Competition and Risk-Taking Behaviour in South African Commercial Banks

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Dedication

This research is dedicated to my father, ***Mkhulekeleni*** **Cedric** ***Nxumalo***. Your unwavering support, wisdom and encouragement have been my guiding light throughout this journey.

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First and foremost, I would like to express my deepest gratitude to God for his endless grace, guidance and strength throughout this journey. Without his blessings, this achievement would not have been possible. I am deeply heartbroken that some of my family members who were supporting me will never see my success such Ntandoyenkosi Nxumalo, Thobekile Nxumalo and Msizi Nxumalo, may their souls rest in peace I will forever Love them.

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Abstract

The study investigated the relationship between banking competition and risk-taking behaviour of the commercial banking sector in South Africa. This research employed two main theories to explain the relationship between banking competition and risk-taking behaviour, namely the Competition Fragility View and Competition Stability. Competition Fragility theory is to justify the increase in banking competition is the increase in bank risk-taking incentives. While the competition stability theory suggests that in less competitive markets, banks charge higher interest rates, which increases loan default risk. There is an ongoing debate on how competition affect the bank risk taking behaviour. This study observed competition in five dominant commercial banks in South Africa. The study uses a panel dataset spanning twenty years, from 2002 to 2022. The level of banking competition was measured by Lerner index and H-Statistic for Panzer Rosse. The fixed effect and random effect models were employed to analyse the effect of competition on South African bank risk-taking behaviour. The fixed effect panel threshold regression model was used to examine whether there is any threshold effect on the relationship between competition and bank risk-taking behaviour in South African commercial banks. Bank risk-taking behaviour amongst three banks was measured by non-performing loans, liquidity risk, capital adequacy risk and the Z-score. The control variables are bank- specific, which are performance and bank size. The macroeconomic context comprised gross domestic product (GDP) and inflation (INFL). The result on the degree of competition estimated by both Lerner index and H-statistic ranges between 0 and 1. This indicates a monopolistic competitive banking system amongst South African commercial banks. The results support the hypothesis that competition has an effect on South African banks' risk-taking behaviour. The finding on possibility of a threshold effect suggests a non-linear relationship between competition and risk-taking behaviour. The double threshold suggests more complex interactions where the effect of competition changes significantly at certain points. The research therefore recommends that competition should be encouraged on the South African banking sector. Furthermore, the South African Reserve Bank and policymakers should consider policies such as free entry to the market, lower capital requirements and uncapped interest ratesto encouraged new banks to enter the market.

Key words; Competition, Risk-taking, Lerner index, H-statistics

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Abbreviations

ABSA	**Amalgamated Banks of South Africa**
TBTF	**Too Big To Fail**
CPI	**Consumer Price Index**
DPTR	**Dynamic panel threshold regression**
FNB	**First National Bank**
GDP	**Gross Domestic Product**
HHI	**Herfindahl Hirschman Index**
INFL	**Inflation**
NPL	**Non-Performing Loans**
PWC	**Price Waterhouse Coopers**
SARB	**South African Reserve Bank**
SCP	**Structural Conduct performance**
ROA	**Return on Asset**
ROE	**Return on Equity**
SBK	**Standard Bank**
LI	**Lerner Index**

CHAPTER 1
INTRODUCTION and BACKGROUND TO THE STUDY

1.1 Introduction

Competition is a powerful stimulus to increase efficiency and reduce information asymmetry, which assists banks in responding to risks better, according to Mirzaei and Moore (2014). Moudud-Ul-Huq (2021) reveals that a more stable banking system is probably the result of increased competition in the banking sector. Competition forces bank managers to engage in riskier investment portfolios to make up for profits that are lost as a result of providing competitive price (Rajan 2005). However, the financial fragility may be exacerbated by these managers' inconsistency in taking calculated risks.

According to Price Waterhouse Coopers PWC (2022), the competition-risk relationship has conflicting mechanisms that are offered by modelling frameworks. These frameworks have been developed to study bank risk-taking behaviour. There is intense competition in the South African banking industry (PWC, 2022). The impact of competition in the banking industry becomes an interesting field of study for researchers and policymakers. Soledad and Peria (2021) stated that interest in competition and risk-taking behaviour was profusely enhanced during the latest global financial crisis, which propelled researchers and policymakers to ascertain whether high competition amongst banks is derived from the major fluctuations in inflation.

The SA banking industry is dominated by five dominant commercial banks. These commercial banks are inclusive of First National Bank (FNB), Absa, Nedbank, Standard Bank and Capitec. Commercial banks play the most important role in the performance of the South African's modern economy (Sikarwar *et al*. 2020; Ouechtati 2020) by providing basic instruments for monetary policy, and also acting as an intermediary between lenders and borrowers. Competitiveness incommercial banks is not only essential for credit enlargement and growth, but also for the quality of monetary policy (Segev and Schaffer, 2020).

The effectiveness of monetary policy is particularly impacted by the degree of banking competition. Monetary policy further affects the level to which changes in the repo rate are passed to the interest rate that economic agents come across (Rapapali and Simbanegavi,

2020). Banking competition refers to the level of contestability and rivalry amongst banks within the banking sector. Competition is an important aspect of a bank's survival in the sector. The degree of competition in the banking sector is influenced by several factors, namely bank size, bank structure, the regulatory environment and market share. Moreover, a lack of competition leads to increased market power in banks, which is very detrimental to an economy. Various studies have established that a lack of competition in the banking sector can lead to high prices of financial products and increased limitations to the access of finance, especially by small and emerging firms (Anzoategui *et al*. 2010).

Many scholars contend that financial institutions' excessive risk-taking was a major cause of the 2007-2008 financial crisis, which compelled policymakers in numerous nations to adopt measures to boost financial stability by reducing competition in the banking industry and increasing concentration (Gonzalez *et al*. 2017). In this regard, the effect of competition on a bank's stability has long been a topic of discussion in public policy circles. However, there are conflicting assumptions regarding how market competition and financial stability in the banking sector relate in both economic theory and actual research. This emphasizes how crucial it is to look at how bank rivalry affects financial institutions' propensity for taking risks. The purpose of this study is to ascertain whether there is a link between banking competition and risk-taking behaviour in South African (SA) commercial banks.

1.2 Research Background

South African banks were under the Department of Finance's supervision until 1986. The South African Reserve Bank (SARB) was subsequently given this responsibility. In 1990, the Banks Act was modified and the SARB's Bank Supervision Department's methodology was updated to accommodate a contemporary risk-based approach to bank supervision. This strategy, which is always being improved, has been beneficial to the banking industry. The strategy was deemed suitable for the nation's needs based on an independent evaluation of SARB's adherence to the Core Principles for Effective Banking Supervision in 1998 and a subsequent IMF Article 4 consultation. Recent research conducted as part of the Financial Sector Assessment Programme led to additional improvements to the supporting laws and supervisory procedures. These refinements made SARB fully compliant with the minimum standards set out in the Core Principles.

The South African banking industry has a complex history. According to the South African Reserve Bank, the Lombard Bank in Cape Town was the first bank to be created in South Africa, opened for business on April 23, 1793. Furthermore, in 1879, plans put up for the creation of a central bank in South Africa were initiated. Appeals were then made again in the next years and on March 31, 1920, a selection committee made up of 10 members of parliament was formed to investigate the viability of setting up a central bank in South Africa. In addition, the South African Reserve Bank became the oldest central bank in Africa on June 30, 1921, when it began for business in accordance with the committee's recommendations. The bank, which is the oldest on the African continent, is currently regarded and acknowledged on a global scale and is anticipating its centennial celebrations on June 30, 2021 (Rossouw, 2011). According to the SARB (1921) and Kock and Smith (2005), the central bank is responsible for issuing bank notes and coins; managing South Africa's foreign exchange reserves; conducting monetary policies; extending credit to banks; overseeing and regulating the banking industry, and serving as the system's lender of last resort. The South African Reserve Bank oversees and facilitates the country's banking industry and has regulatory and prudential jurisdiction over it as well as other financial institutions. Three new banks have been given temporary licenses, according to the South African Reserve Bank's Bank Supervision Department (2017). The country's banking industry has grown, with 19 registered banks, 15 international bank branches, 3 cooperative banks, 3 mutual banks and 31 foreign representative offices (SARB, 2018).

According to Statistics SA (2020), the South African banking industry is one of the most concentrated in emerging nations. It operates in the sixth-largest economy in Africa and is ranked amongst the top twenty global economies in terms of GDP (United Nations, 2015). Despite being the sixth biggest in Africa, its contribution to the world gross domestic product is less than 1%. This suggests that financial institutions still have a significant role to play in the growth of the economy since it is reasonable to assume that economic progress should follow a well-developed financial sector rather than the other way around. Fortunately, South Africa's financial institutions are crucial to the deployment of savings since they lend money to surplus units and promote economic growth overall (Okeahalam, 2001).

The commercial and financial system in South Africa is notable for its size and level of market concentration (SARB, 2020). As a result, concentration characterizes South Africa's overall

commercial structure (SARB, 2020). This tendency will be clarified further in a later section due to South Africa's historical growth. Furthermore, a healthy economy is built on a competitive banking sector, which denotes the effective use of resources in delivering banking services and products to lenders, also known as savers and borrowers. Therefore, given that banks play a crucial role in the transmission of monetary policy through their dominance of the deposit and loan markets, a lack of competition amongst them is detrimental to the economy's overall ability to function.

Furthermore, the banking industry uses a variety of efficiency techniques to keep costs as low as possible, yet excessive concentrations are always associated with a lower degree of efficiency in the industry (Ullah, Majeed and Popp, 2023). Since commercial banks are oligopolistic by nature, they raise the entrance barrier, which makes banking more contestable in their strategy of seeking to enhance their efficiency (Akande *et al.* 2017). The banking survey conducted by Price Waterhouse Coopers (PWC) in 2013 evaluated the South African banking industry as being in a healthy shape, with many banks generating reasonable returns on equity. When these returns are compared to their international correspondents, they show that the country's highly concentrated banking sector is the cause of the inefficiency problem (PWC, 2013).

Consequently, there is a need to measure the stimulus of competition and risk-taking on the banking sector. Therefore, this study aims to inspect the relationship between risk taking attitude and banking competition in South African commercial banks. The higher risk appetite of the banking sector is documented by various scholars as the main course of the global crisis that occurred in 2007-2008, which enforced the decision-makers in some nations to implement tactics to raise the degree of attentiveness and lower the competition in the banking industry so that financial stability could be achieved (Gonzalez *et al*. 2017).

In this regard, the issue of banking competition impacting stability has been widely debated in public policy. Nevertheless, empirical and theorical literature provide conflicting predictions regarding market competition and stability in the banking industry. According to Dam and Sengupta (2022), the lack of consensus between research examining the relationship between banking competition and risk-taking poses a big challenge to both policymakers and academics. Therefore, this indicates the significance of examining the effect of competition and risk-taking

behaviour amongst SA commercial banks.

1.3 Problem statement

The structure of the South African banking sector is distinctive due to its highly sophisticated financial systems and a highly concentrated market. The sector's concentration is significant, with a CR4 ratio exceeding 80% (Simatele, 2015). CR4 represents the market share that is controlled by four largest banks. According to theory, this suggests a low level of competition (Simatele, 2015). However, research indicates that high concentration does not necessarily equate to a lack of competition (Simatele, 2015). Increased competition amongst banks leads to a contest for profitability and market share, which can drive banks to take higher risks through investment portfolios and loans to meet their goals. This relationship between competition and banking stability has produced two opposing views, the competition-fragility view, which posits that increased competition reduces market power and encourages banks to take excessive risks (Aleemi *et al.* 2019). On the other hand, competition stability view, which highlight that higher market power in the loan market result in an increase in bank risk-taking, as banks charge higher interest rate on loan of customers making it difficult for customers to repay loans as they become due (Berger *et al*. 2017).

Several studies have been conducted to investigate the relationship between competition and risk-taking behavior in Sub Saharan African Countries such as Akande and Kwenda, (2017); Sarpong-Kumankoma et al., (2018). Although there is a number of factors that can contribute to the banks taking excessive risk, such as regulations. Hence competition is highlighted as a significant factor for banks to take risk (Tan, 2017). The argument by Arping (2014) maintained that in competitive conditions, banks are most likely to take risks. Kouki and Al-Nasser (2017); De Nicolo (2005) argues that competition reduces risk taking behavior. Studies put more focus on the cross-country, moreover, they also focused on the large samples of the Sub-Saharan Africa region (Akade *et al.*, 2018). Little has been said on the study conducted in South Africa as a single country.

The South African banking sector is amongst the most sophisticated globally, rivalling those in developed countries. According to the global competitive index, it ranks 12th out of 140 countries surveyed (Wanke *et al.* 2017). Understanding the relationship between competition

and risk-taking is crucial for policymakers and regulators, and it has been a major focus of academic debate. However, the effect of competition on risk-taking remains theoretically ambiguous, with mixed empirical evidence. This means that there is no consensus amongst the empirical findings. This study has become more important to be conducted to improve the competition and risk taking behaviour in South African banking system and contribute to economic development and reduce unemployment. The banking system, particularly banks' risk- taking behaviour, significantly impacts the financial stability of the economy (Canta *et al*. 2023). There is limited literature addressing banking competition and risk-taking behaviour in the South African context, and this study aims to update the literature and fill these gaps.

1.4 Research Aim

Given the above background, the aim of this study is to evaluate the relationship between banking competition and risk-taking behaviour in South African commercial banks. This will be achieved with the following three specific objectives:

1.4.1 Research Objectives

- To measure the degree of competition within the South African banking sector;
- To explore the effect of competition on South African banks' risk-taking behaviour; and
- To investigate the possibility of any threshold effect in the relationship between competition and bank risk-taking behaviour in South Africa.

1.5 Research Questions

- What is the degree of competition within the South African banking sector?
- What is the effect of competition on South African banks' risk-taking behaviour?
- Is there a possibility of any threshold effect in the relationship between competition and bank risk-taking behaviour in South Africa?

1.6 Hypotheses

H_0 There is the significant degree of competition in the South African banking sector.

H_1 There is no significant degree of competition in the South African banking sector.
H_2 Competition has a significant effect on the risk-taking behaviour of commercial banks.
H_3 Competition does not have a significant effect on the risk-taking behaviour of commercial banks.
H_4 There is a possibility of a threshold effect in the relationship between competition and bank risk-taking behaviour.
H_5 There is no possibility of any threshold effect in the relationship between competition and banking risk-taking behaviour.

1.7 Significance of the study

This study contributes to the current body of knowledge regarding banking competition by exploring the relationship between competition and propensity for risk-taking amongst commercial banks in South Africa. The existing theoretical and empirical findings on the banking system, market structure, competition and risk-taking reveals that there is a scarcity of research focusing on South Africa. This research is trying to close the existing gap in the literature as there is no research conducted amongst South African banks to measure banking competition and risk-taking behaviour, according to SARB (2020).

The study will not only be used by South African commercial banks, but all developing countries will also be able to benefit from this study, as it aims to provide a comprehensive understanding on the relationship between competition and risk-taking behaviour. The outcome of this study will give clear direction on the best way for bank strategies to manage risks. The study will make recommendations to policymakers, regulators and the South African Reserve Bank (SARB) on how to deal with banking competition and risk-taking behaviour in the banking sector. The significance of this study lies in uncovering the extent to which various factors influence risk-taking behaviour, particularly in South African commercial banks. Therefore, competition is an essential aspect to consider in formulating policies to regulate banks and dictate risk management guidelines amongst individual banks. Hence, the aim of this study is to investigate the relationship between bank competition and risk-taking behaviour in the South African banking sector. The unique contribution of the study its exploration of the threshold effect of competition on risk-taking behaviour within the South African banking sector, a context characterized by significant structural and economic

challenges. By identifying specific levels of competition that influence risk, the study offers practical policy implications for regulators and policymakers aiming to balance financial stability with market competitiveness.

1.8 Scope of the study

The research focus on the competition and risk-taking behaviour of 5 dominant South African commercial banks. The study period covers 20 years from 2002 to 2022.The research will use structural measures to examine competition in the banking sector while risk-taking employing the Z-score, NLPLs, Capital adequacy risk and Liquidity risk.

1.9 Ethical issues

Due to the importance of ethical research, universities make significant efforts to ensure the safety and respect of the individuals involved in studies (Silverman 2009). Singh and Masuku (2014) stated that in order to reduce mistakes, enhance truth and obtain reliable data, it is hypothesized that ethical factors must be taken into consideration when conducting research. The researcher will obtain ethical clearance to successfully accomplish this research from the University of KwaZulu Natal (UKZN). As the part of ethical procedures, the research proposal will need to be approved by the committee in the UKZN School of Accounting, Finance and Economics.

1.10 Structure of the thesis

This research comprises five sections, as follows:

Chapter 1: Introduction

This chapter provides the research background, research problem and outlines the objectives, aim of the study, hypotheses, and significance of the study.

Chapter 2: Literature Review

This chapter reviews relevant literature that consists of the conceptual framework, theoretical framework, and empirical framework. It focuses specifically on banking competition and risk-taking behaviour in commercial banks.

Chapter 3: Research Methodology

This chapter describes the collection of data and the research techniques used for the study. It explains the variables incorporated in the empirical models and the justification for why they were used, the econometric model used, and the specification of the empirical model adopted.

Chapter 4: Data Analysis and Discussion of Results

Chapter Four presents the data analysis and results and discusses the findings.

Chapter 5: Conclusions and Recommendations

The final chapter evaluates the theory and analysis as explained in the preceding chapters. concludes the study, discusses the result, and highlights the recommendations.

CHAPTER 2
LITERATURE REVIEW

2.1 Introduction

Competition is noted to act as a powerful stimulus to increase efficiency and reduce asymmetry in information, which assists banks in responding to risks in a better manner (Mirzaei and Moore (2014). While the PWC (2022) confirms that the connection between competition and risk presents conflicting mechanisms as portrayed in different modelling frameworks designed to evaluate bank risk-taking behaviour. Henceforth, there is intense competition in the South African banking industry (PWC, 2022). Which results to the impact of this competition in the banking industry becomes an interesting field of study for researchers and policymakers (PWC, 2022). Soledad and Peria (2021) stated that interest in competition and risk-taking behaviour was profusely enhanced during the latest global financial crisis, which propelled researchers and policymakers to ascertain whether high competition among banks is derived from the risk-taking behaviour.

Scholarship surveys on both the theoretical and empirical fundamentals upon which the concepts and views established in the current work are built upon in this chapter. The chapter has a clear focus on the analysis of literature encompassing the views and philosophies held by a number of scholars and academics as well as some governing authorities on the contributing factors of the relationship between banking competition and risk-taking behaviour in commercial banks. The objective of this chapter is to explore the relationship between banking competition and risk-taking behaviour in commercial banks. The literature review will investigate the existing empirical evidence on the relationship between South African banking competition and risk-taking behaviour. It will also analyse the theoretical underpinnings of the relationship between competition and risk-taking behaviour, and identify gaps in the literature that require further investigation.

The purpose of this literature review is to review and underpin the conceptual framework, theoretical framework and empirical review. This chapter is organised as follows: firstly, the conceptual framework is described, followed by theoretical frameworks where different theories related to competition and risk-taking behaviour are discussed. Lastly, this chapter

ends with an empirical review.

2.2 Conceptual Framework

This sub-section provides an overview of South African banking systems and further explains the key concepts to this study and gives a clarity to the relationship between the dependent and independent variables. Two concepts that are described for the purpose of this research, namely competition and risk-taking behaviour. The conceptual framework illustrates the relationship between key variables in this study. The variables of this studyare: Lerner index, H- statistic, which represent the independent variables; the Z-score, NLPs, capital risk and liquidity risk which are dependent variables. Additionally, control variables in place are macroeconomic (gross domestic product GDP and inflation INFL) and bank specification, which are bank size and bank performance (Return on asset ROA and Return on equity ROE). The figure below explains the connection between the variables.

Conceptual framework

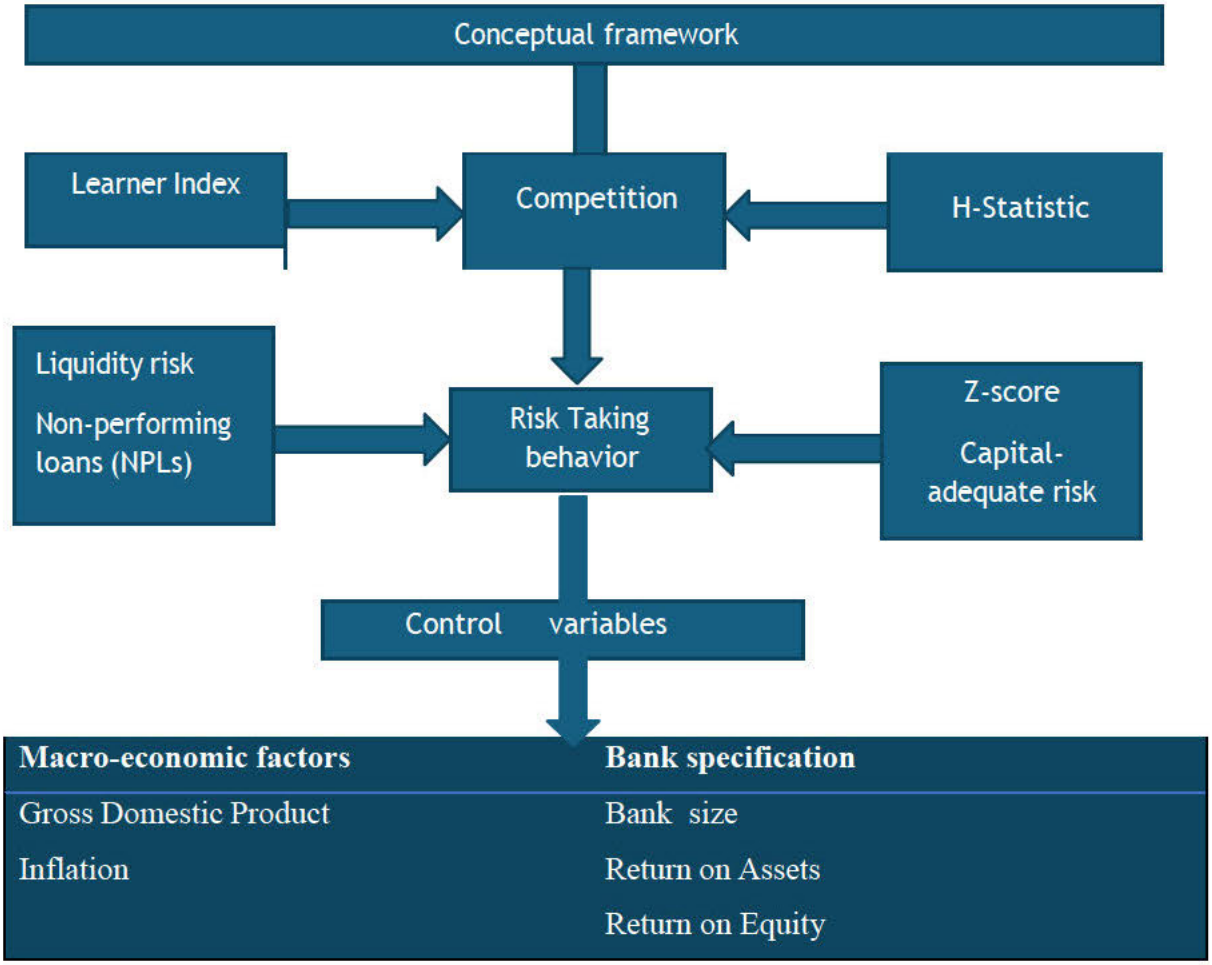

FIGURE 1: THE CONCEPTUAL FRAMEWORK

Source: *Author's own compilation (2023)*

The conceptual framework highlights the interconnected relationships between macroeconomic factors, bank- specific, competition and risk-taking behaviour. Competition, measured through the H-Statistic and Lerner index, influences banks' strategic decisions, with higher competition often leading to increased risk taking as bank compete for market share and profitability. macroeconomic factor like GDP grow encourage risk-taking by creating a stable economic environment with, more lending opportunities, while inflation tends to dampen risk-taking due to heightened uncertainty and cost pressures. Bank specific factors such as size, ROA and ROE further shape risk behaviour, commercial banks typically exhibit lower credit risk and fewer non-performing loans (NPLs), whereas higher profitability may incentivize riskier investments. Risk taking is directly reflected in liquidity risk and NPLs, moderated by control variables such as the Z-score, which measures financial stability, and capital adequacy, which reflect a bank's ability to absorb losses. This framework underscores the dynamic interaction of there variables in influencing banks' risk-behaviour.

2.2.1 Competition in the banking sector

There are many different ways in which competition is defined. Competition refers to an economic rivalry amongst businesses entities of the similar nature for a better position in the market and the chance to make more profit (Cattani et al. 2017). According to Schumpeter (1994), competition is defined as the component of the market function designed to eliminate aberrations from the regular growth of the economy. Smith (1992) defines competition as the rivalry that drives up prices during times of lower supply and reduces them during higher supply, identifying the circumstances of competition. Moreover, competition is the best encouragement for companies to switch to an efficient approach to delivery services, and it creates the advantageous environment for their growth.

According to Park (1998), competition is the lively process where only the strongest firms survive. Additionally, it is assumed that companies contest each other through product, service and price. The World Bank (2016) explained competition in the banking systems as the maximization of economic health and efficiency. However, this research adopts the most recent definition of competition that the concept of competition is always deemed appropriate for every company, particularly within the context of business (Rastogi, Kanoujiya, Bhimavarapu and Gautam, 2022). It is further argued the idea of efficiency and placing the customer at the

centre is embraced, although it might remain more as a theoretical term.

2.2.2 Risk-taking behaviour in the banking sector

There are different versions by which the term ‘risk’ is explained in the literature. Milkau (2017) explains risk as an unpredictable nature of forthcoming results related to decision-making. The notions of risk-taking and risk are closely related concepts, although they exist as separate terms with their own unique characteristics. The main purpose of decision-making in an organization is to enhance and optimize the values it can achieve while operating within the constraints of scarce internal resources (Gupta, Modgil, Bhattacharyya and Bose, 2022).

