Market structure, macroeconomic shocks and banking risk in Kenya

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Declaration

This research paper is my original work and has not been submitted for the award of a degree in any other University.

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This research paper has been submitted for examination with our approval as University supervisors.

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Abstract

Changing market structure in the banking sector following financial liberalization and macroeconomic shocks have the potential to adversely impact banking risk exposure. This research paper investigates the effect of these factors on the risk exposure of commercial banks in Kenya. It is argued that competition resulting from financial liberalization and the impact of macroeconomic shocks may increase bank risk taking incentives and risk exposure. Specifically, it is hypothesized that financial liberalization increases banking fragility by reducing franchise value which induces risk taking and that positive and negative macroeconomic shocks increase banking risk exposure. Annual bank financial performance panel data for the period 2008 to 2013 is used to analyse the impact of market structure and macroeconomic variables on borrowing and lending risk exposure using GMM estimation. The results indicate that there is some support for both hypotheses.

Borrowing risk exposure was found not to be persistent, being mainly affected by the degree of concentration and external economic shocks. Interestingly, the results also suggest that changes in the short-term interest rate do not affect the net interest margin; which may imply that bank deposit and lending rates are rigid and that the interest rate channel is ineffective. Lending risk exposure was found to be persistent, being mainly affected by the degree of concentration, internal economic shocks and external economic shocks. Further analysis of the factors contributing to the persistence of lending risk exposure using a PVAR model found that the banks' loan growth rate and the market interest rate were the key determinants; though the impact of the loan growth rate was about double the impact of interest rate risk, implying that bank risk taking is the key determinant of the persistence of lending risk exposure.

Keywords: Market structure, macroeconomic shocks, macro-financial linkages, banking risk, dynamic panel data

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To my parents

One must act on what has not happened yet

–Lao Zi

Contents

List of Tables

List of Figures

List of Acronyms

FDI	Foreign Direct Investment
FPI	Foreign Portfolio Investment
GMM	Generalized Method of Moments
LRE	Lending Risk Exposure
NIM	Net Interest Margin
NPL	Non-Performing Loans
OLS	Ordinary Least Squares
PRGF	Poverty Reduction and Growth Facility
PVAR	Panel Vector Auto-Regression
REER	Real Effective Exchange Rate
RAROA	Risk Adjusted Return on Assets
ROA	Return on Assets
ROE	Return on Equity
TRWA	Total Risk Weighted Assets
VAR	Vector Auto-Regression

Chapter 1

Introduction

1.1 Background

Commercial banks are generally in the business of managing financial risk, since they earn their profits mainly by taking on specific forms of risk. Banks also grow by taking on more risks and the greater the risks, the higher the profits. Heffernan (2005) explains that risk management is their core business since they face a number of financial risks that are atypical to those faced by non-financial firms, and that inadequate management of these risks threatens their profitability, solvency, and shareholder value-added.

The financial liberalization process in Kenya began in July 1989 resulting in the removal of interest rate controls, the abolition of directed credit, the liberalization of the foreign exchange market, the removal of restrictions on foreign borrowing by residents, the removal of restrictions on foreign investor participation in the local stock market, the removal of restrictions to entry into the banking sector, the reduction of reserve requirements, and the implementation of various other policy measures aimed at increasing competition in the banking sector (Ngugi and Kabubo, 1998). Therefore, financial liberalization opened up new opportunities for banks but also brought about new risks.

In addition to managing the normal banking risks and the risk-taking opportunities created by financial liberalization, banks operating in developing countries such as Kenya are also exposed to frequent macroeconomic shocks. Agenor and Montiel (2008) explain that these economic shocks arise mainly because most developing economies are characterised by unique internal and external

factors that cause instability. Some of these internal factors include political instability, frequent changes in policy regimes, and weak institutions. External factors include volatility in terms of trade, exchange rates, and capital flows.

Financial liberalization is therefore expected to influence banking risk by affecting the ability and incentives for risk taking. Deregulation of the various banking activities increases the ability to take risks and the resulting competitive environment creates incentives to take additional risks to grow market share. Similarly, macroeconomic shocks are expected to influence banking risk by affecting the economic performance of banks and their borrowers. Negative shocks reduce their earnings which affects bank capitalization and positive shocks reduce risk perceptions which creates an environment conducive to increased risk taking.

1.1.1 Financial Sector Reforms

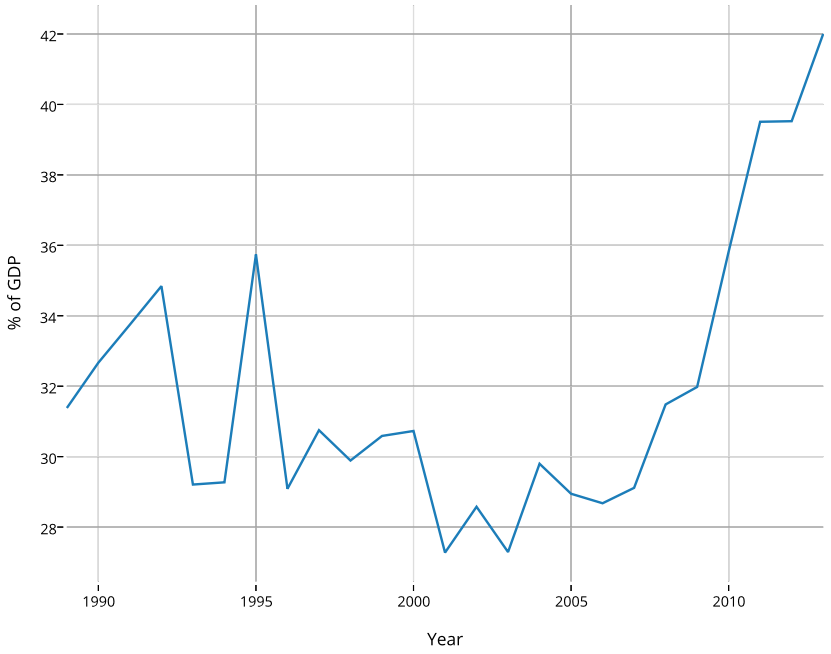
Agenor and Montiel (2008) explain that financial liberalization programmes in developing countries have been informed by the accumulated evidence that financial development can have positive effects on economic development and growth. The programmes usually involve the removal of restrictions associated with financial repression and the implementation of policy measures aimed at accelerating financial development.

However, Arestis *et al.* (2005) argue that in the relationship between financial development and economic growth, there are two possible relationships: a "demand-following" approach where financial development arises as the economy develops and a "supply-leading" approach where the widespread expansion of financial institutions leads to economic growth. They further explain that proponents of financial liberalization lean towards the supply-leading relationship; whereby well-functioning financial systems are able to mobilize savings, allocate resources efficiently, diversify risks, induce liquidity, and reduce transaction costs. The alternative view (institutional school) leans towards the demand-following relationship; whereby growth in economic activities increases demand for capital which creates demand for more financial services and therefore induces the financial sector to grow.

Empirically, Sahoo *et al.* (2001) studied the relationship between savings and economic growth in India and established a strong one way linkage from growth to savings; consequently they refuted the proposition that savings was the engine of growth in the case of India. Similarly, Ang and McKibbin (2005) studied the relationship between financial development and economic growth

in Malaysia and they found that economic growth exerted a positive and uni-directional causal effect on financial development in the long-run. In Kenya and South Africa, Odhiambo (2007) found that the relationship between financial development and economic growth also exhibited a demand-following response. However, in Tanzania he found that it exhibited a supply-leading response. From Figure 1.1 it is quite clear that the financial sector in Kenya began experiencing rapid growth from 2007, after the real economy registered the highest growth rate (of about 7%) in recent decades. However, it is debatable whether this causal effect is uni-directional since this growth rate in real GDP was preceded in 2003 by the lowest[1] market interest rates (of about 1%) in recent decades.

Figure 1.1: Private Credit/GDP, 1989–2013



Source: KNBS (2014) and World Bank (2014)

Financial sector reforms in Kenya, as chronicled by Ngugi and Kabubo (1998), were mainly aimed at improving the mobilization and allocation of domestic resources. They included both institutional reforms, which were aimed at restoring public confidence in the financial system, and various policy reforms aimed at removing distortions in financial resource mobilization and allocation in the economy. The expected positive benefits of financial reforms were not realised in the initial phase as illustrated in Figure 1.1 and according to Ngugi (2001), this was due to

[1]This sharp decline in market interest rates was due to excess liquidity in the money market resulting from the reduction in the cash ratio requirement (from 10% to 6%) in July 2003 and the reduction in government borrowing following the resumption of donor budgetary support (CBK, 2004). Both developments resulted in an expansion of credit to the private sector which facilitated the economic recovery process.

the failure to meet the prerequisites for successful financial liberalization i.e. fiscal discipline, macroeconomic stability, and financial stability. However, the improvement in domestic resource allocation to the private sector began to gather momentum following the second phase of financial reforms that began in 2003 and this phase succeed because macroeconomic stability had been achieved during the period 1999-2003 before implementation began (see Table 1.1). According to CBK (2003), the second phase of reforms was based on the findings of two studies (the Banking Sector Reform Strategy and the IMF's Financial Sector Assessment Program) conducted by local and foreign experts who were commissioned by the government in July 2003. The studies covered the adequacy of prudential regulation and supervision, interest rate spreads, banking sector risks and vulnerabilities, banking competition and costs, and improving access to financial services.

However, Weller and Zulfiqar (2013) caution that though financial liberalization can contribute to macroeconomic stability by lowering credit constraints – resulting in faster economic growth, poverty reduction, and reduced income inequality; it can also be a source of macroeconomic instability since liberalized financial systems can foster excessive speculation in asset and credit markets, which then transforms into greater economic volatility.

Further, Goodhart *et al.* (2004) explain that liberalization of the banking sectors in various parts of the world since the 1970s increased the scope for risk taking and leverage. In their study, they found that enhanced competition led to lower profit margins and a combination of various factors led to the assumption of greater risk. Some of the factors identified included the migration of larger (and safer) borrowers to capital markets, initial inexperience with risk management, the desire to break into new and unfamiliar markets (such as the business of mortgage lending that was previously confined to specialists), and a wish to maintain the Return on Equity (ROE) despite declining margins for safer business. Consequently, the declining profit margins and higher non-performing loans (resulting from riskier business), plus a desire to maintain the ROE, led to a trend decline in capital ratios which implied worsening financial fragility.

1.1.2 Macroeconomic Shocks

Economic shocks cause macroeconomic fluctuations since they often result in sudden changes in one or more of the macroeconomic variables. In addition, the government usually responds to negative shocks by implementing policy measures to mitigate their negative effects and these measures in turn cause changes in other macroeconomic variables which adversely affect economic

growth and investment. According to Agenor and Montiel (2008), supply side shocks (output fluctuations) and external shocks (terms of trade, exchange rates, interest rates, and capital flows) were found to play a more prominent role in most developing countries.

According to Hausmann and Gavin (1996), even though domestic and external economic shocks contribute to macroeconomic volatility, the economy's vulnerability to these shocks depends on its institutional structure and policy regimes, that is, the interaction of economic shocks with the prevailing institutional structure and the economic policy regime determines the severity of macroeconomic volatility. Similarly, Acemoglu *et al.* (2003) found that the main cause of macroeconomic volatility is not "bad" policies (such as excessive government spending, high inflation, and overvalued exchange rates), but rather the underlying institutional weaknesses. This they explained was because weak institutions (such as political institutions that do not constrain politicians and political elites, ineffective enforcement of property rights for investors, widespread corruption, and a high degree of political instability) foster the adoption of distortionary macroeconomic policies, which in turn lead to macroeconomic volatility.

In Sub-Saharan Africa, Fosu (2012) found that policy syndromes have substantially contributed to poor economic growth and that they happen to be very common in most African countries. Some of the policy syndromes he identified are: state controls that distort major economic markets resulting in economic inefficiencies and rent-seeking activities; redistribution policies that favour the constituencies of the government leaders resulting in inefficient resource allocation and polarisation; sub-optimal inter-temporal resource allocation which entails revenue misallocation to ill-advised projects and overspending during booms; and finally, state breakdown that results from acute political instability and civil wars mainly due to resource distribution conflicts.

Table 1.1: Macroeconomic Volatility Indicators, 1989–2013

Coefficient of Variation of:	**89-93**	**94-98**	**99-03**	**04-08**	**09-13**
Real GDP Growth Rate	1.212	0.526	0.704	0.416	0.246
Investment	0.131	0.219	0.125	0.250	0.193
Real Effective Exchange Rate	0.087	0.071	0.055	0.183	0.164
Inflation Rate	0.509	0.903	0.503	0.471	0.458
Fiscal Deficit/GDP	−0.898	−0.485	−0.293	−0.252	−0.179
Money Growth Rate	0.418	0.504	0.382	0.257	0.228
Terms of Trade Index	0.110	0.034	0.042	0.021	0.035
Net FDI	0.976	0.901	0.963	1.609	0.553
Net FPI	0.000	0.439	9.956	0.627	0.527

Source: Computed from KNBS (2014), UNCTAD (2014) and World Bank (2014) data

Table 1.1 depicts the trends in macroeconomic volatility[2] for macroeconomic variables (real GDP growth, investment, Real Effective Exchange Rate (REER), and inflation rate), policy outcomes (fiscal deficit/GDP ratio and money growth rate), and external shocks (terms of trade index, net Foreign Direct Investment (FDI) inflows, and net Foreign Portfolio Investment (FPI) inflows). From the table, it is evident that internal liberalization which began in the period 1989-1993 failed to achieve positive benefits since macroeconomic stability was not achieved before liberalization. However, once the second phase of financial reforms and external liberalization gathered momentum in 2004-2008, volatility of the external indicators and domestic investment increased significantly following the resulting economic recovery that began during this period; however, the other internal indicators remained fairly stable and therefore, the success of the second phase of financial reforms (depicted in Figure 1.1) may be attributable to the fact that macroeconomic stability had been achieved during the period 1999-2003 before implementation began in 2003.

For the macroeconomic variables, real GDP growth and inflation rate volatility has been on a declining trend, however investment volatility doubled in 2004-2008 and has remained relatively high following the implementation of the Economic Recovery Strategy for Wealth and Employment Creation from 2003. In addition, the REER volatility which is affected by domestic inflation, capital flows, monetary policy, and exchange rate regime changes doubled in 2004-2008 and has remained relatively high, and this trend may therefore be attributed to the volatility of macroeconomic policies and capital flows.

For the policy outcome indicators, both the fiscal deficit/GDP ratio and money growth rate volatility have been on a declining trend. The decline in money growth volatility may be partly attributable to the government's resumption of the Poverty Reduction and Growth Facility (PRGF) programme with the IMF in 2003, since one of the key targets under the PRGF Monetary Programme[3] was to reduce the expansion of money supply.

For the external shock indicators, the terms of trade index volatility has been fairly low over the years but both indicators for capital flow volatility have been quite high; probably due to the recent growing trend of transnational corporations setting up their regional headquarters in Nairobi, the rising activity by foreign investors at the Nairobi Securities Exchange, the rising trend of foreign borrowing by residents, and increased oil exploration activities by foreign investors. The

[2]The coefficient of variation of the macroeconomic variables over five year periods is used to capture the trend in macroeconomic volatility.

[3]See CBK (2004, p. 37)

most recent *Foreign Investment Survey* published by KNBS (2014) covers the period 2010-2011, where net FDI inflows increased from KES 98 billion to KES 111 billion and net private foreign borrowing flows increased from a debit of KES 620 million to a credit of KES 15 billion. Even though the report covering the period 2012-2013 has not been released, the data presented in Table 1.2 under external financing indicate that this growing trend continued.

Macroeconomic conditions affect the performance of the banking sector mainly by influencing the ability of borrowers to repay loans and the banks' net interest margin. In their study of banking crises in both developed and developing countries, Demirguc-Kunt and Detagiache (1998) found that a weak macroeconomic environment increased the risk of systemic banking crises; especially low GDP growth, high inflation, high real interest rates, and a large balance of payments deficit.

The financial sector in Kenya faced major systemic banking crises in 1986 and 1993, mainly due to insider lending, excessive risk concentration, under-capitalization, non-performing loans, over-investment in the speculative property market, and weak corporate governance (Nasibi, 1992; Ngugi, 2001). And according to Laeven (2011), the two banking crises experienced in Kenya resulted in output losses (difference between actual and trend real GDP) of 24% and 50% respectively.

1.1.3 Financial Sector Developments

Beck *et al.* (2010) observed that the financial sector debate across Africa in recent years had been dominated by policies to increase access to financial services; however they also point out that the global financial crisis of 2008 shifted the attention of policy makers to improving banking sector stability. They argued that Kenya had made substantial progress in improving the stability and efficiency of its banking system through upgrading of the supervisory framework, the reduction in interest spreads, the reduction in inflation, and the stability of exchange rates. However, they concluded that many challenges remain since the banking system is still fragmented with many small banks serving specific niches, but not contributing to competition in the sector.

Financial and monetary statistics are used to analyse financial developments within a country and to analyse the country's vulnerability to external or internal shocks. Net borrowing or financing requirement in financial statistics is defined as domestic savings plus capital transfers being less than the net acquisition of non-financial assets, which basically means that spending exceeds net income from production (IMF, 2008). When a country's spending exceeds its production, the

difference is financed through either a reduction in net financial assets or an increase in foreign liabilities.

