LOAN RATIOS, INFORMATION ASYMMETRY AND FRAGILITY AMONG COMMERCIAL BANKS IN KENYA

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DECLARATION

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To my late parents Christina Ajiambo Mumbuya and Justino Ombuoro Nabatwa who inculcated in me a sense of hard work and honesty.

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ABSTRACT

Bank distress occurs when an institution is closed, receives open assistance or undergoes distressed merger while bank fragility manifests among others when a large proportion of a bank's total loans is impaired. This study examined loan ratios and their effect on bank fragility as an early warning system to pre-empt bank distress. The study incorporated information asymmetry as a mediator. Though literature suggest information asymmetry plays a part in bank distress, studies incorporating information asymmetry in bank distress are scarce. Kenya's cyclic banking distress has been a major problem; with latest distress event between 2015-2016 in which three commercial banks failed. The general objective of the study was to investigate loan ratios and their relationship with information asymmetry and the link with fragility among commercial banks in Kenya. The specific objectives were to establish the effect of loan growth ratio, loan to deposit ratio, loan quality ratio, insider loans ratio and the mediating role of information asymmetry on fragility among commercial banks in Kenya. The study was anchored on three theories; credit creation theory, which holds that banks transform deposit liabilities into illiquid loans without reducing its other customers' deposits. The new loans enter the economic system as additional deposits enabling banks to lend more. Agency cost theory asserts that bank managers are driven by desire to generate profits and may lend without estimating risks appropriately. Adverse selection theory contends that banks engage in granting credit to high-risk borrowers who are willing to pay high interest rates. High-risk managerial action is possible due to information imbalance with other counterparties. The study period was 2005 to 2015 before imposition of interest rate controls in 2016. The study followed positivism approach with an explanatory research design. The target population was all the forty-two commercial banks in Kenya. Secondary data was collected from Central Bank of Kenya repository of commercial banks annual financial statements. Data was analysed using descriptive and inferential statistics. The research hypotheses were tested using generalised linear model. The results indicated lagged dependent variable had $\beta = +0.87$, $p < 0.05$ a positive statistically significant influence, loan growth ratio $\beta = -0.08$, $p < 0.05$ had a negative statistically significant influence on bank fragility, while loan deposit ratio $\beta = +0.13$, $p<0.05$ had a positive statistically significant influence. The loan quality variable had $\beta = -0.06$, $p>0.0$ while insider loans ratio had $\beta=+0.16$, $p>0.05$ showing negative and positive statistically insignificant influence. The mediating variable had $\beta=-0.37$, $p>0.05$ showing negative insignificant relationship with bank fragility. The Sobel test results had z-score between -1.96 to +1.96 which showed statistically insignificant influence therefore, information asymmetry did not mediate the effect of loan ratios on bank fragility. The study concluded that loan ratios are significant in predicting bank fragility. The study contributes information on early warning systems in bank fragility. The study recommends that regulators, policy formulators and bank managers periodically review loan ratios for signals of fragility. Further research should be conducted on other proxy measures of information asymmetry in bank fragility studies.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

DEFINITION OF TERMS

Adverse Selection: Casu, Girardone, and Molyneux (2006), a market situation where bad results occur due to information imbalance between buyers and sellers.

Bank Distress: A bank is considered distressed if it is closed or if it receives open bank assistance, Altman, Cizel, and Rijken (2014).

Bank fragility: The banking sector is considered fragile when the ratio of non-performing loans to total loans exceeds 10%, Cihak & Schaeck (2010). Demirguc-Kunt and Detragiache (1998) consider the banking industry fragile if the ratio of non-performing loans to total assets is above 10%.

Banking Systemic crisis: occurs when the level of non-performing loans as a proportion of total assets is between 5%-10%, Daumont, Gall, and Leroux (2004).

Information Asymmetry: Claus and Grimes (2003), it exists where one counterparty to an economic transaction has more information than the other.

Insider Loans: credit facilities granted to directors, significant shareholders and their associates, and facilities to employees, CBK Prudential Guidelines 2013.

Loan growth ratio: the percentage growth of loan portfolio from one period (t_0) to the next period (t_1), Rauch (2010)

Loan quality: the ratio of net interest income to total income, Logan (2001).

Loan deposit ratio: End (2016), the ratio of net loans to customer deposits.

Loan ratios: commercial bank specific loan related ratios.

Non-performing Loan: Lu *and* Whidbee (2016), Dungey and Gajurel (2015), credit facilities on which interest and principal repayments are outstanding for 90 days or more.

ABBREVIATIONS AND ACRONYMS

B.I.S.	Bank for international Settlement
BSD	Bank Supervision Department
C.A.M.E.L.S.	Capital adequacy, Assets, Management, Earnings, Liquidity, Sensitivity
CBK	Central Bank of Kenya
FDIC	Federal Deposit Insurance Corporation
GOK	Government of Kenya
KDIC	Kenya Deposit Insurance Corporation
KES	Kenya Shillings
SMES	Small and Medium Enterprises
USM	Under Statutory Management

CHAPTER ONE

INTRODUCTION

1.0 Overview

This chapter provides the background to the problem of bank distress in Kenya, its historical perspective and distress in other countries and the consequences. The chapter is organised as follows: section 1.1 and 1.2 highlight the background to the study and statement of the problem respectively, section 1.3 underlines the general objectives while section 1.4 underscores the research hypotheses. Section 1.5 and 1.6 highlight the significance and scope of the study respectively.

1.1 Background of the Study

The study focused on loan ratios and information asymmetry and their effect on bank fragility in order to avoid occurrence of bank distress. Bank fragility emerges from the institution's liability or asset side of its balance sheet. Shen and Chen (2008) posit weaknesses from the liability side may come about due to depositors run on a commercial bank. The asset side triggers concerns are due to deterioration of the quality of the loan asset. Creel, Hubert and Labondance (2021) in assessing relationship between credit and bank fragility find credit has predictive power. Cihak and Schaeck (2010) argue that declining asset quality due to increase in non-performing loans as a ratio of total loans is indicative of banking turmoil at 10% level. Laeven (2011) shows that large losses on bank's balance sheets render the bank insolvent. Losses normally emanate from long periods of asset quality deterioration due in part to excessive credit expansion. The first step in credit expansion is credit assessment which should be carefully undertaken as it impacts loan performance.

Bank crises, bank fragility and bank distress have been defined differently by various researchers. Daumont, Gall, and Leroux (2004) assert that a systemic banking crisis occurs when non-performing loans to total assets is between 5% - 10%. Demirguc-Kunt and Detragiache (1998) show among episodes that signify bank fragility as; ratio of non-performing loans to total assets greater than 10%, the cost of rescue operation at least 2% of gross domestic product, banking sector problems resulted in large scale nationalization of banks and finally, extensive bank runs took place as emergency measures such as deposit freezes, prolonged bank holidays or generalized deposit guarantees were enacted by the government in response to the crisis. Demirguc-Kunt et al., (1998) argue that such crises could be related to adverse macroeconomic shocks due to bank managers choosing riskier loan portfolios.

Papanikolau (2018) states that a bank is considered distressed if it either receives assistance so it can continue operating or abandon rescue efforts and let it go bankrupt. Further an institution is distressed if it has received capital injection, filed for bankruptcy, has been acquired by another institution or has merged with another institution. Altman, Cizel, and Rijken (2014), Maghyereh and Awartani (2014) find the following as bank distress events, bank liquidation, bankruptcies, regulatory receivership, distressed mergers, distressed dissolutions and open bank assistance. Bank distress according to Altman *et al*., (2014) manifests in two ways, bank closures where the institution ceases to exist. Besides, it could be bank open assistance where the institution receives government bailout and measures to improve long-term viability.

Richardson (2007) considers an institution to be distressed if it is in terminal suspension, which means never to be reopened. Richardson further argues that a bank

is distressed if it is in temporary suspension that is the institution is reopened later or is consolidated with another due to financial difficulties and finally goes through voluntary liquidation. The sequence of bank instability can be summarized as follows; systemic banking crisis followed by bank fragility and finally bank distress.

According to Laeven and Valencia (2012) banking crises are a worldwide phenomenon and occur in waves. Brownbridge (1998b), shows the impact of bank distress in some African countries and states that for period 1993/94 about 11 per cent of total assets of banks and Non-Bank Financial Institutions (NBFIs) was held by collapsed institutions in Kenya, while in Nigeria and Uganda the failed institutions accounted for 8 per cent and 6 per cent of all banks assets respectively. Resolution of bank problems can therefore be costly. According to Granja, Matvos, and Seru (2017), the mean FDIC loss from selling a distressed bank was 28% of assets over the period 2007 to 2013, such losses left the deposit funds reserves virtually depleted. Cleary and Hebb (2016) state that the FDIC fund fell in the red during 2009 a confirmation of the severity of bank distress. Bank distress is a problem to deposit insurance corporations.

Information asymmetry in the banking sector plays a role in bank fragility. Chang, Huang and Yu (2009) in a study of banks in Taiwan indicate that both in theory development and practical discovery, information asymmetry has been identified in commercial bank's lending behaviour. According to Murinde (2012) banks accumulate valuable information on borrowers through their debtor-creditor relationship and through credit information sharing.

Shehzad, Haan and Scholtens (2010) have argued that bank owners and managers may collude against depositors and may grant loans considered high risk that may lead to high levels of impaired loans imperilling the banks health. The choice of riskier loan

portfolios is evidence of adverse selection. Therefore, collapse in asset quality require explanation of irrational behaviour and information asymmetry since the bubbles in respect of the asset price may be devoid of any economic fundamentals.

Caprio and Klingebiel (1997) state that banks can disguise troubled loan credits by rolling them over or embark on deposits expansion to help improve balance sheets outlook. With improved deposits banks invest in high-risk high return areas. Zhang, Cai, Dickinson and Kutan (2016) argue that managers have self-motivation to take on highly risky lending than the desired level because of managerial rent seeking. Banks will then shift this risk to depositors. Such action is difficult to discern by external stakeholders, helping institutions to hide balance sheet weaknesses.

Huang, Chang and Liu (2012) aver that careless action by management causes collapse, which adversely impacts investors, depositors, employees, and interferes with economic dictates. According to Diamond and Dybvig (1983), bank distress cause disruption of the monetary system and leads to reduction in production. Demirguc-Kunt *and* Detragiache (2005) show the tequila crisis caused systemic risk that put bank health at the centre as a key macroeconomic stability component, as this crisis led to financial meltdown in Mexico. Therefore, the real impact of contagious bank problems is that they lead to failure of otherwise healthy banks precipitating cancellation of loan credits and ultimately to stoppage of productive investment. Laeven (2011) confirms the potential debilitating effect of bank instability on the economy due to their role in allocation of funds.

Loan ratios have a role in bank stability. Bashir, Yu, Hussain, Wang and Ali (2017) measured nonperforming loans using ratio of impaired loans to gross loans and contend that a reduction in the variable is a sound way to maintain financial stability

of the banking system. Besides, Bashir et al., (2017) affirm that loan growth has significant effect on financial fragility due to rapid lending. Bashir et al., (2017) also find size has significant impact on fragility and associated this with the too big to fail where large banks had a tendency of high NPL to total loans. The Federal Reserve Bank (FRB) of Kansas City (2016) avers that loans constitute the majority of commercial bank assets, therefore interest earned on this asset class form an important source of revenue stream. In such a case a relatively small problem with the loan portfolio can reduce earnings, deplete capital and precipitate bank distress. Loan quality therefore is significant in bank health.

Thomson (1991) assert that insider loans act as a proxy for management risk that is the risk of fraud and or insider abuse. Insider loans can be treated as self-lending and this is to mainly take advantage of asset price booms. Besides, insider loans may be granted at discretionary rates. Laeven (2011) finds an association between large loan losses and credit facilities granted to bank's related parties on preferential terms. Cecchetti, King and Yetman (2011) show that during the financial crisis of 2007/8 economies where banks had relatively low LDR managed the crisis relatively well compared to those with high LDR.

Due to bank crisis some businesses suffer drains of working capital and investment. Therefore, there is need to distinguish banks according to their financial health and intervene early to avoid economy-wide impact. Thomson (1991) states that the ability to differentiate sound banks from troubled banks is one way of ensuring reduction in expected cost of bank distress.

The Banking industry is considered opaque. Information disclosures tend to arise only in extreme circumstances. James (1991) finds that significant costs in bank instability

result from information asymmetry between the commercial banks' and other market participants. Consequently, bank depositors, borrowers and regulators tend to have inadequate knowledge of the bank. Asymmetric information is therefore a central feature in banks. According to Bleck (2018) when bank management engage in risk-taking, they take on informational advantage over the regulator about the originated activity. It is therefore difficult to tell banks that have taken on overly risky business against those taking low risk business. Consequently, Thomson (1991) affirms the need to have ability to differentiate sound from troubled banks. Andries and Ursu (2016) argue that soundness in the banking sector be centred on good management practices and deliberate effort to reduce information asymmetry among bank stakeholders.

1.1.1. Kenya's Commercial Banking Industry

Kenya has witnessed periodic bank distress with consequences on bank stakeholders and the economy. The first wave of bank distress took place between 1984 and 1989 in which Central Bank of Kenya (CBK) closed eleven institutions as shown in appendix 1 and marked as number (1)-(11). Brownbridge (1996) states that the first cycle of bank distress in Kenya was the period 1984-86, during which time CBK liquidated banks after they failed to repay deposits obtained from state owned enterprises. According to Brownbridge (1996) most of these liquidated institutions were owned by local private sector businesspeople that had ventured into banking business. Daumont, Gall and Leroux (2004) find four (4) banks and twenty-four (24) non-bank financial institutions accounting for 15% of Kenya's financial systems liabilities were affected by liquidity or solvency problems between 1985-1989.

The next wave of bank distress took place between 1993 and 1997 as indicated in appendix 1 where twenty (20) banks failed, listed as number (12) – (31). According to Daumont et al., (2004), between 1993-1995 there were solvency problems accounting for 30% of Kenya's financial system assets. In 1993, 66% of the loans of one-third of the banks were impaired. The third and fourth episodes of bank distress occurred in the period 2000 to 2006 shown as number (32) – (39) and 2015 -2016 being number (40) - (42) as per appendix 1. In aggregate over a period of thirty-two years that is 1984-2016 a total of forty-two (42) institutions have failed. KDIC annual report 2015 shows it is still managing institutions placed under liquidation in 1993. More than two decades later KDIC is still bedevilled by consequences of bank distresses of the 1990s!

According to Central Bank of Kenya Bank Supervision Annual Report 2015, the industry had forty-two (42) commercial banks, but which reduced to forty (40) following the distress of Dubai Bank Ltd and imperial Bank Ltd in 2015. The number reduced further to thirty-nine (39) following distress in 2016 of Chase Bank Ltd with its problems attributed to her annual financial statements of 2015. These forty-two banks were classified according to market share as follows; large banks were seven (7), medium banks were twelve (11) and twenty-one (21) small banks. Chase Bank Ltd was included in this research due to problems related to its financial statements disclosures in 2015 which led to its collapse. Two of the failed banks Imperial bank Ltd and Chase bank Ltd were medium size while Dubai bank Ltd was classified as small.

Due to bank distresses the Deposit Protection Fund (DPF) was established in 1985 under section 36 of the Banking Act, Laws of Kenya, to manage bank distress. Since

formation of DPF a department at CBK, all Commercial banks operating in Kenya and duly licensed by Central Bank of Kenya contributed a deposit premium. A form of insurance to pool resources to refund insured customer deposits to a maximum of Kenya shillings one hundred thousand only as at the period of study. This amount was revised to Kenya shillings five hundred thousand with effect from July 2020. As highlighted above the formation of DPF did not eliminate bank distress. In 2012 Kenya Deposit Insurance Corporation (KDIC) was incorporated following enactment of Kenya Deposit Insurance Act of 2012, with principal responsibility of managing receiverships and liquidations of troubled banks.

US bank regulatory authorities introduced Capital adequacy, Assets, Management, Earnings, Liquidity and Sensitivity (CAMELS) indicators in 1979 to monitor bank health (Roman & Sargu (2013). However, bank problems in the US are still rampant. This study deviated from use of all CAMELS indicators to test for bank fragility. The deviation follows other researchers like Rauch (2010) and Shen and Chen (2014) who indicate liquidity indicators are good early warning tools. DeYoung and Torna (2013) examined non-traditional banking activities as a departure from CAMELS. Whereas a number of studies have isolated information asymmetry and liability side of banks' balance sheet as a contributor to bank fragility, there is scarce research that have tested the assertion with respect to the asset side. Consequently, the gap in research was to model Information asymmetry and its measures and loan ratios and their effect on fragility among commercial banks in Kenya.

The aim of this study was to establish the effect of loan ratios, information asymmetry on fragility among commercial banks in Kenya. The ability to detect bank fragility early stems slide to bank distress. Since early bank distress studies by Meyer & Pifer

(1970), Sinkey (1975), Thomson (1991) and introduction of CAMELS ratings in 1979 banks have continued to fail.

This study is distinct from Sporta (2018) who dwelt on financial distress factors and impact on performance of Commercial banks in Kenya. It is also distinguishable from Muriithi (2016) who examined financial risk and the effect on financial performance of commercial banks in Kenya. Though these two researchers utilised some asset quality indicators, they measured impact on financial performance and credit risk of banks. Waweru and Kalani (2009) investigated the causes of non-performing loans and the mitigating factors taken by the institutions to combat the problem, a perception study of thirty (30) managers selected from the ten largest banks. Sporta (2018), Muriithi (2016) and Waweru et al., (2009) enumerated causes of bank failure, however their studies neither incorporated information asymmetry nor specified loan deposit, loan growth nor loan quality ratio variables in bank fragility. It is also distinct from Brownbridge (1998) who explored the genesis of impaired loans in local banks in Kenya, Uganda, Zambia and Nigeria from 1985-1994. The study highlighted insider lending, over concentration of ownership, political pressure and undercapitalization as causes of non-performing loans.

Andries et al., (2016), Bleck (2018) and James (1991) argue that costs of bank instability are due to information asymmetry and that reduction in information asymmetry is an appropriate way to manage bank fragility and distress. Bashir et al., (2017) assert that market agents require transparency by banks in revealing information to enable them assess bank stability. Bhattacharya, Ecker, Olsson, and Schipper (2012) argue that in situations where market friction is high, information asymmetry is relatively more important as a mediating variable. To the best of the

researcher's ability this thesis is the first of its kind in Kenya to investigate the role of information asymmetry and loan ratios on fragility among Commercial banks in Kenya.

1.2. Statement of the Problem

Kenya's cyclic banking distress is a major concern. According to CBK bank supervision annual report 2015, before the latest episode of bank distress in Kenya 2015-2016; Dubai Bank Ltd had deposit base of Kes 1.75 billion and gross loans and advances of Kes 4.208 billion as at 2014. Chase Bank Ltd had Kes 79.15 billion and Kes 55.837 billion in deposits and gross loans and advances at the end of 2014, while Imperial Bank Ltd had Kes 48.17 billion and 31.827 billion in deposits and gross loans and advances respectively as at end of 2014. An examination of KDIC annual report for 2015 shows total asset base of Kes 54.96 billion with Kes 28.64 billion held in non-current assets and Kes 26.12 billion in current assets. The KDIC investments are wholly in Government of Kenya securities. KDIC total asset base of Kes 54.96 billion was well below the Kes 129 billion total deposits of the three distressed banks. On closure of a bank deposits and loan facilities become inaccessible causing financial distress to customers.

Customers' will be unable to access their banks for authorized credit facilities secured by individual or company collateral thereby resulting in operational difficulties. In case of corporates without additional security, substitute securities to pledge for loans with other banks can be a problem. Inability to provide collateral in such circumstances negatively impact operational capabilities of such customers.

While literature suggests information asymmetry plays apart in bank fragility, it is not well established its extent on balance sheet asset side and relationship with bank distress. There was need to establish the link due to the impact of bank fragility and ultimately bank distress with its economywide problems. The effect of distress on deposit protection fund, disruption of the monetary system, negative social economic disruption on depositors and credit facility holders and the extended time for resolution of instability can be a huge cost.

The motivation to investigate bank fragility became topical with the distress of Dubai Bank and Imperial Bank in 2015. The two bank distresses were followed by closure of Chase Bank in 2016. There was need to find out why the distress after a lull of ten years since the last bank was placed under statutory management in 2006. Besides, test if the distress events could have been foreseen. What role information asymmetry plays in bank distress especially from the asset side of the balance sheet? Join in the search for information on early warning system due to the high cost of bank distress resolution mechanism and adverse impact on social welfare following incidences of bank closure. Bank instability can have other consequences if it leads to customers flight to safety; shifting from banks perceived as weak to those considered financially sound. Researchers need to specifically review predictive ability of loan ratios and incorporate information asymmetry measures in early warning indicators of bank fragility in order to prevent bank distress and its consequences.

1.3. General Objectives

The general objective of the study was to establish the effect of loan ratios, information asymmetry and fragility among commercial banks in Kenya.

1.3.1. Specific Objectives

(i) To establish the effect of loan growth ratio on fragility among commercial banks in Kenya.

(ii) To establish the effect of loans to deposit ratio on fragility among commercial banks in Kenya.

(iii) To establish the effect of loan quality ratio on fragility among commercial banks in Kenya.

(iv) To establish the effect of insider loans ratio on fragility among commercial banks in Kenya.

(v) To determine the mediating effect of information asymmetry on effect of loan growth ratio on fragility among commercial banks in Kenya.

(vi) To determine the mediating effect of information asymmetry on effect of loan deposit ratio on fragility among commercial banks in Kenya.

(vii) To determine the mediating effect of information asymmetry on effect of loan quality ratio on fragility among commercial banks in Kenya.

(viii) To determine the mediating effect of information asymmetry on effect of insider loans ratio on fragility among commercial banks in Kenya.

(ix) To determine the mediating effect of information asymmetry on fragility among commercial banks in Kenya.

1.4. Research Hypotheses

(i) H_{01}: Loan growth ratio has no statistically significant effect on fragility among commercial banks in Kenya.

(ii) H_{02}: Loans to deposit ratio has no statistically significant effect on fragility among commercial banks in Kenya.

(iii) H_{03}: Loan quality ratio has statistically no significant effect on fragility among commercial banks in Kenya.

(iv) H_{04}: Insider loans ratio has statistically no significant effect on fragility among commercial banks in Kenya.

(v) H_{05a}: Information asymmetry does not mediate the effect of loan growth ratio on fragility among commercial banks in Kenya.

(vi) H_{05b}: Information asymmetry does not mediate the effect of loans to deposit ratio on fragility among commercial banks in Kenya.

(vii) H_{05c}: Information asymmetry does not mediate the effect of loan quality ratio on fragility among commercial banks in Kenya.

(viii) H_{05d}: Information asymmetry does not mediate the effect of insider loans ratio on fragility among commercial banks in Kenya.

(ix) H_{06}: There is no significant effect between Information asymmetry and fragility among commercial banks in Kenya.

1.5. Significance of the Study

The study focused on developing an early warning system to detect fragility and enable corrective action before onset of distress. Systemic banking crises and bank fragility are precursors to bank distress and therefore the need to manage bank distress should concentrate on bank systemic risk and bank fragility as early warning systems. This study attempted to measure information asymmetry; an issue seldom researched due to difficulties in its measurement.

The study of Information asymmetry in fragility among commercial banks could hold the key to unravelling the problem of bank distress. When bank fragility ends up as distress event, it creates huge problems for the economy; severe economywide effects;

depositors' funds tied up until resolution except for the guaranteed deposits, inability to access loans and overdraft facilities with the problem institution and the likely impact on the solvency of the deposit protection fund. This new approach focusing on information asymmetry measures will stimulate research on bank fragility as early warning signal in managing bank distress.

This study contributes information on early warning literature on bank fragility in Africa and Kenya in particular. By introducing information asymmetry, bank management and the regulatory authorities can model information asymmetry measures and frequency of financial reports into early warning systems to help identify red flags in a timely manner. It is imperative to commence pre-emptive measures in bank managers' irrational behaviour and stem distress. Focus on loan ratios helps isolate areas of greater scrutiny in bank solvency study since bank loans constitute a significant percentage of total assets.

Consequently, from this study academics, researchers, regulators, bank management policy makers, investors and financial analysts should deduce lessons on management of financial institutions from the importance of loan ratios and information asymmetry measures. Bank management will be interested in safeguarding the institution through constant review of information generated. Regulatory authorities and policy makers will be interested in how well the early warning system is able to help avert bank distress and thereby reduce related costs. Security analysts and investors will be interested in ability to use the study to determine bank health. Finally, researchers will focus on the same or different methodology in studying early warning systems. Such new methodologies in early detection and management of the problem will help reduce the cost of distressed banks to the economy. Besides, new measures

incorporating these methods could be part of monthly asset disclosures in order for the regulators to constantly review Commercial Banks health. Due to the significance of loans in commercial banks a renewed focus on risk management in the credit function would be appropriate.

1.6. Scope of the Study

Fragility among Commercial banks and information disclosure are wide areas of study. It was therefore important to narrow the scope of study to information asymmetry, loan ratios and their effect on bank fragility. This research was conducted in Kenya and utilised commercial banks published annual financial statements held at Central Bank of Kenya repository. The forty-two commercial banks in the study constituted unit of analysis. The study period was 2005 – 2015, a time following adoption of international accounting standards and a year before Charterhouse bank was placed under statutory management.

According to United Nations Conference on Trade and Development (UNCTAD) (2006), Kenya adopted International Accounting Standards (IAS) and International Financial Reporting Standards (IFRS) in 1999.

In order to test the role of information asymmetry and guided by empirical evidence, a period close to distress events of 2015-2016 was found suitable, therefore inferential analysis for period 2010 to 2014 was conducted to test predictive power of the model. Whereas economic conditions, other CAMELS indicators and bank specific factors may lead to bank fragility this study was however limited to loan ratios, information asymmetry and the relationship with bank fragility.

CHAPTER TWO

LITERATURE REVIEW

2.0. Introduction

This chapter explores the background to bank distress and discusses the causes and consequences. The impact of bank distress is the reason bank fragility as early warning indicators are significant. The chapter is organised as follows: section 2.1 and 2.2 discuss financial intermediation and fractional reserve banking respectively as the bedrock of credit creation process. Section 2.3 examines the concept of bank fragility; section 2.4 discusses information asymmetry while section 2.5 deals with the theoretical framework. The empirical evidence on bank fragility is discussed in section 2.6. Section 2.7 and 2.8 review the control variable and conceptual framework respectively.

2.1 Overview of Bank Distress

Bank fragility culminates in bank distress which has negative impact on the economy. Alvarez-Franco and Restrepo-Tobon (2016) state that during and immediately after 2007-2009 US financial crisis three hundred twenty-two (322) US Commercial banks failed with an estimated loss of USD 86 billion to the FDIC compared to the period 1980 -1989 when one thousand four hundred sixty-seven (1467) banks failed with an estimated cost of $62 billion and for period 1990 – 1999, four hundred thirty-six (436) banks failed with estimated loss of $7 billion. These are huge but avoidable losses if banks are well managed.

Kolari, Glennon, Shin, and Caputo (2002) show bank instability that resulted into failures in the US according to FDIC Annual Report as follows, two hundred seven (207) in (1989), one hundred sixty-nine (169) in (1990), one hundred twenty-seven

(127) in (1991) and one hundred twenty-seven (127) in (1992). Further, according to Federal Deposit Insurance Corporation (2016), the number of failed banks was twenty-five (25) in (2008), one hundred forty (140) in (2009), one hundred fifty-seven (157) in (2010), ninety-two (92) in (2011), fifty-one (51) in (2012), twenty-four (24) in (2013) and eighteen (18) in (2014). According to Kolari *et al*., (2002) the failure rate in the U.S. for the period 1989-2002 and 2008 - 2014 was more than the historical levels of about twenty-five (25) failed banks per year.

Papanikolau (2018) using US Commercial and Savings Bank data for period 2003 – 2009 finds that in the course of the global financial crisis a considerable number of banks were distressed which inflicted substantial losses on governments and led to a surge in the level of public debt in a number of countries. Many governments borrowed in order to bail out their banking institutions. Kane and Rice (2000) show that between 1980-1996 there were banking problems in fifty out of fifty-six countries on the African continent. Kedir, Iftikhar, Murinde & Kamgnia (2018) find that trend in non-performing loans in some African banks have led to bank instability. Besides Kedir et al., (2018) find that banks on the African continent have had bad debts problem due to a long-standing problem of credit risk management. Bologna (2015) therefore argues that there is need to regulate financial institutions. This is to ensure preservation of financial stability and protection of depositors as these entities are susceptible to adverse selection and moral hazard.

Demirguc-Kunt *et al*., (2005) state that during the East Asian crisis of 1997-8, banks buckled, depositors lost faith in the banking system, prices of assets crumbled, while capital flows from abroad diminished, consequently bank distress led to economic downturn. The world witnessed bank instability during the great depression of 1930s

and the tequila problem of 1994. The East Asian financial instability of 1997-1998 and the sub-prime problem of 2008 had varied negative impact on economies of developed and developing economies. Kenya's bank instability from 1984-2016, a span of thirty-two (32) years, witnessed forty-two (42) institutions distressed averaging one (1) failure per year. Honohan (2000) states that the financial cost of such distress is borne by depositors, creditors and the government.

Due to documented financial crises, Ozkan-Gunay and Ozkan (2007) argue that it is in order to look for a new crisis prevention, prediction and management method. Altman *et al*., (2014), Maghyereh *et al.*, (2014) affirm the main reason for early warning indicators is to enable early distinction between banks. Baron and Xiong (2017) contend that policy makers should embrace early warning systems in order to stem future financial crises. Messai and Gallali (2015) affirm that the objective of early warning models is to ensure ability to forecast problems in financial institutions and take remedial measures before they occur. Kolari *et* al., (2002) suggest bank examiners are concerned about early warning systems that aid information collected during on-site inspection as this helps predict impending problems and also allow early intervention to prevent failure or reduce costs of distress.

2.2 Concept of Bank Fragility

Thomson (1991) argues that it is only after understanding the factors related to an institutions closure that help in management and regulation of banks more efficiently. The problem however, with most studies on bank distress is that they are ex-post. Berger, Imbierowicz and Rauch (2016) state that after every banking crisis, many stakeholders ask, 'Why do banks fail?' and even though a number of answers have been provided many aspects of the question remain unresolved. Demyanyk and

Hassan (2009) however, aver that recurrence of banking financial instability show that protecting the banking system is rigorous work while DeYoung and Torna (2013) state that the main reason of non-systemic bank weaknesses is not yet fully understood. Laeven (2011) contends that banking crises have been a common feature throughout history. This confirms Berger *et al*., (2016), view that financial crisis demonstrates that the knowledge gained about bank fragility is evidently insufficient to prevent large numbers of banks from being distressed. In their study they find that larger shareholding of junior management and non-Chief Executive Officer (CEO) who are senior management remarkably increase bank's prospect of failure suggesting need to look at other possible causes of bank problems.

The need to investigate bank fragility stems from its debilitating effects on the economy and especially if it ends in bank distress of institutions. Chijoriga (1999) finds that bank crises lead to contraction of activities and decline of output in the economy. Sinkey (1975) finds bank crises as a greater risk to Federal Deposit Insurance Corporation. Sarkar and Sriram (2001) find that bank distress severely strains Federal Deposit Insurance Corporation resources and diminish the confidence of investors.

Bernanke (1983) states that the banking crises of 1930-33 disrupted credit allocation and the alarm caused by bank runs sparked of huge withdrawals of customer deposits. The consequences of such crises means that potential borrowers would not be able to secure funds to undertake investments. A slowdown in investment activities would ensue with economy-wide effect.

Kaufmann (1988) finds that contagious nationwide bank failures destabilise the financial system, which then affects the aggregate economic activities. The evidence

adduced is that effect to the economy is negative which leads to a slow down. Bank fragility has consequences on investors, bank depositors, borrowers, the regulator, the community and the economy. Bank instability disrupts the flow of funds to companies that have overdrafts thereby denying businesses liquidity. It also disrupts consumption patterns by households. Consequently, such problems not only mean failure of ancillary businesses but also indirect effect. Petitjean (2013) argues that the economy wide costs of bank problems are still huge when they occur. Consequently, a defined strategy of resolving distresses is ideal because postponement of resolution when the institution is facing difficulties is not a good option. Dungey and Gajurel (2015), argue that major focus of prudential effort should centre on avoiding banking crises because they are costly.

Huang *et al*., (2012) state that the consequence of bank failure is financial distress, which may affect other industries. Huang et al., assert that banks receive deposits, which they loan out to earn income, it is this intermediation process which fosters industrial growth and economic development, the process that distinguishes banks from other business entities. This process is disrupted when there is bank distress.

The impact on industrial development and economic growth with attendant costs are the reasons banks must be protected. Andries and Ursu (2016) therefore posit that for continual advancement of bank efficiency the focal point should be improvement of managerial practices. An improvement in managerial practices and reduction in information asymmetry helps with the monitoring of banks and instils confidence in the institutions. However, it is difficult for depositors to differentiate banks because of lack of information and therefore need for bank supervision. The supervisors will have information due to off-site and on-site inspection. Equally senior management

will have information that other stakeholders do not have which shows existence of information asymmetry. Bank instability may therefore signal lack of information.