The idea of risk in the context of large banks refer to both profit or loss on their, investment portfolio, business operations (Tan and Floros 2013). Jakubczk *et al*. (2013) argument is that Risk-taking behaviour can be described as both negative and positive result, and potential outcomes are uncertain (jakubczyk *et al*. 2013). There is a number of factors that drive to a certain individual or a group of people to engage to the risk activities directly or indirect to achieve a certain goal. The risk-taking behaviour in the banking industry describes as the tendency in which banks engage in activities that may lead to a potential financial instability (Garcia-Alcober *et al*. (2020). However, banks encounter risk-taking to maximize profit, although excessive risk-taking has potential loss.

There is no general definition of non-performing loans in the world. Budiharya, Lau and Effendi (2017) describe non-performing loans (NPLs) as loans in which borrowers fail to fulfil their financial obligation by not being able to make the required payment for the outstanding loan arrears and the interest within the designated time-frame specified in their loan agreement. Kartikasry, Marsintauli, Serlawati and Laurens (2020) view NPLs as the risk commonly faced by banks that debtor do not honour their liabilities as these become due, which is well known as credit risk. Nathan, Ibrahim and Tom (2020) argue that non-performing loans are included in credit risk. Furthermore, Labondance (2020) defines NPLs as loans that encounter difficulties in the repayment process because of inconsistencies or external aspects beyond the control of the debtor. These implications could emerge from unfavourable economic conditions or interactions with individuals or organizations that now have extra money but are in desperate need of financial assistance.

Zaman (2020) states that economic growth is negatively impacted by the presence of non-performing loans (NPLs). When the NPL increases, it becomes more challenging for banks to provide financial support to new and promising ventures. Commercial banks have an obligation to make provision for bad debtors in preparation of potential losses arising from these non-performing loans. KPMG (2016) argued that the degree of NPLs has the correlation with the bank's failure. Hence, the identification of elements that impede loan repayments within the context of commercial banks will be made possible by the identification of factors that raise the level of non-performing loans. Non-Performing Loans (NPLs) to Loans Advances: Of all the risks that a bank faces, credit risk is a significant factor with respect to the profitability of the bank due to the fact that a large proportion of the profits realized by the bank comes in the form of interest paid by debtors (Boahene, 2012). Nevertheless, the risk attached to interest rates is directly connected to credit risk, meaning that an increase in interest rates is concomitant with loan default (Nsobilla, 2015). Banks that have high NPLs tend to display performance indicators denoting lower profitability and capital provision, and higher finding cost. Yuanita (2019) argues that higher non-performing loans imply higher risk-taking by the banks. Hence, larger NPLs negatively affect the performance of the bank or reduce the profitability of the bank. Mafu (2017) supports the argument that the issue is not about a higher degree of NPLs, but it is more concern over the higher negative effect on the return on equity (ROE) and return on assets (ROA).

2.2.3 Overview of the South African banking sector

The South African banking system is regulated by the central bank which is the South African Reserve Bank (SARB). The responsibility of the central bank is to put monetary policy in place. Van Niekerk (2023) highlights that the independence of the central bank in executing monetary policy, free from the influence of political factors. Hence, the independence of the South African Reserve Bank relies on the level of comprehension, endorsement and reverence this concept holds within the political landscape of South Africa, as well as the extent to which the rule of law is inflexibly entrenched in the country's constitutional framework.

The Structure of the South African banking system.

The SA banking industry is made up of 36 banks, namely 33 commercial banks and 3 mutual

banks,15 banks that are locally listed on the Johnsonburg Stock Exchange (JSE), and 18 foreign banks. SARB reported that there are five dominant commercial banks in the SA banking sector. According to Business Tech (2023), the top five commercial banks in South African are Standard Bank, First National Bank, ABSA, Nedbank and Capitec, which control higher market share in the sector. Rapapali and Simbanegavi (2020) mention that the top 5 largest banks have 89.8% of assets in the market share, while 6% of assets belong to local branch of foreign banks and 4.2% of assets for other banks in the sector.

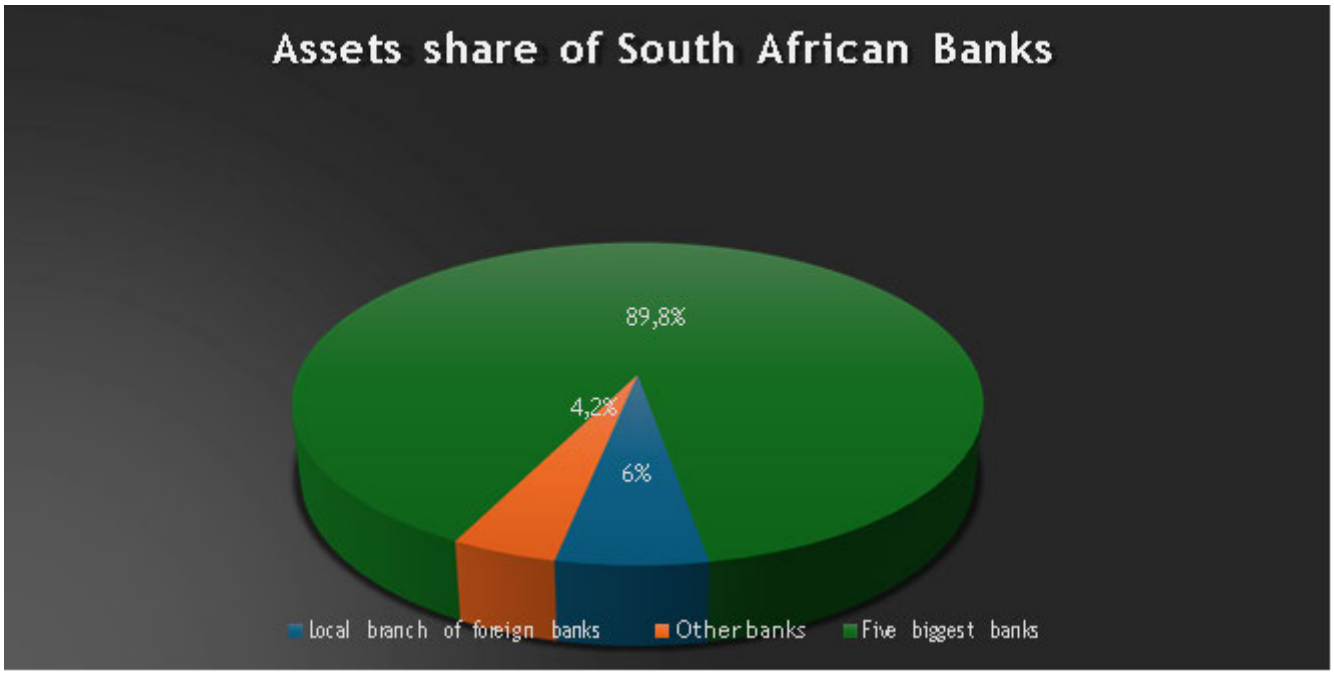

FIGURE 2: THE TOTAL ASSETS OF SOUTH AFRICAN BANKS

Source: Author's compilation (2023)

2.2.4 The relationship between competition and risk-taking behaviour

The relationship between competition and risk-taking behaviour in the banking sector is a broadly debated topic in finance and economics. There are a number of different studies showing that these relationships can be affected by many factors. Majumder and Uddin (2017) maintained that the intense competition in the banking sector resulted in the higher risk-taking attitude. On the other hand, lower risk-taking, and competition may threaten the survival of the banks. Hence, risk-taking is of paramount importance to enhancing banking performance. However, the higher risk-taking behaviour may affect the soundness and survival of the bank.

Banking sector competition may improve a bank's performance, enhance efficiency and provide social welfare gains to an economy. That is, the extent of competition and the efficiency of the banking system affect the success of a bank's intermediation function and its associated social welfare gains. As Bikker (2010) and Mlambo and Ncube (2011) suggest, healthy competition minimizes monopoly and inefficiency. That is, whilst competition is necessary for bank growth and stability, excessive competition could undermine banks' solvency.

Banking competition is level in which the banking sector is competing, to the point to which customers make selections of the extensive range of financial service in a different bank. Competition in the banking sector is completely different form other economic sectors, due to the vital role in promoting qualitative changes to enhance the credit institutions stability, diversify operations, and offer the improved accessibility to financial service. Banking can be classified into four aspects which are as follow's oligopolistic, perfect competitive, monopolistic and monopoly as all other sectors. Chiu *et al.* (2020) consider the monopolistic banking competition as the market structure where the are several banks operating in the sector, due to the differentiation of product each bank have some level of the market power. Oligopoly refers to the small number of banks controlling a higher percentage in the market share.

Competition in the banking sector is significantly important for economic wellbeing (Cetorelli, 2001). Competition in the banking sector improves access to financing by reducing finance costs, thereby achieving financial inclusion. Similarly, the lock of competition in the industry result to the poorer service quality, higher charges, lack of innovation and creative thinking, which leads to dissatisfied customer. Claessens and Leaven (2004) believed that a decline in the degree of competition in the banking industry will increase financing, resulting in reduce financing and slow economic growth. The competition in the banking industry may cause banks to compromise on loan quality and take unnecessary risks, which in turn will affect the stability and function of the banking system and ultimately lead to severe disruption of the operation of the entire financial system. According to Leroy and Lucotte (2016), the increase in banking competition stimulates risk-taking and reduce systematic risk while they decrease stability of individual bank. Cuestas *et.al*. (2017) argue that lower degrees of banking competition are in line with lower risk-taking attitude of banks and insolvency risk. On the other hand, deficiency of competition is more likely to increase the risk-taking attitude of

individual banks that negatively affect the stability of banking sector. According to Martinez-Miera and Repullo (2010), as banking competition increase, banks increase efficiency and reduce their risk profile to an optimal threshold, beyond which further increases in competition lead to increase risk-taking behaviour.

2.3 Theoretical framework

Banking theories

2.3.1 Contestability Theory

The Contestable Market Theory posits that firms with few competitors will behave competitively if the market has low entry barriers (Cremer *et al.* 2023). This theory suggests that even in monopolies or oligopolies, incumbents will act competitively when entry barriers, such as government regulations and high entry costs, are minimal (Tirole, 2023). Without these barriers, existing firms will take measures to prevent new entrants from potentially driving them out of business. Contestability theory not only extends classical competitive theory but also shifts the "focus of competitive action" from within the market to outside it (Panzar, 1996). Instead of emphasizing the strategic interactions amongst existing market participants, this theory highlights the discipline enforced by the potential entry of external firms seeking profit opportunities.

2.3.2 Structural Conduct Performance (SCP) Paradigm

The fact that competition is a complex concept, and therefore not directly observable, has resulted in the development of many methods for its assessment. The assessment of competition in the banking industry has a long tradition. Prior researchers' proxy of competition is generally categorized into two major groups: structural and non-structural approaches (Simbanegavi and Rapapall 2015; Simatele 2015 and Moyo 2018). The structural approach has its roots in the theory of industrial organization that measures competitiveness following the structure-conduct-performance (SCP).

The Structure-Conduct-Performance model (SCP) is defined as the relationship between market structure, firm conduct and firm performance, and postulates that the existence of entry barriers is the major determinant of firm profits, thus the greater cost of entry makes it easier for existing firms to maintain monopoly profits (Widarjono and Anto, 2020). Considered

differently, new entrants will diminish the level of those profits. Therefore, market concentration decreases the cost of collusion between firms and results in abnormal profits for existing firms in the market. The SCP has been one of the most tested hypotheses in the industrial organizations (Sinkey, 1992). According to Sinkey (1992), the microeconomic theory, the structure of the market influences the conduct and behaviour of individual firms. The term 'structure', in the framework of the SCP model, refers to the number of banks serving in the entire industry. Market structure responds to the internal variables, such as competition and regulation, as well as to external variables, such as technological changes, economic and population situations. The term 'conduct' refers to the behaviour of the banks in the market. This includes pricing, marketing and innovative behaviours of the business of banking. The term 'performance' refers to the quantity and quality of products and services provided by the banks in the industry (Rashid *et al*. (2020).

SCP was developed by Bain (1951) to analyse the degree of competition by examining the current structure of the market. The Herfindahl-Hirschman Index (HHI) and concentration ratio are structural measures of banking competition. The concept behind the SPC centres around the notion that the overall organization and function of the banking Industry, alongside the behaviour exhibited by banks, has a profound influence on their effectiveness and accountability. Concentration measures are based on their weighting methods and framework. The number of firms is the simplest index to compute since it had the minimal data requirement. However, the index does not consider how banks are distributed. On the other hand, the bank concentration ratio only adds up the market shares of the top banks in the sector. Due to its simplicity and minimal data needs, the concentration ratio is a commonly employed measure of competition in earlier studies. In contrast, the Herfindahl-Hirschman Index (HHI) demands more data, as it necessitates information on the market share of all banks to determine the concentration level (Azevedo and Gartner, 2020).

The major advantage of concentration measures is fewer required data. Even for developing countries, concentration measures can be computed at least at the national level. Concentration measures are the major indicators used by many academics presently. However, several studies have started to explore different components of the market structure. The theory of contestability contends that firms act intensely without entry and exit? hindrances. Claessens (2009) suggested including regulatory issues to gauge the level of contestability. Contestability

method considers regulatory issues such as entry barriers, openness to foreign bank entry, activity restrictions and capital requirements.

The theory of contestability in contrary to the SCP paradigm suggests that market structure and actual degree of entry or exit are not necessarily the most important factors in determining competition (Bourai *et al.* 2020). If firms in a market with no entry or exit barriers raise their price above marginal cost and begin to earn abnormal profits, potential rivals will enter the market to take advantage of these profits. When the existing firms respond by returning prices to levels consistent with normal profits, the new firms will exit. In this manner, even a single-firm market can show highly competitive behaviour. Despite the fact that the SCP paradigms continue to be widely used in many empirical studies, some authors raised doubt about the reliability of the SCP paradigms and associated structural measures of competition. In response to deficiencies found in the structural methods, the non-structural measures of competition have been developed (Bourai *et al.* 2020).

2.3.3 Non-structural approach

The New Empirical Industrial Organization (NEIO) approach evaluates directly the competitive condition of banks without explicitly employing data on the market structure. The non-structural approach is based on oligopoly theory and a static model of competition, The Lerner index, Panzar-Rosse and the Boone indicator model are attached to this conception of competition. The research into the non-structural approach suggests that the market structure cannot be used to deduce the level of competition by indirectly monitoring a company's behaviour. According to Lipczynski *et al*. (2017), agreement is that instead, it is feasible to ascertain industrial competition by directly examining the conduct of banks.

The main purpose of developing the non-structural model was to address the deficiencies, contradictions and inconsistencies that were presented in the structural model. The non-structural approaches measure competition or the market power by directly quantifying the competitive behaviour of the bank, rather than inferring it from the analysis of the degree of market concentration. The non-structural measure was firstly initiated use a fixed approach of competition and oligopoly hypothesis as the point of reference (Leon, 2015). Lerner index, Boone indicator and Panzer Rosse form part of the non-structural measure of banking

competition (Yuanita, 2019). Each theory has its limitations and specifications. The Boone indicator and Lerner index both need the use of marginal cost, which are not easily measured in the banking sector. On the other hand, the H-statistic may not consistently reduce or increase with regard to the degree competition.

At this juncture, empirical research within the non-structural measure has fundamentally concentrated on estimating behavioural equations. In empirical investigations within the banking sector, statement of comprehensive income (income statement) and statement of financial position (balance sheet) are most commonly used as substitutes for measures of output and input factors. Concerning the intermediary modelling approach in the banking institutions, the total bank assets listed on the statement of financial position are typically employed as a measure of output. This choice is made because these assets are not only accounted for loans generation but also encompass other income reserves. As a proxy for input factor contributing to bank asset production, three categories of expenses are frequently utilized: personal expenses, other financial expenses, and non-financial expenses. These correspondingly represent labour cost, physical capital expenses, and deposits (Leon, 2014).

Although there are many indicators under the non-structural approach, empirical research on competition of banks commonly employs two main indicator, which is Panzer Rosse H-statistic and Lerner Index as the proxy of competition in the sector (Fungacova *et al.* 2015; Coccorese 2014; Prayoonrattana *et al*. 2020) The non-structural proxy of banking competition is made up of the following: Learn (1934); Brenshnahan (1982) Panzar Rosse (1987), which are commonly employed in the previous studies Mlambo and Ncube (2011); Kouki and Al-Nasser (2017); Chitamba (2018); Moyo and Sibindi (2022) to examine the competitiveness of banks in the sector. This study employs two models to assess the degree of banking competition.

2.3.4 Panzer Rosse H-statistics

The H-statistic by Panzar Rosse is the non-structural approach that commonly used to measures the degree of banking competition in the banking sector. This approach has been widely used in previous study as the tool to examine the banking competition. The H-statistics method captures the influence of input price on the total sales of the company (Dubovik and Kalara, 2018). The ability of the firm to control market prices is indicated by the weak influence,

whereas the higher values suggest a more competitive environment. Panzer Rosse (1977) highlighted that the overall sales is decrease if the elasticity of demand is greater than one.

The number of studies has been using the theory to examine the degree of competition in different African countries. Simbanegavi *et al*. (2015) used Panzer Rosse and Bresnahan approach to assess banking competition in South Africa. Mlambo and Ncube (2011) took the analysis a step further by examining the effect of efficiency and competition on the soundness of bank. In addition, Simatele (2015) employs a dynamic Panzer Rosse method to explore the correlation between the structure of bank and competition. They found that the is a monopolistic competitive in South African banking industry. This further support the findings discovered by Simbanegavi *et al.* (2015) along with Mlambo and Ncube (2018) through valid and substantiated evidence.

Given its wide acceptance as an appropriate method for measuring the degree of competition, and its ability to directly quantify the competitive behaviour of the banks and indicate whether it is consistent with monopoly, monopolistic competition, or perfect competition, the research treats this method as the secondary approach for measuring the degree of banking sector competition in this thesis. This approach underscores the growing utilization of specific measure and techniques the assess the level of competition. H-statistics, which scrutinizes how alterations in input prices correlate with changes in banking revenues. When input prices exhibit a strong association with revenue change, it signifies a more competitive market. The calculation of H-statistics involves summing the ratios of percentage changes in interest revenue or total revenue to percentage changes in input prices. The value of H-statistics lies between negative infinity to positive one ($-\infty$ to $+1$). The magnitude of the computed results of the H-statistics shows the market structure of the industry.

The effectiveness of the Panzer Rosse model can be attributed to its simplicity and the lack of strict data prerequisites. It includes conducting just a single equation with a limited number of variables and banks. Consequently, the Panzer Rosse approach can be constructed with relatively few observations, making it particularly valuable for research in emerging or less developed sector. Additionally, Shaffer (2004) highlighted that the Panzer Rosse model remains sturdy regardless of the market's scope because the revenue equation does not specify a particular market definition. The estimation of the revenue equation only necessitates data

from the included in the sample. However, this positively support the cross-country research (Claessen and Laeven, 2004).

Another concern is associated with the continuous nature of the H-statistic. Many empirical studies have adopted this perspective, as shown in Bikker *et al.* (2012). According to Panzer and Rosse (1987), the H-statistic can be seen as a continuously increasing indicator of conduct. It's not just the direction of the H-statistic that's important its magnitude also matters. However, Shaffer (2004) has raised doubts about using the H-statistic as a continuous measure of competition, even though Vesala (1995) has demonstrated that the H-statistic behaves as a continuous measure of competition variable under certain circumstances. In empirical research, the H-value is frequently treated as a continuous variable, but the question of its appropriateness remains unresolved, as noted by Bikker *et al*. 2012.

2.3.5 Lerner index

The Lerner index is a valuable tool for examining the level to which firms control in the particular market (Ahamovna, 2016). It is a precise metric made specifically for banks that allows one to assess the market influence held by a given institution. This index is derived by determining the percentage representing the disparity between the price and marginal cost as the percentage. The index encompasses values from 0 to 1, with zero indicate flawless perfection. In the context of economics, when a competition is based on pricing equal to the marginal cost and is accompanied by significant values, it serves as an embodiment of stronger influence and dominance in the market. The following is the equation of Lerner index.

Over time, the Lerner index will be computed for various banks within the sector. This will enable a comprehensive examination of the level of banking competition, allowing for a trend analysis.as the result, it will shed light on how the degree of competition has evolved during the specified period, particularly given that the data encompasses both the times after and before the 2008 financial crises. Lerner index does not recognize that deviation of price from marginal cost may be due to reasons other than monopoly (for example, efficient use of scale or the need to cover fixed costs). In addition, it does not provide any information on the efficiency structure hypothesis. It assumes that competition enables more efficient banks to achieve superior performance in terms of higher profits at the expense of their less efficient

rivals and also attract greater market share.

The Lerner index's popularity can be attributed to its simplicity, easy-to-understand interpretation, and ability to work well without demanding extensive data prerequisites. As the learner Index furnishes a company specific measure for market power, it opens up the opportunity to examine how bank pricing behaviour changes over the years. Additionally, this measure has other notable benefits. The learner index is adaptable and doesn't necessitate the delineation of the applicable market. It permits the assessment of market power independently for various banking sectors, including geographic and product-base ones. Moreover, Turk Ariss's (2010) research can readily separate monopoly power from monopsony power by excluding financial expenses from total cost and deposit prices. Lastly, the Lerner index can be computed using a small quantity of data points this advantage is particularly significant because competition issue often arises when there are only a few banks in the market. In such situations, average costs can be used as a proxy for marginal costs.

The Lerner index has the significant theoretical and practical limitations. According to Lipczynski *et al.* (2017) emphasise that the Lerner index is primarily assessing pricing market influence, it does not serve as an indicator of banking competition. Prayoonrattana, Laosuthi and Chaivichayachat (2020) state the Lerner index is one of the highly effective and common indicators, it is hired to measure the bank market power from the price mark-up over the marginal cost. additional, since the Lerner index does not necessitate defining the market structure, it is flexible to observe the banking market strength in various market arrangements. Oliver *et al*. (2006) underlines that, when a bank's risk-taking is not accounted for, the Lerner index could overestimate market power, because banks that in relative terms spend more of their resources granting credits enjoy higher margins. According to Koetter *et al.* (2012) these is a problem become an issue for researcher that utilize the Lerner index to explore the relationship between competition and stability of banking sector.

2.3.6 Boone indicator

The Boone indicator quantifies the level of competition by calculating the elasticity of profits in relation to marginal costs (Mirzaei and Moore 2014). Boone *et al*. (2005) introduced the Boone indicator, a measure of the impact of efficiency on performance in terms of profits or

market share. The core idea behind the Boone indicator is that competition improves the performance of efficient banks while harming the performance of inefficient banks, as evidenced by their respective profits or market share. Boone's model hypothesis involves two steps. Firstly, efficient banks, meaning those with lower marginal costs, achieve higher market share or profits. Secondly, the stronger this effect, the higher the degree of competition in that market. Van Leuvensteijn *et al.* (2007) were the first to apply the Boone indicator to the banking market in the Euro area.

Risk-taking Theories

2.3.7 Agency theory

This theory was developed by Jensen and Meckling (1976) and represents a set of recommendation for running the modern corporation, which defines a large group of shareholders that relies on the few distinct individuals to manage and direct the used of their collective capital to achieve future profit (Jensen and Meckling, 1976). Jensen and Meckling (1976) introduce the definition of Agency theory as the connection between the shareholders and manager in the form of agreement, as business owner here managers to run companies on their behalf. Zogning (2017) mentions that owner transfer the right to the management to make decision as the part of contract.

The agency theory suggests that the relationship between owners and managers is the form of delegation where principal assigns decision making power to agent. According to Koolma (2024), manager has the fiducially duty to perform at the best of interest the company, but the might have the diverse goals and objective than the shareholders. Furthermore, manager they turn to behaviour in the manner that serve their interest rather than owners' interest. The theory outlines how principals can motivate agents to act in the principal's best interests, how to design incentives that align the interests of the principal and agent, and how to monitor agent behaviour (Clark and Dolan, 2021).

The Agency theory can also be applied to the various activities of the bank and the relationships between the various stakeholders such as the bank's management may be motivated to take on more risk in order to increase their profits, while the shareholders may be motivated to reduce risk in order to maximize their returns (Ren *et al*. 2023). Bank customers may be motivated to

seek out the best deals, while regulators may be motivated to ensure that the banking system is functioning properly and that customer interests are being protected (Ozili, 2018), which is related to the stability of commercial banks and their operations; hence, banks must have the right balance between risk-taking and oversight to maximize the benefit to all stakeholders.

The concept applies to the current research in the sense that managers may engage in risk-taking behaviours that may be against the wishes of shareholders whose interests are long-term (Bernard, 2014) Owing to information asymmetry between owners and managers, there are numerous instances of fraudulent acts in which one person might cause harm to others because of superior information. Thus, information asymmetry may lead to the destabilization of the firm and that of the entire economy (Rooly, 2021). While the Agency theory is not entirely incorrect, its applicability to real world scenarios where owners and managers possess distinct objectives is limited. Nevertheless, it should be noted that all parties involved have equal access to the available information (Zogning, 2017).

2.4 Theoretical models

To develop the empirical literature review of this study, prior research on the competitiveness of the banking sector and theoretical framework of the research is constructed by the adoption of a number of methods and integrates the theories of competitive conditions in the banking industry. The conceptual framework developed the relationship between various concepts and also the link between variables. The importance of this section is generating a better understanding of the relationship between banking competition and risk-taking in the banking sector. The banking competition and financial stability relationship are comprehensively debated in empirical and theoretical literature inconsistent views which are competition fragility theory and competition stability theory (Berger *et al*. 2006). In the competition fragility view the competition leads to excessive risk-taking and in competition stability the competition reduces the risk-taking.

2.4.1 Competition fragility theory

The franchise value paradigm, which is known as competition-fragility, was formed by (Marcus, 1984). Keeley (1986) states that the franchise value paradigm experience additional support in the literature on competition and risk-taking. The main point of this theory is to

justify the increase in banking competition is the increase in bank risk-taking incentives. Marcus (1984) highlighted that the increase in banking competition results in the decrease of franchise value that led to more adoption of risker strategies. Keeley (1990) and Arping (2019) indicate that the decrease in franchise value increases bank risk-taking.

