchange rate (EXC).

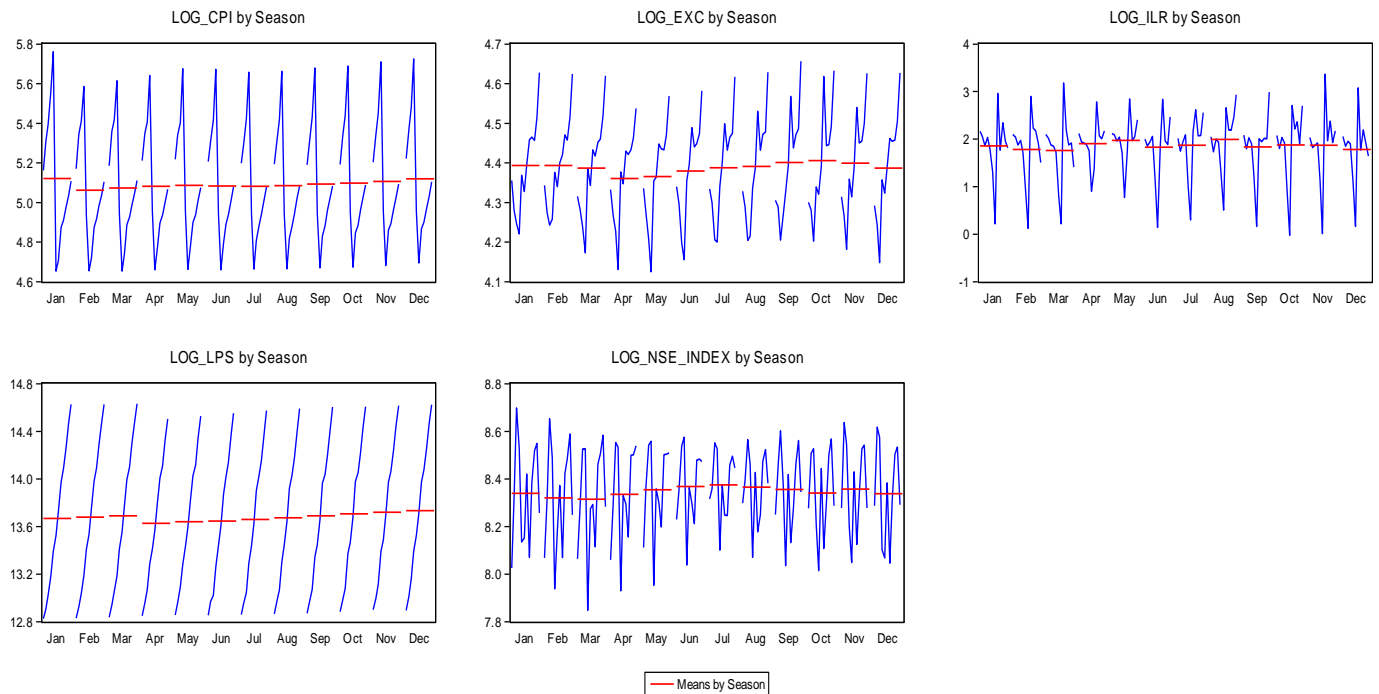
All the variables used in the study are converted into natural logarithms. The study was conducted for a period of 11 years from 2005 to March 2016 where monthly data was obtained from the Statistical Bulletins of the Central Bank of Kenya and releases from the Kenya National Bureau of Statistics.