Berger and Davies (1998) state that the objective of bank examination by regulatory agencies is information acquisition. The regulator is dependent on information disclosure in financial statements and during inspection of the institution. Jagtiani and Lemieux (2001) however argue that need for information by supervisors must be balanced with burden on regulated entities but without compromising on safety and soundness of institutions. Bank weaknesses may also be due to negative macroeconomic circumstances.

Banks could be impacted negatively as a result of unique bank specific circumstances, which may cast aspersions on management competence and the integrity of staff. Kedir, Iftikhar, Murinde and Kamgnia (2018) hold that bank characteristics is a key driver of fragility. However, it is worth noting that episodes of bank instability have occurred since organised banking was established. According to Gorton (2018) financial crises have taken place in market economies throughout history.

2.2.1 Bank Fragility

Ito and Harada (2004) contend that commercial banks are considered fragile when they exhibit, deteriorated capital base, or when a large proportion of total loans consists of impaired loans or when faced by potential losses from other sources. Ozili (2015) asserts that early warning signals of impaired loan asset (NPLs) as a variable is gaining importance to bank managers and credit controllers. An increment in impaired loan asset without corresponding expansion in good loan portfolio reduces the value of the loan portfolio and could precipitate bank solvency problems. Bank fragility is a financial problem that occurs quite often in some jurisdiction, yet the

banking sector remains one of the most regulated worldwide due to its significance in the payments system. According to Rauch (2010), in the USA the bank supervisory agencies are the Office of the Comptroller of the currency (OCC), the Federal Deposit Insurance Corporation (FDIC), the Federal Reserve as well as local state supervisory authorities. These offices regularly examine banks operating business with emphasis on safety and soundness of banks' as they are concerned about consumer protection. It is therefore because of consumer protection and the economy-wide effects of bank failure that regulators take keen interest in the health of banks.

Benston and Kaufman (1996) show that banks are the oldest and largest financial institutions, and their liabilities serve as money which distinguishes them from non-financial institutions, and this is the reason for pervasive government regulation. Allen and Carletti (2010), affirm that the financial services industry is the most regulated sector in practically all economies. Bleck (2018) contends that the regulation spans every aspect of bank activity. With such regulation why do financial crisis come as a surprise?

Iftikhar (2015) lists GDP growth, inflation, real wages, real interest rates and unemployment as macroeconomic variables that affect banks vulnerability. Boudriga, Taktak and Jellouli (2009) suggest the following as internal factors, bank management, bank capitalisation, provisioning plans, earnings, equity structure and industry concentration. According to Brownbridge (1996), the causes of bank distress in Kenya were accumulation of bad debts due to imprudent lending, fraud, insider lending and lending to politicians while Waweru and Kalani (2009) find insider loans to be a cause of bank failure. Meyer and Pifer (1970) segregated bank distress into two broad causes, internal and external. Among the cited internal causes of bank

distress are dishonesty which includes embezzlement and fraud, illegal practices, excessive loans to enterprises in which bank officers are interested or direct loans to officers for speculative purposes. While external factors include local economic conditions, general economic conditions being external, asset depreciation and depression.

Kane *et al*., (2000) description of when and why banks fail focuses on inability to service customer runs and provable contraventions of banking statutes. With studies on internal and external causes having established the real issues, there was need to find out; what else causes bank fragility and what can be done to limit failures in the banking sector, a sector that is considered overregulated? A bank scarcely fails unless it enters bankruptcy. Insolvent institutions normally play fast and loose with their legal commitments. It is rarely in the regulators interest to close an insolvent bank unless and until it experiences palpable liquidity problems.

Kane *et al*., (2000) further argue that by the time an insolvent commercial bank becomes illiquid enough to force government action; its net worth consists almost wholly of taxpayers' risk capital supplied in the form of direct or indirect government guarantees. These are the so-called zombie banks. The zombie banks therefore emerge from regulatory forbearance, which in itself increases the costs of resolution of the problems.

Past studies on bank instability have utilised CAMEL(S), logit regression, survival hazard model to predict bank distress. In their study using multidiscriminant analysis (MDA), Meyer *et al*., (1970) find financial measures can evaluate the relative strength of the bank and correctly predict a lead time of one or two years with eighty per cent observations being correctly classified. Kosmidou and Zopounidis (2008) show that

financial ratios give quantitative information about changes in the central circumstances of the banks. Adverse selection problems with regard to quality of loanees, inept management and poorly capitalised institutions are other cited causes of bank distress.

Brownbridge (1996) argues that the rapid growth of financial institutions in the 1980s was not matched by the expansion of bank supervision department at the CBK. Consequently, with lack of sufficient professional staff the reporting requirements and effectiveness of supervision was wanting. Brownbridge (1998a) further shows that political interference subverted prudential criteria as most of the boards of these institutions had members who were politically active. Politicians were also involved as shareholders and directors and with their interconnections were able to obtain deposits for their banks from public sector entities.

Further, Brownbridge (1998a) states that many of these failed entities in Kenya relied inordinately on public sector deposits from a few state corporations. This effectively meant undiversified deposit base. Besides, Waweru *et al*., (2009) argue that economic distress, impaired loan asset and credit quality are related to bank distress. The customer specific factors for institutions in distress relate to inability to disclose important information at the loan origination process.

Kaufmann (1988), Chijoriga (1999), Wheelock and Wilson (2000), find undercapitalisation, thin capitalisation or inadequate capitalisation as a cause of bank distress. Using CAMEL model Wheelock *et al*., (2000) observe that banks with illiquid poor-quality asset or thinly capitalised were candidates for distress. It is argued that in a thinly capitalised bank, invested capital of a bank as disclosed in its financial statements could be partially fictitious. Consequently losses, which should

be charged, may not be reflected. Subscribers may not have fully paid off their required capital.

Capital by subscribers should be adequate to absorb losses from operations or other causes of distress, because if capital is completely decimated the consequence will be distress. Besides, due to impairment of assets banks are unable to generate income, losses then have the consequence of depleting capital and finally bank closure. Kenn-Ndubuisi, Ifechi, and Akani (2015) provide evidence that capital requirements alone could not achieve soundness and stability in Nigeria's banking industry after the 2008 increase in capital requirements. Shaffer (2012) too finds regulatory capital ineffective on their own and therefore has to be supplemented by additional regulatory instruments.

In effect encouragement of larger size banks can not in itself be particularly beneficial. Effectively capitalisation on its own is not a guarantee against distress. Alston, Grove and Wheelock (1994); Kaufmann (1988); Wheelock *et al*., (2000), Demyanyk *et al.*, (2009) find bank distress to be as a result of exposure to sectoral shocks like geographical markets; due to sharp decline in agricultural or energy prices, real estate markets, decline in commodity and land prices. Sectoral shocks emanate from larger investments in assets in segments of the business, which then suffer depreciation in value due to shocks in the economy. It is these shocks that impair the asset values, with diminution in value the banks suffer losses, which impact on their performance. In discussing causes of bank distress, Wheelock *et al*., (2000) utilise the CAMEL approach, while Demyanyk *et al*., (2009) use Z-score – multidiscriminant analysis, CAMELS, Logit and early warning signals (ews) models. Wheelock *et al*., (2000) model, shocks are exacerbated by impediments to branch banking, which limited

banks to geographically limited markets. Ideally US banks were denied geographical diversification as a strategy to reduce risk.

Sectoral shocks led to sharp decline in prices thereby impacting negatively on the fortunes of the banks. Bernanke (1983); Kaufman (1988); Wheelock *et al*., (2000) find that USA bank distress of 1920s were caused by severe problems in the agricultural sector due to natural causes upon which many small rural banks foundered; a clear case of minimal sectoral and agricultural diversification. Corruption, fraud and violations of laws have also been found to be causes of bank distress. Alston *et al*., (1994); Kaufmann (1988); Chijoriga (1999) and Aharony and Swary (1983) point out that fraud is a cause of bank distress.

Alston et al., aver that fraud becomes rampant when bankers conceal detection of malpractice. Prevention of fraud and other internal causes would limit failure even in bad times. It is evident that fraud becomes pronounced during bad times, because in bad times absorption of losses or concealment of fraud becomes difficult because profit can no longer cover financial impropriety.

Aharony *et al*., (1983) find that bank distress due to specific or unique factors to the institution such as fraud or internal irregularities have no contagious effect. The closure of banks dishonestly run need not cause a panic or loss of faith by the public in the integrity of the banking sector. Meyer *et al*., (1970) conclude that an objective measure of honesty would significantly discriminate between potential problem institutions and sound banks. Excessive risk taking and bad luck also cause bank closures. Wheelock *et al*., (2000); Aharony *et al*., (1983) find that risky loans and investments lead to bank distress. Banks that tend to mismanage their operations are at a greater risk of closure because of higher rate of impaired assets. Excessive risk

taking and especially where economic fortunes have changed negatively would make marginal borrowers' default.

Defaults have serious negative impact on the financial positions of banks. Bad luck at times arises because if economic fortunes had not changed such excessive risky undertaking would have proved high return ventures. The other causes of bank distress are incompetence, faulty management and lax controls. Alston *et al*., (1994) cite incompetence as a cause of bank closures. Incompetence, faulty management and lax controls contribute to bank distress because; with lax internal controls breach of fiduciary duty becomes prevalent.

Besides, due to incompetence, robust methods to ensure systems reliability and reduction in breach is compromised with the consequence that financial impropriety is rampant. It is an established fact that management is a cause of bank failures. Kaufmann (1988) cites mismanagement, while Sarkar *et al*., (2001) outline risky managerial decisions as a cause of bank failures. Sinkey (1975) posits that dishonest management cause bank failure. He further hypothesizes that two major endogenous factors that explain bank failures are quality of management and honesty of employees. Meyer *et al*., (1970) find dishonest management, Chijoriga (1999) management deficiencies, Kenn-Ndubuisi *et al*., (2015) show bad management, as documented causes of bank distress.

Lack of public supervision, ill-equipped supervisors have been found to be a cause of bank distress. Chijoriga (1999) avers that poor supervision capacity was a cause of bank failures in Tanzania. The argument reinforces the need for well-equipped supervisory mechanisms by bank regulators. Due to the public nature of banking institutions and their impact on the financial system, public supervision in order to

forestall a meltdown of the system is necessary. In the absence of supervision, it seems the case that banking institutions may indulge in overly risky undertakings and violation of established banking laws with distress as a consequence.

Overdependence on public sector funds by Nigerian Banks was a cause of bank closure Babajide, Felicia and Folasade (2015). In case of a non-diversified deposit base, change of public sector policy leads to shift of deposits from one bank to another exposing the bank to variability in deposit base.

Dependence on a non-diversified base exposes the bank to inability to pay back deposits in case of a call by depositors. Besides, depositor diversification can extend beyond sectoral diversification to geographical diversification of deposits. Wheelock *et al*., (2000) argue that geographical diversification would have helped limit distress in the US due to sectoral shocks. In a study conducted in Tanzania by Chijoriga (1999) it was affirmed that concentration on a few borrowers or group of borrowers created a fertile ground for possibility of failure, the same applies to concentration on a few depositors.

Insider loans have been found to cause bank failure. Kenn-Ndubuisi *et al*., (2015) and Babajide *et al*., (2015) show that insider loans or gross insider abuses are a cause of bank closures. Insiders are able to abuse the system due to information asymmetry and their ability to conceal loans to their family, related companies and themselves. Therefore, excessive loans to enterprises in which officers are interested, direct loans to officers for speculative purposes are causes of bank instability.

Economic distress has been found to be a cause of bank closure. Alston *et al*., (1994); Meyer *et al.,* (1970). In the 1970s and 1980s bank failures were confined to regions suffering severe economic distress Alston *et al*., (1994). Frolov M (2006) suggests

that cyclical downturns of the 1990s with too many lenders competing for good quality lending opportunities led to bank distress. When banks with mispriced loans during high growth era entered economic downturn period, the loans could not cover for increased credit losses, and insufficient cover resulted in bank distress.

Excessive Competition is a major cause of bank distress. This type of survival for the fittest implies that banks that are unable to withstand competition must fail. Kaufmann (1988) finds poor performance due to competitive environment a cause of bank instability. Frolov (2006) shows that overcrowding with too many lenders are reasons for bank failures. Basu (2003) finds that competition intensifies with many players in the market. Ability to make positive returns in a competitive environment should be a signal of survival and especially for newly incorporated banks. In cases of declining profitability over a period of years, this could be a signal of dwindling fortunes and therefore need for greater scrutiny by regulators.

Cebula, Gillis, McCrary and Capener (2016) indicate that with increased competition the occurrence of bank failure increases due to some banks being unsuccessful in competing for deposits because some of the banks will not match the rates offered by competitors and therefore deposits will shift to where rates are more competitive. In this case Management of an institution performs a significant role in the success or failure of the institution. Therefore, managerial investment decisions will determine the level of performance.

Chijoriga (1999) establishes that inexperienced individuals licensed to operate banking business and concentration of ownership are causes of bank distress. In situations where inexperienced owners run banks, the possibilities of inappropriate business practices are high leading to bad business decisions leading to bank closures.

Banks are financial intermediaries that ensure depositors are able to pool deposits, to be lent to borrowers for investment in economic activities. This traditional role of banks ensures there is credit for those who want to invest in the productive sector. Therefore, those borrowers who are able to pay principal and interest generate income for the bank. The inability of borrowers to repay their loans leads to impairment of credit portfolio. The impairment of credit portfolio means that non-performing loans will arise. Alvarez-Franco *et al*., (2016) state that banks with low quality loans are likely to fail. They measure the low-quality loans using non-performing loans and loan loss provisions. Shaffer (2012) finds that higher expenses and non-performing loans contribute to risk of distress. Kenn –Ndubuisi *et al*., (2015); Frolov (2006) and Babajide *et al*., (2015) find poor credit base, credit quality and poor asset quality as causes of bank failure. Non-disclosure of information ultimately leads to bank failure. Chijoriga (1999) finds that lack of information among depositors induce bank customers to start a run under the mistaken impression that their bank has a problem like the ones in trouble, a contagion effect. Contagion effect is also a subsequent cause of failure, in overnight lending where banks lend to each other to manage temporary liquidity requirements usually on a one-day basis, one bank collapse in the chain can lead to a series of connected failures. Chijoriga (1999) in a study of Tanzanian banks finds connections among banks to be a cause of failure.

Adeyefa, Obamuyi, Kayode, and Owoputi (2015) on the other hand find a contagion effect emanating from other countries. With globalisation and financial integration, economic instability in one region affects other regions of the world. Foreign exchange losses have been found to cause bank failures. Aharony *et al*., (1983) documents the cause of Franklin National Bank of New York (FNB) as having failed due to foreign exchange losses. The failure of FNB led to negative abnormal

performance of various solvent financial institutions, a confirmation of the existence of linkages among banks.

Bank fragility may be caused by new innovative but complex banking products. Demyanyk *et al*., (2009) provide evidence of complexity of instruments using subprime mortgage as a classic case. The complexity of subprime mortgage market was created by multiple securitizations. Even though the sub-prime component of the mortgage market was small, the complexity of the securities created led to a large effect when the sector collapsed. In subprime mortgages, a pool of individual securities is created on an underlying asset, these are pooled and repackages, each stage of the process introduces more leverage leading to more complex financial instruments whose underlying assets cannot be discerned easily. The products are so complex to the extent few in the bank understand the underlying assets that form the basis of the product.

According to DeYoung *et al*., (2013), declining net interest income leads banks into risky businesses in order to generate non-interest income. These risky businesses elevate the leverage of the bank and non-bank institution. Such risky business are the non-traditional banking activities which DeYoung *et al*., (2013) aver have economically meaningful effects on the prospect of bank distress. They find that income from new banking products can be quite volatile leading to volatile earnings by the banks.

2.3 Concept of Information Asymmetry

Akerlof (1970), Spence (1973), Rothschild and Stigliz (1976) brought to the fore the theory about markets with information asymmetry. In case of multiple parties to a transaction, there will be information imbalance among them. Rothschild et al (1976)

show that if individuals were willing or able to reveal their information, everybody could be made better off.

That high-risk individuals cause an externality: the low-risk individuals are worse off than would be in the absence of the high-risk individuals. However, the high-risk individuals are no better off than they would be in the absence of low-risk individuals. Rothschild *et al*., (1976) suggest therefore that ceteris paribus, insured clients with high accident probabilities would demand more insurance than those who are accident free. Akerlof (1970) elucidates the theory of information imbalance using the market for automobiles. Individuals in the market engage without knowing whether the car will be good or bad. However, after a period of ownership, the buyer forms an opinion on the quality of the car. Due to the period of ownership, the new buyer has acquired sufficient information on the quality of the car. This estimate is more accurate than the original estimate.

Information asymmetry therefore arises when there is an imbalance in information between buyers and sellers or generally between parties to a transaction; with one party having more information than the other. Spence (1973) argue that there are high and low ability workers, but none can be identified ex-ante. Even though educational credentials may signal ability of employees, hiring remains an investment under uncertainty. Therefore, employers are never sure of new employee capabilities until after employment. In spence (1973) model the motivation to disclose or not was based on private incentives which may or may not generate desirable outcomes measured in social efficiency terms. Blau, Brough, and Griffith (2017) state that banks arguably display more opaqueness than other business entities. It is this opacity that provides uncertainty to outsiders about the inherent risks of banks. Kedir, Iftikhar, Murinde and

Kamginia (2018) confirm information asymmetry as a key factor in customers' frenzied withdrawal of funds and financial fragility.

According to Demirguc-Kunt and Detragiache (1998), borrowers' information can be mitigated through screening of loan applications, diversifying the loan portfolio and seeking collateral. Cressy and Otto (2001) find good borrowers get larger loans at a lower interest rate than bad ones and that collateral performs a signalling function. However, barely enough information is available on mitigation of information asymmetry by commercial banks.

2.3.1 Bank Opacity

Llewellyn (2002) suggests that inadequate information disclosure is a characteristic of banking distress. Llewellyn further argues that market discipline devoid of full and accurate information disclosure and transparency would be ineffective. Information should be availed to external stakeholders in order to assess asset quality, creditworthiness and the condition of the bank. However, Nurisso and Simpson (2017) state that Continental Illinois experienced a run when the quality of its assets became widely known! This suggests some level of opacity is good for bank survival.

Briscoe and Murphy (2012) define opacity as a practice where key characteristics of an institution are difficult to identify, what the institution does and the degree with which the institution undertakes activities, the resultant effect and who caused the effects are obscure. Banks fit well in this scenario. Depositors, owners, borrowers are unable to observe most of what banks are doing. It is when banks collapse that stakeholders learn an ex-post type of situation as to what might have led to the collapse. Prior to the event much of the information is never disclosed. Gorton (2013) posits that it is the opacity of banks that justifies their regulation and examination.

It is through regulation and examination that the regulator learns about the health of the bank and prescribes measures to strengthen it.

He further avers that opacity has a cost. A financial crisis is an information event because of the suspicion by depositors. Due to opacity of banks, depositors have no way to know which banks are solvent and which are weak. It is due to opacity that Gorton op cit argues that the financial instability of 2007-2008 led to general calls for more openness. Flannery (1998) states that the basis for government prudential supervision derives from the nature of bank assets, which are unusually informationally opaque and illiquid. It is because of opacity that governments have the Lender of last resort and deposit insurance. Consequently, regulators monitor and control banks risk-taking to limit tax-payers liability. Morgan (2002) shows that proposals to increase disclosure by banks would hopefully induce more market discipline by investors. This would then reduce bank failures. Ideally, opacity was the justification for introduction of deposit Insurance in the USA in 1934, it is also the reason for regulatory oversight because markets cannot discipline what is invisible.

Flannery, Kwan and Nimalendran (2013) surprisingly find mixed results on opacity and bank failure. Some researchers argue that opacity is the reason banks exist while others contend opacity is the reason banks fail. Opaque and hard to value assets escalate chances of bank runs due to unpredictability about how depositors assess solvency. Flannery *et al*., (2013) contend that a decline in bank asset values will increase opacity of its equity, and if lack of transparency increases when bank equity cushion decreases the banks are exposed to the chances of damaging runs. Opacity is therefore related to the degree of transparency of accounting standards, which have been blamed for increase in uncertainty on banks actual solvency status. Therefore,

opacity can cause inefficient policy responses, as policy makers are unable to observe quality of assets.

Bhattacharya, Daouk, and Welker (2003) state that opacity in reported income in a region could be due to managerial motivations, accounting standards and their enforcement. Opacity is thus the reason not much is observed about banks. Bhattacharya et al., (2003) state that by weakening the link between reported and accounting earnings and unobservable economic earnings increases asymmetric information. Clearly the problem is compounded. Jiang, Levine, and Lin (2014) state that the frequency with which banks restate their earnings and loan loss provisions are the most important accrual through which banks manage earnings. The managerial motivation is clearly exemplified by Jiang *et al*., (2014), as the motive is to show profitable operations through earnings management. Dang, Gorton, Holmstrom and Ordonez (2014) posit that opacity conflicts with the need for information production in investment projects. Secrecy surround banking operations, but it is opacity that leads to bank runs when depositors question the value of bank assets.

Dang et al., (2014) conclude that banks are purposely opaque by being sparse in publishing information and by investing in assets that are information sensitive. Jones, Wayne, and Yeager (2012) emphatically state that price contagion created by opacity exacerbates the speculative cycles of bubbles and crashes leading to financial instability. They further argue that decline in opacity would necessitate enhanced information disclosure and or a limit in asset complexity which could have costs and benefits that must be weighed by policy makers. Jones *et al*., (2012) further indicate that bank opacity reduces market discipline and leads to greater levels of systemic risk, contagion and bank runs.

Wagner (2007) find that financial development limits opacity of banks current assets, could have undesirable effects, which could include a move by banks into more opaque and less efficient activities. They argue that bank managers value opacity, which makes it difficult for the market to discipline them. Morgan (2002) argues that bank firms are more opaque than other forms of business with the veil between banks and outsider inherent to banking business. In summary opacity and information asymmetry have a relationship with bank disclosure requirements.

2.3.2 Information Asymmetry

Bashir, Yu, Hussain, Wang and Ali (2017) contend increased transparency by banks leads to decreased NPLs which they measured as impaired loans as a proportion of gross loans. Bashir et al., (2017) further cite Barth et al., (2009) who found that information sharing practices minimized chances of fraudulent activities in banks. The role of information disclosures in banking is well documented. Shim (2019) argues that due to client relationships, banks acquire specific information that could have beneficial effect in the provision of other financial services. Murinde (2012) finds that information asymmetry is a major variable in bank instability and financial fragility in most parts of Africa.

Asongu and Nwachukwu (2018) argue that the proliferation of private and public credit bureaus is meant to increase information sharing and mitigate information asymmetry. Mamonov (2018) finds that forensic audit of distressed banks in Russia show that there are serious problems with bank accounting information. Philippon and Skreta (2012) argue that in the face of high interest rates the safest borrowers will normally exit the market. This leads lenders to charge higher rates to the remaining borrowers. However, other market participants are not privy to this exit.

Claus *et al*., (2003) argue that financial intermediation exists because of information and transaction costs that arise from imperfect information between borrowers and lenders. Financial intermediaries obtain information at lower costs than individual lenders because they avoid duplication of production of information. Intermediaries also develop expertise in evaluating prospective borrowers and investment projects to the extent they can utilise cross sectional information and raise the information over a period of time. Casu *et al*., (2006) state that depositors could incur substantial costs if they engaged in the disintermediation process of direct search for borrowers.

Banks have economies of scale and expertise in processing information relating to borrowers, information that is obtained from first contact and over a period of time through repeated dealings with the borrowers.

Agarwal, Chang and Yavas (2012) while discussing securitization in the mortgage market indicate that lenders know more about the quality of borrowers beyond collected information like credit score, income or the borrower's repayment history. Gonzalez-Hermosillo et al., (1997) aver that information asymmetry is evident among borrowers who withhold information and depositors when they precipitate a run on a bank. Besides, banks show information asymmetry in their herding behaviour in risk taking activities. Banks may have an incentive to take advantage of their unobserved private information about borrowers and sell inferior quality loans while retaining higher quality loans on their balance sheet. They may also take on overly risky credit unobservable by the market. This establishes the link between information asymmetry and bank problems. Akerlof shows how information asymmetry creates adverse selection and leads to market inefficiency. This causes market failure, which harms society.

Some of the perverse consequences of market failure are contraction in money supply as a result of bank distress. In order to reduce the harmful effects, it is imperative to equalise information through screening as argued by Stigliz (1976) who defines screening as any mechanism used to differentiate among individuals. This is the same tool banks use to differentiate among borrowers.

Mishkin (1991) affirms problems of asymmetric information following failure of National Cordage Co in 1893, 'Banks in the west and south which were burdened with many problem loans began to face bank runs, and in June led to substantial withdrawal of funds by these banks from banks in New York'. This was a double asymmetric information problem, banks in the west and south having less information on the situation in New York and depositors of banks in the west and south with inadequate information thinking there was a link between the two and in turn precipitating a bank run. Diamond *et al* (1983) point out that asymmetric information is the origin of liquidity demand. Asymmetric information problem therefore may lead to contagion. This problem is both a result of opacity and information asymmetry. Opacity in that the banks are privy to information but which they keep secret. Mishkin (1991) further highlights the gravity of the asymmetric information problem as reflected in the high values of interest rate bid-ask variable.

Another asymmetric information problem relates to banking panic of 1930, said to have started in the agricultural regions, where a contagion of fear spread among depositors leading to failure of two hundred and fifty (256) banks in October 1930 with USD 180 million in deposits. A further three hundred and fifty-two (352) banks failed in November with over USD 372 million in deposits.

According to Friedman and Schwartz in Mishkin (1991), by March 1933 the number of banks in the US had reduced by over a third. Between 1930-36 the interest rate spread variable for subprime versus high quality borrowers remained high for long indicating that the asymmetric information problems were extreme in this period. Consequently, a lack of regulatory intervention to provide liquidity can lead to bank fragility especially for institutions facing short-term temporary liquidity challenges but of which other financial institutions are wary to intervene. It is this unequal information between depositors, shareholders and bank management in banking that creates information asymmetry.

The shareholders and management have more information than the ordinary depositors whose money is used to create risky assets. In a panic, depositors fearing the safety of their deposits, withdraw them from the banking system, causing a contraction in loans and a multiple contraction in deposits. An asymmetric problem arises as depositors withdraw funds from both solvent and insolvent banks since they cannot differentiate between them. As a result, banks offer attractive prices to receive depositors, which increases cost of business and reduces net interest margin. The strong banks offer low prices and risky banks high prices. However, the ordinary investor is never privy to this information about deposits and risk relationship. The supply of deposits depends on price and quality of information about the bank by the bank and not depositors. Depositors' returns are therefore dependent on the strength of the Bank. According to Besanko and Thakor (1987) all lenders use extensive non-interest factors like collateral. The use of collateral may be related to asymmetric information, which could be a significant impediment to free borrowing and lending in the market.

They argue that under asymmetric information, low risk borrowers obtain more credit than under full information. These categories of borrowers obtain more credit and pay higher interest rates than high-risk borrowers. Besides, low risk borrowers put up more collateral than high-risk borrowers. Although asymmetric information induces the allocational distortion of sub-optimally high investments by some borrowers, there is no credit rationing. The precise reason why lenders use interest rate, collateral and even credit rationing is because borrowers have more information than the lender. However, it is not the case that all high-risk borrowers pay lower interest rates than all low-risk borrowers.

Casu *et al*., (2006), Diamond (1984) state that banks are monitors of borrowers. It is more efficient for a bank to monitor borrowers' risk of default because banks have the expertise and economies of scale in processing information. Diamond (1984) argues that an intermediary has gross advantage in collection of information because the alternative would be costly duplication of effort. This delegated role of information gives rise to incentive problems, which can be termed delegation costs. The intermediary chooses contracts, monitors the information, makes proper use of the information, and makes sufficient payments to depositors to attract deposits. These are costs that the intermediary must bear, however, as the numbers of customers' increases, diversification effect sets in which reduces the incentive problems.

According to Diamond (1984) when an intermediary lends depositors funds to the borrowers, it must monitor the outcome of the borrower's project on behalf of the depositors. Lenders can use investment levels and interest rates to screen borrowers but can also resort to collateral alterations.

Hellmann and Stigliz (2000) find that credit rationing can occur when investors have less information than entrepreneurs about the risk of an investment. Besides if there is asymmetry about expected returns, then investors prefer debt over equity and there cannot be any credit rationing. However, the use of collateral may not always suffice to eliminate credit rationing. As Hellman *et al*., (2000) highlight, increasing the price of debt has three effects. The positive price effect due to profitability, positive selection effect of lost low return high risk entrepreneurs and the adverse effect of losing some high return low risk entrepreneurs who switch to equity market. Adverse selection comes from the fact that as prices increase, some of the best entrepreneurs no longer want to invest.

Banks use price that is interest rates to screen out borrowers. The three consequences arising from interest rates increase are, increased profit, marginal borrowers won't apply for loans and consequently the high-quality borrowers will apply for credit. The other effect is that an increase in price will lead to increase in default for existing high risk and marginal borrowers with the result that the bank's capital may be impaired. Marshall and Weetman (2002) summarise that information economics models of voluntary disclosure in a situation of information asymmetry between management and investors are almost universal in agreeing that some information will be given but some will be withheld. In certain situations, information is withheld inadvertently. This is classic information asymmetry in business. More information disclosure can give information advantage to competitors. In the circumstances, Banks, borrowers and depositors will equally withhold information from each other.

Marshall *et al*., (2002), conclude that firm specific information is withheld and that there is indication that companies with the highest levels of potential risk disclose less

than those with marginally lower exposure. The same derives from the credit market where full disclosure in some cases would lead to lack of credit. It would be optimal not to disclose and borrow at a higher rate than full disclosure and be locked out of the market.

Alba and Hutchinson (1987) argue that consumer knowledge has two major components defined as familiarity which means the number of product related experience that have been accumulated by the consumer and expertise which is defined as the ability to perform product related tasks successfully. Whereas consumers of Bank products may exhibit the two categories, it is the case that banking consumers are also categorised by both illiterate uninformed customers and literate and sophisticated consumers. However, banks tend to be special and even with thorough knowledge of their products consumers may not decipher the solvency of the bank itself. Nishihara and Shibata (2018) conclude that even in the presence of financial reporting requirements, outsiders do not completely comprehend corporate earnings. It is the case that there is an imbalance in information held by different stakeholders.

2.3.3 Proxy Measures of Information Asymmetry

The degree of information asymmetry may not directly be observed, Sufi (2007). Armstrong, Core, Taylor and Verrecchia (2011) advance the argument that the use of proxies of information asymmetry is essential. Leary and Roberts (2010) enumerate the following as proxy measures of information asymmetry, firm size, age of the firm, tangible assets, forecast dispersion, analysts' coverage and hot/cold period.

Hot periods are characterised by high equity issuance while low equity issuances are considered cold period. Corwin and Schultz (2012) use daily high and low prices as

proxy for information asymmetry, while market microstructure utilises transaction level using high frequency data to measure information asymmetry. Bhattacharya, Ecker, Olsson, and Schipper (2012) employ trade data in the course of the day to capture adverse selection on specific transactions.

Yoon, Zo and Ciganek (2011) state that proxy measures for information asymmetry include, bid ask spread, trading volume and volatility of stock prices. According to Yoon *et al*., (2011) bid-ask spread refers to the difference between the price quoted by the purchaser and the price quoted by the seller for a particular security. They conclude that a positive relationship subsists between information asymmetry and bid-ask spread because when there is an increase in information asymmetry, the bid-ask spread also increases. This means that because of imprecise information, participants increase the spread to cover lack of information.

Yoon *et al*.,(2011) further argue that a better measure of information asymmetry is the effective spread and define relative spread to equal (ask price-bid price) divide by ((ask price – bid price/2)). The other method to measure information asymmetry is trading volume, of which Yoon *et al*., (2011) conclude that if information asymmetry reduces, the trading volume increases. The third measure of information asymmetry is stock volatility. If there are low incidences of information asymmetry the capital market tends to be efficient and therefore there is a tendency for low equities variability.

Krishnaswami and Subramaniam (1999), outline five measures of information asymmetry. The first measure is the use of forecast error in earnings measured before announcement. The second measure is standard deviation of forecasts, which is measured as the standard deviation of all earnings forecasts made in the last months

of the fiscal year, third method is normalised forecast error, which is defined as the ratio of forecast error in earnings to earnings volatility of the firm. The fourth measure is volatility in abnormal returns around earnings announcement. The fifth measure is residual volatility in daily stock returns. Under these market microstructure measures of information asymmetry, stock market data is useful. However, out of study population of forty-two commercial banks, only eleven (11) are listed on the Nairobi Securities Exchange (NSE). If the researcher decided to utilise stock market information, then the final sample would dwindle which would be too small a sample for any useful inferential work.