The study by Jimenez, Lopez and Sa"rina'(2013) proved more support for the competition fragility theory in limiting the risk tanking of banks. The intense banking competition would result in higher instability as likely to take higher risk investment to make up for the earnings decline brought on by higher rate on deposits. Akande *et al.* (2018) reveal evidence that competition fragility theory allows the non-learner associations between competition and risk in the banking sector.

Arping (2014) further avers that competition leads banks more averse to taking on excessive risks. The research discovered that as competition increase and margins decreased, banks face higher threats of failure (Arping, 2014). They respond to such contingencies by reducing their risk-taking attitude. However, at the same time, banks become riskier. This is attributed to the fact that the direct, destabilizing effect of lower margins outweighs the disciplining effect of competition (Arping, 2014). Moreover, the intense competition reduces banks' encouragement to build precautionary capital buffers. They are different implications regarding this, which is that the effect of competition on risk-taking and failure risk can move in opposite directions. Dermine (1984) reveals that competition has a negative impact on the credit risk of the banks. Broecker (1990) finds more evidence to encourage the theory of competition fragility by revering that the relationship between a bank's competition and credit quality is significantly negative. Mustafa and Toci (2018) state that the increase in the level of risk-taking may result in the lower quality of the bank's asset portfolio.

2.4.2 Competition-Stability Theories.

The other substitute and more recent competition-stability point of view. The competition stability hypothesis was developed by Chan and Greenbaum (1986). The theory suggests that in less competitive markets, banks charge higher interest rates, which increases loan default risk (Boyd and DeNicolo, 2005). The competition stability theory indicates that competition results in higher stability. According to DeNicolo, Boyd andJalal (2009) indicate that banking competition has the negative relationship with risk-taking behaviour on the banking industry.

The formulation of this method is based on the fact that theless competitive banking systems on the operation market they likely to charge more interest on loans (Chan and Greenbaum, 1986). As the result number of non-performing loans grows, chances are extremely high for the banks to run out of cash.

If large banks are considered too vital to fail and as a result receive implicit subsidies through government safety nets, an uncompetitive banking market could result in higher risk-taking (Mishkin 1999). Schaeck and Cihak (2014) maintain that competition stability theory highlights that a lack of competition also aggravates the Bank risk-taking attitude. Boyd, Nicolo, and Jalal (2006) suggested proof that encourages a competition stability view. Theoretical supporting and stability issues were always at the forefront of discussions about banking policy because of the special services that banks offered (Danisman and Demirel 2018).

The study by Martinez-Miera and Repullo (2010) examines the cohabitation of the two mentioned above theories through the nonlinear relationship between competition and risk-taking. Martinezz-Miera and Rapullo (2007) revealed a non-linear association between banking competition and risk-taking in which the probability of bank default decreases initially and then rises once a specific threshold of competition is reached. Putting up front the notion that banking competition can lead to both competition stability and competition fragility simultaneously. Borauzima and Muller (2022) suggest that is a non-linear correlation between competition and risk-taking behaviour, through the cohabitation of competition fragility and competition stability view. Martinez-Miera and Repullo (2010) claim that the U-shaped pattern form the association between competition and the risk of bank failure, further argument that bank risk will decrease with competition at a certain level.

2.4.3 Modern Portfolio Theory

The theory was developed by Markowitz (1952) and aims to ensure that by closely examining the ratio of the collection of assets, the return on investments from a particular portfolio in relation to that portfolio's risk equally reduces the risk of an anticipated return in a specified level. This Theory claims that investors can actively offset certain risks associated with personal stocks by investing in assets whose returns move in a variety of ways. According to

Ferretti *et al.* (2021), this implies that investors should choose assets that are measured financially for their platform by considering each asset's contribution to the platform's overall, mean, and average variance.

Subsequently, this theory tries to guarantee the that expected returns of a amount of platform risk maximized and by selecting the ratio of certain asset risk is maximized at any level. (Jiang *et al*. 2018). According to Pihlaja (2023), diversification can decrease the risk related to a specified individual stock deprived of an additional cost. Koumou (2020) states that Portfolio theory is thought to be one of the theories that affects finance and investing economically. Additionally, Koumou (2020) agrees with the portfolio theory that emphases the importance of evaluate the risk and return to identify the portfolio that will offer the higher return.

According to Jacobs and Levy (2024), on the current portfolio theory when banks or firm's management are perfectly in diversification, they may be able to develop a portfolio that maximizes profit while reducing the operating expenses. Moreover, theoretical research shows that it is not advisable for management to consider the cost-benefit analysis of a single portfolio when making company investment decisions. Jones (2017) states that the is number of investment opportunities available that management should looks at, to for growing the firm operation and the output level should be considered by management while evaluating the various investment possibilities. The availability of the assets to take advantage of the opportunities and the effective use of the resources to boost profitability must then be examined.

The primary reason management should consider investing in alternative investment portfolio and other securities within the banking sector is to reduce risk related with these assets. Furthermore, since return coming for various investment portfolio the firms increase the level of income generated. According to Najan *et al*. (2022) investing in one portfolio is risker while diversifying investment might increase the shareholders' funds as the much safe. In connection with the ongoing investigation, the management makes sure that every resource is used effectively and that diversification opportunities are taken advantage off. The banks' earnings will rise if and when this is done responsibly. Based on this theory, a bank can be validated to lend to a variety of corporate and individual investors by improving the portfolio's attributes and risk management. This is done while keeping in mind that the lending strategy will

maximize absolute return while improving portfolio diversification.

2.4.4 Too Big to Fail Theory

The Too Big to Fail Theory (TBTF) was developed in the 1980s by Stewart McKinney. It was made big and gained significant attention and became famous by the 1994 Continental Illinois Bank rescue case and the 2007-2008 global financial crises. Before the financial crisis of 2007-2008, Continental Illinois was the largest financial institution collapse in the US history. Enormous banks have been accused of carrying with themselves the confidence that they are TBTF, forcing them to conduct unnecessarily risky acts (Barth and Wihlborg, 2016). According to this theory, certain institutions, mostly financial organisations, are so huge and intertwined that their failure would be pernicious to the larger economic system. Consequently, Ioannou *et al.* (2019) emphasize that in is significant that governments must protect commercial banks when they face probable failures. According to Gorton and Tallman (2019), advocate that the collapsing of a large banking institution could result in great losses for other businesses, governments are vigilant of letting large financial organisations to collapse. Furthermore, Boyd and Heitz (2016) indicate that commercial banks collapse it can significantly destruct the functioning of the financial system, creating a threat to the economy as a whole. In the financial sector the TBTF theory has been controversial. While TBTF may help to prevent the economy from large-scale financial disaster, it can also result in potential moral hazard, increased systemic risk, and a lack of competition (Ioannou *et al.* 2019). It is vital that governments take a balanced reach to the issue, ensuring that the benefits of protecting commercial banks outweigh the potential costs.

The theory states that the interdependence of certain enormous financial organisations and their failure present a significant threat to the financial system and the economy (Barth and Wihlborg, 2016). These institutions are considered 'too big to fail' because of the potential economic disaster that could arise from their failure (Koleśnik and Dąbkowska, 2021). As a result, governments and central banks are often compelled to step in to avert the non-success of these organisations. This intervention is often in the form of bailouts and other forms of financial support from the government. This theory has become central to the debate surrounding the 2008 financial crisis (García-Alcober *et al.* 2019). Too big to fail (TBTF) theory is significant for financial markets because it proposes that certain large financial organisations are so interdependent to the global economy that their collapse could lead to a

global financial predicament. The theory suggests that these large financial institutions must receive support bymeans of government intervention and bailouts, if necessary, to protect the global economy from potentially catastrophic failure (Asiama and Amoah, 2019).

In the context of South African commercial banks, the TBTF theory indicate the critical regulation of the country and the related risk connected with the size of this banks. Although the concentration of the few commercial banks in the banking industry proved the efficiency and stability. Moreover, the concentration of this few banks is also posed major challenges connected to systematic risk and the possible need of government support during the times of crisis. This can be done through a combination of regulations, capital requirements, and other measures that ensure that banks are well managed and financially sound as suggested by the TBTF theory. In addition, Owoeye *et al.* (2024) highlights that government can provide financial help to these banks in the occurrences that they become insolvent. By doing so, the government can ensure that the banking sector remains stable and that banks continue to serve the needs of the country.

This theory is important to this study because it states that banking system unsteadiness may constrain credit availability. The concentration of Banks, for example, may respond to their stagnation by lowering overall lending amounts and shortening loan repayment terms. Since there is no finance for expansion, small businesses with no other option but to take credit are coerced to reduce their production and employment. If they spread quickly, all of these issues could have serious ramifications for the economy and the financial system (Wahinya *et al.* 2023). The view of commercial banks, more so the large banks worldwide, is the same as that of Continental Illinois Corporation.

2.5 Empirical review

This part of the chapter will present the review of existing earlier research trying to comprehend the deeper understanding of the international and South African banking industry, its competitiveness and risk-taking attitude. This review aims to synthesize and analyse the findings of various studies, shedding light on the complex interplay between these two important factors in the banking sector. The first sub-section of this review is the overview of south African banking sector. The second sub-topic will review the degree of banking competition, which will provide the deeper understanding on the evidence on the level of

competition in both local and worldwide. The third sub-section will review the effect of competition on bank risk-taking behaviour. The fourth sub-section will review the possible threshold effect on the relationship between competition and risk-taking behaviour.

2.5.1. Empirical studies on the degree of banking competition

Numerous studies worldwide examine banking competition and its impact on risk-taking. Antwi, *et al*. (2017) evaluated the Degree of competition in the United Arab Emirates (UAE) banking sector using the H-statistic which was developed by Panzar Rosse (1987). Datafor the period (2009-2015) has been obtained from different statements of comprehensive income and statements of the financial position of the banks. The coefficient is achieved by theuse of pooled ordinary least squares (OLS) estimator. The finding reveals that the UAE bankingsector is typified by monopolistic competition. During this period, banks get their sales as if running under monopolistic competition environments. Similar results were found by Al- Muharrami (2009), who discovered Qatar banks to be functioning under monopolistic competition.

Neupane (2016) examined the degree of competition in commercial banks in Nepal. It is measured by both non-structural measures (Panzer Rosse H-statistics) and structural measures which are the Herfindhl-Hirschman Index HHI and concentration ratio. The analysis used a ten-year dataset from various sources. The study reveals that the market structure of commercial banks in Nepal is characterized by monopolistic competition. Moreover, the study further suggests that the degree of competition between state-owned commercial banks and private commercial banks have a small difference, but all type of bankhave monopolistic feature.

Fernandez *et al.* (2015) used the HHI and Lerner index as a measure of completion in the Mexican Banking industry, and non-performing loans (NPL) were also used to measure Portfolio risk while banking stability used the z-index as a measure. The study discovered that competition is positively linked to financial stability when using one-step GMM to estimate models. Mateev, Tariq and Sahyouni (2021) examined the impact of competition and the degree of risk-taking on the capital ratio of banks in the (MENA) banking industry. The study used the panel data method; data were collected from 18 countries for 225 banks to examine whether competition increases the reasons banks hold high capital ratios. Banking competition

and concentration are measured by two methods which are HH-index and H-statistic. Findings reveal that bank increase capitalization levels concerning the higher risk relatively than the other way around.

Barros and Mendes (2016) conducted an analysis of the degree of banking competition in Angola banking industry, the data used from the period 2005 to 2014. Panzar Rosse were employed to measure banking competition in Angola banking sector. The evidence reveals that there is a monopolistic competition in Angola's banking sector. These results find that by using the bootstrap procedure which overwhelmed the small data span. They find that higher level of competition is related with increase in loan, denoting that competition is significantly related to the risk-taking behaviour of banks. Moreover, it indicated that the existence of positive association between competition of banks and interest rate margin, demonstrating that as competition of banks become more intensified, banks have the tendency to increase the percentage of risker loans, which result to a higher interest rate margin. Research by Akins *et al.* (2016) states that as the banking competition decrease, the interest rate margin become larger due to higher interest rate to loans as bank they over charge their borrowers. The consistent opinion that banking competition are significations affect the bank risk-taking behaviour with regards to asset quality.

Kabir and Worthington (2017) examined the relationship between competition stability and competition fragility using Islamic banks in 16 emerging economies over the years 2000-2012. They assessed stability using the market and accounting-based criteria. Accounting-based measures are made up of non-performing loans and z-score, market-based include the distance to default. The Learner Index was used to measure the banking competition. The result finds that competition-fragility theory in traditional banks and Islamic banks. They also consider that the expanse of the impact of market power on competition stability is more significant for traditional banks than Islamic banks.

Aleemi, Uddin and Kashif (2019) conducted a study on the relationship between competition and the risk-taking behaviour of Pakistani banks. Data was used for the years 2004 to 2017 from 30 banks, and used the panel dynamic data analysis method of two system GMM. The Lerner index is employed as a measure of the market power of the banking sector. The result finds that competition stability theory indicates that, low competition leads to higher market

power which recommends the higher loan rate to be charged by banks to unfavourably affect borrowers by risk-shifting methods. On the other hand, competition -fragility theory recommends that growth in competition erodes market power and encourages higher risk-taking in banks. These findings are in line with those (Khan and Hanif, 2017) who find that there is perfect competition in Pakistan, different measures of the competition were used.

Kasman and Kasman (2015) conducted a study on Turkish banks using a data sample for the period 2002 to 2012. Banking competition is measured by the Lerner index and Boone indicator, and stability is measured by Z-score and NPL. Their findings proved to support the competition fragility point of view. Where they find that competition is negatively related to NPL but positively associated with the Z-score. The finding suggests that the higher concentrations have a positive impact on an NPL but a negative impact on Z-score.

Abel and Roux (2016) conducted research on measuring the degree of banking competition in Zimbabwe's banking industry for the period 2009 to 2014, using the Panzar Rosse H-statistic. The total revenue regression equation and the panel least square regression method with fixed effects were employed to examine the H-statistics. Using the general method of moments and bank random effect, H-statistic was found at 0.56, which is a confirmed result. The finding indicates that there is monopolistic competition present. Over the course of a year, the findings demonstrate that the banking industry in Zimbabwe is heading toward perfect competition. This escalated competition is apparent as banks employ vigorously advertising, improved marketing of banking products, and longer loan terms of up to three years for individuals, as they strive to surpass each other. Their study suggests that the government refrains from doing something, specifically in relation to one another. Interfering with market forces decreases competition, and therefore should be avoided.

Bosiu (2018) examines the impact of competition on bank risk-taking in sub-Saharan Africa countries for the period 2011 to 2015. The relationship between banking competition and risk was assessed, using the data sample from seven developing countries which are as follows South Africa, Zambia, Uganda, Kenya, Tanzania, Angola and Nigeria (Sub-Saharan African) banking systems. The Lerner index is primarily estimated as the measure of banking competition. The ratio of non-performing loans was used to assess the banks' risk-taking. The result indicates that there is a positive significant franchise value relationship between banking

competition and risk-taking in all sub-Saharan African countries.

Mlambo and Ncube (2011) examined the level of banking competition of South African commercial banks using data from the period of 1999 to 2008. They employed the Panzer Rosse method to drive H-statistic for assessing the competitive condition of the banking Industry. The outcome from the Panzer-Rosse approach indicates that the structure of the South African banking sector is donated by monopolistic competition. This finding may present that those five dominant commercial banks in the South African banking industry control 85 percent of total assets in the sector. This result is consistent with the 2008 report by the competition commission, which discovered that large banks tend to avoid direct competition among themselves. To enhance banking competition and encourage welfare gains for the South African economy, the government needs to make sure that its ongoing reforms great competition.

Igbinosa and Osagie's (2017) study assesses the degree of banking competition and concentration in the sector of four African countries which are as follow: South Africa, Nigeria, Kenya and Egypt for the years 2005 to 2013. Concentration ratios for five large banks in each country were determined by employing the Herfindahl-Hirschman Index (HHI), the study indicated that the banking industry in these countries is concentrated and very few banks control a substantial share of the market size. in particular, the study shows that South African banking industry is highly concentrated while Nigeria is least concentrated. Market competition measured by applying non-structural model of Panzar Rosse. During this period, the findings shows that banks operate under the monopolistic competition in these five countries. The result reveals that African banks do not operate in the competitive market structure and therefore, enjoy monopoly rents. It is suggested that policies promote competition as well as regulatory and supervisory structure.

Simbanegavi *et al*. (2012) examined the degree of banking competition in South African banking sector. Bresnahan (1982) and Panzer Rosse (1987) methods were employed to assess the level of competition. Data used to measure competition is for the period from 1992 to 2008. The evidence reveals that South Africa has the monopolistic competition. These results are in line with those for the study by Bikkier *et al.* (2012) for South Africa. However, the study by Claessens and Laeven (2004) measured a degree of competition using panzer rose method, the

data for the period 1994 to 2001. Evidence found indicates that there is a higher degree of competition in South African banking industry.

Rapapali and Simbanegavi (2020) investigated the degree of South African banking sector for the years from 2008 to 2018. Panzer Rosse and Boone indicators were employed to measure the banking competition. Founding from Boone Indicator suggest that banks have the strong market power. The H-statistic for Panzar Rosse has a corresponding negative value of -0.6, which indicate the existence of cartel or monopolistic attitude. In conclusion, according to the finding South African banks behaviour from 2008 to 2018 can be classified as monopoly instead of monopolistic competition, as seen in the previous studies.

Letlaka (2019) measured the degree of banking competition in South African, Through both structural and non-structural method. Ordinary Least Squares (OLS), Generalized Method of Moments-System (GMM-SYS) and Fixed Effect (FE) were employed for estimation. Panel date harvested from the banks database. Herfindahl-Hirschman Index (HHI), Concentration Ratio, learner index and Boone index are methods used to examined banking competition. Evidence indicates a lower degree of competition in South African banks. It is further highlighted that the level of banking competition in South African banks was consistence lower prior and after 2008 financial crises. Rapapali and Simbanegavi (2020) measured South African banking competition using the Panzar Rosse, H-statistics and Boone indicator. The study conducted over the period of 2008-2018 dataset. Result stipulate that the nature of competition in South African banking sector is monopoly. This further finds that there is weak banking competition over this period.

2.5.2 Empirical studies on effect of competition on risk-taking behaviour

Several studies have been conducted to investigate the relationship between market power or banking competition and risk-taking. Rethnayake and Nanayakkara (2021) investigated the relationship between banking competition and risk-taking behaviour. The study used secondary data analyses performed on commercial banks in Sir Lankan for the period of 2009 to 2019. Banking concentration ratios were used to measure the banking competition.

Mustapha and Toci (2018) explored the effect of banking competition on risk-taking behaviour

in fifteen European countries which are Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, Greece, Kosovo, Moldova, Montenegro, North Macedonia, Serbia, Slovenia, Turkey. They used the H-Statistic of Panzar Rosse to stipulate empirical evidence on the competitive behaviour of banks. Noman *et al*. (2022) examined the effect of banking competition on bank risk-taking from 180 banks for the period of 1990 and 2017 in relation to Southeast Asian counties and it indicated that deposit insurance reduces bank risk in the absence of competition by decreasing both insolvency and credit risk. Therefore, the researchers finds that deposit insurance exacerbates bank risk-taking and reduces bank stability in a highly competitive market. They examined risk-taking with NPLs and Z-score, whereas competition was measured by the Lerner index.

Aleemi, Uddin and Kashif (2019) conducted a study on the relationship between competition and risk-taking behaviour of banks in Pakistani banks. Data used for the years 2004 to 2017, from 30 banks used panel dynamic data analysis method of two systems GMM. The Lerner index is employed as a measure of the market power of the banking sector. The result finds that competition stability theory indicates that low competition leads to higher market power which recommends the higher loan rate to be charged by banks to unfavourably affect borrowers through risk-shifting methods. On the other hand, competition -fragility theory recommends that growth in competition erodes market power and encourages higher risk-taking in banks. These findings are in line with Khan and Hanif (2017), who found that there is perfect competition in Pakistan, and different measures of competition were used.

Turubekova *et al*. (2020) investigate the competition and stability in the banking industry of Kazakhstan, using a private commercial bank. On the relationship between competition and the stability of the banking industry, there were many theories available. However, competition fragility theory and competition stability theory are more accepted in the literature. To measure the degree of banking competition Boone indicator and Lerner index are used. Competition and concertation are examined by applying the correction analysis. The Herfindahl-Hirschman Index (HHI) and concertation ratio CR 5 are employed to measure the concentration in the banking sector. Banking competition is measured by the Boone indicator. The result indicates that there is a low level of competition on Kazakh medium-level commercial banks from the period 2013 to 2015.A comparable study conducted by Iskenderoglu and Tomak (2013) in Turkish banks assessed the relationship between competition and bank stability. Data used for

10 years period from 2002 to 2012, obtained from medium-level 15 non-state-owned commercial banks both local and international banks. Dynamic panel data method was haired to assess the related theories. The result shows not enough clear evidence.

Liu, Molyneux and Nguyen (2012) investigated the effects of competition and risk-taking in four South East Asian commercial banks. Competition and risk-taking are measured using the H-statistic. The data used in the study is made up of financial information for ten commercial banks for the years from 1998 to 2008. The study finds that competition does not increase risk-taking behaviour. Gonzalez *et al.* (2017) examine the competition, concentration and risk-taking in the banking industry of Middle-East and North-Africa (MENA) countries. The data for eight years from 2005 to 2012. The dynamic panel data framework of the Generalized Method of Moments (GMM) perimeter was used in the study. Banking competition is measured by two standards which are the H-statistic and Herfindahl Index, Z-score is used to measure the default risk. The result proposed a U-sharp relationship between banking competition and the risk of non-fulfilment for MENA banks.

Yong and John (2017) studied the impact of competition and risk on the efficiency of the Chinese banking industry for the period 2003 to 2013. Competition is measured by the Lerner index. Risk-taking mainly focuses on risk liquidity, credit, capital, and insolvency risk. The result finds that liquidity risk has a significantly negative effect on Chinese commercial banks. Furthermore, Farooq and Mumtaz (2020) conducted a study on Pakistan commercial banks using data from the year 2001 to 2018. Competition is measured by the structural measure Lerner Index and solvency risk used Z-score. Findings indicate that the banking sector is perfectly elastic, and the banking competition increase had a direct impact on credit risk, liquidity risk, and solvency risk in the banking industry. The result confirms the competition fragility theory.

Saif-Alyousfi *et al.* (2020) investigated the effect of banking competition on the bank risk-taking behaviour of banks in the GCC region for the time 1998-2016. The results of their study suggest that a higher level of banking competition adds to financial fragility. Inconsistency with Akande *et al.* (2018) reported that competition increases bank risk-taking in an investigation based on 440 banks in Africa from 2006 to 2015. Despite the interest in their research to bank risk-taking studies in SSA, the risk-taking proxy employed in Akande *et al*.

(2018) study is skewed to only one type of risk-taking in the region, which is off-balance sheet risk. This may limit the generalization of their findings.

Rakshit and Bardhan (2022) investigated the effect of banking competition on efficiency and risk-taking on profitability in Indian commercial banks for the period of 20 years from 1996 to 2016. The study employee a number of bank specific, macroeconomic, and institutional factors that describe the differences in bank profitability. The results reveal that the higher competition decline the India banking profitability this obtained through two-step system GMM indicator. With regard to the risk-taking attitude the result shows that the growing incidence of the credit risk obstructs the bank profitability for the entire banking sector and across ownerships. Therefore, the higher degree of cost efficiency and profit are positively related to bank performance. There are banking specifications, macroeconomic and institutional variables that appear to have an influenced India's banking profitability. The effect of competition and risk-taking on bank profitability measured by adjusted learner index and Boone indicator. The study finds the higher level of competition significantly decreases profitability of banks as time goes. Increase of risk negatively affect the India banking profitability.

Kutlu and Sickles (2012) argue that the collaboration effect of banking competition and efficiency measures need to be considered in determining banking profitability, as the joint effect deliver more strong interpretation. In line with the argument, we examine the joint effect of efficiency and competition on profitability. The researcher finds that banks exercise higher market power with improved efficiency impact banking profitability positively. Similarly, we examine the joint effect of competition and risk-taking on banking profitability. The study finds that market power and risk-taking positively contribute to bank profitability. Higher market power in the loan market increases the rate of interest. Higher interest rates charged on loans increase customer's risk-taking principles as borrowers find it difficult to repay the loans.

According to Dabla-Norris and Floerkemeier (2006), a lower level of competition amongst banks can negatively impact the interest rate elasticity of demand for loans and deposits. This means that the manner in which savers and borrowers are charged interest rate is significantly influence by the level of banking competition in the banking industry. As a consequence of increasing banking competition, banks are forced to excessive risk-taking behaviour to improve their competitiveness. Banking competition, risk-taking behaviour, and income diversification

activities are the aspects that influence the capability of banks to allocate resources efficiently. thus, systematic risk influences bank performance and intermediation effectiveness (Boamah, *et al.* 2021).

Extremely high banking competition and higher risk-taking behaviour is most likely to increase the chances of bank failure and reduce bank profitability (Akter *et al.* 2017; Majumder and Uddin, 2017). Risk-taking plays an important role in increasing the performance of banks, whereas extreme risk-taking threatens the survival and soundness of banks. A minimal degree of banking competition and lower risk may not be good for the financial health of the banks. A bank needs to strike a proper balance between competition and acceptable risk-taking attitude to avoid failure and reduce the risk of running a loss.

Akande, *et al.* (2018) argue that excess risk-taking behaviour is established in the competition-fragility view, revealing that higher risk related to competition causes instability in the systems of the banking sector. This opinion suggests that higher levels of competition in the banking industry can result in a greater degree of risk-taking behaviour among banks. However, Boyd and De Nicolo (2005) disagree with Akande, *et al.* (2018) by arguing that, higher rivalry in the banking sector may result in a decrease in the general degree of risk-taking behaviour. Their argument is based on the idea that increased competition forces banks to be more stable and resilient in banking systems.

This ongoing debate on banking competition and risk-taking behaviour has gained an impetus and it is getting more attention from both academicians and policymakers (Noman *et al.* 2017). However, there is no clear conclusion on both empirical and non-empirical results on the correlation between competition in the banking sector and risk-taking behaviour. Many researchers found that there is monopolistic competition within the structure of South African banking sector (Mlambo and Ncube, 2011; Agoraki *et al.* 2011; Adu, 2022). Meanwhile, these studies do not consider the effect of the business cycle or macroeconomic condition of stability and degree of portfolio risk in the banking sector.