Table 1.2: Financial and Monetary Indicators, 2007–2013

In KES Bn	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**
Net Borrowing	-123	-269	-276	-304	-593	-703	-853
External Financing:	75	103	180	155	316	432	417
Net FDI	91	53	94	74	160	204	175
Net Foreign Borrowing	49	24	76	93	152	214	281
Net Errors & Omissions	-17	20	4	14	29	45	21
Δ Net Foreign Assets	47	-6	-6	26	25	31	61
Domestic Financing:	48	166	96	150	278	271	437
Δ Domestic Credit	89	159	140	233	317	197	276
Δ Broad Money	113	100	132	201	155	215	202
Other Items (Net)	73	107	87	118	116	289	363
Net Foreign Assets:	255	249	244	270	295	326	387
NFA: Central Bank	205	199	223	252	259	364	432
NFA: Commercial Banks	50	50	21	17	37	-38	-45

Source: Computed from CBK (2014) and KNBS (2014) data

From Table 1.2 it is evident that Kenya's financing requirements have been on an upward trend. However, of interest is the trend in external financing which grew at the rate of 104% in 2011 to plug the difference of about KES 162 billion between change in money supply and change in domestic credit.[4] This trend in foreign financing may explain the recent declining trend in commercial banks' net foreign asset position, whereby some banks are resorting to borrowing from foreign lenders to meet the rising domestic financing requirements. The net errors and omissions represent the statistical discrepancy in the balance of payments statistics. Other items (net) is a balancing item that represents the difference between net borrowing and the sum of external financing and domestic financing. According to IMF (2008), these statistical discrepancies arise in practice due to gaps in coverage or mismeasurement of items.[5]

Higgins (1998) attributes such rising trends in financing requirements to the demographic effects on savings, investment, and the current account balance. High youth-dependency rates reduce

[4]The monetary identity does not balance one-for-one and according to Easterly (2002), this is due to the revaluation of net foreign assets and the endogeneity of the variables.

[5]However, various authors (Quirk, 1997; Vuksic, 2009; Schneider, 2011; Gastrow, 2011) explain that these statistical discrepancies may also be indicative of unreported foreign income from the shadow economy in tourism, the illicit financial flows of criminal activities (such as drug and human trafficking, trade in counterfeit goods and wildlife products, cross-border smuggling of fast moving goods) and commercial activities (such as invoice mispricing, abusive transfer pricing, fake transactions); which distort the economic data when carried out on a large scale – the scale naturally increases following capital account liberalization which opens up more channels for money laundering. For instance, Gastrow (2011) reports that $2.1 billion was smuggled into the Kenyan economy in 2010 and this is evident from the balance for other items (net).

savings supply and increase investment demand, and therefore determine the current account balance. An increasing youth-dependency ratio reduces savings supply by reducing the share of mature adults saving for retirement and increases investment demand by increasing the share of young people who require additional investments via social overhead capital and labour-force growth. His study covered both developed and developing countries and found that the link between youth-dependency and the current account balance is strongest for financially open economies; since access to foreign savings reduces the constraint imposed on investment by the domestic savings supply.

However, Bresser-Pereira and Nakano (2003) argue that even though the "growth *cum* foreign savings" or "growth *cum* foreign debt" economic policies enable developing countries with low savings rates to finance required investments that contribute to economic growth; such dependent growth policies contributed to macroeconomic instability in the Latin American countries that adopted them during the 1990s, since they resulted in high current account deficits, overvalued currencies, high domestic interest rates, and also caused the breach of their external solvency constraints i.e. the threshold limits for foreign debt repayments/exports and short-term foreign debt/international reserves.

Empirically, Dullien (2009) found that developing countries neither need capital imports nor an increase in the household saving rate to make resources available for investment, since a domestically financed credit-investment process was found to have contributed to the two most impressive cases of catch-up-growth i.e. Germany and China. The process was made possible by various preconditions (microeconomic financial sector reforms and macroeconomic factors) that enabled the financial sector to create purchasing power which investors used to increase the capital stock while the incomes created in this process provided *ex post* for the savings necessary to finance the investment at the macroeconomic level. In a country with an under-utilized labour supply such as Kenya, relying on domestic resource mobilization (as per the Keynesian-Schumpeterian approach to finance and development described above) also has the advantage of shielding the country from the danger of sudden stops in capital flows.

1.2 Statement of the Problem

In most developing countries, macroeconomic volatility has gained increasing attention because severe negative economic shocks reduce long-term growth and disproportionately impact the poor. Additionally, given the key role that banks play in the allocation of funds in the economy, banking crises resulting from negative macroeconomic shocks have the potential to adversely affect the real economy by restricting credit and causing costly liquidations that result in output losses and high unemployment. Therefore, the potential impact of severe negative economic shocks is of interest to most market participants.

Various cross-country studies (Demirguc-Kunt and Detagiache, 1998; Bohachova, 2008; Allen *et al.*, 2009; Laeven, 2011) that link macroeconomic factors to banking risks have provided valuable insights on the macroeconomic factors associated with banking vulnerabilities. Additionally, various other cross-country studies (Demirguc-Kunt and Detragiache, 2001; Weller, 2001; Noy, 2004; Agosin and Huaita, 2011) have also linked banking crises in developing economies to financial liberalization. However, the results of such studies cannot be generalized since the causal link is largely determined by the nature and operation of the financial institutions and the policies pursued in each country. Therefore, it is important to carry out country specific studies in order to relate such findings to policy outcomes within a specific economy since, even though a group of economies may share some common features, each economy has its own distinctive characteristics.

According to GOK (2007), the financial services sector is expected to play a critical role in the mobilisation of funds for the implementation of Vision 2030 projects. However, this will be contingent on addressing some of the identified constraints, such as: the high interest rate spread, inadequate provisioning against losses from bad loans, and weak internal controls. One of the factors contributing to the high interest rate spread is the risk premium charged by banks, to compensate for the uncertainty induced by the volatility of macroeconomic variables and for the resulting impact of rising problem loans on bank capitalization. Consequently, the central policy objective of Vision 2030 for the financial services sector is to develop a stable and vibrant financial system.

Otieno and Ndung'u (2010) explain that strengthening the banking sector, maintaining macroeconomic stability, and better management of political transitions are critical requirements for the achievement of the growth and development aspirations outlined in Vision 2030. However, they

also point out that one of the key omissions in Vision 2030 is the failure to address how to cushion the country against the exogenous factors affecting all developing countries; such as commodity price shocks and deterioration of terms of trade, which cause high inflation and negatively impact the economic growth momentum.

This paper will therefore analyse the impact of macroeconomic shocks and the changing market structure due to financial liberalization on banking risk in Kenya, so as to gain better insights into the local banking system and possibly address some of the issues outlined above.

1.3 Objectives of the Study

The main objective of this study will be to analyse the factors influencing the risk exposure of commercial banks in Kenya by focusing on two primary hypotheses. First, changing market structure following financial liberalization increases banking fragility by increasing the ability and incentives for risk taking. Second, positive and negative macroeconomic shocks influence banking risk exposure by affecting the economic performance of banks and their borrowers. The specific research objectives of this study will be to:

A. Analyse the impact of the changing bank market structure on banking risk

B. Analyse the impact of macroeconomic conditions on banking risk

C. Analyse the impact of bank-specific control factors on banking risk

1.4 Significance of the Study

Analysing the relationship between the changing market structure and macroeconomic conditions, using bank-specific control factors that influence risk-taking behaviour, will provide better insights into the local banking system. Additionally, when the financial sector undergoes changes with respect to its size and number of participants following financial liberalization, profit margins are squeezed as the struggle for market share intensifies. Therefore, it also becomes important to assess the risk exposure of banks since those with negative or declining results may assume imprudent risks in an attempt to turn around their earnings.

This research study is therefore timely since a better understanding of some of the factors that

influence banking risk may improve risk management practices by bank management and bank supervisors. While the ability to measure the effects of changes in economic conditions on risk exposure will be beneficial in enabling bank supervisors and bank management to identify unsustainable trends that relate to unusual market conditions.

In addition, the analysis of the factors affecting risk exposure and their measured impact may also enable bank managers to improve their proactive management of risk exposure, which can enable them to increase their market share by reducing the risk premium they charge borrowers and to increase their long-term profitability by efficiently managing their risk exposure. The study may also generate policy implications by identifying the significant factors that affect banking risk exposure. Finally, this research study will contribute to the empirical literature on the impact of financial liberalization and macroeconomic shocks on banking risk in Kenya.

The remainder of the paper is organized in four chapters; Chapter II reviews some of the relevant literature, Chapter III explains the research methodology, Chapter IV reports the empirical results, and finally, Chapter V summarizes and concludes the paper.

Chapter 2

Literature Review

This chapter describes the major types of financial risks and then reviews some of the theoretical hypotheses and empirical studies that link macroeconomic shocks and changes in market structure to the financial risks.

2.1 Financial Risks

Risk is defined as the volatility of net cash flows of the firm and the objective of a firm is usually to add value to the shareholder's equity by maximising the risk-adjusted return. For non-financial firms, huge losses can be incurred as a result of poor financial risk management; but this rarely leads to insolvency if the core business operations are sound. On the other hand, financial risk management is the core business of banks; since in extreme cases, inadequate risk management may threaten the solvency of a bank. Therefore, the profitability and shareholder value-added for banks depends on the management of financial risks (Heffernan, 2005).

Santomero (1996) explains that in the process of providing financial services, commercial banks assume various kinds of risks because they generally act as a principal in the transaction by using their own balance sheet to facilitate the transactions and to absorb the risks associated with them. However, he explains that the risks contained in the bank's principal activities of lending and borrowing are not all borne by the bank itself. Since in most instances the bank will eliminate or mitigate the financial risk associated with a transaction by proper business practices; in other instances, it will shift the risk to other parties through a combination of pricing and product design; while in other instances, the risks will be actively managed by the

bank. However, Hellwig (1995) explains that even such risk management strategies that involve shifting risks to borrowers or to third parties are sometimes ineffective due to the high correlation between credit risk and market risk; whereby such strategies merely replace market risk (such as interest rate risk) with market risk-induced credit risk.

Greuning and Bratanovic (2003) explain that the goal of financial risk management is to maximize the value of a bank, as determined by its profitability and risk level. Since risk is inherent in banking and is unavoidable, the task of financial risk management is therefore to manage it in such a way that the different types of risk are kept at acceptable levels and profitability is sustained. In addition, risk management requires the capacity to anticipate changes and to act in such a way that a bank's business can be structured and restructured to profit from the changes or at least to minimize losses.

The financial risks associated with the provision of financial services by banks differ by the type of service rendered. However, for the banking sector as a whole, these financial risks can be broken down into the following types:[1]

Market Risk

This is the risk that all financial investors assume whenever assets owned or claims issued can change in value due to broad economic factors. Market risk comes in various forms and is generally undiversifiable. For the banking sector, two forms are of greatest concern: variations in the general level of interest rates (interest rate risk) and the relative value of currencies (foreign currency risk).

Interest rate risk refers to the vulnerability of a bank's financial condition to the movement in interest rates which affects net interest income, the value of assets such as bond holdings, and cash flows. Since banks engage in asset transformation, their assets and liabilities often differ in maturity and volume. Consequently, interest rate risk usually arises due to interest rate mismatches between assets and liabilities.

Foreign currency risk is the risk that a bank may suffer a loss due to adverse exchange rate movements during a period in which it has an open position in some foreign currency. When exchange rates are flexible, adverse exchange rate fluctuations will affect the bank's foreign exchange po-

[1]The sub-sections are based on information in Santomero (1996); Heffernan (2005); BIS (2011) & CBK (2013).

sitions and though there is no foreign currency risk when exchange rates are fixed; banks can be suddenly exposed to very large risks (and losses or gains) if the fixed exchange rate arrangement comes under so much pressure that one of the currencies is devalued or collapses.

Credit Risk

This is the risk of non-performance by a borrower due to either inability or unwillingness to perform. Though credit risk is diversifiable,[2] it is difficult to eliminate it completely since the default risk may result from market risk that affects the financial condition of the borrower. Credit risk consists primarily of two components: quantity of risk which is the outstanding loan balance and the quality of risk which is the severity of loss defined by the probability of default reduced by the recoveries that could be made in the event of default. Credit risk rises when a bank has many medium to low quality loans on its books and if a borrower defaults on a loan or unexpectedly stops repayments.

Liquidity Risk

This is the risk of a potential funding crisis that is associated with an unexpected event; such as a large charge off, an unexpected expansion of credit, loss of confidence or a currency crisis. Liquidity is defined as the ability to efficiently accommodate deposit withdrawals, fund loan growth, and fund the off-balance sheet claims. Therefore, liquidity risk is the risk that a bank will have insufficient funds to meet its financial obligations as and when expected, although it may be able to do so in the future. It consists of funding risk (the need to replace net outflows due to unanticipated withdrawals or non-renewal of time deposits), time risk (the need to compensate for non-receipt of expected inflows, such as when performing assets turn into non-performing assets) and call risk (which arises on account of the crystallisation of contingent liabilities and the inability to undertake profitable business opportunities when desired). Such liquidity problems have the potential to create systemic problems, particularly if they occur when markets are illiquid or when asset prices are changing rapidly or if they create concerns about the bank's solvency.

[2]Loan portfolio diversification enables banks to minimise credit risk and it involves setting concentration limits on the amount of exposure in relation to a certain individual borrower or economic sector.

Capital Risk

This is the outcome of the other risks incurred by the bank – such as credit, market or liquidity risk; since the resulting poor earnings put the bank's capital at risk. One of the unique features of banks is that they are more highly leveraged than other businesses and therefore their leverage limit is very critical because their relatively high leverage means that the threshold of tolerable risk is lower in relation to the balance sheet.

Since the Return on Assets (ROA) of banks is on average small (see Table A.3 in the Appendix), the ROE can be increased by higher leverage to improve the return to shareholders; since ROE = ROA x (Leverage Multiplier) or Net Income/Equity = Net Income/Assets x Assets/Equity. However, with higher leverage there's greater risk since the larger risk exposure is associated with a small capital outlay.

2.2 Market Structure

Degryse and Ongena (2005) explain that economic theory offers conflicting predictions about the relationship between bank rents and banking fragility. This is because the concentration-stability view argues that there is a positive link between bank concentration and financial stability. While the concentration-fragility view argues that there is a positive link between bank concentration and financial fragility.[3] They further explain that bank concentration affects financial stability because one of the main sources of bank rents is market structure, which consists of the number of banks in the market and the existence of alternative providers of finance.

In their subsequent study, Degryse and Ongena (2007) found that the source of competition in banking matters in the determination of bank orientation. Stiffer competition from alternative providers of finance reduces relationship lending, while interbank competition leads to more relationship lending. They explain that the resulting mutually beneficial relationship between firms and banks enables the banks to shield their rents better in the context of intense competition. Whereby, a bank offering a relationship loan augments a borrower's success probability and the relationship lending then allows the bank to extract higher rents from the borrower through

[3]Demirguc-Kunt and Detragiache (2001) explain that fragility increases when financial liberalization leads to increased bank competition and lower profit margins, thereby eroding franchise values and distorting the risk-taking incentives of the banks – as moral hazard problems and deposit guarantees cause their risk appetite to be greater than what is socially desirable.

cross-selling.

The concentration-stability view is mainly based on the argument by Hellman *et al.* (2000), that financial liberalization increases competition (by allowing more foreign banks and reducing restrictions on opening branches) and the resulting competition erodes profits. The lower profits imply lower franchise values (the value of expected future profits that acts as intangible capital) and lower franchise values lower incentives for making good loans. Therefore, the higher franchise values associated with concentration increase stability by lowering the incentives for risk-taking. The concentration-stability view is also based on the study by Allen and Gale (2004), who modelled how competition, as a result of financial liberalization, can induce banks to bid up deposit rates and reduce franchise value. In their model, the resulting decline in franchise value, combined with a deposit insurance guarantee, increased risk-shifting incentives; with the resulting moral hazard and risk taking leading to financial instability.

The concentration-fragility view is based on the study by Boyd and De Nicolo (2005). They argued that the model used by Allen and Gale (2004) focussed on banks' strategic interactions in deposit markets but ignored competition in loan markets. Instead they claimed that market concentration can impact bank stability in different ways, depending on the net effect across deposit and loan markets. Specifically, they pointed out that concentration in the loan market can lead to increased lending rates that raise the borrowers' debt loads and default probabilities, as well as their incentive to engage in riskier projects.

Hellwig (1995) explains the problem of "excessive risk taking" as being due to the fact that any firm that is debt financed generally has an incentive to choose a "risky" strategy. Deposit finance is a form of debt finance and therefore it is also susceptible to moral hazard. In addition, deposit finance tends to be artificially subsidized through government-backed deposit insurance schemes. He concludes that the "excessive risk taking" results from the disappearance of oligopoly rents due to the intensification of competition following deregulation and consequently, banks are tempted to replace oligopoly rents with premia on risk taking.

Gan (2004) tested the relationship between market structure and franchise value following deregulation of the American savings and loan industry using data on Texas thrifts and found that market concentration leads to higher franchise value. He also tested the relationship between franchise value and risk (which he identified through an exogenous shock that wipes out rents on assets-in-place) by testing for a difference in the slopes of risk and found that the slope becomes

more negative after the shock (the propensity of thrifts to increase risk was negatively related to franchise value), suggesting that higher franchise value induces thrifts to be more prudent.

A study by Mwega (2011) found that the banking sector in Kenya experienced reduced concentration (increased competition) during the period 1998 to 2008, following the various financial reforms that were implemented, though his analysis of peer groups found that the small banks were the least competitive followed by large banks and then medium-sized banks. However, the degree of competitiveness measure indicated that the banking sector is characterised by monopolistic competition and this was confirmed by the persistence-of-profit measure.

Bremus and Buch (2014) studied the impact of market structure on macroeconomic volatility in low income countries (including Kenya). They found that when the degree of market concentration is sufficiently high, idiosyncratic shocks affecting large banks affect aggregate macroeconomic volatility i.e. if bank sizes follow a fat-tailed power law distribution, shocks to large banks do not cancel out across a large number of banks as under normally distributed bank sizes. They also found that a higher degree of financial integration (high ratios of foreign assets and liabilities over GDP) and a higher ratio of domestic credit relative to GDP also increase macroeconomic volatility.

