Strict banking regulations: Measuring the impact on bank risk

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Dissertation submitted in fulfilment of the requirements for the degree *Masters of Commerce in Risk Management* at the North-West University

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Graduation ceremony: December 2020
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DECLARATION

I Tafara Sani Nasa, student number 24932205, hereby declare that this dissertation is my own original work and it has been submitted in partial fulfilment for the degree Masters of Commerce in Risk Management at North West University (Vaal Triangle Campus) and that it will not be presented at any other University for a similar or any other degree.

…….. **……/……./…...**

Mr Tafara Sani Nasa **Date**

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I have ten years of experience in the field, having worked on multiple doctorates. Currently, I am a member of the Professional Editor's Guild (PEG).

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ACKNOWLEDGEMENTS

I would like to acknowledge the assistance, guidance, and support that I have received from:

- All my friends and family for your support, encouragement, and sound advice throughout my Masters study;
- To Sarah Louise Cornelius for the exceptional language editing;
- Special thanks to North-West University and the Faculty of Economic Sciences for the endless possibilities and the wonderful opportunity that was given to me;
- To my supervisor Mr. Daniel Mokatsanyane and co-supervisor Dr. Zandri Dickason-Koekemoer, thank you for your endless guidance and direction throughout this study. You showed me that anything could be accomplished with the right people around you. I have learnt and will continue to learn from your inspiring academic accomplishments and hope that I will make you proud with my work;
- To my brothers Leslie, Tanatswa, and Takudzwa, I hope that this will serve as an inspiration in everything that you want to achieve in life. Even though I am the eldest, but you guys inspire me to be a better person every day;
- Words cannot begin to express my gratitude towards my parents because that would take endless books and dissertations. In summary, all I can say is thank you for believing in me, allowing me to go after my dreams, for your unconditional love and guidance. May my children feel the same way about me just as I feel about you;
- To myself: To whom much is given much is expected; and
- Thank you, Lord God Almighty, for your grace.

Blessed is the one who trusts in the Lord and whose confidence is in Him - Jeremiah 17:7

STATEMENT TO THE EFFECT THAT THE ARTICLE FORMAT WAS CHOSEN

This dissertation is written in article format and consists of two articles that are intended to be submitted for publication to an appropriate and credited journal as a requirement for the attainment of the degree of Masters of Commerce in Risk Management at the North-West University (Vanderbijlpak Campus, South Africa).

This study is the original work of the author and contains three separate studies, which have not been submitted to a different educational institution in any form. The work of others has been acknowledged accordingly in the text as well as the references and bibliography sections. Chapter 1 includes the objectives for the entire study and each article. The two articles can be found in Chapters 3 and 4; the format of the articles include introductions, literature review, methods, results, conclusions. The articles are written in the same specifications as the rest of the text in the study and will be modified separately to fit their publication journals. The articles are referred to as article 1 and article 2 in the study.

Both articles have been accepted for publication by the accredited journal and will be we will publish it in Acta Universitatis Danubius. Œconomica, Vol 16, issue no. 5, which we will post on the site by the end of October 2020.

ABSTRACT

The banking sector is one of the most integrated sectors in most global economies. As a result of its interaction with other sectors of the economy, any movement in the banking sector needs to be properly managed to avoid potential negative consequences in other sectors. The 2008 global financial crisis (GFC) indicated the effect of negative movement in the banking sector on the economy. The consequences of the 2008 global financial crisis included the closure of banks and other financial institutions globally, a decrease in global gross domestic product and job losses. Additionally, several governments had to assist some financial institutions with money that was not previously included in their state budgets. Thus, sound and effective regulatory measures are required to control and manage risks that are inherent in several banking sectors.

The primary objective of this research was to determine if there is a relationship between regulation and risk for South African banks and the banks in the top 25 soundest banking systems in the World. The study used two articles, namely; article 1 and article 2, to achieve this objective and used data from 2000 to 2017 because the period had data from pre-, during, and post the 2008 global financial crisis (GFC). Article 1 had the aim of determining if a relationship between the implementation of bank regulation and bank risk existed. The article used a sample of the top 5 banks in South Africa with the z-score as a proxy for risk. The risk in article 1 was represented by the solvency of banks. A logit regression between bank regulation and supervision; and bank risk showed that no relationship exists. However, an Auto-Regressive Distributed Lag model (ARDL) model concluded that there is a long-run relationship between bank risk and the implementation of new bank regulation and supervision for the top five South African banks.

Article 2 employed a quantile regression to model the relationship between bank regulation and supervision and bank risk. Data for article 2 was gathered from banks in the top 25 nations with the soundest banking systems in the world that were ranked in the 2018/19 World Economic Forum (WEF) global competitiveness report. Through the use of factor analysis, Capital adequacy, Asset quality, Management competency, Earning quality and Liquidity, Sensitivity to market (CAMELS) indicators were used to derive various risks that can potentially affect bank risks which include liquidity and market risk, capital and earnings risk, and asset quality risk. The results showed that bank regulation and supervision assist in combating various risks faced by banks, especially high-risk banks. Article 1, through the ARDL model, proved that the more bank risk increases, the more bank regulation, and supervision are implemented. Article 2, through the use

of quantile regression, found that there is a negative relationship between bank risk; and bank regulation and supervision. This means that the more bank regulation and supervision are implemented, the bank risk goes down. The findings of both articles also advocated for an increase in bank regulations whenever a potential risk arises.

The study was also faced with a number of limitations that can be rectified for future studies. The first limitation was that even though the study used secondary data, some banks did not fully disclose their financial statements for the required period, which led to a few of the banks being removed from the sample. The other observed limitation was the lack of previous studies that focus on the behavioural patterns of bank risk before a crisis occurred and how those patterns can be used to possibly identify warning indicators that can be used to implement safety measures before a future risk occurs. Therefore, a potential study can research on the effectiveness of African banks to measure and combat different bank risks that they face in their markets. Moreover, another potential study can further research whether banks in Africa are employing the same regulatory measures and, if so, how bank regulatory measures in different African countries are determined to meet their domestic market.

Keywords: bank regulation, quantile regression, z-score, bank risk, global financial crisis, South African banks, autoregressive distributed lag model, logistic regression

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ACRONYMS

ABSA Amalgamated Banks of South Africa

ARDL Auto Regressive Distributive Lag Model

ADF Augmented Dicky-Fuller

BIS Bank for International Settlement

CAMELS Capital adequacy, Asset quality, Management competency, Earning quality and Liquidity, Sensitivity to market

CAR Capital to Asset ratio

CUSUM Cumulative Sum Control

DP Deposits

EA Equity/Assets

EU European Union

GDP Gross Domestic Product

GFC Global Financial Crisis of 2008

GROL Growth Rate of Loans

IE Interest Expense

IMF International Monetary Fund

KMO Kaiser-Meyer-Orkin test

LL	Loan Loss
OE	Operating Expense
OLS	Ordinary Least Squares
PwC	Pricewaterhouse Coopers
ROA	Return on Assets
ROE	Return on Equity
SA	South Africa
SADC	Southern African Development Community
SB	Standard Bank
SARB	South Africa Reserve Bank
TL	Total Loans
AGR	Asset growth rate
UK	United Kingdom
US	United States of America
VBS	Venda Building Society
WEF	World Economic Forum
ZAR	South African Rand

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND OF THE STUDY

The 2008 global financial crisis (GFC) brought forth the bankruptcy and collapse of banks globally (Conyon *et al*., 2011:400). This GFC came as a result of a different number of factors, such as a credit boom, a housing bubble, and growing global imbalances caused by the growth of new capitalist societies in China, India, and some parts of Europe (Acharya & Richardson, 2009:13). The Bank for International Settlement (BIS) also cited poor prudential framework as another cause (Committee on the Global Financial System, 2018:5). However, one factor stood out as being the main cause, which was a lack of proper regulation (Tchana, 2008; Zeidan, 2012:56).

Consequently, multiple negative events in financial sectors occurred globally in the wake of the GFC. Banks declared for bankruptcy in the United States of America (US), the United Kingdom (UK), and the Netherlands and there was an increase in systemic risk for banks in Australia due to the occurrence of the GFC (Shin, 2009:102; Acharya & Mora, 2015:3; Bollen *et al.*, 2015:90; de Haan *et al.*, 2016:580). Despite the GFC originating within the financial sector, the banking environment was not the only area that was affected, as shown by multiple global issues that arose. Such global issues included recessions in multiple European Union (EU) states (Bogetic, 2010; Gaiotti, 2013; Leventi & Matsaganis, 2014:209), disruption in financial markets (Bagliano & Morana, 2012:12), and a decrease in the world economy by 3.1 percent (National Treasury, 2009:19). A bank failure can lead to various disruption in other parts of an economy; thus, there is a potential need for sound regulation in the banking sector (Angkinand, 2009:243).

Financial institutions such as Lehman Brothers and America International Group collapsed in the US as a result of the GFC (de Haas & Van Horen. 2012:231; Peirce, 2014). These collapses gave an example of how a downfall in large financial institutions can potentially affect an economy (Georg, 2011). This downfall can be attributed to what is called systemic risk, which is when the failure of one institution can spill over to other institutions within the same sector (Bollen *et al.*, 2015:90). Despite the difficulties that banks all over the world faced post the GFC, some banks managed to maintain their balance sheet and had sound financial returns

(Eichengreen *et al.*, 2012:1300). The occurrence of the GFC also revealed some the shortcomings of bang regulations that were in place. According to Havemann (2019), strong financial regulation and supervision is essential in combating bank failures that have occurred in the past. Furthermore, the implementation of new banking regulation in response to financial crises such as the GFC highlights the need for robust and sound bank regulation and supervision (World Bank, 2019a).

However, not all banks were adversely affected by the GFC. Banks in India, for example, were less impacted due to their regulatory framework in addition to most of the banks in the country being nationalized (Bhatt, 2011:216). Similarly, the South African financial landscape was still sound during and after the GFC, which was credited to solid macroeconomic policies that were applied in the country (Ikhide & Maredza, 2013:553). No evident common factor between these banks exists except the fact that they are located in different regions of the World. That is not to say that the two economies, South Africa and India, did not face challenges in their financial sectors, but they had less severe impacts compared to their counterparts.

In 2018, The South African financial landscape was faced with several challenges from both local and international factors (SARB, 2018). Firstly, an increase in global risk due to the trade tensions between the US and China (World Bank, 2018). This was combined with the double-digit inflationary pressure from Turkey being a cause for concern in the South African market (SARB, 2018:6). Secondly, uneven global market returns due to the uncertainty of the United States dollar caused instability in global financial markets (Kurov & Stan, 2018:127). Also contributing was low economic growth in South Africa (SA), potentially as a result of a weak global economy (Aslam *et al.*, 2018:440), which resulted in negative effects for the financial sector. Lastly, accounting regulations queries that were highlighted by the Steinhoff scandal (Rossouw & Styan, 2019:163), and financial stability risk which arose from the VBS Mutual Bank scandal were also challenging to the stability of the financial landscape of SA (Hargarter & van Vuuren, 2018:2).

In response to the prior examples in this section, there is a need to determine if an increase in bank regulation affects bank risk. Thus, in order to aid the achievement of this goal, the study is written in an article format that consists of two articles. Article one will focus on the regulations of South African banks from 2000 till 2017 and correlate them with solvency and risk to determine if there is a relationship. Calculating solvency of South African banks will assist in determining if banks were more protected or in more danger whenever new regulation

was passed each year from 2000 until 2017. Article two will focus on the risk and regulation relationship of banks in the top 25 soundest banking systems in the world and include South Africa. The list of the top 25 countries will be adapted from the 2018/19 WEF global competitiveness report (WEF, 2019). The main reason for this is to view how the best banking systems handle regulation and deduce if they can be a possible trend or recommendation for global banking sectors.

1.2 PROBLEM STATEMENT

Bank failures in 2008 caused discussions related to the optimal level of efficiency, capital adequacy, and regulation for banks (Baker & Wurgler, 2015:315). This presents a conundrum as to what the ideal situation is for any given bank to obtain good returns. Additionally, there is difficulty in concluding whether or not different scenarios, such as an increase in regulation, can bring about higher returns. The free banking school of thought view regulation as unnecessary and would opt for more open laws in the banking sector (Dowd, 2013:289). A challenge in regulation as a credible source can be the failure of rating agencies, which were one of the regulators, to identify abnormal risk-taking before the GFC (Carmassi *et al*., 2009:978; DeYoung & Torna, 2013:397). Even some regulations were questionable causes of the GFC, one being the Gramm-Leach-Bliley Act of 1999, which allowed banks to have more freedom in the financial sector.

As noted, bank failures bring about economic losses and can have large financial burdens on all economic stakeholders which include governments and individuals. For example, the ten most expansive cases of bank failures resulted in fiscal losses of 40 to 60 percent of GDP (Havemann, 2019). Moreover, extensive risk-taking by financial institutions and thin capital cushions to cover for unexpected financial losses were some of the causes of the GFC and they prevailed because of lack of regulation for them (World Bank, 2019a). Banks are at the center of economic activity and need to be effectively regulated in order to manage the contagious and destabilizing effect of banking crises or any bank risk on the economic system at large (Soile-Balogun, 2016).

The problem with regulation is that there is no clarity on what the optimal regulation is and when it should be implemented. For example, the strict banking regulation in the South African banking sector protected the banks from failure but the strict regulations potentially prevent the rise of new banks and ultimately competition (Ikhide & Maredza, 2013). Another example

of regulation is the setting of capital requirements. Setting capital requirements as a form of regulation provides a certain level of clarity for banks on issues such as amounts available for loans and the cost of capital (Admati & Hellwig, 2014). Conversely, this does not provide clarity about the capital flow of the bank. Additionally, an increase in banking regulation using capital regulation as a means can result in unintended impacts (Demirguc-Kunt & Huizinga, 2010). These impacts may include a decrease in loans approved and adverse bank risk monitoring incentives (Chortareas *et al.*, 2012; Dermine, 2013). Thus, it is needed to determine if bank regulations are being beneficial to banks, or perhaps it is bringing unintended impacts.

The banking sector is the biggest in the South African market with four banks in top ten most valuable brands in the country (Brand Finance, 2019). Furthermore, the South African banking sector employs over 150 000 employees and each bank employs between 100 to 200 graduates every year from all disciplines ranging from finance, human resources and engineering (Blaauw *et* al., 2015; PwC, 2019). Additionally, the banking sector mobilises savings and channels them to productive sectors thus encouraging the efficient allocation of resources. (Moyo, 2018). Thus any change, either negative or positive in the South African banking sector, can potentially affect the economy (Soile-Balogun, 2016). Therefore, a study in this field will assist bank stakeholders in financial awareness and the potential effects that are presented with regulation. That being the case, article 1, will focus on regulation and risk using solvency as a proxy for risk in South Africa from 2000 till 2017 and article 2, will focus on regulation and risk using the world bank Capital adequacy, Asset quality, Management competency, Earning quality, Liquidity and Sensitivity to market (CAMELS) indicators, from 2000 until 2011 where the last set of data was recorded.

1.3 RESEARCH QUESTIONS

The following questions will assist in providing guidelines on the direction that the study will take:

1.3.1 Primary question

The primary question of this study is:

I. Does the implementation of strict banking regulations affect the ability of banks to remain solvent?

1.3.2 Theoretical questions

I. Has the risk of South African banks increased or decreased from 2000 till 2017?
II. Is there a link between regulation and risk for South African banks?
III. Is there a relationship between regulation and risk for the top 25 soundest banking systems in the World?

1.3.3 Empirical questions

I. Can CAMELS indicators and z-scores be respective measures for risk and return in South African banks?
II. Has regulation been useful in decreasing the risk faced by South African banks? With risk being linked to the solvency of the banks.

1.4 OBJECTIVES

1.4.1 Primary objective

The primary objective of this research is to determine if there is a relationship between regulation and risk for South African banks and the banks in the top 25 soundest banking systems in the World.

1.4.2 Theoretical objectives

The theoretical objectives are:

I. Analyse different types of risks that banks face;

II. Conduct in-depth analysis of the various types of bank regulatory measures;

III. Determining variables that will be used to clarify the relationship between bank risk and regulation and risk;

IV. Defining the criteria for bank regulation in South African and the top 25 soundest banking systems in the World; and

V. Determine if a movement in bank risk can influence an introduction of new regulation in the future.

1.4.3 Empirical objectives

Per the primary objective and theoretical objectives of the study, the following empirical objectives were formulated for each article, respectively:

Empirical objectives for article 1: The relationship between regulation and solvency risk for the top five South African banks

1.1. To analyse the z-score movement of the top five South African banks from the year 2000 till 2017;
1.2. Measure if there is a correlation or relationship between the implementation of new regulation and solvency for the top 5 South African banks;
1.3. Determine whether there is a long run or short-run relationship between bank solvency and the implementation of bank regulation.

Empirical objectives for article 2: *Risk and regulation for the soundest banking systems in the World*

2.1. Analyse the CAMELS indicators to determine the best measure of risk to use in the quantile regression between risk and regulation;
2.2. Determine the best proxies for bank regulation from the World Bank survey on banking regulation and use them as independent variables in the quantile regression between risk and regulation; and
2.3. Evaluate the nature of the relationship between the CAMELS indicator variables and bank regulation variables.

1.5 RESEARCH DESIGN AND METHODOLOGY

1.5.1 Data and data availability

This study will employ both qualitative and quantitative measures to achieve the main purpose of the study. The data collection and data analysis explanations are available in the subsequent paragraph under data availability and section 1.5.2 respectively. For article 1, a z-score will be used to determine the risk aspect of South African banks. A z-score is a proxy for bank risk and indicates the standards deviation that the return on the asset has to be before the equity runs out, and a bank is deemed insolvent (Laeven & Levine, 2009; Demirguc¸-Kunt & Detragiache, 2011; de Haan & Klomp, 2015).

Article 2 will use the CAMELS indicator to determine the risk and regulation relationship aspect of the banks in the top 25 countries with the soundest financial systems. CAMELS indicators are useful in determining the financial soundness of banks.

Article 1: Data Availability

This article aims to analyse the effect of regulation on the top five South African commercial banks. Data was obtained from the five major South African banks' financial statements over 17 years (2000 - 2017). The reason for this period is that the period has data from pre, during, and post the GFC. These banks and their market capitalization values in 2017 are Standard Bank (SB) (R20.8 billion), Amalgamated Banks of South Africa (ABSA) (R18.3 billion), First Rand (R15.9 billion), Nedbank (R12.8 billion) and Capitec Bank (R5.0 billion). Since the data for the financial statement is publicly available on the IRESS website (2019), the study will be making use of secondary data. The data was published for stakeholders and shareholders of the banks to show the performance of the banks over time and will be used in the research because it fits into the z-score formula. Data for calculating the z-score is readily available on the IRESS website, which is a public domain. Other studies that have made use of the same z-score data include Al-Oshaibat and Manaseer (2018); Almamy *et al.* (2016); Altman *et al.* (2017); Boďa and Úradníček (2016), Chiaramonte (2015); Lepetit and Strobel (2015).

Article 2: Data Availability

This article will focus on the risk and regulation relationship for the top 25 countries with the soundest banking systems in the World. South Africa will also be included in the list, even though it is not part of the top 25. According to the latest information on the soundest banking systems in the World, it is ranked at number 29 out of 140 countries on the list (WEF, 2018). The reason for only including the top 25 countries is because their banks are the best, and looking into them can assist banks in other countries on how to look at regulation and risk. The top 25 countries with the soundest banks in the World are Finland, Canada, New Zealand, Australia, Chile, Singapore, Hong Kong SAR, Norway, Luxemburg, Israel, Czech Republic, Guatemala, Dominican Republic, Egypt, Netherlands, Panama, Philippines, Saudi Arabia, Slovak Republic, Taiwan, United States of America, Uruguay, Austria, Brazil and Switzerland (WEF, 2018).