This research examines the link between banking competition and risk-taking attitude which is explained by two main theories of which are competition fragility and stability. Competition fragility consolidates both positive and negative relationships between different ranges of

competition (Carbó-Valverde, *et al*. 2013). The Empirical literature on the research that has been conducted in regard to competition and risk-taking behaviour support the competition fragility view that competition increase the banking risk-taking behaviour (Noman *et al*. 2022; Akande *et al*. 2018; Noman et al., 2017; Berger *et al*. 2009). According to the study by Tongurai and Vithessonthi (2020) investigating the effect of banking competition on risk-taking behaviour in the Japanese region from the years 1993 to 2016. The result confirms that there is positive relationship between competition and bank risk-taking behaviour when it examines by interest rate margin and growth in loans. The study by Akande *et al*. (2018) that examine the relationship between competition and commercial banks' risk-taking behaviour in the SSA region using the sample of 440 commercial banks in 37 Sub-Saharan African countries for the years 2006 to 2015. The findings show that the is positive relationship between competition and both overall risk and credit risk of banks. Moreover, he also concludes by highlighting that competition is connected with the redaction in off-balance sheet risk. Bosiu (2018) also conducted a study on 7 SSA countries that examined the impact of competition on risk-taking behaviour. Result show positive relationship between competition and risk-taking in the banking sector.

On the other hand, there is empirical evidence that support the competition stability view by highlighting that banking competition is decreased by risk-taking. According to Boyd and De Nicolo (2005) advocate this theory argue that higher competition can impact the cost of capital, allowing banks to secure lower interest rate, which in return enhances the project profitability. These banks there too big to fail, more control over the market share, this led to either higher risk-taking or an increase in the competitive market. Several studies used cross-country and large data sets to evaluate the correlation between risk and competition (Sarpong-Kumankoma, *et al*. 2020; Adu, 2022). The evidence of founding provided by prior research that support competition stability view (Kabir and Worthington 2017; Tan 2017; Gonzalez *et al*., 2017; Schaeck 2006; Boyd and De Nicolo 2005). According to the study by Mustapha and Toci (2018) evaluate the impact of banking competition on the risk-taking on 15 Central and Southeastern Europe countries during the years1999 to 2009. Employing Panzer Rosse H-statistic findings provide the evidence that competitive of banking industry has negatively affect the bank risk-taking behaviour this indicate that competition leads to an improvement in the quality of loans portfolios.

South African banks currently had a higher volume of non-performing loans (NPL), which

occurred as a result of the risk-taking attitude (PCW, 2022). Zhang *et al*. (2016) indicate that a higher NPLs ratio leads to risker landing, which may further degrade the loan quality and destabilize the financial system. Zhang *et al.* (2016*),* further argues that a designed strategic policy should be adopted in order to minimize the NPL. Cucinelli (2015) states that the NPL ratio harms the bank`s loaning activities which represents the bank`s ability to take risk. The NPL bank credit quality does not only affect the banking sector but the economy as a whole (Baudino and Yun, 2017). KPMG (2017) highlights that the increase in NPL will affect negatively the bank`s profitability as well as its economic spot which signifies the efficiency of financial regulator. Particular some banks lack on managing their NPLs propel and also do not have substitute proper plan to reduce their NPLs. The increase in NPLs indicates the level of overdue payment of borrowing activities.

2.5.4 Empirical studies on the possible threshold effect on the relationship between competition and risk-taking behaviour

Numerous empirical studies have examined the relationship between competition and risk-taking behaviour in the banking industry, which has been subjected to extensive empirical literature. While certain studies indicate a positive relationship, others suggest a negative association. However, current studies indicate that the relationship between competition and risk-taking behaviour could be non-linear, with a possible threshold effect.

Martinez-Miera and Repullo (2010) discovered that there is a theoretical non-linear relationship between competing banks and risk-taking in the credit market. The information in the Spanish banking system was used to test this hypothesis. After adjusting for macroeconomic factors and bank features, the evidence for a non-linear relationship was discovered using common methods of market concentration in the deposit and credit market. When the method for evaluating market dominance, like Lerner indices, are applied, only the credit market does the empirical findings to keep the original franchise worth hypothesis. 107 commercial and savings banks have provided 1262 bank-year observations over the course of the 14-years sample.

Capraru, Ihnatov and Pintilie (2021) conducted a study that investigate the banking competition and risk-taking behaviour in the European Union region. The sample to carry out the investigation comprises 5119 commercial banks, for the period from 2000 to 2018. Deferent

measures have been considered, including the modified Lerner index, the Boone indicator, the Z-score, the level of liquidity risks present, as well as particulars related to the banker and the country factors. The study shows that there is a strong non-linear relationship between the level of competition and risk-taking behaviour. The result after conducting an inverse U-test ascertained that there is a significant and strong inverse U-sharped relationship between competition and risk-taking behaviour.

Gupta and Moudud-Ul-Huq (2020) adapted GMM system to assess the and they find the positive relationship between banking competition and risk-taking behaviour. Gonzalez *et al*., (2017) investigated the impact of banking competition and stability for Middle East and North Africa (MENA). competition measured by H-statistic and Herfindhal index, framework estimated by using a panel dynamic model in a Generalized Method of Moments (GMM). they reveal a U-shaped relationship between banking competition and risk-taking attitude of banks in the MENA region. Saif-Alyousti *et al*. (2020) conducted a study on Gulf Cooperation Council (GCC) region assessing the impact of banking competition and concentration on the stability and risk-taking behaviour of banks. They employed the GMM technique and dynamic panel model, they indicate that increase in concentration and competition results in financial fragility. Moreover, decrease in asset concentration and competition encourage risk-taking in the middle of the less capitalized, less liquid and small banks, which may increase the vulnerability of the banking sector.

Banyen (2021) examined the effect of financial integration and bank competition changes on bank risk-taking behaviour using data from 405 banks in 47 African countries. Comparing the results across five regional economic communities from the period of 2007-2014. The main outcome suggests that enhancing financial integration has a direct positive consequence on increasing bank risk-taking behaviour in Africa, given the intensified competition. Furthermore, there is evidence supporting the idea of an inverted U-shaped relationship between competition and bank risk-taking behaviour. However, the finding shows a noticeable discrepancy across sub-regional markers, hinting that the financial agenda must suit the market characteristics of individual grouped regional blocs. The investigation has revealed that a shortage in competitiveness is a crucial factor impeding the capacity of banks to reap the advantages of stability presented by financial integration in developing counties.

Gonzalez *et al.* (2017) conducted a study on banking competition and risk-taking behaviour in the Middle East Northern Africa MENA region from the years 2005 to 2012. They found a U-shaped relationship between competition and bank risk-taking. The non-linear relationship between H- Statistics and Z-Score in Gulf countries indicates that the increase in competition leads to a decrease in the degree of financial stability. This result is inconsistent with Liu *et al*. (2013) finding that regional bank stability is associated with a U-shaped pattern in relation to banking competition among banks in the region.

Brei, *et al.* (2022) examine banking competition and credit risk in SSA. They source data from 33 different countries: Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Cape Verde, Central African Republic, Chad, Congo Democratic Republic, Cote d'Ivoire, Equatorial Guinea, Ethiopia, Gabon, Guinea, Kenya, Lesotho, Madagascar, Malawi, Mali, Mozambique, Namibia, Niger, Nigeria, Rwanda, Senegal, Sierra Leone, Swaziland, Tanzania, Togo, Uganda and Zambia, which made a population of 221 banks from the year 2000 to 2015. Learner index measure banking competition and credit risk they find the U-Sharp relationship. This indicates that the lower level of credit risk is correlated with higher degree of competition up to the certain threshold. Above this threshold, more competition increases credit risks as the positive effects of competition are outweighed by the adverse effects of rising competition. Results found that credit risk in Sub-Saharan Africa is not only related to macroeconomic determinants, such as growth, public debt, economic concentration and financial development, but also to the business and regulatory environment. There is a possibility that the increase in competition reduces credit risk through efficiency gains. The related study by Noah, *et al.* (2018) investigated the impacts of competition in SSA on non-performing loans. They found that competition is not solely linked to the macroeconomic established, such as the obligation of government, financial deepening and but it considers the environment in which business are governed.

Tabak *et al*. (2012) conducted a study to evaluate how competition impacted the risk-taking behaviour of banks in ten countries between 2003 to 2008. The benchmark used was competition, which evaluates the impact of efficiency on firms and the corresponding weakening of inefficiency one. Margin costs were similarly considered when measuring banking competition through the Lerner index. By making stability inefficiency the dependent variable, the study revealed a nonlinear correlation between competition and bank risk-taking

behaviours. In particular, competition exhibited an inverted U-shaped curve indicating that both higher and low levels of competition increase financial stability. Finally, the researcher found that average competition reduces stability.

Alhassan and Biekpe (2018) investigated the effect of non-linear competition and risk-taking attitudes in the South African developed insurance sector. Data employed from 79 non-life insurance and competitions are measured by the Lerner Index. The strategies employed include quantile regression, generalized method of moments, and the standard deviation of loss and Z-score are employed to examine risk-taking behaviour. The results support the hypothesis developed by Martinez-Miera and Repullo (2010) which postulates a U-shaped association between competition and insurance solvency. Moreover, there is a piece of evidence to suggest that a weaker financial position will be a high negative impact on competition.

Mateev *et al*. (2022) conducted a hypothesis test that examines how risk-taking in commercial banks and competition are associated from 2006 to 2019 in the MENA region. Ghosh (2014) investigated the connection between capital and risk-taking in 46 Islamic and 57 conventional banking firms in MENA region. According to the findings, banks increase their financing thresholds in reaction to increased risk instead of the other way around. Since no prior evidence exists on the impact of capital requirements on bank insolvency risk, we test the hypothesis that capital adequacy ratio is positively associated with the level of insolvency risk. We find strong support for this hypothesis when the distance to default (or Z-score) is used to measure a bank's default risk. Thus, for the first time, the current study provides evidence that banks in the MENA region attempt to increase their risk level in response to increased regulatory pressure (e.g., increase in the minimum capital requirements).

The study by Akande, Kwenda and Ehalaiye (2018) examines the relationship between competition and the risk-taking behaviour of banks. The study was conducted on 440 commercial banks in SSA regions for the years 2006 to 2015. The study adopted two methods to examine the relationship between competition and risk-taking behaviour. Which is OLS method and GMM technique. The findings support evidence that suggests that there is a significant positive relationship between banking competition and overall bank risk on top of their credit risk therefore it recommend that the off-balance sheet risk reduces banking competition (Akande *et al*. 2018). The result reveals that the increase in risk actually impacts

considerably on the instability of banking system. The increase in credit risk and banking competition in SSA countries accounts for an increase in non-performing loans.

2.6 Gap in literature

The association between banking competition and the propensity for taking risk can be explained by two main theories which is competition fragility has also known as the franchise value paradigm and -competition stability. A further part of the theory consolidates both positive and negative relationships between different ranges of competition. Besides, the theoretical literature review there is empirical evidence in place. A number of scholars has been done in different parts of the universe in both emerging and developed economic countries, Sub Saharan, Mid East North Africa region (MENA). More focus has been put on cross country and large samples used. However, while existing scholars have contributed effective understanding, a significant gap exists in the South African context specifically. Therefore, this research seeks to bridge the existing gap by employing data from South Africa to examine the intricate connection between competition and risk-taking behaviour of commercial banks.

2.7 Summary

Chapter 2 established the theoretical and empirical foundation for the subsequent empirical investigation. It synthesized global findings and emphasized the lack of dedicated research on South African banks. The research is poised to expand the understanding of the competition-risk relationship and offer insights specific to the South African context**.** Chapter 2 comprehensively reviewed existing literature, emphasizing the complex and non-linear nature of the competition-risk relationship. Identified gaps underscore the necessity for a dedicated examination of South African commercial banks. As the research progresses to Chapter 3, the empirical investigation will build upon this foundation, contributing novel insights into the unique dynamics of the South African banking sector.

CHAPTER 3
METHODOLOGY

3.1 Introduction

Research is commonly perceived as the systematic pursuit of knowledge, which is made systematic by a research methodology. Research methodology speaks to how the study was conducted before achieving the set objectives. The research methodology is obligated to ensure that all research questions are answered while also achieving all objectives. Findings and results are highly dependent on the research methodology. This study will adopt a quantitative design. The purpose is to investigate the effect of banking competition on risk-taking behaviour in South African commercial banks. Furthermore, this chapter provides details about the banks that are contributing to the study, the criteria for selecting these banks for inclusion in the research, and the sampling approach that was employed.

This section outlines the methods and data that were applied to address the questions presented in Chapter One. The chapter includes the following sub-topics: the research design, population, study sample, and data collection. Additionally, specific measurements are to be used in exploring the banking competition and risk-taking behaviour. Finally, macroeconomic and bank specification factors are also included as control variables of this research.

3.2 Study Approach and Design

Roux and Viljoen (2018) state that the research design is the approach of combining different elements of the study coherently and understandably. Additionally, the most frequently employed research approaches include the quantitative, qualitative and mixed methods approach. The qualitative approaches consist of language, actions, emotions viewpoints and mental processes, enabling a detailed exploration of a particular topic. The quantitative approach involves working with numerical data and statistical methods, allowing the gathering of a substantial amount of information. Lastly, mixed methods is the combination of both qualitative and quantitative approaches to achieve the research goals (Roux and Vilyoen 2018). The table below further explains the difference between quantitative and qualitative research approaches.

TABLE 1: THE DEFERENCE BETWEEN QUANTITATIVE AND QUALITATIVE RESEARCH

Quantitative research approach	**Qualitative research approach**
Numerical data is gathered through questionnaires and surveys by the researcher.	The researcher is the data gathering instrument.
Although quantitative data may not detect contextual detail, it is more effective and able to test hypotheses.	Qualitative research approach saves time and has minimal chances to be generalized.
Data is represented by numbers and statistics.	Data are in the form of words, pictures or objects.
The details of the study are thoroughly designed before data collection commences.	The design emerges as the study unfolds.

Dehalwar and Sharma (2024)

This study uses a quantitative method which allows numeric and statistical findings. This research design is highly reliant on secondary data collection and tools employed in this study. According to Apuke (2017), quantitative research enables a researcher or an individual to employ numerical data and statistical methods to analyse both independent and dependent variables to achieve the research objectives. In this research, all types of variables were suitable for a quantitative research approach, and the study assessed the effect of these quantitative variables.

The quantitative research design uses procedures such as randomly selecting participants from a study in an honest way, standardized questionnaires received by participants, and statistical approaches utilized to analyse the fixed hypotheses examining the relationship between the selected variables. The choice of research design heavily depends on the research objectives to be achieved, and data requirements significantly influence the research design to be selected in the study. As stated by Senchantichai and Sukamolson (2013), quantitative research involves the representation of numerical data and the interpretation of observations to uncover and clarify the patterns reflected in those observations. Additionally, Cohen, Manion and Morrsion (2002) explain that this research type relies on empirical evidence. Creswell (2013) defines quantitative research as a method that elucidates patterns by gathering numerical data and

subjecting it to mathematical analyses, particularly statistical methods. This concept can be dissected into three key components. The first component focuses on explaining patterns or trends, which are a fundamental aspect of research aiming to provide insights. The second component emphasizes the use of numerical data, closely connected to the third component, which relies on mathematical techniques. For mathematical methods to be applied, the availability of numerical data is essential (Creswell, 2013).

3.3 Model Specification

In the following model specification, the researcher analyses the objective of the study and the relationship between banking competition and risk-taking behaviour in South African commercial banks. The risk-taking behaviour has specific indicators such as credit risk, Z-score, capital risk, liquidity risk and non-performing loans. However, on the other hand, the level of banking competition is specifically measured with the Lerner index and Panzer Rosse H-statistics. A study by Akande *et al*. (2018) highlighted a variety of aspects that affect risk-taking behaviour in the banking industry, which include bank specification and macroeconomics such as an increase in GDP, inflation which is expected to have a good correlation with the risk-taking of banks.

3.3.1 Degree of Competition

There are many ways to measure banking competition. These measures are grouped into two categories, structural and non-structural measures. The structural model was formed by Mason (1939) and Bain (1951). The structural measure was designed in line with the structural conduct performance paradigm (SCP). Structural measures give a demonstration of the bank's market power and express the market structure. This measure is concerned with the concentration ratio and Herfindahl Hirschman index (HHI). Mayo (2018) states that the structural conduct performance approach (SCP) focuses on the performance and conduct of the banks.

The first establishment of the non-structural measure was founded by Lerner in 1934 and expanded by H-statistic (Panzer and Amp; Rosse, 1987) and lastly, expanded by Boone indicator in 2008. The non-structural approach forces investigating the area of competition straight through the bank's behaviour in the market. The main advantage of employing a non-

structural approach is that it examines the degree of competition directly by observing the behaviour of banks in the market. Structural behavioural performance does not measure the competitive behaviour of banks using market structure (Kocabay, 2009). The Lerner index, Boone indicator and H-statistic are most frequently used in measuring competition. However, this study employs the Lerner index as the significant measure of banking competition. This measure quantifies the disparity amongst bank firms when there is a significant gap between the output and marginal cost, and it suggests that the market is less competitive. The H-statistic serves as the secondary measure of competition. This model is commonly used in the literature of the banking industry to examine the degree of competition (Simatele, 2015; Simbanegavi *et al.* 2014; Panzar Rosse, 1978).

The Lerner index has been used to examine the market power of a single bank in the sector, and this model has been commonly used in the banking sector as a measure of competition (Leon, 2016; Fu *et al.* 2014). The advantage of this model is that it is more flexible, and it needs less data to be constructed. The formula for the Lerner index is presented as follows:

$$lerner\ index = \frac{Pit - MCit}{Pit} \quad (1)$$

P_{it} = Price the output bank *i* at period *t.*

MC_{it} = Marginal cost of bank *i* at period *t.*

The above equation basically defines the total revenue (non-interest income and interest) to total assets, where $p_{it}$is the bank price *i* at period *t*. According to Fiordalisi and Mare (2014) and Delis *et al. (2016*), marginal cost is calculated by using the trans log cost function with one output total (asset or loan) and three input prices, which are operating expense, personal expense and interest expense. According to earlier work such as Beck *et al*. (2013) and Berger *et al*. (2016), Marginal cost (MC) is obtained by assuming the use of the following trans log cost function, expressed as:

$$\mathrm{InTC}_{it} = \alpha_0 + \sum_{j=1}^{2} \alpha_1 Inw^j_{it} + \frac{1}{2} \sum_{k=1}^{2} \alpha_{jk} Inw^j_{it} + \beta InTTA_{it} + \frac{1}{2}\beta_2 (InTA_{it})^2 + \sum_{k=1}^{2} \beta_{2j} InTA_{it} Inw^j_{it} + \gamma_{it} T + \frac{1}{2}\gamma_{it} T^2 + \sum_{j=2}^{2} \gamma_{3t} TInw^j_{it} + \gamma_{4t} TInTA_{it} + \varepsilon_I \quad (2)$$

$$MC_{it} = \frac{TC_{it}}{Q_{it}} \left(\beta_1 + \beta_2 InTA_{it} + \sum_{j=1}^{2} \beta_{2j} Inw^j_{it} + \gamma_{4t} T \right) \frac{TC_{it}}{TA_{it}} \quad (3)$$

Q_{it} =Bank output.

TC_{it} =Total Cost

inW_{it} =Three input prices.

T= time trend

TA_{it} =Total Asset of bank *i* period *t.*

γ_{4t} = donated one of the total assets.

The market power of individual banks each year is represented by the Lerner index value, with a value of one indicating higher pricing power and lesser competition in the market condition (Banyen, 2021). As a result, the researcher can estimate the marginal cost using the coefficient estimate from the trans-log cost function. Once one has the marginal cost and the output price, one can calculate the Lerner index for each bank by putting this value into the formula in equation (1).

This study suggests H-statistics as the secondary measure of banking competition. Panzer and Rosse (1987) formulated the technique to measure banking competition using a reduced-form revenue equation (Barros and Mendes 2016). The model examines banking competition by calculating the H-statistic, which is the result of adding the elasticities of revenue due to cost input. Using the H-statistic if the result is between 0 and 1 means that there is monopolistic competition. If H<0, this will indicate a monopoly and H=1 would show perfect banking competition. The main point is that the market is dominated by a perfect market, and the change in the cost factor does not affect the result of the firm. The Panzer and Rosse techniques are given as follows (Simatele, 2015):

$$Rev_{it} = \alpha_0 + \alpha_1 lnPL_{it} + \alpha_2 lnKP_{it} + \alpha_3 lnPF_{it} + \beta_1 lnRISKASS_{it} + \beta_2 lnASSET_{it} + \beta_3 lnBR_{it} + \gamma_1 GROWTH_t + \mu_i + v_{it} + \quad (4)$$

Rev_{it} = This represents the bank revenue divided by total assets.

PL_{it} = the price of the employee's expense by total asset.

PK_{it} = it is a price of capital per unit (the ratio of a capital asset over a Total asset).

PF_{it} = This is the ratio of interest on borrowed funds to total borrowed funds/ loans.

$RISSASS$ = This is the specified effect on cost and revenue, a ratio of provision over Total asset.

$ASSET_{it}$ = the overall asset of the bank *i* by period *t*

$GROWTH_t$ = This is measured by the rate of GDP; it will be verified over the period constantly across banks at the period given.

3.3.2 The effect of competition on risk-taking behaviour

The 2nd Objective was measured:

Previous research in banking literature investigates their empirical methods by the traditional estimators of panel data: pooled-OLS, random effect and fixed effect (Tabak *et al*. 2015). Nevertheless, Baltagi (2008) argue that the random effect and fixed effect are biased on estimators in a dynamic model of panel dataset. He also indicates that pooled OLS is biased and inconsistent even if ε_{it} are not serially correlated. Therefore, this research employed the fixed effect and random effect. This will help to find the relationship between competition and risk-taking behaviour in commercial banks. The increase in loans may increase the assets of the bank and it influences the bank's size. Therefore, multi-capitalization also changes with the size of the bank. Moreover, the bank risk is paramount importance because banks that had a higher risk in the previous year may be most likely to face financial trouble in the coming years. Therefore, the panel var approach fits very well in measuring this objective of the study, since it makes it easy to analyse the dynamics of risk exposure resulting from the changes in the degree of competition. Moreover, it considers the influence of banks and country-specific factors. By using the method, the researcher can refrain from imposing the predetermined assumptions about the correction between the degree of competition and the risk-taking variables within the mode. This study therefore follows the study by Love and Zicchino (2006) and Abrigo and Love (2016), and the approach is presented as follow:

$$y_{it} = A + X_{it}B + \mu_i + \varepsilon_{it} \qquad (5)$$

Where y_{it}represents the bank risk-taking while Xti denotes the explanatory variable, which is the Lerner index and H- Statistics, μ_i is the dependent variable specific panel fixed effect. Therefore, the variables' competition and risk are considered as the endogenous variables in the model. In this regard, endogeneity issues arise due to the causality reverse. However, they also consider the long-run and short-run effect of competition on risk-taking behaviour.

To investigate the effect of competition and bank risk-taking, previous research, such as that of Soedarmono *et al*. (2013), Lee and Hsieh (2013), Fu *et al.* (2014) and Kasman and Kasman (2015), argues that in the research of panel data, a dynamic technique should be employed to estimate the time presence in the bank risk. Therefore, a dynamic model is as follows:

$$BRT_{it} = \alpha_0 + \beta_1 COMP_{it} + \beta_2 BSIZE_{it} + \beta_6 ROA_{it} + \beta_7 ROE_{it} + \beta_8 GDP_{it} + \beta_9 INFL_{it} + \varepsilon_{it} \quad (6)$$

BRT_{it}= examines the banks' risk-taking behaviour for the bank *i* at a time *t*. The bank risk-taking indicators are NPLs, Z-Score, CAR, and LIQ. The banking competition is measured by the Lerner Index and H-statistics. The error term is ε_{it}. As indicated by the literature, the research controls for capitalization, liquidity, size, deposit and age of the banks (Berger *et al.* 2009; Delis *et al*. 2016; Akande *et al*. 2018). Return on Assets and Return on Equity are the controls for bank profitability. Inflection (INFL) and annual growth (GDP) are macroeconomics variables used in the study, which are expected to be positively related to bank risk-taking.

3.3.3 To investigate the possibility of any threshold effect in the relationship between competition and bank risk-taking behaviour

The 3rd Objective was measured:

The study expects non-linear results on the possible threshold effect in the relationship between competition and risk-taking behaviour. The threshold regression model was developed by Hansen (1999). Allowing for fixed individual effects, the panel threshold model divides the observation into two or more regimes, depending on whether each observation is above a threshold. The following approach is employed: the Fixed Effect Panel Threshold regression model. The advantage of the threshold regression model is that the number and location of thresholds are endogenously determined by the data. Hansen (1999) states that this is different from traditional techniques in which the threshold level is determined exogenously, and it is not possible to derive confidence intervals for the chosen threshold, which may present serious inferential problems. This model has been recently used in the literature of banking competition and risk-taking. Akande *et al.* (2021) used the fixed effect panel threshold regression model to

examine whether competition has a non-linear relationship with access to finance. Additionally, it utilizes past iterations of the outcome variable as tools to tackle the issue of endogeneity. A fixed effect panel threshold regression model is presented in the following formula:

$$y_{it} = \mu + X_{it}(q_{it} < \gamma)\beta_1 + X_{it}(q_{it} \geq \gamma)\beta_2 + u_i + e_{it} \quad (6)$$

Where there is yit, it represents the dependent variable; qit is the threshold variable explained by the size and *i* represents the indication of the function. Other equations are as follows:

$$y_{it} = \{^{\mu + X_{it}I\beta_1 + u_i + e_{it}, q_{it} < y,}_{\mu + X_{it}I\beta_2 + u_i + e_{it}, q_{it} \geq y,}\} \quad (7)$$

This equation is separated into the two regime threshold regression models maintained above. *I* represents the cross-sectional unit, *t* represents time,y_{it} is the dependent variable, X_{it} denote the explanatory variable, e_{it} eit is the error term presumed to be an identical distribution and independent, q_{it} represents the threshold variable that is separated into two samples with different regimes depending on whether q_{it} is less or greater than y, where y is denoted by the threshold parameter endogenously determined through the model. β_1 and β_2 are the two coefficients distinguishing the two regressions. To identify the β_1 andβ_2 , it needs the element of X_{it} and are not time invariant.