### 4.2 Pre-estimation Tests

#### 4.2.1 Plot of the data

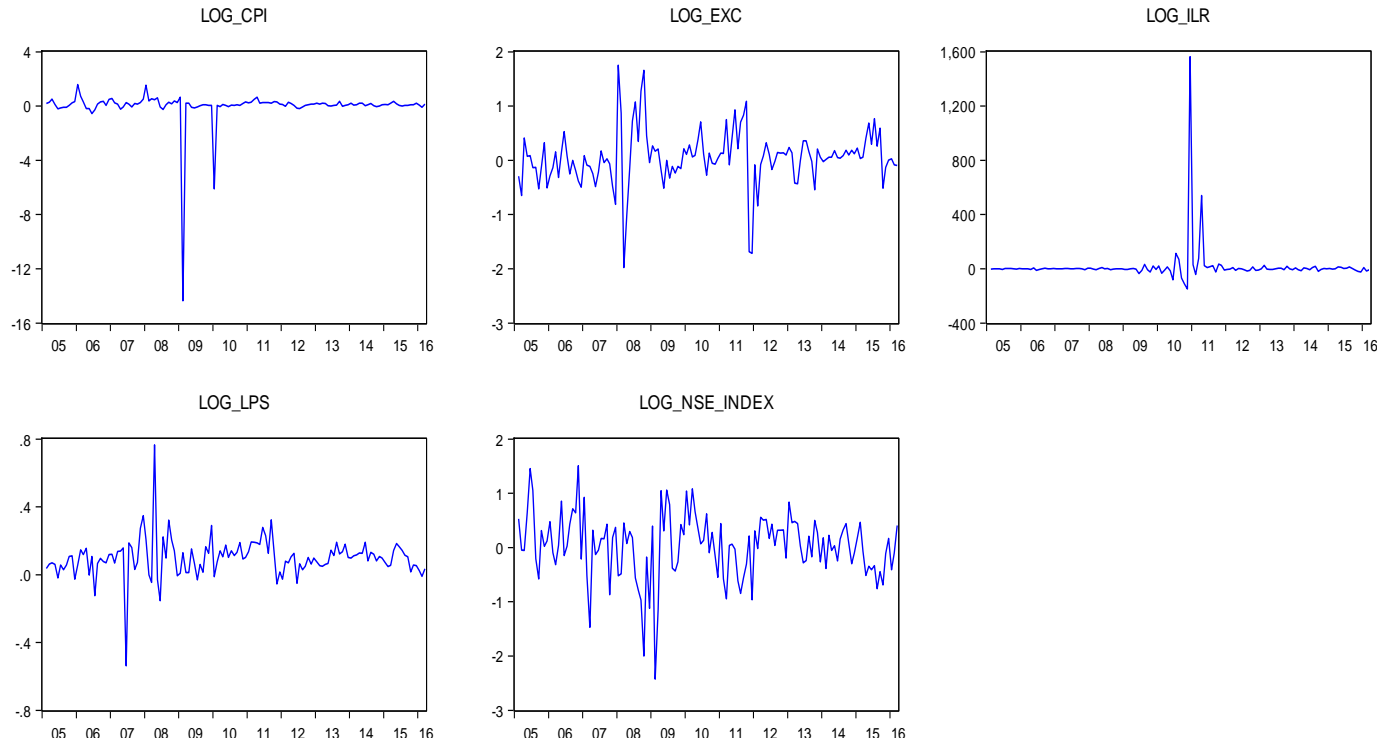
The data being used is not seasonally adjusted; therefore we first evaluate the presence of deterministic trend and any seasonal patterns in the data.

Figure 1: Seasonality



The plots obtained in Figure 1 and 2 indicate that the variables have neither seasonality nor deterministic trend. These results allow us to proceed with the other tests.

Figure 2: Deterministic trend



#### 4.2.2 Unit Root Test

To ensure stationarity of the data extracted as independent and dependent variables, the Augmented Dickey-Fuller (ADF) test and Phillips-Perron (PP) test have to be conducted. Otherwise, the results obtained from the study would be spurious and inaccurate. Table 1 presents the results of the Augmented Dickey Fuller (ADF) test and Phillips-Perron test statistic in examining the presence of a unit root in the variables.

For the Augmented Dickey-Fuller (ADF) test, the null hypothesis that states variables are stationary in the level form should not be rejected. When the same test is conducted for variables in the first difference, then the null hypothesis that states variables are non-stationary should be rejected so that variables consist of one unit root,  $I(1)$ .

Similarly, for Phillips-Perron (PP) test, the null hypothesis states that variables are stationary in the level form should not be rejected. When the same test is conducted for variables in the first difference, then the null hypothesis that states variables are non-stationary should not be rejected.

