EFFECTS OF MACROECONOMIC VARIABLES ON CREDIT RISK IN THE KENYAN BANKING SYSTEM

Gitonga Kariuki Washington

Department Of Commerce and Economics

The School Of Human Resource Development

Jomo Kenyatta University of Agriculture and T*echnology.*

gitongawk@gmail.com

ABSTRACT

The macroeconomic environment is viewed as a critical driver for nonperforming loans. In this regard, the main goal of this study to investigate the Effects of macroeconomic variables on credit risk in commercial banks in the Kenyan banking system. The dependent variable under investigation was nonperforming loans while independent variables were macroeconomic and included: GDP per capita growth rate, Lending interest rates, Exchange rate between the US dollar and the Kenyan Shilling, Inflation rate and Domestic credit to the private sector by the Commercial Banks. The period covered under this study was 1990 to 2013 where annual secondary data was used.

The study used an OLS regression equation, applying an error correction Model on the equation and tested the values at 5% significance level and found evidence that only GDP per capita growth rate was significantly related to credit risk (t-value -4.22) in the short-run. In the long run however all variables were significant in explaining credit risk. Exchange rates between the US dollar and the Kenyan shilling were found to be negative and significantly related to credit risk (t-value -3.40). The study also found that Domestic credit to private sector by the commercial banks was found to be negative and significantly related to credit risk (t-value -4.61).Similarly Inflation was found to be negative and significantly related to credit risk (t-value -3.71). Further, Lending interest rates were positive and significant to credit risk (t-value 3.76), The study recommends that commercial banks managers employ a more flexible approach to dealing with the macroeconomic factors: such as with inflation, an increase in the loan loss provision was recommended when there was high inflation and a decrease in loan loss provision in cases of low inflation rate. A reducing balance approach on loan amounts was also recommended while also incorporating a fixed lending rate approach on loans of huge amounts that span a number of years.

1. INTRODUCTION

1.1 Background of the Study.

Commercial banks in Kenya play an important role to the economy. They enable mobilization of savings, provide investment advice to investors as well as safekeeping and trust services; they also lend out money at an interest to both individuals and corporate customers, Central Bank Of Kenya, (2008). However, loan creation function can lead to extreme losses to the bank if they are not adequately managed. The ratio of non-performing loans to gross loans increased from 4.4 percent in December 2011 to 4.7 percent in December 2012. The increase in non-performing loans signaled an increase in credit risk which was largely attributable to high interest rates in the first half of 2012, Central Bank Of Kenya, (2012).As at 31st December 2012, the banking sector consisted of the Central Bank of Kenya, as the regulatory authority, 44 banking institutions (43 commercial banks and 1 mortgage finance company), Central Bank Of Kenya,(2012).

One of the difficulties in lending is to precisely predict whether a loan will be paid in full. This implies that lending involves credit risk especially default risk. Therefore banks use diverse internal techniques such as client screening to minimize loan default rates and consequently minimize levels of nonperforming loans. A loan is non-performing when payments of interest and principal are past due for over 90 days or more and there are other good reasons to doubt that payments will be made in full IMF,(2009). Adequately managing credit risk in financial institutions is critical for the survival and growth of financial institutions. In the case of banks, the issue of credit risk is of greater concern because of the higher levels of perceived risks resulting from some of the characteristics of clients and business conditions that they find themselves in Central Bank Of Kenya, (2010).

Kenya has experienced banking problems since 1986 culminating in major bank failures (37 failed banks as at 1998) following the crisis of ; 1986-1989, 1993/1994 and 1998, Kithinji and Waweru (2007), and Ngugi (2001) . Twelve banks collapsed between 1984 and 1989.This first wave of bank collapses forced the government to pass the Banking Act of 1989, which among other things tightened requirements for the licensing of new banks and non-banking financial institutions. The minimum capital requirement was substantially increased, deposit insurance was made mandatory, and over-lending and earning interest on non-performing loans were prohibited. To protect depositors and oversee bank liquidation the government set up a Deposit Protection Fund Board, Kenya Bankers Association, (2012). In December 1989, the government combined the deposits and assets of nine of the collapsed banks to form the Consolidated Bank of Kenya.

Despite the government's new regulations, there was a second wave of bank failures between 1993 and1995 affecting 19 banks. Several of these collapsed banks had been indicted in the infamous Goldenberg scandal of the early 1990s through which is estimated to have cost the country billions of Shillings. There was a third wave of bank failures in 1998 affecting Bullion Bank, Fortune Finance, Trust Bank, City Finance Bank, Reliance Bank and Prudential Bank. And between 2000 and 2005 five more banks and non-banking financial institutions collapsed, Kenya Bankers Association (2012)

Given the recent turbulence in banking and the rise in non-performing loans (NPLs) there is renewed interest in the impact of internal and external factors on NPLs of banks. Financial institutions and more specifically the banking industry is faced with an array of risks such as liquidity risk, market risk, and operational risk and credit risk among others.

Credit risk is identified as one of the oldest and major risk factors that banks and other financial institutions have been facing from time to time. Fernández de L., et al., (2002), identified that non-performing loans are known to paralyze institutions performance and also lead to financial crisis, Central Bank Of Kenya, (2010), defines nonperforming loans as loans whose principal payment and interest are not met by the borrower/customer, and observes the period for determining whether a loan has become non-performing under international guides to be 45 to 90 days but this may differ in different countries like in India it is 180days.

The risk of non-performing loans mainly arises as the external economic environment becomes worse off such as when there are economic depressions. Controlling non-performing loans is very important for both the performance of an individual bank and the economy's financial environment, McNulty, et al.,(2001). Due to the nature of their business, commercial banks expose themselves to the risks of default from borrowers. Prudent credit risk assessment and creation of adequate provisions for bad and doubtful debts can cushion the banks risk. However, when the level of non- performing loans is very high, the provisions are not adequate protection/

As banks intensified their credit recovery efforts, the ratio of gross non-performing loans to gross loans improved marginally to stand at 4.7% as at December 2012 compared to 4.4% in December 2011. The sector has largely improved from when the ratio of non-performing loans was still at 9% 5 years ago. The reduction by more than half over the past five years can be attributed to the exemplary regulatory involvement in the sector. Over the years, Central bank under Basel 1 and Basel 11 of the Capital Adequacy Accord has continued to focus on credit risk management and the Risk Based Supervisory (RBS) approach which requires that more resources be dedicated to more risk-prone activity areas, Think business (2013).