2.3 Macroeconomic Conditions

This section reviews some of the theoretical hypotheses and empirical studies that link banking risk to macroeconomic variables. The impact of macroeconomic risks affects banks' directly (market risk exposure) and indirectly, through the impact on bank borrowers (credit risk exposure). In addition, liquidity and capital risk exposure will increase depending on the severity of the impact on market and/or credit risk exposure.

Business Cycle Conditions

According to Agenor and Montiel (2008), the main source of output fluctuations in developing countries is supply shocks that account for over half of the volatility in aggregate output; partly because a significant proportion of exports consist of a narrow range of primary commodities. In addition, shocks to the relative prices of imported goods and intermediate inputs are another key element in output volatility. Rajan (1994) found that banks tighten their credit policy when

the state of the borrowing sector deteriorates i.e. demand shocks have supply side effects. A contraction in credit will accompany an adverse shock to borrowers and this compounds the effect of the adverse shock. In addition, the adverse shock to one borrowing sector affects bank credit policy to some of the other sectors.

Bohachova (2008) points out that since banks perform intermediary functions for the real sector, they are therefore exposed to business cycle conditions that largely determine the aggregate health of the real sector. The risks of intermediation rise as economic condition worsen since banks become more vulnerable to adverse selection and moral hazard behaviour of their borrowers during periods of stagnation or recession. Consequently, it can be expected that bank risk is correlated negatively with the business cycle, rising when economic activity slows. However, she points out that the cyclical downturns are not always the cause of higher risks in banking; instead they reveal weaknesses in bank risk structures that were built up during business cycle upturns.

Goodhart *et al.* (2004) found that in the Nordic and East Asian countries, financial liberalization was followed by boom-bust cycles in bank lending, economic activity and asset prices. They explain that the boom-bust cycles arose because financial liberalization relaxes the borrowing constraints faced by the private sector and therefore, has similar effects to a permanent positive productivity shock to the economy (a shock that leads to an increase in the value of collateral). As the borrowing capacity of private sector depends on the value of their collateral, this gives rise to higher lending, which in turn further fuels boom-bust cycle in economic activity, bank lending, economic activity and asset prices, which again increase borrowing capacity, and so on. Eventually, all variables converge back to their steady-state levels and the boom turns into a bust. Therefore, they concluded that financial liberalization gave rise to more pronounced boom-bust cycles because it was associated with a strengthening of the financial accelerator mechanism.

Interest Rates

Greuning and Bratanovic (2003) explain that when interest rates fluctuate, a bank's earnings and expenses change, as does the value of its assets, liabilities and off-balance-sheet positions. They further explain that the net effect of these changes is reflected in the banks' overall income and capital, and it depends on the divergence between the economic value (fair value based on technical analysis) of the assets or liabilities and their market value (recoverable value based on demand and supply) determined on the marked-to-market basis.

According to Stiglitz and Weiss (1981), the interest rate a bank charges may itself affect the "riskiness" of the bank's loan portfolio by either discouraging safer potential borrowers (the adverse selection effect) or by inducing borrowers to invest in riskier projects (the incentive effect). Basically, rising interest rates increase the average "riskiness" of those who borrow or induce borrowers to undertake projects with lower probabilities of success but higher pay-offs when successful, and both effects have the potential to decrease the bank's profits. Shiller (2003) adds that the incentive effect (moral hazard) occurs when financial arrangements encourage people to pursue flashy opportunities that have only the appearance of potential success, to defer dealing with problems for fear of revealing them to others, to persist for too long in an enterprise that is clearly failing, or to engage in accounting malfeasance.

Demirguc-Kunt and Detagiache (1998) argue that banks are also exposed to interest rate risk through their maturity transformation functions, and therefore, a large increase in short-term interest rates is likely to be a major source of systemic banking problems. The increase in short-term interest rates may be due to various factors, such as an increase in the rate of inflation, a shift toward more restrictive monetary policy, an increase in international interest rates or the need to defend the exchange rate against a speculative attack. They further explain that even in the absence of an increase in non-performing loans following the rise in short-term interest rates, bank balance sheets can deteriorate if the rate of return on bank assets falls short of the rate that must be paid on liabilities, for instance, when an increase in short-term interest rates forces banks to increase the interest rate paid to depositors. Furthermore, high interest rates are likely to hurt bank balance sheets even if they can be passed on to borrowers, because they usually result in a larger fraction of non-performing loans.

According to Gambacorta (2009), the risk-taking channel hypothesis links low interest rates and banks' risk-taking. He explains that the channel operates through two ways: first, low returns on government securities may increase incentives for banks to take on more risk to meet a target nominal return, and second, low interest rates affect asset valuations, incomes and cash flows, which in turn can modify how banks measure risk (by modifying their estimates of probabilities of default and of loss-given-default). Therefore, a significant link exists between extended periods of low interest rates and banks' risk taking. Ramayandi *et al.* (2014) found that falling nominal interest rates led banks to take on more risk in Asian countries by influencing them to invest in more risky assets to achieve their target rate of return and by reducing their incentives for screening loan applications since the low interest rates reduce adverse selection in credit markets.

On the impact of interest rates on bond portfolio holdings, Esch *et al.* (2005) explain that even though a bond is generally considered to be a low risk investment, holding bonds poses certain risks. First, there is the risk of reinvestment; whereby, in the event of a change in market rates, the coupons (and sometimes the repayment value itself) will be reinvested at a different rate. In this instance, an increase (decrease) in the market interest rate will be favourable (unfavourable) to the bank. Second, there is the risk of realisation if the bond is sold before its maturity date; whereby, the sale price is determined by the discounted value of the coupons (discounted at the prevailing market rate) and by the repayment value. In this case, an increase (decrease) in the interest rate will be unfavourable (favourable) to the bank.

On the impact of high interest rates on credit risk exposure, a study by Nkurunziza (2005) found that credit plays a major role in explaining firm failure in developing countries, unlike in developed countries where it is not an important determinant of firm survival. He found that the dramatic increase in interest rates following the effects of macroeconomic shocks that hit the Kenyan economy in the early 1990s caused the failure of a number of manufacturing firms (of different size and age) due to the rising burden of past loans; however, overdrafts did not seem to have had a significant impact on firm failure since access to finance when faced with short-term cash flow problems generally increases firm survival. Additionally, he found that foreign owned firms had a higher failure rate; which implied that following the economic crisis, the foreign owners had the option to close down their business and leave the country to try their luck elsewhere.

On the impact of high funding costs on credit risk exposure, Brownbridge (1998) found that because small local banks were perceived by depositors as being less safe than the established banks, they had to offer depositors higher deposit rates. They also had difficulty in attracting non-interest bearing current accounts because they could offer few advantages to current account holders which could not also be obtained from the established banks. Consequently, the high cost of funds meant that they had to generate high earnings from their assets; for example, by charging high lending rates. Because they had to charge higher lending, it was very difficult for them to compete with the established banks for the "prime" borrowers. As a result, the credit markets were segmented with many of the small local banks operating in the most risky segment; serving borrowers prepared to pay high lending rates because they could not access alternative sources of credit.

Inflation

Financial contracts are written in terms of currency units whose real value is slightly unstable or potentially very unstable. Therefore, as pointed out by Shiller (2003), the problem of inflation in financial contracting is fundamentally a problem of changing units of measurement i.e. problem of a yardstick whose length changes randomly and unpredictably through time. Bohachova (2008) explains that high rates of inflation can have a negative impact on the earnings of existing borrowers and therefore impair the quality of previously extended loans. On the other hand, disinflation can also have a detrimental impact on the bank risk. Whereby rapid disinflation in a previously high-inflation environment results in high real interest rates that exert a contracting influence on the economy and raise credit risk both due to shrinking profits of borrowers and increased risk incentives for lenders similar to those accompanying a rise in nominal interest rates.

Misati *et al.* (2013) point out that fuel inflation and food inflation are the main drivers of inflation in Kenya since they contribute on average to over 80 per cent of overall inflation every month. This they explain is because Kenya is a net importer of oil and therefore changes in the international crude oil prices always interfere with the domestic inflation dynamics. Additionally, frequent food shortages following inadequate rainfall and the occasional droughts increase inflationary pressure which therefore necessitates food importation. In their study, they found that food prices are more important than oil prices in explaining overall inflation; however, the effect of oil prices on inflation was found to be more persistent. They also found that increases in both oil and food prices depreciate the exchange rate immediately and have a more significant influence on non-food non-fuel inflation than the money supply growth rate.

According to Odhiambo (2012), inflation is generally associated with financial repression, whereby the financial sector becomes less developed as the inflation rate increases. This is because inflation adversely affects the holding of all classes of financial assets. His findings on the impact of inflation on financial sector development in Zambia found it to be distinctively negative and that there was a long-run relationship between inflation and financial sector development. Similarly, Ndebbio (2004) studied the impact of inflation on financial deepening in Sub-Saharan Africa and found that rising rates of inflation usually lead to a fall in the purchasing value of the domestic currency; which creates a tendency for economic agents to hold other assets such as gold, physical goods, land, and foreign currency in preference to domestic currency.

High inflation was found by Brownbridge (1998) to intensify both adverse selection and adverse incentives for borrowers to take risks, and thus the probabilities of loan default. This he explained is because high inflation increases the volatility of business profits due to its unpredictability and because it entails a high degree of variability in the rates of increase of the prices. Therefore, the probability that firms will make losses rises, as does the probability that they will earn windfall profits. High inflation also makes loan appraisal more difficult because the viability of potential borrowers depends upon unpredictable developments and the future real value of collateral is also very uncertain since asset prices are also likely to be highly volatile under such conditions.

Exchange Rates

Greuning and Bratanovic (2003) explain that small banks in developing countries often limit their foreign currency business to servicing the currency needs of their customers and this basically involves selling or buying foreign currency on the customer's behalf, a process whereby the open currency positions that such transactions create are normally closed within minutes. However, medium-sized and large banks that maintain correspondent banking relationships with foreign banks or that support customer transactions denominated in foreign exchange are exposed to higher levels of currency risk and the risk is higher still for banks that borrow and/or lend in foreign currency, as this may result in open currency positions or maturity mismatches.

According to Bohachova (2008), the impact of exchange rate fluctuations on bank risk is dependent on the interplay between currency moves and a bank's foreign currency exposure. Domestic currency depreciation can be expected to hurt banks whose foreign currency liabilities substantially exceed their foreign currency assets. However, the effect of exchange rate levels on the performance of bank borrowers is generally the primary impact on bank profitability, that is, the resulting increase in credit risk. On aggregate, domestic currency depreciation is likely to increase credit risk for bank loans extended to importers and decrease credit risk of the exporting sector. Therefore, changes in a bank's overall risk position will be determined by its net exposure to exporting or importing corporate borrowers. Additionally, she points out that a sufficiently strong currency depreciation induces disintermediation which increases bank risk as depositors withdraw their money and seek to invest it in "hard" currency assets.

According to Kandil *et al.* (2007), the debate on the appropriate exchange rate policy in developing countries focuses on the degree of fluctuations in the exchange rate in the face of internal

and external shocks. This is because exchange rate fluctuations determine economic performance through their effects on output growth and price inflation. They explain that the traditional view indicates that currency depreciation is expansionary since it diverts spending from foreign goods to domestic goods, while the new structuralism school stresses some contractionary effects. However, they point out that currency depreciation gives with one hand, by lowering export prices, while taking away with the other hand, by raising import prices. Therefore, if imports exceed exports, the net result is a reduction in real income within the country.

Obstfeld and Rogoff (1995) point out that for countries dis-inflating after periods of price-level instability, fixed exchange rates have the attraction of anchoring price inflation and the monetary authorities are also usually prepared to allow a sharp rise in domestic short-term interest rates to fend off a speculative attack. However, such sharp spikes in interest rates can wreak havoc on the banking system which typically borrows short and lends long, and they can also have profound negative effects on investment, unemployment, the government budget deficit and the domestic distribution of income over the long-term. Therefore, they conclude that a government pledge that it will ignore such side effects indefinitely to defend the exchange rate is not likely to be credible, and this lack of credibility makes a fixed exchange rate more vulnerable to a speculative attack.

Capital Flows

Dunn and Mutti (2004) point out that countries often desire sets of economic outcomes which are impossible (i.e. having one or two makes another unattainable) and that monetary policy under alternative exchange rate regimes represents such a conflict. They explain that many governments prefer fixed exchange rates because they encourage price stability; they also prefer an independent monetary policy which can be used to minimize the problems arising from domestic business cycles; and they value free capital mobility because it may result in large capital inflows that can accelerate economic growth. However, they point out that according to the impossible trinity proposition or "trilemma" in international monetary economics, these three goals cannot all be reached; any two may be available, but the third must be abandoned.

According to O'Connell *et al.* (2010), Kenya's Vision 2030 anticipates a substantial increase in external capital flows and one of the key challenges resulting from enlisting foreign capital flows in support of Vision 2030 is the trade-off between internal (maintaining macroeconomic stability)

and external (supporting export competitiveness) policy objectives in the context of large capital inflows. However, their study found that though capital mobility in Kenya is substantial, it is not perfect; consequently they concluded that the CBK has some "limited scope for pursuing interest rate and exchange rate objectives simultaneously."

Agosin and Huaita (2011) define a capital surge as a sudden increase in the appetite for a country's financial assets on the part of international investors. These could be international banks lending to domestic banks, individuals or institutions investing in the recipient's stock market, or a greater demand for domestic corporate or government bonds. They argue that such inflows can change the recipient's fundamentals in ways that lead to capital account crises, because they can be large relative to the size of the financial sectors of recipients. For instance, they explain that an emerging economy can deviate from its fundamentals when: its current account deficit climbs to the range of 5–10 percent of GDP or beyond and it is financed by short term inflows by agents that are highly leveraged; much of these investments are purely financial with a minimum real correlate; the exchange rate appreciates sharply; and the growth of the non-tradable sectors (basically luxury construction and shopping malls) begins to outstrip the growth of the tradable sectors.

Rodrik (2011) explains that the sudden stop in capital inflows that caused the Asian Financial Crisis in the 1990s was not caused by changes in economic fundamentals. This he explains is because most of these countries had sound fundamentals before the crisis and the quick recovery of South Korea, Thailand, and Malaysia after 1998, once financial conditions stabilized, confirmed that there was nothing fundamentally wrong with their economies. Instead he explains that these countries had succumbed to one of the chronic pathologies of financial markets: a run on the bank, with the "banks" being whole countries that borrowed short term in international financial markets to finance domestic investments. Basically, he points out that financial globalization aggravates (instead of moderating) economic cycles in emerging market economies because "foreign finance is like an umbrella which a man is allowed to borrow, but must return as soon as it starts to rain."

Hansanti *et al.* (2008) point out that the pattern of investment in Thailand changed after the Thai government liberalized its financial system in the early 1990s; since both FDI and portfolio inflows switched from industry and trade to investment projects in non-tradeable sectors, which were not generating foreign exchange earnings to service the foreign debt. In addition, international

investors were willing to lend as long as the borrowers were willing to borrow; due to the stable exchange rate that eliminated the risk of losses and the high interest rate differential between domestic and international markets. Consequently, poor regulation gave rise to misallocation of funds and over-investment in non-tradable sectors (real estate, short-term loans, and portfolio investments), which led to the creation of an asset price bubble.

Jeanneau and Micu (2002) found that the type of exchange rate regime played an explanatory role in international bank lending to emerging countries in the 1990s. Fixed and tightly managed exchange rate regimes encouraged bank lending, while floating rates had an inhibiting influence. Specifically, they explain that such exchange rate arrangements may have worked as an implicit guarantee that encouraged domestic investors to speculate on the often wide interest rate differential between domestic and international rates (or on booming local asset prices) by borrowing from banks abroad to invest in local financial markets.

Weller (2001) found that the vulnerability of emerging economies to currency and banking crises increases after capital account liberalization. This is because capital account liberalization allows more liquidity to enter an emerging economy, which then finds its way into both productive and speculative projects – thanks to internal liberalization. In emerging economies where excess credit is observed, increased liquidity is mostly invested in speculative projects due to rising investor confidence and optimism that favours increasingly speculative financing. The growing trend of more speculative financing increases the divergence between the real and the financial sector, thereby increasing the likelihood of a crisis due to borrower default and the resulting capital outflows.

Calvo *et al.* (1993) found that capital inflows into Latin America were partly explained by conditions outside the region, such as a recession in the United States and falling international interest rates. They also found that the capital inflows were accompanied by an appreciation in the real exchange rate, booming stock and real estate markets, faster economic growth, an accumulation of international reserves, and a strong recovery of secondary-market prices for foreign loans. However, they concluded that the importance of such external factors suggests that a reversal of those conditions in source countries may lead to future capital outflows and thereby increase the macroeconomic vulnerability of recipient countries.

2.4 Overview of the Literature

From the literature reviewed, it is evident that banks are exposed to various macroeconomic shocks. In addition, it is also evident that macroeconomic shocks tend to be correlated. For example, exchange rate fluctuations are affected by interest rates which are affected by the inflation rate. Further, Hellwig (1998) points out that the financial risks in banking are also correlated with each other since they are driven by common underlying factors, and that such exposure was responsible for the American Savings and Loans crisis after deregulation in the 1980s and the various banking crises during the 1990s in Latin American, Scandinavian, and South East Asia countries. Locally, the aftermath of the recent currency crisis confirmed that a rise in market interest rates increases market risk exposure, liquidity risk exposure, credit risk exposure, and eventually capital risk exposure.