From the results in Table 1, the ADF and PP tests indicate non-stationarity in levels and stationarity in first differences for all variables apart from ILR. This infers that all variables are integrated of order 1 or I(1). However the tests have conflicting results when it comes to the stationarity of ILR; whereas the PP test indicates that ILR requires first differencing in order to be stationary, ADF states that ILR is stationary though at the 5% level of significance.

Table 1

Variables	Augmented Dickey Fuller (ADF) Test		Phillips-Perron (PP) Test	
	Levels with constant	First difference with constant	Levels with constant	First difference with constant
NSE	-2.682	-5.964*	-2.539	-8.559*
LPS	0.779	-11.182*	0.718	-11.212*
ILR	-3.148**	-3.905*	-2.540	-10.983*
CPI	-1.596	-11.735*	-1.595	-11.735*
EXC	-0.743	-5.734*	-0.528	-8.299*

Note: the test statistics are compared to the critical values from Mackinnon (1991). \* and \*\* indicate significance at 1% and 5% respectively.

Taken together, these results still allow us to proceed to the Johansen cointegration test.

#### 4.2.3 Johansen Cointegration Test

The trace and maximum eigen value statistics of the test are indicated in Table 2. The tests indicate the presence of a unique cointegrating vector among the five variables at the 5% level of significance. Granger (1988) suggests that cointegration between two or more variables shows the presence of causality at least in one direction. Additionally, if there are any shocks, some variables will be able to adjust in order to correct any deviations from the long run equilibrium. As such, the paper will now focus on how these variables dynamically respond to shocks.

Table 2

Null hypothesis	Test Statistic		5% Critical Value	
	Trace	Max	Trace	Max
$r = 0$	69.10938	35.63667	68.52	33.46
$r \leq 1$	33.47271	14.09527	47.21	27.07
$r \leq 2$	19.37744	11.1668	29.68	20.97
$r \leq 3$	8.210645	7.822901	15.41	14.07
$r \leq 4$	0.387744	0.387744	3.76	3.76

### 4.3 VAR Estimation

Generally, the results from the cointegration test lead us to estimate VAR. It also allows us to simulate impulse response functions that capture dynamic responses of one variable with respect to other variables in the model. The VAR lag order is set to 2 according to AIC, which is found to be sufficient enough to render the error terms serially uncorrelated. We then focus on the impulse-response functions of the two focal variables; loans to the private sector (LPS) and stock prices (NSE) with respect to shocks in the other variables.