Data for the 25 countries are already provided on the World Bank sight in the form of a survey on banking regulation. It is secondary data gathered from the Bank Regulation and Supervision

database of the World Bank, which covers the period from 2011-2018 (World Bank, 2019b). The reason for this period is because that is when the latest accessible edition of the survey from the World Bank was available at the time of this study. It is used to compare information on how banks are regulated and supervised around the World. Data for article 2 is publicly available on the World Bank site and the Bureau Van Dijk site.

1.5.2 Statistical analysis

Statistical analysis for article 1

The risk-taking behaviour of banks was calculated using a z-score. The z-score formula is associated with solvency and was the proxy for risk-taking in this article. Even though there are multiple measures to determine a bank's ability to pay back their loans, the z-score is one of the most widely used (Mare *et al.*, 2017:348). This can be attributed to its combination of information on a bank's performance, leverage, and risk. Applying a z-score to a bank's financial data concludes with a bank either being stable or closer to insolvency.

In this article, the z-score was correlated with the number of regulations that have been passed each year from 2000 until 2017. The existence of a correlation exist indicated that regulation had an impact on banks in South Africa. The implementation of an Auto Regressive Distributive Lag model (ARDL) through the statistical software e-views was used to test for the correlation between risk and regulation. The ARDL model was used in this study because it determines long run and short run relationship of different variables and this factor makes it relevant to the article (Al Yahyaee *et al*., 2019; Nikolaidou & Vogiazas, 2017). Regressions were computed to check the probability values and the r-squared value to determine if there was a correlation between regulation and risk in the South African banking sector. Moreover, this article used a predictive analysis model called logistic regression model to run the data. This model was chosen because it explains the relationship between one dependent binary variable and one or more independent variables to which was the case in this study (Kliestik, & Kovacova, 2017). Other studies that have made use of logistic regression include Adamu (2015); Audrino *et al.* (2019); Comelli (2016); Le and Viviani (2018), Lin and Yang (2016).

Statistical analysis for article 2

Similar to the study by de Haan and Klomp (2012), the article made use of the CAMELS indicators provided by the World Bank as indicators of distress. These indicators were useful

in this article because they are used to determine the soundness of banks in different countries, even though procedures vary based on location (Gasbarro *et al*., 2002:247). CAMELS indicators focus on bank performance based on Capital adequacy, Asset quality, Management competency, Earning quality, and Liquidity (Hashim & Muhmad, 2015:109). Factor analysis on the CAMELS indicators was used to look at the common factors between the banks of the 25 countries to determine the right variables for risk.

A factor analysis was used to explain variability amongst the variables in the CAMELS indicators of the different countries. Factor analysis is a data reduction technique used to identify a small number of factors that explain most of the variance that is observed in a much larger number of variables (International Business Models, 2020). Hence, the reason factor analysis was chosen for this study is because of its dimension reduction characteristic since this article will work with a significantly large amount of data that will need to be reduced. Finally, a multilevel quantile regression function was used to determine the relationship between strict regulation and risks for the identified banks in different countries. The utilisation of this method assited to derive multiple parameter estimates in the quartiles for risk distribution (de Haan & Klomp, 2012:3198). The multilevel quantile regression function was chosen because it is the same technique that was used by de Haan and Klomp (2012), which is the reference paper for article 2.

1.6 SIGNIFICANCE OF THE STUDY

The primary objective of this research was to determine if a relationship exists between bank regulation and bank risk using South African banks and banks in the 25 soundest banking systems in the World. Based on the results produced, the study sought to positively contribute to past, present, and future literature in the field of banking regulation. As such, article 1 sought to assist policy makers by recommending that more regulation needs to be implemented that specifically looks into increasing the solvency levels of South African banks. Moreover, article 2 also had the same contribution to policyholders in its recommendation that more bank risk that focuses on capital regulatory requirements need to be implemented to assist in the reduction of possible risk. Article 1 and article 2 went through a peer review process and were accepted for publication by the Acta Universitatis Danubius journal and may hopefully benefit academia and inform policy that surrounds bank regulation. Possibly the findings will be used by other scholars in their research papers as a reference to their work on bank regulation and risk.

1.7 ETHICAL CONSIDERATIONS

This study made use of annual secondary data of the top five banks in South Africa and 25 international banks collected from 2000 to 2017 and 2011 until 2017, respectively. The bank-specific variable data was available from the IRESS website, World Bank site, and on the Bureau Van Dijk site. This study was presented before the university's ethics committee and was approved with ethical clearance number NWU-00389-19-A4 (Annexure B). Moreover, the study did not violate any confidentiality and anonymity principles as the data disclosed in all the bank's annual financial statements is available to the public. Therefore, there is no need for consent, as the data is publicly available.

1.8 STUDY LAYOUT

The relationship between regulation with risk and return in South African banks is studied using the following layout. The study comprised of two articles, each in correspondence to the main topic. Both articles were presented in Chapters 3 and 4, respectively, and were presented such that they can be published independently of each other. This research targeted to banking regulators who come up with different banking regulation in different parts of the world including South Africa; as a result, this study comprises of the following chapters:

Chapter 1 - Introduction: The first chapter of the study identified and subsequently elaborated upon the introductory subjects leading to the study. It provided the map for the study by outlining the background of the study, the problem statement, and the research objectives of the study, and both theoretical and empirical objectives. It also highlighted the research design, methodology and ethical considerations the chapter concluded by providing the outline of the research chapters.

Chapter 2 – Literature review: This chapter identified relevant literature in the study of bank risk, bank regulation, and bank supervision. In this chapter, the relevant literature were organised according to geographical clusters such as international, Africa, and South Africa. The chapter aimed to provide more insight into the broader topic of strict banking regulation and its impact on bank risk. The incorporated literature studies served as a foundation for the methods and possible outcomes of both article 1 and article 2.

Chapter 3 – Article 1: This chapter is the first article and focused on the effect of regulation on bank returns in South Africa using the z-score as a measure. In this chapter, the z-score was

used to calculate solvency ratios for the top five South African banks and present the results thereof. Different banking legislation that has been implemented in South Africa since the year 2000 were presented and analysed. This chapter also incorporated literature studies that surround the topic of banking regulation and returns in various countries.

Chapter 4 – Article 2: This chapter contained the second article, which focused on the effects of regulation and risk. This chapter focused on the different factors that can be considered as a risk for banks. The literature was provided on the different studies that were done for this topic, and this chapter aimed to add to it. In this chapter, a quantile regression was used to calculate the effects of regulation on risk in banks.

Chapter 5 – Conclusion and recommendation: This chapter provided a general conclusion and recommendation on possible future areas of research based on the identified gaps and results from the studies. This chapter provided an interpretation of the empirical findings of this study; a regression analysis using the panel data method were presented and discussed in this chapter to achieve the empirical objectives.

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CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

In any organisation risk reduction is one of the main drivers that can ensure the sustainability of future business activities (Hargarter & van Vuuren, 2018:2). As such, if an entity or organisation look into measures that can reduce risk in their relative field of business, they might potentially improve the economic and financial outlook of the entity. This also holds for financial institutions, such as banks, as much as it holds for any other entity operating in their respective area. According to McKinsey (2013), for banks to avoid or reduce negative consequences of potential risks they might face, they need to have effective risk management practices; adhere to set regulatory measures and preserve their trust with their customers.

Furthermore, after the 2008 global financial crisis (GFC), banks were faced with stricter regulatory requirements to possibly prevent another crisis of the same nature (Anginer *et al.*, 2014; Baker & Wurgler, 2015: 320). Amongst various reasons, these regulations were put in place to make banks less risky; to raise their cost of capital; increase growth and increase investment within the financial sector. This surge in regulation came forth as a result of a decline in the financial activity of the banking sector. For example, Claessens and van Horen (2015) reported that there was a decline in the entry of banks into new markets through the opening of a branch in a foreign country before the occurrence of the GFC. Before the occurrence of the GFC, there were 120 recorded entries into new markets outside of the home countries by banks in 2007 alone compared to 19 entries in 2013 (Claessens & van Horen, 2015). This decline in expansion signals a decline in growth for some banks, along with potential unemployment issues in areas that foreign banks were potentially going to operate in.

Despite the increase in regulatory measures in the banking sector, there has been relatively limited research into the quantification of the effect of new and more regulatory measures within the banking and financial sector (Pasiouras *et al.*, 2009:294; Joenvaara, 2015). Noteworthy is that regulatory bodies have always paid attention to capital adequacy as a tool to regulate and combat risk in the financial sector (Awdeh *et al.*, 2011). Therefore, there is a gap in the study of bank risk and regulation that needs to be researched and reported for various stakeholders to acquire the knowledge. As a response, the following section will analyse past literature on the relationship between different banks' risk and banking regulation. This will be

in the aim to determine what past studies reported between various forms of bank risk and banking regulation.

2.2 THEORETICAL REVIEW

Bank risk is a multi-faceted concept and represents various aspects of hazards or events that can potentially affect individual banks or the banking sector (Chen *et al*., 2018). A prime example of this is the various threats to the banking and finance sectors that were introduced by the 2008 GFC. Risks such as systemic risk, credit risk, operational risk, systematic risk were amongst some of the threats to the banking sector as a result of the GFC (Anginer *et al*., 2014). As a solution to these risks, global policymakers proposed an increase in the regulations and supervision measures of different financial sectors worldwide (Hsieh & Lee, 2013). The traditional view is that an increase in bank- regulation and supervision assists in the reduction of potential risks that banks may face (Alam, 2012). Also, Tanda (2015) states that the risk-taking behaviour of banks is influenced by bank regulation, but the extent of the influence may depend on other factors such as location and period.

Delis and Staikouras (2011) notes that bank regulation and supervision both aim to reduce or mitigate potential risks that banks may face; however, they have a different meaning. Banking regulation refers to different bank laws that are passed by governing bodies, whilst bank supervision is the actual implementation of these laws through audits and disclosures. The World Bank surveyed over 100 countries to assist as a uniform measure of bank regulation and supervision in studies related to the topic (Cihak *et al*., 2013). This survey is no regulation on its own but a gauge on how different countries deal with different banking regulations in their financial systems. Regulation and supervision also need to be dynamic because a uniform response to risk no longer suffices, resulting from the increase in institutional specific risks (Delis *et al.,* 2012).

2.3 RISKS FACED BY BANKS

Due to their business structure and model, banks are in the business of risk-taking; as a result, risk becomes an integral part of banking. Before the 2008 GFC, these risks were measured and managed separately (Feng *et al.,* 2015). This approach was highlighted by the introduction of a division that required banks to hold capital reserves for the market-, credit- and operational risks (Stulz, 2014). In recent times, bank regulators now use a common measure known as value at risk (VaR), as set out by the Basel ii accord, to set adequate capital requirements for

credit risk, market risk, and operational risk (Hammoudeh *et al.*, 2011; Al-Hassan *et al.*, 2013; Hammoudeh *et al.*, 2016; Esquivel *et al.*, 2020). The need to connect various bank risks was because of the GFC, which showed that these different risks all interconnected and need to be viewed the same (Antão & Lacerda, 2011).

Amongst the various studies that research on the causes of the GFC, the common conclusion is that operational risk played a major role (Jobst, 2010; Tomasic, 2010; de Jongh *et al*., 2013). Other risks that were also prevalent and played a major role were credit risk, market risk, systemic risk, and solvency risk (Chaibi *et al*., 2017). It is relatively essential for risk management of banks to be well-managed because of banks' link to the government, and other stakeholders such as depositors and lenders (Aruwa & Musa, 2014). Furthermore, risk in any form is something that banks cannot avoid because of the nature of the industry that they operate in. For this reason, the risk is classified in either one of two ways, namely bad- and good risk (Stulz, 2014). Bad risks are those risks that only present danger to a bank and should be avoided. Risks that provide an opportunity for potential rewards on a stand-alone basis are called good risks.

If a bank avoids taking risks, it might hinder economic growth because it signals little expansion for the banks. Conversely, if a bank takes too much risk, then economic stability is threatened because government bailouts might be needed to rescue failing banks (Dam & Koetter, 2011). This excessive risk-taking behaviour is what led to the Economic Stabilisation Act of 2008 in the United States of America (US), where President Bush signed a US$700 billion bailout plan for banks affected by the GFC (Lambert *et al*., 2017). This section of the study will analyse these risks, their meanings, and relevance in the banking sector.

2.3.1 Credit risk

According to the Basel 1 capital accord, credit risk is defined as the risk of failure to pay by a counterparty. It was the first risk to be considered by the Basel Committee on Banking Supervision (BCBS) when the Basel 1 accord was drafted in 1988 (Baud & Chiapello, 2017). It is closely related to other bank risks such as market- and operational risk (Aruwa & Musa, 2014). When the default probability of a firm changes unexpectedly, it results in credit risk, which in turn affects the banks' market value and creates market risk. The other connection is between credit and market risk, for example, when human error leads to mistakes in the

handling of loan documentation, which potentially leads to losses should a counterparty default.

2.3.2 Market risk

Market risk is defined as the risk of loss due to movements in the market prices, and it also encompasses other risks such as interest risk, equity position risk, foreign exchange risk, and commodities risk (Ekinci, 2016; Ab-Hamid *et al.*, 2018). Most risks are under the control of banks, but the market risk is outside a banks' control and subject to external factors. It was the second risk after credit risk to be considered by the BCBS and is measured in one of two ways; the standardized approach and internal model approach (Hassan *et al*., 2016; McConnell, 2016). Market risk was incorporated in the Basel II accord and provision was made by the accord to combat this risk (BIS, 2010a).

2.3.3 Systemic risk

Systemic risk is the risk that an individual banks' failure might result in negative consequences to the economy (Dam & Koetter, 2011). Ultimately, systemic risk refers to how an individual firm's micro-economic failures can have potentially tremendous effects on the overall macroeconomic scene. By definition, it is the risk that financial instability becomes so widespread that it impairs the functioning of a financial system to the point where economic growth and welfare suffer materially (Leukes & Mensah, 2019). A prime example of systemic risk is the GFC, which was caused by a failure in the US banking system, which in turn, spilled over to the US financial sector, the national economy, and, ultimately, the global financial market. As a response, the Basel III accord made a provision in order to combat against systemic risk (BIS, 2010b). In perspective, banks and insurance companies are the major contributors to systemic risk in the financial system of South Africa (Leukes & Mensah, 2019).

2.3.4 Operational risk

Operational risk is defined by the BCBS as the risk of loss resulting from inadequate or failed internal processes, people, and systems or failed external events (BIS, 2020a). It can directly be linked to being one of the main causes of the GFC because of its presence in all the stakeholders surrounding the GFC, which include banks, mortgage brokers, credit rating agencies, investment banks, and insurance companies (Andersen *et al.*, 2012). Most of the losses arising from operational risk have occurred at the senior levels of corporate governance

(de Jongh *et al*., 2013). Operational risk contributed to the GFC through loan approval to unworthy individuals, investment banks accepting guaranteeing loans from credit unworthy individuals, bad loans being approved as investment-grade loans, and the issuance of loans by insurance companies without any capital buffers set aside (Andersen *et al.,* 2012). In addition to the operational risk aspect, banks could not absorbs the losses from defaulting customers because they were operating under Basel II which made no provision for such losses (Larsson & Soderberg, 2017).

2.3.5 Solvency risk

Solvency risk is defined as the risk of a bank not meeting their maturing obligations because they have accrued more liabilities than they have assets (Almarzoqi *et al.,* 2015). It can be a result of write-offs on a banks' securities and loans, which leaves the banks' capital base insufficient to cover the losses. A way to potentially manage this risk is to keep adequate capital buffers to be able to contain potential losses that may arise. Clarification needs to be provided between solvency and liquidity risk as the two are almost the same (Imbierowicz & Rauch, 2014). However, liquidity risk refers to the ability of banks not being able to meet up to their short-term liquidity demands when they arise. Conversely, solvency risk deals with debt in the long run.

2.4 BANK REGULATION

Since the occurrence of the GFC, multiple studies have researched the impact of banking regulation and supervision as a safeguarding tool to the financial system (Cihak *et al*., 2013; Calice *et al.,* 2017:183). The definition of the term bank regulation varies in different parts of the world and depends on industry size, bank activity and ownership restrictions, official supervisory power, prompt corrective action, and deposit insurance design (García-Meca *et al*., 2018). Regulation is not the same as bank governance but acts as an additional mechanism that supports bank governance. Bank regulation is the protection of the banking sector from excessive risk-taking through the implementation of supervisory measures and restrictive policies (Ayadi *et al*., 2016; Stiroh, 2019).

Bank regulation was mainly examined during the great depression of 1933 (Diamond *et al*., 2017). This was as a result of multiple bank failures and closures which inspired policies and regulations that aimed at preventing a similar crisis from occurring in the future. Additionally, studies relating to bank regulation and stability began in the 1990s when Keeley (1990) stated

that bank deregulation that occurred in the US in the 1970s and 1980s led to an increase in competition and risk-taking behaviour of banks. Cross-country data provided by the World Bank and International Monetary Fund (IMF) has provided researchers with the opportunity to study the impact of banking regulation in different parts of the World (Gaganis & Pasiouras, 2013).

In the early 2010s, banking regulation gained multiple interests in the aftermath of the GFC (Chan *et al*., 2018; Djalilov & Piesse, 2019; Li *et al*., 2019). Consequently, the consensus is that the GFC was caused by a failure in the regulatory measures within the financial system (Cihak *et al*., 2013; Fratzscher *et al*., 2016:114). Moreover, Chalmers (2017) states that international bank governance was weakened by extended periods of limited regulation and neo-liberal ideological dominance. Poor supervision of the banking sector is also considered to have also contributed to the GFC (Masciandaro *et al*., 2011). There are calls for more stringent bank regulations because of the GFC. As a safeguard against a possible future occurrence, financial regulatory bodies globally have put in place new regulatory measures, more notably the Basel III accord (Bodellini, 2019). However, Li *et al*. (2019) also note that an increase in bank regulation can also lead to unintended effects on bank performance and risk-taking.

Surprisingly, financial institutions such as the World Bank and the IMF are also some of the international institutions that choose to adhere to regulatory measures such as Basel capital requirements to protect their institutions (Cubillas & González, 2014). Regulatory measures are implemented through different measures. Firstly, it can include minimum capital requirements, which aim to ensure that banks are well prepared to take on unexpected losses and shocks resulting from their risk-taking activities (Ozili, 2017). Secondly, activity restrictions limit and monitor the banks operating activities, including insurance and ownership of assets. These restrictions can also pertain to the degree to which banks are allowed to engage in fee-based activities stipulated by the national regulatory authority. These activities include security market activities, insurance activities, and real estate business activities. (Li *et al*., 2019). Thirdly, deposit insurance is a regulatory tool that ensures that deposits are safe and can be accessed whenever they are needed by depositors. Lastly, official supervision ensures that there is accountability in restricting excessive risk-taking within a bank.

Amongst the different ways bank regulation can be implemented, bank capital regulation has gained more interest mostly because it is the building block of bank regulation from the time that it was first introduced in the 1987 Basel I accord (Fratzscher *et al*., 2016:115). There are

arguments for both an increase in capital requirements and arguments against it. Fratzscher *et al*. (2016:115) note that potential capital increases and more stringent banking supervision can potentially protect banks from excessive risk-taking. An increase in capital requirements can potentially cause an increase in the barriers to entry, restrict competition in a bank and increase bank efficiency through more prudent lending decisions by banks (Agoraki *et* al., 2011). These relative benefits can potentially reduce excessive risk-taking and allow banks to hold more reserve capital for unexpected losses (Dam & Koetter, 2011). Conversely, Brown, and Haque (2017) note that an increase in bank capital requirements leads to bank managers and owners opting to pursue riskier investments to compensate for the loss of benefits. The same effect is what Fratzscher *et al*. (2016:115) use as an argument for an increase in capital requirements, which indicates that the same aspect of banking regulation can be interpreted differently by two stakeholders.