Helwege and Liang (1996) utilise the following measures of information asymmetry, Research and Development expenditure, venture capital financial, output growth, age, tangible assets, size and the number of nonfinancial equity offerings in each year. Helwege et al., (1996) argue the age of a firm is a good measure of information asymmetry as it can be inferred that the older, the more mature and therefore the less information asymmetry. Besides with a mature firm it is expected that the market has gathered sufficient information on it. Helwege op cit used net property, plant and equipment as a fraction of assets as another test of information asymmetry and argued that the greater the tangible assets the less the asymmetric information.

They further argued that size as measured by total assets is correlated with less information asymmetry as it is expected size comes with greater diversification and less default risk. Helwege et al., (1996) concluded that except for number of nonfinancial equity offerings, the other variables showed that smaller growing firms are more innovative and develop new products and industries with high growth potential therefore likely to suffer from asymmetric problems than larger firms with

many tangible assets. There is clear justification on the use of property plant and equipment as a proxy for information asymmetry. Meyer et al., (1970) argue that fixed assets are required by banks however a high level of fixed assets to total assets would reduce flexibility of balance sheet adjustments leading to probability of bankruptcy. It therefore follows that fixed assets can be used in a manner that management conveys information.

Armstrong *et al*., (2011) discuss two accounting measures of information asymmetry, the first measure is annual research and development expense as a ratio of sales as a measure of information asymmetry. This measure is also a proxy for the presence of intangible assets, which are associated with higher information asymmetry. The second measure is scaled accruals quality (SAQ) of which Ogneva (2008) finds scaled accruals of a higher ranking than unscaled accruals quality. SAQ is derived by scaling accruals quality by the mean of the absolute value of total accruals over the previous period, Ogneva (2008). Francis *et al*., (2005) argue that when the scaled accrual quality is higher, earnings quality is lower and therefore information asymmetry is higher.

The measure of information asymmetry as advanced by Dechow and Dichev (DD) model for estimating accruals quality is specified as follows:

$$\frac{\text{CAj,t}}{AvgAssetsj,t} = c + \frac{f_1\text{CFOj,t-1}}{AvgAssetsj,t-1} + \frac{f_2\text{CFOj,t}}{AvgAssetsj,t} + \frac{f_3\text{CFOj,t+1}}{AvgAssetsj,t+1} + \text{Vj,t}$$

Where:

CA=total current accruals= Δcurrent assets – Δcurrent liabilities – Δcash + Δdebt in current liabilities.

D=changes from year t to year t-1,

CFO= cash flow from operation=net income before extraordinary items-total accruals

Total accruals=current accruals – depreciation and amortization expense.

Doyle, Ge, and McVay (2007) state that Dechow and Dichev model is theoretically and intuitively appealing. It is estimated as the standard deviation of residuals from a regression of working capital accruals on past, current and future operating cash flows, so that a higher DD measure indicates lower accrual quality. Mashruwala and Mashruwala (2011) aver that accrual quality is poor when the standard deviation of the residuals is higher. Dechow and Dichev (2002), submit that accrual quality has a negative correlation with future cash flows. Therefore, firms with low accrual quality experience more negative cash flows shocks in the future and firms with high accrual quality experience positive cash flows shocks in future. Ogneva (2012) finds that stocks with poor accrual quality that is high DD (Dechow-Dichev model) measure experience significantly more negative cash flow shocks in the near future. Therefore, in accrual basis of accounting, a firm's earnings are treated as a measure of performance, Dechow (1994).

Dechow (1994) further argues that management exercise judgement over recognition of accruals, which can be used to signal private information or is used to opportunistically manipulate income. Cash flows are better measure of performance in cases where it is possible for management to manipulate accruals because it is difficult to manipulate cash flows.

Doyle *et al.*, (2007) aver that accruals can be of poor quality because of intentional bias by management for purposes of earnings management or unintentional errors in

estimation of accruals. This follows Dechow *et al*., (2002) and does not disentangle intentional from unintentional errors since both demonstrate low quality accruals and earnings. It is the existence of information asymmetries between managers and outside parties that creates demand for summary measure of a firm's performance.

Nallareddy and Ogneva (2017) aver that poor accrual quality is related to firm opacity and information asymmetry. Dechow *et al.,* (2002) find that firms with higher DD measure have a higher incidence of losses, which is a pointer to financial fragility. Besides, they also find that higher DD measure is consistent with firms with higher variability of earnings and sales. Ogneva (2012) finds that poor accrual quality firms, that is firms with high DD measure systematically experience more negative cash flow shocks compared to good accrual quality firms that is firms with low DD measure.

Lee *et al*., (2009) state that the Modified DD accruals model is popular for estimating accruals quality in financial accounting studies. Francis, Nanda and Olsson (2008) state that accrual quality is one of the measures extensively used in the literature to measure earnings quality.

McNichols (2002) modified DD model separated accruals based on association with cash flows by regressing working capital accruals on cash flows from operations in the current period, prior period and future period as well as change in revenues and property plant and equipment. McNichols (2002) added sales revenue and property plant and equipment to the DD model then called it modified Dechow Dichev (MDD) as specified below:

$$\frac{\text{CAj,t}}{AvgAssetsj,t} = c + \frac{f_1\text{CFOj,t-1}}{AvgAssetsj,t-1} + \frac{f_2\text{CFOj,t}}{AvgAssetsj,t} + \frac{f_3\text{CFOj,t+1}}{AvgAssetsj,t+1} + \frac{f_4 \Delta Salesj,t}{AvgAssetsj,t} + \frac{f_5 PPEj,t}{AvgAssetsj,t} + \text{Vj,t}$$

Where: Sales=total revenue

PPE= Property, Plant and Equipment. These variables are scaled by the average of total assets between year t-1 and year, t. The addition of sales and property plant and equipment significantly increased evaluative power of the model in cross sectional regression.

Francis et al., (2005), Lee et al., (2009) adopted this modified Dechow and Dichev models in their research. In their estimation of accruals quality Dechow and Dichev (2002) combine intentional and unintentional estimation errors as both imply low quality accruals and earnings. In their calculation of accruals quality, they did not adopt the balance sheet approach. According to Hribar and Collins (2002) the balance sheet approach to deriving cash flow from operations (CFO) leads to noisy and biased estimates. Hribar et al (2002) find that measuring accruals as a change in successive balance sheet (statement of financial position) accounts leads to measurement errors in accrual estimates.

These measurement errors lead to erroneous conclusions on earnings management; therefore, reliance should be put on measures taken directly from cash flow statements. Francis *et al*., (2005) and Mashruwala *et al*., (2011) follow Fama and French (1997) who argued that in each year of study there must be at least twenty (20) observations, in order to compute accruals quality. Lee *et al*., (2009) contend that measures of accounting information quality are reliable proxies for information asymmetry. Lee *et al*., (2009) further argue that a firm's financial health and its performance can be concealed by poor quality accounting information and therefore increase information asymmetry between insiders and outside investors. According to Bartov and Bodnar (1996), Lee *et al*., (2009) the problem with operationalizing

information lies in the fact that degree of information asymmetry among market participants may not be directly observable.

Measures of information asymmetry as highlighted can be grouped into accounting measures, analysts forecast, market microstructure or modified accounting measure popularised by Dechow- Dichev-DD Model for accrual quality. The market microstructure was deemed inappropriate due to the number of listed banks on the Nairobi Securities Exchange, analysts forecast which relies heavily on market data was also found unsuitable.

A majority of the researchers have utilised stock market data to measure information asymmetry. The bid –ask spread is commonly applied, with a wide gap showing significant imbalance in information. Chae (2005) uses firm size, analysts' coverage and average bid-ask spread as proxy measures of information asymmetry.

Chae (2005) suggests that these proxy measures are widely used in economics and finance and have intuitive economic relation with information asymmetry. It is argued that when there is high level of information asymmetry in the market, the bid-ask spread becomes wider. Besides, the level of private pre-disclosure information dissemination has a correlation with firm size that larger size firms tend to have less information asymmetry before announcements. Chae (2005) states that there is no direct measure of information asymmetry therefore various proxy measures are utilised.

Having reviewed proxy measures of information asymmetry, the accrual quality methodology is appealing, however, working capital changes for banking institutions could cause computational problems. The market microstructure proxies could also lead to a sample of eleven banks rendering the analysis deficient. Whereas most

researchers have used bid-ask spread as a proxy of information asymmetry, it suffers from inadequacies like spread being related to order processing costs and inventory holding costs, the observable bid-ask spread has institutionally imposed costs with bigger firms having smaller spreads than smaller firms and thirdly, bid-ask spread are insensitive to changes in information environment. Firm size measured using total assets was utilised in the study as a control variable. The research and development expense were not explicitly identified in commercial banks financial statements.

Following the above argument, Helwege et al., (1996) argument that the ratio of property plant and equipment scaled by total asset was popular because it is associated with greater tangible assets and less asymmetric information was more compelling.

Therefore, this study adopted Leary et al (2016) and Helwege et al., (1996) use of tangible assets (net property plant and equipment) as a quotient of total assets as a measure of information asymmetry.

Table 2.1: Summary Measures of Information Asymmetry

	Author	Measure	Data Source
1	Corwin & Schultz (2012): Bhattacharya et al (2012) & Yoon et al (2011)	1. Stock Market daily High & low prices 2. Intraday stock market prices 3. Bid-Ask Spread, 4. Trading Volume 5. Stock price volatility	Stock Market
4	Krishnaswami et al., (1999)	1. Forecast error in earnings 2. Standard deviation of forecasts 3. Forecast error: 4. Volatility in abnormal returns around earnings announcement 5. Residual volatility in daily stock returns	Stock Market and Analysts Reports
5	Ogneva (2008), (2012). Francis et al., (2005) Lee et al., (2009) Dechow et al., (2002) McNichols et al., (2002)	1. Scaled Accrual Quality	Financial Statements
6	Armstrong et al., (2011)	1. Annual R&D/ Sales 2. Scaled Accrual Quality	Financial statements
7	Chae (2005)	1. Firm size 2. Analysts forecast 3. Average bid-ask spread	Stock market, Financials, analyst reports.
8	Helwege & Liang (1996), Leary & Roberts (2016)	1. R & D Expenses 2. Venture Capital financials 3. Output growth 4. Tangible assets 5. Size 6. Number of non-financial equity offerings in each year.	Financial statements

Source: Researcher, 2021.

2.4 Theoretical Framework

The theories underpinning the study are discussed. Credit creation and Agency cost theories are fundamental to the soundness of the financial system while adverse selection theory explains information asymmetry and its role in bank fragility.

2.4.1 Genesis of Credit Creation

Classical theories hold that the genesis of credit creation is financial intermediation and fractional reserve banking. Therefore before discussing credit creation a brief discussion of financial intermediation and fractional reserve banking is provided.

2.4.1.1 Financial Intermediation

It is commercial banks intermediary role that is the genesis of fragility. According to the Federal Reserve Bank (FRB) of Kansas City (2016), banks enable economic development through granting of loans and investments. However, this intermediation role generates risk which if not well mitigated cause bank instability.

Demirguc-Kunt and Detragiache (1998) argue that by creating short, medium and long-term assets to borrowers using short term deposits, banks end up with mismatch of asset and liabilities. Therefore, a fall in the value of the assets below that of the liabilities creates insolvency. Therefore, Intermediation role is central to bank instability. Huang *et al.,* (2012) state that banks accept deposits and make loans, a classical intermediation process. Casu, Girardone and Molyneux (2006), Diamond (1984) show that financial intermediation is the process of linking savers or depositors to borrowers. Banks attract deposits which are lent to their customers requiring credit facilities. Casu *et al*., (2006) further argue that banks channel deposits from surplus spending units to deficit spending units thereby reconciling the different needs of borrowers and lenders.

The institutions transform small size, low risk and highly liquid deposits into loans of larger sizes, higher risk and illiquid in nature. Wheelock and Wilson (2000) aver that banks are financial intermediaries that convert financial resources, labour and physical capital into loans and other financial assets. Cochran and Call (1998) show that

financial intermediation process is efficiency enhancing since it facilitates the flow of funds from bank deposits to bank borrowers.

Werner (2016) takes a diametrically divergent opinion. He argues that financial intermediation considers banks as financial intermediaries both individually and collectively, rendering them indistinguishable from other non-bank financial institutions in their behaviour especially with deposits and lending and that they are unable to create money individually and or collectively. According to Werner (2016) banks are not different from non-bank financial institutions if this theory holds. By acting as an intermediary, Banks help reduce transaction costs and information asymmetries. The typical transaction costs would be searching for counterparty with funds to lend, the cost of obtaining information about those with surplus funds and those with deficit funds who need to borrow. In obtaining information, three problems are relevant, and they are, not all participants have the same information, none of them has perfect information and some participants to transactions have price sensitive insider information. By its nature insider information is not available to all parties. Bernanke (1983) states that the cost of credit intermediation is the transmission of funds from the savers to proper use by good borrowers. This means screening, monitoring and accounting costs as well as expected losses that will be afflicted by defaulting borrowers.

Banks must therefore choose procedures that minimise costs of credit intermediation. These intermediation procedures must include building expertise at customer or potential customer appraisals, long-term relationships to have intimate knowledge of the clients. This allows a build-up of useful information on clients. Allen and Carletti (2010) argue that conventional banking business of accepting deposits and making

loans has declined in the United States, reflecting loss of standard banking business. Banks market share has shrunk while non-bank institutions business has grown partly due to new technology, which has facilitated payments. This competition has driven banks into more risky business segments in order to reduce reliance on traditional intermediation earnings. This has increased the risk that banks take and therefore increased their vulnerability to runs and collapse.

2.4.1.2 Fractional Reserve Banking

Fractional Reserve Banking suggests that a commercial bank needs to keep part of its customer's deposits as reserve, while the balance is lent out, Meera and Larbani (2009). The percentage is usually set by Central Bank. In some countries it is known as statutory reserve requirement or statutory minimum reserve while in Kenya it is called cash reserve ratio. Bagus, Philip and Howden (2016) argue that banking crises in European and American banks can be traced to fractional reserve banking because lending customer deposits to borrowers who cannot repay jeopardises the depositors' recourse to their money. Consequently, full reserves have the benefit that customers will be paid when they call on the bank without doubt and therefore costly runs are eliminated.

Banks provide liquidity to depositors in a better way than equity or bonds. Besides, banks are able to finance relatively illiquid and higher risk assets using short-term liabilities (deposits) but through diversification of the loan portfolio assure the depositors that their obligations will be met if they require to withdraw funds. According to Casu *et al*., (2006), when banks diversify their balance sheets well, they stand a lower chance of default, thereby meeting their customer obligations. Rauch (2010) argues that by transforming maturities of short-term liabilities into long term

assets, banks hold illiquid assets but are able to offer liquidity to both depositors and borrowers. However, instability sets in when there is heightened deposit demand or increased loan charge offs resulting in banks inability to meet liquidity demand on the liability side.

According to Cochran, Call and Glahe (1999), bank liabilities like deposits form part of the financial intermediation process. The depositors give funds to the bank which may be payable on demand or on notice. The bank then assumes ownership when deposit reserves are loaned out, through this process funds will have been transferred from the saver to the borrower. However, if banks keep cash reserves to back short-term liabilities, total lending will be less than total savings. Cochran et al., (1999) summarise this as 'a dollar held in reserve balance is a dollar saved but not lent to ultimate saver'. Werner (2016) states that fractional reserve holds that the banking system in aggregate can collectively create money while each individual bank will act as a mere financial intermediary. Bank liabilities like deposits have a significant part in fractional reserve banking and therefore are part of the financial intermediation process. On the basis of customer savings banks are able to on lend to generate earnings.

According to Central Bank of Kenya, commercial Banks in Kenya are by law expected to maintain a specified percentage of their total deposits at Central Bank. This proportion is called cash reserve ratio (CRR). The Central Bank can adjust this rate upward or downward to adjust the supply of funds in the market. The funds constituting CRR are held at the Central Bank at no interest rate. Kenya's CRR rate in 2018 was 5.25% of the total of a bank's domestic and foreign currency deposit liabilities. Cochran *et al*., (1999) argue that credit creation through fractional reserve

banking is financial intermediation practice which facilitates flow of resources from savers to investors. Besides, expansion in money supply may be a necessary ingredient to prevent or postpone a recession especially for growing economies. Meera *et al*., (2009) state that Central Banks use the reserve requirement to control money supply in their respective economies.

According to Mcleay, Radia, and Thomas (2014) what happens to newly created money either being destroyed through expenditure on extinguishing an existing loan or being passed on via spending or consumption have different implications on the economy. In a case where money created is passed on to different household and companies each of which decide to increase their expenditure could lead to what is known as 'hot potato effect', that is all else held equal it could lead to inflationary pressure on the economy. It is increased expenditure by households and companies that fuel inflation, which in turn leads consumers to spend more to get rid of the money like hot potato. Benston *et al*., (1996) state that money created through fractional reserve banking system is subject to expansions and contractions when the quantity of the reserve asset changes.

When the Central Banks increase reserve ratio, less money becomes available for lending and when it is reduced then more funds will be available for on lending. In his critique of Rothbard on fractional reserve banking, Rozeff (2010) avers that bank runs occur because depositors have doubts about the safety of their deposits that is if deposits were available to all on demand, that the bank had 100 per cent reserve then bank runs would have no rationale. It is possible that depositors know that their funds are not safe and that banks make many loans some of which go bad and that there are no back up lines or ready assets to liquidate to meet deposit outflows. Benston and

Kaufman (1996) state that banks are believed to be inherently unstable because of structural fragility stemming from maintaining low ratios of cash reserves to asset and capital to asset relative to the high short-term debt held. Due to low reserves, not all demand or short-term depositors can withdraw all their money at the same time even if the bank is solvent because the cash held in the vaults is a fraction of the total deposits by the bank. The bank may be forced to sell some assets or borrow to meet massive withdraws which because of asymmetric information and transaction costs could render the bank insolvent.

The abolition of reserve requirements by Bank of England and Swedish Riksbank according to Werner (2016) shows the lack of effectiveness of fractional reserve theory. However, many countries still maintain reserve requirements, which seem to play a useful economic role means the theory is not yet dead. Chari and Phelan (2014) observe that for individuals and private and public entities to voluntarily use bank deposits backed by fractional reserve banking implies deposits serve a privately useful function. They conclude that fractional reserve banking may continue being applied in many countries' inefficiencies associated with it notwithstanding.

The fact that some countries still maintain reserve requirements do confirm that fractional reserve theory is alive and useful. Therefore, the benefits of fractional reserve banking against 100% reserve banking must be balanced against the social impact of bank runs and other costs related to banking like the higher interest rates on bank deposits as a result of 100% reserve requirements. It is because of fractional reserve banking that banks are able to give out loans. Banks are aware, only a small fraction of customer deposits will be held by the bank while a greater percentage will be lent to borrowers.

Most of the loans are highly illiquid assets and therefore any massive withdrawals of deposit liabilities may not be covered 100%. The fact that banks hold only a small fraction of deposits coupled with loan defaults means diminution in available funds for depositors' consequently any bank run will result in failure. Banks will not disclose to depositors when loan portfolio is impaired which is an asymmetric problem. Since it would be rare for banks to collapse with 100% reserves, therefore it can be argued that it is lending under fractional reserve and information asymmetry that precipitate fragility.

2.4.1.3 Credit Creation Theory and Bank Fragility

Credit creation theory suggests that individual commercial banks can generate money through their actions of lending and do not depend on customer deposits. Werner (2014) cites as an early proponent of credit creation who said, " a bank is therefore not an office for "borrowing" and "lending" money, but it is a manufactory of credit" Macleod (1891):ii/2,594. Xing, Wang, Wang and Stanley (2020) argue that commercial banks create deposits and loans simultaneously through balance sheet expansion.

Turner (2012) states that the most distinctive thing banks do is to create credit, which result in spending power. Credit creation according to Meera *et al*., (2009) is an accounting process that does not involve real money. When a bank approves and disburses a loan to its customer, it does not reduce deposits of any of the other customers. Meera *et al*., (2009) further argue that when a loan is disbursed, the borrower is denoted a debtor to the bank because of the loan and at the same time as a depositor because of the credit entry. It is simply book-keeping and does not involve physical currency notes, a process banks utilise to create money out of thin air.

Cochran, Call, and Glahe (1999) show that money enters the economic system as banks grant new loans. These loans are negotiated through use of other people's money. They further argue that money creation does not involve reduction of present satisfaction on the part of depositors and can therefore finance investments without any previous equal savings. It is further argued that this is recognizable as credit creation as opposed to financial intermediation. According to Werner (2016), the credit creation theory holds that each bank can individually create money out of nothing through accounting operations and it is done when creating loan facilities.

MCleay *et al*., (2014) state that when a bank grants a loan, it concurrently creates a matching deposit in the borrowers' bank account. It is argued that is the way new money is created. They argue that commercial banks create money in the form of bank deposits by making new loans, which are credited to the borrower's bank account. Werner (2014a) asserts that when a bank extends credit to a customer, it creates a fictitious deposit by recording the loan amount in the borrowers account even though no deposit was made.

Two entries are made, a credit to the borrower's current account and a debit to the borrower's loan account. What is created is a loan whose disbursement creates a deposit, an imaginary deposit. Cochran and Call (1998) show that borrowed money can be spent and return to the banking system as additional deposits and the process continues as new deposits and lead to additional loanable funds.

At the time of loan disbursement, a deposit equivalent to the amount of the loan is created in the borrower's account. However, even though banks create money there is a limit. The market forces limit how much individuals and corporates can borrow. Banks are constrained by how much they can lend and thereby create credit because

of risks associated with loans. In many jurisdictions, credit creation will be constrained by regulatory policy, which reduces the negative impact of credit creation to the stability of the financial system. The borrowers can also limit money creation through utilisation of the loan proceeds through repaying other loans owed by them. Individual bank credit creation will also be limited by the risk of default that is credit risk, the risk that some borrowers will be unable to repay their loans. Credit creation can also be limited by monetary policy through Central bank influencing interest rate levels. The level of interest rates will ultimately influence the rate at which commercial banks lend to individuals and other entities. Turner (2012) shows that the ability of banks to create credit and money has implications on demand and can be disastrous if the loans created are poor credits. These poor credits can easily lead the bank to insolvency especially if depositors precipitate a run on the bank. In view of these there are necessary prudential controls on maturity transformation and the degree of leverage by the bank.

Werner (2014a) concludes that because banks invent funds by crediting the borrowers account with a deposit when no new deposit has actually taken place is clear empirical evidence of credit creation. Werner (2014b) further questions the legality of classifying such bank liabilities as customer deposits in the absence of new deposit to the bank. According to Werner (2014a), 2014(b) and 2016 there is no evidence supporting fractional reserve banking and financial intermediation theory. The conclusion from his papers holds that banks loan out money to borrowers and do not transfer the money away from other customers' accounts whether internal or external accounts. Whereas the conclusion is persuasive, there are many countries that maintain statutory reserves. Besides, it is not clear what type of organisation can create money from inception if financial intermediation does not exist. In the absence of

initial deposits or loan capital, how would the borrowers draw cash from the bank without cash holding by the bank?

In the circumstance that the cash is transferred by issuance of a cheque how would the bank manage the clearing system without reserves in an account at Central bank?

A bank creates deposits from nothing when it credits borrowers both insiders and outsiders' current accounts with loan proceeds. This artificial deposit means the level of deposits goes up as more loans are granted. As the level of deposits increases, therefore the bank can lend more, the process continues like that if the borrowers do not use the funds for consumption. However, due to impairment of the loan portfolio, credit creation must have a limit. With increased loans, some get impaired.

An impaired loan portfolio may lead the bank to non- disclosure of material facts, which ultimately lead to bank instability when the deterioration reaches an unsustainable level. Credit creation is linked to the quality, growth, insider credit and concentration of the loan portfolio.

2.4.2 Agency Cost Theory and Bank Fragility

Xing, Wang, Wang and Stanley (2020) find that commercial banks are driven by desire to make more profits and therefore lend without properly estimating risks and guaranteeing liquidity and equity positions. Therefore, in such cases professionals who manage other people's funds may not exhibit skills and care to perform compared to co-owners of a firm. Jensen and Meckling (1976), Jensen (1986) show that managers have divergent interests, where they want to maximize their income and may choose riskier projects with lower expected values. Managers may be motivated to cause firms to grow beyond their desired size. This motivation is normally in the managers' interest as growth increases their power because of the resources they

control. Besides, such growth of the firm is positively related to changes in compensation in managers' interests rather than shareholders.

Managerial compensation based on profit generated acts as an incentive for managers to manipulate information and favour low to negative net present value projects, but which promise immediate profit. In case of positive growth, bank management can still plead bad luck when outcomes are poor according to Heffernan Shelagh (2010). Ang, Cole, and Lin (2000) aver that when managers own less than 100 per cent of the firm's equity, shareholders suffer costs emanating from management shirking and perquisites consumption of fringe benefits.

Arnould Richard (1985) argues that managers seek goals that deviate from those of the owners and especially where ownership of the firm is widely distributed as to put control in the hands of management. In a study of Austrian cooperative banking, Gorton and Schmid (1999) find that bank performance diminishes with increase in the number of cooperative members. Clearly, this is a reinforcement of the held view that as the magnitude of ownership dispersion goes up agency costs increase. According to Mendez and Willey (1995), the spread of ownership in itself leads to an increase in the cost of monitoring managerial activities. It is the dispersed ownership, which then leads to higher agency costs.

Bank managers engage in expense preference behaviour, which means managers maximise expenses instead of maximising profit through executive compensation perks. Bernanke and Gertler (1989) show that information asymmetries and the inability of lenders to monitor borrowers costlessly lead to agency costs, which create a rift between the costs of internal and external financing for a firm. Fama *et al*., (1983) state that because contracts cannot be costlessly written and enforced that is the

genesis of agency problems. These agency costs include the cost of structuring, monitoring and bonding a set of contracts among agents with varying interest.

Heffernan (2009) states that agency cost in banks can be categorised into four; the shareholders as principal and management as agents; the bank as principal and officers as agents; the bank as principal and debtors as agents and lastly the depositors as principal and the bank as agent. The shareholders as principal delegate the daily operations of the institution to management with the understanding that management will conduct the operations in the interests of the principals.

It is in the interests of the two to align their expectations in order to derive full benefits, but this is not always the case. The next agency relationship is between the bank and the officers. The bank's management should operate in the best interests of the bank in order to grow profitability, however officers maximise their interests at the expense of the bank. In view of this the bank has to monitor the operations of its officers through internal audit and external audit mechanism to ensure alignment of interests.

In the process of aligning their interests officers create suboptimal credits which when expectations are good lead to good profits but when the expectations are negative lead to bank failure. The next agency problem and which banks act as principal and debtors as agents; the debtors who are borrowers are expected to operate in the bank interests, invest in positive net present value and eventually pay back their loans. However due to information asymmetry, debtors maximize their interests as they know more than the bank about their projects. This is part of the reason for poor quality of loan portfolio. The last relationship, depositors acting as principal and banks as agents. Depositors entrust banks to utilise their savings in a manner the deposits will be

repayable on demand or notice, however, banks in an effort to make profits may lend to debtors who turn out to be bad credits thereby impacting the depositors' funds.

In the case where the bank fails, depositors may not recover 100% of their deposits. It is those who are fully covered by the deposit insurance who receive their funds in full, the rest may have to wait for realisation of bank assets and recovery of loans before they are paid. The above four agency relationships show that principals delegate decision making authority to agents.

Fama *et al*., (1983) state that principals must therefore provide motivating incentives for the agent. There are costs to ensure the agents act in the best interests of principals. Agency cost theory helps explain the loan growth ratio, loan deposit ratio, loan quality ratio and insider lending ratio. The agents possess more information than the principals and will grow the loan portfolio knowing well that their remuneration will be measured by the bank performance. The rapid loan growth ratio may come with bank management who are agents lending to themselves, that is insider loans for their own projects. This may have undesirable consequences on the quality of the loan portfolio.

2.4.3 Adverse Selection Theory and Bank Fragility

Akerlof (1970) argues that in insurance adverse selection is where high risk individuals are more likely to buy insurance. The insurance companies cannot discriminate against such individuals due to lack of information. In banking, banks engage in adverse selection by accepting higher risk credit customers which owners and regulators are unable to tell ex-ante. Adverse selection will emerge where the quality of the average borrower declines as the interest rate or collateral increases.

Overall loan profitability may decline as only higher risk borrowers are willing to pay higher interest rates.

Brownbridge (1998a) states most local banks in Kenya suffered from adverse selection of their borrowers; most of the borrowers had been rejected by foreign owned banks due to strict credit assessment criteria. These high-risk borrowers were however granted credit facilities by local banks. The adverse incentives by local banks taking on risky investments at high interest were done in owners' self-interest.

According to Heffernan (2009) banks face adverse selection problem because of asymmetric information between principals and agents. The bank as principal has less information about probability of default on a loan than the borrower, the agent. Morris and Shin (2012) suggest that adverse selection arises because of imbalance between participants' level of information, with some having private information and better expertise in evaluating financial instruments and markets. Some market players may therefore be reluctant to trade because of lack of common knowledge about an asset.

In adverse selection, it is the uninformed traders who tend to be reluctant to trade as they do not want informed traders to profit on their lack of information. Such adverse selection is a market situation characterised by a knowledgeable trader benefitting from trading or otherwise contracting with a less informed counterparty. Asongu et al.,(2018) claim lenders face adverse selection problems from borrowers because of inability to observe borrowers' characteristics. Equally external parties are unable to observe what banks do, especially in the lending process. The uninformed trader is ignorant about an observed characteristic of the informed person. However, Allen (1990) avers that when information is incapable of direct verification and risk aversion is unobservable, an information seller can only capture a portion of the value of his

information. Nayyar (1990) postulate that buyers face a difficult and costly task in ascertaining the attributes of services before purchase due to information asymmetries in buyer seller relationships. Nayyar and Templeton (1994) document that when there is information asymmetry, firms trying to differentiate their products may find that buyers are unable to perceive and value any differences. Hence, they may be unwilling to pay higher than average prices. This makes it difficult to reap the intended benefits from a differentiation strategy.

Firms might differentiate their services by varying the mix and quality of core service features they offer that is basic attributes such as the physical design of tangible components, location, technology and features such as delivery arrangements, financial terms and after sales support. Other aspects such as reputation, brand name, guarantees, the level and type of advertising that may be perceived as enhancing value. Nayyar (1990) further argues that buyers' ability to evaluate service quality varies with level of expertise. Buyer expertise reduces risk due to information asymmetry in judging service quality.

Dell'Ariccia (2001) document that financial institutions offering credit face uncertainty about their borrowers' credit worthiness to the extent that they cannot discern their characteristics and actions. This type of information asymmetry may therefore lead to credit rationing. Therefore because of imprecise information, informational asymmetries affect the financial strength of a bank through the adverse selection of borrowers, Brownbridge (1998b). Asymmetric information between borrowers and lenders also results in a moral hazard problem, which impacts the efficiency of financial markets. According to Stigliz (1976) moral hazard can be

described as opportunism characterised by knowledgeable person taking advantage of a less informed person through unobserved action.

Because lenders have trouble establishing the quality of investment projects that borrowers wish to undertake, the borrowers have motivation to engage in activities that may be beneficial to themselves but have the chance to increase default and thus harm the lender. Mishkin (1991), states that a sharp deflation transfers wealth from borrowers to creditors, causing deterioration in business firms net worth.

The resulting increase in asymmetric information problems is reflected in increase in the interest spread, which can be a key propagation mechanism during recession. Kirabaeva (2011) states that because of an informational imbalance between parties, adverse selection can negatively affect the efficient functioning of the market. Adverse selection explains the prevalent freezes of the market. Asymmetric information between parties generates adverse selection as prices fall, parties with high quality assets exit leaving lemons, Akerlof (1970).

According to Kirabaeva borrowers always know more about the quality and riskiness of their projects than the lenders. Since potentially high and low risk borrowers are identical ex-ante, it therefore means high-risk borrowers benefit at the expense of low-risk borrowers. Ultimately shocks that cause balance sheet deterioration of banks make the problem of adverse selection worse by escalating credit risk. Stigliz and Weiss (1990) indicate that a loan contract where a penalty is imposed for default of payment prevents the individual from obtaining a new loan in future which acts to reduce information asymmetry. According to Stigliz *et al*., (1990) contingency contracts and thereof the possibility of termination of contract stimulates behaviour that the bank, the employer, the seller finds desirable. However, it does not stop bank

risk taking behaviour. Rannenberg (2012) posit that banks can collect household's deposits then deliver a fraction of assets and declare bankruptcy a manifest case of information asymmetry. Banks therefore attract deposits from households if expected profitability is sufficiently high such that it has no incentive to divert assets and thus household deposits are safe. Adverse selection theory explains the behaviour of bankers when faced with uncertain credit performance and therefore the incentive to withhold information from the market.

2.5 Empirical Evidence on Bank Fragility

This section explores evidence by researchers on the problem of bank fragility. The evidence available indicates both ex-ante and ex-post problem. Where the problem is identified early, the supervisors take remedial action promptly, however, there are instances when the instability comes as a surprise or after regulatory forbearance.