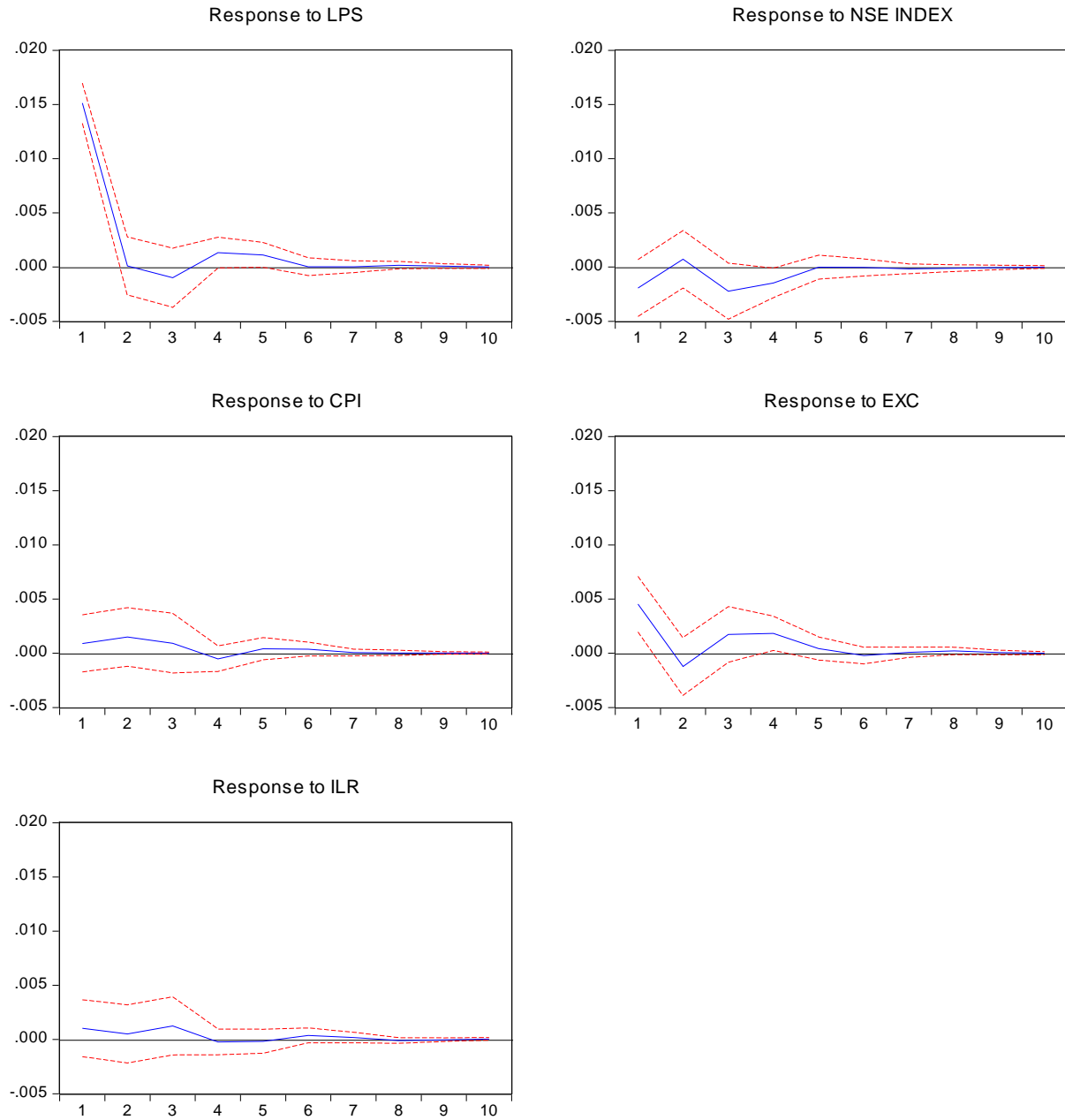
### 4.4 Impulse-response functions

We plot selected impulse-response functions from the VAR estimation. The plots include two standard deviations bands. If the zero line is not within the bands then the responses are significantly different from zero.

Figures 3 and 5 show the generalized impulse-response functions of bank loans and stock prices. The results are generally intuitive. In Figure 3, bank loans respond positively and significantly to ILR, CPI and EXC. However stock prices have a negative relationship to loans whereby shocks in stock prices leads to a drop in loans to the private sector. The negative relationship between stock prices and loans contradicts Kim and Moreno's (1994) findings for the case of Japan. A positive relationship between bank loans and interest rates is expected as an increase in interest rates leads to an increase in bank loans as well. This is due to the increase in loan supply as a result of increased interest rates.

Kim and Moreno found that a precipitous fall in stock prices comes before a contractionary measure by banks. In the case of Kenya, the 2007/ 2008 global financial crisis that was felt in Kenya, albeit at a smaller scale, lays credence to this.