Anginer *et al*. (2019) noted that banking regulation post the GFC has become stricter and complex compared to regulation before the GFC. This was evident in the introduction of regulation and legislation reforms by the European Union (EU) countries such as Capital Requirements Directive IV, the Capital Requirements Regulation, and the Bank Recovery and Resolution Directive. In order to research more on different regulatory measures, this section of the study will analyse the different bank regulations introduced in different parts of the World to be measured against future financial or bank crises. However, before the analysis of different bank regulations, it is important to distinguish between macro- and micro-prudential regulations.

2.4.1 Macro-prudential vs. micro-prudential regulation

Before the occurrence of the GFC, it was believed that the market was self-correcting and regulation needed to concentrate on firm-level (Yellen, 2011:3). Micro-prudential regulation is what some deem to be the cause of the global financial crisis (French *et al.,* 2010; Hanson *et al.,* 2011:3). This regulation type brought forth studies into multiple new banking regulations after it failed to cope with the financial shock of the 2008 global financial crisis (De Nicolò *et al.,* 2014:2097). As a response to this, the Basel III Capital Accord increased its capital to risk-weighted assets requirements from 8 percent under Basel II to 10.5 percent under Basel III (BIS, 2019).

One of the objectives of micro-prudential regulation is to preventing crises of individual financial institutions. It does not consider the external risks that an institution can face and does not take into account any financial system externalities (Persaud, 2009). Other factors, such as general market and macroeconomic conditions, are also not taken into effect (de Haan *et al.,* 2013:21). Under this type of regulation, banks finance themselves and have insurance from the government (Hanson *et al.,* 2011:3). Even though micro-prudential regulation limits the distress of individual institutions, its overall objective is to protect depositors and investors (Galati & Moessner, 2018:736).

According to some policymakers, macro-prudential regulation is what was needed to be the focus before the 2008 global financial crisis (Galati & Moessner, 2013:846; Masciandaro & Volpicella, 2016). Macro-prudential regulation protects the financial system as a whole from systematic risk (Kelber & Monnet, 2014:151). Since the financial system as a whole needs to be protected, the term Macro-prudential regulation was widely used soon after the global financial crisis of 2008 (Clement, 2010; Gauthier *et al.,* 2010). Even though the term became popular post the crisis, it is not new to the World of finance and has been in use since the 1970s (Green *et al.,* 2011). Some measure taken in the 1930s and 1950s by the US to support their financial system and influence credit supply is viewed as being macro-prudential tools (Galati & Moessner, 2018:735).

Moreover, some of the laws and other responses that were passed to be agents of macro-prudential regulation include the Dodd-Frank Act of 2010 in the US (Yellen, 2011), Bank Recovery and Resolution Directive in Germany (IMF, 2016), the Europe Systematic Risk Board (European Systematic Risk Board, 2019) and the Financial Policy Committee of England (Bank of England, 2019). It is worth noting that even though the acts are from a Macro-prudential approach, they have some micro-prudential aspects to them. That is to say that, micro- and macro-prudential regulations are interlinked in some aspects (Gallali & Messai, 2015:11; Williams, 2015:1; Neanidis, 2019:78). The response to the 2008 global financial crisis was bank regulation that targets both individual banks and the entire financial system (Cai *et al.*, 2015:1404). This is evidenced by the implementation of the Basel III Capital Accord, which had the goal of being macro-prudential focused but initially focused on individual banks (Shin, 2011:5). Table 2.1, below, indicates some of the differences between macro- and micro-prudential regulation.

Table 2.1: Differences between macro- and micro-prudential perspectives

Objective(s)	Macro-prudential	Micro-prudential
Proximate objective	Limit financial system-wide distress	Limit distress of individual institutions
Ultimate objective	Avoid macroeconomic costs linked to financial instability	Consumer (Investor/depositor) protection
Characterization of Risk	"Endogenous" (dependent on collective behaviour)	"Exogenous" (Independent) of individual agents' behaviour)
Correlations and common exposures across institutions	Important	Irrelevant
Calibration of prudential controls	In terms of system-wide risk; top-down	In terms of risks individual institutions; bottom-up

Source: Adapted from Galati and Moessner (2013)

The following section will provide an overview of global banking regulation. This will include regulations that were implemented on a global scale and their aim and targets regarding the bank and the reduction of bank risk.

2.4.2 Bank regulation globally

One of the most common regulations put in place after the GFC is the Dodd-Frank Act of 2010 (Li *et al.*, 2019). It was introduced in the US as a measure to regulate the US financial market and protect consumers from the occurrence of another crisis. The main goal of the act is to improve accountability and transparency in the US financial system to promote stability in the US financial system (Scholes, 2010). The implementation of the Dodd-Frank Wall Street Reform and the Consumer Protection Act of 2010 sparked various debates on the use of more stringent regulations in the US banking sector (Li *et al.*, 2019). To some regulators, more stringent banking regulations will result in a more stable and resilient banking sector (Repullo & Suarez, 2013).

According to Kilinc and Neyapti (2012), the existence of banking regulation and supervision is justified through two explanations. Firstly, the use of regulations and supervision potentially mitigates rising conflicts of interests within the banking sector, which will, in turn, benefit the banking sector and the economy. Lastly, bank regulation and supervision promotes stability within the banking sector and provides safety measures in the event of unexpected losses for banks. However, there are also downsides to implementing strict regulatory measures within the banking system (Li *et al.*, 2019b). Increasing banking regulations, such as stringent capital adequacy requirements, may potentially increase financial costs for banks (Chalmers, 2017).

On the international market, stringent domestic regulation potentially makes banks less competitive. This translates to a challenge for bank regulations, with them having to tighten bank regulations whilst maintaining competitiveness. The subsequent literature evaluates a case where banks where in favour of, and removed some banking regulatory measures to promote growth in the banking sector.

There was a high number of financial deregulation occurring in the Asian region before the 1997 Asian Financial crisis. This deregulation resulted in a plethora of foreign capital inflow, increased domestic consumption, high-level investments, and credit expansion within the region. There was also economic growth in the region relative to countries in Europe and North America (Li *et al*., 2019b). However, the downside to this was that an increase in financial deregulation led to the exposure of the systematic weakness of the Asian region's financial sector (Fu *et al*., 2014). Consequently, the Asian Financial Crisis occurred and severely affected most of the economies within the Asian region.

Following the occurrence of the crisis, Asian nations began to implement structural reforms within their respective financial sectors, which led to an increase in the asset quality of Asian banks (Lee & Rosenkranz, 2019). During the GFC, banks in the Asian region maintained their return on asset ratio compared to other nations, which experienced significant drops in their return on asset ratios (Li *et al*., 2019b). This can perhaps be attributed to the regulatory measures that they had put in place after the Asian financial crisis and their level of preparedness for a new crisis. In response to the Asian crisis, banks in Indonesia adopted the twin approaches of compliance-based-supervision and risk-based-supervision (Hidayat *et al*., 2012). These two approaches highlight the importance of bank compliance monitoring and a forward-looking approach allowing supervisory authorities to take the best action they see fit should a new risk emerge.

Various banking regulations have been put in place to provide a cushion for different potential future crises that may occur. For example, the Dodd-Frank Act of 2010 was implemented as a response to the concept that some banks were intertwined with most of the activity in the banking sector, thus making them too big to fail. Other forms of new regulations, such as the Basel accords, were put in place because policymakers felt that the growth in external activities that were not in the traditional banking system was part of the problem (Diamond *et al*., 2017. Against this backdrop, the following section will highlight a brief history of the Basel accords and improvements made to them.

2.4.2.1 Basel Committee on Banking Supervision

In 1974, after the failure of Bankhaus Herstatt, a bank in West Germany, central bank Governors from ten countries came together to establish the Committee on Banking Regulations and Supervision practices (BIS, 2020b). Its goal was to increase global financial stability through the use of quality global banking supervision and be a forum for cooperation on bank regulation and supervision for all its members. The first committee meeting was held in February 1975, and they have been holding meetings every three or four times a year at the head offices in Basel, Switzerland. It has 45 members to date, and South Africa is one of those members. The committee, now known as the Basel Committee on Banking Supervision (BCBS), provides a structural framework on regulations through the publication of capital adequacy requirements frameworks, most notably the Basel accords (Brown & Haque, 2017:273).

The first of these accords, known as Basel I, was published in 1987 and released to banks in July 1987, focusing on a common capital measurement system for banks (BIS, 2020a). The Basel I Accord advised banks to have a minimum capital to risk-weighted assets of 8 per cent to protect against credit risk, and this was welcomed by not only member banks but banks all over the World. In 1997, the Basel I accord was amended to cater for market risk (BIS, 2020c). In order to improve the way that regulatory requirements tackle credit and market risk, the BCBS introduced new accords in June 1999 set to be released in 2004, known as Basel II. This revised accord consisted of three pillars, namely, minimum capital requirements, which sought to develop and expand the standardised rules set out in the 1988 Accord, supervisory review of an institution's capital adequacy and internal assessment process and effective use of disclosure as a lever to strengthen market discipline and encourage sound ban. The Basel III accords were introduced in 2010 in response to the 2008 global financial crisis, and more stringent measures on minimum capital requirements were introduced (BIS, 2020d). Table 2.2 shows how the Basel accords changed over time.

Table 2.2: Basel Accords over time

Regulation	Year implemented	Description
Basel I accord	1988	Sets out the minimum capital requirements of financial institutions with the goal of minimizing credit risk.
Basel II accord	2004	An amendment of the Basel I accord and has a framework that operates under 3 pillars namely, capital adequacy requirements, supervisory review and market discipline
Basel III accord	2009	Implemented as a response to the GFC with the aim of improving banks' ability to handle financial shocks and improve their transparency and supervisory disclosure.
Basel IV accord	2017	Make bank capital more robust in order to increase confidence in the banking system.

Source: Adapted from BIS (2020a); BIS (2020c); BIS, (2020d); PwC (2020)

2.4.3 Bank regulation in Africa

Research on bank risk, bank regulation, and supervision focused on the African banking sector is limited, but this section will provide some available literature on the topic. Calice *et al.* (2017) researched the relationship between bank efficiency and regulation in Africa. The research was motivated by the implementation of bank reforms by African countries during the 1980s and 1990s to align with international banking regulations that were being put in place at the time to protect the bank from risk and increase bank efficiency and stability. Despite this increase in regulation, there is a criticism against African countries. Researchers such as Beck

et al. (2011) are of the view that African countries should adopt methods of best fit as opposed to methods of best practice when it comes to banking regulation. The method of best fit allows for the implementation of regulatory measures that are more related to the goals and outcomes of banks in Africa as opposed to global goals, which may not align with the regulatory goals of Africa. Calice *et al.* (2017) concluded that should the implementation of best fit regulation provide tangible results for the African banking sector, then the rest of the World can also develop regulatory measures that are useful to them.

Using a sample of 132 North African and Middle East commercial banks, Brown and Haque (2017) examined how bank regulation and ownership can influence bank efficiency. They concluded that bank regulation in North Africa and the Middle East assist in the allocation of resources compared to a system where there is no regulation, and the banking sector is corrected by market forces. Furthermore, their results suggest that bank regulation post the GFC highlighted an increase in bank efficiency compared to bank regulation pre the GFC. This increase in efficiency can possibly be attributed to regulation, such as the Basel III accord, which was implemented after the GFC (BIS, 2020b). There was also an increase in bank efficiency after the GFC resulting from bank-specific regulations such as an increase in capital requirements, official supervisory power, and restrictions on banking activity. However, there was no effect of these regulations before the occurrence of the crisis.

One of the first measures to be introduced by the Basel III accords was macro-prudential regulation on the global banking sector. At the time, Bagyenda *et al*. (2012) argued that these regulations might not be relevant for Africa, but they may not have been able to address systemic risks on the African continent, such as threats arising from cross border capital outflows. Their proposed solution to this was African specific regulations such as restrictions on foreign exchange exposure and large loan concentrations. This advocated for a more Africa specific focused bank regulatory measure. Furthermore, regulatory measures related to the Basel capital accords have been slightly modified by African countries to cope with their banking sectors (Bagyenda *et al*., 2012). Additional measures by African banking regulators can relatively mean that banks in Africa are more protected from various risks due to more number of precautionary measures compared to banks in developed countries.

2.4.4 Bank regulation in South Africa

The South African financial sector is one of the advanced sectors in the African financial sector. Evidently, in 2005 it became the first African country to implement a legal framework for the consumer credit market (Schraten, 2014). Moreover, it also managed to mitigate some of the adverse effects of the GFC that were evident in other parts of the World (National Treasury, 2011). The ratio of domestic credit to the private sector as a percentage of GDP in South Africa stands at 138 percent, whereas the global average is 129.7 percent (World Bank, 2020). This ratio shows financial resources flowing from financial institutions to the private sector, and a higher percentage indicates a strong and stable financial system. Some various bodies and institutions aid in the stable and effective regulations and supervision of the South African banking sector.

The primary regulator for banking regulation and supervision for the banking sector in South Africa is the South African Reserve Bank (South African Reserve Bank, 2020). Moreover, due to the 2017 twin peaks model, the South Africa Reserve Bank also regulates all activity within the South African financial sector and not only banking institutions (Leukes & Mensah, 2019). One of the objectives of the South African Reserve Bank in the context of banks is to maintain an effective and sound banking system that protects the interests of bank depositors and the overall economy. In order to achieve this objective, the SARB issues banking licenses and implements bank-related Acts that are in line with this objective. Other regulatory bodies that supervise and regulate South African banks include the Financial Services Board, National Credit Regulator, Johannesburg Stock Exchange, Financial Intelligence Centre, South African Revenue Service, National Treasury, and Department of Labour (Nedbank, 2020). The functions along with the supervisory and regulatory powers of these institutions are listed below:

- South African Reserve Bank (SARB) – The primary objective of the SARB is to maintain price stability towards the attainment of sustainable economic growth in South Africa (South Africa Reserve Bank, 2020). Secondary objectives and responsibilities included assessing the stability of components that of the South African financial sector. Its approach to the South African financial market is heavily reliant on the market to self-correct, and the SARB only intervenes to contain and eradicate systemic risk within the financial sector. It works closely with other bank sector regulatory bodies and supervisors in South Africa towards the implementation of macro-prudential regulation in the banking system.

- The Financial Sector Conduct Authority (FSCA) – its function is the regulation and supervision of market conduct for financial bodies in South Africa. It performs this function by providing bank stakeholders such as customers by equipping them with financial education and ensure that they are not unfairly treated by banks (Financial Sector Conduct Authority, 2020).
- The National Credit Regulator (NCR) – This regulatory body is responsible for the South African credit industry and oversees all aspects of credit-related issues in the county. Its supervisory powers result from the National Credit Act No. 34 of 2005. Amongst other functions, the regulatory body educates relevant stakeholders on credits, creates credits policies, and it ensures compliance of the credit act by all stakeholders, including banks that operate in South Africa. Subsequently, this body ensures that the credit market is accessible to all, and fair practice is enforced whenever credit is given by banks and other financial institutions. (National Credit Regulator, 2020)
- Johannesburg Stock Exchange (JSE) – Opened in 1887, the JSE is the largest stock exchange in Africa whilst also ranking amongst the top 20 globally. It is responsible for the regulation of trading activities within the South African financial market. It also creates the requirements that all companies need to adhere to when they want to sell part or all of their company equity in the form of shares. The regulatory reports of the JSE are reported to the FCSA (Johannesburg Stock Exchange, 2020).
- The Financial Intelligence Centre (FIC) – This regulatory body is responsible for receiving and analysing all financial related data from South African financial bodies. Their main aim is to identify financial proceeds that result from crime and money laundering or might lead to the financing of terrorism. It does this by seeking to (i) Supervise and enforce compliance with the FIC Act; (ii) Facilitate effective supervision and enforcement by supervisory bodies; (iii) Receive financial data from accountable and reporting institutions; (iv) Share information with law enforcement authorities, intelligence services, the South African Revenue Service, international counterparts and supervisory bodies; (v) Formulate policy regarding money laundering and the financing of terrorism; (vi) Provide policy advice to the Minister of Finance and (vii) Uphold the international obligations and commitments required by the country in respect of anti-money laundering and combating the financing of terrorism (Financial Intelligence Centre, 2020).

- The South African Revenue Service (SARS) – This is the supervisory authority in the country that handles all tax-related issues. It operates under the South African Revenue Service Act 34 of 1997 (South African Revenue Service, 2020).
- The National Treasury – It is a governing body that is responsible for the management of the finances of the South African government. It operates under Chapter 13 of the South African Constitution and aims to promote transparency, accountability, and effective financial control in the way it manages public finances (National Treasury, 2020).
- Department of Labour - It is responsible for the regulation of the South African labour market. It implements the following as measures to meet its goal; enforcement of labour-related regulation and legislation, human rights protection, employment services provision, promotion of equity in the workplace, and provides a platform for social dialogue (Department of Labour, 2020).

The nineteen new banking regulations that were implemented in South Africa are shown in Table 2.3.

Table 2.3: Bank related regulations implemented in South Africa from 2000 to 2017

Year	Regulation
2017	Financial Sector Regulation Act 9 of 2017 (President of the Republic of South Africa, 2017)
2016	King IV (KPMG, 2016)
2015	Bank Amendment Act 3 of 2015 (President of the Republic of South Africa, 2015)
2013	Protection of Personal Information Act 4 of 2013 (President of the Republic of South Africa, 2013b)
2012	Financial Markets Act 4 of 2013 (President of the Republic of South Africa, 2013a)
2010	Basel III (South African Reserve Bank, 2013)
2009	Taxation Laws Amendment Act 17 of 2009 (President of the Republic of South Africa, 2009b), King III (de Beer and du Toit, 2014)
2008	Consumer Protection Act 68 of 2008 (President of the Republic of South Africa, 2009a)
2007	Bank Amendment Act 20 of 2007 (President of the Republic of South Africa, 2007), Corporative Bank Act 40 of 2007 (President of the Republic of South Africa, 2008)
2005	National Credit Act 34 of 2005 (President of the Republic of South Africa, 2005)
2004	Basel II (South African Reserve Bank, 2004)
2003	Bank Amendment Act 19 of 2002 (President of the Republic of South Africa, 2003)
2002	King II (Decker, 2002), Financial Advisory and Intermediary Services Act 37 of 2002 (President of the Republic of South Africa, 2000)
2001	Financial Intelligence Centre Act 38 of 2001 (Minister of Finance, 2001)
2000	Bank Amendment Act 36 of 2000 (President of the Republic of South Africa, 2000)

2.5 EMPIRICAL LITERATURE

The empirical literature referenced in this study focuses on studies that researched different studies that relate to various forms of bank risk and bank- regulation and supervision.

2.5.1 International studies

Barakat and Hussainey (2013) investigated the impact of bank supervision on risk reporting using the operational risk disclosure quality of European banks. The study used data from 2008 to 2010 using data from 137 banks across the European Union (EU) region. Data for the banks was obtained from the Bankscope database, and they constructed their operational risk disclosure quality index. Due to a lack of sufficient information for some banks, they had to exclude 14 banks from the initial sample, and 38 more banks were excluded because they were subsidiaries of other banks. This left them with a sample size of 85, and their asset size represented approximately 74 percent of the total assets in the European banking industry in 2008. The study had an unbalanced panel of data because different banks had different data availability periods from the chosen sample period of 2008 to 2010. The study found that banks that had higher levels of supervision provided sound and quality operational risk disclosure results. This means that there exists a positive relationship between risk reporting and bank supervision.