2.5.1 CAMELS indicators

CAMELS indicators have been the standard for rating commercial banks. It was significant to discuss the indicators then show departure as has been articulated by other researchers. Kerstein and Kozberg (2013) assert that the Federal Reserve and FDIC developed their own methodology to identify distress in the banking sector called CAMELS. Altman et al., (2014), Galil et al., (2018), Makinen et al., (2018), Jing et al., (2018) utilize balance sheet ratios such as, impaired loans to equity and loan loss provisions to gross loans to measure asset quality, in order to measure earnings, the ratio of net interest margin to total asset or total income is utilized, while in measuring liquidity they use net loans to total deposits.

Equity as a ratio of total loans is utilized to measure Capital strength of the institutions. Finally, the log of total asset is utilized as a control variable to measure the impact of

size. It is evident total loans, income from loans, impaired loan portfolio are useful indicators of the condition of commercial banks. Any significant impairment of loan portfolio has consequences on the solvency of the bank. Due to existence of banks of different solvency levels, a lemons problem will be experienced with good banks and bad banks, Akerlof (1970). Loan indicators are also implicit measures in management, earnings indicators and sensitivity to market risk. It is as a result of this evidence that loan ratios form the focus of this study.

Table 2.2: CAMELS Indicators

Capital Adequacy	$\frac{Equity}{\text{Total Assets}}$
Asset Quality	$\frac{\text{Loan Loss provisions}}{\text{Net Interest Revenue}}$ $\frac{\text{Total Loans}}{\text{Total Assets}}$ $\frac{\text{Impaired Loans}}{\text{Gross Loans}}$
Management	$\frac{\text{Operating Expenses}}{\text{Total Assets}}$ $\frac{\text{Interest Expenses}}{Deposits}$
Earnings	Return on Assets (ROA) Return on Equity (ROE) $\frac{Cost}{Income}$
Liquidity	$\frac{\text{Net Loans}}{\text{Deposits \& Short term funding}}$ $\frac{\text{Liquid assets}}{\text{Deposits \& Short term funding}}$
Sensitivity to Market Risk	$\frac{\text{Total Assets}}{\text{Total Sector Assets}}$

Source: Adapted from Roman & Sargu (2013)

2.5.1.1 Capital Adequacy

In bank distress predictive studies, capital adequacy plays a key role in ensuring bank health. Galil et al., (2018), Makinen et al., (2018), Roman et al., (2013), Sarkar et al.,

(2001) argue that Capital acts as a shield which absorbs any losses and shocks and therefore a decline in capital adequacy would be symptomatic of bank's financial difficulties. FRB of Kansas City (2016) argues that thin capital base would provide banks with little room for error. In case of thin capital base, if a bank suffers large loan loss provisions or fraud, the bank may be left with inadequate capital protection. Therefore, if a bank has a high level of problem assets it will require more capital to absorb any losses that may arise.

Makinen et al., (2018) further state that capital is bank's own equity therefore higher capital reserves improve a bank's ability to tolerate financial losses. Gasbarro, Sadguna & Zumwalt (2002) state that higher values of equity reflect greater alignment of owners with the success of the bank. Besides, such high equity stake not only acts as protection to deposits in case of distress but also limits potential bail cost to taxpayers. Wheelock et al., (2000) indicates a negative relationship between equity and total assets as proxy for capital adequacy, the less equity the less protection against loan losses or other declines in assets.

2.5.1.2 Assets (Bank Loans)

Galil et al., (2018) argue that the state and nature of assets can precipitate financial problems and accelerate bank fragility. Consequently, they find that the higher the ratio of loan loss provisions to gross loans or impaired loans to gross loans the poorer the quality of the loan portfolio and therefore a pointer to distress. Makinen et al., (2018) state that higher loan losses are positively associated with bank fragility, due to deteriorating asset quality which endangers bank survival. Asset quality measured as non-performing loans to total loans according to Roman et al.,(2013) is dependent on quality of loans since loans represent a significant percentage of the overall balance

sheet total assets. Therefore, a high ratio of non-performing loans to total assets or total loans means a low-quality asset, Wheelock et al., (2000). Sarkar et al., (2001) argue that asset risk means banks stand a chance of not collecting 100% of loans granted. Impaired loans is the accounting term for non-performing loans according to Iftikhar (2015), who argues that the lower the ratio of impaired loans to gross loans the better the asset quality and vice versa. Consequently, a higher average impaired loan is symptomatic of declining quality of the loan book and possibility of bank distress.

2.5.1.3 Management

Management drive the strategic direction of the institution. It is their ability and skills that plays a crucial role in performance and success of the bank. Galil et al., (2018) contend that if management competence is low, then vulnerability to instability increases and likelihood of inappropriate decision leading to fragility.

2.5.1.4 Earnings

Bank earnings help improve capital and economic performance. Galil et al., (2018) argue that earnings ratio indicate the sustainability of earnings. Besides they indicate a negative relationship between earnings and probability of distress. Net interest margin is defined as the difference between interest income from earning assets mainly loans while interest expense is the cost of deposits. The margin when expressed as a percentage of total assets mainly measures the return on assets from which it earned income Galil et al., (2018). A strong earnings level lowers the probability of distress, Makinen et al., (2018). Besides as argued by Wheelock et al., (2000) with healthy earnings banks will be less likely to fail.

2.5.1.5 Liquidity

The liquidity of a bank is essential in order to meet maturing short-term obligations. A higher loan to deposit ratio implies a higher level of deposits tied up in loans, therefore the less liquid the bank, the higher its risk of distress, Galil et al.,(2018). According to Central Bank of Kenya Prudential Guidelines (2013) the minimum liquidity ratio is set at 20% of the aggregate deposits, matured and short-term liabilities in liquid form. The import of this restriction is that a commercial bank cannot lend one hundred percent (100%) of deposits since 20% of the total deposit liabilities must be set aside as a cushion against maturing obligations as they fall due. Commercial banks that have high loan deposit ratio imply a high level of loan capital. Such capital tends to be unstable, costly and risky compared to demand deposits, savings and term deposits held by a Commercial bank.

2.5.1.6 Sensitivity

In order to measure sensitivity, Jing et al., (2018) utilises net interest income as a ratio of total asset and total securities as a ratio of total assets. This is further indication of use of loan related variables in CAMELS proxy variables.

2.5.2 Loan Ratios and Bank Fragility

Loans play significant part in fragility studies therefore were identified as variables for the study. According to Makinen and Solanko (2018), poor asset quality has a positive association with bank fragility. Whalen and Thomson (1988) argue that non-performing loans are good proxy for asset quality, with asset quality having predictive ability in assessing the solvency of a bank. Growth of indebtedness (loans) by directors, officers and employees (DOE) is considered a red flag. Meyer et al., (1970) state that loans to insiders are riskier than loans to outsiders, with large loans to insiders considered a

pointer to poor management or embezzlement. Sarkar and Sriram (2001) argue that deterioration of asset quality is a risk that indicates that a bank is unlikely to collect 100% of its asset, which means a lower asset quality could lead to greater loan charge off during bad economic times leading to increased chances of insolvency. Since banks are highly leveraged institutions, a combination of higher credit risk, interest rate risk, loan and security losses could easily trigger distress. With bank fragilities the question often asked is "why do banks fail?" Berger et al., (2016). The focus on loan ratios in this study was predicated on the fact that loans constitute the highest percentage of bank assets. Loans are a source of fraud in form of insider loans. Loans cause liquidity risk if the rate of loan default is high. Loans are a source of interest income and therefore high loan default leads to lower profitability or losses, which losses have to be absorbed by bank capital. Therefore, the loan growth ratio, loan quality, loan to deposit ratio and insider loans are significant variables.

Uysal (2013) states that loans and deposits make up about 65% and 80% of banks assets and liabilities respectively; this makes Commercial banks financial statements different from those of other firms. According to Wheelock *et al*., (2000) loans constitute the most illiquid and risky bank assets. Besides, the more concentrated bank assets are in loans the more the possibility of distress. Poghosyan and Cihak (2009) find that asset indicators play an important role in early warning models of bank fragility. Berger *et al*., (2016), analyse the influence of corporate governance characteristics on bank failure. This study follows such departure and therefore looks at the relationship between loan ratios, information asymmetry and bank fragility. According to Ozkan-Gunay et al., (2007) asset quality variables present a better picture of performance with a lower portion of non-performing loans to total loans.

Cole and White (2010) find that banks with better asset quality stand a lower chance of financial distress, with worse asset quality associated with probability of failure. According to Makinen and Solanko (2018) it has been established that better asset quality is negatively correlated with bank fragility. Rauch (2010) examines bank fragility when analysing regulatory and supervisory authorities in the U.S., and bank liquidity indicators a departure from the use of all CAMELS indicators.

Ozkan-Gunay and Ozkan (2007) find that CAMELs is a good method of checking on financial soundness of financial institutions. Rauch (2010) argues that CAMELS scores, which are based on financial statements of entities, have been used by regulators and supervisors over the years, however new techniques like liquidity indicators have been developed. Shen, Chung-Hua & Ting-Hsuan Chen (2014) find liquidity indicators useful tools as early warning indicators of bank distress.

Loans are an integral part in virtually all CAMELS indicators. Besides loans constitute the most significant percentage of total assets, Uysal (2013). Sarkar & Sriram (2001), Ozkan-Gunay and Ozkan (2007) use non-performing loans to primary capital as a measure of capital adequacy and state that capital adequacy is useful for survival because capital absorbs losses. Tatom & Houston (2011), Zaghdoudi (2013), End (2016) measure liquidity indicators using total credit to total deposits. When a bank issues loans, borrowers pay interest, which is bank revenue. When the borrowers' default, the interest income is lost. Besides when periodic repayment of principal stops banks face a liquidity crunch.

2.5.2.1 Bank Fragility

Boudriga, Taktak and Jellouli (2009) argue that aggregate rate of NPL is a frequently used measure of bank soundness. Further they state that NPLs are a major problem

for both local and international regulators and whereas aggregate NPLs exhibit wide disparities between countries, some suffer severely with rates greater than fifteen (15%) percent. Creel et al., (2021) find the ratio of NPL to gross loans a good warning signal for systemic banking crisis. High levels of NPL constrain bank capital limiting the institution's ability to increase lending.

A number of researchers including Demirguc-Kunt (1989), Whalen (1991) find asset quality as a predictor of bank failures. Fofack (2005) states that incidences of banking crises is frequently associated with a huge build-up of non-performing loans. Further non-performing loans account for a sizeable percentage of total assets of distressed financial institutions. Fofack (2005) states that the banking crises that affected most sub-Saharan African countries was precipitated by an accumulation of nonperforming loans.

2.5.2.2 Loan Growth Ratio and Bank Fragility

Lu *and* Whidbee (2016) state that excessive loan growth rate is related to high likelihood of distress. Iftikhar (2015) finds loan growth as a significant cause of bank riskiness. Essentially, at the peak of a boom, rapid loan growth is a predictor of bank fragility. According to Rauch (2010), the higher the loan growth the higher the probability that the banks have started accepting loans from less creditworthy borrowers and therefore the higher loan charge off and probability of failure. Jones, Lee and Yeager (2011) find that managers of financial institutions with deteriorating credit quality can postpone disclosure to the market and increase loan volume, which generates profitable upfront fees and improves the bank's income. However, due to the fact that it is not easy to see inside banks, when earnings dip, banks tighten credit policy and decrease loan volume. Messai and Gallali (2015) find that during

expansion phase banks take on more risks through uncontrolled lending activities without considering the quality of individual loans. Such loans are prime candidates of impairment during economic downturn thereby exposing the bank to insolvency. Altunbas, Manganelli and Marques-Ibanez (2015) concur and state that aggressive loan growth and excessive reliance on short term funding point to accumulation of risk.

Jin, Kanagaretnam and Lobo (2018) find a positive association between higher loan growth rates and bank fragility. Logan (2001) also finds that the failure of Bank of Credit and Commerce International SA (BCCI) was due to among other reasons, dependency on net interest income, low loan growth and low profitability. Logan (2001) argues that when there is fast loan growth, concentrations occur, appraisal standards may become weaker, and may be financed by more volatile funding sources. Following this sequence loan quality problems start, profits decline, and inadequate provision levels start to surface. These factors eventually lead the bank to distress.

2.5.2.3 Insider loans and Bank Fragility

The Banking Act and Central Bank of Kenya Prudential Guidelines (2013) limit borrowings by a single insider to twenty percent (20%) of the bank's core capital. Besides, in aggregate credit facilities to all insider is capped at 100% of core capital. These prohibitions ensure that facilities to insider are limited to owner's capital component and therefore limit the level of depositors' funds that may be misapplied by directors, management and staff and their related associates. Brownbridge (1998a) finds that the most significant contributor to bad debts of the failed banks in Kenya, Nigeria, Uganda and Zambia was insider lending. Insider loans accounted for 65% of

the total loans of four banks liquidated in Nigeria in 1995, and almost half of the loan portfolio of a bank taken over by Bank of Uganda.

2.5.2.4 Loan Quality and Bank Fragility

Logan (2001) states that management should diversify into other types of businesses to earn fees, commissions or trading income. However, this is in contrast to DeYoung *et al*., (2013) who show that non-traditional banking activities contribute significantly to probability of bank failure.

DeYoung *et al*., (2013) find that net interest income is the most traditional source of bank income. Besides, the probability of a bank failing declines with increase in net interest income. A declining net interest income can result from poor loan quality and also increase in interest expense. An increase in interest expense means the sources of deposit are expensive thereby undermining the return from interest on loans.

Clancy and Zhao (1999) show performance of a bank in the intermediation function is determined by its efficiency. Failing banks tend to pay higher interest rates in order to attract deposits and earn lower returns on loans due to high levels of underperforming assets. High level of non-performing loans is therefore a pointer to poor loan quality. Lu *et al*., (2016) affirm that non-performing loans increase the likelihood of failure. According to Cebula (2010) the worse the performance of the bank's loan portfolio the greater the likelihood of bank closures. A declining net interest income could lead banks into other risky businesses in order for them to generate non-interest income and satisfy the various stakeholders' demands. Basu (2003) however, points out that credit standard requirements protect banks from failure. A credit standard is simply substitute means of payment that a bank demands prior to advancing loans, it is a fallback position in case the original source of

repayment is adversely affected. Dependency on net interest income is a pointer to lack of functional diversification that could lead to distress. Jin, Kanagaretnam & Lobo (2018) find net interest margin as a key performance indicator of a bank's lending business. Net interest margin variability may signal volatile bank performance showing a riskier strategy by the bank, which may lead to more uncertain interest margin with a negative impact on solvency.

2.5.2.5 Loan Deposit Ratio and Bank Fragility

Kazandjieva-Yordanova (2017) argues that deposits attracted by banks are a stable source of funding. In the circumstances, banks should be advised to cover their lending by resources attracted as deposits. Berg (2012) assert that regulatory authorities normally advise banks to fund their credit portfolio using customer deposits to avoid a liquidity crunch. The argument is premised on the fact that market funding has negative impact on financial stability as these funds tend to be less stable. Market funding tends to expose banks to external vulnerabilities. Berg (2012) further argues that whenever a bank grants a loan to its customer, a corresponding amount is moved to a deposit account, which supports credit creation theory. Kazandjieva-Yordanova (2017) summarizes that losses of distressed small banks are borne by the uninsured depositors and investors who have advanced loan capital to the bank.

Berg (2012) states that during the run up to the Norwegian banking crisis of 1990-92 the LDR declined from 100% to 60%; then rose to 80% but then declined from 1995 to 50% by 2012. According to Disalvo & Johnston (2017), LDR is a measure that a bank has inadequate liquid assets to cover a sudden loss of funding. Therefore, LDR is monitored as a measure of liquidity, a bank which finds itself with few deposits to fund loans must rely on non-deposit sources whose availability and prices are much

more sensitive to changing economic and financial conditions. In a situation where non deposit funding become too expensive, the bank will be under no obligation to renew borrowers' loans and this will be a set back to its funding ability and will possibly weaken the banks stability and thereafter its viability as a going concern. Therefore, LDRs are closely related to banks financial health.

End (2016) states that LDR is an indicator of liquidity mismatch risk and therefore when loans exceed deposit base the funding gap has to be met through access of funds in the financial markets. Generally, banks with high LDR which are above average are likely to be risky, their lending is probably aggressive and with lower credit appraisal standards. A number of regulators therefore consider LDR of about 80% to be normal. However, as argued by End (2016), on multiple country analysis, LDR over 120% is an early indicator of banking crisis and an LDR of 80% is associated with impaired financial intermediation.

End (2016) summarises that a high LDR is linked to high volatility since a high funding gap makes the business of banks more sensitive to market fluctuations.

Therefore, an expansion of non-deposit funding raises the LDR. A decrease in LDR will be influenced by deposits since loan book tends to have on average longer maturity and therefore cannot be easily adjusted by banks. Cucinelli (2015) finds that lower level of the ratio of loans to deposits represents a lower dependence on wholesale funding which means that the bank is less market constrained in its asset growth. Momparler, Carmona and Climent (2016) also find that the higher the net loan to deposits the higher the chance of future financial distress. In a study conducted by Wood and Skinner (2018) on commercial banks in Barbados, they found LDR to have a significant effect on non-performing loans; ultimately increase in LDR leads

to aggressive lending resulting in setting aside funds to low quality borrowers thereby increasing the riskiness of the loan portfolio and thus pointer to bank distress.

Arnould (1985) confirm LDR as a measure to be significant confirming agency cost theory. It therefore follows that managers will grant loans to generate additional income of which they will benefit in form of managerial compensation. LDR may show the structural model of funding between retail and wholesale funding, of which regulators need to devise a long-term trend. End (2016) argues that this will ensure the banking industry functions well and avoid excessive funding risks or impaired intermediation. End (2016) further avers that there is need to prescribe lower and upper limits LDR and shows that China imposed upper limit of 75% for her banks.

An upper limit can help avoid mismatches between loans and stable funding and help check a build-up of systemic risks in the banking system. Bologna (2015) finds empirical evidence that the chance of bank default increases with the level of LDR.

Therefore, the extent of the stability of deposits plays a part in bank defaults. Galil, Samuel and Shapir (2018) indicate the ratio of net loan to total deposits reflect how much deposits are held up in loans. They find that the higher the ratio the less liquid the bank and the higher the chances of distress risk. However, Disalvo et al; (2017) contend that the larger the bank the higher the LDR due to economies of scale. Besides larger banks tend to have a greater access to funds than the small and medium banks.

2.5.2.6 Information Asymmetry and Bank Fragility

Cressy and Otto (2001) argue that bank managers utilise quantitative customer information to categorise entrepreneurs, this identification and categorization can discriminate customers. Further, they argue that not much is known about the structure

of real-world credit contracts or the nature of the underlying informational regime in which they are predicated.

Claus and Grimes (2003), show that information asymmetry arise between borrowers and lenders because the borrowers normally have more information about their investment projects than the lenders. Information asymmetry in such cases can arise ex-ante or ex post, the former when lenders can not differentiate borrowers with different credit risks before providing loans and lead to adverse selection problem or ex-post when only borrowers are able to observe actual returns after project implementation. James (1991) finds that the loss on assets for distressed banks is around 30% with direct expenses related to bank closures being around 10% of assets. James (1991) argues that the significant costs are partly because of information asymmetry between the bank and other market participants concerning the quality of bank assets, a lemons problem.

According to Basu (2003), banks grant loans in the absence of accurate knowledge in relation to the outcome of the borrowers' investment projects. This creates uncertainly in ability of the borrowers to repay the loans. In this situation there is imbalance in information between the two parties that is the bank and the borrower. The uncertainty emanates from the presence of hidden information because the bank is unable to tell the borrowers risk appetite. Therefore, financial intermediaries that specialise in collecting information, evaluating projects and monitoring borrowers can help overcome information problems. Basu (2003) argues that the main reason of bank runs is information asymmetry between banks and depositors. Depositors unable to discern whether an individual bank is solvent or insolvent but can observe the impact

of the shock on the bank's portfolio, this observation triggers a run on banks leading to its failure.

Mishkin (1991) argues that borrowers have information advantage over lenders because borrowers are more familiar with their investment projects. A lemons problem according to Mishkin (1991) happens in debt markets when lenders have trouble distinguishing a good borrower from a bad one. If a lender is unable to set part the borrowers of good quality and bad quality, he will only lend at an interest rate that reflects the average of the good and bad borrowers. High quality borrowers, therefore, pay a higher interest rate than they should because low quality borrowers pay a lower interest rate than they should. Lenders reduce the adverse selection problem in the debt market by taking security to cover loans. Consequently, if borrowers' default on the loans, the lender can take the title to the collateral, sell it to make up the loss.

Leland and Pyle (1977), suggest that borrowers know their collateral, industriousness and moral rectitude better than lenders; entrepreneurs possess inside information about their own projects for which they seek financing. Lenders would therefore benefit by knowing the true characteristic of borrowers. The lemon's problem analysis indicates that the increased importance of adverse selection will lead to a decline in lending and therefore a decline in investment and aggregate economic activity. Kanagaretnam et al.,(2010) state that managers have an incentive to manage earnings due to expectation to beat benchmarks set, avoid small losses, meet or even beat prior year's earnings. Richardson (2000) posits that when there is high information asymmetry stakeholders do not have the necessary information to disentangle the managed earnings, which tends to hide problems in an industry.

The more the level of earnings management the greater the level of information asymmetry, consequently stakeholders may not get the information necessary to undo the earning management. Richardson (2000) further argues that existence of firms with high levels of information asymmetry is evidence of shareholders without resources sufficient enough, lack of incentives and access to relevant information to monitor managers' actions, which may give rise to the practice of earnings management. Depositors are stakeholders that may lack the necessary resources to monitor managers and therefore they may depend on the regulatory authorities' supervision of banks. According to Lee and Masulis (2009) managers have better internal sources of information. Therefore, poor quality accounting information increases uncertainty about a firm's true financial condition for outside investors.

The holder of asymmetric information exploits the less informed party. Such pretentious behaviour may lead to market failures with huge impact, thereby destroying any profitable opportunities afforded by competitive markets. This scenario obtains in the banking industry where management and employees possess more information than other bank stakeholders like shareholders, customers, and suppliers and therefore withhold adverse information on the bank to external stakeholders. Calomiris and Gorton (1991), Mishkin (1991) and Gorton (2009) suggest that there is clear evidence that asymmetric information plays a critical role in bank crises.

In summary, bank supervisory authorities can effectively improve the quality of bank management by emphasizing upon sound loan and investment policies as well as by the detection of fraudulent and illegal practices through both on and off-site methods. An attempt to prevent distress by encouraging development of banks of larger size

cannot in itself be expected to be particularly beneficial. Besides, lax supervision of banks because of inadequate banking laws and underpaid, overworked and inefficient examiners, stockholders' equity as a necessary feature of sound banking have also been shown as causes of bank distress. The supervisory authorities must utilise tested methodologies of distress measures and supplement the same with in-depth onsite visits due to the nature of information asymmetry.

2.6 Control Variable

Becker, Atinc, Breaugh, Carlson, Edwards and Spector (2016) argue that control variables are useful in testing and providing accurate relationships among variables. However, they caution that control variables incorporated wrongly could produce results that cannot be interpreted. Becker et al., (2016) provide guidance on the use of control variables, arguing that researchers must justify the measures and methods of controls, that results should be compared before and after incorporating control variables. Further they state that an explanation must be provided how each control variable was measured and why it was measured in the manner the researcher applied it. In this research the control variable was bank size measured by total assets.

2.6.1 Bank Size

Asongu et al., (2018) argue that bank size controls for potential abuse of market power and reliance on Too-Big-To-Fail (TBTF) principle. Ioannou, Wojcik, and Dymski (2019) state that the TBTF is a threat to the integrity of the financial system. An institution grows too large to the extent its failure would hugely impact the national economy. As argued by Nurisso and Prescott (2017), size matters in bank distress studies. According to Nurisso eta al., (2017) regulators apply the essentiality doctrine which holds that commercial bank are essentially in the business of providing services

in the community, the reason TBTF applies to large banks whose distress can have serious consequences on the economy.

Aharony and Swary (1983), utilised the total deposits to measure size of a bank while Logan (2001), Shaffer (2012), Lu et al., (2013) use total assets to measure size. Wheelock and Wilson (2000) and Papanikolaou (2018) use log of total assets as a measure of size. Kedir et al., (2018) use log of total assets to measure size and state that big size banks are capable of managing credit risk and have adequate resources to deal with credit facility defaulters. Iqbal, Strobl and Vahamaa (2015) find that the most important control variable when comparing financial institutions is size, which is measured using logarithm of total assets. However, Shaffer argues that the use of total assets shows the decline of too big to fail principle. Therefore, Commercial bank size has implications for distress. Wheelock et al., state that small banks may be more susceptible to distress. With big size it is assumed the bank will enjoy economies of scale, reduce risk through diversification and therefore reduce chances of fragility.

Zhang, Cai, Dickinson and Kutan (2016) discuss bank size as an important factor in NPLs since large banks tend to have the implicit Too Big To Fail (TBTF) implicit insurance against failure, which signifies a positive correlation between size and level of NPLs. This study adopted Shaffer (2012) who used total assets as a measure of size.

2.7 Conceptual Framework

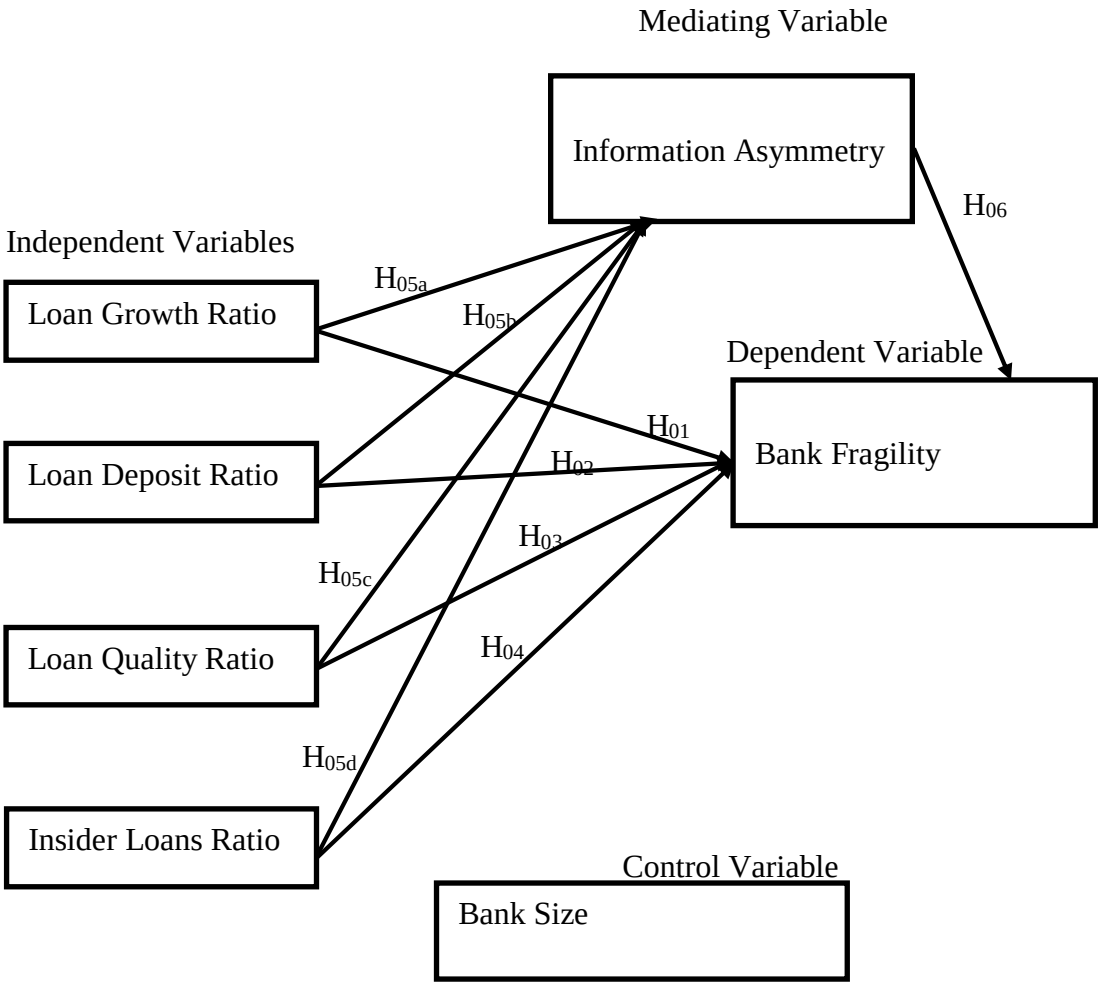

Figure 2.1: Conceptual Framework

Source: Researcher, 2021.

The schematic diagram of the conceptual framework is predicated upon arguments by Baron and Kenny (1986); Preacher and Hayes (2004); Wu *et al*., (2008); MacKinnon *et al*., (2012) and Hayes & Preacher (2014).

The argument for mediation is that there is need to understand what bridges the causal relationship and what alters the causal relationship. According to Wu et al., (2008) a mediator will enable a deeper and more refined understanding of the causal relationship between the predictor and predicted variable.

Baron et al., (1986), Preacher eta al (2004), Wu et al., (2008), Mackinnon et al., (2012) and Hayes et al., (2014) state that the independent variable is presumed to cause the mediator and in turn the mediator causes the response variable. Zhao, Lynch and Chen (2010) have criticised the Baron-Kenny procedure for causing authors with promising projects and journals from rejecting deserving publications. They criticise Baron-Kenny requirement that mediation is strongest when there is an indirect effect but no direct effect in the equation $Y = i_3 + cX + bM + e_3$. They state that it is the strength of mediation measured by size of indirect effect and not the lack of direct effect which matters. Two, they state that there need not be a significant effect to be mediated as given in the equation, $Y = i_2 + c'X + e_2$. The requirement should be that the indirect effect a x b be significant to establish mediation.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter explores the study area and methodological issues. The chapter is organised in the following sections: section 3.1 provides the study area, section 3.2 and 3.3 explain the research philosophy and design respectively. Section 3.4 shows the target population while section 3.5 discusses the data types, sources and collection procedures. Section 3.6 and 3.7 discuss data analysis and missing data procedures respectively. Section 3.8 and 3.9 review the model assumption and diagnostic tests. Section 3.10 and 3.11 discuss variable measurements and ethical considerations respectively. The chapter concludes with a summary of hypotheses tests.

3.1 Area of Study

The study was conducted in Kenya. The study tracked the descriptive statistics for period of study 2005-2015 to have a better and objective view of the banking industry's fragility variables over a longer time. The population for the study was forty-two Commercial banks in Kenya. In the study period, six (6) financial institutions as shown in appendix 1 were distressed and are currently under management of the KDIC. The six institutions were Daima Bank Ltd closed in 2005, Prudential Building Society Ltd distressed in 2005 and Charterhouse Bank closed in 2006, Dubai Bank Ltd and Imperial Bank Ltd failed in 2015 while Chase Bank Ltd failed in 2016 during analysis of data and was therefore included in the study of distressed institutions. The banks distressed in 2005 and 2006 did not comprise part of the population as the institutions collapsed at the start of the study period. There were thirty-nine commercial banks in operation in 2015 as indicated in appendix 2.

3.2 Research Philosophy

The research philosophy adopted was epistemology, which according to Saunders *et al.,* (2009) relates to the development of knowledge and the nature of that knowledge. The choice of epistemology was therefore based on deriving some logical conclusions from the research and knowledge claim. This study was underpinned by positivism. Bryman (2012) states that positivism is an epistemological position that advocates the application of natural sciences to study social reality and beyond. Saunders *et al*., (2009) on the other hand state that when research reflects positivism it means working with an observable social reality and that the end product can be law like generalizations. Positivism approach for this research entailed measurement, hypothesis testing and ability to explain predicted results.

According to Smith, Thorpe and Jackson (2012), with positivism, hypothesis can be derived from existing theory and literature, data collected, analysed and tested to either accept or reject the hypotheses. This approach helps evaluate the study problem and objectives and contribute to knowledge. The explanations indicate the causal relationships between different variables and how they relate to the theory and the study. Further a positivist approach defines the variables and how they are measured and the statistical probability. Besides, it justifies the sampling techniques, specifies the unit of analysis, indicates the data collection process, who and how it was collected and recorded and finally in what ways the results add to existing theories.

3.3 Research Design

Research design is a plan on how to collect the data, analyse and from the resultant information answer the relevant research questions in the study. Bryman (2012) shows that a research design provides a framework for the collection and analysis of data.

Research design shows the importance given to causal relationship among variables and the generalisations to larger groups from the sample. The research design helps one understand behaviour and meaning and also temporal appreciation of social phenomena and interconnection. The research design in this study was explanatory research. Saunders *et al*., (2009), Adams, Khan, Raeside and White (2007) and Bhattacherjee (2012) argue that explanatory research seeks to establish causal relationships between variables, seeks explanation of observed phenomena, problems or behaviours and aims at advancing knowledge about structure, process and nature of social events. It is suitable where a researcher wants to probe, explore or find insights into a subject area. Therefore, using explanatory research design the researcher was able to test the direct and indirect effect of the predictor and mediating variable on the dependent variable.