1.2 Statement of the Problem

The Kenyan banking system has experienced banking problems since 1986 which has led to the collapse of 42 commercial banks. The ratio of non-performing loans to gross loans increased from 4.4 percent in December 2011 to 4.7 percent in December 2012. The increase in non-performing loans signaled an increase in credit risk. The collapse of the banks which was due to imprudent measures on credit risk, have led to unemployment, slowed economic growth, and halted the development of banks over the period of time, Central Bank Of Kenya (2012).

Most of the studies on factors explaining credit risk in banks have been carried out in the advanced economies .This include, Aver (2008), on his study of credit risk factor on Slovenian banking system; Das and Ghosh (2007), in their study on determinants of credit risk in state-owned banks in India. These studies have been conducted under unique regulatory and economic environments where the level of market efficiency is advance compared to those of emerging and developing countries like Kenya.

Previous studies on the Kenyan context concentrated largely on the effects of credit risk management on performance of commercial banks in Kenya. This includes: Kithinji and Waweru (2007), on credit risk management and profitability of commercial banks in Kenya. Warue (2013), on the effects of bank Specific and macroeconomic factors on nonperforming Loans in Commercial Banks in Kenya: A Comparative Panel Data analysis, Musyoki (2011) and Ogilo (2012), who separately conducted an empirical study on the impact of credit risk management on financial performance of Kenyan banks and Ngetich (2011), who analyzed the effects of interest rates spread on the level of non-performing assets on commercial banks in Kenya. A close scrutiny of these studies shows that the evidence on macroeconomic

determinants of credit risk in commercial banks in Kenya is scant. This study aims at filling this research gap.

1.3 Objectives

1.3.1 General objective

The main objective of this study is to evaluate the effects of macro-economic variables on credit risk in the Kenyan banking system. Specifically the study sought to establish:

1) The effect of GDP per capita growth rate on credit risk in commercial banks.
2) The effect of Lending interest rates on credit risk in commercial banks
3) The effect of Exchange rates on credit risk in commercial bank.
4) The effect of Inflation rate on credit risk in commercial banks.
5) The effect of Domestic credit on credit risk in commercial banks.

On the basis of the specific objectives, the study drew appropriate policy recommendations which aimed at helping all the relevant stakeholders to take stock of the effects of the different macroeconomic variables on credit and ensure a strong, stable and reliable financial sector.

1.4 Research Questions.

Consistent with the research problem outlined in section 1.3, the study sought answers on the following research questions.

1) Does GDP per capita growth rate influence the level of credit risk in commercial banks?
2) To what extent does lending interest rate influence credit risk in commercial banks?
3) Do exchange rates influence credit risk in commercial banks?
4) What is the impact of inflation rate on credit risk in commercial banks?
5) How does credit growth influence credit risk in commercial banks?

1.5 Justification of the Study.

The research findings of this study will help in addressing the existing knowledge gap in literature of Effects of macroeconomic variables on credit risk in Kenyan commercial banks. It will also be a valuable addition to the existing knowledge and provide a platform for further research which will be useful to scholars. An understanding of the Effects of the macroeconomic variables on credit risk in the Kenyan banking system is important to the senior management and investors of financial institutions in Kenya. The study findings will enable managers and investors make timely decisions on how to avoid risk, transfer risks, risk reduction (mitigating risk) or retain the risk in a bid to maximize returns. On the policy front the study findings are also important to the government, regulatory bodies and to the commercial banks themselves. It will help the regulators to know exactly how credit risk is affected by macroeconomic variables and how to strengthen the financial industry in terms of policies.

2. LITERATURE REVIEW.

2.1 Introduction

This chapter presents theoretical and empirical survey of the literature on macroeconomic factors explaining credit risk.

2.2 Theoretical Review

Theories underpinning non performing loans

The theories of credit risk relate non-performing loans external and internal factors. There are three theories that have provided insight into how these factors influence nonperforming loans levels.

2.2.1 Deflation Theory

The first is deflation theory, Fisher (1933), which suggests that when the debt bubble bursts the following sequence of events occurs; debt liquidation leading to distress selling and contraction of deposit currency, as bank loans are paid off. This contraction of deposits cause a fall in the level of prices, which leads to greater fall in the net worth of business, hence precipitating bankruptcies which leads the concerns running at a loss to make a reduction in output, in trade and in employment of labor. These cycles cause complicated disturbances in the rates of interest and a fall in the money value.

The complicated disturbances described above can be summed as both external and internal forces (macro and micro factors) influencing state of over-indebtedness existing between, debtors or creditors or both which can compound to loan defaults.

2.2.2 Financial Theory:

The second theory, "Financial theory" pioneered by, Minsky (1974) also known as financial instability hypothesis, attempted to provide an understanding and explanation of the characteristics of financial crisis.

The theory suggests that, in prosperous times, when corporate cash flow rises beyond what is needed to pay off debt, a speculative euphoria develops, and soon thereafter debts exceed what borrowers can pay off from their incoming revenues, which in turn produces a financial crisis. As a result of such speculative borrowing bubbles, banks and lenders tighten credit availability, even to companies that can afford loans and the economy subsequently contracts.

The theory identifies three types of borrowers that contribute to the accumulation of insolvent debt: The "hedge borrower" can make debt payments (covering interest and principal) from current cash flows from investments. For the "speculative borrower", the cash flow from investments can service the debt, i.e., cover the interest due, but the borrower must regularly roll over, or re-borrow, the principal. The "Ponzi borrower" borrows based on the belief that the appreciation of the value of the asset will be sufficient to refinance the debt but cannot make sufficient payments on interest or principal with the cash flow from investments; only the appreciating asset value can keep the Ponzi borrower afloat.

Financial theory underpin this study in that, a hedge borrower would have a normal loan and is paying back both the principal and interest; the speculative borrower would have a watch loan; meaning loans' principal or interest is due and unpaid for 30 to 90 or have been refinanced, or rolled-over into a new loan; and the Ponzi borrower would have a substandard loan, meaning the payments do not cover the interest amount and the principal is actually increasing. The primary sources of repayment are not sufficient to service the loan. The loan is past due for more than 90 days but less than 180 days. Substandard loans are nonperforming loans, hence applicability of financial theory in this study.