By also using banks in the European region as a sample, Ameur *et al.* (2014) investigated the effect of bank regulation and supervision on the profitability and risk of banks in Europe. The data was gathered from the Bankscope database, and six countries from Europe were chosen as the sample countries. From these countries, the top 10 largest banks by asset size were chosen dependent variables of the study. The banking regulation and supervision survey were constructed by Barth *et al.* (2008). A period of 2005 to 2011 was chosen as the time frame because it captured the trends before, during, and after the GFC. To run the data, a two-step dynamic panel data approach was implemented, and a generalised method of moments was used to deal with potential issues regarding endogeneity, heteroskedasticity, and autocorrelation. The results of the study show that an increase in banking regulation and supervision potentially improves profitability in banks and decrease risk-taking behaviour.

Ly (2015) used data from 4 114 European banks located in 27 European countries for the period 2001 to 2011 to determine if a relationship existed between liquidity risk and bank-performance, and regulation. Data for liquidity risk was compiled from the financial statements

of the sample banks reported on the Bankscope data site. Data for bank- supervision and regulation was obtained from the World Bank survey on banking supervision by Barth *et al.* (2001). An ordinary least squares regression was used to determine and interpret the relationship between liquidity risk and regulation. The results of the study showed that there is a negative relationship between liquidity risk and bank performance, whilst there is a positive relationship between bank performance and regulations on bank capital and supervision. Against such, it can be deduced that a negative relationship exists between regulations and supervisions on banks' capital and liquidity risk. This result was against what other results in this literature concluded.

Ongena *et al.* (2013) investigated whether bank regulation in one country can affect the risks of banks from that country operating as subsidiaries in other countries. It was motivated by the assumption that bank risk positively responds to regulation and supervision in the home country. The sample countries were 16 emerging central and western European countries and 155 banks present in these countries. From the 155 banks in the sample, 28 were domestic banks, and 127 were branches or subsidiaries of 23 foreign banks. Data were obtained from databases compiled by Barth *et al.* (2006); Barth *et al*. (2008) and Abiad *et al.* (2010). The study concluded that regulation in the home country slightly decreases the risk-taking behaviour of banks in foreign markets. It can be concluded that bank- regulation, and supervision have an impact even for banks that are not operating in their home country. This result is in line with most of the results of studies relating to bank risk and bank- regulation and supervision in the European region.

Other studies looked at risk and regulation in other parts of the world and not only the European region. De Haan and Klomp (2014) used data from 400 banks located in 70 non-industrial countries from 2002 to 2008. The objective of the study was to examine the effect of banking regulation and supervision on bank risk. Similar to other studies in this literature, data for bank risk and bank regulation and supervision was obtained from the Bankscope data site and the World Bank survey on banking regulation and supervision. The study also controlled for various macroeconomic factors such as inflation, economic growth, exchange rate depreciation, external debt, current account balance, and shocks to terms of trade. The study used a generalised method of moments estimator similar to what other studies in the literature used to model the relationship between banking regulation and supervision with bank risk. The results of the regression showed that more stringent bank regulations, especially capital

regulations and supervisory control, reduce bank risk. The results of the study also showed that liquidity regulations and activity restrictions are also useful in decreasing bank risk, but this varies based on institutional quality.

Delis and Staikouras (2011) investigated the role of banking supervision in controlling bank risk using the sample period 1998 to 2008. This was unlike most studies in the literature which investigated the relationship of bank- regulation, and supervision on banking risk before, during, and after the 2008 global financial crisis. Moreover, this study used a sample of 17 countries distributed between Europe, North America, and Oceania. However, risk data is gathered from the Bankscope data site, and regulation and supervision data are compiled from the World Bank survey on banking regulation, which is similar to what other studies in the literature did. The study also used a generalised method of moments to regress the data and concluded that an increase in capital regulations decreases bank risk for banks that are compliant with the capital requirements. Another conclusion was that supervision rather than the adoption of regulatory measures is a key driver of bank risk reduction.

2.5.2 African studies

Haque (2019) investigated the influence of risk-taking behaviour can be influenced by bank regulations and ownership structure. The study used data from 144 conventional banks that are located in North Africa and the Middle East. A two-step system generalized method of moments was used in the study to analyse the data. The overall finding of the study was that regulatory measures such as the Basel II accords did not have any significant impact on the risk-taking behaviour of North African and the Middle East countries. Additionally, the study also found that there is a positive relationship between official supervisory power and bank risk but only for banks that have high ownership concentration. This also led to the discovery that strict capital regulatory measures increase bank risk, and market discipline reduces bank risk. Lastly, the study stated that there is a negative relationship between foreign ownership and bank risk-taking.

In East Africa, Bai *et al*. (2016) studied the effectiveness of the interbank market in Kenya in complementing banking regulation to combat bank risk. A generalised method of moments was used to model the relationship using a sample period of the first quarter of 2003 to the first quarter of 2011. Their results concluded that interbank activity could generally lead to a decrease in the level of banks, possibly due to banks actively working together. However, if

there is an increase in interbank activity, it might lead to a point whereby bank risk moves from being reduced to being increased. The change is heavily dependent on the size of the bank and mostly adversely affects small, local, non-listed, and newer banks.

Using data from 164 banks in 37 African countries, Ngoka *et al.* (2017) researched the influence of capital regulatory requirements on financial sector stability. This study was motivated by African countries committing themselves to increase their capital regulatory requirements as a complementary measure to the Basel III accord. Some of the African countries who required their banking sectors were Zambia who aimed to increase regulatory capital from US$358 000 to US$2.2 million in 2007, Algeria required an increase in regulatory capital from US$39 million to US$ 155 million and Kenya regulatory requirements increased from US$ 3.3 million to US$12.5 million (Ngoka *et al*., 2017). The results from the study indicated that an increase in capital regulatory requirements increases financial stability for small African banks. These results implied that there was no relationship between tightening capital regulatory measures and financial stability for African banks. Furthermore, the results of the study showed that the increased capital regulatory requirements in African banks worked in favour of foreign-owned banks due to domestic banks being made less competitive.

The empirical studies, their authors, methodology and results are summarised in Table 2.4 below:

Table 2.4: Summary of empirical studies

Year	Study name	Author(s)	Methodology	Results
2019	Ownership, regulation and bank risk-taking: evidence from the Middle East and North Africa (MENA) region.	Haque	Generalised method of moments estimator.	The overall finding of the study was that regulatory measures such as the Basel II accords did not have any significant impact on the risk-taking behaviour of

				North African and the Middle East countries.
2017	Capital requirement, bank competition and stability in Africa.	Ngoka, Odongo and Oduor.	Ordinary least squares.	An increase in capital regulatory requirements increases financial stability for small African banks.
2016	The Peer Monitoring Role of the Interbank Market in Kenya and Implications for Bank Regulation.	Bai, Birmingham, Green, Maana, Murinde, Ngoka-Kisinguh,and Tiriongo.	Generalised method of moments estimator.	Interbank activity could generally lead to a decrease in the level of banks, possibly due to banks actively working together. However, an increase in interbank activity, it might lead to a point whereby bank risk moves from being reduced to being increased.
2015	Liquidity risk, regulation and bank performance: Evidence from European banks.	Ly, K. C	Ordinary least squares regression.	The results of the study showed that there is a negative relationship between liquidity risk and bank

				performance, whilst there is a positive relationship between bank performance and regulations on bank capital and supervision.
2014	The Effects of regulation and supervision on European Banking profitability and risk: a panel Data Investigation.	Ameur, H. B., Bouheni, F. B., Cheffou, A. I. & Jawadi, F.	Two-step dynamic panel data approach and a generalised method of moments estimator.	The results of the study show that an increase in banking regulation and supervision potentially improves profitability in banks and decrease risk-taking behaviour.
2014	Bank regulation, the quality of institutions, and banking risk in emerging and developing countries: an empirical analysis.	De Haan and Klomp	Generalised method of moments estimator.	The results of the regression showed that more stringent bank regulations, especially capital regulations and supervisory control, reduce bank risk. The results of the study also showed that

				liquidity regulations and activity restrictions are also useful in decreasing bank risk, but this varies based on institutional quality.
2013	Bank governance, regulation, supervision, and risk reporting: Evidence from operational risk disclosures in European banks.	Barakat, A. & Hussainey, K.	Operational risk disclosure quality index (Self-contructed)	Banks that had higher levels of supervision provided sound and quality operational risk disclosure results.
2013	“When the cat's away the mice will play”: Does regulation at home affect bank risk-taking abroad?	Ongena, S., Popov, A. and Udell, G. F.	Probit regression.	The study concluded that regulation in the home country slightly decreases the risk-taking behaviour of banks in foreign markets. It can be concluded that bank- regulation, and supervision have an impact even for banks that are not

				operating in their home country.
2011	Supervisory effectiveness and bank risk.	Delis and Staikouras	Generalised method of moments estimator, Ordinary least squares regression and and Z-score regression.	An increase in capital regulations decreases bank risk for banks that are compliant with the capital requirements. Moreover, rather than the adoption of regulatory measures is a key driver of bank risk reduction.

2.5.3 South African literature

Research work that focuses on bank regulation and bank risk in South Africa is limited, and there are only a few studies in the literature that examine these aspects. Lindop *et al*. (2013) state that since the occurrence of the GFC, there has been a need for effective risk management and risk reporting in the South African overall market sector. As a build-up, this section of the study provides insight into the data, methods, conclusions, and possible recommendations that some studies on banks risk and regulation provided.

Hargarter and van Vuuren (2018) researched the ways that South African banks can ensure sustainability whilst aiming to combat conduct risk. Conduct risk arises from the sale of inadequate or unsuitable financial products to achieve or meet sales targets in a financial institution (Miles, 2017). The study was conducted to provide insight on conduct risk in South African banks and how it can be managed to ensure a sound and effective banking sector. Data for the study was gathered using qualitative methods of surveys and interviews with experts in the area of conduct risk in South Africa. The interpretive analysis was used to model and interpret the responses from the interviews and surveys. The results of the study indicated that

banks are more focused on developing ethical conduct aimed at top management and rarely focus on the lower level where some employees interact with customers. The authors recommend that banks need to focus on developing ethical standards from a top-down approach and actively pursue the outcomes of their customers from a bottom-up approach.

Manguzvane and Muteba-Mwamba (2019) applied conditional quantile regression to model systemic risk in the South African banking sector to identify banks that were both systemically important and more exposed to systemic risk in South Africa. Using time from June 2007 to April 2016, the data sample was daily stock market prices from Standard Bank, Amalgamated Banks of South Africa, Nedbank, Capitec, and lastly African Bank. Their results show that there was a significant increase in market risk for all the sample banks during the 2008 global financial crisis, and African Bank was the most at-risk bank during this period. The largest contributor to systemic risk during the period was First Rand Bank, and African Bank was the least contributor. The results indicated that large banks pose the largest contributor to systemic risk in the South African banking sector. Furthermore, the study indicated that different banks pose different threats to the South African banking sector. Failure to eradicate or mitigate these different risks that individual banks may pose to the banking system potentially leads to bank failure. Conventional bank regulatory and supervision measures were not able to prevent the failure of African Bank in 2014 due to bad debt (de Jongh *et al*., 2017).

2.6 CONCLUSION

This chapter indicated that since the occurrence of the GFC, there had been a growing number of studies related the bank regulation and supervision. Furthermore, these studies are divided between the implementation of more regulation and the relaxation of some regulations to allow for flexibility in the banking sectors. A study on the deregulation of the Asian banking sector showed significant signs of improved efficiency in the banking sectors of Asian nations before the Asian Financial crisis occurred in 1997. Studies in the area note that the deregulation of most measures in the financial system may have left the banking sector vulnerable and caused the occurrence of the Asian Financial Crisis. Over ten years after the crisis, when the GFC occurred, most of the banking sectors in the Asian market were not adversely affected, which can be attributed to the regulations that they had set in place after the Asian Financial Crisis.

Another finding of the chapter was the rise of the BCBS as a regulatory body for banking regulation globally. Even though the BCBS has member countries, banks from non-member

countries can also adopt the policy recommendations of the BCBS and implement it in their banks. Additionally, their regulatory policies are not only limited to commercial banks but have also been adopted by other global financial bodies such as the World Bank and the IMF.

A recurring observation was most of the studies that research on bank risk and bank- regulation, and supervision obtained their bank risk data on the Bankscope data site and their bank-regulation, and supervision data from the World Bank survey on banking regulation and supervision compiled by Barth *et al.* (2008). Another general conclusion for most of these studies was that a positive relationship exists between bank risk and bank- regulation, and supervision. For most of the studies, bank regulation was consistent, but the bank risk proxy was different and touched on different types of risk that banks can be potentially faced with. Furthermore, most of the literature relied more on European banks, which shows the response by European nations to implement new banking regulations after the occurrence of the GFC. Literature also pointed out the difference between bank regulation and bank supervision, which meant bank laws and the implementation of bank laws, respectively.

African studies that are directed at the relationship or interaction between bank risk and bank-regulation, and supervision are limited. This can be linked to most of the effects of the GFC being linked to North America and Europe. Most of the African studies have either bank risk, bank regulation, or bank supervision being investigated with other factors such as bank ownership and bank efficiency. However, the most common variable in most of the studies in both Africa and the rest of the world was the use of a general method of moments as a tool to model relationships in the various studies. Perhaps this indicates the effectiveness of the model to produce efficient and sound regression results.

In the literature, studies by Ameur *et al,* 2014; Barakat and Hussainey, 2013; de Haan and Klomp, 2014; Delis and Staikouras, 2011; Ly, 2015, and Ongena *et al,* 2013 all focused the relationship of banking regulation and bank risk of European states and developing states but not on African countries nor the best performing banking nations in the world .Thus, this study aims to bridge that gap and focus on the relationship between bank regulation and bank risk of an African country and that of the 25 best performing banking nations in the world.

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CHAPTER 3

ARTICLE 1: THE RELATIONSHIP BETWEEN REGULATION AND SOLVENCY RISK FOR THE TOP FIVE SOUTH AFRICAN BANKS

Abstract

Objectives: the objectives of this article were to analyse different types of risks that banks face, conduct in-depth analysis of the various types of bank regulatory measures, and determine whether there is a long run or short-run relationship between bank solvency and the implementation of bank regulation **Prior Work** this research builds up on studies about bank risk and regulation but include an African aspect **Approach** Secondary data from banks' financial statements was used to calculate solvency risk using a z-score model. The results of the z-score model represented solvency risk and performed as the dependent variable in the study. **Results** Logit Regression showed that the z-score for South African banks cannot be used to predict whether new regulation will be implemented in the future. However, an ARDL model indicated that there is a long-run relationship between the z-score for the top five South African banks and new regulation being implemented. **Implications** This study can be used by academic researchers as a comparison to their own academic work **Value** Based on the varying results from the different methodologies implemented in this study, it can be recommended that more regulation needs to be implemented that specifically looks into increasing the solvency levels of South African banks.

Keywords: z-score; Auto-Regressive Distributed Lag model, logistic regression

3.1 INTRODUCTION

There is no actual figure or measure set in place to determine the optimal level of banking regulation (Demirguc-Kunt *et al.*, 2008; Delis *et al.*, 2011). As such, it is of concern for policymakers to choose between implementing stricter bank regulation or relax current regulation. Bank regulation has both desirable and non-desirable aspects attached to it (Wilf, 2016:769). For example, stringent regulations such as strict capital requirements, limit the risk-taking behaviours of banks, which could result in credit rationing (Dawid & van der Hoog, 2017:1208). The costs of regulation include a restriction on risk-adjusted leverage, and the benefits that come with it include cheaper-funding and insurance (Kim & Mangla, 2019:485). On account of this, there are arguments for both stricter bank regulations and some for limited

bank regulation (Beck *et al.*, 2010:1665; Brandao-Marques *et al*, 2020; Chava *et al.*, 2013:767; Greenwood *et al*, 2017; Levine *et al.*, 2014:3).

Levine *et al.* (2014:25) argue that bank deregulation can be used to ensure bank productivity, which can mean that the banking system can properly function with little or no regulation. Removal of some banking regulations, notably the Glass-Steagall Act of 1932, and relaxing some regulations such as the Mcfadden Act of 1927 in the United States (US) allowed commercial banks to grow rapidly at the beginning of the 1980s through to the early 2000s (DeYoung, 2010:11). In response to this, there were various mergers and acquisitions within the US banking industry. In the 1980s, there were over 350 commercial bank mergers and acquisitions each year, 500 in the 1990s, and 300 in the early 2000s. However, there are some, such as Laeven & Levine (2009) and de Haan & Klomp (2015), who argue that implementing stricter banking regulations will reduce solvency risk within banks.

De Haan *et al.* (2013:2) suggest that good regulation counteracts failures that are inherent to the market and creates more opportunity for the market to function smoothly. As a result, it is important to determine whether any change in banking regulation can have an impact on the profits of banks. The reason for a study in this field is that in the event of corporate failures, there are various economic costs to the society, including economic downturns and recessions (Johnstone *et al.*, 2017:3).

In this study, a z-score measure will be used to determine if the banking regulation in South Africa (SA) has been favourable among the top five commercial banks in the country. A shock in the financial sector also affects other businesses that may not be in the financial area (Larsson & Soderberg, 2017). Even though the South African market was protected by sound financial regulation (Ikhide & Maredza, 2013:553; Foggitt *et al.*, 2017:3) during the crisis, it also suffered the consequences with over a million jobs lost (National Treasury, 2011:4). Based on the results that will be obtained, policy recommendations on South African banking regulation will be made.

3.2 SOUTH AFRICAN BANKING LANDSCAPE

SA has the most advanced financial market in all of the Southern African Development Community (SADC) and has no close competitors in this regard (Bara & Le Roux, 2017:400). In SA, since the early 1990s, there has also been a rise in the introduction of new legislation, technology, and several new participants in the financial sector, which has contributed to an

increase in competition. Evident of the competition is the monopolistic competitive environment that banks in the country operate under (Simatele, 2015:833).

In perspective, SA has 17 authorised local banks, two mutual banks, four local branches, two co-operatives, and 43 foreign banks (Chitamba, 2018:1). The top five banks, namely Standard Bank (SB), First Rand Bank, Nedbank, ABSA, and Capitec Bank, own 90 percent of the total assets in the banking sector of SA (South African Reserve Bank, 2018:7). Outside investors have the highest bank ownership in SA with 49 percent ownership, South African savings via mandated investment schemes own 34 percent, and other investors own 17 percent (The Banking Association South Africa, 2019:5). The US$ 5.5 billion purchase of 20 percent of Standard Bank by the Industrial and Commercial Bank of China is one such example of foreign ownership of SA banks (Ifeacho & Ngalawa, 2014:1184). The high number of foreign ownership indicates the likelihood that SA banks are highly regarded amongst their global peers.

Moreover, the banking system is considered developed, and in the 2012/13 WEF global competitiveness report, SA was rated 2nd out of 144 surveyed countries (Bany-Ariffin *et al.*, 2015:54). The recent 2018/19 WEF global competitiveness report lists SA as number 29 out of 141 surveyed countries, which is a drop from the 2012/13 results (WEF, 2018). South African banks are high influencers in the African landscape with 42.4 percent of bank deposits, 49.9 percent of bank credit, 34.6 percent of net earnings, and 40.4 percent of total bank assets out of the top 200 African banks surveyed in 2008 (Kamarudin, & Sufian, 2016:521). This means that any financial shock experienced in South African markets can be felt across Africa and the different regions such as the Southern African Development Community (SADC).