It is also clear that the market structure in the banking sector has the potential to either amplify or dampen the effects of these macroeconomic shocks on banking risk. For instance, Maila (2010) explains that when compared to oligopolistic financial markets; competitive markets yield smaller spreads, have smaller unrecognised concentrations at the institutional level, and tend to create superior levels of liquidity. However, he cautions that competition is not a panacea for systemic stability; since even such a policy, in the short term, may be subject to the law of unintended consequences and thus fail to produce the desired effects – such as when the entry of new competitors triggers unanticipated reactions in a specific or related market segment and subsequently new or mutating risks emerge. Further, Breiding *et al.* (2009) point out that increased market concentration, widespread application of similar strategies (when many actors simultaneously move towards a critical state), de-compartmentalization (combining commercial banking, mortgage lending, and investment banking), and a lack of transparency reduce the robustness of the financial system when the external or internal conditions of the system change beyond a certain threshold.

Chapter 3

Methodology

This chapter explains the analytical framework, the variables, and the data sample used in the research study. It then describes the model estimation technique used and concludes with a brief overview of the relevant model validation tests.

3.1 Analytical Framework

Risk is defined as the volatility of net cash flows of the firm. In banking, the volatility of net cash flows results from the expected and unexpected losses arising from the principal activities of lending and borrowing. In this study, the Risk Adjusted Return on Assets (RAROA) will be used to analyse banking risk exposure to the two activities since, as pointed out by Hannagan (2007), it provides an economic view of bank earnings performance by adjusting for the opportunity cost of risk associated with holding the assets. In addition, it is a commonly used measure of bank performance used for internal reporting that captures the impact of both lending and borrowing risks. The use of this framework is also based on similar studies (Gurbuz *et al.*, 2013; Kohler, 2013) that have used this and other risk-adjusted performance measures.

$$RAROA = \frac{EP}{TA} = \frac{PAT - EL}{TA}$$

where EP denotes Economic Profit, TA Total Assets, PAT Profit After Tax, and EL Expected Loss.[1] However, since the risk associated with lending activities usually takes time to materialise – even though it may be affected by the same macroeconomic risks as the risk associated with

[1]Expected Loss is captured by statutory loan loss reserve and financial assets revaluation reserve.

borrowing activities; the RAROA cannot capture the impact of both risks following a change in macroeconomic conditions in a specific year. Therefore, the RAROA is broken down into its key income and expense components to derive the two risk measures that will be used to separately analyse the two risks:

$$RAROA = \frac{NII}{TA} + \frac{NIR}{TA} - \frac{OPEX}{TA} - \frac{NPLP}{TA} - \frac{EL}{TA} - \frac{TX}{TA}$$

where NII denotes Net Interest Income, NIR Non-Interest Revenue, OPEX Operating Expenses, NPLP Non-Performing Loans Provision, and TX Taxes Paid. The risk associated with borrowing activities impacts the Net Interest Margin (NIM), while the risk associated with lending activities impacts the Non-Performing Loans (NPL) and Expected Loss. These three components are exposed to macroeconomic risks and market competition pressures, while the other three components tend to be within the control of bank management; though non-interest revenue is sometimes exposed to macroeconomic risks since it comprises foreign exchange trading revenue. Therefore, bank risk exposure will be measured by change in NIM ($\frac{NII}{TRWA}$) and change in Lending Risk Exposure (LRE). Whereby LRE is calculated as the logarithm of the sum of non-performing loans and expected loss (the logarithmic transformation of the data is done to reduce the skewness and heteroskedasticity). While net interest margin is calculated using Total Risk Weighted Assets (TRWA) instead of total assets since, as pointed out by Peng *et al.* (2003), TRWA captures interest earning assets and avoids distortions in NIM due to changes in other assets resulting from valuation effects.

The use of NPL instead of NPLP to measure risk exposure to lending activities is due to the fact that the decision by a bank to provision is often discretionary and partially motivated by capital adequacy considerations. The choice of this risk measure is also based on the finding by Rajan (1994) that banks generally charge-off loans (when losses are realized) which reduces loan loss reserves or add to reserves (when the potential for losses are recognized) which reduces earnings, only when such actions are anticipated by the market. In addition, he also found that banks' provisions/charge-offs are also influenced by the provisions/charge-offs of other banks in the same lines of business. Therefore, he concluded that voluntary loan loss provisions and charge-offs will tend to have limited information effects.

The use of LRE instead of the NPL ratio to measure risk exposure to lending activities is due to the fact several studies (Serwa, 2013; Coelho and Vivan, 2013) have found that the standard NPL

ratio may vary in time inadvertently due to reasons not related directly to credit risks. Some of these reasons include rapid credit growth (see Figure 1.1) and the time a loan remains in the NPL condition (before being renegotiated, regularized or written-off). Therefore, modifications in the level of credit risk may be offset by movements in any of these other factors and hence be concealed or amplified, which in turn could make the NPL ratio pro-cyclical. Consequently, several adjustments to the standard NPL ratio (that control for changes in credit growth and fluctuations in the term structure of bank loans) have been proposed for countries with rapidly developing banking sectors; however, these adjustments require data on bank loan portfolios that was not readily available.

3.1.1 Model Specification

The aim of this research study is to analyse the impact of macroeconomic shocks and the changing market structure, due to financial liberalization, on banking risk in Kenya by estimating the following equation:

$$R_{it} = \delta R_{i,t-1} + \beta_1 X_{it} + \beta_2 Y_t + \beta_3 Z_t + \eta_i + \lambda_t + \varepsilon_{it} \tag{3.1}$$

where R_{it} is a vector of observations on the bank risk measure of bank i at time t, $R_{i,t-1}$ is the lagged bank risk variable, X_{it} is a vector of time-varying bank-specific control variables, Y_t is a vector of time-varying economic variables, Z_t is a vector of time-varying market structure variables, η_i and λ_t are the unobservable bank-specific and time-specific effects respectively, the $\beta's$ are coefficients of the fixed effects that are estimated across banks, δ is the coefficient of the lagged bank risk variable and ε_{it} is the disturbance term. This model specification follows similar specifications by Gerlach *et al.* (2004), Gurbuz *et al.* (2013), and Ramayandi *et al.* (2014).

3.1.2 Explanatory Variables

Market Structure Variables

The degree of concentration *(CONC)* in the banking sector is measured by the percentage share of the assets of the three largest banks in total banking assets. As discussed in Section 2.2, a high degree of concentration implies reduced competition and thus higher franchise values of banks; banks that experience less competition should theoretically be more risk averse.

The size of the banking market *(MSIZE)* is measured as the share of domestic credit to the private sector relative to GDP. Following Bremus and Buch (2014), it will be used as both a measure for financial development and a measure for the degree of leverage in the economy. The expected impact is not clear, since the more financially developed the country is the lower should be the volatility of macroeconomic aggregates. However, the higher the credit ratio the higher would be the expected volatility for a given economic shock, because higher credit implies larger multiplier effects.

All of the market structure variables enter the LRE equation with a lag to account for the delay with which the changing market structure affects banks' credit portfolios.

Macroeconomic Variables

The annual rate of growth of real GDP *(RGDPG)* is used as a measure of business cycle conditions. It is included to control for changes in the demand for loans and to isolate the effects of monetary policy on the supply side of the market for loans; since as discussed in Section 2.3, the business and financial cycles tend to co-move. Therefore, the expected impact on borrowing risk exposure is positive and on lending risk exposure is negative.

The average rate on 91-day Treasury Bills *(INT)* is used as a measure of the short-term interest rate levels. The expected impact on borrowing risk exposure is negative and on lending risk exposure is positive; since as discussed in Section 2.3, lower interest rates increase bank risk-taking (reduce lending risk exposure) and higher interest rates reduce bank risk-taking (increase lending risk exposure).

The annual inflation rate *(INFL)*, the USD & EUR exchange rates *(ER)* and the annual net capital flows *(NCF)* are also included in the model as explanatory variables. As discussed in Section 2.3, the more volatile the inflation rate and exchange rate, the higher the risk exposure (the lower the bank risk-taking), while the volatility of net capital flows generally depends on the volatility of the inflation rate and the exchange rate. Therefore, the expected impact of these three variables on borrowing risk exposure is negative and on lending risk exposure is positive.

Due to the seasonal variation in short-term interest rate, inflation rate and exchange rates (see Figures B.3, B.5, B.7, and B.9 in the Appendix); the annual average for end of quarter values is used to try to capture the seasonal trends (the most effective method of capturing the seasonal

impact of these variables on bank performance would have been through the use of a quarterly financial performance model. However, this is not possible in the current study due to the difficulties of manually collecting quarterly financial statement data). All of the macroeconomic variables enter the NPL equation with a lag to account for the delay with which macroeconomic shocks affect banks' credit portfolios.

Bank-specific Control Variables

The bank's market share *(MSHARE)* of total banking assets is included to proxy for bank size, since bank risk may increase in size. However, the link between bank size and risk is not clear, a priori. According to Saunders *et al.* (1990), larger banks appear to be more sensitive to general market movements but are better able to diversify their interest rate and asset risk exposure. Therefore, bank size has different and offsetting effects on a bank's market, credit and interest rate risk exposures. Similarly, Bremus and Buch (2014) explain that larger banks are less risky since they are more diversified and have better risk screening models. However, they also enjoy a too big to fail subsidy, which increases their risk-taking incentives.

For the NIM equation, the loans to total assets ratio *(LTA)* reflects the choices by bank managers for riskier investments compared to holding government securities and the expected sign, as pointed out by Love and Ariss (2013), is negative since a higher proportion of assets allocated to loans increases credit risk exposure at banks and may therefore result in more problem loans that increase fluctuations in interest income. For the LRE equation, the rate of loan growth *(LOG.LOAN)* is included, since excessive credit growth at an individual bank fills the bank's balance sheet with more risks and the expected sign is positive.

For the NIM equation, the degree of functional diversification *(DIVERSE)*, which is gauged by calculating the share of a bank's non-interest revenue in its total operating revenue, is also included and the expected sign is negative. For the LRE equation, the capital adequacy ratio *(CAR)* is included since according to Bremus and Buch (2014) banks with riskier loan portfolios may need higher capital buffers to insure against the resulting credit risks and the expected sign is positive.

For the NIM equation, differences in the technical efficiency across banks are accounted for by the ratio of non-interest operating costs to total income *(CTI)*, since banks differ both with respect to scale economies and with respect to their cost structures. Boyd *et al.* (2009) explain that

differences in banks' technologies may enable more efficient banks to gain larger market shares due to their ability to set prices lower than their competitors and the expected impact on the NIM is negative. For the LRE equation, the variable return on equity *(ROE)* is used to capture the trade-off that banks face between risk and return, following Buch *et al.* (2007). According to Love and Ariss (2013), the charter value of banks increases with more profitability, therefore higher ROE is likely to curb bank risk-taking and improve the incentives to monitor the performance of the credit portfolio and the expected impact on lending risk exposure is negative.

Banks that grow faster are likely to increase their exposure to more risky ventures. Therefore all of the bank-specific variables (with the exception of market share) enter the LRE equation with a lag to account for the delay with which idiosyncratic shocks affect banks' credit portfolio.

The following model specification is used to investigate the determinants of risk exposure associated with borrowing activities:

$$\begin{aligned} NIM_{it} = {} & \delta NIM_{i,t-1} + \beta_1 MSHARE_{it} + \beta_2 DIVERSE_{i,t-k} + \beta_3 LTA_{i,t-k} \\ & + \beta_4 CONC_t + \beta_5 MSIZE_t + \beta_6 RGDPG_t + \beta_7 INT_t + \beta_8 INFL_t + \beta_9 ER_t \\ & + \beta_{10} NCF_t + \eta_i + \lambda_t + \varepsilon_{it} \end{aligned} \tag{3.2}$$

While the following model specification is used to investigate the determinants of risk exposure associated with lending activities:[2]

$$\begin{aligned} lnLRE_{it} = {} & \delta lnLRE_{i,t-1} + \beta_1 MSHARE_{it} + \beta_2 lnLOAN_{i,t-k} + \beta_3 CAR_{i,t-k} \\ & + \beta_4 CONC_{t-1} + \beta_5 MSIZE_{t-1} + \beta_6 RGDPG_{t-1} + \beta_7 INT_{t-1} + \beta_8 INFL_{t-1} \\ & + \beta_9 ER_{t-1} + \beta_{10} NCF_{t-1} + \eta_i + \lambda_t + \varepsilon_{it} \end{aligned} \tag{3.3}$$

3.2 Data and Sample

Data on market structure variables will be obtained from the CBK Bank Supervision Annual Reports, data on macroeconomic variables will be obtained from the Economic Surveys and CBK Rates, and data on the bank-specific variables will be obtained from their annual financial statements.

[2]The dynamics of both models will be determined by trying out several lags and then removing the non-significant lags.

The bank sample is drawn from banks that have end-of-year information for the period 2008 to 2013. The bank sample comprises 32 out of the 43 banks operating at the end of 2013, which account for about 95% of the total banking assets (see Table A.1 & Table A.2 in the Appendix).

The choice of the study period is informed by the work of Pasinetti (1993) on structural economic changes and two relevant developments: first, the economic recovery that was realised in 2007 permanently changed the structure of the economy due to the significant investment in production capacity (see Table 1.1) and second, this change in economic structure marked the beginning of the current cycle of credit expansion (see Figure 1.1) since the resulting growth in economic activity increased demand for liquidity which created demand for more financial services – thereby also marking the beginning of the permanent change in bank market structure (see Figure B.1 in the Appendix).

3.3 Model Estimation

One of the benefits for using panel data is that the analysis of panel data can reveal individual variation that is unobservable in time series and it can also reveal time variation that is unobservable in cross-sections. Therefore, this implies that the error term ε_{it} in Equation 3.1 may be higher or lower for some banks than for other banks, or it may be higher or lower for some time periods than for other time periods; the former variation is accounted for by individual effects and the latter by time effects (Wang, 2009).

A dynamic panel data model is a model in which the lagged dependent variable appears on the right-hand side of the equation. In Equation 3.1, the lagged bank risk variable is included as an explanatory variable since Ramayandi *et al.* (2014) explain that the persistence of the bank risk variable may reflect the existence of intense competition or the pro-cyclical risk-taking behaviour in line with the business cycle dynamics. The coefficient of the lagged bank risk variable is viewed as the speed of convergence to equilibrium; whereby a statistically significant value of zero implies that bank risk is characterized by a high speed of adjustment, while a value of one means that the adjustment is very slow, and values between 0 and 1 suggest that risk persists but will eventually return to its mean. Consequently, a static model would be biased if bank risk is persistent.

The simplest dynamic panel model (excluding regressors) is one where the dependent variable

follows an AR(1) process:

$$y_{it} = \delta y_{i,t-1} + \varepsilon_{it} \Rightarrow i = 1, ..., N; t = 1, ..., T; \mid \delta \mid < 1 \tag{3.4}$$

where $\mid \delta \mid < 1$ to ensure stationarity.

However, Baltagi (2005) explains that inclusion of a lagged dependent variable creates problems; since R_{it} in Equation 3.1 is a function of ε_{it}, it immediately follows that $R_{i,t-1}$ is also a function of ε_{it}. As a result, $R_{i,t-1}$, a right-hand regressor, is correlated with the error term and this renders the Ordinary Least Squares (OLS) estimator biased and inconsistent even if the ε_{it} are not serially correlated. To resolve this problem, Arellano and Bond (1991) proposed a Generalized Method of Moments (GMM) procedure that leads to consistent and efficient estimates by using the dynamic endogeneity inherent in the explanatory variables (i.e. lags of endogenous variables) as instruments.[3] Heij *et al.* (2004) explain that GMM is based on estimating population moments by means of sample moments – the procedure derives parameter estimates by equating sample moments to unobserved population moments with the assumed statistical distribution and then solving the equations. For instance, suppose that the data y_i consist of a random sample from a population with unknown mean μ, so that:

$$E[y_i - \mu] = 0$$

The moment estimator of μ is obtained by replacing the population mean *(E)* by the sample mean $(\frac{1}{n}\sum_{i=1}^{n})$, so that:

$$\frac{1}{n}\sum_{i=1}^{n}(y_i - \hat{\mu}) = 0$$

that is, $\hat{\mu} = \frac{1}{n}\sum_{i=1}^{n} y_i$

In the case of a multivariate regression expressed in compact form $y = X\beta + u$, the moment conditions are specified as:

$$E[Z'(y - X\beta)] = 0 \tag{3.5}$$

where Z is a vector of regressors that contains some of X and may contain instrument variables, and β is a vector of coefficients.

Bond (2002) explains how the additional instruments can be obtained in a dynamic panel data

[3]Since the risk measure in Equation 3.1 is explained by past values (one lag) of the risk measure, all lags of this explanatory variable beyond lag 1 will be used as instruments.

model if one utilizes the orthogonality conditions that exist between lagged values of the dependent variable and the error terms, and illustrates this with the simple autoregressive model with no regressors:

$$y_{it} = \delta y_{i,t-1} + u_{it} \Rightarrow i = 1, ..., N; t = 1, ..., T; \mid \delta \mid < 1 \tag{3.6}$$

where $\mid \delta \mid < 1$ to ensure stationarity, y_{it} is an observation on some series for individual i in period t, $y_{i,t-1}$ is the observation on the same series for the same individual in the previous period and u_{it} is assumed to follow a one-way error component model where $u_{it} = \eta_i + v_{it}$ with $\eta_i \sim IID(0, \sigma_\eta^2)$ and $v_{it} \sim IID(0, \sigma_v^2)$, that is, they are independent of each other and among themselves. Whereby η_i is an unobserved individual-specific time-invariant effect and v_{it} is a disturbance term. The v_{it}, are assumed to have finite moments and in particular $E(v_{it}) = E(v_{it}v_{is}) = 0$ for $t \neq s$, that is, lack of serial correlation is assumed but not necessarily independence over time. With these assumptions, values of y lagged two periods or more become valid instruments in the equations in first differences.