2.3 Quantifying Bank Risk

A big challenge for the empirical model at hand is to identify an appropriate measure of credit risk. In theoretical discussions, the term credit risk often implies expected and/or unexpected losses (in

the statistical sense) for a bank where, expected losses refer to the average or mean losses anticipated over a particular period, while unexpected losses refer to a measure of the dispersion, or degree of uncertainty that surrounds that outcome, Borio, et al., (2001) For the purposes of econometric modeling, however, there are varying measures such as KMV portfolio approach which quantifies credit risk to portfolio management, benchmarking, and performance attributions which was a good fit for our sample and a risk proxy was therefore sought.

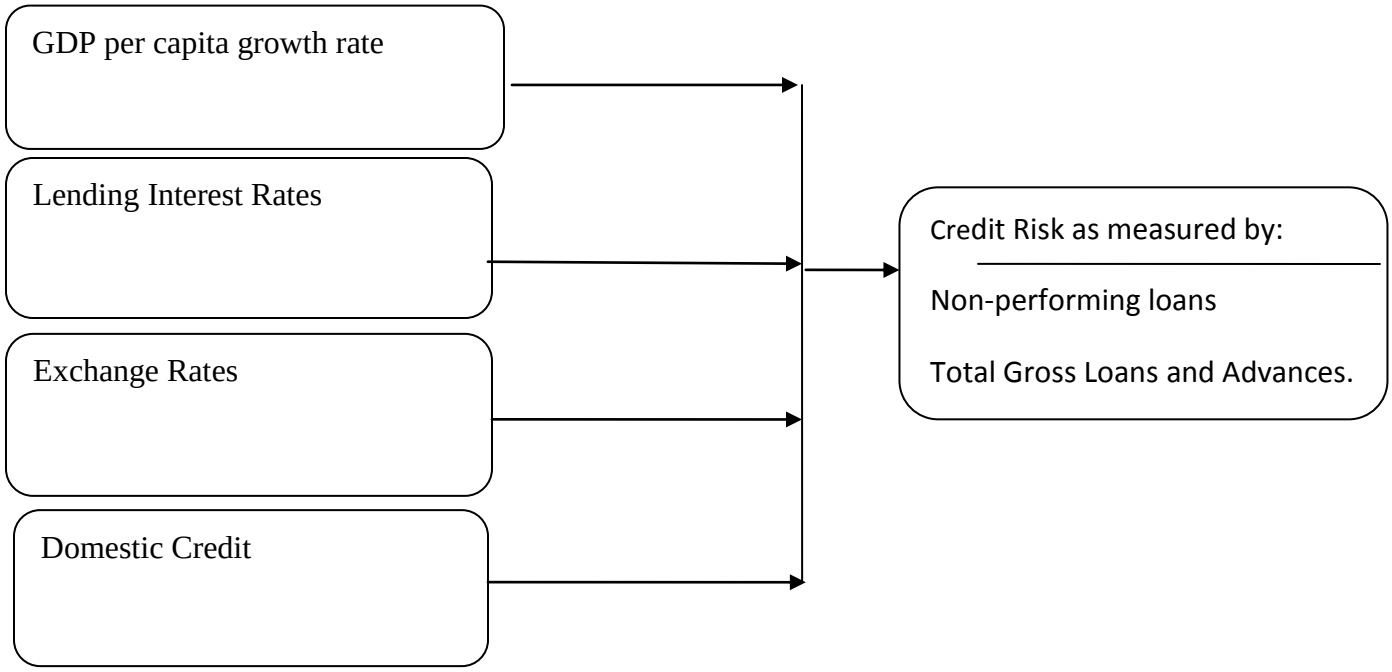
Various proxies for credit risk have been suggested in empirical literature. The study sought to use one used in Research by Warue, (2013), in investigating the effects of Bank Specific and Macroeconomic Factors on nonperforming Loans in Commercial Banks in Kenya: A Comparative Panel Data Analysis using panel econometrics approach employing both pooled (unbalanced) panel and fixed effect panel models estimated credit risk as a ratio of:

$$\text{NPL} == \frac{\text{Outstanding principal balance of loans past due more than (90) days}}{\text{Outstanding principal balance of all loans}}$$

This is also supported by studies by Vogiazas & Nikolaidou, (2011), Ngetich (2011), along these lines, the study will use a similar measure Credit Risk as measured by:

$$\text{CREDIT RISK} = \frac{\text{Non-performing loans}}{\text{Total Gross Loans and Advances.}}$$

2.4 Conceptual Framework



Independent Variables **Dependent Variable**

Source: Author 2014

2.5: Empirical Literature.

Empirical studies suggest that for every banks crisis there are some macro economic variables relating bank crisis to the economic performance.

Several studies have found GDP per capita growth rate as a significant variable explaining credit risk. Employing estimate fixed-effects and dynamic panel regressions on the basis of annual data for the change in the aggregate NPL ratio Beck, et al., (2013), investigated For 75 advanced and emerging economies in the period from 2000 to 2010, employing estimate fixed-effects and dynamic panel regressions on the basis of annual data for the change in the aggregate non performing loans ratio found GDP rate to have a positive significance effect to non performing loans. This confirms previous studies by Thiagarajan, et al., (2011), Derbali, (2011), Ali and Daly, (2010). The findings are however in sharp contrast with Nkusu (2011), who also analyses the issue with a sample of 26 advanced economies over the period 1998-2009 using single equation panel regressions and a panel vector autoregressive model and found that GDP had a negative relationship on credit risk, this further affirmed by the study of Warue, (2013), Salas and Saurina, (2002), the study showed that banks accumulate risks more rapidly in economic boom and some of these risks materialize as asset quality deteriorates during subsequent economic recessions.

Several studies have found Lending interest rates as a significant variable explaining credit risk. Warue, (2013), in investigating the effects of Bank Specific and Macroeconomic Factors on nonperforming Loans in Commercial Banks in Kenya: A Comparative Panel Data Analysis using panel econometrics approach employing both pooled (unbalanced) panel and fixed effect panel models found that lending interest rates were both positive and significant in affecting non-performing loans in commercial banks this goes to confirm previous studies done on the same by Beck, et al., (2013), Souto, et al., (2009),and Aver, (2008). This however showes disparity with Park and Zhang, (2012), who investigated the effects of macroeconomic and Bank-Specific Determinants of the U.S. Non-Performing Loans: Before and During the Recent Crisis, using two distinct time periods 2002-2006 before the crises and 2007-2010 after the crises and showed that the coefficients for the Federal Funds rate/interest rate was negative in relation to credit risk.