The fixed effect panel threshold regression approach contains a number of advantages to compare to the linear regression model, such as the following: the panel threshold regression approach resolves the issue of endogeneity by condoning the non-linear relationship amongst the variables. Secondly, it enables modelling changes in the relationship between variables uniquely for various units in the panel. Thirdly, the fixed effect panel threshold regression approach authorizes as the change in the connection amongst variables by modelling the change in the function of threshold variables. This model also heeds the relationship in the variables, which may not be effectively explained by the linear approach. Furthermore, it also shows heterogeneity across the banks and is effective for modelling. Lastly, it considers the different form of functions to be employed to perfect the link between variables, which enhances the elasticity of the model to adaptability to intricate data. According to

Seo *et al*. (2019), maintain that one of the most important restrictions in place with the algorithm of fixed effect panel threshold models is its incapacity to deal with multiple thresholds during the analysis.

3.4 Variables Description

3.4.1 Risk-taking indicators dependent variable

The main aim of this study is to investigate the relationship between competition and the risk-taking behaviour of commercial banks. The study will first measure the level of competition in South African commercial banks, followed by measuring the banks' risk-taking. The study examines the different types of banks' risk-taking behaviour in South African commercial banks. The forces on the four types of risk are as follows: liquidity risk, insolvency risk, capital risk and credit risk. The above-mentioned risk must be examined by accounting-related ratios. Liquidity risk measures as the ratio of liquid assets to all assets, with the higher value of this ratio being an indication of the lower liquidity risk (Redic *et al.* 2012). The capital risk is measured using all regulation capital ratios, with a big total regulatory capital ratio indicating a lower banking capital risk (Molyneux *et al.* 2014; Onali, 2014). The credit risk is measured using the non-performing to total loans ratio. With the high ratio indicating that credit risk is too high (Clark *et al.* 2018, Farruggio and Uhde, 2015; Liang *et al*. 2013).

The insolvency risk is measured using a Z-score, which indicates that banks are more stable and the lower profitability of being insolvent (Norman *et al*. 2018). The higher value of the Z-score indicates lower insolvency risk.

$$Z - score = \frac{ROAi,t - EAi,t}{\sigma ROAi,t} \qquad (8)$$

ROA_{it}= return to asset

EA_{it}= equity to asset

σROA_{it}= standard deviation of Return on Asset

Credit risk

Credit risk refers to the possibilities that the borrower's failure to honour their repayment of

loans as they become due. Almekhlafi *et al*. (2016) describe credit risk as the most serious threat that banks go through, since the substantial portion of the banks' earnings stems from credit transections, such as interest paid on loans. According to Mpofu and Nikolaidou (2018), a number of research studies look at the factors that contribute to the credit risk in the banking industry since it is the main risk face by banks. Adekunle, Alalade and Agbatogun (2015) explained that credit risk is a potential risk associated with customer failing to meet their loan obligation or respond to their debts to the bank promptly and in their entirety. According to Louhichi and Boujebene (2016), the credit risk exposure is reflected by the non-performing loans ratio.

According to Ombaba (2013), the NPLs are frequently employed measures amongst analysts because NPLs present a significant threat to the stability of the banking system, and they can directly affect a bank's profitability due to the presence of these bad loans. Following the outcomes of Kayode *et al.* (2015), the increase in exposure to credit risk negatively impacts bank profit margins. According to Kusi *et al*. (2016), this implies that the NPLs ratio, done by dividing impaired loans by total loans, offers a more accurate depiction of a bank's credit risk as it conveys the real credit risk or losses within a specific time-frame. In contrast, another commonly used measure of bank credit risk, such as non-performing loans, looks at past performance.

The NPLs is calculated by taking the number of loss loan divided by total loans. As a result, the higher the ratio is the greater the credit risk. Hossain *et al*. (2020) used credit risk as an alternative to measuring risk-taking, this ratio of non-performing loans over total assets, the higher ratio indicates greater bank's risk-taking in landing. $NPLR =$ log modification of the non-performing loans of banks, *i* in time *t*.

$$NPLRs = \frac{NPL\ ratio_{it}}{1 - NPL\ ratio_{it}} \quad (9)$$

Liquidity risk

Liquidity risk pertains to the potential danger that arises when a bank cannot fulfil its financial commitments, such as paying off deposits and short-term debts, as they become due (Liang and Liu, 2021). This means that it is a risk where that current asset is not enough to pay their current liabilities as they become due. Cheng *et al*. (2015) argue that the liquidity can be a very

harmful threat when it becomes extremely higher. However, the liquidity risk presented a number of obstacles in the general context of risk management. It is of highest significance for the banking industry to accurately determine the key factors that affect liquidity risk to ensure financial stability. To assess the reliability and resilience of the current banking sector, it is important to gather specific data on liquidity risk and develop strategies for effectively managing fluctuations in liquidity (Islam and Jahan, 2018).

Vazquez and Federico (2015) state that banks that had lower levels of liquidity structural and higher leverage before the financial crises had a greater probability of experiencing failure in the subsequent period. Moreover, the likelihood of a bank facing failure also to the extent of risk-taking by the banks. A number of studies by Dahir, Fauziah and Ali (2018) and Khan *et al*. (2017) highlighted that a reduction of liquidity risk is associated with an increase in bank risk-taking, this suggests that there is a negative relationship between bank risk-taking and liquidity risk. The banks that possess sufficient funding liquidity are at a lower risk of encountering liquidity problems. As a result, banks need to limit their ability to create loans to meet liquidity demands and ensure that they maintain a higher level of liquidity.

In investigating the effect of liquidity risk on risk-taking behaviour study used data such as the total short-term assets including cash. Which can be collected from annual or financial reports publication by each bank. According to the research by Andreou *et al.* (2016), earlier studies have explored the influence of managerial competence on the generation of bank liquidity and risk-taking behaviour in the financial sector. Khan *et al.* (2017) state that the bank is highly stimulated to take riskier investments when banks are experiencing less funding liquidity risk. The theory of lending formulated by Acharya and Naqvi (2012), agreed that banks become more riskier in the event where they are facing lower funding liquidity risk, examined by liquidity asset to Total asset.

$$liquidity\ risk = \frac{liquidity\ asset}{Total\ asset} \quad (10)$$

Capital risk

Capital risk proxy is an essential part of risk management in many industries, especially in the banking sector. To ascertain how much is the appropriate amount of capital to be set aside to cover potential loss, entails evaluating and quantifying the financial risk that an organization or bank faces. Anginer and Deemirguc-Kunt (2014) argue that measuring capital risk is a crucial component of prudent risk management, particularly in industries with high potential financial loss. The research by Abbas and Ali (2020) demonstrates that the effect of capital risk influences the risk-taking behaviour is more important for under-capitalized banks compared to well-capitalized commercial banks.

Athanasoglou *et al.* (2008) state that examining the capital risk is paramount important in economic growth. Previous studies used two methods of capital ratios which are regulation and actual capital ratios. The regulatory capital ratio indicates the risk-weighted assets which is also called the capital adequacy ratio. Most research recently used this method to examine capital risk (Rahman *et al*. 2017; Zheng and Moudud-UI-Huq, 2017). Shareholders' funds (Equity) to total asset, this is known as actual capital ratio, this measure is broadly used by previous studies such as Dietrich and Wanzenried (2011). This research used actual capital ratio as the measure of the capital risk, the equation is as follows:

$$capital\ risk = \frac{shareholder\ funds}{total\ asset} \qquad (11)$$

3.4.2 Competition Independent Variables

Lerner index

The Lerner index was established by Lerner in 1934, as an indicator of market power, using a price-cost margin. Therefore, the Lerner index was chosen as the direct measure of banking competition because it highlights the market, which is visible in the difference between the price and the marginal cost. This measure captures the amount of which a bank may raise its prices above its magical cost. The Lerner power index has a value between 0 and 1, where the value indicates the perfect competition and bank with no market power. Where the Lerner index value near to 1 indicate that the banks has market power because of a larger mark-up and the weakness of banking competition at the pricing level. The Lerner index has been used by a number of researchers some are the world bank researchers such as (Demicguc-Kunt *et al.*

2010; Anzoategui *et al.* (2010) as well as other scholars Fernandez de Guevara (2005), Weill, (2013) and Moyo (2018), amongst others.

Panzar Rosse H-statistic

The Panzar Rosse technique proposes a method that adopts a simplified structure using information form either the banking or industry sector to determine the H-statistics, and indicator of competitiveness. This is achieved by computing the sum of the total revenue elasticity of the banks utilizing reduced from equations, which reflects the labour, fund and capital prices specific to each institution. H-statistic is commonly used to assess the degree of competition. It evaluates how responsive revenues are to input prices (Panzar Rosse, 1987). It is generally accepted that a positive H statistic is sufficient to exclude substantial market power. In fact, there is an extensive spread belief that monopolistic constantly have a non-positive H statistic like study by Noman *et al*. (2017) and Camino-Morgo and Armijos-Bravo (2018). The Panzar Rosse technique makes a competition indicator (H statistics) that stipulates a quantitative assessment of the competitive nature of a market.

3.4.3 Control variables

The additional variables are the control variables which consist of bank-specific and macroeconomic variables. According to Borauzima and Muller (2023) in the African banking sector, both specific features of the bank and macroeconomic factors have a significant influence on the relationship between competition and bank risk-taking. Adu (2022) further agrees that indeed competition and risk-taking behaviour has been impacted mostly by the macroeconomic and bank specifications in the Sub-Sahara African region. Moreover, Borauzima and Muller (2023) argue that dynamic macroeconomics and bank specific features have a significant contribution on competition, risk-taking relationship amongst African banking sectors.

Mokuoane (2016) states that macroeconomic factors have been found to have a significant influence on the basic decision of how to layer a firm's capital structure and the speed with which that structure can be adjusted towards achieving a target capital structure. Furthermore, Hackbarth *et al*. (2006) argue that macroeconomic conditions should have a large impact not

only on credit risk but also on firms' financing decisions. Indeed, if one determines optimal leverage by balancing the tax benefit of debt and bankruptcy, then both the benefit and the costs of debt should depend on macroeconomic conditions. Almaqtari, Al-Homaidi, Tabash and Farhan (2019) recommended the gross domestic product, inflation, exchange rate are the factors that form part of macroeconomics, on the other hand bank specific include the following: bank size, bank deposit.

3.4.3.1 Bank performance

Return on asset

The banking performance is measured using return on asset (ROA), which is the ratio of earning before taxes to overall assets. This ratio represents the generation of earnings by employing per unit of asset and needs to reflect ability of management to use resources to generate earnings. Golin and Delhaise (2013) indicate that return on assets (ROA) is an important ratio for performance evaluation which has been broadly used in prior studies. Love and Peria, (2015) state that bank profitability increases charter value and risk-taking is reduced by higher profitability. Return on Asset (ROA): ROA is measured as the ratio of net profit after tax to total assets and provides information on management's ability to generate income from using the assets of the business. ROA is a key performance indicator for banks, and it is used to monitor changes in the efficient use of assets over time (Osman and Iddrisu, 2015). This studytherefore used ROA as a measure of Financial Performance.

$$\text{Return on Asset} = \frac{earnings}{TOTAL\ ASSET}$$

Return on equity

The return on equity is commonly used to determine the revenue generated based on the different element of shareholders' funds or equity. It's calculated as the percentage of net profit to shareholders funds. The higher ratio indicate that bank has good has good utilization of its capital equity. Furthermore, it may also highlight that bank has large leverage and debt. If bank has the higher leverage both ROE and ROA need to be reduced. Adu *et al.* (2023) state that most bank developed significant financial leverage in order to enhance their competitiveness.

$$\text{Return on equity} = \frac{earnings}{SHAREHOLDERS\ EQUITY}$$

3.7.3.2 Banks size

The size of the bank is contemplated as a significant factor in the determinant of risk-taking attitude in the banking sector. Bank size is one of the significant aspects in the banking system since it impacts the performance of the bank. According to Ugwuanyi (2015), bank size is significant in investigating the risk-taking attitude of banks in the sector. Bank's size is typically quantified using the natural logarithm of their total asset (Chan *et al*. 2016). Correspondingly, Tabak *et al*. (2012) suggest that commercial banks highly benefit from the competition as they appreciate the market power and different opportunities for their investment as compared to the small banks. Moreover, commercial banks may guarantee higher consistent profit without being enticed to take on excessive risk, resulting in their financial stability. Additionally, Schaeck and Cihak (2014) argue that Commercial banks benefit from the minimized production cost due to their substantial market dominance, and bank size increases bank stability through efficiency channels. Roy (2008) highlights those commercial banks engage in a number of separate categories of activity, which makes it easy to expand their portfolio, therefore risk will be minimized. Commercial banks possess a significant capacity to diversify their operation and thus reduce their risk exposure. Furthermore, Ben-Jabra *et al*. (2017) argue that commercial banks might exhibit a higher sensitivity to market fluctuation compared to smaller banks. Moudud-Ul-Huq and Rahman (2023) state that commercials tend towards risk-taking behaviour. As argued by Bertay, Demirguc-Kunt and Huizinga (2013), there is no need for commercial banks to take more risk than small banks as they can secure funding that are non-deposit. The study by Williams (2014) indicates a positive correlation between bank size and its propensity to engage in risk-taking behaviour, as measured by Z-score. Additionally, Smaoui, Mimouni, Miniaui and Temimi (2020) state that a large bank has a lower liquidity risk as they manage to avoid higher risk-taking. The study by Klomp and Haan (2012) reveals that there is a positive correlation between bank size and the risk-taking attitude of banks. Similar results were found by the study of Moudud-Ul-Huq and Rahman (2023) as the studies indicate the significantly negative impact of bank size on risk. Consequently, commercial banks may be more inclined to extend credit to risk clients and allocate substantial funds over extended periods, partly due to the presence of a deposit. The augment by Liu *et al.* (2012) highlights those larger financial institutions have higher chances of growing their risk-taking attitude. Furthermore, Rokhim and Min (2020) state that the risk-taking behaviour of a bank may well be related to its size. Consequently, from the commercial banks that might not the Too Big Too

Failure. This situation increases as the banks, are supported by government safety net subsidies.

The bank size variable is included in both risk and capital equations to consider the size effects. Bank size is considered an important determinant of bank risk-taking and capital. However, the bank size has been recognized as one of the determinants of risk in the bank risk-taking literature. According to Bougatef and Mgadmi (2016), correlation was discovered between the size of banks and the level of risk they undertake, which supports the idea that commercial banks are better at managing risk of utilising diversification. Bank size has an impact on various activities of banks including investing opportunities, portfolio diversification, reputation and access to equity capital (Zhang *et al.* 2008). As large banks have easy access to the equity capital market, thus we expect a large bank will have a lower capital ratio than smaller banks. In addition, Roy, (2008) maintains that as large banks can carry out a large number of different activities, so they can diversify their portfolio, and hence credit risk will be decreased (Roy, 2008). Larger banks may be considered safer considering that they might have been operating for a longer period in the market, during which they may have established lending relationships with their clients which, in turn, gives them an advantage in terms of the information they possess. According to Hossain *et al.* (2020), banking size is one of the most important elements in risk-taking behaviour of that banks. Rahman *et al.* (2017) highlighted that the greater a bank's asset, the larger the bank size. This variable coefficient could have a negative or positive sign. The variable in this study was represented by the ratio of a banking asset to the total asset of the banking industry. The variable, denoted by bank size, was used to adjust for the effect of a banking sector size on its risk-taking appetite.

3.4.3.3 Gross domestic Product

Gross domestic product refers to the total value of goods and services that are produced in the local economy (Dean *et al.* 2020). The following researchers: Zheng *et al.* (2022); Bongiovanni *et al.* (2021) and Banya and Biekpe (2017), have employed annual GDP as the gauge for evaluating the general state of an economy and used it as the key macroeconomic variable throughout various research. According to Tesfaye (2012), GDP is the total reliability economic of the nation. The growth in the country's economy is considered to be a highly important aspect of financial health. The gross domestic product variable is proxied by the capital of each production. The argument by Quang and Nhi (2017) state that the increase the

degree of gross domestic product is determined by more levels of income which demands the enhancement of the debt serving capacity of loans. In addition, the growth in the degree of serving influence the investment in the market cannot be overlooked. Calmes and Theoret (2020) noted that effective liquidity matching requires banks to track external shocks, such as GDP growth shocks, to optimize the allocation of assets between loans and other lines of business. At the same time, changes in banks may in turn affect economic and financial conditions such as GDP. Martins *et al*. (2019) also pointed out that GDP has a significant impact on the profitability of real estate banks. When GDP is high and the national economy is developing well, the efficiency of banks is often also high. On the contrary, when GDP is low and the macroeconomic environment is poor, banking efficiency is not ideal. Interruptions within the banking industry can compromise the stability of the whole financial system and have a significant lasting negative outcome. Therefore, it is important to not underestimate the effect of those consequences. Additionally, the country's gross domestic product (GDP) is greatly influenced by the expansion of its economy as measured by the economic activity that occurred within a particular time. Different economic development backgrounds lead to different businesses of banks, which affect the evaluation of bank performance. Therefore, taking GDP growth as an exogenous variable makes the model more logical and the measurement of banking efficiency more convincing. Unvan and Yakubu (2020) found that profitability, bank size and liquidity are all important determinants of bank deposits when controlled by macroeconomic factors. Macroeconomic instability due to inflation also has a significantly negative impact on bank deposits. Afza and Asghar (2017) concluded that commercial banks operate at optimal levels because of their large size, increased solvency, and greater minimum capital requirements.

The gross domestic product (GDP) real growth incorporates the regression to control for the economic condition change. The growth in the companies' operations in the economy indicated by the increase in real GDP suggests a higher degree of income and excellent business performance. The increase in business performance and income in the economy is expected to reduce the default rates of the borrowers and, consequently, reduce the credit risk for the banks (Taiwo *et al.* 2017). As a response to the decrease in credit risk, banks are expected to reduce their risk premiums on their loan rates, thus reducing their net interest margins. However, when the economy is growing, aggregate demand increases, thus encouraging firms to further expand their business activity (Nail and Lahrichi 2022). The expansion of business activity implies

higher investments which, in turn, increases the demand for loans. The increase in the demand for loans may cause upward pressure on the loan interest rates, which implies that the growth rate of the real GDP may have a positive impact on the net interest margin. Nevertheless, it must be considered that despite the potential increase of loan interest rates due to the higher demand, the net interest margin may not be much affected if banks have to offer higher deposit rates to be able to finance the credit growth. When the economy is growing, savers have more favourable opportunities to invest their savings. Hence, higher interest rates must be offered to attract depositors to save their money in the banks.

3.4.3.4 Inflation

Inflation in the regression is represented by the annual growth rate of the Consumer Price Index. Higher inflation reduces real wages when the wages are not adjusted for inflation, thus weakening the loan repayment capacity of the borrowers and leading to higher loan-loss provisions. On the other hand, if loan interest rates are fixed and not adjustable to inflation, then the real interest rate may decline and make it easier for borrowers to repay their loans when inflation increases. Piper (2016) described inflation as an overall increase in the level of prices. Inflation is measured by the country's customer price index (CPI). Additionally, Dunn *et al.* (2018) state that it represents the bullish movement pattern of the price of goods and services within the market. In other words, it is considered as the currency loss power of purchase.

The inflation rate (INFL) is a measure of monetary instability, as inflation could influence the bank's risk-taking behaviour (Chen *et al.* 2019). According to Adu (2022), inflation is significantly associated with the risks that the banking sectors of the SSA region face. Chinoda and Mingiri-Kapingura (2024) argue that inflation affects the bank taking risk-taking in different ways as, inflation can negatively impact the bank by raising costs. Secondly, inflation can lead to the central bank issuing excessive currency, which benefits debtors (including banks). Thirdly, during periods of economic prosperity, countries often implement tight monetary policies to control inflation, which can have a detrimental effect on the banking system.

3.5 Data source

To investigate the relationship between banking competition and risk-taking in South African commercial banks, the dataset covers the period of 20 years starting from 2002 to 2022, the sample period relies on the availability of data on the South African Reserve Bank (SARB). The data frequency is annual. Therefore, data was collected from five dominant commercial banks for the period 2002 to 2022. The researcher collected the data from the Annual Financial Statements for each bank, which is the statement of comprehensive income and statement of financial position. The data collected included the total revenue and operation income, expense, total cost (interest expense and non-interest expense), non-interest income, and on the balance sheet, short-term assets, total loans and securities. This data was collected from the website of each bank in the sample, Bloomberg and SARB BA900 surveys, which are annual financial statements. These sources were selected due to their established credibility and relevance to the South African banking industry.

TABLE 2: DESCRIPTION OF VARIABLES

Variable	**Classification**	**Description**	**References**	**Source**
	Dependent variables			
Risk measures	Z-score	This is the ratio of the sum of the average of ROA and ROE ratio to the standard deviation of ROA	Lepetit and Strobel 2015 Mare *et al.* 2017 Wu *et al.* 2020	Author calculation
	NPLs	Nonperforming loan to asset	Ho *et al.* 2021. Borauzima and Muller 2023	Bank scope
	CAR	Equity to total asset this serves as proxy of capital risk.	Tan and Anchor 2017	Bank scope
	LIQ	Liquidity asset to total asset this serves as the liquidity.	Ashraf 2017	Bank scope

	Independent variables			
Competition				
	LI	Lerner Index	Fu *et al.* 2014 Leon *et al*. 2016 Akande *et al.* 2018	Author calculation
	H-Statistic	Sum of elasticities of the bank with respect to the input prices.	Tabak *et al.* 2015 Adu 2022 Simatele *et al.* 2015	Author calculation
	Control variables			
Macroeconomic variables				
	INFL	The annual inflation	Mustafa and Toci 2018	World bank
	GDP	The real gross domestic product growth	Chen *et al.* 2019 Louhichi *et al.* 2020	SARB
Bank specification				
	BSize	The bank total asset logarithm	Mustafa and Toci 2018 Adu 2023	Bank scope
Bank Performance				
	ROE	Earnings over Equity	Moudud-Ul-Huq 2021	Bank scope
	ROA	Earnings over total asset	Moudud-Ul-Huq. 2021 Adu 2022	Bank scope

Sources: Author's compilation (2024)

3.6 Estimation techniques

Several regression models were employed to properly achieve the objectives of this research and analyse the relationship between the dependent variable of the banking industry, the independent variable and other control variables. Panel data was used for this study and the researcher choose to use the balance panel data of South African dominant commercial banks. The panel data combines both the cross-section and time-series, it reveals the wide range of

information needed to investigate any specific phenomenon. The panel data was employed to estimate the models that are related to the non-learner, on the learner model fixed and random effect will be used to estimate. Although the literature indicates that GMM is the most commonly used model in the study of this nature, since it addresses endogeneity issues. However, this dissertation it is not applicable since the time period was greater than the number of banks.

3.6.1 Fixed and random effect

To estimate the equation for Objective Two, both fixed effect and random effect methods were employed. The Hausman test was employed to decide on the most appropriate estimator to be used between the fixed and random estimates. As detailed in sources like Wooldridge (2010) and Greene (2018), fixed effects estimation addresses a key issue in cross-sectional studies: the possible omission of relevant control variables. Fixed effects models account for any time-invariant characteristics within the cross-sectional data and are particularly useful for analyzing the impact of variables that change over time. They are also effective in examining the relationship between explanatory variables and outcomes within each cross-sectional unit. Conversely, a random effects model assumes that explanatory variables have consistent relationships with the response variable across all observations, but these fixed relationships can differ from one observation to another, typically following a normal distribution. Random effects estimation offers insight into both specific levels (like fixed effects) and overall population-level trends.

3.6.2 Ordinary least squares

In the ordinary least squares (OLS), the adequacy of a model specification can be checked in part by developing whether there is an autocorrelation of the regression residuals. Problematic autocorrelation of the errors, which themselves are unobserved, can generally be detected because it produces autocorrelation in the observable residuals. Autocorrelation of the errors violates the ordinary least squares assumption that the error terms are uncorrelated, meaning that the Gauss Markov theorem does apply and that OLS estimators are the best model. Therefore, OLS was employed in this study.

3.7 Diagnoses tests

The diagnostic test is significant for validating the parameter estimation outcome of the estimated model when analysing the influence of banking competition in risk-taking attitudes in South Africa. Diagnostic test the stochastic parameter for approaches like residual autocorrelation, normality and homoscedasticity were done. The diagnostic tests that were employed in this research are briefly explained as follows:

3.7.1 Autocorrelation

Autocorrelation indicates the degree of correlation between similar variables over successive time periods as it measures the link between a variable's historical values and present values within the series. Additionally, the purpose of autocorrelation analysis is to find any underlying patterns by assessing the relationship between the observations at different time intervals. The autocorrelation test is performed to analyse whether there is the autocorrelation between error terms in the modelling. The Breusch-Godfrey LM test is used to assess the autocorrelation of variables. This examination involves performing a regression analysis on the residuals from the original model, considering both extra explanatory variables and their lagged values to ascertain if the coefficient related to the lag are statistically meaningful. To conduct this test, a regression analysis must be done in the first difference of the residuals. Their lag value and other explanatory factors must be considered, and the statistical significance of the coefficient linked to the lag value.

H0= there is no autocorrelation
H1= there is autocorrelation
There will be no autocorrelation if the p-value is higher than five percentage.

3.7.2 Normality test

The assumptions of the normality test hold the most importance in ensuring to the validity of specification tests, forecasting and inference procedures. Alejao *et al.* (2015) developed the metrics to examine skewness and kurtosis in both the individual and residual components independently and collectively. The study undergoes the normality test to examine the normal

residuals (Sendo, 2019). To examine normality, the study used a Shapiro Wilk test for normality, which was founded in 1965 by Samuel Shapiro and Martin Wilk. This test has been normally employed by various fields like finance and economics to assess the normality assumption of data. Thode (2002) and Leander and Norgren (2019) mentioned that they serve as an approach for selecting models, and there are different ways of interpretations based on one's understanding of probability. The null hypothesis of normality test H_0 assumes that there is no residual normal distribution, and H_1 assumes that there is a residual normal distribution. However, if the probability is greater than 5%, this means that there is a residual normal distribution, and if it is less than 5%, the is residuals are not normal.