Taking the difference operation once on all the variables in Equation 3.6 yields:

$$\triangle y_{it} = \delta \triangle y_{i,t-1} + \triangle u_{it} \tag{3.7}$$

where $\triangle y_{it} = y_{it} - y_{i,t-1}$ and $\triangle u_{it} = u_{it} - u_{i,t-1}$, which is MA(1) with unit root (i.e. has a first-order moving average form of serial correlation) and the first period we observe this relationship is t=3, where we have:

$$y_{i3} - y_{i2} = \delta(y_{i2} - y_{i1}) + (u_{i3} - u_{i2}) \tag{3.8}$$

In Equation 3.8, y_{i1} is a valid instrument since it is highly correlated with $(y_{i2} - y_{i1})$ and is not correlated with $(u_{i3} - u_{i2})$ as long as the u_{it} are not serially correlated. Baltagi (2005) explains that one can continue adding an extra valid instrument with each forward period, so that for period T, the set of valid instruments becomes $(y_{i1}, y_{i2}, ..., y_{i,T-2})$.

In this context, GMM provides a convenient framework for obtaining efficient estimators by using

an instrument matrix of the form:

$$Z_i = \begin{bmatrix} y_{i1} & 0 & 0 & \dots & 0 & \dots & 0 \\ 0 & y_{i1} & y_{i2} & \dots & 0 & \dots & 0 \\ \vdots & \vdots & \vdots & \ddots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & \dots & y_{i1} & \dots & y_{i,T-2} \end{bmatrix}$$

where the rows correspond to the first-differenced equations for period t=3,...,T for individual i and exploit the moment conditions:

$$E[Z_i' \triangle u_i] = 0 \tag{3.9}$$

where $\triangle u_i = (\triangle u_{i3}, \triangle u_{i4}, ..., \triangle u_{iT})'$ describe the moment equations for the differenced error term in Equation 3.7.

The GMM estimator of the model is derived from minimising the following:

$$\left(\sum_{i=1}^{N} Z_i' \triangle u_i\right)' W_N \left(\sum_{i=1}^{N} Z_i' \triangle u_i\right) = \left(\sum_{i=1}^{N} \triangle u_i Z_i\right) W_N \left(\sum_{i=1}^{N} Z_i' \triangle u_i\right) \tag{3.10}$$

Wang (2009) explains that the alternative choices of the weight matrix W_N yield different GMM estimators that are all consistent for large N and finite T, but they differ in their asymptotic efficiency. One of these optimal weight matrices is:

$$W_N = \left(\frac{1}{N} \sum_{i=1}^{N} Z_i' \triangle \hat{u}_i Z_i' \triangle \hat{u}_i\right)^{-1} \tag{3.11}$$

Using the weight matrix W_N of Equation 3.11, the first differenced GMM estimator is derived as:

$$\hat{\delta} = \left[\left(\sum_{i=1}^{N} \triangle y_{i,-1}' Z_i\right) W_N \left(\sum_{i=1}^{N} Z_i' \triangle y_{i,-1}\right)\right]^{-1} \times \left[\left(\sum_{i=1}^{N} \triangle y_{i,-1}' Z_i\right) W_N \left(\sum_{i=1}^{N} Z_i' \triangle y_i\right)\right] \tag{3.12}$$

When exogenous independent variables are involved in the model and defined as:

$$\beta^e = \begin{bmatrix} \delta \\ \beta_1 \\ \vdots \\ \beta_k \end{bmatrix} \textit{ and } x_{i,-1}^e = \begin{bmatrix} y_{i,2} & x_{1,i,1} & \dots & x_{k,i,1} \\ \vdots & \vdots & \ddots & \vdots \\ y_{i,T-1} & x_{1,i,T-2} & \dots & x_{k,i,T-2} \end{bmatrix}$$

The first differenced GMM estimator vector is then derived as:

$$\hat{\beta}^e = \left[\left(\sum_{i=1}^{N}(\triangle x_{i,-1}^e)' Z_i\right) W_N \left(\sum_{i=1}^{N} Z_i' \triangle x_{i,-1}^e\right)\right]^{-1} \times \left[\left(\sum_{i=1}^{N}(\triangle x_{i,-1}^e)' Z_i\right) W_N \left(\sum_{i=1}^{N} Z_i' \triangle y_i\right)\right] \tag{3.13}$$

To complement the multivariate analysis above and identify the key determinants of risk persistence, a Panel Vector Auto-Regression (PVAR) model will be used. The PVAR framework is ideal for this purpose because it simultaneously takes into account interactions between all the macroeconomic variables and bank-specific variables in the model, unlike the separate model specifications used in the multivariate analysis.

Pfaff (2008a) explains that the basic Vector Auto-Regression (VAR) model consists of a set of K endogenous variables $y_t = (y_{1t}, ..., y_{kt})$ for k = 1,...,K and that the VAR (p)-process is defined as:

$$y_t = A_1 y_{t-1} + ... + A_p y_{t-p} + C D_t + u_t \tag{3.14}$$

where A_i are $(K \times K)$ coefficient matrices for i = 1,...,p and u_t is a K dimensional white noise process. The matrix C is the coefficient matrix of potentially deterministic regressors with dimension $(K \times M)$, and D_t is an $(M \times 1)$ column vector holding the appropriate deterministic regressors, such as a constant, trend, and/or dummy variables. Canova and Ciccarelli (2013) explain that PVAR models are built on the same structure as VAR models (all variables are assumed to be endogenous and interdependent), with a cross sectional dimension included that makes them well suited for analysing the transmission of shocks across units and time. Therefore, following Love and Ariss (2013), the PVAR model used to identify the transmission of macroeconomic shocks is defined as:

$$y_{it} = U_i + A(L) y_{it} + e_{it} \tag{3.15}$$

where A(L) is the lag operator, U_i is used to control for unobserved bank heterogeneity and y_{it} is a vector of macroeconomic and bank-specific variables. Variables that enter first in Equation 3.15 are assumed to be the most exogenous and hence affect subsequent variables both contemporaneously and with a lag, whereas variables that are ordered later are less exogenous and affect previous variables only with a lag. System GMM is then used to estimate the coefficients of the PVAR model.

3.4 Model Validation

In dynamic panel data GMM estimation, the moment conditions utilize the orthogonality conditions between the differenced errors and lagged values of the dependent variable; which is based on the assumption that the original disturbances in Equation 3.1 are serially uncorrelated and that the differenced error term is MA (1) with unit root. As a result, diagnostic tests are computed to test for first order and second order serial correlation in the disturbances.

Arellano and Bond (1991) proposed a test for the hypothesis that there is no second-order serial correlation for the error terms of the first-differenced equation, because the consistency of the GMM estimator relies upon the fact that $E[\triangle v_{it} \triangle v_{i,t-2}] = 0$. The test statistic for second-order serial correlation based on residuals from the first-difference equation takes the form:

$$m_2 = \frac{\hat{v}'_{-2}\hat{v}_*}{\hat{v}^{1/2}} \sim N(0,1)$$

This hypothesis is true if the v_{it} are not serially correlated and under the null hypothesis of no second-order serial correlation, the test statistic is asymptotically distributed as standard normal.

To test the overall validity of the instruments, Arellano and Bond (1991) and Blundell and Bond (1998) suggested Sargan's test of over-identifying restrictions which is given by:

$$s = \hat{v}Z \left[\sum_{i=1}^{N} Z'_i \hat{v}'_i \hat{v}_i Z_i \right]^{-1} Z'\hat{v} \sim \chi^2_{p-K-1}$$

where p refers to the number of columns of Z and $\hat{v}$ denotes the residuals from a two-step estimation. Under the null hypothesis of instrument validity, the test statistic is asymptotically distributed as χ^2 with the degrees of freedom being equal to the number of instruments minus the number of parameters estimated. The validity of the instruments is guaranteed under the hypothesis that the error terms are not second-order serially correlated, while the coefficient estimates are consistent and efficient if both the moment conditions and the no-serial correlation assumptions are satisfied.

Chapter 4

Results

4.1 Descriptive Statistics

The descriptive statistics of the variables used in the study are summarized in Table 4.1. Note that the bank sample shows a large variability in bank size as measured by market share *(MSHARE)* and a large variability in bank risk profile as measured by the capital adequacy ratio *(CAR)*, which minimize the potential of sample selection bias.[1]

Table 4.1: Descriptive Statistics

Statistic	N	Mean	St. Dev.	Min	Max
Net Interest Margin, NIM	192	9.63	3.98	0.23	25.89
Lending Risk Exposure, LOG.LRE	192	6.61	1.23	3.64	9.70
Market Share, MSHARE	192	3.13	3.59	0.10	15.31
Degree of Diversification, DIVERSE	192	34.15	12.41	6.90	94.98
Costs to Income Ratio, CTI	192	65.55	31.23	15.30	274.35
Loan to Assets Ratio, LTA	192	52.61	11.24	21.01	75.66
Loan Growth Rate, LOG.LOAN	192	9.54	1.30	6.86	12.20
Capital Adequacy Ratio, CAR	192	22.85	9.36	8.87	64.78
Return on Equity, ROE	192	14.32	13.59	−66.72	38.35
Real GDP Growth Rate, RGDPG	192	3.95	1.41	1.53	5.76
91-Day T-Bill Rate, INT	192	8.06	2.64	3.17	11.01
Inflation Rate, INFL	192	9.81	4.58	3.80	16.58
Net Capital Flows, NCF	192	262.10	143.93	100.61	514.39
US Dollar Exchange Rate, USD	192	81.19	6.55	69.62	89.44
Euro Exchange Rate, EUR	192	110.86	6.44	104.03	123.29
Degree of Concentration, CONC	192	32.57	2.65	29.24	37.40
Market Size, MSIZE	192	34.33	3.86	29.13	39.42

[1]Data analysis and presentation in this research study has been performed by R using the plm, vars, and stargazer packages developed by Croissant and Millo (2008), Pfaff (2008b) and Hlavac (2014) respectively.

The variability in the bank sample is captured in more detail in the bank descriptive statistics (see Table A.3 in the Appendix). There are 192 observations for the bank-specific control variables for the 32 banks sampled during the study period 2008 to 2013. While there are 6 observations for the macroeconomic and market structure variables captured during the study period.

4.2 Correlation Analysis

Macroeconomic variables are not independent and therefore multi-collinearity may be a problem when using these variables in the same regression equation. Table 4.2 shows that some of the macroeconomic variables that will be used in the study are highly correlated and thus multi-collinearity is indeed a problem.

Table 4.2: Correlation of Macroeconomic Variables

	RGDPG	INT	INFL	NCF	USD	EUR
RGDP	1					
INT	-0.16	1				
INFL	-0.72	0.53	1			
NCF	0.58	0.41	-0.27	1		
USD	0.74	0.47	-0.27	0.82	1	
EUR	0.30	0.67	0.25	0.67	0.83	1

Though their interdependence reinforces their individual influence on bank risk, it can also make an empirical assessment of their relative importance for bank risk difficult; therefore, additional regressions will be run so that the macroeconomic variables can be included in separate model specifications.

4.3 Panel Unit Root Tests

One of the requirements for regression analysis using time series data is that the data to be analysed must be stationary i.e. integrated of order zero or have no unit roots, unless there is cointegration. Panel unit root tests are used to examine whether there is a unit root in the time series and to determine if non-stationary data should be first differenced or regressed on deterministic functions of time to render the data stationary. Examples of some of the economic and financial time series that exhibit non-stationarity in the mean include: asset prices, exchange rates, and the levels of macroeconomic aggregates like real GDP.

Wang (2009) points out that economic and financial time series can be combinations of trends and cycles. The long-run characteristics in economic and financial data are usually associated with non-stationarity in time series and are called trends, while the short-term fluctuations are stationary time series and are called cycles. He explains that a shock to a stationary time series would have an effect which would gradually disappear, leaving no permanent impact on the time series in the distant future. While a shock to a non-stationary time series would permanently change the path of the time series. Therefore, panel unit root tests provide an overall aggregate statistic to examine whether there is a unit root in the pooled cross-section time series data, which helps to avoid obtaining contradictory results in individual time series by evaluating the time series property of the data accordingly.

Heij *et al.* (2004) explain that the Dickey-Fuller (DF) test examines the null hypothesis of a stochastic trend against the alternative of a deterministic trend. The null hypothesis of a stochastic trend is rejected if the t-value of the coefficient of the lagged variable ($\Delta y_t = \alpha + \beta t + \rho y_{t-1} + \varepsilon_t$) falls below the critical value of the Dickey–Fuller distribution. The augmented Dickey-Fuller (ADF) test is obtained by including lagged values of Δy_t as additional regressors. Under the null hypothesis of a stochastic trend, the series y_t is integrated of order 1 so that the added regressors Δy_{t-k} are all stationary. The Phillips-Perron (PP) test is a Dickey–Fuller t-test based on the Newey–West correction for serial correlation and is used to compute the standard error of the estimated parameter of the lagged variable ($\Delta y_t = \alpha + \beta t + \rho y_{t-1} + \varepsilon_t$). It addresses the problem of the critical values being invalid due to residuals being serially correlated (owing to the time series being characterized by short-term fluctuations) by using non-parametric test statistics for the null hypothesis of a unit root that explicitly allows for weak dependence and heterogeneity of the error process.

According to Pfaff (2008a), one of the shortcomings of the ADF and PP tests is their relatively low power if the true data-generating process is an AR (1)-process with a coefficient close to one; due to the fact that a unit root process is specified as the null hypothesis. He explains that the Elliott-Rothenberg-Stock (ERS) test addresses this problem by using a local to unity detrending of the time series which improves the power of the unit root test. The other shortcoming of DF-type tests is that the nuisance parameters (the coefficients of the deterministic regressors) are either not defined or have a different interpretation under the alternative hypothesis of stationarity. This drawback is addressed by the Schmidt-Phillips (SP) test which uses a Lagrange multiplier (LM)-type test statistic that defines the same set of nuisance parameters under both the null and

the alternative hypotheses.

Table 4.3: Panel Unit Root Tests Results

Variable	ADF Test	PP Test	ERS Test	SP Test
RGDPG	11.86***	3.81***	−0.66***	3.86***
	(0.02)	(0.30)	(0.09)	(0.42)
INT	24.20***	8.09***	−2.93***	8.04***
	(1.16)	(0.62)	(0.14)	(0.84)
INFL	29.44***	14.34***	−0.10***	14.23***
	(0.77)	(0.70)	(0.04)	(1.12)
NCF	783.48***	274.21***	−0.92***	273.40***
	(44.15)	(21.76)	(0.13)	(37.29)
USD	242.40***	70.65***	−0.26***	70.87***
	(11.01)	(5.85)	(0.07)	(6.00)
EUR	332.50***	143.17***	−0.75***	143.20***
	(17.13)	(7.73)	(0.12)	(7.84)
CONC	97.04***	32.56***	−0.52***	32.48***
	(5.02)	(2.37)	(0.10)	(2.46)
MSIZE	102.80***	24.25***	−0.88***	24.30***
	(3.86)	(2.41)	(0.12)	(2.52)
NIM	3.80***	3.46***	−0.32***	5.15***
	(0.95)	(0.58)	(0.07)	(1.01)
LOG.LRE	1.85***	1.48***	−0.15***	1.94***
	(0.40)	(0.31)	(0.04)	(0.42)
MSHARE	0.49*	0.29**	−0.04*	1.02**
	(0.29)	(0.14)	(0.02)	(0.48)
DIVERSE	11.05***	15.01***	−0.25***	11.91***
	(2.98)	(2.19)	(0.07)	(2.86)
CTI	13.99**	30.01***	−0.24***	15.89***
	(5.19)	(4.43)	(0.07)	(6.08)
LTA	11.90***	15.76***	−0.28***	15.18***
	(2.92)	(2.78)	(0.06)	(3.05)
LOG.LOAN	2.23***	1.74***	−0.17***	2.51***
	(0.54)	(0.42)	(0.05)	(0.55)
CAR	11.17***	7.42***	−0.30***	9.00***
	(2.12)	(1.31)	(0.06)	(2.06)
ROE	5.98**	6.11***	−0.29***	13.05***
	(2.32)	(1.16)	(0.07)	(2.94)

Note: *,**,*** denote significance at 10%, 5% & 1% levels.

Table 4.3 presents the results of the panel unit root tests, all the tests reject the presence of unit roots in the panel. *(MSHARE)*, *(CTI)* and *(ROE)* are not significant at the 1% level; probably due to the effects of rising competition and growing market size on the market shares, managerial efficiency, and shareholder returns of some of the banks.

4.4 Empirical Results

The empirical analysis proceeds in three steps. The first step involves running a GMM regression for the borrowing risk exposure model. The second step involves running a GMM regression for the lending risk exposure model. The final step involves analysing the key variables contributing to risk persistence by using a PVAR model to interact the significant variables from the risk exposure models.

4.4.1 Net Interest Margin

Table 4.4 presents the GMM regression results for the NIM model. The different columns indicate the separate model specifications for the macroeconomic variables as discussed in Section 4.2; whereby the macroeconomic variables are included separately to avoid problems of multicollinearity. The validity of the results for all the model specifications is confirmed by the various model diagnostic tests. The Sargan test of over-identifying restrictions meets the requirement of failing to reject the null hypothesis that the instruments are not correlated with the errors in the first-differenced equation. The AR (1) and AR (2) tests meet the requirements of rejecting the null hypothesis of no first-order serial correlation and failing to reject the null hypothesis of no second-order serial correlation in first-differenced errors. Therefore, the validity of the instruments is guaranteed under the hypothesis that the error terms are not second-order serially correlated. In addition, the results of the Wald test of joint significance show that the coefficients are jointly significant.