Before the 2008 global financial crisis, from 2005 to 2007, commercial banks in SA had an increase in bank performance measured by profitability, liquidity, and credit quality (Kumbirai & Webb, 2010:48). The progress was halted post-2008 due to the 2008 global financial crisis and a slowing economy. In 2011, the South African financial sector comprised of at least ZAR6 trillion in assets, contributed over 10.5 percent of the Gross Domestic Product (GDP), and 15 percent of corporate income tax (National Treasury, 2011:2). Furthermore, over the ten years from 2000 to 2010, the sector grew at an annual rate of 9.1 percent, which was three times more than the economic growth over the same period. Total banking assets to GDP of South African banks increased from 89.2 percent in 1999 to 136.8 percent in 2008 (Mlambo & Ncube, 2011:6). Over the 2017/18 period, the top four banks, excluding Capitec, had combined

headline earnings of R40.4 billion, which indicated a 12.1 percent year on year growth (Pricewaterhouse Coopers, 2018:4). Over the 2017/18 financial period, an excess amount of R336.8 million was paid to the National Treasury by four of the top five banks, as interest from tax and loan accounts (National Treasury, 2018:20).

Surprisingly, there are a few controversial issues that have plagued the South African banking system. In 2014, African Bank Limited collapsed due to the issuance of multiple loans and credit cards mostly at high-interest rates for low-income customers whilst taking in a few deposits to match the outflow of cash through loans and credit cards (Foggitt *et al.*, 2017:3). Similar to the cause of the 2008 global financial crisis, loans were granted to un-creditworthy individuals. As a result, the South African Reserve Bank (SARB) provided a bailout to the amount of R17 billion (IMF, 2014b:7). However, the regulatory environment of South African banks was put under the spotlight and prompted a review in supervisory procedures (The Banking Association South Africa, 2019:10). In 2017, there were price-fixing allegations by 17 banks, of which three were from SA (Moyo, 2018:2). Lastly, in March 2018, the Venda Building Society (VBS) was placed under curatorship by the SARB as a result of their imprudent banking practices. This meant that the executive management and board of directors of VBS were all replaced by management appointed by the SARB (Chipatiso & Kawadza, 2018:39). On 29 October 2018, an application was issued to the High Court of SA for the liquidation of VBS (SARB, 2018b).

In contrast, regulation in the South African banking landscape is to provide the establishment of principles that assist in the maintenance of effective risk management by banks (Government Gazzette, 2012:10). Commercial banks are required to have cash reserve balances with the SARB, which complies with the SARB Act of 90 of 1989 (SARB, 2017:92). In 2017, the reserve balance was below the required amount by R2 billion, which they improved to R35.5 million below the required reserve in 2018 (SARB, 2018c:41). SA introduced the Financial Sector Charter in 2004, which aimed to increased financial inclusion (The Banking Association South Africa, 2019). As a result, there has been an increase in financial inclusion in the country from 55 percent in 2005 to 85 percent in 2016 (Treasury, 2017:165). This shows that most adults in the country have access to different types of finance-related products from financial institutions. The following section discusses the methods that were used to run and interpret the chosen data.

3.3 LITERATURE REVIEW

Banking regulation increases the flexibility of the financial sector so that it will not find itself in a strained situation (Bessis, 2011:2). Additionally, banking regulation aims to obtain stability without sacrificing the market discipline of risky banks (Iyer *et al.,* 2016:2721). It is set in place to prevent bank crises as they are costly and affect not only the banking sector but numerous macroeconomic sectors (Tchana, 2008). Ultimately, bank regulation looks to provide financial stability, create equality amongst financial institutions, and mitigate any potential threat to the financial sector (Jacobs & Van Vuuren, 2014:268). Thus, taking this into account, globally, the banking sector is one of the most regulated and monitored sectors (PwC, 2019). Despite this, Demirgüc-Kunt and Detragiache (2011) could not identify any significant relationship between bank risk and regulation.

Furthermore, Angkinand (2009:240) studied the relationship between regulation and banking crises using the sample period of 1970 to 2003, and a sample size of 35 economies. The objective was to determine whether strict banking regulations can reduce the effects of bank crises. The study concluded that there is no evidence to support bank supervision as a measure to decrease bank crises. It did, however, note that countries had lower cost crises if their banks provided deposit insurance coverage and enforced strict capital adequacy requirements. Delis *et al*. (2011) examined the relationship between regulation and the supervisory framework of banks from over 22 countries covering the period 1999 to 2009. The study combined the Malmquist index estimates with bootstrap regression and concluded that there is a positive impact on bank productivity if the regulation in place promotes private monitoring.

Additionally, Barth *et al.* (2013) conducted an unbalanced panel analysis on 4050 banks from the year 1999 to 2007 to determine the effects of banking regulation and supervision on bank efficiency. It built upon three surveys on banking regulation by Barth *et al.* (2004; 2006; 2008), to which they concluded that strict banking restrictions are negatively correlated with efficiency in banks. They also concluded that an increase in capital regulation for banks results in a positive increase in bank efficiency. Similarly, Pasiouras *et al.* (2009) studied the impact of regulatory and supervisory frameworks on bank efficiency using data from 615 commercial banks in 74 countries from 2000 to 2004. Using a stochastic frontier analysis, they found that regulation on market discipline leads to an increase in cost- and profit efficiency.

De Haan and Klomp (2014:19) examined the effect of bank regulation and supervision on banking risk using data of 371 banks from non-industrialised countries for the period 2002 to 2008. Their results concluded that imposing strict banking regulation and supervision results in low risk for banks. However, du Jardin *et al.* (2017:4) argued that these studies make use of accounting variables, which only represent one aspect of insolvency prediction. To resolve this, de Haan and Klomp (2015) performed another study on the impact of regulation and supervision using z-scores on 1238 banks from 94 developed countries. They used data from the Bankscope of Bureau van Dijk and bank regulation and supervision surveys combined by Barth *et al.* (2004) and Barth *et al.* (2008) from 107 countries for the period 1999 to 2008. The study concluded that the z-score measure increased when there was an increase in bank regulation and supervision. A low z-score means a relatively high level of risk whereby a high z-score means a relatively low-risk.

Another study done by Zeidan (2012) researched the effects of illegal financial activities in the US banking sector and whether or not regulation is effective in combating this. Using a sample of 80 US banks covering 20 years, it was found that the enforcement of regulation on those banks did not have any effect on illegal banking activities. Costello *et al.* (2019) used US banks to determine if strict banking regulation improves financial reporting transparency. The results showed that regulations are important when it comes to financial reporting and even more so in periods before economic crises. Though much work has been done on the study of bank regulation and bank performance, to the best knowledge of the researcher, there has not been a study that looked at the relationship of regulation in South African banks to combat the risk of insolvency. This study will aim to fill this gap and share some light to policy developers on how banking regulation affects the solvency of South African banks. The following section will discuss several measures that can be used to predict whether a specific bank can fail due to insolvency.

3.4 Bank failure prediction models

Prediction of a company failure can be traced to the 1840s when the company Dun and Bradstreet was incorporated to provide independent creditworthiness of different companies (Jayasekera, 2018:207). In 1966, Beaver (1966) presented univariate modelling to predict distress, and Altman (1968) used discriminant analysis two years later to develop a prediction model (Appiah, 2011:39; Gepp & Kumar, 2015:397).

Some signals are implemented to assist in the prediction of the future financial situation in banks. Such signals are grouped into two measures, namely market- and accounting-based measures (Chiaramonte *et al*., 2015:112). These are part of parametric models for bankruptcy prediction and make use of financial information to predict bankruptcy in banks (Mishra & Singh, 2016:4). This study will make use of an accounting-based measure which is called the z-score. There is a higher level of risk-adjusted return when accounting-based models are implemented in bankruptcy prediction (Altman *et al.*, 2017:113). Apart from the z-score model, there are various other accounting-based models, namely, Ohlson O-score and the Zmijewski X-score model (Mishra & Singh, 2016:5). The difference between these models lies in their theoretical approaches and the information that they use to model bank insolvency.

Market-based measures are an alternative to the accounting-based measures and counter the criticisms that surround the accounting-based measures. These types of measures investigate the insolvency of both individual banks and the financial system as a whole (Tinoco & Wilson, 2013:396). Advantages of the market-based models include the reflection of all available information in an efficient market, the low likeliness of market variables being influenced by firms accounting policies, and the reflection of future expected cash flows by market prices (Fu *et al.*, 2014:65). These models have to be able to provide in-depth information that is not already provided by banks on a firm-level when it comes to a driver of systemic risk (Cai *et al.*, 2015: 1405). There are a few differences between market and accounting based predictive models, but the use of accounting models allows for the use of higher risk-adjusted return on credit activity (Altman *et al.*, 2017:133).

The following section will provide an overview of the South African banking sector landscape. It also covers some scandals that faced the SA banking system and details some information regarding bank regulation in SA.

3.5 METHODOLOGY

3.5.1 Research design

This article made use of a case study research design to aid in examining the impact of banking regulation and supervision on solvency risk for South African banks. This research design made use of the following analytical tools, logistic regression, and an Auto-Regressive Distributed Lag model (ARDL) and quantile regression. The main contributing factor to the

use of this research design in this article was that the numerical data was readily available, and could be measurable.

3.5.2 Data selection and description

The sample was comprised of the top five South African commercial banks by market size. According to the South African Reserve Bank (2018), these banks make up 90.5 percent of the banking sector in South Africa and thus relatively represent the South African banking sector. These banks are Standard Bank (SB), ABSA, First Rand Bank, Nedbank, and Capitec Bank.

The data were comprised of the return on assets and capital to asset ratio, which is found on the banks' financial statements, which are publicly available on the IRESS website. Therefore, secondary data were used to calculate solvency risk using a z-score model. The data were published for stakeholders and shareholders of the banks to show the performance of the banks over time and will be used in the research because it fits into the z-score formula used in this study. Studies that used similar data include Angkinand (2009); Barth *et al.* (2013), Costello *et al.* (2019); de Haan and Klomp (2014), de Haan and Klomp (2015); du Jardin *et al.* (2017).

The results of the z-score model represented solvency risk and was the dependent variable in the study. The period for data gathering was from 2000 to 2017 because the period had data from pre-, during, and post the 2008 global financial crisis (GFC). Additionally, for a z-score to be calculated, there needs to be at least four years' worth of data from the time of the study therefore this study meets the statistical requirement on data time period (Smit & Swanepoel, 2016:116). The other variables in this study will be bank regulations that were implemented in South Africa from 2000 to 2017. The implemented bank regulations from 2000 to 2017 are noted in chapter 2 of this study.

3.5.3 Model specification and procedure

This study uses two different methods to run the chosen data to achieve the empirical objectives of this study. The two methods are logistic (Logit) regression and the Auto-Regressive Distributed Lag model (ARDL). For both models, the Augmented Dicky-Fuller (ADF) unit root tests were conducted to determine if the variables are stationary. The discussion and steps taken for these two models are noted in the subsequent paragraphs. As a way to determine the probability of insolvency for South African banks, this study implements the z-score as a method of calculation. A z-score is a proxy for bank risk and indicates the standards deviation

that the return on the asset has to be before the equity runs out, and a bank is deemed insolvent (de Haan & Klomp, 2015; Demirguc¸-Kunt & Detragiache, 2011; Laeven & Levine, 2009). In both methods, the average z-scores of the chosen banks are the independent variables, and the implementation of the new regulation is the independent variable.

Secondary data obtained from the Iress data site for the seventeen years from 2000 to 2017 were used in this study. There was no data for Capitec bank for 2000 and 2001 due to the bank commencing its operations on the 1st of March 2001 (Capitec Bank, 2019). In order to compensate for this lack of data, zeros were put in place as placeholders for the Return on Assets (ROA) and Capital to Asset Ratio (CAR) values for 2000 and 2001. The following z-score formula is used as a measure:

$$Z = \frac{\text{CAR} + \text{ROA}}{\sigma\text{ROA}} \tag{1}$$

Where CAR is the capital to assets ratio, ROA is the return on assets, and σROA represents the standard deviation of the return on assets (Li *et al.*, 2017:12). Unlike the Altman z-score, there are no benchmarks, since this z-score is not complex and uses accounting information to indicate whether a bank may be nearing bankruptcy (Swanepoel, 2016:19). For a bank to be considered as insolvent, the following condition needs to be present CAR + ROA $\leq$ 0 (Lepetit & Strobel, 2013:74). A high z-score value means that there is a relatively low level of bank risk, and a low z-score means that there is a relatively high level of bank risk. Microsoft Excel was used to compute the individual z-scores of the five banks.

Secondly, the study used Logit Regression to determine the probability of the occurrence of new regulation as a result of increased volatility. This means that it studied whether an increase in the z-score can be related to the introduction of new banking regulation. The Logit Regression presents binary outcomes, which can either be an occurrence or non-occurrence of an event (Sperandei, 2014). In this study, the Logit Regression is represented by the following:

$$\text{Y}=\begin{cases} 1, \text{if there was a new regulation} \\ 0, \text{if there was no new regulation} \end{cases}$$

Y is the dependent variable, and the values 1 and 0 represent the implementation and non-occurrence of new banking regulation, respectively. These variables were coded in the data analysis tool, E-views 11, and the Logit Regression equation is presented as the following:

$$ln\left(\frac{p}{1-p}\right)=\beta_0+\beta_1 X \quad (2)$$

Where:

$\left(\frac{p}{1-p}\right)$ = the odds ratio; P = the introduction of new regulation; 1-P = No new regulation introduced; β_0 = Coefficients; X = intercepts

Since this will be an estimate of the probability, an estimated regression model will be used which is represented by the following equation $ln\left(\frac{\hat{P}}{1-\hat{P}}\right) = b_0 + b_1 x$. All the variables retain their meaning, with the exception of the fact that they are now estimates. The focus of the results from this equation is on the sign and not the magnitude of the value obtained. Thus, if the value of the coefficient is greater than 0, it indicates that an increase in the coefficient increases the likelihood of the implementation of new bank regulation. Therefore, it would mean that an increase in the intercept X would increase the likelihood of new regulation being passed. Alternatively, if the coefficient value is less than 0, then a decrease in the intercept X decreases the likelihood of the passing of new regulation.

If the values of the Logit Regression are statistically significant, then the equation is represented as:

$$\ln\left(\frac{\hat{P}}{1-\hat{P}}\right) = \alpha_0 + b_0 X_1 \text{ z-score} + b_1 X_2 \text{ z-score} + b_2 X_3 \text{ z-score} + b_3 X_4 \text{ z-score} + b_4 X_5 \text{ z-score} \quad (3)$$

Where: X_1 = ABSA, X_2 = Capitec, X_3= First Rand, X_4= Nedbank, X_5= SB

Lastly, to test whether there is a long run or short-run relationship between the variables, an autoregressive distributed lag model, known as the ARDL model, was used. The model is represented by the following equation:

$$\Delta Y_t=\beta_0+\sum_{i=1}^{n}\beta_i \Delta Y_{t-1}+\sum_{i=0}^{n}\delta_i \Delta X_{t-1}+\varphi_1 Y_{t-1}+\varphi_2 X_{t-1}+\mu_t \quad (4)$$

Where:

β_1 & δ_i = Short-run equations; φ_1 & φ_2 = ARDL long-run coefficients; μ_t = Disturbance term

The variables are logged in the E-views programme, and the first step is to determine the optimal number of lags. Thus, the analysis uses the lags chosen as the optimal number of lags. After the optimal lags are chosen, the model is run using the following formula:

$$\Delta Regulation = \beta_0 + \sum_{i=1}^{n} \beta_i \Delta Regulation(-1) + \sum_{i=0}^{n} \delta_i \Delta Average(-1) + \varphi_1 Regulation(1) + \varphi_2 Average(-1) + \mu_t \quad (5)$$

3.6 RESULTS AND DISCUSSION

The data were initially tested for stationarity, and all the variables were found to be stationary at level expect for the z-score values of ABSA and Capitec bank, which were stationary after first differencing. The z-score results and their order of integration are listed in Table 3.1 and Table 3.2, respectively.

Table 3.1: Z-score results using bank data

Year	ABSA	Capitec bank	First Rand	Nedbank	SB	Average
2000	7.226	0.000	6.045	6.015	5.558	4.969
2001	7.144	0.000	5.988	5.350	6.947	5.086
2002	7.222	0.189	5.972	5.320	6.409	5.022
2003	7.108	0.190	5.979	5.435	-3.230	3.096
2004	7.007	0.191	5.900	5.344	9.382	5.565
2005	7.092	0.191	5.227	5.118	6.884	4.903
2006	6.869	0.191	5.067	5.166	6.822	4.823
2007	6.746	0.190	5.450	5.193	5.461	4.608
2008	6.798	0.188	5.948	5.255	7.252	5.088
2009	7.007	0.189	6.071	5.287	7.304	5.172
2010	6.989	0.186	5.471	5.289	7.188	5.024
2011	6.895	0.187	13.376	5.246	7.115	6.564
2012	6.949	0.187	5.287	5.196	7.147	4.953
2013	6.950	0.188	5.241	5.169	7.025	4.915
2014	6.935	0.189	5.193	5.138	7.062	4.903
2015	6.965	0.188	5.559	5.130	7.193	5.007
2016	7.018	0.188	5.787	5.165	6.987	5.029
2017	6.987	0.188	5.760	5.100	6.873	4.982
Average	6.995	0.168	6.073	5.273	6.410	

Table 3.2: Order of Integration

	ABSA	Capitec bank	First Rand	Nedbank	SB	Average
Order of Integration	I(1)	I(1)	I(0)	I(0)	I(0)	I(0)

Logit Regression results

Thereafter, a binary Logit Regression was run to determine the level of significance and interpret to signs of the coefficients. The results of the regression p-values and unit root tests are summarized in Table 3.3. Variables that were significant under the 1, 5 and 10 percent significance level were the ones that were chosen for the forecasting of new regulation being implemented. However, none of the regressors were significant under all the significance levels. This led to the conclusion that there was no relationship between the new regulation being implemented in South African banks and the banks' z-score level. This result was contradictory to the results found by de Haan and Klomp (2015), who concluded that there is a positive relationship between bank regulation and bank risk measured by the z-score.