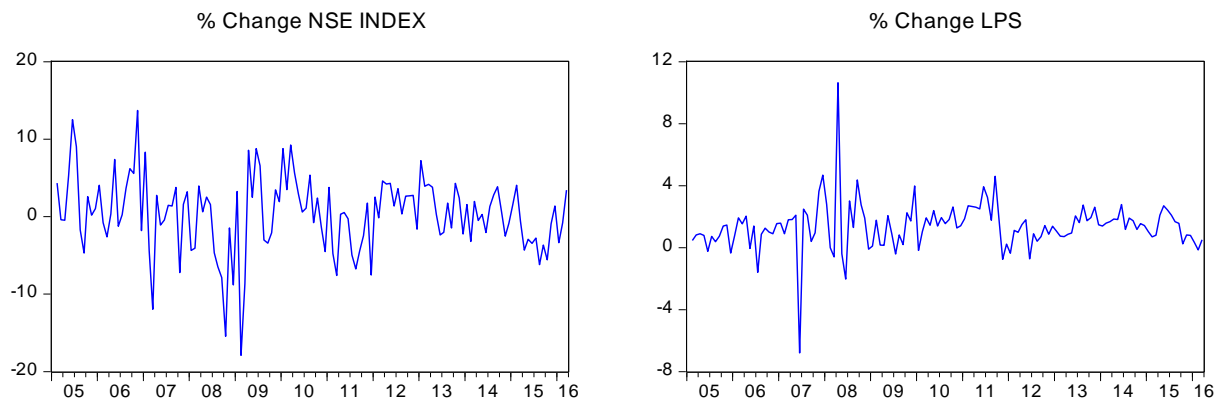
Figure 3: Generalized responses of bank loans



In as much as domestic credit to the private sector was still on an upward trend in 2007, the amount of loans that were disbursed reduced significantly in comparison to the previous year as shown in Figure 4. Following the fall in stock prices in early 2007, bank loans to the private sector contracted after a few months and recorded a negative growth of -6.8% during June of 2007.

There are two theories as to why this may be the case. In times of financial crisis, banks may be exposed to substantial default risk as a result of a significant rise in non-performing loans. As a result, they may adopt a contractionary policy which subjectively lowers the amount of loans disbursed during such a period in order to cushion themselves from losses.

Figure 4



Stock prices can also affect bank loans by influencing loan demand. A commonly known phenomenon in finance theory is that stock prices reflect investors' expectation of future real activity. Therefore a change in stock prices signals a change in future real activity, thereby influencing loan demand. Therefore, the reduction in loans to the private sector may also have been influenced by the reduced uptake of loans in the economy due to a grim expectation of future real activity in the economy. This may have been a result of the 2007/2008 financial crisis as well as the general elections that were held during that period.

The same can be said about subsequent elections that were held in 2012. A run up to the election date saw a bearish stock market with the stock index falling from previous highs of 4536 at the beginning of 2011 to lows of 3199 at the beginning of 2012. This was also followed by a

subsequent reduction in domestic credit to the private sector from previous highs of 9.69% in 2011 to lows of 0.6% in 2012. An important implication of this is that significant shocks to the stock market can lead to a negative influence to lending in the banking sector.

The findings also indicate that a shock to exchange rates leads to a rise in loans to the private sector. A more plausible explanation for this is that for a depreciating currency to benefit the private sector, then the amount borrowed should be used in exporting goods which will lead to higher profit. Hence the reason as to why a higher exchange rate would seem to favor net exporters acquire more loans.

Lastly, inflationary shocks positively impact bank lending to the private sector. A more plausible explanation for this would be that the Central Bank of Kenya's contractionary policies are ineffective. Inflation is when the economy grows due to increased spending. This leads to higher prices thereby eroding the country's currency value. In order to contain inflation, the central bank enforces policies that are aimed at reducing money supply in the economy.

In Figure 5, stock prices respond positively to shocks in CPI and interest rates. There is also no feedback effect in the relationship between stock prices and bank loans. The Kenyan government has also undertaken an expansionary monetary policy that tries to encourage lending while boosting confidence in the stock market. The evidence that there is no causal relation between the two variables indicates that this policy is not as effective.