Castro, (2012), analyzed the link between the macroeconomic developments and the banking credit risk in a particular group of countries – Greece, Ireland, Portugal, Spain and Italy (GIPSI), while employing dynamic panel data approaches to these five countries over the period1997q1-2011q3 and found that there was a negative relationship and significant relationship between Exchange rate and credit risk. This confirms previous studies Zribi & Boujelbene,(2011), Vogiazas and Nikolaidou (2011) Gunsel, (2008), Kalirai and Scheicher,(2002), Aver (2008), and Fofack (2005).

Several studies have found inflation rate as a significant variable explaining credit risk. In this regard Mileris (2012), studied the macroeconomic determinants that significantly influence the changes of loan portfolio credit risk in banks and to develop the statistical model for prediction of the proportion of doubtful and non-performing loans and employed an OLS regression model for 22 EU countries that were grouped into 3 clusters according to their similarity in changes of the doubtful and non-performing loans percentage in banks for the time period between 2007-2011 and found that an increase in inflation rate had a profound positive relationship to non-performing loans This confirms previous studies by Kochetkov, (2012), Derbali, (2011), Renou, (2011). This was in stark contrast with Warue, (2013) who employed a Comparative Panel Data Analysis using panel econometrics approach employing both pooled

(unbalanced) panel and fixed effect panel models, in investigating the effects of Bank Specific and Macroeconomic Factors on nonperforming Loans in Commercial Banks in Kenya, and came to the findings that inflation was negatively related to credit risk /non-performing loans.

Several studies have found Credit growth rate as a signifcant variable explaining credit risk. Castro, (2012), analyzed the link between the macroeconomic developments and the banking credit risk in a particular group of countries – Greece, Ireland, Portugal, Spain and Italy (GIPSI), while employing dynamic panel data approaches to these five countries over the period1997q1-2011q3 and found that there was a negative and significant relationship between credit growth and credit risk. Since when credit expands or grows faster, the risk of more defaults in the future may increase because that expansion might be achieved at the cost of more risky loans. The effect of which may not be felt immediately. This confirms the previous studies of Igan & Pinheiro, (2011), Mendoza and Terrones, (2008) and Tamirisa and Igan, (2007).

2.6 Research Gaps

A review of previous literature in the preceding section shows that most of the studies carried out in the Kenyan context on credit risk have largely concentrated on the Effects of credit risk management on performance of commercial banks in Kenya, and Bank specific factors that affect credit risk in commercial banks. No study in Kenya has so far looked at the effects of Macroeconomic factors on credit risk in the Kenyan commercial banks. Furthermore, a close scrutiny of all the study variables shows that the there is a disparity between the different findings of the different variables and hence the study aims at filling this gap.

For example Salas and Saurina, (2002), Ali and Daly, (2010) and Nkusu (2011), found that GDP per capita had an inverse relationship to non-performing loans in their respective studies while Beck, et al., (2013), found a positive relationship between GDP and non-performing loans . In the case of lending interest rates, Warue (2013), Beck, et al., (2013) and Souto, et al., (2009) found a positive relationship between lending interest rates while Park & Zhang, (2012) found that lending interest rates had an inverse relationship to non-performing loans. In the case of Inflation rate, Mileris (2012) and Renou (2011) in their respective studies found that Inflation rate had a positive relationship with non-performing loans, while Warue (2013) in the study found a negative relationship between inflation rate and non-performing loans. In the case of credit growth there is no study in Kenya which references or uses credit growth as a variable in finding a relationship to non-performing loans.

3. RESEARCH METHODOLOGY

3.1 Introduction

This chapter covers data sources, definition and description of the key variables. It encompasses the research design, target population, data collection techniques, data collection procedures and finally data analysis, the econometric framework, the model specification, the estimation results and, finally, the robustness checks on the selected model.

3.2 Research Design

Research design refers to the methods used to carry out research. The research problem was studied through the use of a descriptive research design. A descriptive study is concerned with finding out the what, here, and how of a phenomenon, Cooper and Schindler, (2008).). Descriptive research design is

going to be employed as it enables the researcher to generalize the findings to a larger population. This study was therefore generalized to all the commercial banks in Kenya. The main focus of this study was quantitative. The choice of the methodology was informed by the data generating process. Previous studies that have used a similar research design include: Gremi,(2013), Park and Zhang, (2012), Mileris, (2012), Castro, (2012), Renou, (2011), Igan andPinheiro, (2011), Vogiazas & Nikolaidou,(2011), Salas and Saurina, (2002).

3.3 Target Population

There are 43 commercial banks in Kenya Central Bank of Kenya, (2013). This study shall use time series data from all the 43 commercial banks in Kenya to avoid the sampling bias problem covering the annual period from 1990 to 2013

3.4 Definition and Measurement of Variables.

This study used annual data from the Central Bank of Kenya, World Bank and KNBS covering the period from the year 1990 to 2013. The study employed the use of secondary data in its analysis from the aforementioned sources.

The GDP per capita growth rate variable in this study is one of the five independent variables for the equation which will show the relationship between it and credit risk. Annual data from 1990 to 2013 was used, and the data was sourced from the World Bank website.

Lending Interest rates was also used in the study as an independent variable for the period from 1990 to 2013. It is defined as the amount charged, expressed as a percentage of principal, by a lender to a borrower for the use of assets. Annual data was used to apply consistence with the other data formats for other variables employed in the study.

Inflation is an increase in the general price level and is typically expressed as an annual percentage rate of change. Inflation is important for banks in their capacity of financial intermediation having adjusted for anticipated inflation, and can suffer massive default risk depending on the fluctuation of inflation between the anticipated and actual inflation rates on their fixed instruments Glogowski, (2008). Rising inflation tend to lead to an increase in non-performing loan, credit risk. The inflation rate data for this study was sourced from the Kenya National Bureau of Statistics for the twenty four year period of 1990 to 2013.

Exchange rate is another variable used in this study. This is the price of a nation's currency in terms of another currency .Data for exchange rate was sourced from the Central Bank of Kenya website for the period 1990-2013.

Credit growth to the private sector by commercial banks was another variable used in this study. It is defined as the increase in the loans for the private sector, individuals, establishments and public organizations. The data set will be from the year 1990-2013 and secondary data shall be sourced from the World Bank website.

Table 3.1: Summary of Variables and Measurement.