3.4 Target Population

Target population according to Welman *et al*., (2001) is the population in which the researcher would ideally like to generalise the results. The target population of this research was forty-two (42) commercial banks as shown in appendix 2 and summarized in Table 3.1. With a target population of forty-two commercial banks over 11-year period, it was expected that would give cumulative four hundred and sixty-two firm years of data. However, the descriptive statistics for period 2005-2015 had a cumulative of 424 firm years due to differences in dates of licensing of institutions, and effect of mergers and acquisitions. Besides data available for the three distressed banks did not extend to 2015. The financial statements for Chase Bank Ltd for 2015 could not be relied on following discovery of inaccurate insider loans disclosures.

Table 3.1: Target Population

Data Period	Population	Number of years	Data Years
2005-2015	42	11	462

***Excludes Charterhouse Bank under statutory management since 2006.**

Source: Researcher, 2021.

The study did not extend data collection to 2016 and 2017 financial year as such data was unavailable for distressed banks. Besides, the Banking (Amendment) Act of 2016, which introduced interest rate caps in Kenya in September 2016, could have had an impact on banks in operation yet Chase bank distress in 2016 occurred before interest rate controls. Consequently, useful data was for period before distress.

In this study a census was adopted. The one hundred per cent (100%) sample size was predicated upon the fact that the size was small. The general idea in a census is to collect information on all eligible elements in a defined population. According to Bryman (2012), a census study is justified if the entire population is very small. Further, the data is to be gathered on every member of the population. Kolari *et al*., (2002) used a sample of fifty (50) large failed banks, which they considered a small sample for early warning system. The data for this study therefore fits the small sample description.

3.5. Data Types, Sources and Collection procedures

The data was collected from Central Bank of Kenya's repository of audited annual financial statements of commercial banks. The study period was 2005 to 2015. Banks that ceased to exist due to mergers and acquisition or were licensed in 2015 or thereafter were excluded from the study. In this category were the following banks, Giro Commercial Bank that was acquired in 2017 by I & M Bank. Besides, Fidelity Commercial Bank Ltd acquired by SBM Bank of Mauritius in 2017 was excluded.

Habib Bank Ltd was acquired in 2017 by Diamond Trust Bank Kenya Ltd and therefore according to Central Bank of Kenya, ceased to be a bank on 1st August 2017. Where a merger occurred in the period of interest 2005-2015, the bank that lost her identity was dropped from the analysis. Besides, the analysis of the merged entity commenced the first full year of operation after the combination. Fidelity Commercial Bank Ltd, Giro Commercial Bank Ltd and Habib Bank Ltd were excluded as they had ceased to exist at the time of data collection and analysis in 2018.

According to CBK the following mergers occurred in the period 2000-2017, Universal Bank and Paramount Bank merged on 11th January 2000, therefore full year analysis was 2005; Citibank and ABN –AMRO merged on 16th October 2001, therefore analysis commenced 2005; Biashara Bank Ltd merged with Investments & Mortgage Bank Ltd on 1st December 2002 to form I & M Bank therefore analysis period adopted was 2005 – 2015. First American Bank Ltd and Commercial Bank of Africa Ltd merged on 1st July 2005 to form CBA Ltd, analysis period was therefore 2006 – 2015; CFC Bank Ltd merged with Stanbic Bank on 1st June 2008, analysis period 2009 – 2015. Equatorial Commercial Bank and Southern Credit banking Corporation Ltd merged on 1st June 2010 to form Equatorial Commercial Bank Ltd. Though Equatorial Commercial Bank Ltd was later acquired by Mwalimu Sacco society Ltd on 13th December 2014, the entity maintained its identity therefore the analysis period was 2011- 2015; however, the entity did not meet the minimum 5-year data for computation of impact of mediating variable on loan ratios therefore it was excluded from analysis.

Ecobank acquired EABS Bank Ltd on 16th June 2008 to form Ecobank Bank Ltd, therefore analysis period was 2009-2015. On 30th April 2004 Bank of Africa Kenya

Ltd acquired Credit Agricole Indosuez (K) Ltd to form Bank of Africa, analysis period was therefore 2005 to 2015. Whereas Centum Ltd acquired K-Rep on 29th October 2014 and the bank later changed their name to Sidian Bank Ltd, this change of ownership was inconsequential and therefore analysis period remained 2005 to 2015. Lastly, City Finance merged with Jamii Bora Bank Kenya Ltd to form Jamii Bora Bank Ltd on 11th February 2010; the analysis of this bank was 2011 to 2015. Where a bank merged with its subsidiary, this was assumed to be group re-organisation and therefore the date the bank was licensed to operate was taken as start date of the analysis, if the date or reorganisation or license was earlier than 2000, then the analysis date was assumed to be financial year 2005.

3.5.1 Banks Excluded from Inferential Analysis

The inferential analysis period was 2010-2014 which excluded 2015 since that is the year two banks were distressed. Further, the analysis in this segment was carried out after excluding Victoria Commercial Bank that had zero non-performing loans for the period 2009 to 2015. Besides UBA bank was excluded due to the fact the bank had zero non-performing loans for 2009- 2010 and had zero loans outstanding for year 2009. Besides, the two (2) non-bank financial institutions distressed in the period 2005-2006 were excluded as the study focused on Commercial bank fragility. Banks that did not meet the five-year threshold for data analysis were excluded. Consistent with DeYoung et al., (2013), commercial banks with less than five (5) years of operation were excluded, Spire Commercial Bank and Jamii Bora Bank fell in this group. The two banks that carry on business of Islamic banking that is First Community Bank and Gulf African Bank were excluded.

Fidelity Commercial Bank, Giro Commercial Bank and Habib Bank Ltd were excluded following their acquisition in 2017. Banks operating as branches of foreign banks were also excluded, these were, Citibank N.A., Bank of India and Habib Bank AG Zurich.

Table 3.2: Summary of Exclusion Criteria

CENSUS	**42**
Less: Islamic Banks	2
Less: Banks with zero NPL or Zero Outstanding Loans	2
Less: Banks with less than 5-years data	2
Less: Merged banks up to 2017.	3
Less: Branches of foreign banks	3
Total Banks for Data Analysis 2010-2014	**30**

Source: Research Data, 2021.

According to Logan (2001) analysis of branches and subsidiaries of foreign banks is normally complicated by the fact that they are affected by events happening to the parent bank abroad. DeYoung et al., (2013) excluded banks with more than 50% foreign ownership, loans less than 25% of their total assets and banks with no deposit financing and which had been in operation for less than three (3) years from analysis of traditional banking activities and relationship with bank failure. Therefore, the study exclusion criteria were consistent with Logan (2010) and DeYoung et al (2013).

3.5.2 Data Sources and Collection Procedures

Dawson (2002) states that secondary data involves the collection of information from studies that other researchers have made. Saunders *et al*., (2009), state that secondary data is data that has already been collected for other purposes. This secondary data may include raw data and published summaries. In this research, data was collected from CBK using a data collection checklist guide shown in appendix 3 to ensure accuracy.

The data was keyed into a data collection tool checklist guide (excel spreadsheet) prepared by the researcher. This helped with speed of data collection. The researcher undertook data input at the Central Bank of Kenya offices. The researcher then recruited two research assistants who were university students proficient in Microsoft excel. The two helped to check data input accuracy using the original source documents. The reason for recruitment of university students was they understood reasons for accuracy and ethics in research. The data was confirmed for accuracy before computations were made. Thereafter the computed variables were exported to Stata 13 for analysis.

3.6 Data Analysis

Data analysis was undertaken in two stages; the period 2005-2015 tracked the variables and then a period close to distress event being 2010-2014 for inferential statistics; it is this period that was used to test for mediation. Since Dubai Bank and Imperial Bank were distressed in 2015, while the financial statements for Chase Bank for 2015 could not be relied upon it was imperative to conduct inferential statistics up to 2014 before the distress events. The 5-year period 2010-2014 was analysed by conducting diagnostic tests, correlation analysis, Hausman test, Generalized Linear Model (GLM) regression analysis, Baron-Kenny four-step approach and finally impact of mediating variable using Sobel test. The period 2010-2014 forms the bedrock of inferential analysis. Grodecka, Kenny and Ogren (2018) argue that in order to test the power of bank's balance sheet characteristics as predictors of the past, it is imperative to consider a time period that is arguably close to the crisis event.

3.6.1 Correlational Analysis.

Correlational analysis was conducted to establish if an association existed between the variables and the extent of the relationship. Brooks (2008), the correlation between two variables measures the degree of linear association, however, the extent is known using correlation coefficient. According to Ross, Westerfield, and Jaffe (2013), correlation coefficient can in principle vary between 1 to +1; with -1 being perfectly negatively correlated which means the variables move in opposite direction and +1 being perfectly positively meaning the variables move in the same direction.

3.6.2 Regression Analysis

The researcher used autoregressive model to test the study model. Autoregressive model in this study was found appropriate because it shows the path of the dependent variable. Gujarati et al., (2009) argue that the dependent variable responds to the independent variables with a lapse of time. Consequently, since bank fragility is a consequence of long-term loan growth, loan deposit ratio, loan quality and insider loans, lagged bank fragility was a useful additional variable. According to Keele & Kelly (2006), Wilkins (2018), the use of lagged dependent variable is part of robust estimation strategy. Besides, it is a strategy to eliminate autocorrelation in the residuals. Keele et al., (2006) argued against the use of lagged independent variables as they would be highly collinear and would lead to imprecise estimates of betas. For this study only the dependent variable was lagged. Baltagi (2005) states that dynamic relationships require the presence of lagged dependent variables among the independent variables of the model.

Multiple regression analysis was considered ideal in establishing if a relationship existed between variables. The equation was specified as follows:

$$g\left(E\left(Y\middle|X_1, X_{2,} \ldots X_P, M\right)\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_K X_K + \gamma M$$

The variables were defined as follows:

Y denotes Y_{BFit} = Bank Fragility for i^{th} firm in t^{th} year

β = intercept for each entity

β_1 to β_k= Coefficient of independent variables

i = 1, 2, ……. 30 (Individual banks)

t = 1, 2, 3, ……..5 (time indicator)

The independent variables were defined as X_1 to X_K as shown below:

lagged bf_{it}= lagged dependent variable for firm i in year t

lg_{it}= Loan growth ratio for firm i in year t

ldr_{it} = Loan Deposit Ratio for firm i in year t

lq_{it} = Loan quality ratio for firm i in year t

il_{it}= Insider Loans ratio for firm i in year t

M_{it}=mediating variable for firm i in year t

3.6.2.1 Generalised Linear Model (GLM)

Osborne (2010) states that many statistical analyses assume variables are normally distributed. Statistical analysis also assumes homoscedasticity of variances. However, as argued by Bishara & Hittner (2015), non-normal data is common in social sciences and therefore need to transform data. Olivier & Norberg (2010) state that researchers should transform such data to approximately normal.

The diagnostic tests carried out using Shapiro-Wilk W test and White's test show research data failed the normality and homoscedasticity OLS test respectively, a violation of regression assumptions which are required for valid inferences. As argued by Olivier et al., (2010) response variable may be transformed to improve linearity and homogeneity of variables to enable application of linear model. However, in transforming, the variable will have changed, and the transformation may not be defined on the boundaries of the sample space. Osborne (2010) argued that data transformation introduces complexity in substantive interpretation of results. The complexity arises due to changes in the nature of the variables following transformation. Lo and Andrews (2015) further argue that log and inverse transformations distort the ratio scale properties of measured variables. Consequently, the researcher, used the Generalized Linear Model.

The GLM is preferable where variables show non-normality. The assumptions underlying GLM state that the data Y_1, Y_2, …. Y_n are independently distributed, the dependent variable Y_1 does not need to be normally distributed but assumes a distribution from the exponential family, does not assume a linear relationship between dependent and independent variables but assumes a linear relationship between the transformed response in terms of the link function. Besides, the independent variable can take on power terms or some non-linear transformation, the homogeneity of variances does not need to be satisfied, errors need to be independent but not normally distributed.

Generalised Linear Model (GLM) was specified as follows:

$$g\left(E\left(Y\middle|X_1, X_2, \ldots X_P, M\right)\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_K X_K + \gamma M$$

Where X_1, X_2, X_K represent the independent variables $lagbf_{t-1}$, Lg_{it}, ldr_{it}, lq_{it}, il_{it} while M represents the mediating variable.

Agresti (2013) considers ordinary regression models for continuous responses as a special case of Generalized Linear Models that assume normal distribution for the dependent variable Y and model its mean directly using identity link function. Agresti (2013), Fox (2008) and Preacher (2015) state that Generalized Linear Models (GLM) consist of three components, the random part specifying the conditional distribution of the dependent variable, Y_i given the values of the predictor variables, a second one being linear predictor of the form $\eta_i = \alpha + \beta_1 X_{i1} + \beta_2 X_{i2} + \ldots\ldots \beta_K X_{iK,}$ the third being the smooth and invertible linearizing function g(.) which transforms the expectations of the response variable, $\mu i \equiv E(Yi)$, to the linear predictor: $g(\mu i) = \eta_i = \alpha + \beta_1 X_{i1} + \beta_2 X_{i2} + \ldots\ldots \beta_K X_{iK.}$ The function g is the link function, it specifies the link between random and systematic components.

The GLM is an exponential family which includes Gaussian, Binomial, Poisson, gamma and inverse Gaussian. According to Preacher (2015) GLM represents a unified family of models that can accommodate violations of normality and heteroscedasticity. GLM accommodates such outcomes in median analysis. The range of Y_i for the exponential is such that Gaussian ranges from negative infinite to positive infinite, Binomial from zero to n_i, Poisson from 0, 1, 2, …. , Gamma from 0 to infinite, while Gaussian inverse ranges from zero to infinite.

The basis for GLM was established and therefore which member of the exponential family to adopt was the next decision. The research data ranges from negative to positive numbers satisfying continuous classification and therefore Gaussian exponential family with identity function was the most appropriate. Fox (2008) states

that the main advantage of gaussian method is the assumption that after data adjustment the error is normally distributed, and the variance is constant.

3.6.2.2 Mediation Effect with Generalized Linear Regression Models

Schluchter (2008) states that the regression coefficient of independent variable (X) on dependent variable (Y) not adjusting for the mediator (M) gives the total effect, which can be separated into the sum of the direct effect coefficient of X on Y adjusting for M, which is the indirect effect. The purpose of this study was to make inferences about the magnitude of the indirect effect.

$$g\left(E\left(Y\middle|X_1, X_{2,} \ldots X_P, M\right)\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_K X_K + \gamma M$$

The function g of the conditional mean of Y given the X variables and or the M-variable was expressed as a linear function of independent variables.

$$g\left(E\left(Y\middle|X_1, X_{2,} \ldots X_P\right)\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_K X_K$$

The coefficient β represents the direct effect of X_1 on Y that is the effect of X_1 on Y that is not through M. The researcher used Baron et al., (1986) four step approach and Sobel test to investigate the mediation effect.

3.6.2.3 Baron Four Step model

The model was to test for effect of loan ratios on fragility then test of information asymmetry as a mediator between loan ratios and fragility. According to Baron *et al*., (1986) to test for mediation three regression equations should be run, the first is to regress the mediator on the explanatory variables, the second regression should be the dependent variable on the regressor variables, and the third regression is the dependent variable on both the predictor variable and the mediator variable. It is the case that, the three regressions test the linkages of the mediation model that the predictor

variable affects the mediator, the predictor variable affects the regressand and in the last equation, mediator must affect the dependent variable. Hayes (2009) confirms the popularity of Baron and Kenny method for simplicity. GLM regressions suitably mirrored the four-step model indicated below.

Baron et al., (1986) four step Mediation Testing Model:

Step 1: $Y_{BFit} = \alpha + \beta_1 Y_{BFit-1} + \beta_2 lg_{it} + \beta_3 ldr_{it} + \beta_4 lq_{it} + \beta_5 il_{it} + \varepsilon_{it}$

Shows the direct effect of X on Y, path c.

Step 2: $MV_{it} = \alpha + \beta_1 Y_{BFit-1} + \beta_2 lg_{it} + \beta_3 ldr_{it} + \beta_4 lq_{it} + \beta_5 il_{it} + \varepsilon_{it}$

This step shows the effect of X on M, path a

Step 3: $Y_{BFit} = \alpha + \beta_6 MV_{it} + \varepsilon_{it}$

The effect of M on Y was investigated using this regression, path b.

Step 4: $Y_{BFit} = \alpha + \beta_1 Y_{BFit-1} + \beta_2 lg_{it} + \beta_3 ldr_{it} + \beta_4 lq_{it} + \beta_5 il_{it} + \beta_6 Mv_{it} + \varepsilon_{it}$

The combined effect of X and M on Y- path C'.

The four regressions investigated the indirect effect of X on Y via the mediator (M).

The regression analysis was to establish the effect of independent variables and the mediator, independent and the dependent variable, and the effect of independent variables, mediating variable and dependent variable consistent with Baron *et al*., (1986), Hayes & Preacher (2013), MacKinnon et al., (2012) testing for mediation.

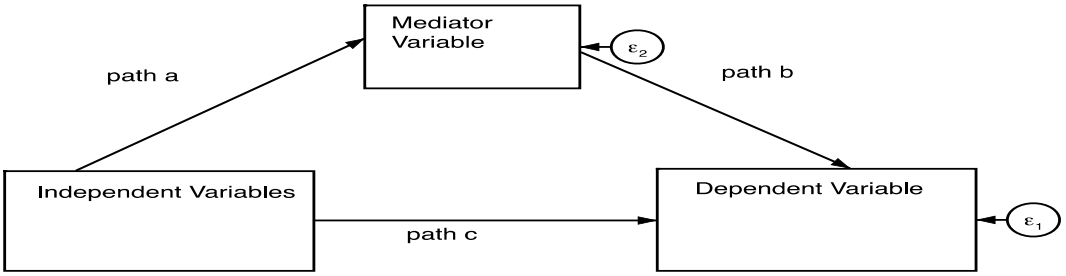

Figure 3.1: Mediation Diagram

Source: Adapted from Baron & Kenny, 1986.

3.6.2.4. Sobel Test

According to Baron et al., (1986), Zhao, Lynch & Chen (2010), the Sobel test is given by the formula below and uses the unstandardized coefficients.

$$Z = \frac{\text{a x b}}{\sqrt{b^2 S_a^2 + a^2 S_b^2}}$$

In order to get coefficient **a** and standard error $\mathbf{S_a}$, a regression of $M = i_1 + aX + e_1$

was run, that is the independent variable predicting the mediator. A regression of the mediator predicting the dependent variable generated the coefficient b and standard error S_b from equation, $Y = i_3 + cX + bM + e_3$

S_a^2 = standard error of a

S_b^2 = standard error of b

3.7 Missing Data Procedures

Adams *et al*., (2007) avers that missing data can limit analysis. In order to avoid missing data problems, banks that had less than five years data were excluded from the analysis due to incomplete data.

3.8 Model Assumption

The regression model in this study was to entail evaluation of the effect of one or more predictor variables and mediating variable on dependent variable. It was expected the predictor variables and mediating variable could predict the outcome of a predicted variable. The study undertook a panel data regression analysis. Baltagi (2005) states that panel data is pooling of observations on a cross section of firms over a number of time period. While Gujarati et al.; (2009) contend that panel data is same cross-sectional unit surveyed over time. According to Brooks (2008), panel data specification has ability to address a range of issues more complex than pure time series analysis. Besides, it is able to determine how variables change overtime.

Gujarati and Porter (2009) further argue that panel data estimation can take diversity into account and allow for commercial bank specific variables. Besides, with panel data specification, it gives more informative data, more variability, less collinearity among variables and more efficiency. Panel data can better detect and measure effects than pure time series or cross section and helps study more complicated models. According to Baltagi, panel data is able to identify and measure effects that are simply not detectable in pure cross or time series data.

3.8.1. Panel Data Model Specification

According to Brooks (2008) panel data embodies information across time and space. This means each commercial bank in the study was tracked over time. In analysing panel data, either fixed effects or random effects model is used. Further panel data models can be balanced or unbalanced, where balanced panel has same number of time series observations for each cross-sectional unit. On the other hand, unbalanced panel means some cross-sectional elements have fewer observations at different time

to others. Bollen and Brand (2010) observe that the major attraction of fixed and random effects in panel data research is that they control for all time invariant variables that influence the dependent variable whether these variables are known or unknown.

3.8.1.1. Indicators of Fixed Effects Model (FEM)

Fixed effect models are designed to study causes of changes within an entity. In effect the time invariant characteristics may not cause any changes to the variables. According to Gujarati et al., (2009) in FEM each cross-sectional unit has its own fixed intercept value in all N such values across N cross-sectional units. Therefore, for FEM the intercept may differ across subjects, however each entity's intercept does not vary across time, it is time invariant that is the behaviour does not change with time.

3.8.1.2 Indicators of Random Effects Model (REM)

Baltagi (2005) argues that a random effects model is suitable in a situation where N individuals are drawn randomly from a population. Therefore, the individual effect is characterised as random with inferences being related to the population from which the individual was randomly chosen.

According to Gujarati et al., (2009) in REM the common intercept represents the mean value of all the cross-sectional intercepts and the error component ε_i represents the random deviation of individual intercept from the mean value.

3.8.1.3 Hausman Test

Gujarati et al.; (2009), Bollen and Brand (2010), show that the Hausman test is used by researchers to decide whether the fixed effect model (FEM) or random effect model (REM) is to be applied. The Hausman specification error test was used to determine

the hypothesis that there was no misspecification in the model, with the alternative hypothesis that there was misspecification. Consequently, a fixed and random effects test was run on the data. Gujarati et al., (2009) further state that if the error component ε_i and the X regressors are uncorrelated then random effects model is appropriate however, if ε_i and the Xs are correlated then the fixed effects model is ideal.

3.9 Diagnostic Tests

According to Brooks (2008), under classical linear regression models (CLRM) when the assumptions are violated, this results in biased, inefficient and inconsistent parameter estimates consequently there is need to carry out diagnostic tests to ensure the regression model is properly specified. Brooks (2008) further states that diagnostic tests are required to show estimation techniques have a number of desirable properties and that the hypothesis tests regarding the coefficient estimates can be validly conducted.

3.9.1 Normality Test

The linear regression model assumes that the error term is normally distributed which is a requirement to conduct single or joint hypothesis tests about a model's parameters, Brooks 2008. There are several tests of normality including histogram of residuals and normal probability plot. However, for this study the researcher carried out the Shapiro-wilk W test of normality.

3.9.2 Heteroscedasticity Test

The assumption is that the variance of the errors is constant, and this is called homoscedasticity. If the errors do not have a constant variance, then there is heteroscedasticity. If heteroscedasticity is assumed, inferences may be misleading. Gujarati *et al*., (2009) indicate that there are several methods of testing for

heteroscedasticity among others Breusch Pagan and White's test. According to Brooks (2008) a regression model with evidence of heteroscedasticity has the consequence that the estimation will provide unbiased coefficient estimates but will not be best linear unbiased estimates. The researcher faces the danger of misleading inferences if the study proceeds without transforming the variables.

According to Ott et al., (2010) a researcher can use four step approach to Breusch Pagan test. The first step is to fit the regression model to the data and obtain the residuals and the sum of the squared residuals, followed by second step to regress the squared residuals on the explanatory variables and obtain the regression sum of squares from fitting the model. The third step is to compute the Breusch pagan statistics. The fourth step is to reject or fail to reject the null hypothesis that the variances are homogeneous. Ott el al., (2010) state that the Breusch Pagan test can only be used following confirmation of a normal distribution of residuals.

The other test for heteroscedasticity is White's test. Having dropped Breusch-Pagan test due to non-normality of data, White's test was found desirable.

3.9.3 Autocorrelation Test

In regression the assumption is that there is no pattern in the errors. When the error terms of a regression model are correlated among themselves, they are said to display serial correlation or autocorrelation, Brooks (2008). Therefore, autocorrelation refers to patterns in the residuals from a regression model. Gujarati *et al*., (2009) state that there are many tests of autocorrelation, but none is unequivocally best. Brooks (2008) asserts that Durbin Watson test is the simplest test to check for autocorrelation whereas Gujarati et al., (2009) assert that Durbin-Watson d Test is the most popular test for detecting serial correlation. However, it is ideal for time series data. Besides

Durbin Watson test has restrictions that lagged values of the regressand are not included among the regressors.

According to Gujarati et al (2009) autocorrelation is defined as interrelationship between members of series of observation as ordered in space. Autocorrelation is said to be common in time series data. In cross sectional data it is called spatial correlation. In the presence of autocorrelation, the t and F tests are generally not reliable. Evidence of patterns in the residuals from a regression model suggests presence of autocorrelation. If a researcher ignores autocorrelation the consequence is that the ordinary least square (OLS) estimation will provide unbiased estimates but will not be best linear unbiased estimates according to Brooks (2008). Gujarati et al., (2009) argue that in cross sectional studies data is collected from a random sample of cross-sectional units and therefore it would be unusual to hold that the error term of one firm would be correlated to the error term of another firm.

Besides, a combination of time series of cross section variables in panel data leads to more variability and less collinearity among variables. The researcher used an autoregressive model and therefore did not run the Durbin Watson test. Besides, the evidence from correlation matrix and multicollinearity did not indicate any serious collinearity and given that the data was cross sectional there were minimal chances of spatial autocorrelation.

3.9.4 Multicollinearity Test

According to Brooks (2008), the assumption in regression is that the independent variables are not correlated with one another. If there are no relationships between the independent variables, they are said to be orthogonal to one another. Therefore, adding or removing a variable from regression equation would not cause the values of the

coefficients on other variables to change. Multicollinearity therefore implies that independent variables in a regression are highly correlated. This could mean one predictor variable can be predicted from the other predictor variables. Gujarati et al., (2009) argue that researchers do not test for multicollinearity rather measure its degree in any particular sample. According to Gujarati et al., (2009) the CLRM assumption is that there is no exact linear relationship between independent or explanatory variables that is no multicollinearity. Ott et al., (2010) argued that the consequences of highly correlated independent variables is that the overall F-Test would be highly significant but none of the individual t-tests would come close to significance.

This is important because in the presence of multicollinearity, OLS estimators and their standard errors become very sensitive to small changes in the data and tend to be unstable. Gujarati (1992) argues that it becomes difficult to estimate the true value of the estimators because of large variances and standard errors of the OLS estimators. The presence of multicollinearity means estimators will be unreliable. The variance inflation factor (VIF) was used to test for the presence of multicollinearity among the independent variables of the study.

3.9.5 Stationarity Test

Gujarati et al., (2009) state that a time series is said to be stationary if the mean and variance do not vary systematically over time. According to Brooks (2008), if variables in a regression analysis are non-stationary then assumptions for asymptotic analysis are invalid. The researcher used Harris Tzavalis unit root to test for stationarity of data.

3.10 Operationalization and Measurement of Variables

Table 3.3: Variable Measurement

Variables	Researcher(s)	Measures
Bank fragility	Carapeto, Moeller, Faelten, Vitkova & Bortolotto (2010)., Iftikhar (2015); Shehzad et al., (2010) and Shen et al., (2008). Cihak et al., (2010)	$\frac{\text{Gross Non-Performing Loans}}{\text{Total loans}}$
Loan growth ratio	Rauch (2010), Jin, Kanagaretnam & Lobo (2018).	$\frac{\text{Total loans year t minus total loans year t-1}}{\text{Total Loans year t-1}}$
Loan quality ratio	Calomiris & Mason (2003), Logan (2001)	$\frac{\text{Net Interest Income}}{\text{Total Income}}$
Loans to Deposit Ratio	End (2016); Cecchetti, King & Yetman (2011)	$\frac{NetLoans}{CustomerDeposits}$
Insider Loans ratio	Thomson, J. B. (1991)	$\frac{\text{Total Insider Loans}}{\text{Total Assets}}$
Information Asymmetry	Helwege & Liang (1996)	$\frac{\text{Net property plant and Equipment}}{\text{Total Assets}}$
Bank Size	Shaffer (2012)	Total assets

Source: Researcher 2021.

3.10.1 Bank Fragility

The NPL variable expressed as a percentage of impaired assets to gross loans has been utilised as a standard proxy for bank asset risk according to Shehzad, Haan and Scholtens (2010). Galil et al., (2018), Kanga, Murinde and Soumare (2021) state that the ratio of NPL to total loans assesses the quality of the bank's assets, if it is high the quality of the loan portfolio is poor and can trigger financial problems and accelerate bank fragility. Gonzalez-Hermosillo, Pazarbasioglu and Billings (1997) observed that a large stock of NPL to total loans lead to losses on a substantial part of the credit portfolio and this reduces net earnings with the ultimate result being decimation of capital.

Dimitrios, Helen and Mike (2016) concur with the above conclusion and state that bank insolvency arises from deterioration in asset quality over time. Jing and Fang (2018) conclude that it is important to predict bank distress to enable regulatory authorities to take timely action and reduce the costs associated with their resolution. Mannasoo and Mayes (2009) in their study of bank distress in Eastern European economies find that where there is a higher loan to assets ratio and higher share of non-performing loans there is a trigger for a crisis. The NPL/total loans variable was found appropriate as a dependent variable of the study following the empirical review of literature.

3.10.2 Loan Growth Ratio

Zhang, Cai, Dickinson and Kutan (2016) argue that banks with high NPLs take on more risks so that they offset the losses associated with NPLs and therefore lead to increase in NPLs as a result of higher loan growth. The dilution effect could be achieved by the bank lowering standards and accepting riskier applications with potential to generate higher future losses. This argument is consistent with Foos et al., (2010). Kerstein and Kozberg (2013) argue that banks excessive credit supply generates interest income for the institution. It is therefore possible for herd behaviour among banks to compete to achieve maximum growth with resultant income initially.

Gonzalez-Hermosillo et al., (1997) consider rapid growth in bank lending increasingly leading banks to destabilising shocks. Banks drive each other into excessive risk taking, which leads to deteriorating loan portfolio in the future. Loan growth ratio has a link to credit assessment standards and ultimately to NPL. The variable was found sound in the study.

3.10.3 Loan Quality Ratio

Galil et al., (2018), Altman et al., (2014) employ net interest margin to total assets as an explanatory variable to measure earnings. The ratio shows the income the bank earned on assets during the period. When expressed as a ratio of total income, it measures dependency on loans as a source of income. Net interest income is the difference between interest income and interest expense. When the cost of customer deposits and loan capital are high, they depress the net interest income.

3.10.4 Loan Deposit Ratio

Galil et al., (2018) aver that the ratio measures the liquidity of the bank to cover short-term obligations. Higher LDR are indicative of a less liquid bank and therefore high risk of distress. Kanga et al., (2021) argue that the ratio assesses the liquidity of the banking sector. A high ratio is considered a pointer to insufficient liquidity to cover unforeseen fund requirements while a low ratio could imply the sector is too liquid, the consequences of too much liquidity is that the sector may not earn as much as expected.

The FRB of Kansas City (2016) considers high LDR to mean either lower costs funds have been exhausted to support more loan growth or liquidity is being sacrificed for earnings. The variable was found suitable since net interest margin has a relationship with quality of loan portfolio and the mix of deposits. In case of high loan capital utilisation, this depresses interest margin due to high cost of wholesale funds.

3.10.5 Insider Loans Ratio

Loans to directors, management and staff and their associates can be a source of fraud, bank instability or misuse of fiduciary responsibility. Commercial banks have a duty to invest depositors' funds responsibly. La Porta, Lopez-De-Silanes and Zamarippa (2003), using data set of Mexican banks find insider lending to be at favourable rates

compared to outsiders. Besides, insiders have a 3% more likely chance to default and where they default have a 30% chance of recovery compared to unrelated parties. Brownbridge (1998a), Thomson (1991) find insider abuse a significant factor in bank failure. Brownbridge (1998a) indicates insider abuse as a cause of bank instability, while Thomson (1991) considers it as proxy for management risk.

La Porta et al (2003) consider insider lending a manifestation of looting. The study adopted the looting view which according to La Porta et al., (2003) holds that insider credit facilities are attractive since insiders are able to divert resources from depositors, take excessive risk on favourable terms, however, full risk is borne by other parties.

3.10.6 Lagged Dependent Variable

Iftikhar (2015) utilised lagged dependent variable of the relationship between impaired loans to gross loans and found financial weaknesses of the previous year have an impact on the current year. Flannery and Hankins (2013), Iftikhar (2015) and Baltagi (2005) state that dynamic relationships are characterised by the presence of a lagged dependent variable among the explanatory variables. Gujarati et al., (2009) state that autoregressive and distributed lag models are used extensively in economic analysis. Autoregressive models show the path of the dependent variable in relation to its past. The reasons for lags include psychological reasons as a result of habits which do not change immediately, technological reasons where imperfect knowledge accounts for lags and also institutional factors contribute to lags, in case of contracts it may switch to alternative easily. In the study distributed lags were not utilised. Gujarati et al (2009) argue that distributed lags produce highly correlated values therefore introducing problems of multicollinearity leading to imprecise estimations.