One of the key results is that the lagged dependent variable is statistically indistinguishable from zero. This implies that borrowing risk exposure is not persistent.

Bank-specific Variables

First, the relationship between the degree of functional diversification *(DIVERSE)* and borrowing risk exposure is found to be negative and statistically significant. This implies that as the share of a bank's non-interest revenue in its total operating revenue increases, NIM reduces due to the declining proportion of interest revenue.

Second, the relationship between the loan to assets ratio *(LTA)* and the NIM is found to be

Table 4.4: GMM Regression Results for Net Interest Margin

	(1)	(2)	(3)	(4)	(5)	(6)
L1.NIM	−0.149	−0.149	−0.128	−0.067	−0.097	−0.095
	(0.151)	(0.149)	(0.152)	(0.121)	(0.147)	(0.146)
DIVERSE	−0.145***	−0.144***	−0.147***	−0.142***	−0.148***	−0.148***
	(0.028)	(0.028)	(0.028)	(0.027)	(0.028)	(0.028)
L1.DIVERSE	0.014	0.013	0.023	0.028	0.030	0.031
	(0.025)	(0.025)	(0.024)	(0.025)	(0.024)	(0.024)
MSHARE	−0.389	−0.391	−0.369	−0.343	−0.348	−0.346
	(0.385)	(0.384)	(0.385)	(0.360)	(0.381)	(0.381)
LTA	−0.168***	−0.170***	−0.158***	−0.166***	−0.153***	−0.153***
	(0.045)	(0.045)	(0.044)	(0.044)	(0.044)	(0.044)
L1.LTA	−0.072*	−0.072*	−0.076*	−0.081*	−0.080*	−0.080*
	(0.043)	(0.042)	(0.044)	(0.043)	(0.045)	(0.045)
CONC	0.953	1.062*	1.207**	−0.325	1.420**	1.121*
	(0.636)	(0.579)	(0.578)	(1.213)	(0.598)	(0.590)
MSIZE	0.329	0.394	0.456*	0.077	0.682**	0.452*
	(0.305)	(0.267)	(0.266)	(0.364)	(0.293)	(0.271)
RGDPG	0.073					
	(0.140)					
INT		−0.009				
		(0.041)				
INFL			−0.049*			
			(0.026)			
NCF				−0.009		
				(0.007)		
USD					−0.130**	
					(0.065)	
EUR						−0.049**
						(0.025)
Num. obs.	192	192	192	192	192	192
Num. obs. used	128	128	128	128	128	128
Sargan Test: p-value	0.936	0.933	0.946	0.922	0.945	0.944
AR (1) Test: p-value	0.005	0.005	0.007	0.008	0.008	0.008
AR (2) Test: p-value	0.237	0.249	0.190	0.217	0.181	0.182
Wald Test: p-value	0.000	0.000	0.000	0.000	0.000	0.000

Note: *,**,*** denote significance at 10%, 5% & 1% levels. Standard errors in brackets.

negative and statistically significant. The relationship is also found to be negative and statistically significant for the previous period's loan to assets ratio. This implies that an increase in the size of the proportion of loans tends to reduce the NIM in the current and following year, probably because the higher liquidity requirements following credit expansion and/or the resulting rise in NPLs increases funding costs. This result is similar to the finding by Love and Ariss (2013) that banks in Egypt which had a higher proportion of assets allocated to loans also had higher credit risk exposure, and the resulting problem loans increased fluctuations in interest income.

Third, the results indicate that market share *(MSHARE)* has no impact on borrowing risk exposure. This is consistent with the findings of Bremus and Buch (2014), that bank size does not matter for idiosyncratic fluctuations for banks in low income countries because the return on assets does not reduce bank-level risk.

Market Structure Variables

First, the relationship between the degree of concentration *(CONC)* and the measure for borrowing risk exposure is found to be positive and statistically significant for model 2, model 3, model 5,

and model 6. This implies that increased competition in the deposit market reduces the franchise value of banks by reducing the NIM. This is consistent with the finding by Hellman *et al.* (2000), that financial liberalization increases competition (by allowing more foreign banks and reducing restrictions on opening branches) and the resulting competition erodes profits. Similarly, Allen and Gale (2004) found that competition, as a result of financial liberalization, can induce banks to bid up deposit rates and reduce franchise value.

Second, the relationship between the size of the banking market *(MSIZE)* and the measure for borrowing risk exposure is also found to be positive and statistically significant for model 3, model 5, and model 6. This implies that the higher the credit ratio, the higher the volatility of a given economic shock (in this case the inflation rate, USD exchange rate, and EUR exchange rate); because a higher credit ratio implies higher leverage in the economy which implies larger multiplier effects. This is consistent with the findings of Bremus and Buch (2014), that macroeconomic fluctuations are higher in low income countries with a large banking sector relative to GDP since the high level of credit to GDP increases bank-level volatility.

Macroeconomic Variables

First, the relationship between changes in the inflation rate *(INFL)* and the measure of borrowing risk exposure is found to be negative and statistically significant. This implies that rising inflation increases borrowing risk exposure (reduces NIM) and this is consistent with the finding by Odhiambo (2012), that inflation in Zambia adversely affects the holding of all classes of financial assets. Similarly, Ndebbio (2004) found that rising rates of inflation tend to induce disintermediation by causing economic agents to hold other assets such as gold, physical goods, land, and foreign currency in preference to domestic currency.

Second, the results indicate a negative and statistically significant relationship between changes in the exchange rates *(USD & EUR)* and the measure of borrowing risk exposure. This implies that depreciation in the exchange rates increases borrowing risk exposure (reduces NIM) and this is similar to the finding by Ramayandi *et al.* (2014), that exchange rate volatility increases banking risk.

Third, the results indicate that the relationship between the measure of borrowing risk exposure and *(RGDPG)*, *(INT)* and *(NCF)* is not statistically significant. Of great interest is the result for *(INT)*, which indicates that changes in the short-term interest rate do not affect the net

interest margin. This result may imply that bank deposit and lending rates are rigid. Aziakpono and Wilson (2010) explain some of the factors that affect the stickiness of bank interest rates as comprising: the oligopolistic behaviour of banks that causes market interest rates to adjust asymmetrically to an increase or a decrease in the official rate, a control monetary policy regime that is inherently rigid since changes in market interest rates generally occur only when the monetary authority adjusts the set rates, a high interest rate spread that causes the bank loan rate to be relatively insensitive to small changes in the official rate, an open financial system (access to external sources of finance that reduces reliance on the accommodation facilities from the central bank) slows the response of bank interest rates to increases in the official rate, and a developing financial system (limited access to alternative investment instruments or financing sources to bank deposits and loans) causes bank interest rates to be less flexible in responding to changes in market conditions.

Empirically, the interest rate channel in Kenya was found to be ineffective (Misati *et al.*, 2011; Mahasi and Pokhariyal, 2013) since it took between 10 to 24 months to fully transmit monetary policy shocks to the lending and deposit rates. In Asia, Ramayandi *et al.* (2014) found that changes in the short-term interest rates do not have a significant impact on most measures of bank risk (except in the case of non-performing loans) in ten Asian economies. In South Africa, Aziakpono and Wilson (2010) found that banks were more rigid in adjusting their lending rates and deposit rates upward in response to a positive shock in the official rate, thus providing support for the adverse customer reaction hypothesis and the collusive behaviour hypothesis respectively. While in Hong Kong, Peng *et al.* (2003) found that changes in the short-term interest rate had no impact on the intermediation spread.

The overall impact of macroeconomic variables is consistent with the finding by Janvisloo and Muhammad (2013), that the impact of external macroeconomic shocks on the Malaysian banking system is greater than that of internal shocks. As was discussed in Section 2.3, the inflation rate in Kenya is very sensitive to international oil price shocks. However, in Kenya the effect is greater for borrowing risk exposure (since Table 4.5 indicates that the effect of internal shocks is greater for lending risk exposure) probably due to the comparatively lower degree of financial integration.

4.4.2 Lending Risk Exposure

Table 4.5 presents the GMM regression results for the LRE model. The different columns indicate the separate model specifications for the macroeconomic variables as discussed in Section 4.2; whereby the macroeconomic variables are included separately to avoid problems of multicollinearity. The validity of the results for all the model specifications is confirmed by the various model diagnostic tests. The Sargan test of over-identifying restrictions meets the requirement of failing to reject the null hypothesis that the instruments are not correlated with the errors in the first-differenced equation. The AR (1) and AR (2) tests meet the requirements of rejecting the null hypothesis of no first-order serial correlation and failing to reject the null hypothesis of no second-order serial correlation in first-differenced errors. Therefore, the validity of the instruments is guaranteed under the hypothesis that the error terms are not second-order serially correlated. In addition, the results of the Wald test of joint significance show that the coefficients are jointly significant.

Table 4.5: GMM Regression Results for Lending Risk Exposure

	(1)	(2)	(3)	(4)	(5)	(6)
L1.LOG.LRE	0.506**	0.501**	0.641***	0.651***	0.651***	0.680***
	(0.202)	(0.202)	(0.195)	(0.210)	(0.210)	(0.201)
CAR	0.001	0.001	0.001	0.003	0.003	0.002
	(0.006)	(0.006)	(0.007)	(0.007)	(0.007)	(0.007)
MSHARE	−0.029	−0.027	−0.093	−0.111	−0.110	−0.117
	(0.070)	(0.070)	(0.075)	(0.081)	(0.081)	(0.079)
LOG.LOAN	0.821**	0.813**	1.010**	0.935**	0.933**	1.019**
	(0.365)	(0.361)	(0.450)	(0.427)	(0.427)	(0.455)
L1.LOG.LOAN	−0.067	−0.064	−0.063	0.101	0.102	0.020
	(0.316)	(0.315)	(0.333)	(0.309)	(0.311)	(0.326)
L1.CONC	0.020	0.061*	0.022	0.131***	0.205***	0.128***
	(0.036)	(0.035)	(0.036)	(0.048)	(0.079)	(0.044)
L1.MSIZE	0.019	−0.011	−0.031	−0.058*	−0.007	−0.003
	(0.017)	(0.017)	(0.019)	(0.035)	(0.018)	(0.017)
L1.RGDPG	−0.116***					
	(0.032)					
L1.INT		0.043***				
		(0.012)				
L1.INFL			0.032***			
			(0.009)			
L1.NCF				0.003**		
				(0.001)		
L1.USD					0.045**	
					(0.022)	
L1.EUR						0.020***
						(0.007)
Num. obs.	192	192	192	192	192	192
Num. obs. used	128	128	128	128	128	128
Sargan Test: p-value	0.999	0.999	0.997	0.999	0.998	0.997
AR (1) Test: p-value	0.057	0.060	0.021	0.025	0.025	0.020
AR (2) Test: p-value	0.804	0.811	0.616	0.716	0.715	0.693
Wald Test: p-value	0.000	0.000	0.000	0.000	0.000	0.000

Note: *,**,*** denote significance at 10%, 5% & 1% levels. Standard errors in brackets.

One of the key results is that the lagged dependent variable is statistically significant. This implies that lending risk exposure is persistent; but since the coefficient is less than 1, lending risk exposure will eventually return to its mean. The results also suggest that all the macroeconomic

variables used are significant determinants of lending risk exposure for banks in Kenya. This finding on macroeconomic variables is consistent with that of Love and Ariss (2013) on the impact of macroeconomic variables on the loan portfolio quality of banks in Egypt.

Bank-specific Variables

First, the relationship between the loan growth rate *(LOG.LOAN)* and lending risk exposure is found to be positive and statistically significant. This implies that rapid credit growth fills the bank's balance sheet with more risks and this impact is confirmed by the statistically significant lending risk persistence measure. Greuning and Bratanovic (2003) found that rapid credit growth increases credit risk when the bank fails to match its growing loan portfolio with adequate credit risk management capacity. In another study, Love and Ariss (2013) found that the effect was due to the relationship between rapid loan growth and adverse selection, which reduces asset quality.

Second, the results indicate that market share *(MSHARE)* has no impact on lending risk exposure and this is consistent with the findings of Bremus and Buch (2014), that bank size does not matter for idiosyncratic fluctuations for banks in low income countries because the return on assets does not reduce bank-level risk.

Market Structure Variables

First, the relationship between the degree of concentration *(CONC)* and lending risk exposure is found to be positive and statistically significant for model 2, model 4, model 5, and model 6. This implies that reduced competition in the loan market increases the lending risk exposure and is consistent with the finding by Boyd and De Nicolo (2005), that concentration in the loan market can lead to increased lending rates that raise both the borrowers' debt loads and default probabilities as well as their incentive to engage in riskier projects. Since the degree of concentration has been declining during the study period, the positive relationship does not support the franchise value paradigm; whereby the decline in franchise value resulting from competition (see Table 4.4) is expected to increase lending risk exposure. Therefore, the results imply that bank competition in the loan market increases banking stability.

Second, the results indicate a negative and statistically significant relationship between the size of the banking market *(MSIZE)* and lending risk exposure for model 4. This implies that a

larger banking market provides more opportunities to diversify risk and this effect is explained by Bremus and Buch (2014) as being due to the fact that the more financially developed a country is, the lower is the volatility of a given economic shock (in this case, the positive shock of net capital flow inflows).

Macroeconomic Variables

First, the relationship between real GDP growth *(RGDPG)* and following period lending risk exposure is found to be negative and statistically significant. This implies that an improvement in economic conditions reduces lending risk exposure in the following period. This is similar to the finding by Love and Ariss (2013), that a negative shock to GDP growth feeds into the credit channel through higher loan loss reserves and a worsening of the loan portfolio. Similarly, Ramayandi *et al.* (2014) found that better economic conditions reduce the overall credit risks of banks.

Second, the relationship between changes in the interest rate *(INT)* and following period lending risk exposure is found to be positive and statistically significant. This implies that a rise in interest rates increases lending risk exposure in the following period and this is similar to the finding by Love and Ariss (2013), that the positive relationship supports the moral hazard incentives of borrowers to take on riskier projects to meet the higher interest payments, thereby increasing default risk. Similarly, Ramayandi *et al.* (2014) found that a rise in interest rates increased the likelihood of loans turning non-performing.

Third, the relationship between changes in the inflation rate *(INFL)* and following period lending risk exposure is found to be positive and statistically significant. This implies that rising rates of inflation increase lending risk exposure in the following period and this is consistent with the finding by Brownbridge (1998), that high inflation increases the volatility of business profits because of its unpredictability and because it entails a high degree of variability in the rates of increase of the prices. Similarly, Bohachova (2008) found that high rates of inflation have a negative impact on the earnings of existing borrowers and therefore impair the quality of previously extended loans.

Fourth, the relationship between changes in the net capital flow *(NCF)* and following period lending risk exposure is found to be positive and statistically significant. Though marginal, the relationship may imply that an increase in foreign borrowing may give rise to misallocation of

funds and over-investment in the non-tradeable sectors (real estate and short-term loans) which increases lending risk exposure. This is consistent with the finding by Hansanti *et al.* (2008), that following financial liberalization in Thailand, both FDI and portfolio inflows switched from industry and trade to investment projects in non-tradeable sectors; which led to the creation of an asset price bubble.

Fifth, the results indicate a positive and statistically significant relationship between changes in the exchange rates *(USD & EUR)* and following period lending risk exposure. This implies that depreciation in the exchange rate increases lending risk exposure in the following period and this is similar to the finding by Ramayandi *et al.* (2014), that exchange rate volatility increases bank risk. Similarly, Beck *et al.* (2013) found that exchange rate depreciations lead to an increase of non-performing loans in countries with a high degree of lending in foreign currencies to unhedged borrowers. Specifically, they found that the depreciation of local currencies against the Swiss Franc and the Euro – in Poland, Hungary, and Croatia where lending in these currencies was widespread – negatively affected bank asset quality via negative balance sheet effects.

4.4.3 Analysis of Risk Persistence

The focus of this study was to analyse the impact of the factors affecting banks' borrowing risk exposure and lending risk exposure. From the results presented in the preceding sections, it is evident that lending risk exposure is persistent and therefore requires further analysis. This section uses a PVAR model to analyse how the key variables affect lending risk exposure.

The PVAR model specification considers three significant macroeconomic variables (real GDP growth rate, short-term interest rate, and the USD/KES exchange rate) and three bank-specific variables (lending risk exposure, loan growth rate, and capital adequacy ratio). Variables that enter first in the PVAR model (Equation 3.15) are assumed to be the most exogenous and hence affect subsequent variables both contemporaneously and with a lag, whereas variables that are ordered later are less exogenous and affect previous variables only with a lag.

The original shock is assumed to come from changes in the USD exchange rate which has a contemporaneous impact on real GDP growth rate, short-term interest rate, and all bank-specific variables. While all the other variables impact the USD exchange rate with a lag. For the bank-specific variables, the shock is assumed to come from changes in the lending risk exposure, which affects the loan growth rate and capital adequacy ratio contemporaneously. While the

loan growth rate and capital adequacy ratio affect the lending risk exposure with a lag. Love and Ariss (2013) explain that due to the fact that all macroeconomic variables are entered first into the system, they have an immediate impact on bank-specific variables, while the feedback from bank-specific variables on macroeconomic variables occurs only with a lag. They further explain that this assumption is in line with the intuition that macroeconomic shocks are more likely to be transmitted to individual banks rather than for individual bank problems to be reflected in the macroeconomic aggregates.