Variable	**Description**	**Predicted Effect**	**Research Support**	**Data Sources**
GDP per Capital Growth rate	Measure of the size of an economy adjusted for price changes and inflation. It measures in constant prices the output of final goods and services and incomes within an economy	Negative	Beck, et al., (2013), Thiagarajan, et al.,(2011), Derbali,(2011), and Ali & Daly, (2010).	WDI
Lending Interest Rates	The rate at which banks lend money to borrowers of loans.	Positive	Warue, (2013), Beck, et al., (2013), Souto, et al., (2009), and Aver, (2008)	WDI
Exchange Rates	It is also regarded as the value of one country's currency in terms of another currency	Negative	Vogiazas and Nikolaidou, (2011) and Aver , (2008). Gunsel, (2008), Fofack,(2005)	WDI
Inflation Rate	Inflation is an increase in the general price level and is typically expressed as an annual percentage rate of change.	positive	Mileris,(2012), Kochetkov,(2012), Renou,(2011), Derbali, (2011),	KNBS
Credit Growth Rate	The rate at which domestic growth is expanding in an economy as advanced by banks in form of loans to both the public and private individuals and corporate.	Positive	Castro,(2012), Igan and Pinheiro, (2011), Mendoza andTerrones, (2008) and Tamirisa and Igan, (2007).	WDI

3.5 Data Analysis and Presentation.

Before the data was subjected to a regression analysis, a normality test through the descriptive statistics of the variables was carried out to find out whether the variables were normally distributed. The variables residuals were also tested for normality and a histogram of the results graphed out. Correlation among the variables was tested by and compared by use of a correlation matrix to find out whether the variables could be regressed together or they were too highly correlated. i.e. > 0.8.

3.6 Econometric Methodology

In order to explain the determinants of the non-performing loans in the banking industry in Kenya, the study shall use the ordinary least squares model (OLS). Under this approach it needs to be considered that the OLS's main assumption is that the errors must be uncorrelated.

$$y_t = \alpha + x'_t\beta + \varepsilon_i$$

Consistent with, Brooks, (2008), the econometric model is specified;

Model Specification.

$$NPL_t = \alpha + \beta_1 \Delta GDPPCGR_t + \beta_2 \Delta LIR_t + \beta_3 \Delta EXCH_t + \beta_4 INFLR_t + \beta_5 DC_t + \varepsilon_t$$

Where,

NPL_t = Non-performing loans at time, t

$GDPPCGR_t$ = GDP Per capita growth at time, t

LIR_t = Lending Interest Rate at time, t

$EXCH_t$ = Exchange Rates at time, t

$INFLR_t$ = Inflation Rate at time, t

DC_t = Domestic credit growth to private sector by commercial banks at time, t

t = time

ε_t =the error term is assumed to be normally and independently distributed with mean zero and constant variance, t

α_t = captures all other explanatory variables which affect stock returns, but are not captured in the model.

$\beta_1, \beta_2, \beta_3, \beta_4, \beta_5$ are the coefficients of Credit risk, measured with respect to GDP,LIR,EXCH,INFLR,DC respectively. Previous studies have shown that OLS is a suitable model to describe NPL time series Espinoza & Prasad, (2010)

4. EMPIRICAL RESULTS AND DISCUSSION

4.1 Introduction

The main objective of this study was to investigate the determinants of credit risk across commercial banks. This chapter covers the empirical analysis of the factors that explain credit risk. The data was tested for normality of the variables, Correlation analysis, Co-integration, regression of the

variables and Error correction. Post-estimation tests were also carried out for normality of the residuals, autocorrelation and Heteroskedasticity

4.2 Univariate Analysis.

Time series data often have time-dependent moments (e.g. mean, variance, skewness, and kurtosis). When analyzing time series data, the initial step is to investigate whether the variables under study are normally distributed. To test for normality of the variables, descriptive statistics was undertaken putting keen interest on the Jarque-Bera probability. Our concern being also on the measures of central tendency that comprises of the mean, median, and the mode as well as the measures of variability or dispersion that comprises of standard deviation (or variance). When using the jargue Bera test a null hypothesis of normal distribution was tested against the alternative hypothesis of non-normal distribution. For normal distribution the JB statistics is expected to be statistically indifferent from zero thus;

Ho: JB=0 (Normally distributed)

H1: JB≠0 (Not normally distributed)

Rejection of the null for any of the variables would imply that the variables are not normally distributed. Table 4.1 presents the results of descriptive statistics of all the variables for the period 1990-2013. . There is a wide variation in credit risk across the banks. The minimum and maximum values of credit risk are unevenly distributed. Table 4.1 shows that all the variables are normally distributed except for inflation. To confirm that the variables are normally distributed a post estimation residual normality test was carried out (See Figure 1 in the Appendix).

4.3 Correlation Analysis.

The correlation analysis is statistical technique employed to measure the strength or degree of linear association between two variables. Correlation analysis is used to check for multicollinearity between the variables. Multicollinearity is a serious problem if the correlation coefficient between two regressors is above 0.8. The correlation coefficient can range from -1 to +1 with -1 indicating a perfect negative correlation +1 indicating a perfect positive correlation , and 0 indicating no correlation at all. Table 4.2 shows the relationship between the dependent and independent variables. From the correlation matrix, Gdp per capita growth rate is negatively correlated with credit risk (-0.24 or 24%). Lending interest rate is positively correlated with credit risk (0.34 or 34%). Exchange rate is negatively correlated with credit risk (-0.22 or 22%). Inflation is negatively correlated with credit risk (-0.06 or 6%). Domestic credit is negatively correlated to credit risk (-0.59 or 59%).The correlation matrix shows that all the variables can be included in the same model since they are below the multicollinearity. These low correlations also give the signal of no multicollinearity among the variables

4.4 Stationarity Test.

When estimating a model of time series variables, it is necessary to ensure that all time series variables are stationary. The mean or variance of many time series increases over time. This is a property of time series data called non stationarity. As Granger and Newbold,(1974) demonstrated, if two independent, non-stationary series are regressed on each other, the chances for finding a spurious relationship are very high. Shocks (e.g. the 2007/08 ethnic clashes) to a stationary series are temporary; the series reverts to its long run mean. For non-stationary series, shocks result in permanent moves away from the long run mean of the series.

Augmented Dickey-Fuller (ADF) test was conducted and the results reported in Table 4.3. The decision criterion involves comparing the computed ADF statistic values with the critical values at 5%. If the computed ADF statistic is greater in absolute terms compared to the critical values, the null hypothesis of non-Stationarity in time series variables is rejected and vice versa.