3.10.7 Information Asymmetry

According to Wu and Zumbo (2008), mediation analysis is an attempt to the intermediary process that moves from the independent variable through the mediator to the dependent variable. Mackinnon, Lockwood, Hoffman, West and Sheets (2002) refer to mediating effect as indirect effect, surrogate effect, intermediate effect or intervening effect. Mackinnon, Coxe, and Baraldi (2012) state that mediated effect represents the effect of the independent variable on the dependent variable via the mediator, that is, it is an indirect or intervening effect. Kumar (2011) argues that an intervening or mediating variable links the independent and dependent variable.

Information asymmetry in this study was measured as net property, plant and equipment scaled by total assets. A number of studies have utilised property, plant and equipment scaled by totals assets as a proxy measure of information asymmetry. Helwege et al., (1996) stated that PPE as a ratio of total assets is associated with greater tangible assets and less information asymmetry. Leary et al., (2016) adopted the same measure as a proxy for information asymmetry.

3.10.8 Summary of Hypothesis Testing

Table 3.4: Hypothesis Testing

Number	Null Hypothesis
H_{01}	Loan growth ratio has no statistically significant effect on bank fragility
H_{02}	Loan to deposit ratio has no statistically significant effect on bank fragility
H_{03}	Loan quality ratio has no statistically significant effect on bank fragility
H_{04}	Insider loans ratio has no statistically significant effect on bank fragility
H_{05a}	Information asymmetry does not mediate the effect of loan growth ratio on bank fragility
H_{05b}	Information asymmetry does not mediate the effect of loan to deposit ratio on bank fragility
H_{05c}	Information asymmetry does not mediate the effect of loan quality ratio on bank fragility
H_{05d}	Information asymmetry does not mediate the effect of insider loan ratio on bank fragility
H_{06}	There is no significant effect between Information asymmetry and bank fragility.

Source: Research Data, 2021.

3.11 Ethical Considerations

Prior to commencement of data collection, the researcher got an introduction letter from the University as shown in appendix 6 identifying him as a student at the institution, carrying out research on fragility among commercial banks in Kenya. Besides, the researcher sought and was granted research authorisation from National Commission for Science, Technology and Innovation appendix 7. Mutchnick and Berg (1996) highlight three cases of ethical issues in research. The Burt case in which the researcher

falsified data related to his study. The second is Humphrey's case which involved a researcher who did not identify himself as such, observed, facilitated, interviewed participants under false pretences and failed to report behaviour that violated the law. The third case is the Milgram case in which the researcher used deceptive tactics and did not obtain informed consent of participants.

Gregory (2003) avers that to engage in research which occasion harm and distress to the respondents is objectionable. Accordingly, a person has been fully informed, if explained to him anything that reasonably and foreseeably might influence the decision whether or not to agree to be a participant in the research. Besides, consent should not be procured through ignorance of the participant or by undue influence by the researcher. According to Creswell (2009) participants' rights have to be protected during data collection. Welman and Kruger (2001) state that ethical considerations come into play when participants are recruited, during the measurement procedures and in the release of results obtained while Nachmias *et al.,* (2003) aver that participants in a research project should not be misled.

Consequently, CBK staff were informed of the reason for the research and that data collected was to be kept confidential. The members of staff at CBK involved in data dissemination were guaranteed confidentiality, though the data collected was published annual financial statements of commercial banks. Confidentiality according to Gregory (2003) is the price demanded for sharing and ensuring respondents secret thoughts and feelings are kept secret by the researcher. Once confidentiality is guaranteed the researcher is under a moral obligation to ensure that the duty of secrecy prevails. Nachmias et al., argue that the greater the sensitivity of the information the more researchers will be obligated to protect the privacy of the research participants.

Sensitivity of information means how personal or potentially threatening the information is that the researcher wishes to collect. Privacy of participants has to be guarded.

As expounded above ethical issues in this research were split into three, during data collection, at data analysis and results stage. Data collection was made without any deception or non-disclosure of material fact. At the data analysis and results stage, no findings were invented or fabricated to meet the researcher's expectations.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATIONS

4.0 Introduction

This chapter presents the analysis and interpretation of results. Section 4.1 and 4.2 provide the descriptive statistical analysis and its conclusion respectively. Section 4.3 examines correlation analysis while section 4.4 discusses the diagnostic tests. Section 4.5 gives discussion of panel data. Section 4.6 shows optimal combination variables while section 4.7 discusses generalised linear model and the output. Section 4.8 considers mediation tests, results and discussion.

4.1 Descriptive Statistical Analysis

The data collection and variable computation was conducted using Microsoft Excel before exporting to Stata statistics/Data Analysis package version 13. The mean, standard deviation, minimum and maximum values for the dependent and independent variables of the study were highlighted and discussed in view of the literature reviewed. The findings are presented in the form of descriptive statistical analysis for eleven (11) year period 2005-2015 mapping the variability of the study variables. An extract of descriptive statistics for the three distressed banks and National Bank of Kenya are shown in appendix 6.

Data analysis was conducted for 2005-2015 on cross sectional analysis to identify commercial banks with results above industry averages; then journey testing non-performing loans as a percentage of total assets and NPL/total loans as measures of banking sector fragility. Findings for the period 2005-2015 comprised all Commercial Banks in operation at the end of the accounting period, 31st December of every year. The analysis excluded Charterhouse Bank under statutory management since 2006.

The total number of firm years was four hundred twenty-four (424) over the eleven (11) year period due to differences in the time banks were licensed to operate in Kenya. Besides, in order to avoid complications due to mergers and acquisitions, where an entity merged and lost its identity the analysis considered the new bank from the date of successful merger or takeover. Altman et al., (2014) assert that it is proper to analyse bank solvency from developments in a number of bank indicators in the period leading up to a distress event. This helps identify performance dimensions in which distressed banks diverge from non-distressed ones. It is with such argument that the researcher adopted the period 2010-2014 for inferential statistics to test the predictive ability of loan ratios and mediating variable on fragility among commercial banks in Kenya.

4.1.1. Bank Fragility

In this study bank fragility ratio is defined as NPL as a ratio of total loans. Table 4.1 shows proxy of bank fragility statistics with the number of Commercial banks over a period of eleven (11) years, the nature of cross section (N) over time period (t) with some banks closing and others being licensed to operate. The NPL/total loans were at minimum of 0.00% with a maximum of 417.21%. For the period 2005 – 2007 the gross non-performing loans as a percentage of total loans was high but declining since Kenya was emerging from the banking crisis of 1993-2006. Thereafter, the maximum ratio ranged from 37.80% to 80.28%. During the period under review Imperial Bank and Chase Bank had bank fragility ratios of 10.02% and 7.48% respectively. On the other hand, Dubai Bank Ltd gross non-performing loans to total loans was 101.20% as shown in appendix 6.

Table 4.1: Proxy of Bank Fragility

Year	N	Mean	Sd	Min	Max
2005	33	0.4087375	0.7768731	0.0167364	4.172078
2006	34	0.2721234	0.3856532	0.0059963	1.707729
2007	34	0.2122351	0.2945185	0.0033501	1.16441
2008	36	0.1597563	0.1957502	0	0.8028391
2009	40	0.1162156	0.1345746	0	0.6267483
2010	40	0.0977027	0.1073367	0	0.4493554
2011	42	0.0896979	0.1125715	0	0.5960265
2012	42	0.0833657	0.0760755	0	0.3780146
2013	42	0.0882673	0.1086208	0	0.6784101
2014	42	0.1046848	0.1328875	0	0.7940975
2015	39	0.1096047	0.0888995	0	0.4071137
Total	424	0.1507352	0.2896993	0	4.172078

Source: Research Data, 2021.

It is not clear how banks with NPL to total loans of over 100% were able to generate income, considering interest does not accrue on NPL instead it is placed in suspense account. However, the maximum 417.2078 was attributed to a commercial bank that had failed but was revived under new management. The minimum of zero for the proxy variable was attributed to Victoria Commercial Bank Ltd which for many years did not have non-performing loans and UBA Bank Ltd which was licensed in 2009 and at the end of the financial year had no loans outstanding. Evidence shows that over the ten-year period Dubai bank exhibited financial instability, however, it seems with regulatory forbearance it was allowed to operate until 2015 when it was closed. The industry bank fragility maximum consistently declined from 417.21% in 2005, 170.77% in 2006, 116.44% in 2007 to a low of 40.17% in 2015. The mean over the period 2005 to 2015 was 15.07%. The mean bank fragility was above 10% a sign of fragility by the sector.

Whereas the banking sector on average seemed stable, the period indicated shows some banks in operation had problematic non-performing loans level. The explanation on poor state of health by many banks over the period could be drawn from Bongini, Claessens and Ferri (2000) who show that politics, regulatory capture and forbearance have a role in dealing with financial crisis. It is worth of noting that mean bank fragility for 2005-2009 was above 10%, then declined in 2010 but started to rise from 2013. By 2015 the bank fragility variable was at 11% which showed a deterioration in the health of the industry. Fofack (2005) reports NPL/total loans in sub-Saharan Africa reached 32% in 1993, and 25% during the 1997 Asian financial crisis. Therefore, the level of Kenya's bank fragility variable was at crisis level for some Commercial Banks compared to the 1993 sub-Saharan Africa banking industry problem and 1997 Asian financial crisis. Gonzalez-Hermosillo et al., (1997) showed Mexican bank fragility from 1993-1995 when NPL to total loans were 5.5% in 1992, 7.3% in 1993, 8.3% in 1994 and 10.3% in 1995. Using the same yardstick, it was concluded Kenya's Commercial banking sector was fragile considering the lowest mean fragility ratio for the entire eleven-year period was 8.33%.

4.1.2 Loan Growth Ratio

Appendix 6 shows maximum loan growth for Dubai, Imperial and Chase Bank at 39.69%, 40.40% and 65.03% respectively. The average growth in banking industry during the period was minimum of 21.30% with highest growth of 333.44%. Dubai Bank and National Bank of Kenya had negative growth of 5.36% and 70.39% respectively. Though the overall industry growth from 2005-2015 ranged from 21.30% to 41.16% there was mixed growth percentages. The loan growth of 272.34% was attributed to one new bank that had entered the Kenyan market while 333.44% was due to a merger between a bank and a microfinance finance institution.

A rapid increase in loan portfolio could signal low standards of loan underwriting while a negative loan growth ratio signals a contraction in loan asset ultimately resulting in decline in interest income. A decline in loan portfolio growth implies poor financial performance with undesirable consequences if the slide is not halted. A balanced growth is therefore desirable.

Table 4.2: Loan Growth Ratio

Year	N	Mean	Sd	Min	Max
2005	33	0.2131825	0.2140217	-0.1630371	0.9786386
2006	34	0.213021	0.2107561	-0.1630371	0.9786386
2007	34	0.2519601	0.2824062	-0.7039372	0.9978042
2008	36	0.3711972	0.3451691	-0.1250662	1.562112
2009	40	0.2270918	0.2748775	-0.1883741	1.562112
2010	40	0.2599354	0.1968056	-0.068375	0.6502594
2011	42	0.4116382	0.492529	0.0893787	3.334437
2012	42	0.2443357	0.5162727	-0.1799585	3.334437
2013	42	0.2779468	0.3017702	0.0093115	1.910619
2014	42	0.2144532	0.1802936	-0.1512667	0.6589835
2015	39	0.2154551	0.4496083	-0.1848745	2.723433
Total	424	0.2649128	0.3424105	-0.7039372	3.334437

Source: Research data, 2021.

According to Odunga (2014), National Bank of Kenya made huge write-offs of non-performing loans during the period 2005-2006 that shrunk the loan portfolio and therefore reflected negative loan growth. With industry mean loan growth ratio of 26.49% and minimum growth of -70.39% the variable was a pointer to instability. Foos, Norden and Weber (2010) find loan growth a key factor in bank risk studies.

They argue that some of the methods of loan growth include lower interest and or lowering of credit standards. Due to these loosening of standards, loan growth should be examined as part of information on early warning systems of bank fragility.

Fahlenbrach, Primeier and Stulz (2016) observe that banks that tend to grow rapidly do grant loans whose performance is worse than loans of other banks. Fahlenbrach et al.,(2016) concluded that loan growth is related to granting poor loans and therefore an indicator of bank fragility. Baron and Xiong (2017) state that when the change in bank credit is high the rapid growth in new lending could correspond with lower lending quality. Kedir et al., (2018) find that excessive loan growth is a symptom of deteriorating underwriting standards and could lead to fragility. It means an agency problem arises where credit expansion reflects active risk seeking by bankers to generate income as a result of their misaligned incentives with their shareholders. Kedir et al., (2018) found loan growth global average of 18.72%, therefore loan growth greater than this was considered a sign of granting sub-optimal loans.

4.1.3. Loan Deposit Ratio

Analysis of table 4.3 shows that LDR peaked at 200.46%. The minimum zero LDR relates to UBA Bank Ltd a bank that was licensed in 2009 and had no outstanding loans at the end of 2009. As indicated in appendix 6 the LDR for the three distressed banks was as follows; Dubai Bank minimum 74.80% and maximum 163.98%; Imperial Bank 65.75% minimum with maximum at 81.54% while Chase Bank had minimum of 62.32% and maximum of 101.68%. The mean LDR range for the industry for the period was between 66.39% and 80.21%. LDR as a measure of distress isolates Dubai Bank as an institution that had weaknesses long before 2015. Consistent with IMF prescriptions LDRs of 130% are crisis level percentages. End (2016) states that deposits and loans should be analysed together due to the liquidity transformation function. Besides, this is the classic intermediation function. The maximum LDR for the period ranged from 103.24% to 200.46%.

During the entire period of eleven years, the maximum LDR was above 100.00% signalling overreliance on loan capital by some Commercial Banks, a potential destabilizing situation for the banking sector due to contagion. It could also indicate a commercial bank with difficulties attracting deposits. Since deposits can decline faster than loans, it is possible with a fall in deposits due to various reasons for the LDR ratio to rise sharply. A total of nine (9) commercial banks had maximum LDR greater than 100% of which two failed, two merged while the others are still in operation with varied record of financial performance.

Table 4.3: Loan Deposit Ratio

Year	N	Mean	Sd	Min	Max
2005	33	0.7341218	0.2766879	0.2789369	1.49235
2006	34	0.6854252	0.2048741	0.2990568	1.197418
2007	34	0.6971794	0.2449538	0.2258798	1.557511
2008	36	0.7335653	0.2336494	0.2611004	1.563182
2009	40	0.7084006	0.2926496	0	2.004624
2010	40	0.6639429	0.1895773	0.2021739	1.316728
2011	42	0.7227055	0.1846156	0.3912855	1.419091
2012	42	0.7063401	0.1880586	0.3004646	1.310066
2013	42	0.7600754	0.2112341	0.3181635	1.562456
2014	42	0.7697374	0.2129954	0.2052573	1.639842
2015	39	0.802096	0.1460029	0.4293477	1.03243
Total	424	0.7266285	0.2198255	0	2.004624

Source: Research data, 2021.

Though Bologna (2011) argues that LDR provides a measure of funding mix by a bank to finance its loan portfolio, higher LDR as shown by some banks in this study reflect less customer deposits to fund loan book. This could be inability to attract deposits from the market. Loan capital providers are sensitive to market conditions. Therefore, such high LDR levels have negative effect according to Bologna (2011) which leads to the likelihood of bank fragility.

It is established that higher level LDR means higher reliance on alternative funding compared to customer deposits significantly increasing the banks default probability. Bologna (2011) further argues that defaults are more likely immediately after higher level of LDR are observed but two to three years after such an increase. It is therefore important for banks to achieve a level of balance in their deposit mix and loan capital. According to End (2016) an LDR of 120% is a presumptive benchmark for a banking crisis while an average of 80% according to ECB (2012) is a sign of impaired financial intermediation. End (2016) state that the IMF applied the upper limit of LDR of 120-125% for adjustment programmes of Ireland and Portugal for period 2011-2012. Practically, LDRs above such prescriptive rates were considered a sign of bank fragility.

4.1.4. Loan Quality

Loan quality is a measure of dependency on interest income. During the period under study the minimum loan quality was 1.28% and maximum 76.92%. The three distressed Banks had the following ratios, Dubai Bank 30.23% minimum with maximum of 64.82%; Imperial Bank had minimum 32.65% and maximum 51.11% while Chase Bank had minimum 34.53% and maximum 54.85% as shown in appendix 6. Except for 2012, when the industry mean loan quality ratio was 37.55%; the other years show stable mean net interest income to total income ranging between 43.99% to 48.82% as shown in Table 4.4. The industry average was 45.50%, a confirmation of interest income as a major source of revenue for Commercial Banks in Kenya. It also shows the structure of deposit and Loans in Commercial banks businesses. Alvarez-Franco et al., (2016) observe that loan quality is an important pointer to bank survival. They argued that less diversified banks are more likely to fail due to dependence on interest income.

In 2012 one Commercial Bank had loan quality ratio of 1.28% and maximum 38.33% which questions the quality of its financial performance and sustainability given evidence most banks in Kenya consider interest income significant in their revenue generation. Such low loan quality ratio calls for further interrogation of the commercial bank's survivability.

Table 4.4: Loan Quality Ratio

Year	N	Mean	Sd	Min	Max
2005	33	0.4882343	0.1135493	0.1025641	0.6630435
2006	34	0.4775237	0.0832258	0.293578	0.6396761
2007	34	0.4698134	0.0949192	0.1084337	0.6398467
2008	36	0.47167	0.0819143	0.2827225	0.6449865
2009	40	0.4752037	0.1086106	0.2406417	0.7692308
2010	40	0.4425364	0.1196403	0.1871508	0.6845361
2011	42	0.4603842	0.1195319	0.1791383	0.6973684
2012	42	0.3754972	0.1644486	0.0128168	0.6723744
2013	42	0.4714465	0.1090485	0.2572081	0.6862327
2014	42	0.448489	0.1122881	0.1553398	0.6792123
2015	39	0.4399926	0.11167	0.1708075	0.6492212
Total	424	0.4549881	0.1165592	0.0128168	0.7692308

Source: Research data, 2021.

The year-on-year maximum loan quality was above 63% throughout the eleven-year period. A loan quality above 51% is evidence of reliance on interest income, however this is also reflective of the structure of banking business in Kenya where most of the income is derived from loans. A high level of non-interest income would be desirable however, the nature of business should be suitable. As argued by DeYoung et al (2013) non-interest income could be generated from more risky business thereby endangering the survival of the institution.

4.1.5 Insider Loans

The mean insider loans to total assets in the industry was low as shown in Table 4.5, however some banks had a high ratio of 54.11% and 59.66% in 2005 and 2006, the

years immediately following bank distress events of 1993-2006 which could be expected. The ratio declined thereafter. As shown by Odunga (2014) part of this decline can be attributed to National Bank of Kenya's loans write-off which led to decline in total assets.

Table 4.5: Insider Loans Ratio

Year	N	mean	sd	min	Max
2005	33	0.0484101	0.0972467	0.0053989	0.5411552
2006	34	0.0460712	0.1001267	0.0062645	0.5966282
2007	34	0.0305265	0.0262466	0.0046404	0.1294629
2008	36	0.0294487	0.0255902	0.0034999	0.1387994
2009	40	0.0311615	0.0311458	0	0.1863853
2010	40	0.0301898	0.0257053	0	0.1434271
2011	42	0.0279721	0.0194431	0.0012477	0.0893372
2012	42	0.0326445	0.0310684	0.0012059	0.1838235
2013	42	0.0312339	0.0231369	0.0010416	0.1252847
2014	42	0.0327975	0.0268342	0.0014548	0.147168
2015	39	0.030574	0.0219513	0.0013282	0.1016804
Total	424	0.0333577	0.045707	0	0.5966282

Source: Research data, 2021.

The minimum insider loans level of zero was attributed to UBA bank that was new in the market having been licensed in 2009. The maximum of 59.66 was for National Bank of Kenya as shown in appendix 6. As highlighted in appendix 6 the level of insider loans at Dubai Bank was at minimum of 3.60%, maximum 18.38% and average of 7.86%. Imperial bank had the following levels, 0.08%, 5.53% and 3.36% being minimum, maximum and average respectively over the period. Chase Bank had minimum insider loans level of 2.0%, maximum 8.69% and average 4.08%. The industry average insider loans for the period was 3.3% between 2005 and 2015. However, the statistics for the period 2005-2006 are indicative of a problem time with maximum insider loan levels of 54% to 59.7% for some of the banks. This was a clear

breach of fiduciary duty by the directors, management and staff of the commercial banks, an indication of insiders' use of customer deposits for their own self-interest. However, whereas insider loans did not seem a problem, Central Bank of Kenya found Chase Bank Ltd had inaccurate records of actual insider loans before the bank was placed under receivership. Discovery of undisclosed insider loans at Chase Bank by the regulatory authority, brought to question disclosure quality and accuracy of monthly and quarterly reports by Commercial banks. Bleck (2016) summarised that banks' hide information from the regulators by manipulating risk weights for regulation, this argument could apply to insider loans disclosures.

4.1.6 Loan to Total Assets Ratio

The ratio of gross loans to total assets and NPL to total assets though not part of the study variables contributes to investigation about fragility among Kenyans banks. Table 4.6 depicts the importance of loans in Commercial Banks balance sheet. Kanga et al.,(2021) argued that the ratio of loans to total assets measures the asset competition between lending and non-lending interest bearing activities. It is further stated that a high ratio is indicative of concentration on lending activities, less diversification and ultimately exposure to default. The maximum loan to total assets was 83.21% with industry average between 48.55% and 57.69% over the period. Uysal (2013) found that loans constitute between 65% to 80% of banks total assets. The minimum ratio ranged from 0.00% to 30.21%; while the maximum was 69.06% to 83.21%. The maximum level of loans to total assets was within the range 69% to 83% consistent with Uysal (2013) findings. This evidence shows loans constituted the largest asset on Commercial banks' balance sheets, and useful in generating operating revenue.

Table 4.6: Gross Loans to Total Assets

Year	N	Mean	Sd	Min	Max
2005	33	0.5150742	0.1415738	0.2238372	0.7430947
2006	34	0.5085424	0.1230724	0.2442232	0.7333555
2007	34	0.4996252	0.1379822	0.1893804	0.7262395
2008	36	0.5209389	0.1235739	0.2096215	0.7251955
2009	40	0.508829	0.135772	0	0.716792
2010	40	0.4855396	0.1207714	0.09214	0.6905988
2011	42	0.5200352	0.1284983	0.1458937	0.7247559
2012	42	0.516057	0.113426	0.1504788	0.7285774
2013	42	0.5466358	0.1151183	0.212938	0.7564059
2014	42	0.5567189	0.1239865	0.1543314	0.8320959
2015	39	0.5768643	0.1065207	0.3020976	0.7511157
Total	424	0.5239579	0.125661	0	0.8320959

Source: Research data, 2021.

For the period 2005-2015 Commercial banks in Kenya consistently maintained a high level of gross loans to total assets with mean of between 50% - 58% except 2007 and 2010 which were marginally lower at 49.96% and 48.55% respectively. The minimum of zero relates to UBA Bank Ltd. Kenya had a general election in 2007 and referendum in 2010. The same drop is not reflected in 2005 and 2013 when Kenya had referendum and general elections respectively. Curiously, perhaps researchers may want to find out if there is any correlation between elections and Commercial bank asset expansion.

4.1.7 Non-Performing Loans to Total Assets

Demirguc-Kunt et al., (1998) utilised the ratio of non-performing loans to total assets as a measure of bank fragility. In 2005 and 2006 the NPL/total assets ratio was 18.70% and 13.58% which were above the measure of fragility pegged at 10% of the ratio. The two years 2005-2006 coincide with the end of 1993-2006 bank distress episode, closure of Charterhouse Bank and clean-up of National Bank of Kenya's distressed loans.

Table 4.7: NPL to Total Assets

Year	N	mean	sd	min	Max
2005	33	0.1870357	0.2666168	0.0075973	1.026731
2006	34	0.1357565	0.1920376	0.0030345	0.9315948
2007	34	0.0934425	0.1182658	0.0019366	0.490285
2008	36	0.081946	0.1017988	0	0.4197682
2009	40	0.0629958	0.0831811	0	0.4492481
2010	40	0.0484044	0.0537299	0	0.2604055
2011	42	0.0428235	0.0447897	0	0.228411
2012	42	0.0434899	0.045313	0	0.2608359
2013	42	0.0520122	0.0787318	0	0.5131534
2014	42	0.0636486	0.1045178	0	0.6607653
2015	39	0.064975	0.055702	0	0.2341396
Total	424	0.0763867	0.1228863	0	1.026731

Source: Research Data, 2021.

It is after 2005-2006 that the ratio of NPL to total assets declined from 9.34% in 2007 to 4.28% in 2011; then started an upward trajectory in 2012 at 4.35%, 2013 at 5.20% and had reached 6.36% and 6.50% by 2014 and 2015 respectively. The ratio was impacted by newly established banks that had 0.00% outstanding loans and /or non-performing loans for the period 2008 – 2015 thereby pulling down the mean. The maximum sectoral ratio show means of 5.20% in 2013 up from 4.35% in 2012 and 6.36% in 2014. The minimum NPL/Total assets ranged from 0.00% to 0.76%; maximum ratio oscillated from 22.84% in 2011 to 102.67% in 2005. The minimum of zero related to Victoria Commercial Bank Ltd and UBA Bank Ltd which had no non-performing loans. The maximum ratio in 2013 and 2014 was 51.32% and 66.08% respectively from 26.08% in 2012. The spike in the ratio started one-two years before distress events of 2015- 2016.

According to Demirguc-Kunt et al., (1998) and Daumont et al., (2004) prescriptions, between 2005-2006 Kenya's commercial banking sector was in turmoil, 2007-2009 in systemic banking crisis, 2010-2012 the sector was stable but slipped back to systemic banking crisis between 2013-2015.

4.1.8 Summary of Descriptive Statistical Analysis

According to IMF guidelines Dubai Bank had impaired intermediation in 2010 then entered crisis level in 2012 yet Central Bank of Kenya closed it in 2015 three years of financial crisis by the bank. Whereas LDR is not static, banks with inordinately high ratios must be put on a watch list for closer supervision. Kao & Liu (2004) state that the total loans extended by a bank may not exceed balance of total deposits as per Taiwanese law, a finding that could offer guidance to Kenya's policy makers. With lessons learnt from ECB and IMF, it should be considered that industry LDRs of 120% and above are presumptive indicators of a banking crisis. The banking sector had fragile institutions the entire period 2005 -2015 with maximum NPL/Total assets between from 102.67% in 2005 and 22.84% in 2011. The maximum was 51.31% in 2013, 66.07% in 2014 and 23.41% in 2015.

The mean industry range above 5% is indicative of systemic banking crisis. However, on year-by-year basis there was evidence of bank fragility. Cihak et al., (2010) state that if the level of NPL to total loans is greater than 10%, that is indicative of banking turmoil. Systemic banking crisis as argued by Daumont et al., occurs when the level of NPL to total asset is 5% to 10%. The study showed mean range of 4.28% to 18.70%. The lowest mean range was between 2010-2012. The measure of bank fragility according to Demirguc-Kunt et al., (1998) is computed as NPL to total assets. The above statistics confirm the ratio generally greater than 10%.

The measure of bank fragility the dependent variable with mean ranging from 8.34% to 40.87% and maximum between 37.80% to 417% is evidence of serious bank instability during the period of study. According to Kedir et al., (2018) ratios of 11.66% are high by international standards therefore, the decision to use a longer period 2005-2015 to test the stability of study variables was not in vain.

4.3 Pearson Correlation Matrix

The hypotheses under Pearson correlation were:

H_0: No linear relationship between the dependent and independent variable, $\rho=0$.

Ha: Linear relationship exists between the dependent and independent variable, $\rho\neq0$.

Table 4.12 shows a high significant positive correlation 0.89 (0.000) at 0.05 with significance levels in parenthesis. As expected, the lagged dependent variable is highly correlated with the dependent variable. There is evidence that the correlation coefficient is not qual to zero, therefore the null hypothesis is rejected. The dependent variable is negatively correlated to loan growth -0.12 (0.15), the p-value at 0.15 indicates the null hypothesis is accepted that there is no linear relationship between loan growth and bank fragility. The loan deposit ratio 0.39 (0.000) shows that there is a linear relationship between loan deposit ratio and dependent variable therefore the null hypothesis is rejected. The loan quality -0.30 (0.000) indicates that the null hypothesis is rejected as the p-value is 0.00. Insider loans ratio 0.47 (0.000) meaning the null hypothesis is rejected. The control variable, total assets -0.36 (0.000) had a linear relationship with bank fragility therefore rejected the null hypothesis, finally the mediator variable had -0.05 (0.54) which meant the null hypothesis was not rejected.

Table 4.8: Pearson Correlation Matrix

	bf	lagbf1	lg	ldr	lq	il	med	ta
bf	1.0000							
lagbf1	0.8948*	1.00						
	0.0000							
lg	-0.1190	0.0752	1.00					
	0.1468	0.4141						
ldr	0.3949*	0.3378*	-0.1292	1.00				
	0.0000	0.0002	0.1151					
lq	-0.3032*	-0.3403*	0.0320	0.0436	1.00			
	0.0002	0.0001	0.6976	0.5961				
il	0.4747*	0.4897*	-0.0589	0.3207*	0.0519	1.00		
	0.0000	0.0000	0.4743	0.0001	0.5282			
med	-0.0508	-0.1142	0.1024	-0.0632	0.1693*	-0.0574	1.00	
	0.5368	0.2142	0.2126	0.4426	0.0384	0.4855		
ta	-0.3646*	-0.3939*	-0.1052	-0.0097	0.4861*	-0.2523*	0.0378	
	0.0000	0.0000	0.2003	0.9058	0.0000	0.0018	0.646	1.00

* 95% confidence interval

Source: Research Data, 2021.

The control variable that is total assets is significantly negatively correlated with the dependent variable while the mediator variable is negatively correlated with the dependent variable but not significant at 5% level. Correlation between variables lies between +1 to – 1, with a perfectly positive correlation +1 and perfectly negatively correlated -1. If the correlation is zero (0) it means there is no relationship between the variable. A correlation coefficient of 0.8 between independent variables is symptomatic of collinearity. The correlation between the independent variables were all below 0.8 and therefore it was concluded that there was no serious problem of collinearity between independent variables. The Pearson Correlation matrix confirmed decision not to carry out autocorrelation test.

4.4 Diagnostic Tests

According to (Brooks 2008), diagnostic tests are carried out to ensure the assumptions of Classical linear regression model (CLRM) are not violated. A violation of CLRM assumptions results in biased, inefficient and inconsistent parameter estimates. The following diagnostic tests were carried out to ensure the CLRM were properly specified: normality, heteroscedasticity, multicollinearity and stationarity.

4.4.1. Normality Test Results

The CLRM assumes that the error term is normally distributed a requirement for hypothesis testing of the model parameters. The researcher utilised Shapiro- wilk W test for normality. The null hypothesis (H_0) was data is normally constructed.

Table 4.9: Shapiro Wilks Test

Variable	Obs	W	V	Z	Prob>z
bf	150	0.67496	37.82	8.236	0.00000
lagbf1	120	0.72676	26.293	7.325	0.00000
lg	150	0.96654	3.893	3.082	0.00103
ldr	150	0.86905	15.237	6.175	0.00000
lq	150	0.96489	4.086	3.191	0.00071
il	150	0.76482	27.364	7.502	0.00000
med	150	0.86373	15.856	6.265	0.00000
ta	150	0.7901	24.423	7.244	0.00000

Source: Research Data, 2021

According to Gujarati et al (2009) if the computed p-value is sufficiently low then the hypothesis that the residuals are normally distributed is rejected. The p-values for all variables are, prob >z, 0.00. The p-values in this case are low therefore, the normality test assumption was rejected and concluded that the residuals were non-normally distributed. The H_0 = data is normally distributed was rejected.

4.4.2 Heteroscedasticity Test Results

Under CLRM it is assumed that the variances of the errors are constant. If the errors do not have a constant variance that is the variance changes from observation to observation, then there is unequal or non-constant variance showing presence of heteroscedasticity in the data Ott et al., (2010).

White's Test for H0: Homoskedasticity

Against Ha: unrestricted heteroskedasticity

$chi^2(35)$ = 87.76

Prob > chi2 = 0.0000

Cameron & Trivedi's decomposition of IM-test

Table 4.10: White's Test

Source	chi^2	Df	P
Heteroskedasticity	87.76	35	0.0000
Skewness	24.93	7	0.0008
Kurtosis	1.41	1	0.2356
Total	114.09	43	0.0000

Source: Research Data, 2021

A null hypothesis was constructed that the variance of the error term was constant that is homoscedastic**.** Ott el al., (2010) state that the null hypothesis is Ho: Homogeneous variances while Ha: test heterogeneous variances for the regression model. The above White's test $Chi^2(35)$= 87.76, Prob > Chi^2 = 0.0000 shows evidence of heteroscedasticity, therefore the null hypothesis that the variances are constant was rejected.