Table 4.6: Coefficient Estimates for the PVAR Model

	USD_t	INT_t	$RGDPG_t$	$LOG.LRE_t$	$LOG.LOAN_t$	CAR_t
USD_{t-1}	1.150^{***}	0.020^{***}	0.075^{***}	0.002	0.007^{***}	0.216^{**}
	(0.024)	(0.005)	(0.002)	(0.005)	(0.002)	(0.088)
INT_{t-1}	-1.657^{***}	0.114^{***}	-0.075^{***}	0.037^{**}	-0.020^{***}	-0.248
	(0.027)	(0.007)	(0.003)	(0.015)	(0.006)	(0.170)
$RGDPG_{t-1}$	-1.361^{***}	1.347^{***}	-0.041^{***}	-0.012	-0.013	-1.306^{***}
	(0.073)	(0.016)	(0.006)	(0.030)	(0.011)	(0.453)
$LOG.LRE_{t-1}$	0.320	-0.161^{**}	0.039	0.863^{***}	-0.002	-0.921^{*}
	(0.213)	(0.070)	(0.033)	(0.038)	(0.019)	(0.493)
$LOG.LOAN_{t-1}$	0.598^{***}	0.175^{***}	-0.107^{***}	0.075^{**}	0.990^{***}	0.108
	(0.126)	(0.057)	(0.025)	(0.035)	(0.014)	(0.431)
CAR_{t-1}	0.080^{***}	-0.006	-0.003	-0.005	-0.001	0.768^{***}
	(0.017)	(0.006)	(0.002)	(0.004)	(0.002)	(0.055)

Note: *,**,*** denote significance at 10%, 5% & 1% levels. Standard errors in brackets.

Table 4.6 presents the estimation results and most coefficients are found to be statistically significant. From the PVAR results, the key variables affecting the persistence of lending risk exposure are the previous period's loan growth rate and interest rate. They are both positively related with lending risk exposure and the estimated direct effects are 0.075 and 0.037, respectively. Therefore, this implies that the impact of bank risk taking on lending risk exposure is about double the impact of interest rate risk.

There are various factors that influence excessive risk taking by banks. However, several studies (Johnson, 1994; Godlewski, 2007; Abdellaoui *et al.*, 2013) have found that prospect theory best explains risk taking decisions that increase risk exposure in banking, that is, increased risk taking due to negative or declining returns. Prospect theory, which was developed by Kahneman and Tversky (1979), states that the tendency to over-weigh outcomes that are considered certain relative to outcomes which are probable (the certainty effect) contributes to risk aversion in choices involving sure gains and to risk seeking in choices involving sure losses. Therefore, following Johnson (1994), the risk-return trade-off for banks with above median ROE and below median ROE is depicted in Figure A.5 where banks operating above the median ROE tend to cluster around the same level, while there are a couple of exceptional observations for banks operating below the median ROE (especially small banks) which may indicate excessive risk taking in the

face of negative or declining target returns. This tendency of excessive risk taking is also depicted in Figure A.4, where the few banks with the highest loan growth rate also happen to have an NPL ratio that is above the median.

4.5 Robustness Analysis

To check the robustness of the results presented in the preceding section, other variables are added (cost to income ratio and return on equity) and some variables are dropped (market share and capital adequacy ratio) to test the sensitivity of the critical core variables. White and Lu (2010) define critical core variables as being those whose effects are of primary interest to the research study. They explain that robustness analysis is necessary for valid causal inference by checking whether the coefficients of the critical core variables are insensitive to adding or dropping non-core variables, under appropriate conditions.

Table 4.7: Robustness Check for NIM Model

	(1)	(2)	(3)	(4)	(5)	(6)
L1.NIM	−0.144	−0.141	−0.129	−0.024	−0.093	−0.090
	(0.146)	(0.145)	(0.148)	(0.114)	(0.143)	(0.143)
DIVERSE	−0.131***	−0.130***	−0.137***	−0.121***	−0.137***	−0.137***
	(0.030)	(0.030)	(0.031)	(0.030)	(0.031)	(0.031)
L1.DIVERSE	0.014	0.013	0.025	0.040	0.037	0.038
	(0.026)	(0.026)	(0.025)	(0.026)	(0.025)	(0.025)
CTI	−0.009	−0.009	−0.010	−0.017*	−0.013	−0.013
	(0.008)	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)
L1.CTI	0.000	0.001	−0.003	0.000	−0.005	−0.005
	(0.007)	(0.007)	(0.008)	(0.007)	(0.008)	(0.008)
LTA	−0.156***	−0.158***	−0.145***	−0.146***	−0.138***	−0.137***
	(0.041)	(0.041)	(0.040)	(0.041)	(0.039)	(0.039)
L1.LTA	−0.067	−0.066	−0.071	−0.074*	−0.074	−0.074
	(0.044)	(0.043)	(0.045)	(0.043)	(0.046)	(0.046)
CONC	0.921	0.954	1.093*	−1.030	1.320**	0.979
	(0.658)	(0.621)	(0.621)	(1.381)	(0.637)	(0.639)
MSIZE	0.322	0.338	0.400	−0.128	0.648**	0.386
	(0.314)	(0.290)	(0.290)	(0.426)	(0.311)	(0.296)
RGDPG	0.024					
	(0.132)					
INT		0.008				
		(0.039)				
INFL			−0.051*			
			(0.026)			
NCF				−0.013*		
				(0.007)		
USD					−0.148**	
					(0.068)	
EUR						−0.056**
						(0.026)
Num. obs.	192	192	192	192	192	192
Num. obs. used	128	128	128	128	128	128
Sargan Test: p-value	0.928	0.927	0.934	0.915	0.935	0.935
AR (1) Test: p-value	0.003	0.003	0.004	0.004	0.004	0.004
AR (2) Test: p-value	0.268	0.288	0.194	0.241	0.178	0.178
Wald Test: p-value	0.000	0.000	0.000	0.000	0.000	0.000

Note: *,**,*** denote significance at 10%, 5% & 1% levels. Standard errors in brackets.

The results in Table 4.7 are generally consistent with the findings in Table 4.4 since the sign and magnitude of the critical core variables remain fairly stable. Therefore, the estimated regression

coefficients can be reliably interpreted as the true causal effects of the associated explanatory variables. In addition, the relationship between NIM and net capital flows becomes statistically significant.

The results also indicate a negative and statistically significant relationship between the cost to total income ratio *(CTI)* and net interest margin for model 4. This implies that a reduction in the cost to total income ratio will increase the net interest margin, an effect that was found by Boyd *et al.* (2009) as being due to the fact that more efficient banks are able to gain larger market shares due to their ability to set prices lower than their competitors. In addition, Berger (2003) found that technological progress may deliver some traditional banking services with fewer distance-related dis-economies. For instance, credit scoring technology that is provided at greater distances with little or no additional cost was found to yield benefits by increasing lending at higher interest rates to "marginal applicants" that might not otherwise receive bank credit; such is the case with the local M-Shwari product by CBA.

Table 4.8: Robustness Check for LRE Model

	(1)	(2)	(3)	(4)	(5)	(6)
L1.LOG.LRE	0.478**	0.475**	0.559***	0.527**	0.526**	0.560***
	(0.206)	(0.207)	(0.204)	(0.221)	(0.221)	(0.212)
LOG.LOAN	0.793**	0.788**	0.878**	0.772**	0.771**	0.842**
	(0.322)	(0.319)	(0.369)	(0.343)	(0.342)	(0.362)
L1.LOG.LOAN	−0.103	−0.100	−0.110	0.003	0.004	−0.053
	(0.316)	(0.315)	(0.337)	(0.316)	(0.316)	(0.329)
ROE	−0.007*	−0.007*	−0.007	−0.008*	−0.008*	−0.008
	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)
L1.ROE	−0.003	−0.003	−0.004**	−0.006***	−0.006***	−0.005***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
L1.CONC	0.011	0.046	0.008	0.086*	0.139*	0.088**
	(0.033)	(0.033)	(0.033)	(0.046)	(0.077)	(0.041)
L1.MSIZE	0.014	−0.012	−0.023	−0.038	−0.002	0.002
	(0.018)	(0.016)	(0.018)	(0.034)	(0.018)	(0.018)
L1.RGDPG	−0.102***					
	(0.032)					
L1.INT		0.038***				
		(0.012)				
L1.INFL			0.026***			
			(0.010)			
L1.NCF				0.002		
				(0.002)		
L1.USD					0.032	
					(0.023)	
L1.EUR						0.015**
						(0.007)
Num. obs.	192	192	192	192	192	192
Num. obs. used	128	128	128	128	128	128
Sargan Test: p-value	0.999	0.999	0.999	0.999	0.999	0.999
AR (1) Test: p-value	0.100	0.102	0.068	0.097	0.097	0.082
AR (2) Test: p-value	0.686	0.677	0.834	0.566	0.566	0.648
Wald Test: p-value	0.000	0.000	0.000	0.000	0.000	0.000

Note: *,**,*** denote significance at 10%, 5% & 1% levels. Standard errors in brackets.

The results in Table 4.8 are generally consistent with the findings in Table 4.5 since the sign and magnitude of the critical core variables remain fairly stable. Therefore, the estimated regression coefficients can be reliably interpreted as the true causal effects of the associated explanatory

variables. However, the relationships between LRE and both net capital flows and USD exchange rate cease to be statistically significant.

The results also indicate a negative and statistically significant relationship between the return on equity *(ROE)* and lending risk exposure. This implies that as the return on equity increases the lending risk exposure reduces, an effect that was found by Love and Ariss (2013) as being due to the fact that rising ROE increases the charter value of banks and this improves the incentive to monitor the performance of the credit portfolio and reduce risk-taking.

The robustness checks confirm that the coefficients estimated in the preceding section were for effects of interest and not optimal linear prediction coefficients. Therefore, since the coefficients are plausible and robust, this can be interpreted as evidence of structural validity.

Chapter 5

Conclusions

5.1 Summary

This paper investigates the factors influencing the risk exposure of commercial banks in Kenya. It is argued that competition resulting from financial liberalization and the impact of macroeconomic shocks may increase bank risk taking incentives and risk exposure. Specifically, it is hypothesized that financial liberalization increases banking fragility by reducing franchise value which induces risk taking and that positive and negative macroeconomic shocks increase banking risk exposure. Annual bank financial performance panel data for the period 2008 to 2013 is used to analyse the impact of market structure and macroeconomic variables on borrowing and lending risk exposure using GMM estimation. The results indicate that there is some support for both hypotheses.

Borrowing risk exposure was found not to be persistent, being mainly affected by the degree of concentration and external economic shocks. Specifically, the coefficient of the lagged dependent variable was found to be statistically indistinguishable from zero; the degree of concentration was found to have a positive and statistically significant impact on the net interest margin (implying that bank competition in the deposit market reduces the franchise value), while the exchange rates were found to have a negative and statistically significant impact. Interestingly, the results also suggest that changes in the short-term interest rate do not affect the net interest margin, which may imply that bank deposit and lending rates are rigid and that the interest rate channel is ineffective.

Lending risk exposure was found to be persistent, being mainly affected by the degree of con-

centration, internal economic shocks and external economic shocks. Specifically, the coefficient of the lagged dependent variable was found to be statistically significant; the degree of concentration was found to have a positive and statistically significant impact on the lending risk exposure (implying that bank competition in the loan market increases banking stability as per the concentration-fragility view), the real GDP growth rate was found to have a negative and statistically significant impact and the other macroeconomic variables were all found to have a positive and statistically significant impact. Further analysis of the factors contributing to the persistence of lending risk exposure using a PVAR model found that the banks' loan growth rate and the interest rate were the key determinants; though the impact of the loan growth rate was about double the impact of interest rate risk implying that bank risk taking is the key determinant of lending risk exposure.

5.2 Policy Implications

These results have an important implication as far as bank regulation is concerned. Specifically, the persistence of lending risk exposure can be reduced by improving the capacity of the regulator to monitor overall bank risk taking. This recommendation is based on the findings by Taylor (1998), that lax and pro-cyclical regulation of the private sector (both domestic and foreign) was the common element in the Southern Cone, Mexican, East Asian, and Russian financial crises. Wide financial spreads between returns to domestic assets (due to high interest rate bonds, capital gains from a booming real estate sector or capital gains from a booming stock market) and borrowing rates abroad generated capital inflows (since the fixed nominal exchange rate reduced foreign currency risk) which pushed the domestic financial system in the direction of being long on domestic assets and short on foreign currency holdings (Table 1.2 depicts a similar declining trend in local commercial banks' net foreign assets). Consequently, after a few years of this process the overall balance sheet of their financial system became risky – since potential losses from the long position were finite while potential losses from short-selling foreign currency were in principle unbounded.

The USD exchange rate has a negative relationship with and the biggest effect on the net interest margin (see Table 4.4). Therefore, the biggest threat to borrowing risk exposure is USD exchange rate depreciation. According to Moore and Pentecost (2006), one possible mitigating measure involves distinguishing between permanent and transitory shocks on the exchange rate so as

to avoid the potentially damaging attempt to stabilise exchange rate changes that are due to structural changes in the economy; since it can result in an overvalued currency that can lead to a speculative attack. While according to Agenor and da Silva (2013), another possible mitigating measure involves adopting an integrated inflation targeting framework that combines monetary policy with macro-prudential policies, whereby the policy interest rate is also set to respond directly to a pre-defined measure of the private sector credit growth gap, to jointly achieve macroeconomic and financial stability – since credit booms are well-documented leading indicators of financial crises. In addition, in an environment with a high degree of uncertainty about real time estimates of the output gap, the credit growth gap may produce a more reliable and timely measure of excess demand.

The real GDP growth rate has a negative relationship with and the biggest effect on lending risk exposure (see Table 4.5). Therefore, the biggest threat to lending risk exposure is a negative shock in any of the key economic sectors. It is thus prudent for policy makers to continue monitoring the potential for such developments and ensure that the existing institutional structure can dampen such fluctuations or that timely mitigating measures can be implemented to reduce the persistence of the ensuing gap between actual and potential output. In addition, Bak *et al.* (1993) explain that fluctuations in aggregate economic activity can also result from many small independent shocks to individual sectors of the economy - for instance, the recent negative shocks to the tourism, horticulture export, and miraa export sectors. The effects of the small independent shocks can fail to cancel out in the aggregate due to the presence of non-linear local interactions between productive units (each unit's production decision depends only upon the actions of a small number of other units that deal directly with it) and non-convex production costs (non-linearity in producers' responses to demand variations, due for example to indivisibilities). Consequently, the law of large numbers (that is expected to cancel out the effects of local variations on the aggregate economy) may not apply due to the absence of the kind of linear aggregation of shocks required for the law to apply.

The short term interest rate and the USD exchange rate are the other major variables that have a significant effect on lending risk exposure. Therefore, interest rate and exchange rate fluctuations pose significant threats to lending risk exposure. It is thus prudent for policy makers to continue monitoring the potential of the recent capital inflow surge to limit the ability of the CBK to maintain macroeconomic stability due to the impossible trinity. In addition, the government should implement some of the recommendations in the Kenya National Assembly (2012) report

that identified the enhancement of strategic food and oil reserves as having the potential to reduce erratic fluctuations in the USD exchange rate and domestic interest rate. Further, food and oil price shocks in Kenya were later identified by Misati *et al.* (2013) as being the key drivers of inflation and causes of immediate exchange rate depreciations.

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Appendix A

Bank Sample Data

Table A.1: List of Sample Banks

Code	Bank	Code	Bank
01	Kenya Commercial Bank	30	Chase Bank
02	Standard Chartered Bank	31	CfC Stanbic Bank
03	Barclays Bank of Kenya	35	ABC Bank
05	Bank of India	39	Imperial Bank
06	Bank of Baroda	41	NIC Bank
07	Commercial Bank of Africa	42	Giro Commercial Bank
08	Habib Bank	43	Ecobank
10	Prime Bank	49	Equatorial Commercial Bank
11	Co-operative Bank of Kenya	53	Guaranty Trust Bank
12	National Bank of Kenya	55	Guardian Bank
16	Citibank NA	57	I&M Bank
17	Habib Bank AG Zurich	59	Development Bank of Kenya
19	Bank of Africa	60	Fidelity Commercial Bank
20	Dubai Bank	63	Diamond Trust Bank
23	Consolidated Bank	66	K-Rep Bank
25	Credit Bank	68	Equity Bank

Table A.2: Sample Description

	All Banks	Sample Banks	Proportion
No. of Banks	43	32	74%
Total Assets in Bn	2,657	2,531	95%
Profit After Tax in Bn	88	86	97%

Note: As at 31 December 2013

Table A.3: Bank Descriptive Statistics

	All	**Large**	**Medium**	**Small**
Total Assets in Mn	55,188	169,665	48,943	9,108
	(65,878)	(60,184)	(27,670)	(4,283)
Loans/Total Assets	52.61%	55.58%	50.47%	53.34%
	(11.24)	(6.78)	(11.81)	(11.99)
NPL/Loans	7.62%	4.78%	4.33%	12.12%
	(8.68)	(2.91)	(4.81)	(11.10)
Equity/Total Assets	14.63%	15.27%	14.11%	14.84%
	(4.78)	(4.23)	(3.70)	(5.84)
Return on Equity	14.92%	23.08%	17.08%	9.10%
	(13.18)	(5.36)	(13.12)	(13.23)
Return on Assets	2.21%	3.58%	2.48%	1.33%
	(1.74)	(1.28)	(1.69)	(1.48)
Net Interest Income/Total Income	65.88%	61.36%	66.50%	67.33%
	(12.61)	(6.47)	(13.53)	(13.43)
Non-Interest Revenue/Total Income	34.15%	38.64%	33.50%	32.73%
	(12.41)	(6.47)	(13.53)	(12.97)
Operating Expenses/Total Income	65.55%	59.26%	58.20%	75.57%
	(31.23)	(8.94)	(38.43)	(27.22)
Capital Adequacy Ratio	22.85%	21.45%	22.03%	24.28%
	(9.36)	(5.95)	(9.06)	(10.71)

Note: Means and Standard Deviations (in brackets) for the period 2008–13.