When variables are integrated at different levels as above, the first task is to test for co-integration of the variables that are integrating at 1. The results are reported in Table 4.4. It is well known that if two series are integrated at two different orders, linear combination of them will be integrated to the higher order of the two orders. But it is possible that certain combinations of the non-stationary series are stationary. Then it is said that the pair $y_{t,}$ x_t are co-integrated. The results show that the variables are integrating and therefore we can run a regression.

Table 4.4. Co-integration Test.

Date: 05/10/14 Time: 12:03

Sample (adjusted): 1992 2013

Included observations: 22 after adjustments

Trend assumption: Linear deterministic trend

Series: CRISK INTRST INFL EXCH DC

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 *	0.970442	215.0712	95.75366	0.0000
At most 1 *	0.900174	137.6004	69.81889	0.0000
At most 2 *	0.763339	86.90528	47.85613	0.0000
At most 3 *	0.720055	55.20053	29.79707	0.0000
At most 4 *	0.705370	27.19094	15.49471	0.0006
At most 5	0.013820	0.306151	3.841466	0.5800

Trace test indicates 5 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		Max-Eigen	0.05

No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.970442	77.47074	40.07757	0.0000
At most 1 *	0.900174	50.69514	33.87687	0.0002
At most 2 *	0.763339	31.70475	27.58434	0.0139
At most 3 *	0.720055	28.00959	21.13162	0.0046
At most 4 *	0.705370	26.88479	14.26460	0.0003
At most 5	0.013820	0.306151	3.841466	0.5800

Max-eigenvalue test indicates 5 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 co-integration results as shown in table 4.4 using the Johansen co-integration test show that there are five co-integrating equations and therefore there is a long run relationship and equilibrium on the variables. The existence of co-integrating vectors imposes the transformation of the OLS model into a VECM model to analyze the dynamic inter-relationships. The numbers of observations are however too few to run a VECM. Hence an OLS was done followed by an Error correction Model on the equation. The validity of the specification depends on the serial non-correlation, normality and homoskedacity of the residuals. This is reported in Table 4.6.2, Figure 1 Table 4.6.3 respectively.

4.5 Empirical results and discussion

Having analyzed the summary statistics we focus on a more comprehensive model specification to further test the link between credit risk and macroeconomic variables. Table 4.5 reports results from our basic specification using non-performing loans as the credit risk measure. Interesting and new findings emerge.

Table 4.5: The Effects of Macroeconomic Variables on Credit risk.

Variable	**Notation**	**Model**		**Model with ECM**
Constant	**C**	69.49**	**C**	-0.29
		(6.61)		(-0.31)
GDP per capita growth rate	GDPPCGR	-0.46**	D(GDPPCGR)	-0.15*
		(-4.22)		(-1.80)
Lending interest rate	INTRST	0.58**	D(INTRST)	0.16
		(3.76)		-0.7
Exchange rate	EXCH	-0.24**	D(EXCH)	-0.11

		(-3.40)		(-0.59)
Inflation	INFLATION	0.58**	D(INFLATION)	-0.18
		(-3.71)		(-0.59)
Domestic credit	DC	-1.24**	D(DC)	-0.24
		(-4.61)		(-0.65)
Error correction Term			U(-1)	-0.35
				(0.09)*
	R2	0.76	**R2**	0.26
	Adjusted R2	0.69	**Adjusted R2**	(0.01)
	F stat	11.38	**F stat**	0.97
	Prob(F-statistic)	0.00	**Prob(F-statistic)**	0.47
	DW	1.75	**DW**	1.36

Note: The 1%, 5% and 10% significant level is denoted by ***, ** and * respectively. The parentheses indicate t-statistics

From the ECM regression model the results show that error correction term is significant at 10% level of significance, the coefficient of the error term is negative and indicates that the speed of adjustment is -0.34 and which goes to show that the ECM is normalizing the errors at the rate of negative 34% annually in the short-run. Our preferred model with ECM suggest that in the short-run only GDP per capita growth rate is significant and important in explaining the credit risk in Kenyan commercial banks in Kenya. From the equation the coefficient of U (-1) is negative and less than one and the corresponding coefficient of determination in the ECM is less than the Durbin Watson statistics hence our ECM results are not spurious and are therefore valid. In the long run however the results were obtained after the variables that were stationary at I (1) were found to be co-integrated hence regressed with the variables at I (0). The regressed results from our basic OLS model form the basis of results interpretation in the long-run.

Estimation of the model took the linear shape

CRISK = 69.46 -0.46*GDPPCGR + 0.58*INTRST - 0.24*EXCH - 0.58*INFL - 1.25*DC

From the equation, an examination of the econometrics results further shows that the overall fit is satisfactory with an adjusted R-squared ($R^{2)}$ of 0.69 or 69%. It implies that Gdp per capita, Lending interest rates, Exchange rates, Inflation rates, and domestic credit from previous periods explained about 69% change of the credit risk over the observed years in the Kenyan commercial banks. The Durbin Watson is 1.75 for the model

4.6: Post Estimation Tests

4.6.1: Normality test for Residuals

Jarque –Bera test is a test statistic for testing whether the series is normally distributed. The test statistic measures the difference of the skewness and kurtosis of the series with those from the normal distribution Figure 1 in the appendix is a histogram of residuals used to provide a graphical representation

of the behaviour of the random variables for estimation. The Figure shows that the residuals are normally distributed

4.6.2: Test for Autocorrelation:

To test for first order autocorrelation, we use the Durbin-Watson (DW) d statistic (see Table 4.8 in the Appendices) which test for the 1st order correlation and found no correlation since the DW was approximately 2.

4.6.3: Test for Heteroskedasticity

Heteroskedasticity does not cause ordinary least squares coefficient estimates to be biased, although it can cause ordinary least squares estimates of the variance (and, thus, standard errors) of the coefficients to be biased, possibly above or below the true or population variance As shown in Table 4.6

4.7 Results Discussion

Our estimates in the basic OLS model suggest that GDP per capita growth rate has a negative and significant relationship with credit risk at 5% significant level. This is an overwhelming support for our hypothesis. The finding is also consistent with Beck, et al., (2013), Thiagarajan, et al.,(2011), Derbali,(2011), and Ali and Daly, (2010). A plausible interpretation of these results is that an increase in the GDP per capita growth will lead to a decrease in credit risk of banks since there will be improved economic conditions of both households and corporate hence they will be able to repay their borrowed amounts owing to the improved economy.