Table 3.3: Logit Regression and unit-root results

Z-score Variable	P-value	Order of Integration
DAbsa	0.9274	I(1)
DCapitec	0.6692	I(1)
First Rand	0.1907	I(0)
Nedbank	0.2634	I(0)
SB	0.8098	I(0)

Thereafter, an ARDL model was done between the new regulations implemented and the average z-score movement for South African banks from 2000 to 2017. The ARDL model was relevant to this study because the z-score values are integrated of order 0 and 1 but not two as shown in Table 3.2. Based on the lag length criteria, the optimal number of lags to be used was 7 lags. The results of the ARDL regression are shown in Table 3.4:

Table 3.4: Regression results

Variable	P-value
Short-run variables	
D(Regulation(-1))	0.5924
D(Average(-1))	0.3377
Long-run variables	
Regulation(-1)	0.0070
Average(-1)	0.2312
F-Statistic Probability value	0.0049

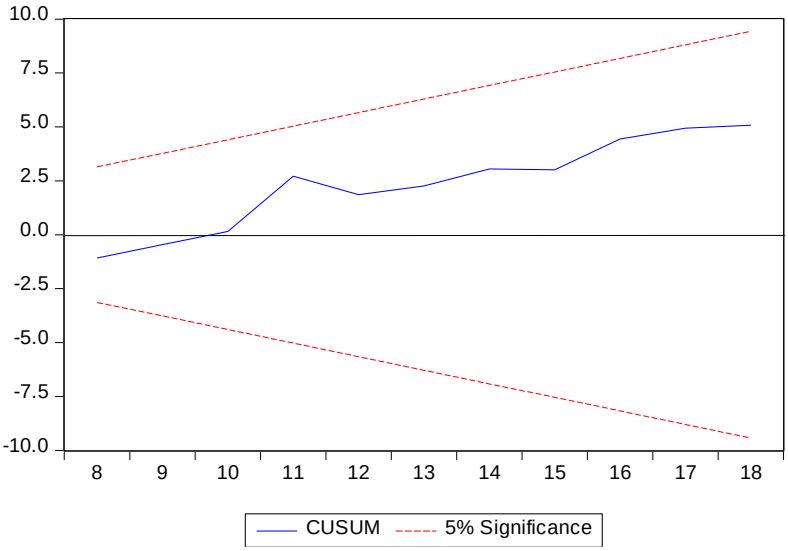
Model diagnostic, in the form of a serial correlation test, had to be performed before the results of the ARDL model were interpreted. The results of the Breusch-Godfrey serial correlation Langrange Multiplier (LM) test are shown in Table 3.5 below:

Table 3.5: Breusch-Godfrey Serial correlation LM test

F-stat	0.2722	P-Value	0.9357
Obs*R-Squared	5.1634	P-value Chi-Square	0.5400

From Table 3.5, the p-value associated with the chi-square distribution was greater than the significance value of 0.05. Therefore, we do not reject the null hypothesis that there is evidence of serial correlation. Thereafter, model stability was done via a cumulative sum control chart (CUSUM chart) shown in Figure 3.1:

Figure 3.1: CUSUM Chart



The results show that the trend line lies within the boundaries; thus, the model is stable. Thereafter, the bounds test was performed between the two long-run variables to check if they are statistically significant. The null hypothesis under the Wald test is that the two long-run variables are both equal to zero. The results of the regression are shown in Table 3.6 below:

Table 3.6: Wald Test results

Wald Test			
Test Statistic	**Value**	**Df**	**Probability**
F-statistic	7.251003	(2, 11)	0.0098
Chi-Square	14.50201	2	0.0007

The p-value of the F-statistic in the Wald test shows statistical significance; however, that is not the determinant of significance when it comes to Wald tests. In order to determine significance, a Pesaran table was used to determine whether the p-value is significant. The p-value is significant if the calculated F-statistic value is greater than the upper bound value from the Pesaran table, and under the 5 percent significance level, the lower and upper bound values from the table are 4.94 and 5.73 respectively. Thus, from the ARDL model regression, it was concluded that the model is significant, and there is a long-run relationship between bank regulation, and bank solvency risk which was represented by the z-score since the calculated F-statistic value of 7.25 is greater than the upper bound value from the Pesaran table.

3.7 CONCLUSION

This study aimed to determine the relationship between banking regulation and solvency levels of five major banks in SA. The main objective was to determine if the implementation of new

bank regulations was assisting bank solvency or not. By using z-scores to determine the levels of solvency in the top five banks, the results showed that four of the five banks had had stable z-scores over the period from 2000 until 2017. The only exception was Capitec bank, which had low z-score measures, which could indicate that it has been on the edge of bankruptcy since the turn of the century. There is no study from the empirical literature that supports nor contests this finding; therefore, this could relatively be a new finding in this field of study. This finding can also be a potential area of a study looking into how Capitec bank has been existing with relatively low levels of solvency.

Logit Regression showed that the z-score for South African banks could not be used to predict whether new regulation will be implemented in the future. This result showed that there was no relationship between bank solvency, and new regulation implemented in South African banks was in support of some of the studies in the literature, which also found no relationship between bank risk and bank regulation. A relative conclusion can be drawn that the implementation of banking regulation does not affect bank risk using solvency levels as a proxy. This could mean that they may be other factors such as economic variables and the micro- and macroeconomic environment that can influence the solvency levels of banks.

However, using an ARDL model, results showed that there is a long-run relationship between the z-score for the top five South African banks and new regulation being implemented. This result was in support of the result by de Haan and Klomp (2015), who also used z-scores as a risk proxy against bank regulation and found a positive relationship between the two variables. The study also found that there have been nineteen new regulations, including amendments of the bank act, that have been introduced to South African banks since 2000 until 2017. Based on the varying results from the different methodologies implemented in this study, it can be recommended that more regulation needs to be implemented that specifically looks into increasing the solvency levels of South African banks.

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CHAPTER 4

ARTICLE 2: RISK AND REGULATION FOR THE SOUNDEST BANKING SYSTEMS IN THE WORLD

Abstract

Objectives The objectives of this paper were to analyse the different risk measures to determine the best measure of bank risk to use in the quantile regression between risk and regulation; determine the best proxies for bank regulation from the World Bank survey on banking regulation and evaluate the nature of the relationship between bank risk and bank regulation variables **Prior Work** this study built on the work done in 2012 by Klomp and De Haan and added a new focus study to their methodological approach **Approach** A factor analysis was used to explain variability amongst the variables in the risk indicators of the different countries. After that, a principal component analysis was performed with the regulation data of the sample. Finally, a multilevel quantile regression function was used to determine the relationship between strict regulation and risks for the identified banks in different countries. **Results** The results indicated that bank regulation and supervision mainly affect high-risk banks which are in the 0.75 and 0.95 quantiles. This finding was also similar to what de Haan and Klomp discovered in their results. **Implications** The study highlighted the lack of literature for African studies in the bank risk and regulation topic post the 2008 global financial crisis. **Value** The paper indicated that more bank risk that focuses on capital regulatory requirements need to be implemented to assist in the reduction of possible banks risk.

Keywords: bank risk indicators; sound financial systems; global financial crisis

4.1 INTRODUCTION

Each year the World Economic Forum (WEF) publishes a global competitiveness report which assesses the competitiveness landscape of 140 economies (WEF, 2019). The assessment evaluates and compares how countries perform in various sectors of their economies compared to their peers. One of the sectors evaluated in the report is the banking sector. In this sector, the soundness of the different banking systems in the specific economies is compared and ranked. The rankings show the best nations with robust financial systems and are well regulated and less susceptible to various bank risk. This feature of the WEF global competitiveness report is

the main reason why the best 25 nations was chosen for this study. Since the occurrence of the 2008 global financial crisis, an emphasis has been placed on the importance of sound banking regulation and supervision (de Haan & Klomp, 2012:3197).

Subsequently, the 2008 global financial crisis brought forth several consequences in the global market including, a liquidity crisis, a slowdown in the global economy, and a downturn for countries in Eastern Europe (Pintea *et al.*, 2015:4). As a result, it was labelled as the most disruptive and complex crisis since the great depression of 1929 (Celik-Girgin *et al.*, 2017). Global aggregate losses in 2008 amounted to an estimate of US $50 trillion, which equalled one year worth of economic output (Drezner & McNamara, 2013). As a rescue measure, the United States (US) led by the Bush administration offered financial bailouts of US $ 700 billion into the US financial system (Bhatt, 2011:212). To aid in mitigating another crisis with such losses from occurring in the future new banking regulations such as the Basel III and Basel IV accords were implemented (Sironi, 2018).

Therefore, because of the above literature that identifies the importance of the banking sector in the overall economy, the risk faced by banks need to be effectively identified and managed. Moreover, there is a need for more literature that identifies whether protective measures of banks are efficient and able to mitigate future bank risk. Thus, this study will aim to determine the relationship between bank risk and bank- regulation and supervision for the top 25 soundest financial systems in the world ranked by the WEF. Additionally, the study will also aim to determine which type of regulatory and supervision measures are more effective in combating certain types of bank risks compared to others. Research in this focus area can assist bank regulatory policymakers in their policy formulations; it can also add to the body of knowledge that exists on the topic.

The rest of the study is organised as follows: section two will provide a literature review on the use of Capital adequacy, Asset Quality, Management Ability, Earning Quality, Liquidity, and Sensitivity to market (CAMELS) indicators in different financial sectors. Then proceed to provide a section of the data description and methodology in section three, while section four details the results and discussion thereof. Thereafter section five will conclude the study and also provide recommendations.

4.2 LITERATURE REVIEW

Various studies that relate to banking and regulation exist, more so, after the occurrence of the crisis in 2008, with some examples being studies by Fratzscher *et al.* (2015) and Schwarcz (2015). The study by Fratzscher *et al.* (2015) analysed how implementing tighter banking regulations can increase bank stability and how it also affects credit provision. The results of the study showed that the tightening of bank regulatory requirements affects credit growth and bank stability irrespective of the institutional quality. Schwarcz (2015) analysed how bank regulation can be implemented in a way that also addresses market failure caused by bank asset securitisation in the finance sector. The conclusion was that a regulatory framework that is transparent, simple, and standardised could assist in addressing market-failure caused by bank asset securitisation. More extensive studies on banking regulation and supervision follow.

Mayes and Stremmel (2012) examined bank distress with a sample of US banks that were insured by the FDIC from 1992 to 2012. They compared two models used in bank failure prediction, namely the logistic (logit) technique and discrete survival time analysis, which incorporated CAMELS indicators to conclude on the stability of contributing banks' characteristics. The results showed that the logit model could separate sound banks from failing banks with an accuracy of 80 percent, and the survival time model can do it with an accuracy of 98 percent. However, evidence was found that there is a slight difference in the influence of the characteristics of the two methods. Kupiec *et al.* (2017) used a novel strategy to quantify the impact of the average bank supervisory CAMELS rating on the loan growth of a bank. The sample consisted of quarterly data from US banks from the period of 1994 to 2011. They discovered that poor a CAMELS rating adversely impacts the growth of bank loans.

In another study, Fredrick (2013:22) determined if there was a relationship between the financial performance of commercial banks in Kenya and credit risk management proxied by CAMELS indicators. The study used multiple regression analysis on secondary data obtained from banking sector surveys done by the Central Bank of Kenya. The results of the study indicated that CAMELS indicators and financial performance have a strong impact on each other. It also concluded that the CAMELS indicators could be used as a proxy for credit risk management. Since the indicators predict bank failure, they should contain important information that relates to credit risk (Hasan *et al.*, 2016:277). Using Malaysian banks as a sample, Hashim and Muhmad (2015:109) investigated the bank performance of both domestic and foreign banks in the country using CAMELS indicators. The study used regression analysis

and concluded that CAMELS indicators have an impact on the performance of Malaysian banks.

In another eastern hemisphere bank study, Kumar and Sayani (2015) evaluated the soundness of Islamic banks from 2008 to 2014 using CAMELS indicators along with the z-score model. The results indicated that the chosen banks had sufficient capital during the period but showed a decrease in the asset quality and earnings ability, but it was not severe enough to lead them to bankruptcy. Altan *et al.* (2014) appraised the financial performance of 15 state-owned and private Turkish banks using 23 CAMELS indicators from 2005 to 2012. The results showed that each of CAMELS aspect had a different bank that was more efficient in that area than the other banks. Roman & Şargu (2013) used the CAMELS indicators on 15 commercial banks in Romania to comparatively analyse their financial soundness. The data used was obtained from the Bureau Van Dijk Bankscope database along with the financial statements of the banks. Amongst other conclusions, they noted that their largest bank in the sample ranked best in one of the indicators, which were management's ability but did not produce high ranking results for the other factors.

Sayed and Sayed (2013) employed the CAMELS indicators on the top four private banks in India, namely; Axis Bank, Housing Development Financial Corporation Bank, Industrial Credit and Investment Corporation of India Bank, and Kotak Mahindra Bank, at the time to evaluate the performance and quality. The banks were chosen based on data from the Economic Times Intelligence group database for three years; 2008-09, 2009-10, and 2010-11. After comparing all the CAMELS weights for the chosen banks, Kotak Mahindra Bank was chosen as the best amongst the four according to its overall score. Another study, Ahmadvand *et al.* (2016), used the CAMELS indicators along with a qualitative system dynamics approach to determine the performance of Iranian banks. The conclusion was that Capital Adequacy, Asset Quality, and Management ability were the most important factors that Iranian banks need to develop to have soundbanks.

Aydoğan *et al*. (2014) compared the performance of conventional Turkish banks against Islamic banks using logistic regression for a period of 2001-2009. In the study, CAMELS indicators were used to evaluate the banks' managerial and financial performance. The conclusion was that Islamic banks in Turkey perform better than domestic Turkish banks except for the sensitivity to the market aspect. De Haan & Klomp (2014) used data from 371 banks that were from nonindustrial countries from the period of 2002 to 2008, to examine the

effect of bank regulation and supervision on bank risk. They discovered that strict regulation, such as capital regulations and supervisory control, reduces risk. Additionally, they concluded that the level of development also affects the impact of regulation and supervision in a bank. The CAMELS variables are summarised in Table 4.1.

Table 4.1: Predictor Variables for CAMELS Indicators

CAMELS	**Predictor Variables**
Capital Adequacy	Equity/Total Assets (E/A)
	Leverage effect
	Solvency ratio
Asset Quality	Total loans / total assets (TL/TA)
	Asset growth rate (AGR)
	Loan loss / total loans (LL/TL)
	The growth rate of loans (GROL)
Profitability	Return on Assets (ROA)
	Return on Equity (ROE)
Liquidity	Loans / deposits (L/D)
	Net stable Funding Ratio
Quality Management	Interest Expense / deposits (IE/D)
	Operating expense/deposits (OE/D)
Sensitivity to market	Bank assets/total assets of the banking system

Source: Adapted from Maria-Daciana and Nicolae (2014:136)

Through various forms and methods, the studies in this literature evaluated the interaction between bank risk with bank- regulation and supervision. The literature also indicated various methods that can be used in the study of bank risk, bank regulation, and bank supervision such as multiple regression analysis, logistic (logit) technique, and discrete survival time analysis. The conclusion for most of the studies was that a positive relationship exists between bank risk and bank- regulation, and supervision regulation and supervision that targets capital requirements assisted in the reduction of risk. The results of the studies in the literature can assist as a benchmark for comparison for the results that will be obtained in this study.

4.3 METHODOLOGY

4.3.1 Research design

This study will make use of quantitative research design to aid in examining the impact of banking regulation and supervision on bank risk. This research design will make use of the following analytical tools, factor analysis, and quantile regression. The main contributing

factor to the use of this research design in this study is that the numerical data is readily available, and it can be measurable.

4.3.2 Sample selection and data description

The sample will comprise 133 banks from the top 25 soundest banking systems in the world, according to the 2018/19 WEF global competitiveness report. According to the report, the top 25 countries with the soundest banking systems in the world are Finland, Canada, Singapore, Australia, Chile, Hong Kong SAR, Luxembourg, Switzerland, New Zealand, Slovak Republic, Panama, Israel, Czech Republic, Philippines, Dominican Republic, Uruguay, United States of America, Taiwan, Saudi Arabia, Austria, Netherlands, Egypt, Austria, Guatemala, and Brazil. South African (SA) banks will also be included to compensate for the lack of presence of banks in Singapore and the Czech Republic due to data availability issues. South Africa was ranked as number 29 on the soundest banking systems in the world survey.

Banks should always be healthy, solid, and stable; thus, the need to periodically evaluate them and correct any potential threats that they can be faced with (Roman & Şargu, 2013:703). One of the most efficient ways to periodically evaluate them is through the use of Capital adequacy, Asset quality, Management ability, Earnings ability, Liquidity, and Sensitivity to market (CAMELS) indicators CAMELS indicators. The indicators take into consideration the scale of the bank, complexity, and risk level to determine whether the operations of a bank are effectively managed (Chen, 2014:535). In other words, it measures the performance of a bank over a given period. The different components are each assigned a rating from 1 to 6, good and bad, respectively (Kanagaretnam *et al.*, 2016:34). After they are all assigned individual ratings, they are combined to find an average result called a composite rating. A result of one to two indicates that there is little or no intervention needed, whereas a rating of three and above indicates that a certain bank is in need or potential intervention (Mayes & Stremmel, 2012:4). Any rating that is greater than four is given to banks that are in dire need of intervention and are facing great safety and soundness issues (Kupiec *et al.*, 2017:29).

It was originally made up of five indicators, and the last indicator's sensitivity to the market was introduced in 1996 as a representative of risk (Roman & Şargu, 2013:704). They take into account different aspects of a bank, which include financial statements, funding sources, macroeconomic data, budget, and cash flow (Dang, 2011:16). Gallali and Messai (2015:11) performed a study on 618 European banks from the period 2007-2011 to determine which

distress prediction method was the most efficient and CAMELS indicators were found to be superior. Since the indicators provide different financial ratios thus the profitability, liquidity, and solvency aspects of it are more useful in the short-run, whereby the asset quality aspects are useful in the long run (Duraj & Shkurti, 2016:35). The indicators are useful in assisting bank regulators and other stakeholders in raising any potential threats that can eventually lead to bank failure (Azar & Vaidyanathan, 2015:11). These indicators have been in use as an early warning system since they were developed by the Federal Deposit Insurance Cooperation (FDIC) in the US in the late 1970s (Azar & Vaidyanathan, 2015:2). In the US, CAMELS ratings represent both the central and comparable output of banking supervision, along with being a major input for some regulatory decisions (Agarwal *et al.,* 2014:896). Such decisions include approval of mergers, license issuance to regulators, access to government programs, and lending to micro-organisations.

Leading indicators of bank distress are grouped into three, namely, balance sheet and income statement financial ratios, market prices of financial instruments, and thirdly, less common measures such as deposit rates or indicators characterizing the economic environment in which the banks operate (Arabi, 2013:160). From these groups, CAMELS indicators fall under the first one and have been popular among studies of distress. Capital adequacy has been the most popular regulatory tool that is being used in prudential regulation (Lall, 2012:610). In this study, the CAMELS indicator will be used as the proxy for risk level.

This study also includes control variables similarly done by de Haan and Klomp (2012). To properly control for macroeconomic influence, nine (9) control variables will be used in the analysis. Macroeconomic control variables include inflation, economic growth, depreciation of the exchange rate, current account balance, income per capita, exports, imports, government revenue. According to Asongu *et al.* (2018), these control variables are relevant because of the positive relationship that exists between growth in the economy and stability within the financial sector. The second set of control variables tests for a relationship between banking risk and capital outflows. The interest rate will be the sole control variable under this section. This variable is significant because one of the regulatory measures discussed in this study is capital, regulatory measures, and the addition of this variable will assist in capturing how the capital flow is affected.

4.3.3 Model specification

Quantile regression

This study uses quantile regression to determine if there is a relationship between bank risk and regulation. It is used to describe the distribution of the dependent variable and assess both the lower and higher extremes of the dependent variable. In the quantile regression model, the independent variables are labelled as x and the conditional quantiles of the dependent variable are labelled as y. This means that it estimates different quantile functions, which provides a more comprehensive description of the heterogeneous relation between bank regulation and supervision and bank soundness. This characteristic of the model makes it more suitable for this study as compared to other techniques such as the ordinary least squares (OLS), which only focus on the mean (Waldmann, 2018). The quantile regression function estimates the median of the conditional distribution. The τth quantile of the conditional distribution is estimated by minimizing:

$$\phi_\tau = (Y - X\beta) \tag{1}$$

with respect to β, where $\phi_\tau(u) = \phi(\tau - \mathrm{I(u < 0)})$ where I is an indicator function, and u equals $Y - X\beta$. This function can be interpreted as the inclination of bank riskiness (Y), which is dependent on observed variables (X) and a random error term (u). The conditional quantile function can be formally expressed as:

$$Q_{yi} = (\tau|x_i) = X_i'\beta(\tau) \tag{2}$$

The baseline quantile regression formula is given by:

$$Q_{\tau ijt}(BR_{kijt}) = \alpha_{\tau ijt} + \theta_\tau BR_{kijt-1} + \gamma_\tau RI_{jt-1} + \eta_t + \varepsilon_{i,t} + \varepsilon_{j,t} \tag{3}$$

Where BR_{kijt} is the risk indicator of type k for bank i in country j at time t. The parameter η_t captures time fixed effects. The final two terms are error terms measured on bank-level i and country-level j, respectively. The regression is estimated for τ-quantiles, where τ is the 25th, 50th, 75th, and 95th quantile. The factor analysis procedure for the identified risks is shown in section 4.4.4.1.