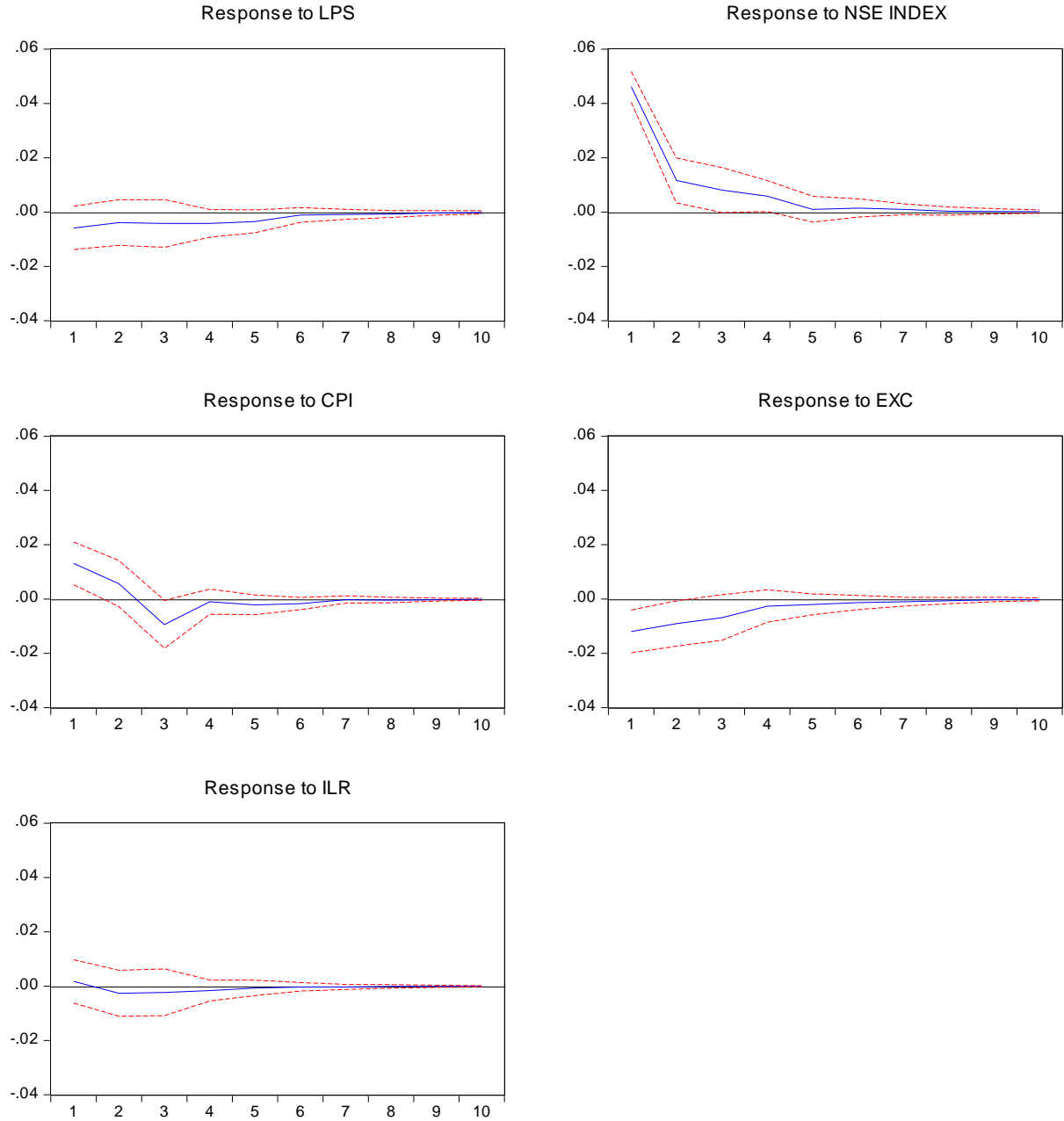
A positive increase in stock prices as a result of a shock in price levels shows that the stock market can provide a good hedge against inflation. If the rate of inflation goes up, then it would imply that the immediate response of the stock market would be to increase thereby providing a hedge against inflation.

Currency depreciation would lead to a fall in share prices. Given that the Kenyan currency is pegged to other currencies, a depreciation of the Kenyan currency would lead to anticipation of further depreciation in the currency and as a result drive out investments in the stock market. Moreover, depreciation can erode the value of companies which have foreign debt as it would increase their debt burden. This would lead to decreased stock prices.