Our estimates in the model suggest that Lending interest rates have a positive and significant relationship with credit risk at 5% significant level of which is in line with our hypothesis. The findings are also consistent with Warue, (2013), Beck, et al., (2013), Souto, et al., (2009), and Aver, (2008). A probable interpretation of these results is that an increase in the lending interest rates will lead to a significant increase in the credit risk since banks attach most loans to a floating lending interest hence with an increase in the rate the borrower will find it hard to repay the amount since their income is most likely fixed and with increased burden of higher rates on a fixed income will lead to defaulting of loans by the holders of the loans.

From our model the estimates suggest that Exchange rates negative which is in tandem with our hypothesis and insiginificant with credit risk at 5% significant level. A plausible explanation of these results is that most of the borrowers of money / loan holders borrow in local currency hence the exchange rates between the local currency and the US dollar doesnot affect the credit risk.

From our model 4 the estimates show that inflation rate is negative and significant with credit risk at 5% significant level. This is was also inconformity with Warue, (2013). This implies that Non-performing loans are not responsive to changes in inflation. A probably interpretation of these results is that inflation leads to more profitability as more money chases few goods. Most borrowers are business people who seem to pass over the cost of inflation to consumers. For instance, when fuel prices go up, road transport players raise fare to consumers of their services. Thus business people retain their ability to repay their loans.

From our model the estimates suggest that domestic credit has a negative and significant relationship with credit risk at 5% significant level. Which is stark contrast with our hypothesis and the findings are also inconsistent with: Castro,(2012), Igan and Pinheiro, (2011), Mendoza andTerrones, (2008) and Tamirisa and Igan, (2007). A plausible interpretation of these results is that all the above

studies have been done outside Kenya and under different macroeconomic conditions. Furthermore, there has been a trend in a decrease in non-performing loans(15.6 in 1990 and 30 in 1997 to 3.34 in 2013 representing a 78% decrease in non-performing loans) as an increase in domestic credit to has doubled from (18.65% in 1990 to 36.5% in 2013 representing a 95% increase in domestic credit lending) This can be explained by the fact that the loans borrowed were put into productive activities and in hence earning a return which in turn repays the loans. Secondly their has been a more active approach by banks to screen loan applicants and also reference them through the Credit Reference Bureau and as such serial defaulters are weeded out hence a decrease in non-performing loans since the loan uptakers are vetted out.

5. SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presents a summary of the major findings that are presented in chapter four, summary conclusions and recommendations suggested by the researcher. All findings are summarized in line with the objectives and shows how the objectives have been achieved.

5.2 Summary

The study sought to establish the Effects of Gdp per capita growth rate, Lending interest rates, Exchange rates, Inflation and Domestic credit on credit risk in commercial banks in Kenya using the OLS model. The study used all the 43 commercial banks in Kenya and found that GDP, lending interest rate, Inflation and Domestic credit all to be important and significant in explaining credit risk in commercial banks. Exchange rates were found not to be important and significant in explaining credit risk in commercial banks.

5.3 Conclusions

The first objective of the study was to establish the effect of GDP per capita growth rate on credit risk in commercial banks. The findings indicate that Gdp per capita growth rate has a negative and significant effect on the credit risk. This implies that continued improvement of the economy will see households and corporate easily repay their loans due to improved economic conditions.

The second objective of the study was to establish the effect of lending interest rates on credit risk in commercial banks. The findings indicate that Lending interest rates have a positive and significant effect on credit risk in commercial banks. This implies that an increase in the lending rate on commercial banks will further push holders of loans to default hence an increase in the non-performing loans.

The third objective of the study was to establish the effect of exchange rates on credit risk in Kenyan commercial banks. The findings indicate that exchange rates were positive and insignificant in explaining the credit risk in commercial banks. This implies that fluctuations in exchange rates in Kenya do not affect credit risk. This can partly being explained by the fact that most of the loans are borrowed by the locals and in local currency hence exchange rate fluctuations does not affect their repayment schedules.

The fourth objective of the study was to establish the effect of Inflation on credit risk in Kenyan commercial banks. The findings indicate that Inflation is negative and significant in explaining the credit risk in Kenyan commercial banks. This is explained by the fact that inflation will lead to too much money

chasing goods and that business people will always pass on the burden of inflation to the consumer hence will always be able to service their loans.

The fifth objective of the study was to establish the effects of domestic credit on credit risk in the Kenyan commercial banks. The findings indicate that Domestic credit is negative and significant in explaining the credit risk in the Kenyan commercial banks. The negative relationship was explained by the fact that credit risk in Kenya had decreased over the study period as the domestic credit risk increased over the same period of time due to reasons such as stricter loan requirements rules and scrutiny, and on the assumption that loans borrowed were actually put to productive activities hence earning a return that was used in the loan repayment. The findings were in contrast to what other foreign studies have found, there was no study in Kenya which had researched on the same and thus the results proved to be precedence for other studies.

5.4 Recommendations

The study sought to provide more information to the Central Bank, Managers of commercial banks and Investors on the effects of varying macroeconomic factors on credit risk so as to make informed decisions. Following the conclusions drawn from the above findings of the study, it is recommended that in that the Central Bank of Kenya should play a more regulatory and active role by ensuring that banks have adequate provisions for bad loans, that they also play an active role in forecasting of macroeconomic changes hence can alert banks well enough of time so that they can input the changes/ shifts into their operations. Banks should keep the lending rate as low as possible to make sure that repayment is easy and affordable for the holders of loans, the banks should consider fixed lending interest rates for huge sums of money so as to minimize the default amount. Another recommendation would be for banks to use a reducing balance approach on loans this would greatly reduce the rate of loan defaulters and ultimately reduce credit risk. The banks should shift their mindset of earning much of their income from interest loans and divest into bank charges and voluminous loan holders through cheaper lending rates while still applying stringent security checks for loan applicants and holders and emphasis should be put on the credit history of people up taking loans so as to safeguard against credit default.

5.5 Suggestions for Further Research

The effect of Macroeconomic variables on credit risk in Kenyan commercial banks is a research area where a lot of research has not been carried out and also varying results have been published on the same. Domestic credit as a variable has not been explored as a factor influencing credit risk in Kenyan commercial banks and research on the same would be an area of interest.

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Abbreviations

Crisk	Credit default risk.
GDPPCGR	GDP per capita growth rate
Intrst	Lending Interest rates
Exch	Exchange rates
DC	Domestic credit
WDI	World Bank Indicator Database.
CBK	Central Bank of Kenya
KNBS	Kenya National Bureau of Statistics.
NPL's	Non-performing loans.