4.3.4 Procedure

The study used 24 variables from CAMELS indicators, which represented banking risk. Factor analysis was used to extract and group variables that represented specific risks from within the CAMELS indicators. More specifically, dynamic factor analysis was used to combine the different indicators using the period from 2011 to 2018 from the banks in the top 25 countries with the soundest banking systems. The indicators are divided according to their classes in the CAMELS list and are listed in Table 4.1.

4.3.4.1 Factor analysis

The following factor analysis procedure used in the study was adopted from the International Business Machines (2019) website and the results of the procedure are shown in section 4.5To determine the specific variables to choose from the factor analysis, the eigenvalues which measure the variance that is accounted for by a specific variable were assessed. A low eigenvalue, a value less than one, meant that a specific factor did not contribute to explaining the variance, and a high variance meant that the variable had more influence in the variance. Every factor with an eigenvalue that was lower than one were removed from the list using the Kaiser criterion. These factors were graphically shown on a Cattell scree test, which has the eigenvalues on the vertical axis and the factors on the vertical axis. Thereafter, varimax rotation, which is an orthogonal rotation method that matches each item with an individual factor, was used to interpret the chosen factors. The Kaiser-Meyer-Orkin test (KMO) was used to determine whether the results of the factor analysis are valid. The KMO value ranges from 0 to 1, and values that are above 0.5 are considered useful whilst those less than 0.5 cannot be used.

Since the banks are from different countries with different regulations, the chosen banks were put in the study based on data availability. Unlike de Haan and Klomp (2012), who included banks with at least 75 percent of the information available, this study only included banks with over 80 percent of the information. The information being the variables that are represented in Table 4.1.

4.3.5 World Bank survey on banking supervision

Data from the World Bank survey on banking regulation and supervision is used as the proxies for bank regulation, and supervision and the responses from the survey act as the independent

variables in this study. It was created in the early 2000s and has been released a total of 3 times after the initial release, namely in 2003, 2007, and 2012 and the fifth edition was released in September 2019 (World Bank, 2019). For this study, the 2012 version is being used as the independent variable. The survey has questions that are categorised into 14 different categories, namely, that relate to the way that banking systems in different economies are regulated and supervised. Questions from the survey relate to the following categories, (1) entry/licensing, (2) ownership, (3) capital, (4) activities, (5) external auditing, (6) internal management or governance, (7) liquidity and diversification, (8) depositor protection, (9) provisioning, (10) disclosure and information, (11) dealing with problem institutions and exit from the industry, (12) supervisory powers, (13) banking sector characteristics and (14) consumer protection.

From the survey, the different questions are sorted based on their ability to be computed into a factor analysis. That is to say that questions that can be coded to be run into statistical software. Examples of questions that cannot be run into statistical software include questions that ask about who the regulatory body in a country is. Much alike to the dependent variable factors, factor analysis is used to extract the components from the survey response, which will be able to represent the independent variables. The results of the factor analysis will then determine the variables that will be used to run the quantile regression as independent variables.

4.4 RESULTS AND INTERPRETATION

This study uses CAMELS indicators to measure the relationship between risk and regulation for the soundest banking systems in the world. De Haan & Klomp (2014) used data from 371 banks located in nonindustrial countries from the period of 2002 to 2008 to examine the effect of bank regulation and supervision on bank risk.

4.4.1 Correlation matrix

Table 4.2 shows the correlation matrix of the indicators used as proxies for bank risk that is to say CAMELS indicators. Based on the results of the factor analysis, there are four dimensions or factors that can be used to represent banking risk, and they make up 81.77 percent of the variance explained by the variables. The scree plot from the factor analysis shown in Figure 4.1 also confirms this graphically. The KMO test of sphericity has a figure of 0.520, which is slightly above the minimum threshold shows the results are valid and can be trusted. Thus, according to both the Kaiser rule and the scree plot, banking risk can be represented as a four-dimensional construct.

Table 4.2: Correlation matrix of CAMELS indicators variables

	E/A	TL/TA	AGR	LL/TL	GROL	ROA	ROE	L/D	IE/D	OE/D
E/A	1.000									.
TL/TA	-0.065	1.000								
AGR	-0.021	0.013	1.000							
LL/TL	0.096	0.147	-0.002	1.000						
GROL	0.033	-0.022	0.978	-0.019	1.000					
ROA	0.761	-0.059	0.007	0.172	0.040	1.000				
ROE	0.166	0.036	0.067	0.156	0.056	0.666	1.000			
L/D	-0.010	0.031	-0.035	-0.034	-0.026	-0.016	-0.004	1.000		
IE/D	-0.002	0.023	-0.036	-0.020	-0.027	-0.011	-0.007	0.997	1.000	
OE/D	0.016	0.013	-0.023	0.050	-0.008	0.044	0.068	0.916	0.909	1.000

Figure 4.1: Scree plot for CAMELS indicators

The first factor has variables on liquidity and management that have high values, and this study labels this factor as liquidity and management risk. The second factor has variables related to capital adequacy and earnings risk score high, thus label it as capital and earnings risk. Unlike de Haan and Klomp (2012), this study has third and fourth factors that have variables in asset quality that score high and, therefore, will be combined and labeled as asset risk. Therefore, this study is represented by three distinct risks that form part of dependent variables. The results of the rotated component matrix from the factor analysis and risk classification are shown in Table 4.3.

Table 4.3: Factor Analysis results for CAMELS indicators

Variables	Risk Type		
	Liquidity & Management	**Capital & Earnings**	**Asset Quality**
L/D	0.991		
IE/D	0.989		
OE/D	0.959		
E/A		0.800	
ROA		0.978	
ROE		0.687	
TL/TA			0.781
AGR			0.995
LL/TL			0.691
GROL			0.992
Kaiser-Meyer-Olkin test		0.520	
Significance level		0.000	

*Blank spaces indicate no relevant relationship

The questions from the world bank survey on bank regulation and supervision were categorised into seven groups namely, (1) capital regulations; (2) regulations on private monitoring; (3) regulations on activities restrictions; (4) supervisory control; (5) deposit insurer's power; (6) liquidity regulations, and (7) market entry regulations. After a factor analysis was run on the survey questions, ten factors resulted. However, some of the factors interlinked and ultimately resulted in 5 factors. The classification of the factors is, (1) Capital adequacy regulation; (2) Activities restrictions; (3) Transparency supervision, (4) Market entry; and (5) Private sector monitoring. The survey questions, variance, mean, and classification of factor questions are shown in Appendix A.

After the dependent and independent variables, along with the control, were established, multiple quantiles regressions for the three different measures of risk are run. The results of the three regressions with the control variables alone are shown in Table 4.4. The main quantile regressions, which include the variables for bank risk and regulation, are shown in Table 4.5. Both tables show the probability value along with the coefficient value of every statistically significant variable in the different regressions. Statistical significance was taken and considered from the 0.01; 0.05, and 0.10 significant levels.

Table 4.4: Quantile regression with control variables

Quantile	Liquidity and Management risk				Capital and Earnings risk				Asset quality			
	.25	.5	.75	.95	.25	.50	.75	.95	.25	.50	.75	.95
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Current account balance	.275	.525	.479	.102	.163	.664	.262	.070 **.04**	.497	.947	.132	.000 **.04**
Economic growth	.869	.936	.543	.219	.475	.734	.424	.001 **-2.2**	.380	.847	.443	.000 **.13**
Exchange rate	.326	.624	.399	.929	.751	.874	.148	.219	.185	.969	.051 **-.00**	.000 **-.01**
Exports	.009 **5.39**	.193	.149	.369	.436	.579	.188	.443	.003 **2.7**	.971	.000 **-5.3**	.000 **-2.9**
Imports	.001 **-4.2**	.136	.056 **-4.3**	.308	.598	.302	.205	.802	.000 **-2.0**	.988	.000 **5.6**	.000 **2.52**
Income per capita	.614	.772	.229	.004 **.00**	.529	.466	.614	.005 **-.00**	.880	.919	.849	.000 **9.69**
Inflation	.423	.785	.960	.470	.710	.803	.170	.012 **-1.0**	.973	.930	.517	.503
Interest rate	.426	.061 **-.00**	.912	.944	.369	.003 **.21**	.015 **.013**	.186	.570	.884	.981	.956
Revenue	.328	.604	.390	.933	.742	.833	.157	.276	.199	.967	.044 **2.3**	.000 **1.43**

*Bold denotes the coefficient value of statistically significant variables

From the initial regression shown in Table 4.4, all the control variables are significant in at least one of high-risk banks, represented by the 0.75 and .095 quantiles for the three different risk types of this study. Control variables such as exports and imports, also show the significance for low-risk banks, represented by 0.25 and the 0.50 quantiles, but only for asset quality risk and liquidity and management risk. The magnitude and effect of these statistical significant variables vary on each quantile even for the same independent control variable. For example, exports present a negative relationship between asset quality risk and high-risk banks, upper quantile banks, but a positive relationship between asset quality risk and low-risk banks. The statistical significance of the control variables is also in line with the study by de Haan and Klomp (2012), who showed statistical significance control variables for most high-risk banks.

Thereafter, variables representing bank regulation and supervision were included in the quantile regression, and the results are shown in Table 4.5. The objective of the study was to determine the relationship between bank risk and bank- regulation and determine which type of regulatory and supervision measures are more effective in combating certain types of bank risks compared to others. Against these objectives, the results of the study will be interpreted.

The first regulation and supervision variable is capital adequacy regulation, and it showed statistical significance for high-risk banks of all three risk types captured in the study. The results show that there is a negative relationship between capital adequacy regulation and two risks, namely; liquidity and market risk, and capital and earnings risk. This means that an increase in the regulatory measures relating to capital adequacy decreases significantly the occurrence of liquidity and management risk along with capital and earnings risk for high-risk banks represented by the 0.75 and 0.95 quantiles. However, an increase in measures relating to capital adequacy risk also increases the occurrence of asset quality risk in high-risk banks.

The second regulation and supervision type relates to private sector monitoring and is statistically significant on asset quality risk and capital and earnings risk. The results show that an increase in private sector monitoring also increases capital and earnings risk for high-risk banks in the 0.75 quantile but reduces asset quality risk for high-risk banks in the 0.95 quantile. The third regulation type related to the restriction of certain activities performed by banks and showed significance on all three risk types. An increase in regulation and supervision relating to bank activity restriction reduces liquidity and management risk for high-risk banks in the 0.75 quantile and reduces capital earnings risk for high-risk banks in the 0.75 and 0.895 quantile. Increasing bank activity regulation and supervision does, however, also increase asset quality risk for high-risk banks in the 0.95 quantile.

Regulation and supervision relating to transparency only have a positive effect on liquidity and management risk on high-risk banks in the 0.75 quantile. Lastly, there is no relationship between regulation and supervision relating to market entry and any of the three risk types, which means that bank regulations and supervision that are in place for market entry do not influence the risks that can potentially be faced by banks. This can suggest that the entry of new banks in the banking system is not related to the increase in bank risk.

Table 4.5: Quantile regression between bank risk and bank regulation and supervision

Quantile	Liquidity and Management risk				Capital and Earnings risk				Asset quality			
	.25	.5	.75	.95	.25	.50	.75	.95	.25	.50	.75	.95
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Capital adequacy regulation	.572	.595	.097 **-.32**	.085 **-11**	.259	.044 **-5.3**	.084 **-7.4**	.259	.332	.213	.801	.073 **.049**
Private sector monitoring	.835	.909	.157	.215	.505	.272	.015 **0.44**	.629	.617	.706	.901	.001 **-.05**
Activity restriction	.635	.692	.013 **-.18**	.113	.289	.756	.090 **-1.6**	.076 **-13**	.693	.429	.869	.001 **.29**
Market entry	.371	.120	.541	.925	.692	.495	.677	.851	.401	.754	.983	.799
Transparency supervision	.474	.255	.010 **0.96**	.101	.261	.203	.869	.318	.638	.449	.881	.110

*Bold denotes the coefficient value of a statistically significant variable

4.5 DISCUSSION

This study aimed to determine the relationship between different bank risk and banking regulation and supervision for banks in the top 25 soundest banking systems in the world, according to the 2018/19 WEF global competitiveness report. Additionally, the study also aimed to determine which type of regulatory and supervision measures are more effective in combating certain types of bank risks compared to others. It derived the methodology from a study performed by de Haan and Klomp (2012). Data for this study were collected from 133 banks from the 25 sample countries using a period of 2011 to 2018.

The independent variables were chosen from a 2011 survey compiled by the World Bank on bank regulation and supervision. Factor analysis was used to extract different components from the study that captured different types of banking regulation and supervision. From the factor analysis, five different aspects of banking regulation and supervision were captured, namely;

capital adequacy regulation, private sector monitoring; regulations on activity restriction; market entry regulation; and transparency supervision. These different regulation variables were then regressed with the different risk types identified from the study.

4.6 CONCLUSION

Based on the set objectives, the study found that there is a relationship between the different types of bank risk and bank regulation and supervision. Factor analysis was also used on the CAMELS indicators to determine the different risk types to be used as the dependent variables of the study. From the factor analysis, three different risk types were identified, and they are liquidity and market risk, capital adequacy risk, and asset quality risk. Quantile regression was used, and the 0.25; 0.50; 0.75 and 0.95 quantiles were used as the subjects of choice to measure if regulation and risk had an effect on bank risk. However, there was no relationship between regulations relating to market entry and any of the risks identified by the study. Furthermore, the results indicated that bank regulation and supervision mainly affect high-risk banks, which are 0.75 and 0.95 quantiles. This finding was also similar to what de Haan and Klomp (2012) discovered in their results.

As a recommendation to policymakers, more bank risk that focuses on capital regulatory requirements need to be implemented to assist in the reduction of possible banks risk. Future studies can focus on how bank risk in Africa is affected by various regulatory and supervision measures implemented post the 2008 global financial crisis. The reason for this is the limited literature that focuses on regulation in the African banking sector.

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CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

This chapter provides a summary of the study and discusses how the theoretical and empirical objectives that were set in Chapter 1 were achieved. It also provides limitations encountered throughout the study and offers recommendations on future studies. The chapter concludes by providing a general conclusion of the study and highlights the limitations of the study and areas for future research.

5.2 REALISATION OF THE OBJECTIVES OF THE STUDY

The GFC came with multiple negative effects for the financial world, which includes the closure of some banks and financial losses for investors. Various laws relating to bank regulation and supervision were passed to safeguard against the occurrence of a potentially similar incident in the future. Some of the regulatory laws that were passed into law include the Dodd-Frank Act of 2010 and the Basel III accord. These two laws were put forth as direct responses to the causes and effects of the crisis. As a result, this study aimed to determine whether the implementation of bank regulation and supervision laws had any direct effect on the risks faced by banks.

The primary objective of the study was to determine if there was a relationship between regulation and risk for South African banks and the banks in the top 25 soundest banking systems in the World. This was done through the use of articles, namely; article 1 and article 2, article 1 had the aim of determining if a relationship between the implementation of bank regulation and bank risk existed. The article used a sample of the top 5 banks in South Africa with the z-score as a proxy for risk. The risk in article 1 was represented by the solvency of banks. That is to say, the risk of banks not being able to meet up to their long term obligations when they mature. A logit regression between bank regulation and supervision; and bank risk showed that no relationship exists. However, and Auto-Regressive Distributed Lag model (ARDL) concluded that there is a long-run relationship between bank risk and the implementation of new bank regulation and supervision for South African banks.

Article 2 employed data from banks in the top 25 nations with the soundest banking systems in the world, according to the 2018/19 WEF global competitiveness report. Through the use of factor

analysis, CAMELS indicators were used to derive various risks that can potentially affect banks. Identified risk in article 2 were liquidity and market risk, capital and earnings risk, and asset quality risk. The article employed a quantile regression to model the relationship between bank regulation and supervision and bank risk. The results showed that bank regulation and supervision assist in combating various risks faced by banks, especially high-risk banks.

Article 1, through the ARDL model, proved that the more bank risk increases, the more bank regulation, and supervision are implemented. Article 2, through the use of quantile regression, found that there is a negative relationship between bank risk; and bank regulation and supervision. This means that the more bank regulation and supervision are implemented, the bank risk goes down. The findings of both articles also advocated for an increase in bank regulations whenever a potential risk arises.

5.2.1 Theoretical Objectives

The following theoretical objectives were formulated for the study to achieve the primary objective:

- Analyse different types of risks that banks face;
- Conduct an in-depth analysis of the various types of bank regulatory measures;
- Review variables that will be used to clarify the relationship between bank risk and regulation and risk;
- Defining the criteria for bank regulation in South Africa and the top 25 soundest banking systems in the world; and
- Discuss how a movement in bank risk can influence an introduction of new regulation in the future.

Chapter 2 aimed to achieve theoretical objectives I and II that were established in Chapter 1. The chapter began by outlining that the need by banks to reduce their risk exposures to ensure sustainability for future business activity. Furthermore, the chapter highlighted the various risks that banks might face in their daily business activities, and the risks that were of main concern included credit risk, market risk, systemic risk, operational risk, and solvency risk. The different risks were highlighted to be of main concern because of their role in the 2008 global financial crisis (GFC). Chapter 2 also discussed some of the bank regulatory measures that were implemented pre- and post the global financial crisis and their impacts on bank risk prevention.

Moreover, the chapter also distinguished between micro-and macro-prudential regulation whereby micro-prudential regulation was established to be part of the cause of the GFC, and macro-prudential regulation was part of the solution. The chapter also discusses the history and impact of the Basel Committee on Banking Supervision (BCBS) as a global regulatory body. Additionally, the different bank regulatory bodies that are present in South Africa were also highlighted, and their functions are explained. The chapter also presented literature on previous studies that researched the relationship between bank risk and bank regulation.

Chapter 3, which was entitled article 1, focused on achieving theoretical objectives III, IV and V. The chapter substituted the z-scores as proxies for bank risk within the country using data from top five banks in the country namely; Standard Bank, ABSA, Nedbank, First Rand Bank, and Capitec Bank. The chapter begins by stating the benefits that banking regulation can provide to the global banking area. Subsequently, it also contrasts the differences between loose and stringent banking regulation and notes that both regulatory measures provide advantages and disadvantages should they be implemented. Previous studies that focused on bank risk and regulation in South Africa and from other parts of the world are also presented. Thereafter, the chapter discusses market- and accounting-based measures of determining bank failures. The z-score measure that was used in the study is part of the accounting-based measure.

Chapter 3 continues by analysing the South African financial landscape and how it fares compared to its global and regional counterparts. The finding from this is that the South African financial sector is the best in the Southern African Development Community (SADC) region and also amongst the best in the world. The South African banking sector was at one point ranked as the 2nd soundest banking system in the world, according to the 2012/13 WEF global competitiveness report. The chapter then focused on the methodology that was applied in the study, specifically the research design, data selection and data description, and the model specification and procedure. Data for the chapter was gathered from the financial statements of the top five largest banks in South Africa from 2000 to 2017. Furthermore, government gazettes were also used to gather data to determine how many new banking regulations were implemented in South Africa from 2000 to 2017. The study made use of ARDL and quantile regression as analytical tools to run the chosen data. The findings of the empirical analysis are summarised below in section 5.3.

Chapter 4 was article 2 of the study, and similar to article 1 also focused on achieving theoretical objectives III, IV, and V. The chapter set out to determine the relationship between Risk and

regulation for the soundest banking systems in the world. The introduction of the chapter highlighted the significance of the banking sector to the economy, specifically how movement in the banking sector can positively or adversely affect the economy. Literature provided on the losses sustained in the GFC advocated for a study on the influence of banking regulation and bank risk. Global aggregate losses from the GFC amounted to a years-worth of economic output, thus administrations around the world had to organise and provide bailouts for their financial sectors.