It is interesting to note that a shock in the interest rates does not have a significant immediate effect towards share prices in Kenya. This implies that the private sector in Kenya still does not

consider the stock market as an alternative source of capital. This reflects literature that indicates that most developing countries have bank-based economies.

Figure 5: Generalized responses of stock prices



#### **4.5 Interpretation of results**

The study shows empirically the negative responses of bank loans to fluctuations in share prices. This allows us to turn to the question as to whether stock prices affect bank lending to the private sector. The answer is negative. In as much as stock prices do indeed affect bank lending immediately a shock is exerted on them, over the long run stock prices fail to have any significant effect on bank loans. To ascertain this, reference can be made to Figure 3 with respect to the response of bank loans to stock prices. The graph reaches its long term equilibrium in five periods. The implication of this finding is that bank loans tend to follow share prices significantly only in extreme cases, such as the case of the financial crisis of 2007/2008. However, under normal market conditions and with small shocks to the share prices, bank loans tend not to be affected by changes in the stock market. The study also indicates that there exists no causal relationship between stock prices and bank loans.

## **Chapter 5: Conclusion**

### **5.1 Summary of Study**

This study examines the dynamic relationships between stock prices and bank loans for the case of Kenya. The banking sector plays a crucial role in the Kenyan economy. It is one of the principal channels through which open market operations initiated by the central bank is transmitted through. As a result, the study investigated whether stock prices in the Kenyan market can be used as a suitable proxy for forecasting bank lending behavior of banks. It also seeks to illuminate the direction of causality between the two variables.

In the analysis, the study uses a five-variable VAR model consisting of bank loans, stock prices, price level, interest rates and exchange rates. The last three variables are included in the study as control variables. We then simulated impulse-response functions to assess how the variables interact in response to either of the focal variables.

We find evidence that shocks in stock prices leads to a fall in bank loans in the short run. However, the shocks do not have a long term effect in the lending behavior of banks in Kenya. In the long run, shocks in stock prices generally converge towards zero thereby indicating no significant influence to bank loans. This means that Kenya's share prices do not reflect all information in the economy hence their inability to significantly forecast bank lending in the long run.

However, given a short term correlation between bank loans and share prices, this means that adverse effects on the stock market may hurt the banking sector's health if not mitigated properly. During the 2007/2008 crisis, an attempt was made to mitigate stock market decline by promotion of bank lending activities by the Central Bank of Kenya. Our analysis suggests that this attempt was successful as the general economy was not adversely affected by the global crisis.

### **5.2 Policy Implications**

This paper scrutinized the impacts caused on bank lending activities as a result of changes in share prices in the stock market. Contrary to the findings of Kim and Moreno's (1994) paper, this study finds that there exists a negative relationship between stock prices and bank lending which subsides over time.

This implies that a sudden shock to the stock market will lead to a negative reaction in bank lending activities which should necessitate action from the Central Bank of Kenya.

This paper has also found that bank loans respond positively to interest rates and inflation in the economy. Upon knowing that interest rates and inflation drive up bank lending activities in Kenya, the Central Bank which is mandated in ensuring long term stability of the economy can factor this in their overall analysis of best policies to apply.

Secondly, investors should also be informed on the potential existence of a good hedge between the Kenyan stock market and inflation. A shock in inflation affects share prices positively as per the paper's analysis. Upon sudden shocks in the inflation rate, investors should switch their investments into stocks which will help hedge against any depreciation in other assets.

Thirdly, the management of banks should also understand how drastic effects of share prices may affect their bank lending operations. The paper suggests that the impact is only temporary and does not last for a long time since there exists no significant relationship between bank lending and share prices in the long run.

### **5.3 Limitations and Recommendations for Further Study**

Due to limited resources, this study is confined within the Kenyan stock market for a period of 10 years. The study should be conducted using real output (GDP) as an added control variable and impulse-response functions simulated for it. The time period should also be extended in order to have a wide data set where inferences can be made from. That being done, researchers could detect whether a significant relationship between bank loans and share prices exists and how such a relationship can imply to the economy.

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