Table A.4: Return on Assets

	All	**Large**	**Medium**	**Small**
Net Interest Income/Total Assets	5.90%	7.27%	5.27%	5.88%
	(2.19)	(1.87)	(1.73)	(2.44)
Non-Interest Revenue/Total Assets	3.17%	4.52%	2.66%	3.04%
	(1.72)	(1.14)	(1.22)	(2.02)
Operating Expenses/Total Assets	5.16%	6.27%	3.95%	5.83%
	(2.76)	(1.38)	(1.85)	(3.45)
NPL Provision/Total Assets	0.79%	0.63%	0.44%	1.19%
	(1.15)	(0.33)	(0.66)	(1.57)

Note: Means and Standard Deviations (in brackets) for the period 2008–13.

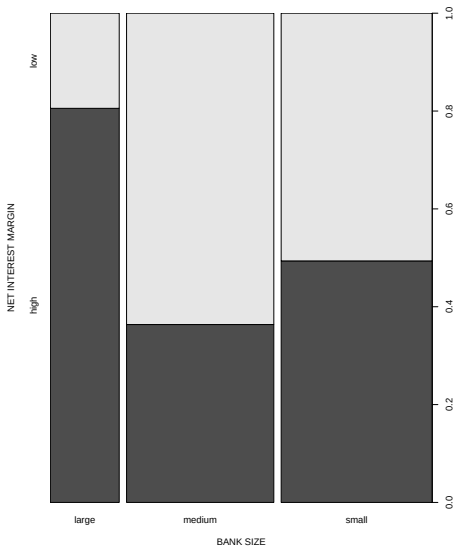

Figure A.1: Bank Size and NIM

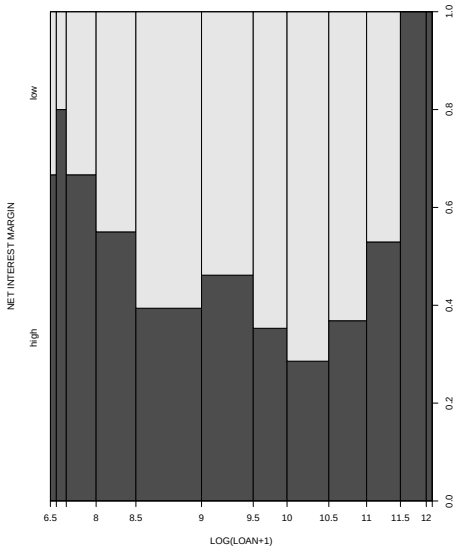

Figure A.2: NIM depending on log-loan

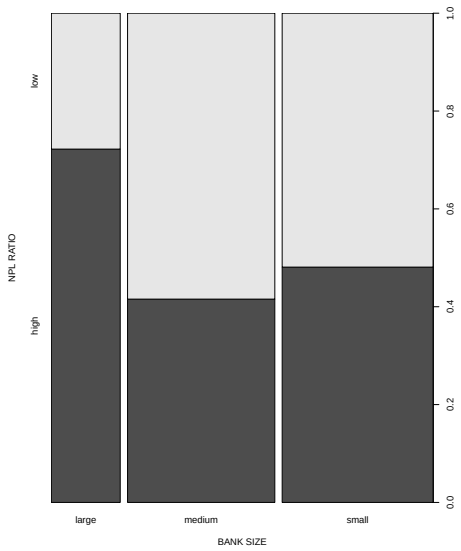

Figure A.3: Bank Size and NPL Ratio

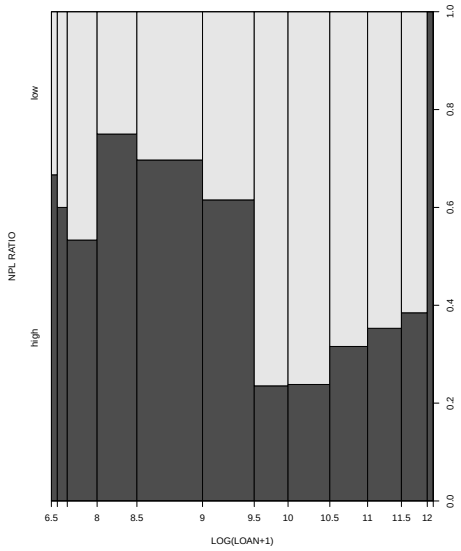

Figure A.4: NPL Ratio depending on log-loan

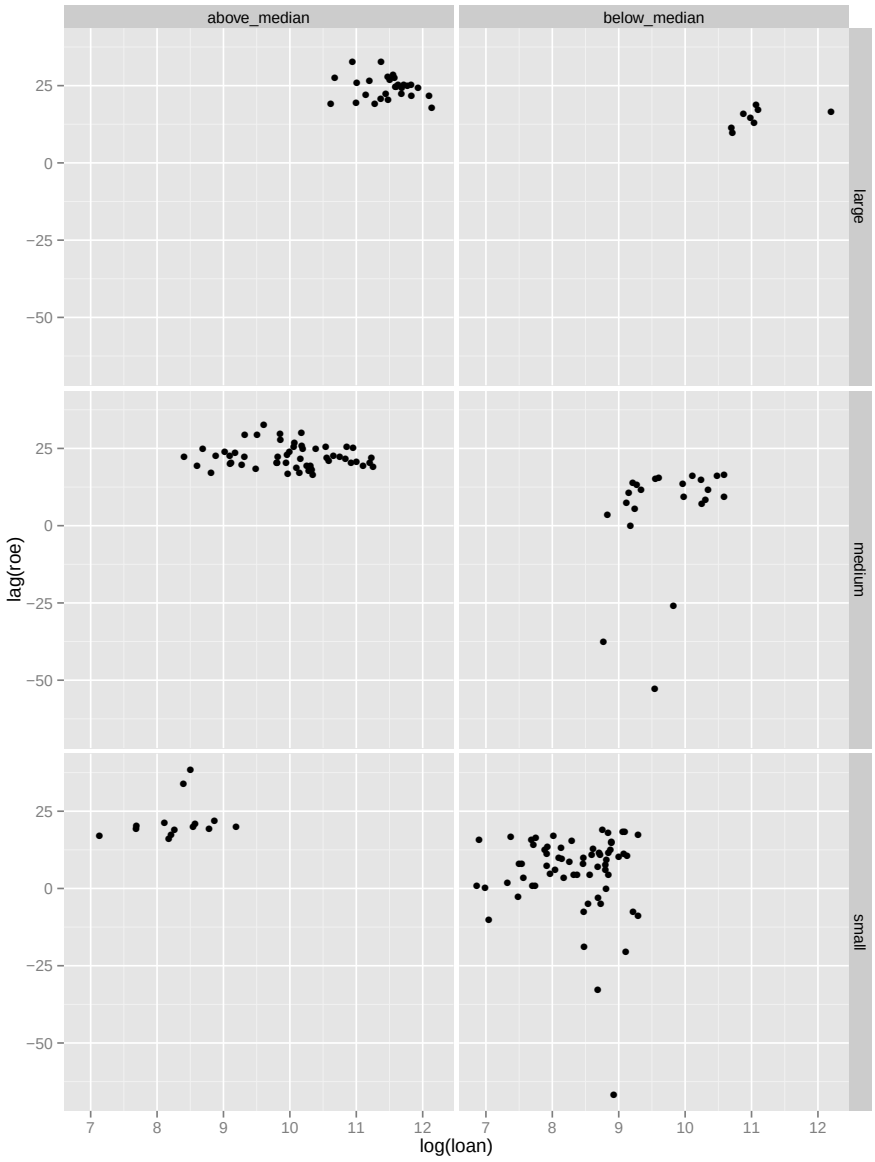

Figure A.5: Distance from median ROE

Appendix B

Other Research Data

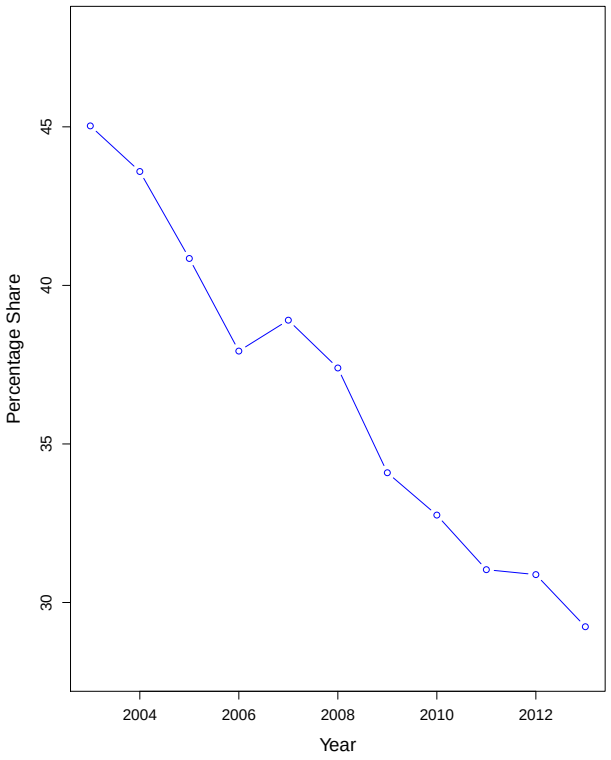

Figure B.1: Degree of Concentration

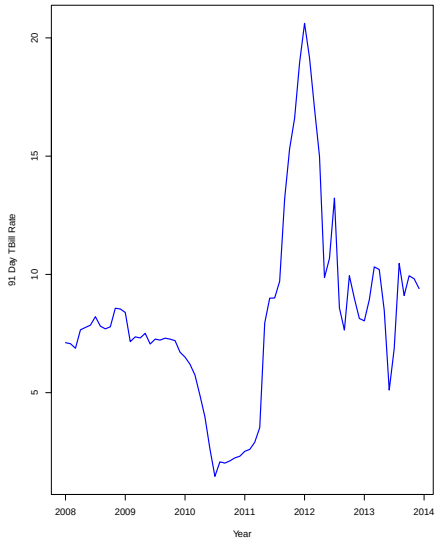

Figure B.2: Short Term Monthly Interest Rate

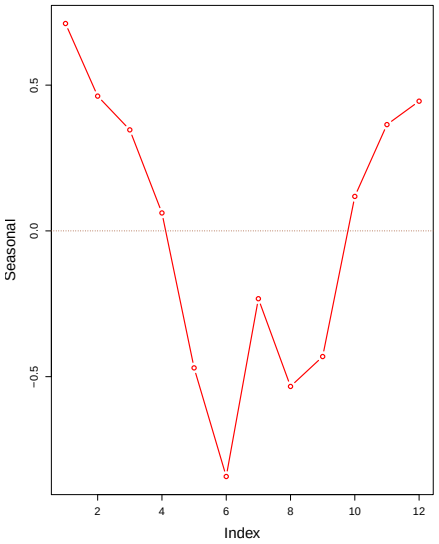

Figure B.3: Seasonal Effects for Interest Rate Data

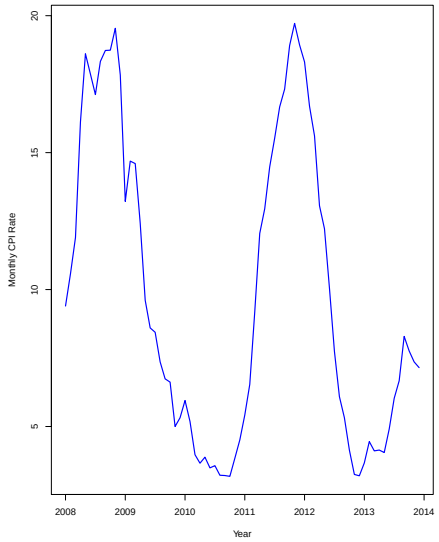

Figure B.4: Monthly Inflation Rate

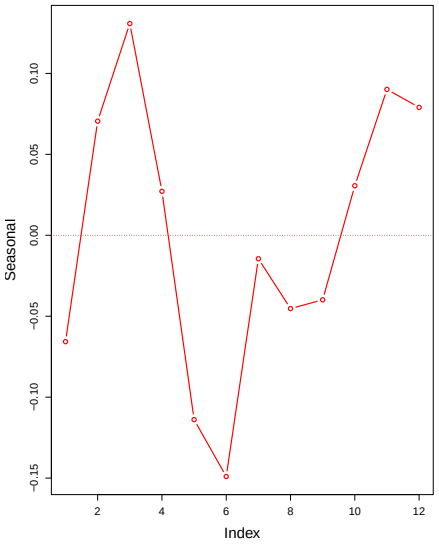

Figure B.5: Seasonal Effects for Inflation Rate Data

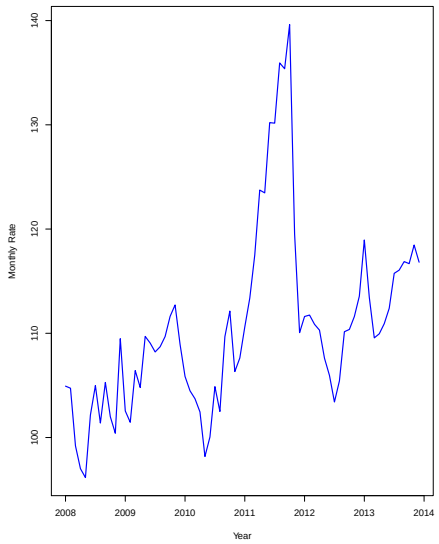

Figure B.6: EUR/KES Monthly Exchange Rate

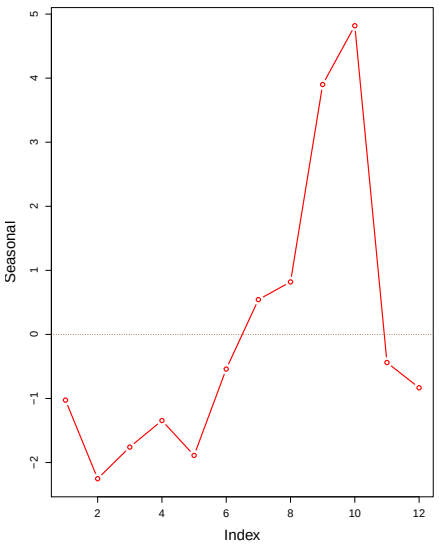

Figure B.7: Seasonal Effects for EUR/KES Data

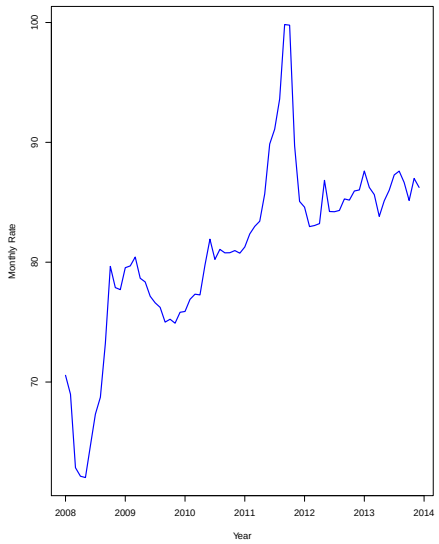

Figure B.8: USD/KES Monthly Exchange Rate

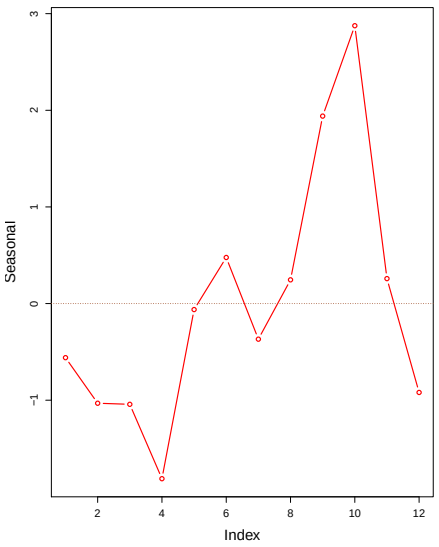

Figure B.9: Seasonal Effects for USD/KES Data

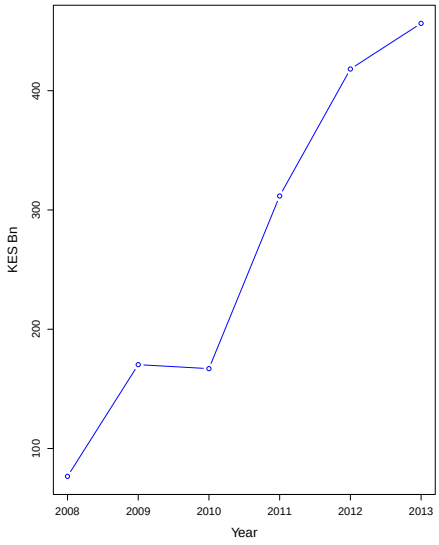

Figure B.10: Net Capital Flows

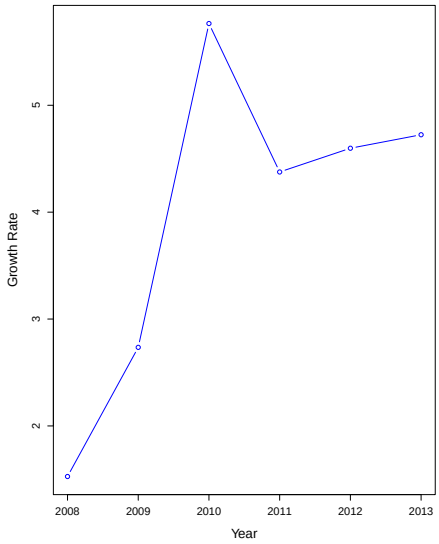

Figure B.11: Real GDP Growth Rate