4.4.3 Multicollinearity Test Results

Table 4.11: Multicollinearity Test

Variable	VIF	1/VIF
lagbf1	1.77	0.566405
lq	1.68	0.594996
il	1.59	0.630091
ta	1.58	0.634338
ldr	1.24	0.809002
lg	1.08	0.926329
med	1.04	0.962504
Mean VIF	1.42	

Source: Research Data, 2021.

The Variance Inflation Factor (VIF) for lagged bank fragility is 1.77; insider loans 1.59, loan quality 1.68, total assets 1.58, loan deposit ratio 1.24, loan growth 1.08 and mediator variable 1.04. Table 4.11. indicates that VIF for all the variables was below 10 and 1/VIF was above 0.1 a confirmation of tolerable levels of collinearity. Gujarati et al (2009) argue that multicollinearity is a matter of degree. The researcher concluded collinearity between the independent variables was too low to be problematic. It would have been a problem if the independent variables were highly correlated with VIF above 10.

4.4.4 Stationarity Test Results

A null hypothesis was constructed that data contained unit root. The alternative was that data was stationary. According to Gujarati et al., (2009) estimating regression without taking stationarity into consideration would lead to spurious regression.

Harris-Tzavalis unit-root test

Ho: Panels contain unit roots — Number of panels = 30

Ha: Panels are stationary — Number of periods = 5

Table 4.12: Stationarity Test

	Statistic	z	p-value	Variables
rho	0.6701	1.9119	0.9721	(Bank Fragility)
rho	-0.1115	-6.8725	0.0060	(Loan growth)
rho	0.4393	-0.6821	0.2476	(Loan deposit ratio)
rho	-0.2744	-8.7040	0.0000	(Loan quality)
rho	-0.2130	-8.0134	0.0000	(Insider Loans)
rho	0.1347	-2.5130	0.0060	(lagged bank fragility)
rho	0.3311	-1.8986	0.0288	(med-Mediator)
rho	1.0555	6.2437	1.0000	(ta-Control variable)

Source: Research Data, 2021.

Table 4.12 evidenced stationarity of some of the study data. The null hypothesis that the data was unit root was rejected for the following variables, loan growth (p-value=0.0000), loan quality (p-value =0.0000), insider loans (p-value=0.0000), lagged dependent variable (p-value=0.0060) and mediating variable p-value=0.0288). Evidence of unit root was noted in bank fragility (p-value=0.9721); Loan deposit ratio (p-value=0.2476) and control variable-total assets (p-value=1.0000). In the presence of stationarity, the researcher is expected to transform data to avoid spurious regression results.

4.5 Panel Data Analysis

According to Baltagi (2005) panel data is derived from pooling of cross section of units in this case Commercial banks over several time period. In order to conduct tests using panel data, the distinction between fixed effects and random effects models is important. Balanced panel data was used in the analysis.

4.5.1 Hausmann Test

A Hausman test was used to differentiate between random effects and fixed effects model. The hypothesis being tested was the null against the alternative hypothesis as shown below:

H_0= Cov (αi, Xit) = 0 then use random effects model (REM).

H_1= Cov (αi, Xit) $\neq$ 0 then use the fixed effects model (FEM).

If the null hypothesis holds, then it means consistent estimators and therefore random effect model is the more efficient estimator. However, if the alternative hypothesis holds, then the fixed effects estimator is solely consistent. If the null hypothesis is true, H_0= Cov (αi, Xit) = 0 the variance of fixed effects is greater than the variance of the random effects estimator.

4.5.2 Random and Fixed Effects Regression Output

In view of the above the researcher conducted a fixed and random effects regression in order to establish the appropriate model. Table 4.13 shows fixed effects (within) regression with prob >F = 0.000 which is less than 0.05 therefore the fixed effects model coefficients are different from zero. The lagged bank fragility variable had coefficient of 0.65, t-value = 7.92; p > t = 0.000. This means the variable had a significant positive influence on the dependent variable. Rho 0.66 shows that the variances are due to differences across panels.

Besides when lagbf1 increases by one unit it causes a 0.65 increase in bf (bank fragility). The coefficient, t-statistic and p > t for loan growth (lg) was -0.13, -5.14 and p> t= 0.000. The loan growth had a significant negative effect on the bank fragility variable. The other variable with significant influence was loan deposit ratio (ldr) with coefficient of 0.28, t-statistic=6.82; p> t= 0.000 which means the ldr variable had a

significant positive effect on bank distress. Loan quality (lq) had coefficient of -0.11, t-statistic -1.72 and p >t = 0.09 while insider loans (il) had coefficient of -0.45, t-statistic = -1.60 and p > t= 0.11. However, from fixed effect regression model alone no conclusion could be made on which model was appropriate. The researcher then ran a random effect model.

Table 4.13: Fixed Effects Regression Output

```
Fixed-effects (within) regression               Number of obs      =       120
Group variable: bankname1                       Number of groups   =        30
R-sq:  within  = 0.6304                         Obs per group: min =         4
       between = 0.7960                                        avg =       4.0
       overall = 0.7669                                        max =         4
                                                F(5,85)            =     29.00
corr(u_i, Xb)  = 0.0426                         Prob > F           =    0.0000

------------------------------------------------------------------------------
          bf |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      lagbf1 |   .6462379   .0815458     7.92   0.000     .4841031    .8083728
          lg |  -.1283664   .0249528    -5.14   0.000    -.1779792   -.0787536
         ldr |   .2798748   .0410607     6.82   0.000     .1982352    .3615144
          lq |  -.1086974   .0632228    -1.72   0.089    -.2344012    .0170064
          il |  -.4521202   .2821365    -1.60   0.113    -1.013083    .1088429
       _cons |  -.0921081   .0384769    -2.39   0.019    -.1686105   -.0156058
-------------+----------------------------------------------------------------
     sigma_u |  .04717677
     sigma_e |  .03420695
         rho |  .65541906   (fraction of variance due to u_i)
------------------------------------------------------------------------------
F test that all u_i=0:     F(29, 85) =      3.28                 Prob > F = 0.0000
```

Source: Research Data, 2021.

Under random effects model it is assumed that variations across entities are random and uncorrelated with independent variables of the model. In the random effects model Table 4.14, lagbf1 z =14.78, p > z is 0.000 which is less than 0.05, the variable has a significant influence on bank fragility. The lg variable z = -4.11, ldr z= 5.94, lq z=-1.65 and for il z=0.49. The p > z was 0.00, 0.00, 0.10 and 0.63 for lg, ldr, lq and il respectively. In this regression, wald chi2(5) was 443.39 which means the coefficients in the model were different from zero. A good model has wald chi less than 0.05.

Consequently, the researcher had to conduct a Hausman test to determine the appropriate model.

Table 4.14: Random Effects Regression Output

Random-effects GLS regression				Number of obs	=	120
Group variable: bankname1				Number of groups	=	30
R-sq: within = 0.5755				Obs per group: min	=	4
between = 0.9176				avg	=	4.0
overall = 0.8573				max	=	4
				Wald chi2(5)	=	443.39
corr(u_i, X) = 0 (assumed)				Prob > chi2	=	0.0000
bf	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lagbf1	.8180062	.0553361	14.78	0.000	.7095494	.9264629
lg	-.0991381	.024095	-4.11	0.000	-.1463634	-.0519127
ldr	.1685111	.0283749	5.94	0.000	.1128973	.2241249
lq	-.073842	.0447524	-1.65	0.099	-.161555	.013871
il	.0971072	.1989834	0.49	0.626	-.292893	.4871074
_cons	-.0633804	.0274643	-2.31	0.021	-.1172095	-.0095513
sigma_u	.0216057					
sigma_e	.03420695					
rho	.28517329	(fraction of variance due to u_i)				

Source: Research Data, 2021.

Under the Hausman test model, two hypotheses were tested as follows:

H0: Random Effect model is the appropriate

Ha: Fixed Effects model is the appropriate

Table 4.15: Hausman Test

	---- Coefficients ----			
	(b) fe	(B) re	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
lagbf1	.6462379	.8180062	-.1717683	.0681319
lg	-.1283664	-.0991381	-.0292283	.0118656
ldr	.2798748	.1685111	.1113637	.0338845
lq	-.1086974	-.073842	-.0348554	.051265
il	-.4521202	.0971072	-.5492274	.229407

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg
Test: Ho: difference in coefficients not systematic

$chi^2(5) = (b-B)'[(V\_b-V\_B)^{(-1)}](b-B)$

$= 19.92.$ $Prob>chi^2 = 0.0013$

Source: Research Data, 2021.

Hausman test hypothesis states that the preferred model is a random effects model and the alternative is that the preferred model is fixed effects. In Table 4.15, the prob > chi2 = 0.0013, which is less than 0.05. This means it is significant and therefore the null hypothesis is rejected. The preferred model was therefore the fixed effects model.

Table 4.16: Summary of Hausman Test Output

	Fixed Effects Model		**Random Effects Model**	
R-sq	76.69%		85.73%	
	t-statistics	p >t	t-statistics	p> t
lagbf	7.92	0.00	14.78	0.00
lg	-5.14	0.00	-4.11	0.00
ldr	6.82	0.00	5.94	0.00
lq	-1.72	0.09	-1.65	0.10
il	-1.60	0.11	0.49	0.63

Source: Researcher, 2021

The above table shows three variables, lagged dependent variable (lagbf), loan growth (lg) and loan deposit ratio (ldr) have significant influence on the dependent variable. The R-squared for the FEM was 76.69% while for REM was 85.73%. Both models are able to explain more than 76.69% and 85.73% of the variances in the dependent variable. However, having established the above, and in view of the non-normality of the study variables, generalized linear model was adopted. The conclusion from the Hausman test was significant because it highlighted significant variables, what level of changes in the dependent variable could be explained by the models and therefore the direction of GLM results would not deviate from OLS which is considered a special case of GLM.

4.6 Optimal Combination of Variables

A number of regressions were run to establish the optimal combination. Using Akaike Information Criterion (AIC) as highlighted in appendix 4, Model 1 had AIC -3.41, BIC -545.56, Model 2 had AIC -3.39, BIC-540.78, Model 3 showed AIC -3.42, BIC -555.13 while Model 4 had AIC -3.40 with BIC -550.35. According to Agresti (2013), AIC judges a model on how close its fitted values are to the true expected values. The optimal model using AIC is the one that has its fitted values closest to the true outcome probabilities. AIC and Bayesian Information Criterion (BIC) are goodness of fit statistics. The lower the AIC the better the model. According to the AIC and BIC, model 3 had the best combination of variables.

4.7 Generalized Linear Model (GLM)

GLM regression was conducted without and with the control variable to test the effect of size on the dependent variable.

4.7.1 GLM Regression Analysis

The GLM regression results without control variable Table 4.17. shows lagged bank fragility variable β=0.87, Z= 17.30, P > z = 0.00, while loan growth ratio variable had β=-0.08, Z= -3.19, P> z = 0.00, Loan Deposit ratio β0.13, Z= 5.49 with P > z = 0.00.

Table 4.17: GLM Regression without Control Variable

Generalized linear models				No. of obs	=	120
Optimization : ML				Residual df	=	114
				Scale parameter	=	.0018501
Deviance	= .2109083935			(1/df) Deviance	=	.0018501
Pearson	= .2109083935			(1/df) Pearson	=	.0018501
Variance function: V(u) = 1				[Gaussian]		
Link function : g(u) = u				[Identity]		
				AIC	= -3.405946	
Log likelihood	= 210.3567642			BIC	= -545.5632	
		OIM				
bf	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lagbf1	.8669464	.0501002	17.30	0.000	.7687519	.9651409
lg	-.0794346	.0249037	-3.19	0.001	-.128245	-.0306242
ldr	.1318089	.0239893	5.49	0.000	.0847907	.178827
lq	-.0561592	.0388189	-1.45	0.148	-.1322428	.0199244
il	.1607703	.1802658	0.89	0.372	-.1925442	.5140848
_cons	-.0539984	.0234647	-2.30	0.021	-.0999883	-.0080084

Source: Research Data, 2021.

The lagged dependent variable had the most significant influence on bank fragility followed by Loan Deposit ratio, an increase in lagged bank fragility increased the risk of bank fragility, besides an increase in LDR increased fragility and was indicative of future instability of the institution. The loan growth ratio had negative significant relationship with bank fragility. The loan quality ratio had β=-0.06, Z=-1.45, P > z = 0.15; Insider Loans β=0.16, Z= 0.89, P > z = 0.37.

The loan quality had a negative but insignificant relationship while Insider loans had positive but insignificant relationship with bank fragility.

Table 4.18: GLM Regression with Control Variable

Generalized linear models			No. of obs	=	120	
Optimization : ML			Residual df	=	113	
			Scale parameter	=	.001865	
Deviance = .2107427351			(1/df) Deviance	=	.001865	
Pearson = .2107427351			(1/df) Pearson	=	.001865	
Variance function: V(u) = 1			[Gaussian]			
Link function : g(u) = u			[Identity]			
			AIC	= -3.390065		
Log likelihood = 210.4039098			BIC	= -540.7758		
bf	OIM Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lagbf1	.8653275	.050594	17.10	0.000	.766165	.9644899
lg	-.0806072	.0253115	-3.18	0.001	-.1302168	.0309976
ldr	.1323969	.0241664	5.48	0.000	.0850316	.1797622
lq	-.0499523	.04419	-1.13	0.258	-.1365632	.0366586
il	.1458365	.1877986	0.78	0.437	-.222242	.513915
ta	-1.53e-08	5.13e-08	-0.30	0.766	-1.16e-07	8.53e-08
_cons	-.0548437	.0237292	-2.31	0.021	-.1013521	-.0083354

Source: Research Data, 2021.

Analysis of table 4.18 shows lagged bank fragility β=0.86, P > z = 0.00 < 0.05 and z-value of 17.10 at 95% level. The lagged bank fragility variable had a significant positive influence on bank fragility. Bashir, Yu, Hussain, Wang and Ali (2017) find the same in their study where NPL previous period affects the next period. The level of NPL_{t-1} has an influence on the subsequent years bank fragility. Ho, Huang, Lin and Yen (2016) argued that the higher the ratio of the NPL to total loans the higher the default rate. The fragility ratio seems sticky unless counterbalanced by growth in good credit with a much lower impairment to offset the previous NPL levels.

The loan growth β=-0.08, z = - 3.18, p > z = 0.00<0.05 shows that loan growth was significant. The β=-0.08, z-value of -3.18 was indicative of its negative relationship. Logan (2001) found loan growth at 5% level with coefficients of -0.0635 and t-value of -2.9811 and at 1% level coefficient of -0.0606 with t-value of -3.0259. Foos et al

(2010) lagged loan growth (1-4) and found p-value of alg t-1 0.099, alg t-2 0.000, alg t-3 0.000 and alg t-4 0.005. Oordt & Zhou (2018) found that banks with asset growth rate that was 10% or more were associated with high bank tail risk, a higher probability of failure. Iftikhar (2015) concluded that an abnormal loan growth of 18.7% led to an increase in relative loan losses and therefore lowered bank solvency. This is consistent with Lu & Whidbee (2013) who state that loan growth is proxy for lax underwriting standards. Iftikhar (2015) found p-values significant at 1% and concluded that loan growth was significant variable in bank fragility in financial reform situations. Iftikhar (2015) measured financial fragility using ratio of impaired loans to gross loans.

Berger et al (2016) used quarterly data and found quarterly growth in total volume of outstanding loans to be statistically significant at 1% level in predicting distress in 1-year. The coefficient of loan growth from table 4.18 indicates that for every one unit change in growth in loans, bank fragility declined by -0.08 which seems consistent with Kedir, Iftikhar, Murinde & Kamgnia (2018) who found that growth of loan was statistically significant at 10% level with coefficient of -0.019 which meant high loan growth reduced fragility as measured by impaired loans as a percentage of gross loans. This finding indicated that increases in loan growth was due to performing loans with good quality underwriting standards.

Therefore, the conclusion on loan growth variable for this study was consistent with Kedir et al., (2018). However, the mean loan growth ratio of 26.49% for this study is above Oordt et al., (2018) and Iftikhar (2015) and therefore should be a major concern for regulators and policy makers. According to table 4.18 the loan deposit ratio had β-coefficient of 0.13, z-value 5.48 and p-value 0.00<0.05. Loan deposit ratio is a significant variable in bank fragility studies as confirmed by p-value. A 1% change in

LDR leads to a 13% increase in bank fragility. Wood & Skinner (2018) found LDR coefficient of 0.334, p > t of 0.028 which was significant at 5% level and concluded that LDR had a significant positive effect on non-performing loans, a proxy for distress Almanidis & Sickles (2012), Cleary & Hebb (2016) find that loan deposit ratio is negatively related to bank failure. Cucinelli (2015) concluded that loan deposit ratio had a significant effect at 5% level on bank lending behaviour. The findings of this study show LDR is positively related to bank fragility. The mean LDR of 72.66% and maximum over period 2005-2015 ranging between 103.24% and 200.46% confirm the predictive ability of the variable in bank fragility studies.

The loan quality variable had coefficient of -0.06, z-value -1.13 and p-value 0.26 > 0.05. Huang et al., (2012) found p-value for ASEAN at -0.156; G8 -0.859, EU at -1.253, NIC at -0.086 and G-20 at -0.258 all being significant at 5% level that is p-value<0.05 and concluded that net interest income best predicted financial distress of global banks. Logan (2001) found bank distress to be positively related to dependence on traditional sources of income that is net interest income for the banks. DeYoung et al., (2013) however found that one standard deviation increase in net interest income reduced chances of failure by 27%. The above results are at a variance with Huang et al., (2012) and DeYoung et al., (2013).

Most Kenyans commercial banks have reduced dependency on interest income and ventured into non-interest income due to among others legislation to control interest which had been discussed for a long time and culminated in-duplum rule section 44A (1) and (2) of the Banking Act which was enacted in 2006 and interest rate capping in 2016.

The insider loan variable had coefficient of 0.16, z-value 0.78 and p-value of 0.44 > 0.05. Thomson (1991) used insider loans as a ratio of total assets as a proxy for fraud and insider abuse. Using logit regression Thomson found insider abuse positively related to bank distress. The proxy could predict distress well beyond 36 months before actual failure. The coefficient for 6-12 months was 28.44, 12 - 18 months 30.08 and 18- 24 months being 30.86; with significance level at 1% being -4.20, -3.67 and -3.48 for 6-12 months, 12 -18 months and 18 -24 months respectively. The results of this study contradict evidence by Thomson (1991).

The control variable, total assets had coefficient of -1.53e-08, z-value -0.31 and p-value of 0.759. The control variable does not have a significant relationship with bank fragility, however, there is a negative relationship which indicates that size matters. This result is consistent with Altunbas, Gambacorta and Marques-Ibanez (2009) who found the effect of size to be negative. The bigger the bank the less vulnerable it is to fragility.

4.8 Testing for Mediation

The study tested for mediation using Baron's four step approach and the Sobel test.

4.8.1 Four Step Approach

The GLM regressions followed mirrored Baron et al., (1986) equations below.

Step one regression model:

(i) $Y_{bfit} = \alpha + Y_{bfit-1} + \beta_1 X_{it} + \varepsilon_{it}$

$Y_{bfit} = -0.05 + 0.87Y_{bfit-1} - 0.08lg + 0.13ldr - 0.06q + 016il$

Shows the direct effect of X on Y.

Table 4.19: Step one: Regression Test for Path 'c'

Generalized linear models		No. of obs	= 120
Optimization : ML		Residual df	= 114
		Scale parameter	= .0018501
Deviance	= .2109083935	(1/df) Deviance	= .0018501
Pearson	= .2109083935	(1/df) Pearson	= .0018501
Variance function: V(u) = 1		[Gaussian]	
Link function : g(u) = u		[Identity]	
		AIC	= -3.405946
Log likelihood	= 210.3567642	BIC	= -545.5632

bf	OIM Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lagbf1	.8669464	.0501002	17.30	0.000	.7687519	.9651409
lg	-.0794346	.0249037	-3.19	0.001	-.128245	-.0306242
ldr	.1318089	.0239893	5.49	0.000	.0847907	.178827
lq	-.0561592	.0388189	-1.45	0.148	-.1322428	.0199244
il	.1607703	.1802658	0.89	0.372	-.1925442	.5140848
_cons	-.0539984	.0234647	-2.30	0.021	-.0999883	-.0080084

Source: Research Data, 2021.

Step two: Regression Test of Path 'a'

(ii) $M_{it-1} = \alpha + Y_{bfit-1} + \beta_1 X_{it} + \varepsilon_{it}$

$M_{it-1} = 0.02 + 0.003Y_{bfit} + 0.00lg - 0.004dr + 0.02lq - 0.02il$

Table 4.20: Step two: Regression Test of Path 'a'

Generalized linear models		No. of obs	= 120
Optimization : ML		Residual df	= 114
		Scale parameter	= .0001882
Deviance	= .0214506963	(1/df) Deviance	= .0001882
Pearson	= .0214506963	(1/df) Pearson	= .0001882
Variance function: V(u) = 1		[Gaussian]	
Link function : g(u) = u		[Identity]	
		AIC	= -5.691613
Log likelihood	= 347.4967709	BIC	= -545.7526

med	OIM Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lagbf1	-.0029439	.0159776	-0.18	0.854	-.0342595	.0283717
lg	.0006225	.0079421	0.08	0.938	-.0149438	.0161888
ldr	-.0038563	.0076505	-0.50	0.614	-.018851	.0111385
lq	.0197003	.0123799	1.59	0.112	-.0045639	.0439644
il	-.0197312	.0574893	-0.34	0.731	-.1324082	.0929458
_cons	.0176666	.0074832	2.36	0.018	.0029997	.0323334

Source: Research Data, 2021

This step is conducted to test independent variables predicting the mediator. The loan growth was insignificant at 95% level with β=0.00; z-value = 0.08 and p-value of 0.94. The loan growth had a positive but insignificant influence on the mediating variable. Besides, loan deposit ratio had β=-0.004; z-value = -0.05 and p-value of 0.61 insignificant negative relationship with information asymmetry. The loan quality had β=0.02, z=1.59 and p-value f 0.11, while insider loans had β=-0.02, z=-0.34 and p-value of 0.73. In summary all the variables had insignificant relationship with the mediating variable.

Step three: regression test of path 'b'

$Y_{bfit} = \alpha + \beta_1 M_{it} + \varepsilon_{it}$

$Y_{bfit} = 0.11 - 0.37 M_{it}$

This step tests the predictive ability of the mediator on the dependent variable. The mediator had β=-0.37 p > z = 0.54 with z-value of -0.62. A decline in information increased possibility of fragility, however the mediator could not predict the dependent variable.

Table 4.21: Step three: Regression Test of Path 'b'

Generalized linear models				No. of obs	=	150
Optimization : ML				Residual df	=	148
				Scale parameter	=	.013018
Deviance	= 1.926670279			(1/df) Deviance	=	.013018
Pearson	= 1.926670279			(1/df) Pearson	=	.013018
Variance function: V(u) = 1				[Gaussian]		
Link function : g(u) = u				[Identity]		
			AIC	= -1.490298		
Log likelihood	= 113.7723719		BIC	= -739.6474		
	OIM					
bf	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
med	-.3701186	.5978023	-0.62	0.536	-1.54179	.8015525
_cons	.1102753	.016827	6.55	0.000	.0772949	.1432556

Source: Research Data, 2021

Step four: Regression of independent and mediator predicting dependent variable.

(iv) $Y_{bfit} = \alpha + Y_{bfit-1} + \beta_1 X_{it} + + \beta_2 M_{it} + \varepsilon_{it}$

$Y_{bfit} = -0.06 + 0.87_{Ybfit-1} + 0.22\ MV_{it-1} - 0.08lg + 0.13ldr - 0.06lq + 0.17il$

Step four tests the combined effect of independent variable and mediator on predicting the dependent variable.

Table 4.22: Step Four: Independent and Mediating Variables on Dependent Variable

Generalized linear models				No. of obs = 120		
Optimization : ML				Residual df = 113		
				Scale parameter = .0018576		
Deviance = .2099098995				(1/df) Deviance = .0018576		
Pearson = .2099098995				(1/df) Pearson = .0018576		
Variance function: V(u) = 1				[Gaussian]		
Link function : g(u) = u				[Identity]		
				AIC = -3.394025		
Log likelihood = 210.641494				BIC = -540.7767		
	OIM					
bf	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lagbf1	.8675816	.0502096	17.28	0.000	.7691726	.9659905
lg	-.0795689	.0249551	-3.19	0.001	-.1284799	-.0306579
ldr	.1326409	.0240649	5.51	0.000	.0854746	.1798071
lq	-.0604095	.0393275	-1.54	0.125	-.13749	.016671
il	.1650273	.1807259	0.91	0.361	-.1891889	.5192435
med	.2157506	.2942772	0.73	0.463	-.361022	.7925232
_cons	-.0578099	.0240804	-2.40	0.016	-.1050066	-.0106133

Source: Research Data, 2021.

Baron et al., (1986), Kenny (2016) and Mehmetoglu (2018) asset that the Baron et al four-step model is capable of establishing partial or complete mediation. According to Kenny (2016), Mehmetoglu (2018) path c as indicated by figure 3.1 should be statistically significant to justify the effect to be mediated. Using the autoregression results the lagged dependent variable z-value=17.28, loan growth z-value =-3.19 and loan deposit ratio z-value = 5.51 with p-value > t = 0.00 are all statistically significant. Therefore, three independent variables pass the test for step one. The rule for test two, which is a regression of the mediator on the independent variables must also be statistically significant. This is the test for path a as shown above. Mehmetoglu states that this regression should show evidence of the mediator and independent variable relationship.

The lagged dependent variable β= -0.003, z= -0.18 and p-value = 0.854, loan growth variable, β= 0.000, z= 0.08 and p-value = 0.938, loan deposit ratio β= -0.004, z= -0.50 and p-value = 0.614, loan quality β= 0.02, z= 1.59 and p-value = 0.112 and insider loans β= -0.02, z= -0.34 and p-value = 0.731. These variables were statistically insignificant therefore an insignificant relationship with information asymmetry.

According to Kenny (2016) and Mehmetoglu (2018) step three is an estimate of path b, which must be statistically significant. The mediator variable predicting the dependent variable with β=-0.37, z=-0.62 and p>z=0.54 was statistically insignificant. The negative relationship implying as information disclosures declined, bank fragility went up. Finally step four was a regression of independent and mediator variable on the dependent variable. Mehmetoglu (2018), Kenny (2016) argue that path c should be zero, implying a diminished impact after controlling for the mediator. Path c, was not fully met therefore indication information asymmetry does not mediate effect of loan ratios on bank fragility.

Zhao et al., (2010) argue that there are five mediation effects. Complimentary mediation is where both mediated effect a x b and direct effect c exist and that both point the same direction which they claim is partial mediation using baron et al (1986) model. The second is called competitive mediation where both indirect effect a x b and the direct effect c exist however they point in different directions. The third is indirect only mediation where a x c exist but no direct effect which conforms to Baron et al full mediation result. The fourth is called direct only non-mediation where direct effect of c exists but there is no indirect effect.

Lastly, the fifth mediation is no-effect non-mediation where there is neither direct effect nor indirect effect. Zhao et al argue that there need not be a significant zero order effect

of the independent variable (x) on the dependent variable (y) to establish mediation. The zero-order effect they further argue is equivalent to the total effect of x on y that is C'= (a x b) + c. Zhao et al., (2010) argue that many research work has been abandoned because data did not conform with Baron and Kenny (1986) criteria. In their opinion conforming with Baron et al., (1986) ends up as an impediment to theoretical development. Zhao et al., provide a decision tree to follow in establishing mediation or no mediation. The coefficients of a and b, standard error of a and b were extracted from step two Table 4.20 for a and SE(a) and Step four Table 4.22 for b and SE (b).

Table 4.23: Summary of Coefficients and Standard Errors for Testing Mediation

	Y=Cx+bM-Path b			**$M=i_1+\alpha X+e_i$**
	Coefficient (b)	S.E (b)	Coefficient (a)	S.E (a)
Lagbf1	0.8675816	0.0502096	-0.0029439	0.0159776
Lg	-0.0795689	0.0249551	0.0006225	0.0079421
Ldr	0.1326409	0.0240649	-0.0038563	0.0076505
Lq	-0.0604095	0.0393275	0.0197003	0.0123799
Il	0.1650273	0.1807259	-0.0197312	0.0574893
Med	0.2157506	0.2942772		

Source: Research Data, 2021.

4.8.2. Sobel Test Results

$$Z = \frac{\text{a x b}}{\sqrt{b^2 S_a^2 + a^2 S_b^2}}$$

The z-statistics computed below were derived from the above formular. The p-values were computed using Hayes Sobel calculator. **http://quantpsy.org/sobel/sobel.htm**

Lagged dependent variable

$$= \frac{-0.0029439\ x\ 0.2157506}{\sqrt{0.2157506^2\ x\ 0.0159776^2 + -0.0029439^2\ x\ 0.2942772^2}} = -0.18$$

The Z-score for the lagged dependent value is -0.18 which is less than 1.96 besides the p-value is 0.86 which is greater than 0.05 therefore statistically insignificant. It was therefore concluded that information asymmetry as defined had statistically no significance on bank fragility. Therefore, the researcher could not reject the null hypothesis.

Loan Growth ratio

$$= \frac{0.0006225\ x\ 0.2157506}{\sqrt{0.2157506^2\ x\ 0.0079421^2 + 0.0006225^2\ x\ 0.2942772^2}} = 0.08$$

The z-score of 0.08 and p-value of 0.94 showed that information asymmetry could not mediate the relationship between loan growth ratio (lg) and bank fragility. The researcher failed to reject the null hypothesis.

Loan Deposit ratio

$$= \frac{-0.0038563\ x\ 0.2157506}{\sqrt{0.2157506^2\ x\ 0.0076505^2 + -0.0038563^2\ x\ 0.2942772^2}} = -0.42$$

The Loan Deposit Ratio (ldr) had a z-score of -0.42 and p-value 0.68. The null hypothesis that information asymmetry does not mediate the relationship between loan deposit ratio and bank fragility could not be rejected.

Loan Quality ratio

$$= \frac{0.0197003\ x\ 0.2157506}{\sqrt{0.2157506^2\ x\ 0.01237992^2 + 0.0197003^2\ x\ 0.2942772^2}} = 0.67$$

The loan quality variable had a z-statistic of 0.67 and p-value 0.51 signifying statistically insignificant relationship between information asymmetry, loan quality and bank fragility. The researcher failed to reject the null hypothesis.

Insider Loans ratio

$$= \frac{-0.0197312\ x\ 0.2157506}{\sqrt{0.2157506^2\ x\ 0.0574893^2 + -0.0197312^2\ x\ 0.2942772^2}} = -0.31$$

The insider loans variable was statistically insignificant at 0.05 level, z-score -0.31 and p-value 0.76. The researcher failed to reject the null hypothesis.

The z-score from Sobel test for the independent variables was follows; loan growth z = 0.08, loan to deposit ratio z = -0.42, loan quality ratio z = 0.67, insider loans z = -0.31 and lagged dependent variable z = -0.18. Sobel test results at 95% level fall within the range -1.96 and +1.96. Therefore, for z-scores less than 1.96 means the null hypothesis is accepted that information asymmetry does not mediate the relationship between the independent variables and bank fragility. Any values of z-score greater than 1.96 means it is statistically significant and therefore reject the null hypothesis. All the study variables fall within the accept area. However, Sobel test has its own weaknesses, it works well with large samples. The study used a small sample which may have led to the above results. According to Mackinnon et al.,(2002) the standard normal distribution that is z-scores require a sample large enough to enable mediation analysis to be conducted.

Hayes (2009) states that the sampling distribution of ab tends to be asymmetric rather than normal, this is a major weakness of Sobel test which assumes the sampling

distribution of the indirect effect is normal. According to appendix 5, net property plant and equipment scaled by total assets had mean of 2.344%, minimum 0.205% and maximum 11.423% showing net property plant and equipment constitute a very small part of total assets. This could in part have contributed to the above results where the measure of information asymmetry was insignificant on the effect of loan ratios on fragility indicator. Investments in tangible assets by commercial banks in Kenya is small.