3.7.3 Heteroscedasticity test

The research uses the Breusch-Pagan Cook-Weisberg test and residuals from the explanatory variable regression to assess group-wise heteroscedasticity in the dataset. According to Kpegba *et al.* (2023), the null hypothesis posits constant variance, which should be rejected if the p-value connected with the research variables are less than 5%. This emphasises the heteroscedasticity in the residuals, and execution of the standard error that is unreliable for use.

3.7 Summary of the Chapter

Chapter 3 described the methods employed to achieve the objectives of this study. Panel data were employed for the period of 20 years from 2002-2022. Banking competition was examined using non-structural measures, which is the Lerner index and H-Statistic. The dependent variables are the risk indicators, which is the Z-score, NPLs, LIQ and CAP. Control variables are macroeconomic factors and bank- specific. The effect of competition on risk-taking behaviour is estimated by OLS fixed and random effects. The fixed effect panel threshold regression model was employed to examine the possible threshold effect on the relationship between competition and risk-taking behaviour. Diagnoses tests considered are the autocorrelation, normality test and heteroscedasticity test.

CHAPTER 4
ANALYSIS AND INTERPRETATION OF RESULT

4.1 Introduction

This chapter proffers an analysis, interpretation and discussion of the empirical findings obtained from the investigation into the relationship between competition and bank risk-taking behaviour in the South African banking sector. Drawing upon the research objectives outlined in Chapter 1, this chapter examines the collected secondary data to address the study's central hypotheses and research questions. As alluded to previously, the data analysis employs a combination of descriptive statistics and graphical representations to effectively communicate the key trends and patterns. To achieve these objectives, panel data and econometrics functions were utilised, mirroring the methodologies adopted in similar studies by prominent researchers like Vilakazi (2021).

The chapter unfolds in a logical sequence, commencing with a discussion of the econometric tests conducted to ensure the robustness of the regression analysis. These tests assessed normality, autocorrelation and heteroscedasticity in the model's residuals. The chapter will detail the results of these tests and their implications for the validity of the statistical inferences drawn from the analysis.

Following the discussion of the diagnostic tests, the chapter presents and analyses the findings regarding the competition measures employed in the study. These measures focused on the Lerner index and H-statistic, which capture different aspects of market competition within the South African banking sector. A nuanced understanding of these competition metrics will be crucial for interpreting the relationship between competition and risk-taking behaviour.

The chapter will mainly focus on the analysis and discussion of financial competition and risk findings. This section will leverage established risk-taking measures such as the Z-score and non-performing loans. By analysing these metrics, the chapter aims to illuminate the impact of competition on the overall risk profile of South African banks. Finally, the chapter culminates in a comprehensive summary that synthesises the key findings regarding the influence of competition on bank risk-taking behaviour, accounting for the influence of bank-specific factors. This concluding section will provide a clear and concise overview of the competition-

risk nexus within the South African banking context.

Throughout this chapter, the analysis is grounded in relevant academic literature, ensuring a well-informed interpretation of the empirical results. By adhering to this structured approach, this chapter strives to offer valuable insights into the intricate interplay between competition and risk-taking behaviour in the South African banking sector, contributing to the broader discourse on financial stability and regulatory implications.

4.2 Descriptive statistics

The analysis that follows examines the descriptive statistics for various variables relevant to investigating the relationship between banking competition and risk-taking behaviour in South African commercial banks. Bank risk-taking is measured by four different variables, namely NPLs, Z-score, CAP and LIQ. The Z-score indicates an overall risk of 2.48847 on average for the banks included in the sample, which is consistence with the result of Gonzalez *et al.* (2017) where the Z-score indicate risk amounted to 4.32. Chen *et al.* (2019) state that the Z-score shows the position of banks from insolvency. This means that the greater value of the Z-score indicates the financial stability of the bank. The non-performing loans have a mean of 9.274927 with a standard deviation of 1.542047. The relatively low standard deviation is consistent with the previous analysis. This suggests similar levels of non-performing loans across banks, potentially due to common risk management practices or industry-wide economic factors affecting all banks. High non-performing loan ratios can signal weaknesses in credit risk management and asset quality, potentially undermining financial stability (Goddard *et al*. 2007).

Berger *et al.* (2009) argue that great capitalization can be used as a risk management tool to decrease both credit risk and insolvency risk to banks. The capital risk result shows a mean of 16.90515 and a standard deviation of 11.67348. The CAR figures are consistent with the previous literature where Obadire and Obadire (2023) examined bank risk-taking behaviour in Africa and their CAR was more than 8%. The larger the CAR, the implication is that South African commercial banks are maintaining their capital adequacy ratio. The liquidity risk has an average of 1.054156, while the standard deviation reflects 0.5952615.

Variables such as the H-Stat (H-Statistics) and LI (Lerner index) are commonly used to

measure the degree of competition within an industry (Vilakazi, 2021). The Lerner index and H-Statistics represent the level of banking competition, with an average amount of 0.999 and 0.8539 and a standard deviation of 0.008726 and 0.1205961 respectively. The summary of a matrix of banking competition ranges between an average of 0 and 1. This result implies that there is monopolistic competition across the banks in the South African banking sector. This market structure aligns with a number of studies that have found monopolistic competition in banking systems across the SSA region (Akande *et al*. 2018; Fosu *et al.* 2017).

TABLE 3: DESCRIPTIVE STATISTICS

Variable	Obs	Mean	Std. Dev	Min	Max
NPLs	105	9.274927	1.542047	5.001453	11.25726
Z-Score	105	4.734786	2.488847	3.122493	22.32054
CAP	150	16.90515	11.67348	5	83.4
LIQ	105	1.054159	0.5952615	0	5.735612
LI	105	0.9909486	0.008726	0.9397912	0.9992031
H Stat	105	0.8539272	0.1205961	0.5144629	0.9999708
INFL	105	5.52619	2.023013	1.39	11.02
gdp	105	26.53386	0.2877345	25.58602	26.85168
B SIZE	105	865304.1	679013.4	408.877	2882397
ROA	105	2.327481	2.376039	-0.5017	11.2115
ROE	105	18.85377	7.173404	-11.1525	37.1357
Bank Size	105	12.8651	2.025598	6.013414	14.87413
NPL Ratio	105	0.1361458	0.4174878	0.0062498	2.20056
GDP	105	3.46e+11	7.89e+10	1.29e+11	4.59e+11

Source: *Autho'rs own estimates* (*2024*)

The other part of the descriptive statistics includes the analysis of control variables which are macroeconomics and bank-specific. The country's inflation and gross domestic product has an average of 5.52619, 3.46e+11 and a standard deviation of 2.023013, 7.89e+11. The bank-specific variables are donated by bank size and bank performance, which is ROA and ROE. The size of the commercial bank has a mean of 865304.1 million with a standard deviation of 6790134.

TABLE 4: CORRELATION RESULT

	ZSCORE	H-stat	LI	BSIZE	LIQ	ROE	CAP	ROA	NPLRatio	INFL	GDP
ZSCORE	**1.0000**										
Hstat	0.2578	**1.0000**									
LI	-0.5646	0.1700*	**1.0000**								
BSIZE	-0.4274	-0.1084	0.2558	**1.0000**							
LIQ	0.6107	0.1572	-0.6289	-0.2649	**1.0000**						
ROE	0.0468**	0.5524	0.2545	-0.3238	0.0973*	**1.0000**					
CAP	0.5877	0.4241	-0.3972	-0.4333	0.2545	0.1941	**1.0000**				
ROA	0.6257	0.4407	-0.6229	-0.5587	0.4472	0.3261	0.6407	**1.0000**			
NPL Ratio	0.4353	0.1379	-0.5500	-0.2885	0.4384	-0.1145	0.4386	0.6395	**1.0000**		
INFL	0.0671*	0.0404**	0.0669**	-0.0641*	0.0015***	0.0632*	0.0665*	-0.0028***	-0.0622**	**1.0000**	
GDP	-0.1995	0.1988	0.2724	0.3685	-0.0971	0.0784*	0.0702*	-0.0069**	-0.0691	-0.2184	**1.0000**

Source: *Author's own estimates* (*2024*)

The author's estimation derives from bank scope data for 5 banks across South African commercial banks for 2002 to 2022. 10% * ,5%** and 1%*** represents the level of significance. It was observed that when the regressor exhibits a higher correlation between variables, there is a greater possibility of getting unreliable estimates due to multicollinearity, which inflates the standard error coefficients and consequently impacts the predictors. To ascertain that there is no multi-collinearity, the correlation coefficient should be below 8 percent. The correlation matrix also shows that regression variables are normal, with 2 or less indicating evidence of multicollinearity. Multicollinearity is only implied when 2 variables have a significant correlation coefficient below 0.7 (Bushashe, 2023). The correlation measured between variables confirms that some of the variables are moderately related. The weak correlation means that changes in one variable are not strongly associated with changes in the other.

Variables such as the Z-score and LI present a negative moderate correlation of -0.5646 while ROA and LI have positive 0.6257 correlations. The LIQ and bank Size variables show a negative -0.687 moderate correlation. This highlights that a LIQ increase depends on the increase of LI and bank size. Moreover, positive moderate correlations were observed, such as Z-Score to NPLs Ratio (0.7353), LI to Bank size (0.2558) and LIQ to ROE (0.0973). Overall, while these moderate correlations provide valuable insights into the relationships between the variables, further analysis and contextual understanding are necessary to fully interpret their implications within the specific domain or research context.

4.3 Pesaran test

To test for cross-sectional dependence in the panel data, Pesaran (2004) was used. The CD-test of 1.28 is used to establish whether there is a cross-sectional dependency between the variables of the panel data. The P-value is greater than the 0.05 significance level, hence the test failed to reject the null hypothesis. The null hypothesis for this test indicates that there is no cross-sectional dependency, which indicates that the residuals are independent across variables in the panel. The average correlation coefficient of 0.088 signifies that there is an insignificant positive correlation amongst the residuals. The absolute correlation is 0.282 and indicates that the average of the residuals has a moderate correlation.

TABLE 5: CORRELATION COEFFICIENT & PESARAN (2004) CD TEST

Variable	CD-test	p-value	Corr	Abs(corr)
Mg_res	1.28	0.202	0.088	0.282

Note: under the null hypothesis of cross-sectional independence CD~ N(0.1) Residual series tested: mg_res.

Source: Author's own estimates (2024)

The presented p-value of 0.202 is larger than the conventional significance level of 0.05. Therefore, there is insufficient evidence to reject the null hypothesis of cross-sectional independence. This suggests that according to this test, the panel data residuals do not exhibit significant cross-sectional dependency. As a result, the residuals from the model appear to be largely independent across the different cross-sectional units in the panel, supporting the reliability of the panel regression findings based on the assumption of cross-sectional independence.

Objective 1

4.4 To Measure the degree of competition within the South African banking sector

TABLE 6: DEGREE OF COMPETITION MEASURED BY LERNER INDEX

Years	ABSA LI	CAP LI	FNB LI	NED LI	STB LI
2002	0,990853673	0,975198174	0,999203073	0,991541316	0,99211443
2003	0,986695838	0,939791233	0,999050989	0,986627667	0,992326153
2004	0,989110363	0,947255487	0,999016493	0,987879369	0,99591209
2005	0,988553466	0,960316903	0,993385386	0,989453998	0,996764536
2006	0,991802365	0,970353684	0,994377245	0,99159601	0,996920599
2007	0,991608461	0,980130587	0,995402959	0,992067601	0,994922342
2008	0,991193362	0,982149731	0,99789129	0,992840468	0,990274969

2009	0,990000818	0,983551292	0,998485347	0,991373508	0,992120179
2010	0,989582499	0,9890008	0,998688194	0,991003832	0,992640039
2011	0,989772214	0,989675834	0,99909929	0,990503079	0,992067895
2012	0,990629472	0,992062177	0,998576464	0,990522951	0,994495412
2013	0,990692013	0,993953993	0,998733294	0,99055658	0,990640577
2014	0,990274454	0,994480726	0,998686783	0,990402658	0,991371105
2015	0,990833043	0,994494219	0,998595487	0,99051635	0,990645266
2016	0,990130542	0,994997698	0,998543939	0,98985478	0,990431652
2017	0,990483189	0,995061744	0,998531452	0,990092678	0,990909739
2018	0,989505649	0,99548474	0,998725152	0,99009561	0,990154611
2019	0,990150227	0,99611872	0,998616149	0,990480127	0,990652839
2020	0,990709729	0,996708906	0,998067588	0,989854289	0,990320489
2021	0,991318199	0,995134538	0,998597613	0,989398175	0,989524751
2022	0,991761369	0,996614758	0,998788457	0,990968957	0,989504345
Mean	**0.9902696**	**0.9839303**	**0.9980506**	**0.9903633**	**0.9921292**
Std- Div	**0.0011831**	**0.0166668**	**0.0015935**	**0.0013493**	**0.0023268**
Min	**0.9866958**	**0.9397912**	**0.9933854**	**0.9866277**	**0.9928405**
Max	**0.9918024**	**0.9967089**	**0.9992031**	**0.9895043**	**0.9969206**

Source: *Author's own estimates* (*2024*)

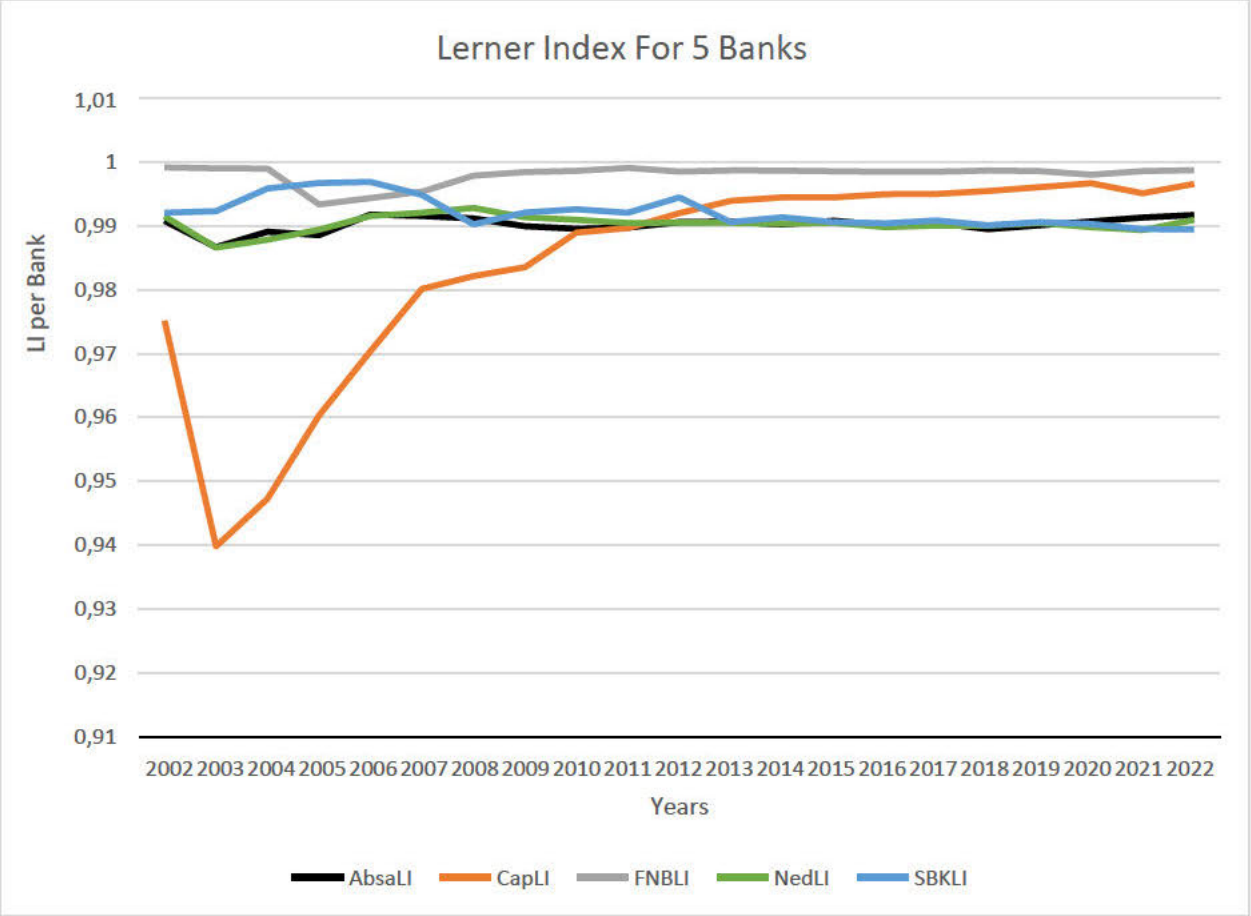

FIGURE 3: LERNER INDEX FOR ALL 5 BANKS

Source: Author's compilation (2024)

The degree of competition is measured by the Lerner index for each bank for the period 2002 to 2022 with market power ranges between 0.00 to 0.99, that is the minimum and the maximum of individual banks over the given year. This highlights that the market structure is very strong.

According to this analysis, the industry is dominated by a small number of very big banks, which could result in increased market concentration. For example, Capitec's Lerner index fell to 0.94 in 2002, but starting in 2003, it increased significantly. With a standard deviation of 0.01667 and a mean Lerner index of 0.9983, Capitec demonstrates comparatively strong market power with minor temporal fluctuation. The Lerner indices of Absa and Nedbank show a minor decline in market power, falling from 0.99 to 0.98 before beginning to rise once more. With averages of 0.99027 and 0.99806, Absa and Nedbank have standard deviations of 0.00118 and 0.00159 respectively. Standard Bank's Lerner index increased from 0.9923 to 0.9969 between 2003 and 2007, indicating a rise in market dominance. Standard Bank's Lerner index has a mean of 0.99212 and a standard deviation of 0.0023268. Various patterns draw attention to the

different levels of market strength that various banks possess and imply that some are solidifying their position as industry leaders. This outcome validates the existence of monopolistic competition in the banking sector of South Africa. The market structure in question aligns with the conclusions of multiple research studies, such as Mlambo and Ncube (2011) and Simbanegavi *et al.* (2015), which have likewise suggested that monopolistic competition prevails in the South African commercial banking industry.

TABLE 7: DEGREE OF COMPETITION MEASURED BY H-STATISTICS

Years	AbsaHstat	CapHstat	FNBHstat	NedHstat	SBKHstat
2002	0,741081106	0,954685625	0,990325677	0,61329978	0,702651837
2003	0,702283456	0,920109623	0,995206948	0,6003212	0,673141238
2004	0,642782399	0,914358613	0,994735254	0,51446292	0,906981977
2005	0,662944915	0,90955319	0,948210349	0,60355264	0,929111409
2006	0,798536935	0,926911381	0,954750577	0,66806757	0,91985549
2007	0,818358961	0,937099421	0,964036589	0,72324956	0,994442627
2008	0,812278864	0,946257375	0,995374031	0,73245565	0,77928916
2009	0,795771311	0,943209476	0,97267863	0,69957466	0,904839626
2010	0,791776173	0,946724309	0,987119974	0,67754899	0,910287046
2011	0,786907299	0,947900962	0,994121731	0,69701841	0,868460315
2012	0,831615037	0,958438125	0,999348352	0,71300735	0,905506543
2013	0,855817225	0,962707873	0,990247751	0,72000339	0,75984477
2014	0,858355679	0,962592177	0,99064403	0,73349716	0,797630295
2015	0,842716672	0,967877912	0,990708994	0,70720913	0,782797823
2016	0,871924779	0,975128837	0,990478201	0,74226018	0,821049294
2017	0,889220715	0,975755133	0,990529833	0,74353064	0,821003302
2018	0,852108238	0,979959991	0,990454598	0,7398723	0,800076881
2019	0,855077644	0,989512698	0,99052523	0,71938365	0,796546864
2020	0,825966097	0,993469382	0,964337583	0,70310465	0,751105742
2021	0,837515079	0,99579928	0,99423315	0,7356527	0,745974892
2022	0,862919049	0,999970836	0,990620526	0,767092	0,814923873
Mean	**0,8064742**	**0,9575249**	**0,9846994**	**0,6930555**	**0,827882**
Std. dev.	**0,0673261**	**0,0267919**	**0,0145654**	**0,0618323**	**0,0828483**

Min	**0,6427824**	**0,9095532**	**0,9482103**	**0,5144629**	**0,67314112**
Max	**0,8892207**	**0,9999708**	**0,767092**	**0,767092**	**0,9944426**

Source: *Author's own estimates* (*2024*)

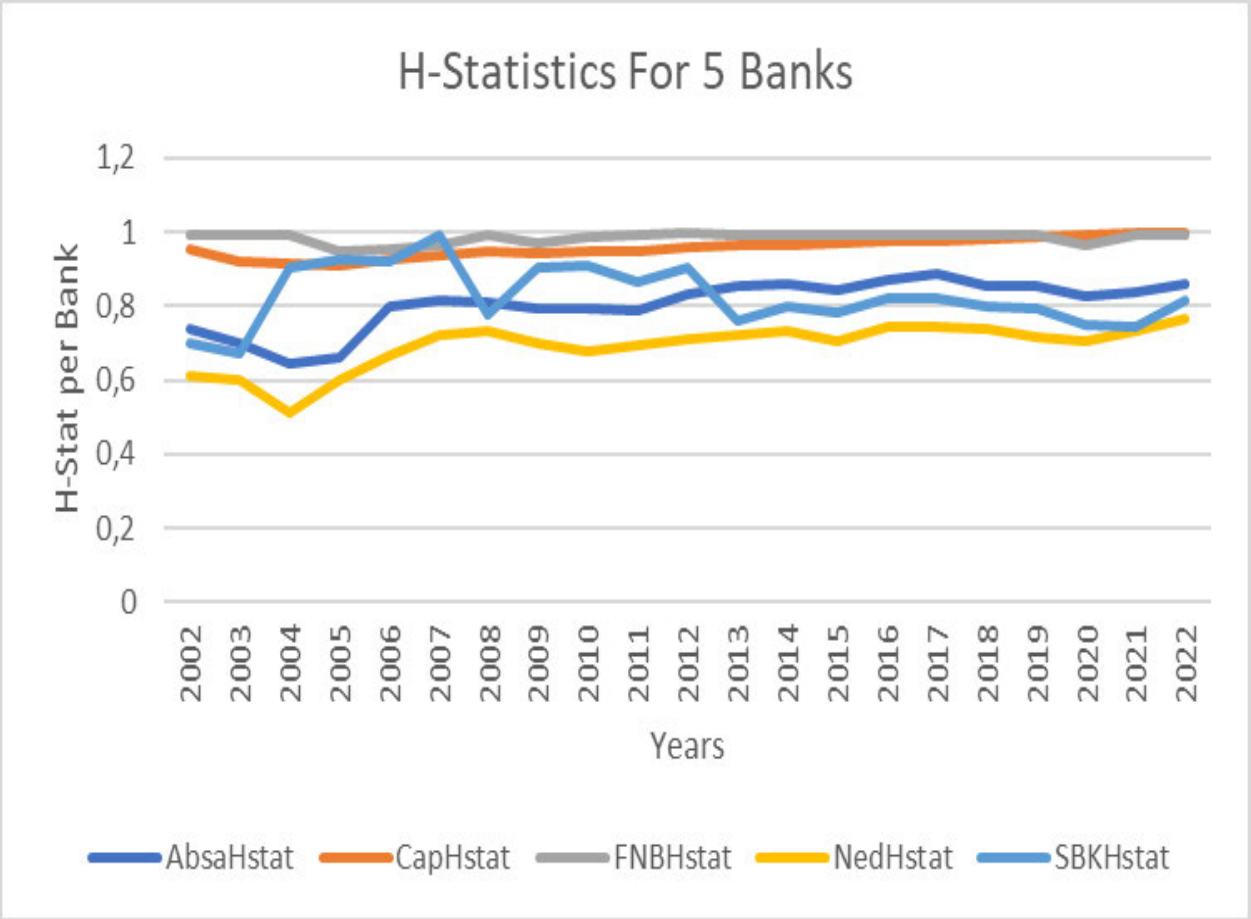

FIGURE 4: H- STATISTICS FOR ALL 5 BANKS

Source: Author's compilation (2024)

The degree of competition is measured by H-statistics with South Africa's big-5 commercial banks. The H-statistics highlighted for all banks range from 0> H<1 and confirm the monopolistic competition amongst commercial banks. The output of the analysis indicate that H-statistichas a minimum of 0.6427824 for Absa Bank; 0.9095532 for Capitec; 0.9482103 for FBN; Nedbank is 0.5144629 and Standard bank has a Min of 0.67314112. Therefore, the result confirms that there are monopolistic competitive banking systems across this sector. These findings are consistent with prior scholars who employed H-statistics to examine the level of competition between banks (Fosu *et al*., 2017; Mlambo and Ncube 2017). The study by Mlambo and Mupunga (2018) examines the degree of competition in Zimbabwe's banking industry. Two measures of competition were employed, namely the H-statistic and Lerner index. The findings for both approaches signify that banks are operating in a monopolistic

condition. The result was estimated as follows: the Lerner index is 0.3 and the H-statistic is 0.461 for the years 2009-2016.

Objective 2

4.5 To Explore the effect of competition on South African banks' risk-taking behaviour

Both the fixed and random effects models were used in the study to investigate how competition affects banks' willingness to take risks. Four risk-taking metrics were used in the analysis: Z-score, capital adequacy ratio (CAR), cost-to-assets ratio (CAR), and non-performing loans (NPLs). The outcomes of these models satisfied the regression approach's prerequisites. The H-statistic and Lerner index were employed as stand-ins for the level of bank rivalry. Furthermore, macroeconomic variables and attributes unique to individual banks were used as control variables.