To provide a more stable base for the study, previous studies that focused on bank risk and regulation were presented and analysed. Moreover, the chapter focused on the methodology that was applied in the study, which included an analysis of the research design, data selection and data description, and the model specification and procedure. The sample study for the chapter had comprised 133 banks from the top 25 soundest banking systems in the world, according to the 2018/19 WEF global competitiveness report. A measure known as Capital adequacy, Asset quality, Management ability, Earnings ability, Liquidity, and Sensitivity to market (CAMELS) indicators were used to derive risk measures from the banks in the sample. Data from the World Bank survey on banking regulation and supervision is used as the proxies for bank regulation and supervision. Quantile regression was used to run the data from the dependent and independent variables, and the empirical findings of the chapter are summarised below in section 5.3.

5.2.2 Empirical Objectives achieved

The primary objective of this study was to determine if there is a relationship between regulation and risk for South African banks and the banks in the top 25 soundest banking systems in the World. The following empirical objectives were formulated to achieve the primary objective.

- **Empirical Objective 1.1:** To analyse the z-score movement of the top five South African banks from the year 2000 till 2017;

This objective was achieved in Section 5.3 in Chapter 3 of the study. Yearly individual z-score from every bank was calculated using the following z-score formula: $Z = (CAR + ROA) / \sigma ROA$, where CAR is the capital to assets ratio, ROA is the return on assets and σROA represents the standard deviation of the return on assets. The results of the z-scores were then recorded on an excel spreadsheet and analysed. After the z-score variables were calculated, they were tested for stationarity, and all the variables were found to be stationary at level except for the z-score values of ABSA and Capitec Bank, which were stationary after first differing. The results of the z-score

analysis showed that four of the five banks had good solvency levels from 2000 to 2017. Capitec Bank was the only outlier that showed that the z-score level of the bank was relatively low, which signalled that it had been close to insolvency.

- **Empirical Objective 1.2:** Measure if there is a correlation or relationship between the implementation of new regulation and solvency for the top 5 South African banks;

This objective was achieved in Section 5.3 in Chapter 3 of the study. A logistic regression formulated in Section 5.2 of Chapter 3 was used to model the relationship between the implementation of new regulation and solvency for the top 5 South African banks. The research conducted in the study noted that they were 18 new bank-related regulations that were passed in South Africa from 2000 to 2017. The implementation of the new regulation was modelled in the logistic regression as the independent variable, and the solvency levels were modelled as the dependent variable. Results from the regression were interpreted using the 1, 5, and 10 percent significance levels. The results showed that none of the regressors was significant under the three different significance levels. This led to the conclusion that there is no relationship between the new regulation being implemented in South African banks and the banks' solvency level represented by the z-score.

- **Empirical objective 1.3:** Determine whether there is a long run or short-run relationship between bank solvency and the implementation of bank regulation

An ARDL model was used to provide a solution to empirical objective III, as set in Chapter 1. The results from the regression indicated that there was no short-run relationship between bank solvency and the implementation of bank regulation, but a long-run relationship existed. However, a model diagnostic had to be conducted before the existence of a long or short-run relationship between bank solvency, and the implementation of bank regulation was confirmed. Firstly, a Breusch-Godfrey serial correlation test was conducted, and the results indicated that the p-value associated with the chi-square distribution was greater than the significance value of 0.05. This meant that we could not reject the null hypothesis that there is evidence of serial correlation. Thereafter, a cumulative sum control chart (CUSUM chart) was used to determine if the model was stable enough to be used in an ARDL model. The results show that the trend line lies within the boundaries of the CUSUM chart, which signified the stability of the model.

Furthermore, the bounds test that determines whether long-run variables are statistically significant was performed using the Wald test. The null hypothesis under the Wald test was that the two long-run variables are both equal to zero. The results of the regression indicated that the model was significant; however, to confirm the significance a Pesaran table had to be used. The p-value was significant if the calculated F-statistic value was greater than the upper bound value from the Pesaran table, and under the 5 percent significance level, the lower and upper bound values from the table were 4.94 and 5.73, respectively, to confirm significance. The calculated F-statistic value was 7.25, which was greater than the Pesaran upper bound value of 5.73, and this meant that the model was significant, and a long-run relationship existed between bank solvency and the implementation of bank regulation.

- **Empirical objective 2.1:** Analyse the CAMELS indicators to determine the best measure of risk to use in the quantile regression between risk and regulation;

Article 2 used CAMELS indicators to measure the relationship between risk and regulation for the soundest banking systems in the world. Data for the Article was collected from 133 banks from the 25 sample countries using a period of 2011 to 2018. To determine the most optimal variables to be used as proxies for bank risk, dynamic factor analysis was used to extract and group variables that represented specific risks from within the CAMELS indicators. The indicators were divided according to their classes in the CAMELS list and are listed in Table 5.1.

Table 5.1: Predictor Variables for CAMELS Indicators

CAMELS	Predictor Variables
Capital Adequacy	Equity/Total Assets
	Leverage effect
	Solvency ratio
Asset Quality	Total loans / total assets
	Asset growth rate
	Loan loss / total loans
	The growth rate of loans
Profitability	Return on Assets (ROA)
	Return on Equity (ROE)
Liquidity	Loans / deposits
	Net stable Funding Ratio
Quality Management	Interest Expense / deposits
	Operating expense/deposits
Sensitivity to market	Bank assets/total assets of the banking system

Source: Adapted from Maria-Daciana and Nicolae (2014:136)

Factor analysis was conducted on the variables in Table 5.1 above to determine the specific variables to use as proxies for bank risk. The best variables were the ones that had high singe values according to the factor analysis. A low eigenvalue, a value less than one, meant that a specific factor did not contribute to explaining the variance, and a high variance meant that the variable had more influence in the variance. Every variable from Table 5.1 that had an eigenvalue lower than one was removed from the list using the Kaiser criterion.

Thereafter, varimax rotation, which is an orthogonal rotation method that matches each item with an individual factor, was used to interpret the chosen factors. The Kaiser-Meyer-Orkin test (KMO) was used to determine whether the results of the factor analysis are valid. The KMO value ranges from 0 to 1, and values that are above 0.5 were considered useful whilst those less than 0.5 could not be used. The CAMELS indicator variables that were chosen to represent bank risk in article 2 were equity/total assets, total loans/total assets, asset growth rate, loan loss/total loans, the growth rate of loans, return on assets, return on equity, loans/deposits, interest expense/deposits and operating expense/deposits.

- **Empirical objective 2.2:** Determine the best proxies for bank regulation from the World Bank survey on banking regulation and use them as independent variables in the quantile regression between risk and regulation.

Data from the World Bank survey on banking regulation and supervision was used as the proxies for bank regulation and supervision, which meant that it was the independent variable in this study. For this study, the 2012 version was used because it was the latest dataset from the time of the commencement of the study. The survey has questions that are categorised into 14 different categories, namely, that relate to the way that banking systems in different economies are regulated and supervised. Questions from the survey relate to the following categories, (1) entry/licensing, (2) ownership, (3) capital, (4) activities, (5) external auditing, (6) internal management or governance, (7) liquidity and diversification, (8) depositor protection, (9) provisioning, (10) disclosure and information, (11) dealing with problem institutions and exit from the industry, (12) supervisory powers, (13) banking sector characteristics and (14) consumer protection.

From the survey, the different questions were sorted based on their ability to be computed into a factor analysis. That is to say that questions that can be coded to be run into statistical software. Questions that could not be run into statistical software included, for example, questions that asked about who the regulatory body in a country is. Much alike to the dependent variable factors, factor analysis was used to extract the components from the survey response, which was able to represent the independent variables. The results of the factor analysis determined the variables that were used to run the quantile regression as independent variables. The following categories from the factor analysis were chosen to represent bank regulation, capital adequacy regulation; private sector monitoring; regulations on activity restriction; market entry regulation; and transparency supervision.

- **Empirical objective 2.3:** Evaluate the nature of the relationship between the CAMELS indicator variables and bank regulation variables

Quantile regression was used, and the 0.25; 0.50; 0.75 and 0.95 quantiles were used as the subjects of choice to measure if regulation and risk had an effect on bank risk. The reason for including these four quantiles was their ability to capture risk from different scales. Thus, to achieve this objective, a quantile regression was used whereby CAMELS indicator variables were the dependent variables, and bank regulation variables were the independent variables. The overall conclusion from the regression was that there is a relationship between the different types of bank risk and bank regulation and supervision. However, not all regulatory measures and risks indicated a significant relationship. The regression indicated that there is no relationship between regulation and supervision relating to market entry and any of the three risk types, which means that bank

regulations and supervision that are in place for market entry do not influence the risks that can potentially be faced by banks. Furthermore, the results indicated that bank regulation and supervision mainly affect high-risk banks, which are 0.75 and 0.95 quantiles. The regression also indicated that bank regulation and supervision helps to combat risk for banks that are highly faced with risk but has no effect on low-risk banks.

5.3 GENERAL CONCLUSION

The banking sector is one of the most heavily regulated sectors in the world. This high regulation can be partly attributed to the influence of the banking sector in the other parts of the economy and not only the financial environment. The evidence of how the banking sector is interconnected with other sectors was shown during the GFC, and because of this interconnectedness, there were global financial losses in many parts of the world. Thus, this study set out to determine the usefulness of banking regulation in the South African banking sector and the different banking sectors globally.

The contributing factor to this was to determine if multiple bank regulatory measures are implemented to subdue banks until the next crisis comes, and they get revised or if current bank regulation is robust and positively contributes to reducing bank risk. Moreover, through article 1 and article 2, which use different samples, techniques, and periods, the overall conclusion was that there is a significant relationship between bank regulation and various bank risks. Therefore, there is a need to constantly monitor the sector and be more proactive than reactive when implementing bank regulations that can make the sector more secure and reduce the occurrence of any form of risk in the sector for all stakeholders.

5.4 RECOMMENDATION

This section will provide recommendations to various stakeholders that are associated with the study. These stakeholders include researchers, banking professionals, and policymakers. This section aims to provide a guide on how the findings of the study can be adapted to the different fields that the aforementioned stakeholders operate in.

In practice, investors and bankers can use the findings of this study to identify countries with banking sector factors that are relatively more regulated compared to their counterparts. This can help inform investment decisions or form part of the strategy when looking to invest in foreign financial sectors. Researchers can use this study to compare with their findings on research that

involve banking regulations and supervision. Furthermore, this study can be used as a case study on the interactions or relationship between banking regulations and supervision.

A significant contribution of the study was that it demonstrated that bank regulation and supervision is an important tool that policymakers can use to combat the potential occurrence or effects of the different types of risk banks face. Amongst other findings, this study indicated that banking regulation has a more impact on high-risk banks compared to low-risk banks. Thus, policymakers can utilise this by developing regulations that are more risk-specific.

5.5 STUDY LIMITATION AND FUTURE RESEARCH

5.5.1 Study limitations

The first limitation was that even though the study used secondary data, some banks did not fully disclose their financial statements for the required period, which led to a few of the banks being removed from the sample. The other observed limitation was the lack of previous studies that focused the behavioural patterns of bank risk before a crisis occurred and how those patterns can be used to possibly identify warning indicators that can be used to implement safety measures before a future risk occurs.

5.5.2 Areas for future research

The study provided various avenues for future research in this field. Firstly, article 1 focused on bank risk and solvency relationships using South African banks. Therefore, future research can broaden the sample and include other banks from groups such as SADC and the Brazil, Russia, India, China, and South Africa (BRICS) group. Furthermore, literature from article 1 highlighted that there had been at least three major bank crises from 1996 to 2019, namely, the 1997 Asian Financial Crisis (AFC), GFC, and the 2011 Greece debt crisis. Thus, the scope of the study can be more focused on researching the movement of bank risk before a major crisis such as the AFC, GFC, and the 2011 Greece debt crisis.

Additionally, the literature section of article 1 also underscored the lack of studies involving bank regulation and bank solvency in African countries. Therefore, a potential study can research on the effectiveness of African banks to measure and combat different bank risks that they face in their markets. Moreover, the potential study can further research whether banks in Africa are employing

the same regulatory measures and, if so, how bank regulatory measures in different African countries are determined to meet their domestic market.

Article 2 also presented its unique potential points that can be used as further studies. There is a need to research the relationship between risk and regulation for the top banks by market size in their country, as such literature lacks. This eliminates the constraints on the number of sample countries in the study and ensures that data from the top banks in the desired countries are chosen. This ensures that there is enough data to run the regression because data for the top banks are relatively more available depending on the regulatory laws in the banks' operating country. Future studies can also research on how consumer behaviour towards engaging with banks is affected whenever new bank regulation is implemented.

ANNEXURES

ANNEXURE A: WORLD BANK REGULATION SURVEY QUESTION CLASSIFICATION; VARIANCE AND MEAN

Question number	Question	Coding rule	Average	Standard deviation
Variables included in factor analysis of capital adequacy regulation				
1.4.3	Can the initial disbursement or subsequent injections of capital be done with assets other than cash or government securities?	A score of 0 was assigned for no, and a score of 1 was assigned for yes.	.565	.5069
3.1.a	Was Basel I used as a regulatory capital adequacy regime at the end of 2010?	A score of 0 was assigned for no, and a score of 1 was assigned for yes.	.348	.487
3.1.b	Was Basel II used as a regulatory capital adequacy regime at the end of 2010?	A score of 0 was assigned for no, and a score of 1 was assigned for yes.	.783	.421
3.6.1	Do you require banks to perform an internal assessment of their capital adequacy against their economic capital?	A score of 0 was assigned for no, and a score of 1 was	.696	.471

		assigned for yes.		
3.6.2	Do you review internal assessments performed by banks?	A score of 0 was assigned for no, and a score of 1 was assigned for yes.	.696	.4705
3.7	Does your agency have the legal authority to require additional capital that is over-and-above the minimum required capital for individual banks if deemed necessary?	A score of 0 was assigned for no, and a score of 1 was assigned for yes.	**.**870	.344
5.6	Is the audit report on the financial statements of a bank required to be publicly disclosed together with these financial statements?	A score of 0 was assigned for no, and a score of 1 was assigned for yes.	.826	.3876
Variables included of factor analysis of activity restrictions				
1.4.1	Does the minimum capital entry requirement vary depending on the nature of the banking businesses that are licensed?	A score of 0 was assigned for no, and a score of 1 was assigned for yes.	.609	.4990

4.1	What are the conditions under which banks can engage in securities activities?	A score of 1 was assigned to unrestricted and 2, 3 and 4 to permitted, restricted, and prohibited, respectively	1.696	.7648
4.3	What are the conditions under which banks can engage in real estate activities?	A score of 1 was assigned to unrestricted and 2, 3 and 4 to permitted, restricted, and prohibited, respectively	2.565	1.199
4.4	What are the conditions under which banks can engage in non-financial businesses except those businesses that are auxiliary to banking business (e.g., IT company, debt collection company, etc.)?	A score of 1 was assigned to unrestricted and 2, 3 and 4 to permitted, restricted, and prohibited, respectively	2.652	1.152
Variables included in factor analysis of transparency supervision				
1.4.2	Are the sources of funds to be used as capital verified by the regulatory/supervisory authorities?	A score of 0 was assigned for no, and a score of 1 was assigned for yes.	.870	.3444
1.5	Can initial capital contributions by prospective shareholders be in the	A score of 0 was assigned for no, and a	.391	.499

	form of borrowed funds?	score of 1 was assigned for yes.		
1.6.a	Is Draft bylaws legally required to be submitted before issuance of the banking license?	A score of 0 was assigned for no, and a score of 1 was assigned for yes.	.913	.2881
5.1.2	Are specific requirements for the extent or nature of the audit spelt out?	A score of 0 was assigned for no, and a score of 1 was assigned for yes.	.826	.3876
5.3	Are banks required to promptly report to the banking supervisor any change of external auditor and the reasons for the change?	A score of 0 was assigned for no, and a score of 1 was assigned for yes.	.696	.471
7.1	Are banks limited in their lending to a single borrower or a group of inter-related borrowers?	A score of 0 was assigned for no, and a score of 1 was assigned for yes.	.957	.209
8.1	Is there an explicit deposit insurance protection system for commercial banks?	A score of 0 was assigned for no, and a score of 1 was assigned for yes.	.783	.422
10.4	Are banks required to submit their financial statements to the banking supervisor	A score of 0 was assigned for no, and a score of 1 was	.304	.471

	before public disclosure?	assigned for yes.		
10.5.2	Are bank directors legally liable if the information disclosed is erroneous or misleading?	A score of 0 was assigned for no, and a score of 1 was assigned for yes.	.913	.288
10.7	Are commercial banks required by supervisors to have external credit ratings?	A score of 0 was assigned for no, and a score of 1 was assigned for yes.	.174	.3876
Variables included in factor analysis of market entry regulation				
1.7	In the past 5 years (2006-2010), how many applications for commercial banking licenses from domestic entities (i.e., that 50% or more domestically owned) have been denied	As a share of received applications.	.120	.298
1.8	Are foreign entities prohibited from entering as a branch?	A score of 0 was assigned for no, and a score of 1 was assigned for yes.	.043	.208
1.9	If acquisitions of domestic banks by foreign banks are 0t prohibited, what is the maximum percentage of foreign ownership that is legally allowed?	A score of 0 was assigned for no, and a score of 1 was assigned for yes.	92.391%	22.857%
1.12	In the past 5 years (2006-2010), how many applications from foreign banks to enter by opening a	As a share of received applications	.0503	.209

	branch were denied?			
3.1.c	Was Leverage ratio used as a regulatory capital adequacy regime at the end of 2010?	A score of 0 was assigned for no, and a score of 1 was assigned for yes.	.261	.449
4.4.1	Can banks own voting shares in non-financial firms?	A score of 0 was assigned for no, and a score of 1 was assigned for yes.	1.435	1.16
5.3.1	Are banks required to nominate more than one external auditor?	A score of 0 was assigned for no, and a score of 1 was assigned for yes.	.043	.209
Variables included in factor analysis of private-sector monitoring				
10.8	How many of the top ten banks (in terms of total domestic assets) are rated by international credit rating agencies (e.g., Moody's, Standard and Poor)?	In percentage	81.304	25.638
10.9	How many of the top ten banks (in terms of total domestic assets) are rated by domestic credit rating agencies?	In percentage	3.261	4.266

ANNEXURE B: ETHICAL CLEARANCE LETTER

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Economic and Management Sciences
Research Ethics Committee (EMS-REC)
Tel: 018 299-1427
Email: Bennie.Linde@nwu.ac.za

25 April 2019

Dr E Swanepoel
Per e-mail

Dear Dr. Swanepoel,

FEEDBACK – ETHICS APPLICATION 25042019 – T S Nasa (24932205)(NWU-00389-19-A4) – MCom in Risk Management – Dr. E Swanepoel

Your ethics application on Strict banking regulations: Measuring the impact on bank risk, that served on the EMS-REC meeting of 25 April 2019 refers.

Outcome:

Approved as a minimal risk study. A number NWU-00389-19-A4 given for three years of ethical clearance.

Kind regards,

Prof B Linde
Chairperson: Economic and Management Sciences Research Ethics Committee (EMS-REC)

ANNEXURE C: TURN IT IN REPORT

Analysis of quotations identified by Turn-It-In		 NORTH-WEST UNIVERSITY ® YUNIBESITI YA BOKONE-BOPHIRIMA NOORDWES-UNIVERSITEIT VAAL TRIANGLE CAMPUS
Name of student	Tafara Sani Nasa	
Student number	24932205	
Title of document	Strict banking regulations: Measuring the impact on bank risk	
Study leader / promoter	Mr D Mokatsanyane & Dr. Z Dickason-Koekemoer	
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B) Appropriate brief quotations		No action necessary	
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Initials and surname of MA candidate	T.S Nasa	Initials and surname of supervisor	D. Mokatsanyane
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Date	12/08/2020		

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