Table 4.24: Summary of Hypothesis Testing

Number	Null Hypothesis	Results	Decision
H_{01}	Loan growth ratio has no statistically significant effect on bank fragility	β=-0.08 Z=-3.19 p>z=0.00	Reject **H_{01}**
H_{02}	Loan to deposit ratio has no statistically significant effect on bank fragility	β=0.13 Z=5.49 p>z=0.00	Reject **H_{02}**
H_{03}	Loan quality ratio has no statistically significant effect on bank fragility	β=-0.06 Z=-1.45 p>z=0.15	Failed to reject **H_{03}**
H_{04}	Insider loans ratio has no statistically significant effect on bank fragility	β=0.16 Z=0.89 p>z=0.37	Failed to reject **H_{04}**
H_{06}	Information asymmetry has no statistically significant effect on bank fragility	β= -0.37 Z= -0.62 p>z= 0.536	Failed to reject H_{06}
H_{05a}	Information asymmetry does not mediate the effect of loan growth ratio on bank fragility	z-score= 0.08 p-value= 0.94	Failed to reject **H_{05}**
H_{05b}	Information asymmetry does not mediate the effect of loan to deposit ratio on bank fragility.	z-score= -0.42 p-value= 0.68	Failed to reject **H_{06}**
H_{05c}	Information asymmetry does not mediate the effect of loan quality ratio on bank fragility	z-score = 0.67 p-value= 0.51	Failed to reject **H_{07}**
H_{05d}	Information asymmetry does not mediate the effect of insider loans ratio on bank fragility	z-score= -0.31 p-value= 0.76	Failed to reject **H_{08}**

Source: Research Data, 2021.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

The main objective of this study was to analyse the effect of loan ratios and the mediating role of information asymmetry on fragility among commercial banks in Kenya. The study findings examined the effect of loan ratios and information asymmetry and the transmitted impact on bank fragility. This chapter is divided into eight sections as follows: section 5.1 provides a summary of findings; section 5.2 summarizes the mediating effect of Information asymmetry while section 5.3 gives research contribution. Section 5.4 provides the conclusion while section 5.5 and 5.6 give study and policy recommendations respectively. Sections 5.7 and 5.8 discuss recommendations for further research and the limitations of the study.

5.1 Summary of Findings

Kenya's Commercial banking sector experienced systemic banking crisis and bank fragility between 2005 – 2015. The data analysis presented evidence of variability and sectoral problems. There is need for the regulator to institute decisive action to ensure stability and that the sector ratios revert to below pointers of systemic banking crisis.

Loan decisions made today affect performance in subsequent years, showing the importance of lagged dependent variable. Therefore, the level of non-performing loans to total loans today has a significant impact on the proportion of non-performing loans to total loans in the future. The z-statistic for lagged dependent variable was +17.30, p-value 0.00 and β=+0.87. The variable had a significant positive influence and could explain bank fragility.

The loan growth ratio had z-statistics -3.19 with p-value = 0.00 and β=-0.08. As the loan portfolio increases the chances of fragility declines, while as the loan portfolio declines the chances of fragility increases. The expansion of credit by commercial banks in Kenya helped improve the solvency of the institutions. This holds due to the fact that quality credit expansion enhances revenue generation in form of interest income. The generation of quality income is a sign of stability.

The loan deposit ratio (LDR) had z-statistics +5.49, p-value of 0.00 with β=+0.13. Therefore, as LDR increases the chances of bank instability increases due to reliance on information sensitive wholesale deposits. High LDR ratios are symptomatic of problems, commercial banks are forced to source expensive loan capital which depresses the net interest income. This undermines the institutions stability if the continued reliance on loan capital is long term.

The loan quality ratio had z-statistics -1.45 p-value 0.15 and β=-0.06 while insider loans had z-statistics +0.89 with p-value =0.37 with β=+0.16. As loan quality declines bank fragility increases. An increase in the level of insider loans increases probability of bank instability. The two variables loan quality and insider loans ratio had negative and positive relationship with bank fragility respectively but were statistically insignificant. When control variable was incorporated in the analysis, the lagged dependent variable had z-statistic of +17.10, β=+0.87 and p-value = 0.00; loan growth ratio had z-statistic of -3.18, β=-0.08, p-value of 0.00, while loan deposit ratio had z-statistic of +5.48, β=+0.13 and p-value of 0.00. These three variables were significant at 95% level of confidence. The loan quality ratio had z-statistic of -1.13, β=-0.05, p-value 0.26. Insider loans ratio had z-statistic +0.78, β=+0.15 with p-value 0.44.

The control variable had z-statistic -0.30, β=+0.00 with p-value of 0.77, which was statistically insignificant. The control variable had no major influence on the independent variables. The AIC for GLM regression without control variable was -3.41 while with control variable the AIC was -3.39 which meant the model without control variable had a better fit.

5.1.1 Loan Growth Ratio and Bank Fragility

The loan growth ratio had a surprisingly negative significant effect on bank fragility. The inverse relationship meant an increase in loan portfolio improved bank solvency and therefore lowered the possibility of fragility. This also means banks that experienced declining loan growth had increased chances of instability. A distressed bank would be hard pressed to attract deposits in order to create credit. The evidence adduced shows a number of commercial banks with loan growth ratios above the mean of 26.49%. Though, the overall results indicate such growth had positive impact on fragility indicators in Kenya's commercial bank industry, such growth rates are a cause for alarm.

5.1.2 Loan Deposit Ratio and Bank Fragility

The loan deposit ratio was a powerful predictor, one bank with inordinately high loan deposit ratios of more than 120% failed. The ratio could therefore explain bank fragility. The loan deposit ratio z-statistic and p-value confirmed the importance of LDR in commercial bank stability. There is need for the regulator to assess the solvency of Commercial banks with high loan deposit ratios. The mean ratio of 72.67% was indicative of a stable sector with good intermediation, however, at individual bank level a number of banks consistently had LDR above 100% signifying impaired intermediation capability.

5.1.3 Loan Quality and Bank Fragility

The loan quality variable measuring dependence on interest income by commercial banks was insignificant. The z-statistics and p-value showed the variable could not explain bank fragility. As loan quality increases bank fragility declines. The variable had insignificant effect on bank fragility contrary to expectations. This could be explained by diversification of income streams undertaken by Commercial banks in Kenya. The mean ratio of 45.50% was indicative of non-dependency by the sector, however, some banks showed higher ratios above 51%. The mean ratios seemed to camouflage a dependency problem for individual banks.

5.1.4 Insider Loans and Bank Fragility

Insider loans variable was insignificant in explaining bank fragility. The mean ratio was 3.33% which showed insider loans were not a problem in the sector. The variable showed positive insignificant effect on fragility, which was at variance with findings related to one Commercial bank closed between 2015- 2016. The bank had understated its level of insider loans. Forensic analysis found abuse by insiders, but this was not evident from periodic returns by the bank, which could be a case of selective disclosures to the regulator.

5.2 Mediating Effect of Information Asymmetry

The study adopted net property plant and equipment scaled by total assets as mediating variable.

5.2.1 Information Asymmetry, Loan Growth Ratio and Bank Fragility.

The loan growth ratio had insignificant positive effect on the mediating variable with GLM regression output $\beta = 0.01$, $z = 0.08$ and p-value = 0.94. Loan growth could increase as a result of hidden negative information held by management.

Besides, management grow the loan portfolio to enable cover up the deteriorating loan book granted in the previous years however, the results of the study contradict this notion. The variable could not mediate the effect of loan growth ratio on bank fragility with Sobel test z of 0.08 and p-value 0.94, z less than 1.96 therefore insignificant.

5.2.2 Information Asymmetry, Loans to Deposit Ratio and Bank Fragility

The loan deposit ratio GLM output had β= -0.004, z = -0.50 and p-value 0.61. The variable had a negative statistically insignificant effect on information asymmetry. Sobel test results were z = -0.42 > -1.96 with p-value 0.68, the variable could not mediate the effect of loan deposit ratios on bank fragility.

5.2.3 Information asymmetry, Loan Quality and Bank Fragility

The loan quality ratio measured as net interest income to total income had statistically insignificant effect with information asymmetry. The relationship was positive but insignificant with GLM output showing β=0.02, z-statistic = 1.59 and p-value 0.11. Sobel test z-value= 0.67 < 1.96, p-value 0.51 there was insignificant intervening role played by the variable on effect of loan quality ratio on bank fragility.

5.2.4 Information Asymmetry, Insider Loans and Bank Fragility

The GLM output for Insider loans was β=-0.02, z-statistic = -0.34, p-value 0.73, a negative statistically insignificant effect with the mediator. It was the researcher's expectation that the effect would be significant as management avoid disclosure of insider lending to hide poor loan portfolio. It has also been empirically proved that insider loans are a pointer to fraud and poor management. The Sobel test was z-value -0.31 > -1.96 and p-value 0.76 showing a negative and insignificant effect.

5.2.5 Information Asymmetry and Bank Fragility.

A test of path b, the mediator predicting the dependent variable had β=-0.37, z-statistic -0.62 with p-value 0.54. The effect was negative and insignificant. There was no evidence to show a statistically significant effect, consequently, the measure of information asymmetry as defined could not predict bank fragility. Tangible assets constitute an insignificant percentage of total assets. Evidence derived from the study shows loans constitute more than 50% of total commercial banks assets, therefore the nature of banking business is that investment in property, plant and equipment is insignificant. This could be the reason why the variable was unable to predict bank fragility.

5.3. Contribution to Research

The contribution of this thesis hinges on the ability of the regulatory authorities, policy formulators, banking institutions and investors to follow changes in fragility indicators. That persistent loan deposit ratios above one hundred percent are symptomatic of fragility. That loan growth ratios have a negative significant effect on fragility among commercial banks in Kenya.

The other significant finding is that the proxy measure of information asymmetry measured by net property plant and equipment scaled by total assets could not mediate the effect of loan ratios on bank fragility. The variable had insignificant effect on loan ratios and fragility. Property plant and equipment constitute a small percentage of commercial banks total assets. Whereas researchers have used property plant and equipment scaled by total assets as a measure of information asymmetry, the evidence in this study suggests the hunt for an appropriate measure for information asymmetry for commercial banks in Kenya continues.

5.4 Conclusion

The objectives of the study were to test the predictive power of loan ratios and their interaction with information asymmetry and the effect on bank fragility. The study concluded that the loan ratios had powerful predictive ability on fragility among commercial banks in Kenya. The loan growth ratio had a negative relationship with bank fragility. The study concluded that regulatory authorities should watch loan growth with attention on banks with declining growth rates and high growth ratios above 15%.

The long-term loan deposit ratio was 72.7% with maximum being 200%. Loan deposit ratio was a better predictor for bank fragility. The regulatory authorities and policy makers should examine this ratio for evidence of weaknesses in the system. Inordinately high loan deposit ratio could be indicative of inability to attract cheap retail deposit and therefore reliance on expensive and volatile wholesale deposits, increasing chances of instability. The maximum loan quality of 76.9% showed overdependence on interest income for some commercial banks, which should then have emerged as a predictor of fragility for banks that are not well diversified. The study concluded that the maximum could have been an outlier and therefore Kenyan banks exhibited good degree of income diversification with mean of 45.49%. It was also established that information asymmetry does not mediate the effect of loan quality ratio on fragility among commercial banks in Kenya.

The insider loans variable had insignificant effect on bank fragility. The study concluded that insider loans were insignificant in predicting fragility. There is need to review methods of disclosure and measurement to identify abuse of customer deposits being advanced to insiders in the bank following discovery of insider loans disclosure

problems at one distressed bank. It was concluded that information asymmetry does not mediate the relationship between insider loans and bank fragility.

5.5 Study Recommendations

The study findings were broken into two, loan ratios and effect on fragility and effect of information asymmetry, loan ratios and bank fragility. The Central Bank of Kenya as the regulator of commercial banks should focus on loan growth ratio. The loan growth ratio should be closely monitored as symptoms of instability emerge from the variable. Therefore, commercial banks with loan growth rates above industry averages from one month to the next whether positive or negative be placed on watch list to help the regulator monitor bank health.

The loan deposit ratio was found a key variable in detecting bank health. The regulator should model monthly reporting requirements to ensure banks are able to disclose the ratio and explain any significant positive change. It was found the ratio was able to detect weaknesses in banks long before one bank was placed under receivership. Besides, a monthly monitoring of the ratio will be able to disclose reduction in customer deposits and increase in volatile and sensitive wholesale funding. There is need for policy pronouncement on the variable to protect loan capital investors due to the significant role of commercial banks in the financial system.

The study recommends search for new measure of income diversification since net interest income as a ratio of total income was found insignificant. The shift from interest income was thought of as a shift of risk to non-interest income segments of the bank. The shift to new segments must be monitored to minimise build-up of systemic risk in the sector.

The nature of insider loans should be a matter Central Bank of Kenya must undertake on-site inspection due to the ease with which management can camouflage them as part of external loans. Insider loans remain a major source of instability in Kenyan banks, however the study found the variable insignificant in detecting fragility.

This study focused on Kenyan banks and showed loan ratios could explain bank fragility. It is time to review CAMELS indicators first introduced in 1979, more than forty (40) years ago as the asset side (loan ratios only) could detect weaknesses in commercial Banks equally well.

5.6 Policy Recommendations

The level of NPL can act as an incentive for bank managers to seek deposits and lend more thereby exacerbating the problem. Consequently, it is recommended that any bank with NPL to gross loans greater than a certain regulatory determined threshold should not be allowed to attract more deposits whether or not the value of collateral exceeds the level of gross NPL to ensure the NPL to total loans ratio progressively reduces to below 5%. The regulatory authorities should also review high loan growth ratios.

The second policy is that the regulatory authorities should review LDR with a view to find a level at which they would intervene in commercial bank's operations. This would limit attraction of loan capital by fragile banking institutions. Customer deposits constitute the most stable form of loanable funds. Besides, such deposits tend to be cheaper compared to wholesale deposits which are expensive and volatile. Loan capital investors are not protected by the deposit insurance therefore need to limit their exposure.

The findings of the study should enable the regulatory authorities and investors to follow changes in fragility indicators. Besides, they should be able to anticipate changes

that induce fragility in the sector. Finally, the need to establish to what extent the market can rely on loan ratios in predicting fragility will be appropriate.

5.7 Recommendations for Further Research

This study focused on loan ratios, information asymmetry and the effect on bank fragility. Early warning systems should incorporate all CAMELs indicator to find out the composite role of information asymmetry on bank fragility. Besides use of monthly data would be appropriate in flagging out weaknesses early instead of using year end data by which time significant negative changes could have taken place. There is need to model accounting and market microstructure proxy measures of information asymmetry as mediators. The use of accrual quality using cash flows should also be used to test the mediating role of information asymmetry in bank fragility. The fragility indicator impaired loans to totals loans should be tested against deposit mobilization. There has been an assertion that high NPLs act as an incentive for bank managers to carry out aggressive deposit mobilisation and lend more thereby exacerbate the problem.

In order to determine if the model can be subjected to extensive regulatory use, a large sample of both banks in operation and failed banks should be tested. Specifically, this model should be applied to US bank data since the country has the highest number of failed banks therefore sufficient data and large population on which to draw conclusions.

Examine factors limiting loan quality and insider loans as predictors of bank fragility and the limiting role of loan deposit ratio on credit creation. With utmost care studies should examine the logarithm of total assets as a proxy measure of information asymmetry bearing in mind more than 50% of commercial banks assets comprise loan

assets. It would also be appropriate to conduct research on fragility among commercial banks in Kenya before and after the event window of 2015-2016.

5.8 Limitations of the Study

This study relied on secondary data from the CBK repository of commercial banks annual audited financial statements. However, material misstatement in financial statements may not be completely eliminated. The investigations in this study may fall short of addressing all the drivers of bank fragility due in part to the small population. Besides, having chosen to probe loan ratios, it may not capture other drivers like capital, management, earnings, liquidity and sensitivity to the market.

The use of property plant and equipment scaled by total assets requires further review since property plant and equipment comprise a small percentage of total assets of commercial banks. The use of GLM regression with standardized coefficients could have had a limiting effect on mediation analysis.

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APPENDICES

Appendix 1: Distressed Banks & Non-Bank Financial Institutions 1984-2016

	Name of Institution	Licensed	Closed
1	*Rural Urban Credit & Finance Ltd	1982	1984
2	*Continental Bank of Kenya Ltd	1982	1986
3	*Continental Credit & Finance Ltd	1982	1986
4	*Capital Finance Ltd	1981	1986
5	*Business Finance Ltd	1983	1989
6	*Estate Finance Company of Kenya Ltd	1985	1989
7	*Home Savings & Mortgages Company Ltd	1982	1989
8	*Nationwide Finance Company Ltd	1981	1989
9	*Union Bank of Kenya Ltd	1984	1989
10	*Jimba Credit Corporation Ltd	1980	1989
11	*Kenya Savings & Mortgages Ltd	1983	1989
12	*Postbank Credit Ltd	1990	20/05/93
13	*Middle Africa Finance Corporation Ltd	1982	20/08/93
14	*Trade Bank Ltd	1985	18/08/93
15	*International Finance Company Ltd	1984	16/04/93

*Source: *Central Bank of Kenya BSD annual Report 1994*
*** KDIC Annual Report 2015/2016*
**** Central Bank of Kenya BSD Annual Report, 2017.*

Appendix 1: Distressed Banks & Non-Bank Financial Institutions 1984-2016

	Name of Institution	Licensed	Closed
16	*Allied Credit Limited	1983	20/08/93
17	*Trade Finance Limited	1982	18/08/93
18	*Diners Finance Limited	1988	20/08/93
19	*Nairobi Finance Corporation Ltd	1987	16/04/93
20	*Inter –Africa Credit Finance Co Ltd	1985	31/01/93
21	*Central Finance (Kenya) Ltd	1984	19/05/93
22	*Exchange Bank	1991	1993
23	*United Trustee/United Bank	1985	1994
24	*Export Bank of Africa Ltd	1992	1994
25	*Pan-African Credit & Finance Ltd	1981	18/08/94
26	*Pan-African Bank Ltd	1982	18/08/94
27	*Thabiti Finance Company Ltd	1982	19/12/94
28	**Heritage Bank Limited		13/09/96
29	**Meridien Biao Bank (K) Ltd		15/04/96
30	**Kenya Finance Bank Ltd		29/10/96

*Source: *Central Bank of Kenya BSD annual Report 1994*
*** KDIC Annual Report 2015/2016*
**** Central Bank of Kenya BSD Annual Report, 2017*

Appendix 1: Distressed Banks & Non-Bank Financial Institutions 1984-2016

	Name of Institution	Licensed	Closed
31	**Ari Banking Corporation Ltd		05/12/97
32	**Fortune Finance Co. Ltd	Closed	2000
33	**Prudential Building Society Ltd	Closed	2005
34	**Reliance Bank Ltd	1995	12-Sep-00
35	**Prudential Bank Ltd	1995	05-May-00
36	**Trust Bank Ltd	1988	15-Aug-01
37	**Eurobank Ltd	1995	21-Feb-03
38	**Daima Bank Ltd	1992	13-Jun-05
39	**Charterhouse Bank Ltd	1998	USM 2006
40	***Dubai Bank Kenya Ltd	1982	2015
41	***Imperial Bank Ltd	1996	2015
42	***Chase Bank (K) Ltd	1996	2016

*Source: *Central Bank of Kenya BSD annual Report 1994*
*** KDIC Annual Report 2015/2016*
**** Central Bank of Kenya BSD Annual Report, 2017.*

Appendix 2: Commercial Banks in Kenya as at 31st December 2015

	Name	Licensed
1	Bank of India	1953
2	Citibank N.A. Kenya	1974
3	Habib Bank A.G. Zurich	1978
4	Habib Bank Ltd	1956
5	Bank of Baroda (K) ltd	1953
6	Barclays Bank of Kenya Ltd	1916
7	Diamond Trust Bank Kenya Ltd	1994
8	K-Rep Ltd/Sidian Bank Ltd	1999
9	Standard Chartered Bank (K) Ltd	1910
10	Ecobank Ltd	2008
11	Gulf African Bank (K) Ltd	2007
12	First Community Bank	2008
13	Bank of Africa (K) Ltd	2004
14	UBA Kenya Bank Limited	2009
15	Consolidated Bank of Kenya Ltd	1989
16	Development Bank of Kenya	1996
17	Kenya Commercial Bank Ltd	1896
18	National Bank of Kenya Ltd	1968
19	Stanbic Bank Ltd	2008
20	African Banking Corporation Ltd	1994
21	Jamii Bora Ltd	2010
22	Commercial Bank of Africa Ltd	1967
23	Co-Operative Bank of Kenya Ltd	1968
24	Credit Bank Ltd	1994
25	Equatorial Commercial Bank Ltd	1995
26	Equity Bank Ltd	2004
27	Family Bank Ltd	2007
28	Fidelity Commercial Bank Ltd	1996
29	Guaranty Trust Bank Kenya Ltd	1995
30	Giro Commercial Bank Ltd	1992
31	Guardian Bank Ltd	1995
32	Investment & Mortgages Bank Ltd	1996
33	Middle East Bank (K) Ltd	1980
34	NIC Bank Ltd	1995
35	Oriental Commercial Bank Ltd	1991
36	Paramount Universal Bank Ltd	1995
37	Prime Bank Ltd	1992
38	Transnational Bank Ltd	1985
39	Victoria Commercial Bank Ltd	1996

***** Distressed Banks:** 40. Chase Bank, 41. Imperial Bank and 42. Dubai Bank

Source : Central Bank of Kenya, Bank Supervision Annual Report, 2015.

Appendix 3: Data Collection Tool

Bank Name	End of year results	Gross NPL	Net Loans & Advances	Net Interest Income	Property, Plant & Equipment
	2015				
	2014				
	2013				
	2012				
	2011				
	2010				
	2009				
	2008				
	2007				
	2006				
	2005				

Bank Name	End of year results	Customer Deposits	Total Income	Insider Loans	Total Assets
	2015				
	2014				
	2013				
	2012				
	2011				
	2010				
	2009				
	2008				
	2007				
	2006				
	2005				

Appendix 4: Tests of Optimal Model

Model 1. glm bf lagbf1 lg ldr lq il, family(gaussian) link(identity)

Iteration 0: log likelihood = 210.35676
Generalized linear models No. of obs = 120
Optimization : ML Residual df = 114
Scale parameter = .0018501
Deviance = .2109083935 (1/df) Deviance = .0018501
Pearson = .2109083935 (1/df) Pearson = .0018501
Variance function: V(u) = 1 [Gaussian]
Link function : g(u) = u [Identity]
AIC = -3.405946
Log likelihood = 210.3567642 BIC = -545.5632

bf	OIM Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lagbf1	.8669464	.0501002	17.30	0.000	.7687519	.9651409
lg	-.0794346	.0249037	-3.19	0.001	-.128245	-.0306242
ldr|	.1318089	.0239893	5.49	0.000	.0847907	.178827
lq	-.0561592	.0388189	-1.45	0.148	-.1322428	.0199244
il	.1607703	.1802658	0.89	0.372	-.1925442	.5140848
_cons	-.0539984	.0234647	-2.30	0.021	-.0999883	-.0080084

Model 2. glm bf lagbf1 lg ldr lq il med, family(gaussian) link(identity)

Iteration 0: log likelihood = 210.64149
Generalized linear models No. of obs = 120
Optimization : ML Residual df = 113
Scale parameter = .0018576
Deviance = .2099098995 (1/df) Deviance = .0018576
Pearson = .2099098995 (1/df) Pearson = .0018576
Variance function: V(u) = 1 [Gaussian]
Link function : g(u) = u [Identity]
AIC = -3.394025
Log likelihood = 210.641494 BIC = -540.7767

bf |	OIM Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
lagbf1 |	.8675816	.0502096	17.28	0.000	.7691726	.9659905
lg |	-.0795689	.0249551	-3.19	0.001	-.1284799	-.0306579
ldr |	.1326409	.0240649	5.51	0.000	.0854746	.1798071
lq |	-.0604095	.0393275	-1.54	0.125	-.13749	.016671
il |	.1650273	.1807259	0.91	0.361	-.1891889	.5192435
med |	.2157506	.2942772	0.73	0.463	-.361022	.7925232
_cons |	-.0578099	.0240804	-2.40	0.016	-.1050066	-.0106133

Model 3. glm bf lagbf1 lg ldr, family(gaussian) link(identity)

Iteration 0: log likelihood = 209.1052
Generalized linear models No. of obs = 120
Optimization : ML Residual df = 116
Scale parameter = .0018565
Deviance = .2153540135 (1/df) Deviance = .0018565
Pearson = .2153540135 (1/df) Pearson = .0018565
Variance function: V(u) = 1 [Gaussian]
Link function : g(u) = u [Identity]
AIC = -3.41842
Log likelihood = 209.1052024 BIC = -555.1337

bf|	OIM Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
lagbf1	.9101973	.0406044	22.42	0.000	.8306141	.9897805
lg	-.086297	.0245144	-3.52	0.000	-.1343444	-.0382497
ldr	.1297462	.0231959	5.59	0.000	.0842831	.1752093
_cons	-.0732897	.0192039	-3.82	0.000	-.1109286	-.0356508

Model 4. glm bf lagbf1 lg ldr med, family(gaussian) link(identity)

Iteration 0: log likelihood = 209.24243
Generalized linear models No. of obs = 120
Optimization : ML Residual df = 115
Scale parameter = .0018684
Deviance = .21486203 (1/df) Deviance = .0018684
Pearson = .21486203 (1/df) Pearson = .0018684
Variance function: V(u) = 1 [Gaussian]
Link function : g(u) = u [Identity]
AIC = -3.404041
Log likelihood = 209.2424313 BIC = -550.3467

bf	OIM Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
lagbf1	.9123203	.0409435	22.28	0.000	.8320725	.9925681
lg	-.0867394	.0246077	-3.52	0.000	-.1349696	-.0385091
ldr	.1300509	.0232775	5.59	0.000	.0844278	.1756739
med	.1497891	.2919011	0.51	0.608	-.4223266	.7219047
_cons	-.0769649	.0205534	-3.74	0.000	-.1172487	-.0366811

Appendix 5: Descriptive Statistics for Mediating Variable

Summary for variables: med
by categories of: year (Year)

year	N	mean	sd	min	max
2010	30	.0281727	.0214348	.0037115	.1142285
2011	30	.0255079	.0156692	.0035694	.065348
2012	30	.0225024	.013071	.0034679	.0522586
2013	30	.0215075	.01296	.0025566	.0528041
2014	30	.0195131	.0128069	.0020502	.062214
Total	150	.0234407	.0156359	.0020502	.1142285

Appendix 6: Statistics for three distressed Banks and National Bank of Kenya

Summary statistics:	N, mean,	sd, min, max			
by categories of:	bankname	(BANK NAME)			
bankname	bankfragility	loangrowth	loandeposit	loanquality	Insiderloans
CHASE BANK-REC	10	10	10	10	10
	0.0531	0.4842	0.7614	0.4483	0.0408
	0.0140	0.1920	0.1137	0.0537	0.0196
	0.0329	0.1922	0.6232	0.3453	0.0200
	0.0748	0.6503	1.0168	0.5485	0.0869
DUBAI BANK-(LIQ)	10	10	10	10	10
	0.6162	0.1455	1.1247	0.4766	0.0786
	0.2028	0.1698	0.2960	0.1074	0.0430
	0.3487	-0.0536	0.7480	0.3023	0.0361
	1.0120	0.3969	1.6398	0.6482	0.1838
IMPERIAL BANK-(R	10	10	10	10	10
	0.0689	0.2544	0.7594	0.4270	0.0336
	0.0169	0.1187	0.0509	0.0668	0.0139
	0.0448	0.0383	0.6575	0.3265	0.0084
	0.1002	0.4040	0.8154	0.5111	0.0553
NBK	11	11	11	11	11
	0.3888	0.1931	0.5316	0.5187	0.1392
	0.4993	0.3739	0.2362	0.0691	0.2129
	0.0426	-0.7039	0.2259	0.4153	0.0347
	1.3817	0.6590	0.9589	0.6397	0.5966

Appendix 7: University Research Introduction Letter

MOI UNIVERSITY
SCHOOL OF BUSINESS AND ECONOMICS

Tel: (020) 2211206
Fax No: (020) 220247
Telex No. 35047 MOIVARSITY

P. o. Box 63056
Nairobi
KENYA

Ref: MU/SBE/ACD//2/RES/M

26th November, 2018

TO WHOM IT MAY CONCERN

Dear Sir/Madam,

RE: BWIRE ALBERT CAMUS ONYANGO
REG/NO: SBE/D/104/14

This is to confirm that the above named is a bonafide student of Moi University registered for Doctor of Philosophy in Business Management (Finance)

In partial fulfillment for the award of the Doctor of Philosophy, students are expected to learn to apply theories using the latest tools and techniques and practice making real-world business decisions to help solve a wide range of problems. In this regard they are expected to write a **Thesis** on current issues affecting business and society.

His thesis topic is ***"THE MEDIATING EFFECT OF INFORMATION ASYMMETRY ON THE RELATIONSHIP BETWEEN LOAN ASSET INDICATORS AND COMMERCIAL BANK DISTRESS IN KENYA"*** This is to request you to assist him with information from your organization. All the information provided will be used for academic purposes only.

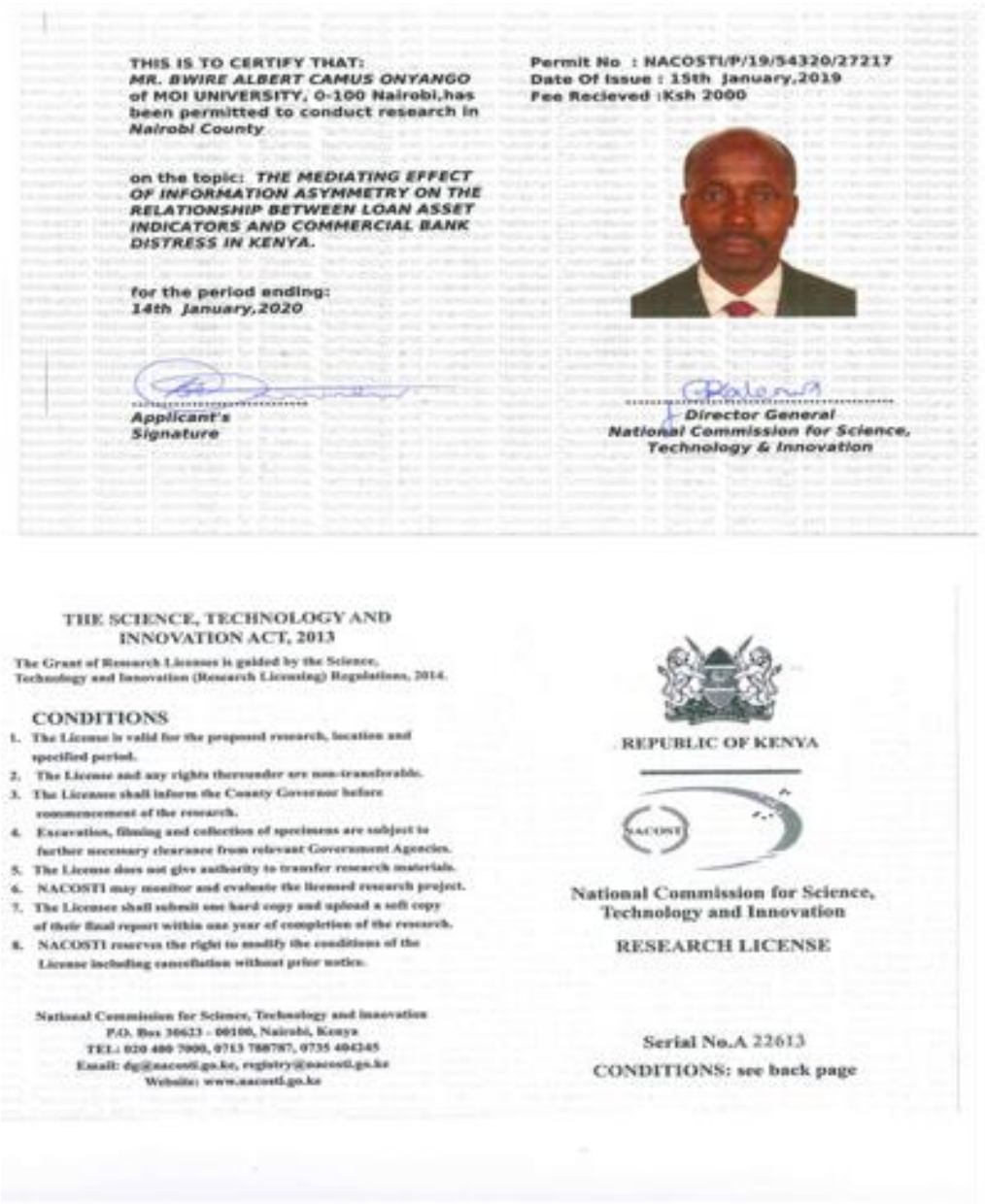
Any assistance given to him will be highly appreciated.

Yours faithfully,

MOI UNIVERSITY NAIROBI SATELLITE CAMPUS 28 NOV 2018 SCHOOL OF BUSINESS & ECONOMICS P.O. BOX 63056 NAIROBI

DR. ROBERT ODUNGA,
FOR: DEAN, SCHOOL OF BUSINESS AND ECONOMICS.

Appendix 8: Research Authorisation Permit



THIS IS TO CERTIFY THAT:
MR. BWIRE ALBERT CAMUS ONYANGO
of MOI UNIVERSITY, 0-100 Nairobi,has
been permitted to conduct research in
Nairobi County

on the topic: *THE MEDIATING EFFECT OF INFORMATION ASYMMETRY ON THE RELATIONSHIP BETWEEN LOAN ASSET INDICATORS AND COMMERCIAL BANK DISTRESS IN KENYA.*

for the period ending:
14th January,2020

Applicant's Signature

Permit No : NACOSTI/P/19/54320/27217
Date Of Issue : 15th January,2019
Fee Recieved :Ksh 2000

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