Lerner Index Random effect GLS

The above table represents the findings of the regression of panel par on the effect of banking competition on banks' risk-taking measured using the Lerner index, including the risk-taking behaviour proxy, which are the Z-score, non-performing loans and CAR. Bank specification and macroeconomic factors were banks' control variables. The Lerner index coefficient proxy on Z-score (3.445771), NPL (-10.426033) and CAR (10.496323). The p-value indicates significance at 1% for the Z-score, while it is at 5% for CAR and NPLs. Competition is positive and significant with the Z-score and CAR, while on the other hand, competition is negatively related with NPLs. Some studies conducted in South Africa and the SSA region used LI to investigate the effect of banking competition on risk-taking. The findings of this study are in line with the other scholars (Leroy and Lucotte, 2017).

TABLE 8: LERNER INDEX RANDOM EFFECT GLS RESULT

Variable	NPL	LIQ	CAP	ZSCORE

LI	**-27.82749**	**-119.6184**	**576.2553**	**-153.3893**
	*0.000***	*0.000***	*0.000***	*0.000***
BSIZE	**.0628832**	**.0195242**	**-1.73918**	**-.8059804**
	*0.058***	*0.798*	*0.048***	*0.000***
ROA	**.111477**	**-.504191**	**4.637631**	**-.2574719**
	*0.000***	*0.000***	*0.000*	*0.191*
ROE	**-.0050919**	**.0486309**	**-.4911395**	**.0423771**
	*-.012****	*0.000****	*0.000*	*0.087**
GDP	**-.3275445**	**.4217688**	**6.23577**	**1.150016**
	0.000	*0.024***	*0.009*	*0.063**
INFL	**-.0126876**	**.388284**	**.4988206**	**.123993**
	0.196	*.039***	*0.055***	*0.065**
_cons	**35.50044**	**108.1895**	**-701.5093**	**135.7054**
	0.000***	0.000***	0.011**	0.000**
No OB	**105**	**105**	**105**	**105**
R^2	**0.7993**	**0.256**	**0.8195**	**0.7345**
Prob	**0.0000**	**0.0000**	**0.0000**	**0.0000**

Source: *Author's own estimates* (*2024*)

where

p value in *italic*

*** = statistical significance at the p<1% level of significance (l.o.s)

** = statistical significance at the p<5% level of significance (l.o.s)

* = statistical significance at the p<10% level of significance (l.o.s)

The empirical results on banking competition as determined by the Lerner index are shown in Table 8, along with risk-taking-related control factors. Liquidity risk and non-performing loans (NPLs) have coefficients of -119.6184 and -27.82749 respectively. The Z-score has a value of

-153.3893, whilst the Capital Adequacy Ratio (CAP) displays a coefficient of 576.2553. Strong negative relationships are indicated by the negative coefficients for NPLs, Liquidity Risk and Z-score, all of which are significant at the 1% level. These results imply that risk-taking behaviour in South African commercial banks is strongly influenced by competition, as determined by the Lerner index. More specifically, a higher Z-score denotes more financial stability when market power is reduced or competition is increased, as long as a higher Lerner index denotes less competition.

The percentage of loans that are either in default or unlikely to be repaid by borrowers is represented by the Non-Performing Loan (NPL) ratio, which is a crucial measure of credit risk (Beck *et al*. 2013). The analysis finds that while there are notable correlations between risk-taking and competition at some banks, there are no discernible patterns at all. These results are consistent with the theoretical frameworks put forth by Boyd and De Nicolò (2005) and are backed by empirical research highlighting the intricate and multidimensional characteristics of bank risk-taking and its determinants, including studies by Berger and Bouwman (2013), Demirgüç-Kunt and Huizinga (1999) and Jiménez *et al.* (2014).

The regression results reveal mixed findings regarding the relationship between banking competition and risk-taking behaviour, as measured by the NPL Ratio, across different South African commercial banks. While some banks exhibit significant associations between competition and risk-taking, others show no clear pattern. The findings resonate with theoretical frameworks proposed by Boyd and De Nicolò (2005) and empirical studies by Berger and Bouwman (2013), Demirgüç-Kunt and Huizinga (1999) and Jiménez *et al*. (2014), which highlight the multifaceted nature of bank risk-taking and its determinants.

This finding is consistent with the evidence in the literature on banking competition, which it measured using the Lerner index (Jimenez *et al*. 2013; Tan 2016; and Siaf-Alyousfi *et al.* 2020). The study of Moudud-Ul-Huq (2021) examines banking competition and risk-taking in BRICS countries from the period 2000 to 2015. The finding shows that the Lerner index has negative significance to NPLs and Z-score. According to Louhichi *et al*. (2020), the Lerner index reflects a significant negative coefficient with the Z-score. Additionally, the study by Mateev *et al.* (2021) investigated the impact of market competition and regulation on the risk-taking behaviour of 18 Middle East and North African banks. The data for 14 years from the

period of 2005 to 2018 were used. The study found that competition has an insignificant influence on the connection between CAR and risk.

TABLE 9:H- STATISTIC RANDOM- EFFECTS GLS REGRESSION RESULT

Variable	**NPL**	**LIQ**	**CAP**	**Z Score**
Hstat	**.1099061**	**.1791795**	**13.47455**	**3.527095**
	0.682	*0.764*	*0.037***	*0.036***
BSIZE	**.0319017**	**-.1611964**	**-1.834404**	**-1.113409**
	0.461	*0.094**	*0.078***	*0.000****
ROA	**.1636172**	**-.016593**	**2.71894**	**-.1256724**
	*0.000****	*0.843*	*0.003****	*0.594*
ROE	**-.02133035**	**-.0008777**	**-.2484441**	**-.0642353**
	*0.000****	*0.922*	*0.011***	*0.011***
GDP	**-.4303197**	**.1668223**	**8.420586**	**.5939891**
	*0.000****	*0.503*	*0.002****	*0.397*
INFL	**-.223295**	**-.0006889**	**.6485893**	**.0615915**
	*0.069**	*0.980*	*0.028***	*0.423*
_cons	**11.19415**	**-1.392502**	**-199.6604**	**1.449413**
	*0.000****	*0.813*	*0.002****	*0.930*
No OB	**105**	**105**	**105**	**105**
R^2	**0.6830**	**0.2269**	**0.7658**	**0.6504**
Prob	**0.0000**	**0.0001**	**0.0000**	**0.0000**

Source: *Authors own estimates* (*2024*).

where

p value in *italic*

*** = statistical significance at p<1% level of significance (l.o.s)

** = statistical significance at p<5% level of significance (l.o.s)

* = statistical significance at p<10% level of significance (l.o.s)

Table 9 above is regressed using Random effects GLS regression approach, to show the effect of banking competition on risk-taking behaviour. The H-statistic is the proxy of banking competition while risk-taking represented by the Z-score, NPLs, CAR, CAP and control variables (bank specification and macroeconomic factors) were in place in this examination.

The coefficient of competition proxied by the H-statistic to NPLs has 0.1099061 with a p-value of 0.682, which indicates a positive correlation with no significance. LIQ has a coefficient of 0.1791795 with the corresponding p-value of 0.764 also not significant. CAP and Z-score have a positive coefficient of 13.47455 and 3.527095, and the p-value amounted to 0.037 and 0.036 respectively. They both indicate a 5% significance level. Bank size shows positive insignificance to NPLs, while ROA, ROE and GDP are significant at 1% to NPLs and IFLN with a 10% significance level. The positive coefficient of the H-statistic and significance shows that any increase in banking competition leads to a decrease in the market power. The result links with the findings of prior research that employs the H- statistic to assess the banking competition (Bosiu 2018; Mlambo and Ncube 2011). This finding contradicts some expectations in the literature, which propose that increased competition might drive risk-taking behaviour as banks seek to gain market share (Boyd and De Nicolò, 2005). However, it aligns with the argument put forth by Jiménez *et al*. (2014), who found that higher market concentration can lead to lower risk-taking due to reduced competitive pressures.

TABLE 10: LERNER INDEX FIXED EFFECTS REGRESSION RESULT

Variable	**NPL**	**LIQ**	**CAP**	**Z Score**
LI	**-20.70441**	**-119.6184**	**606.4182**	**-308.7411**
	*0.000***	*0.000***	*0.000***	*0.000***
BSIZE	**-.0150206**	**.0195242**	**-2.280738**	**-.6960595**
	0.673	*0.798*	*0.032***	*0.004****
ROA	**.1457521**	**-.504191**	**4.030851**	**.0672642**
	*0.000****	*0.000****	*0.000****	*0.000*
ROE	**-.0131079**	**.486309**	**-.4725927**	**.0672642**
	*0.001****	*0.000****	*0.000****	*0.006****
GDP	**-.174181**	**.4217688**	**6.799229**	**1.654349**
	*0.045***	*0.024***	*0.009****	*0.004****
INFL	**-.0105377**	**.0388384**	**.481233**	**.1830774**
	0.227	*0.039***	*0.064**	*0.002****
_cons	**25.43422**	**108.1895**	**-738.223**	**276.5875**
	*0.000****	*0.000****	*0.000****	*0.000****
No OB	**105**	**105**	**105**	**105**
R^2	**0.7484**	**0.0256**	**0.8178**	**0.1678**

Prob	**0.0000**	**0.0000**	**0.0618**	**0.0000**

Source: *Author's own estimates* (*2024*)

where:

p-value in *italics*

*** = statistical significance at the p<1% level of significance (l.o.s)

** = statistical significance at the p<5% level of significance (l.o.s)

* = statistical significance at the p<10% level of significance (l.o.s)

This is the result of the fixed effect regression model, which investigates the effect of competition on bank risk-taking behaviour. Competition is measured by the Lerner index, while the risk-taking matrix is measured by the NPLs, LIQ, CAP and Z-score. This interpretation puts more focus on the coefficient and p-vales of the variables. The Lerner index indicates the coefficient -20.70441 with a p-value of 0.000 highly significant to the NPLs. This suggests that banking competition increases as NPLs decrease. Furthermore, results indicate that when there is intense competition, few banks take risks and have better credit performance. The negative coefficient of -119.6184 and highly significant p-value of 0.000 on the Lerner index for LIQ is found. This specifies that as competition increases, banks' liquidity decreases. South African commercial banks highly used their liquid assets in competitive environments to invest. A positive coefficient of 606.4182 and significant p-value of 0.000 for the learner index on CAP signify that banks are motivated to keep more capital as a safeguard against risk-taking when there is intense competition. The Z-score has a Lerner index with a coefficient of -308.7411 and a p-value of 0.000. This result implies that an increase in competition reduces the insolvency risk of banks. Mustafa and Toci (2018) examine the impact of competition on bank risk-taking in transitioning economies of Central and South-Eastern Europe using the Panza Rosse H-statistic. The panel data set of 15 banks for the period 1999 to 2009 were employed and measured using the Fixed effect method. The evidence suggests that competition negatively impacts the bank's risk-taking.

TABLE 11: H-STATISTIC WITH FIXED EFFECT REGRESSION

Variable	**NPL**	**LIQ**	**CAP**	**Z Score**
H-Stat	**.8621916**	**.5667406**	**6.831715**	**5.904569**
	*0.017**	*0.596*	*0.528*	*0.048***
BSIZE	**-.0721878**	**-.2564656**	**-1.000929**	**-1.463029**

	*0.042***	*0.016***	*0.350*	*0.000****
ROA	**.2335827**	**.0271661**	**1.284492**	**.003612**
	*0.000****	*0.761*	*0.158*	*0.988*
ROE	**-.0221825**	**-.002125**	**-.2189569**	**-.065422**
	*0.000****	*0.814*	*0.019***	*0.010***
GDP	**-.2364529**	**.3644033**	**6.425239**	**1.202011**
	*0.012***	*0.194*	*0.025***	*0.122*
INFL	**-.0210576**	**.0019786**	**.6155162**	**.0638746**
	*0.023***	*0.942*	*0.029**	*0.400*
_cons	**6.593543**	**-5.833467**	**-148.8009**	**-12.5074**
	*0.002****	*0.359*	*0.023***	*0.477*
No OB	**105**	**105**	**105**	**105**
R^2	**0.9909**	**0.8516**	**0.9887**	**0.9778**
Prob	**0.0000**	**0.0028**	**0.0010**	**0.0173**

Source: *Author's own estimates* (*2024*)

where: p-value in *italics*

*** = statistical significance at the p<1% level of significance (l.o.s)

** = statistical significance at the p<5% level of significance (l.o.s)

* = statistical significance at the p<10% level of significance (l.o.s)

These results include findings from the panel fixed effect regression model, which examines the effect of competition using the H-statistic to examine banking competition. The dependent variables that represents bank risk-taking are NPLs, LIQ, CAP and Z-score. The H-statistic as the measure of competition signifies that NPLs and Z-scores have positive coefficients 0.86219 and 5.904569 respectively, significant at the 5% level, with the corresponding p-values of 0.017 and 0.048. Positive coefficients indicate that the increase in competition is connected with higher NPLs. This suggests that banks may take on riskier loans to compete more fiercely, which could increase loan defaults. The positive significant coefficient implies that competition rises and the Z-score increases, demonstrating that banks may become stable and less risky, even while engaging in the more competitive market. It is noted that LIQ and CAP have coefficients that are positively not significant, specifying that there is no statistical significance in the effect of competition on both LIQ and CAP. These findings were in line with the result

of Banyan (2021), who examined the effect of competition on risk-taking behaviour in 47 African countries. The findings that competition and risk-taking behaviour have a significantly positive impact in Africa support the competition fragility views relationship.

4.6 Hausman test

The Hausman test results provided include the coefficients, degrees of freedom (DF), m-value, and p-value (Pr > m) for several variables: NPLs (Non-Performing Loans), CAP (Capital), Z-SCORE, and LIQ (Liquidity). This is when the H-stat is introduced as the measure of competition.

TABLE 12: HAUSMAN TEST FOR RANDOM EFFECTS (WITH H-STAT AS A MEASURE OFCOMPETITION)

Hausman Test for Random Effects				
Variable	**Coefficients**	**DF**	**m Value**	**Pr > m**
NPLs	6	6	4.21	0.6484
CAP	6	6	8.19	0.2245
Z-SCORE	6	6	5.92	0.4322
LIQ	6	6	4.65	0.5900

Source: *Author's own estimates* (*2024*)

H_0: The random effects model is appropriate

H_1: The fixed effects model is appropriate

The findings from the Hausman Test for Random Effects indicate that for all the variables listed (NPLs, CAP, Z-SCORE, LIQ), the p-values are greater than 0.05. This means that for each variable, the null hypothesis indicates that the difference in coefficients is not systematic and cannot be rejected. Therefore, the random effects model is appropriate for these variables, implying that the unique errors (random effects) are not significantly correlated with the regressors.

The Hausman test results provided include the coefficients, degrees of freedom (DF), m-value and p-value (Pr > m) for several variables: NPLs (Non-Performing Loans), CAP (Capital), Z-SCORE and LIQ (Liquidity). This is when the LI is introduced as the measure of competition.

TABLE 13: HAUSMAN TEST FOR RANDOM EFFECTS (WITH LI AS A MEASURE OF COMPETITION)

Hausman Test for Random Effects				
Variable	**Coefficients**	**DF**	**m Value**	**Pr > m**
NPLs	6	6	1.86	0.9318
CAP	6	6	2.73	0.8416
Z-SCORE	6	6	12.87	0.0451
LIQ	6	6	20.83	0.0020

Source: *Author's own estimates* (*2024*)

H_0: The random effects model is appropriate

H_1: The fixed effects model is appropriate

The findings from the Hausman test for Random Effects suggest that the random effects model is appropriate for NPLs and CAP as there is no significant evidence of correlation between the random effects and the regressors. In contrast, for the Z-score and Liquidity (LIQ), the fixed effects model is recommended because the p-values are below 0.05, indicating significant differences that imply a correlation between the random effects and the regressors. Based on these results, one can further explore the implications and reasons for choosing between fixed and random effects models for the variables NPLs, CAP, Z-score and LIQ. This choice is crucial as it affects the interpretation of the model and the reliability of the estimates.

Objective: 3

4.7 To Investigate the Possibility of Any Threshold Effect in the Relationship Between Competition and Bank Risk-Taking Behaviour in South Africa

4.7.1 Relevant Results and Analysis

The contradictory results on competition measures and the literature that supports them point to the possibility of a non-linear relationship between competitiveness and risk-taking in South

African banks, even though a formal test for a threshold effect is not practical. In the future, a larger dataset and more sophisticated econometric techniques could be used to more thoroughly investigate the existence and characteristics of any threshold effects.

The idea of a threshold effect raises the possibility that there may be more to competition and risk-taking than meets the eye. There can be a certain degree of competitiveness at which the direction of the impact on risk shifts. For example, some research, such as that done by Boyd et al. (2009), contends that little competition lowers the motivation to take unwarranted risks in highly concentrated markets. However, in very competitive markets, banks can use aggressive lending techniques to draw in business, which could raise their exposure to risk.

The inconsistent findings for competition measures, such as the H-Stat and Lerner Index, throughout the regressions may point to a non-linear relationship, even if data restrictions preclude formal testing for a threshold impact. The market concentration-based Lerner Index may be a better measure of the relationship between competition and risk in South Africa. A more conclusive understanding of this link may be possible with threshold econometric techniques and larger sample sizes in future research.

TABLE 14: FIXED EFFECT PANEL THRESHOLD REGRESSION RESULT

Variable		**NPL**		**CAP**		**LIQ**		**ZSCORE**
	Model 1	**Model 2**	**Model 1**	**Model 2**	**Model 1**	**Model 2**	**Model 1**	**Model 2**
Dome-to-p- threshold								
0	**-16.588**	**-6.296**	**404.434**	**437.019**	**-13.399**	**-127.668**	**-207.192**	**-347.634**
	*0.000***	*0.194*	*0.000***	*0.000***	*107*	*0.000***	*0.000***	*0.000***
1	**-15.302**	**-7.417**	**220.176**	**431.748**	**-168.532**	**-127.322**	**-537.113**	**-344.106**
	*0.015***	*0.122*	*0.210*	*0.001***	*0.000***	*0.000***	*0.000***	*0.000***
2		**-6.438**		**459.089**		**-126.884**		**-342.581**
		0.184		*0.000***		*0.000***		*0.000***
3		**-6.301**		**433.954**		**-127.382**		**-343.805**
		0.195		*0.001***		*0.000***		*0.000***
_cons	**60.294**	**12.280**	**393.692**	**-514.010**	**13.934**	**114.884**	**205.634**	**299.333**

	*0.000***	*0.013**	*0.000***	*0.000***	*0.086**	*0.000***	*0.000***	*0.000***
TH-1	**7.1203**	**22.229**	**5.7504**	**22.616**	**8.933**	**28.147**	**6.214**	**22.229**
TH-21		**22.441**		**22.616**		**28.147**		**22.229**
TH-22		**22.616**		**22.229**		**22.229**		**-11.152**
TH-3		**26.874**		**19.489**		**10.192**		**28.147**
Threshold effect								
F-stat-p-value								
Single	**42.82**	**7.450**	**34.76**	**3.250**	**134.09**	**11.370**	**150.77**	**6.150**
	*0.093**	*0.360*	*0.003***	*0.617*	*0.000***	*0.277*	*0.000***	*0.777*
Double		**32.740**		**61.380**		**9.740**		**8.950**
		*0.000***		*0.000***		*0.207*		*0.303*
Triple		**4.980**		**10.590**		**3.530**		**4.800**
		0.810		*0.520*		*0.910*		*0.693*
Obs	**105**	**105**	**105**	**105**	**105**	**105**	**105**	**105**
Rsquared	**0.8417**	**0.9922**	**0.6469**	**0.9903**	**0.902**	**0.5606**	**0.9508**	**0.0816**
Rho	**0.324**	**0.865**	**0.761**	**0.278**	**0.1066**	**0.910**	**0.4959**	**0.855**
Prob >f	**0.000**	**0.0000**	**0.000**	**0.000**	**0.0000**	**0.0000**	**0.0000**	**0.0003**

Source: *Author's own estimates* (*2024*)

The single threshold is represented by the Th-1, while the Th-21 and Th-22 donate a double threshold and the is a three threshold model TH-3. Different thresholds are represented as 0, 1, 2 and 3. The F-statistic and its corresponding p-value are used to analyse the threshold effect which has the single, double and triple threshold. The p-value in *italic* *** = statistical significance at the p<1% level of significance (l.o.s), ** = statistical significance at the p<5% level of significance (l.o.s), and * = statistical significance at the p<10% level of significance (l.o.s).

The result of model 1 revealed a negative relationship with competition, indicating that increased competition may reduce NPLs (coefficient: -16.588, p-value: 0.000). CAP shows a strong positive relationship (coefficient: 404.434, p-value: 0.000), suggesting that competition boosts capital adequacy. LIQ shows a negative impact of competition on liquidity (coefficient: -13.399, p-value: 0.107). The Z-score indicates a negative relationship (coefficient: -207.192,

p-value: 0.000), suggesting that competition might reduce stability. Model 2 suggests a similar negative relationship, but with varying intensity across thresholds (coefficients: -6.296 to -7.417, p-values: 0.194 to 0.122). Model 2 also supports this finding with even stronger coefficients at certain thresholds (up to 459.089, p-values: 0.000), also provides a more varied picture with larger negative impacts (coefficients: -127.668 to -168.532, p-values: 0.000). and shows an even significantly negative impact (coefficients: -342.581 to -537.113, p-values: 0.000).

The presence of single, double and triple thresholds highlights the non-linear effects of competition on risk-taking. The single threshold captures the basic impact of competition on risk-taking behaviour. Initial increases in competition are often beneficial, improving loan quality and capital adequacy. The double threshold Th-21, Th-22 suggests more complex interactions where the effect of competition changes significantly at certain points. The distinctions in the coefficients across the threshold indicate the non-linear effect on the relationship between banking competition and risk-taking behaviour. For example, banks might initially respond to competition by improving capital but later face liquidity challenges. Moreover, the triple threshold Th-3 represents a different indication that beyond a certain level, the adverse effects of competition on liquidity and stability become more pronounced.

The analysis reveals a complex interplay between competition and risk-taking in South African commercial banks, characterized by threshold effects. While competition can enhance credit quality and capital adequacy, it also poses challenges to liquidity and stability at higher levels. These insights underscore the importance of balanced regulatory frameworks that foster competition while mitigating potential risks. The findings from the analysis provide strong evidence to reject the null hypothesis (H0) and support the alternative hypothesis (H1). The presence of statistically significant thresholds in the relationship between competition and bank risk-taking behaviour indicates that competition impacts banks differently depending on its intensity. This underscores the importance of considering these threshold effects in regulatory and competitive strategies for the banking sector.

Moreover, the inconclusive findings for the competition measures and the existence of relevant literature suggest a non-linear relationship between competition and risk-taking. This finding is supported by the theoretical framework of Martinez-Miera and Repullo (2010), which indicates the U-sharp relationship between competition and risk-taking behaviour. Another

related study supports the non-linear relationship between competition and risk-taking behaviour (Jimenez, Lopez and Saurina 2013; Pozo and Rojas 2020). Gonzalez *et al.* (2017) investigate the correlation between banking competition and the stability of the MENA region. A sample of 356 banks was used for the years 2005 to 2012. Evidence confirms the U-sharp relationship between competition and risk-taking behaviour of the MENA banking sector.

This Graph Explain the Threshold Effect

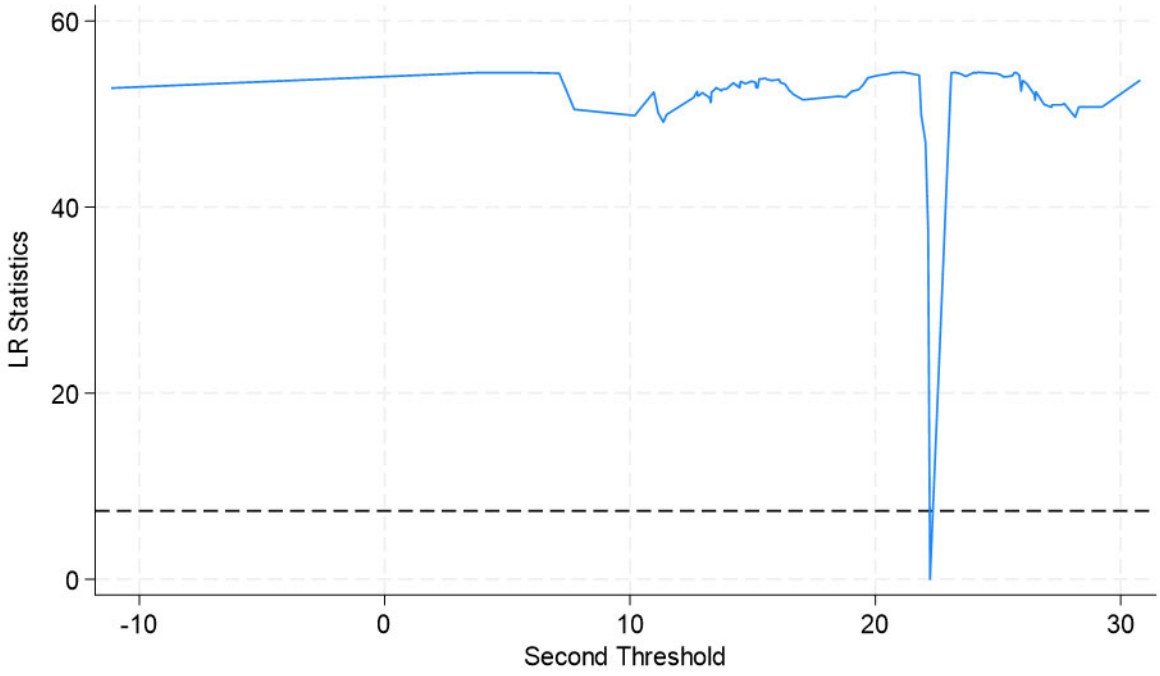

FIGURE 5: GRAPH EXPLAIN THE THRESHOLD EFFECT

Source: Author's compilation (2024)

The findings from the Figure 5 point at around the threshold value of 21, where the LR statistic significantly exceeds the critical value, strongly suggesting that a threshold exists. The horizontal line donates the critical value at 7.35 of the LR statistic at the 95 percent confidence level. This signifies that there is a non-linear relationship between competition and risk-taking behaviour. This result supports the hypothesis that there is a threshold effect in the relationship between competition and bank risk-taking behaviour. This is statistically indicated by the changes in LR statistics at the threshold, highlighting the shift in the risk-taking behaviour of banks. These findings are aligned with the literature of the study by Shabir *et al.* (2021) that investigated the effect of economic policy uncertainty on stability panels that were employed from the years 2005 to 2019. The result indicates a significant threshold effect on bank stability. Furthermore, the single and double threshold are statistically significant, while the triple

threshold is not statistically significant. Akande *et al*. (2021) conducted a study that assessed the effects of competition on financial access. The fixed effects panel threshold regression model was used to measure the threshold effect of competition. Evidence shows the existence of a threshold effect on firm's access to finances.