APPENDICES: TABLES

Table 4.1: Descriptive Statistics.

	CRISK	GDPPCGR	INTRST	EXCH	INFL	DC
Mean	17.84	5.06	19.54	65.98	12.09	30.16
Median	18.00	4.74	17.88	71.22	9.84	29.24
Maximum	34.00	29.53	36.24	88.81	46.00	39.45
Minimum	3.34	-32.11	5.08	22.91	1.60	24.60
Std. Dev.	9.81	12.94	8.22	17.99	10.00	4.29
Skewness	0.02	-0.60	0.41	-1.08	1.92	0.68
Kurtosis	1.87	4.23	2.37	3.34	6.77	2.32
Jarque-Bera	1.29	2.93	1.08	4.75	29.00	2.32
Probability	0.53	0.23	0.58	0.09	0.00	0.31
Sum	428.10	121.33	468.84	1583.49	290.10	723.85
Sum Sq. Dev.	2213.28	3852.51	1555.30	7447.33	2301.70	424.10
Observations	24	24	24	24	24	24

Table 4.2 Correlation Matrix

	CRISK	GDPPCGR	INTRST	EXCH	INFL	DC
CRISK	1.00					
GDPPCGR	-0.24	1.00				
INTRST	0.34	0.15	1.00			
EXCH	-0.22	0.11	-0.02	1.00		
INFL	-0.06	-0.49	0.23	-0.43	1.00	
DC	-0.59	-0.08	-0.15	-0.09	0.11	1.00

Table 4.3: Stationarity Test.

Variable	Levels				1st Difference				Order of Integration
	Constant		Trend and Intercept		Constant		Trend and Intercept		
	t-stat	5%	t-sta	5%	t-cal	5%	t-stat	5%	
Crisk	-0.73	-1.96	-1.5	-3.62	-3.64**	-1.96	-	-	**I(1)**
Gdppcgr	-2.86**	-1.96	-	-	-	-	-	-	**I(0)**
Intrst	-1.08	-1.96	-2.06	-3.69	-2.96**	-1.96	-	-	**I(1)**
Exch	1.26	-1.96	-3.45	-3.64	-3.96**	-0.96	-	-	**I(1)**
Inflation	-1.48	-1.96	-1.83	-3.64	-5.73**	-1.96	-	-	**I(1)**
Dc	0.34	-1.96	-0.49	-3.63	-5.96**	-1.96	-	-	**I(1)**

Note: The 1%, 5% and 10% significant level is denoted by ***, ** and * respectively. The parentheses indicate t-statistics

Table 4.6 Test for Heteroskedasticity

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.795263	Prob. F(6,16)	0.1635
Obs*R-squared	9.254079	Prob. Chi-Square(6)	0.1598
Scaled explained SS	7.276159	Prob. Chi-Square(6)	0.2961

Figure 1: Normality test for residuals

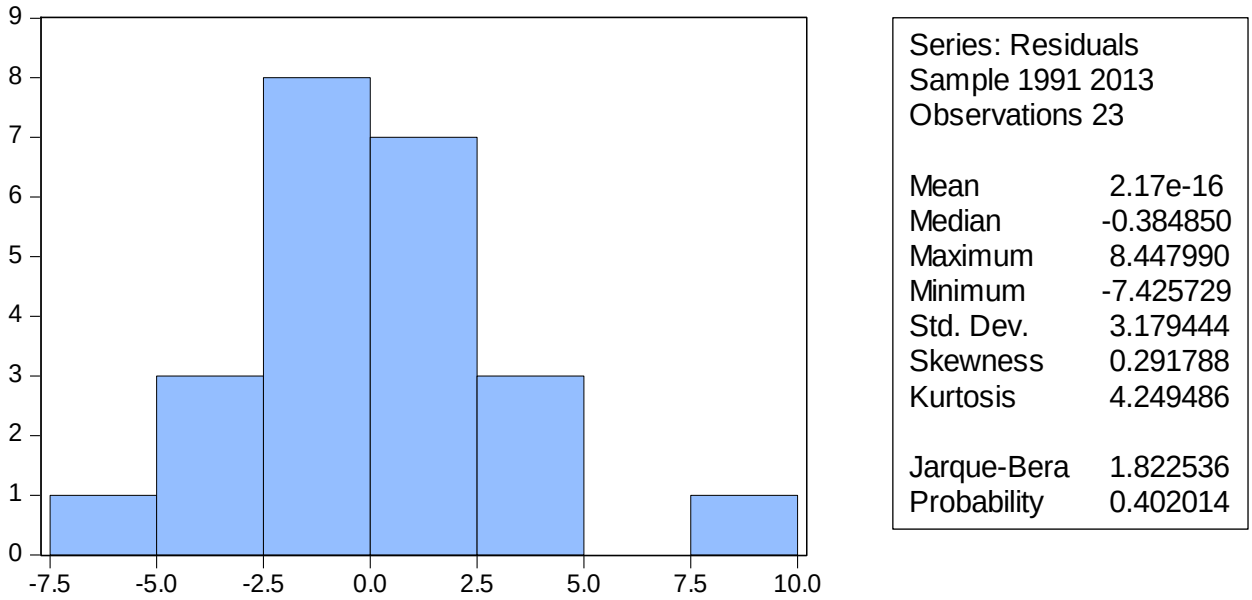

Table 4.8: Test for Autocorrelation using the DW test.

Dependent Variable: CRISK

Method: Least Squares

Date: 05/10/14 Time: 11:48

Sample: 1990 2013

Included observations: 24

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDPPCGR	-0.45503	0.107824	-4.220109	0.0005
INTRST	0.575877	0.153042	3.762858	0.0014
INFL	-0.58401	0.157367	-3.711126	0.0016
EXCH	-0.24208	0.071105	-3.404546	0.0032
DC	-1.24555	0.270108	-4.611293	0.0002
C	69.4857	10.50654	6.613564	0

R-squared	0.759622	Mean dependent var	17.8375
Adjusted R-squared	0.69285	S.D. dependent var	9.809676
S.E. of regression	5.436628	Akaike info criterion	6.436513
Sum squared resid	532.0247	Schwarz criterion	6.731027
Log likelihood	-71.2382	Hannan-Quinn criter.	6.514648
F-statistic	11.37642	Durbin-Watson stat	1.753519
Prob(F-statistic)	0.000046		

Appendix11: StationarityGraphs.