4.8 Diagnostic Test

4.8.1 Test for Normality: Shapiro–Wilk W Test

The Shapiro–Wilk W test is a statistical method employed to assess the normality of data distribution. In the context of investigating the relationship between banking competition and risk-taking in South African commercial banks, this test becomes crucial for understanding the underlying assumptions of the data.

TABLE 15: SHAPIRO–WILK W TEST RESULTS

Variable	Obs	W	V	Z	Prob>z
CAP	105	0.98912	2.734	2.034	0.5774
CAR	105	0.92608	1.811	1.201	0.11487
NPL	105	0.89028	2.689	2.000	0.2277
Z-Score	105	0.95483	1.107	0.205	0.41864

Source: *Author's own estimates* (*2024*)

As shown in Table 15 the Shapiro-Wilk test for LIQ produces a W statistic of 0.98912, and the p-value shows an insignificant 0.5774, which is higher than 0.05. This indicates that the null hypothesis of a normal distribution is not rejected. For CAP, the W statistic is 0.92608 and the Z statistic is 1.201. The p-value of 0.11487 is greater than 0.05, suggesting that there is insufficient evidence to reject the null hypothesis. Therefore, CAP can be considered approximately normally distributed. The W statistic for NPLs is 0.89028, the Z statistic is 2.000, and the p-value is 0.2277. Similar to CAP, the p-value is above 0.05, indicating an absence of significant evidence against the null hypothesis. Therefore, NPL can be assumed to be reasonably normally distributed. Lastly, the Z-score has a W statistic of 0.95483, which confirms the higher quality of normality between variables since the W value is closer to 1. The p-value of 0.41864 is higher than 0.05, therefore the study fails to reject the null hypothesis, which implies that the Z-score has been normally distributed.

The findings align with Tabachnick and Fidell's (2013), emphasising the importance of normality assumptions. Research by Tabachnick and Fidell (2013) suggests that normality assumptions are essential for accurate inferential statistics. It is essential to acknowledge that normality assumptions are often challenging to meet in real-world financial data. The Shapiro–Wilk W test results highlight variable-specific deviations from normality. CAP, LIQ, NPL and Z-score show relatively normal distributions. These findings contribute to the nuanced understanding of the data's characteristics, guiding the researcher in choosing appropriate statistical methods for subsequent analyses.

4.8.2 Test for Autocorrelation: Breusch–Godfrey LM

The Breusch–Godfrey Serial Correlation LM test is a valuable statistical tool for detecting the presence of autocorrelation in the residuals of a regression model. Autocorrelation, or serial correlation, occurs when error terms in a time-series model are correlated across periods (Akpan and Moffat, 2018). In examining the relationship between banking competition and risk-taking in South African commercial banks, identifying autocorrelation is crucial as it can significantly impact the reliability of regression analysis results. The test results for autocorrelation in this study are as follows:

TABLE 16: BREUSCH–GODFREY LM TEST RESULTS

lags(p)	chi2	Df	Prob > chi2
1	0.138	1	0.7102

Source: *Author's own estimates* (*2024*)

The Breusch–Godfrey LM test's null hypothesis states that there is no serial correlation of any order up to p. This study's specific test, with one (1) lag, yields a chi-square statistic of 0.138 with a p-value of 0.7102. Given that the p-value is significantly above the conventional significance level of 0.05, this study does not have sufficient evidence to reject the null hypothesis. This indicates that there is no significant autocorrelation in the residuals of the regression model at lag 1. The findings align with the literature on financial studies, emphasising the importance of diagnostic tests to ensure the robustness of regression analysis. For instance, Wooldridge (2010) highlights that detecting autocorrelation is paramount in time-series analyses to avoid spurious regression results. This study's adherence to these diagnostic

checks enhances the credibility and reliability of the findings regarding the impact of banking competition on risk-taking behaviour. The Breusch–Godfrey LM test for autocorrelation indicates no significant serial correlation in the residuals of the model. This finding underpins the validity of this study's regression analysis, supporting the integrity of this investigation into the dynamics of banking competition and risk-taking in South African commercial banks. The absence of autocorrelation, a critical assumption in regression analysis, suggests that the estimated relationships are reliable, providing a solid foundation for further analysis and discussion on the topic.

4.8.2.1 Significance of Results

The absence of autocorrelation is a positive outcome for this analysis. Autocorrelation can lead to inefficient ordinary least squares (OLS) estimators, making standard errors biased and leading to unreliable hypothesis tests. These results suggest that the OLS estimators used in this study's analysis to investigate the relationship between banking competition and risk-taking amongst South African commercial banks are BLUE (Best Linear Unbiased Estimators), assuming that other classical linear regression assumptions hold.

4.8.3 Test for Heteroscedasticity: Breusch–Pagan/Cook–Weisberg Test

The Breusch–Pagan/Cook–Weisberg test assesses heteroscedasticity in the model's error terms, a critical aspect in studying the relationship between banking competition and risk-taking in South African commercial banks. The results from the Breusch–Pagan/Cook–Weisberg test for the current study are as follows:

TABLE 17: TEST FOR HETEROSCEDASTICITY: BREUSCH–GODFREY LM TEST RESULTS

chi2(8)	**Prob > chi2**
12.37	0.1352

Source: *Author's own estimates* (*2024*)

The null hypothesis for the Breusch–Pagan/Cook–Weisberg test posits that there is homoscedasticity, meaning that the variance of the error terms is constant across all levels of the independent variables. A rejection of this hypothesis would imply evidence of heteroscedasticity. Given the p-value of 0.1352, which is greater than the conventional alpha

level of 0.05, the study fails to reject the null hypothesis. This suggests that there is no statistically significant evidence of heteroscedasticity in the model, which is also evident in the scatter plot below, indicating that the variance of the residuals is constant across the various levels of the independent variables.

The study's statistical conclusions are supported by the lack of heteroscedasticity in this investigation. This result demonstrates the objectivity of the computed standard errors of the regression coefficients, supporting the validity of the confidence intervals and hypothesis testing carried out in this investigation. This strengthens the validity of the study on how risk-taking behaviour in South African commercial banks is influenced by banking rivalry. These results are in line with the larger body of empirical research, which often stresses how crucial it is to test for heteroscedasticity in regression studies, particularly when dealing with financial and economic contexts. Such tests are necessary to ensure analytical accuracy because financial datasets frequently have features that can contribute to heteroscedasticity, as noted by Greene (2018). Additionally, this study's approach is consistent with research like that of Demsetz and Strahan (1997), which investigated the connection between market structure and bank performance and emphasized the importance of thorough econometric diagnostics.

The results from the Breusch–Pagan/Cook–Weisberg test suggest that the current model does not suffer from heteroscedasticity. This finding is pivotal for the research into the relationship between banking competition and risk-taking in South African commercial banks as it validates the use of standard econometric approaches for inference. By ensuring that the current model's residuals exhibit constant variance, the researcher lays a solid foundation for accurately interpreting the effects of banking competition on risk-taking behaviours, contributing valuable insights into the financial stability and regulatory implications for the South African banking sector.

4.9 Discussion of findings and policy implications

Table 6, the degree of competition in the banking sector, is measured by the Lerner index. The results on the South African banking industry indicate that there is a higher market power and relatively low competition amongst commercial banks. This implies that the South African banking sector is concentrated, which gives large banks an advantage to keep their dominance

and it has a barrier for new banks to enter the market. This result is consistent with the findings of Moyo (2018) and Vilakazi (2021), whose evidence shows that South African banks operate in a lower competitive market which leads to higher market concentration. Table 7 used the H-statistic to examine the level of banking competition. Results range between $0<H<1$, which signifies that the competitive environment in South African commercial banks is monopolistic. These findings are in line with prior studies on banking competition (Simatele 2015; Simbanegavi *et al*. 2015; Moyo 2018), which commonly observed monopolistic competition within the South African banking industry. Policymakers and decision-makers need to enforce regulations that will enhance banking competition, especially amongst these five dominant banks.

The effect of competition on bank risk-taking behaviour is estimated by the fixed and random effects. As banking competition is measured by the Lerner index and H-statistic, it also signifies the different effects to risk-taking. Tables 8 and 10 Lerner index indicated the most negative significance to the risk indicators, which are NPLs, LIQ and Z-scores, while the CAP has positive significance. The negative coefficient of competition measure LI raises it and decreases the degree of risk-taking. However, the rise in LI denotes a decline in banking competition. The inverse correlation between LI and the degree of risk-taking suggests that a decrease in competitiveness leads to a decrease in risk. This indicates that competition and risk level go hand-in-hand, showing a positive relationship. The negative sign shows that South African commercial banks choose to take less risk by investing in low-risk portfolios, or they are more cautious when there is a decrease in competition, leading to an increase in the Lerner index (Siaf-Alyousfi *et al*. 2020). The negative significance of competition aligns with the competition fragility theory, which indicates that the banks engage in risky investments to protect their competition intensification (Akande *et al.* 2018;). The evidence indicates that the competition by LI is the risk-taking behaviour in the South African banking sector, regardless of risk measure. This is consistent with the existing literature that used LI to examine banking competition (Jimenez *et al.* 2013; Tan 2016; and Siaf-Alyousfi *et al.* 2020).

However, when competition is measured using the H-Sata on Table 8 and Table 10, findings show a positive coefficient for all risk measures. However, not all of them are significant, as Table 9 shows that the CAP and Z-score are statistically significant while the NPLs and LIQ are insignificant. Table 11 indicates a significant NPLs and Z-score, while CAR and CAP show

that they are not significant. The significant positive coefficient on CAP signifies that as competition increases, South African banks tend to hold larger capital. This serves as a safeguard since a higher capital adequacy ratio indicates a cautious approach to risk management and acts as a buffer against possible loss (Noman *et al*., 2017). In intensely competitive conditions, commercial banks may feel under pressure to take on higher-risk activities to maintain holding higher market shares (Keeley, 1990). Furthermore, these banks understand the significance of keeping more capital to protect against the intensity of banking competition. The liquidity risk and NPLs coefficient are positively not statistically significant. This implies that although competition may have some impact on the degree of NPLs and LIQ, these changes are not material enough to be conclusive (Tan and Anchor, 2017). However, it is most likely that elements such as prevailing economic conditions and regulatory policy have significant influence on these findings. The strong positive relationship found between competition and Z-scores implies that South African commercial banks get more robust when the degree of competition increases. The Z-score examines the distance to the insolvency risk. However, in this finding, the Z-score implies that the competitive condition of commercial banks takes the initiative to decrease the overall insolvency risk (Wu *et al.* 2020) These results argue that an increase in bank competition reduces bank fragility, which leads to higher risk-taking as banks try to maintain their profitability and market share.

The control variable is made by two aspects: bank-specific and macroeconomics. On bank-specific, there are two variables, which is bank size and bank performance (return on assets and return on equity). The bank size examined finds a negative coefficient across all the models measured. This indicates a negative relationship between commercial banks and their attitude to minimal risk-taking (Adu, 2022). In contrast to the risk measures, the two-performance metrics produced contradictory findings. The ROA shows a positive significant coefficient in relation to NPLs and CAP, which indicates that banks increase return on assets as the percentage of NPLs also rises. This implies that a larger profit of the bank may be engaging in risk lending that will result in a higher possibility of NPLs increase. On CAP it signifies that commercial banks use their higher profit to build capital buffers that can protect against the unanticipated loss. The ROE has a negative significant coefficient across the models. Both ROA and ROE findings highlight significant determinants of risk-taking behaviour in South African commercial banks which influence different factors of risk (Nguyen *et al.* 2019). Lastly the terms of the control variable are macroeconomic which are gross domestic product and

inflation. They both have a negative significant coefficient to the risk-taking behaviour (Gonzalez *et al.* 2017). This study confirms that competition has a significant effect on South African bank risk-taking behaviour.

Overall, the findings highlight the multi-faceted nature of bank risk-taking behaviour and the need for a comprehensive approach to assessing risk in the South African banking sector. Future research that incorporates additional bank-specific data that explores alternative competition measures and considers potential threshold effects would provide a more nuanced understanding of the dynamics between competition and risk-taking in this context. While the support for the franchise value hypothesis through the Lerner index results was expected, the mixed findings for the H-Stat coefficient and the possibility of a threshold effect were somewhat surprising. These findings emphasise the need for further research to fully understand the complexities of the competition-risk relationship in the South African banking sector.

The Figure 5 and Table 11 analysis shows a clear threshold effect in the relationship between competition and risk-taking behaviour amongst South African commercial banks. This effect indicates the non-linear dynamic within the banking industry. Moreover, this result suggests that both regulators and bank managers need to consider the dynamics of their decision-making. The finding does not only support the existence of the threshold effect, but it also considers the understanding that competition can influence bank risk-taking behaviour.

4.9.1 Policy Implications

The inconclusive nature of the findings regarding the competition-risk nexus in South African banks presents a challenge for policymakers. On the one hand, fostering competition can potentially enhance efficiency and innovation within the banking sector. On the other hand, excessively fierce competition might incentivise banks to engage in riskier lending practices, potentially jeopardising financial stability.

In light of these considerations, a nuanced approach to competition policy is warranted. Policymakers should consider a framework that promotes a healthy level of competition while mitigating potential risks. Furthermore, the South African banking competition is very low,

and regulators have to enforce competition amongst commercial banks. This might involve encouraging the entry of new, innovative players while ensuring that all banks maintain adequate capital buffers and adhere to sound risk management practices. Additionally, exploring alternative measures of competition and financial stability could provide further insights to inform policy decisions.

4.10 Chapter Summary

This chapter delved into the analysis and interpretation of the empirical findings regarding the relationship between competition and bank risk-taking behaviour in the South African banking sector. Drawing upon the research objectives outlined in Chapter 1, the chapter meticulously examined the collected secondary data to address the study's central hypotheses and research questions.

A critical initial step involved ensuring the robustness of the regression analysis through a series of diagnostic tests. These tests assessed for normality, autocorrelation and heteroscedasticity in the model's residuals. The chapter detailed the results of these tests and their implications for the validity of the statistical inferences drawn from the analysis. Shifting the focus to the core competition measures employed in the study, the chapter presented and analysed the findings for the Lerner Index and the H-statistic. The Lerner Index, which captures market concentration, exhibited a positive and significant relationship with bank health (Z-score and Capital Adequacy Ratio) and a positive but statistically insignificant relationship with the NPLs. This partially supports the competition-stability hypothesis, suggesting that banks in less competitive environments might engage in less risky behaviour to protect their long-term profitability. In contrast, the H-statistic coefficient, another measure of competition, showed mixed significance across the regressions. This highlights the complexity of the competition-risk nexus and the potential limitations of using a single measure to capture the nuances of competition within the South African banking sector.

Furthermore, the chapter explored the possibility of a threshold effect, suggesting that the relationship between competition and risk-taking might not be linear. The mixed findings for the competition measures and the existence of relevant literature point towards the possibility of a non-linear relationship. Future research with a larger dataset and employing threshold

econometrics could definitively explore this possibility.

The chapter then examined the impact of competition on financial stability as measured by the Z-score and the NPLs. The results presented a complex picture. The Lerner index, which again served as a proxy for market concentration, displayed a positive association with bank stability (Z-score). This aligns with the competition-stability hypothesis. However, the relationship between competition and the NPLs was inconclusive. These findings resonate with prior research by Zigraiova and Havranek (2016), who emphasise that the correlation between competition and financial stability can vary depending on the definition of the measure used for stability. The current study highlights the limitations of drawing definitive conclusions based on a single measure of financial stability.

CHAPTER 5
SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary

The purpose of the research was to examine the relationship between banking competition and risk-taking behaviour in the top five South African banks from 2002 to 2022 which is a period of 20 years. Descriptive statistics offer a robust foundation for the subsequent quantitative analyses, providing a nuanced view of the variables under consideration. The unique distributional characteristics of each variable underscore the need for sophisticated modelling techniques to unravel the intricate relationship between banking competition and risk-taking in South African commercial banks.

This research intended to assess the effect of risk-taking behaviour in South African commercial banks. The study specified the objectives that were developed to achieve the main objective as follows: Firstly, to measure the degree of competition; secondly, to explore the effect of competition on banks' risk-taking behaviour; thirdly, the study investigated the possibility of any threshold effect in the relationship between banking competition and risk-taking behaviour in South Africa. The Lerner index and H-Statistic were applied to measure the degree of competition. The result from the Lerner index shows monopolistic competition amongst the top 5 commercial banks in South Africa. The Lerner index lay between 1 and 0 with the average of 0.99. Furthermore, competition is negatively significant with the Z-score. The Learner index indicates that competition measures generally show a negative and significant association with NPL for most banks, indicating that increased competition might be associated with lower levels of NPL. This aligns with the theoretical expectation that competition incentivises banks to improve their credit risk management practices. This finding aligns with the competition fragility theory, suggesting that heightened competition may drive banks towards riskier strategies (Boyd and De Nicolò, 2005). This outcome finds support in studies by Jimenez *et al.* (2013) and Akande *et al.* (2018), highlighting the potential for heightened risk-taking under intense competition.

The result from the panzer rose H-statistic of 0.8539 indicates monopolistic competition within the South African banking sector. The H-Statistics ranges between 0 and 1, which implies that

banks are monopolistic and competitive in the sector. These findings are consistent with the results of Simbanegavi *et al.* (2015) and Ngonyama and Simatale (2017) in studies testing competition in South Africa. The effect of competition on the banking sector was examined using the fixed effect and random effect. The result suggests that competition significantly negative influences risk-taking behaviour. The Lerner index shows that competition has significant negative effects related with the NPLs for commercial banks in South Africa. The Z-score shows a significant effect on the relationship between competition and risk, proxied by the Lerner index.

The Lerner index indicates that competition measures generally show a negative and significant association with NPLs for most banks, indicating that increased competition might be associated with lower levels of NPLs. This aligns with the theoretical framework that competition incentivises banks to enhance their credit risk management practices. This indicated that with the increase in banking competition in the banking sector, fewer losses are likely to arise through non-performing loans. This study also found capitalisation to have a significant influence on risk-taking behaviour. Bank size suggests that there is a link importantly found in revealing the banks' credit risk level. The study found that large banks are less likely to build up NPLs. Profitability was also found to significantly impact credit risk levels. Banks that are more profitable were found to have a tendency of keeping their credit risks low. Economic growth plays an important role in affecting the credit risk level within banks. Specifically, it highlights that banks take more risk as the GDP increases, while less risk is assumed during the inflationary periods. It was further found that less credit risk could be witnessed when inflation rates were high. It is suggested that banks, as a strategy to strengthen their credit management policies, shy away from giving credit to a number of sectors during times of inflation, which could bring down the non-performing loans. The persistence of NPLs impliesthat in the event of a shock in the banking sector, this could either increase or decrease the levelof NPLs as the process of adjustment to the average levels takes some time.

This implies that banks with higher returns on equity may be more inclined to engage in riskier lending practices. The impact of Bank SIZE is negative, suggesting that larger banks may adopt more conservative lending approaches. This nuanced relationship reflects the intricate interplay of various factors in determining risk-taking behaviours. The results provide valuable insights

into the relationship between banking competition and risk-taking in South African commercial banks. The varying impacts across different dimensions highlight the multifaceted nature of this relationship. The significant negative relationship between Return on Equity and Non-performing Loans is particularly noteworthy, contributing to the broader discourse on risk management in the banking sector.

5.3 Conclusion

The conclusion is that competition has a greatly significant effect on South African bank risk-taking behaviours. The body of literature points out two opposing theories, namely competition stability and fragility view. The competition stability theory, championed by Marcus (1984) and Keeley (1986), suggests that increased competition erodes bank franchise value, prompting them to adopt riskier strategies to compensate for declining profits (Arping, 2019). The competition fragility theory finds support in studies by Jimenez *et al.* (2010) and Akande *et al.* (2018), highlighting the potential for heightened risk-taking under intense competition. The result of the study supports the risk-shifting paradigm that propounds that competition was related risk levels in commercial banks.

This study explains its independent variable using the Lerner index and H-Statistic, while the dependent variable is measured by the Z-score, non-performing loans, and capital adequacy risk. Additionally, control variables were considered, which include both macroeconomic factors (gross domestic product and inflation) and bank specifications such as bank size, return on equity and return on assets. The research finds that competition has a significant effect on South African banking risk-taking behaviour. This study used a robust approach to investigate the nexus between competition and risk-taking. The result of the study supports the risk-shifting paradigm that propounds that competition is negatively related to risk levels in commercial banks. This implies that when competition is enhanced in the banking sector, fewer non-performing loans will be reported by banks. The results also confirm a negative relationship between profitability and credit risk, implying that more profitable banks have less credit risk. The study also confirms that larger banks have lesser credit risks than small ones, while better capitalized banks are more attracted to credit risks than less capitalised ones. The study also found that banks are likely to accrue less credit risks during times of higher GDP growth rate, and less at times of inflation.

5.4 Recommendations

The study provides a productive ground for further research and improvements in the field in the region as highlighted below. Firstly, the study examined the direct impact of competition on risk-taking. However, future studies can expand this study by investigating how capital requirements and bank competition may affect bank risk-taking in the South African context. Secondly, future studies may offer more insights by exploring the joint impact of banking regulation and competition on bank risk-taking in South Africa. Lastly, given the likely impact of foreign banks on bank risk-taking in the region, future studies may investigate the impact of the entry of foreign banks on risk-taking behaviour in the region.

Therefore, as a policy suggestion, competition should be fostered in the banking sector. Policies such as free entry into the market, uncapped interest rates and lower capital requirements which enhance the entry of new firms in the market should be adopted. The South African Reserve Bank should also consider lifting the moratorium on banks to enable new banks to be incorporated. This will stiffen competition and as a result reduce credit risks.

5.5 Limitations of the study

While this study offers valuable contributions to the understanding of competition and banks' risk-taking behaviour, it is not without limitations. This research has limitations on the sample size and methods employed in this study. Competition is measured using two structural approaches, which are the Lerner index and Panzer ross H-statistics. The research uses data from 2000 to 2022 for five dominant commercial banks in South Africa. This research has the possibility for extension by exploring how competition influences risks in banks with varying ownership structures. Another avenue for investigation could focus on the impact of competition on various types of risks, such as operational risks, security risks, and those previously mentioned. Additionally, future studies in this area could consider integrating alternative measures of competition, such as the HHI, CR3, CR5 and Boone indicator to provide a more comprehensive understanding. Lastly, other research could be done using all South African commercial banks.

5.6 Future Research Directions

This study opens doors for further research endeavours. Future studies could benefit from employing a larger sample size to allow for more robust statistical analysis, particularly regarding the potential existence of a threshold effect. Additionally, incorporating bank-specific variables such as bank size, business model and risk management practices could provide a more comprehensive understanding of the dynamics between competition and risk-taking behaviour. Investigate the effect of finch on banking competition and risk-taking behaviour. Other studies could consider the emerging markets or developed economies could add both depth and global relevance to the study. Finally, exploring alternative measures of competition and financial stability could yield further valuable insights into this complex relationship.

In conclusion, this chapter provided a comprehensive analysis of the competition-risk nexus in the South African banking sector. The findings highlight the intricate interplay between competition and risk-taking behaviour, with the relationship potentially varying depending on the specific competition measure and the chosen indicator of financial stability. These insights offer valuable considerations for policymakers and stakeholders as they navigate the delicate balance between fostering competition and safeguarding financial stability within the South African banking system. Future research with a larger sample size and employing threshold econometrics could definitively explore this possibility. Furthermore, bank size shows a negative association with the capital adequacy ratio but a positive association with the Z-score. This suggests that larger banks might manage risk through diversification, even if it means having a lower capital adequacy ratio. Lastly, profitability measures and inflation displayed no clear and consistent relationship with risk across the regressions. This might be due to specific bank strategies or the limitations of the chosen model.

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EDITING LETTER

[redacted]

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Durban

4091

10 September 2024

To: Whom it may concern

Editing of Masters: PB Nxumalo

COMPETITION, AND RISK-TAKING BEHAVIOUR IN SOUTH AFRICAN COMMERCIAL BANKS

This letter serves as confirmation that the aforementioned dissertation has been language edited. The requisite grammatical conventions have been met. Suggestions have been made to the candidate.

Any queries may be directed to the author of this letter.

Regards

[redacted]

MP MATHEWS

Lecturer and Language Editor

[redacted]

[redacted]

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

19 Oct 2023

Mr Philani Busani Nxumalo (220082077)
School Of Acc Economics&Fin
Westville

Dear Mr Philani Busani Nxumalo,

Original application number: 00023765
Project title: Competition, and risk-taking behavior in South African commercial banks

Exemption from Ethics Review

In response to your application received on 12 Oct 2023 , your school has indicated that the protocol has been granted **EXEMPTION FROM ETHICS REVIEW.**

Any alteration/s to the exempted research protocol, e.g., Title of the Project, Location of the Study, Research Approach and Methods must be reviewed and approved through an amendment/modification prior to its implementation. The original exemption number must be cited.

For any changes that could result in potential risk, an ethics application including the proposed amendments must be submitted to the relevant UKZN Research Ethics Committee. The original exemption number must be cited.

In case you have further queries, please quote the above reference number.

PLEASE NOTE:
Research data should be securely stored in the discipline/department for a period of 5 years.

I take this opportunity of wishing you everything of the best with your study.

Yours sincerely,

[redacted]

Prof Josue Mbonigaba
Academic Leader Research
School Of Acc Economics&Fin

COMPETITION AND RISK-TAKING BEHAVIOUR IN SOUTH AFRICAN COMMERCIAL BANKS

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