An Evaluation of the Relationship between Banks' Regulatory Capital Adequacy Ratios and Profitability in the South African Banking Sector

A research report submitted by

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Date submitted: 31 March 2024

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in partial fulfilment of the requirements for the degree of

Master of Commerce in Accounting

University of the Witwatersrand

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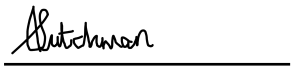
DECLARATION

I, Shaina Lutchman, declare that this research report is my own work, except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Commerce in Accounting at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other university.



Ms. Shaina Lutchman

Signed at Sandton, Johannesburg on the 27th day of March 2024.

ACKNOWLEDGEMENTS

This thesis has undoubtedly been one of the hardest academic hurdles that I have faced. However, in saying that, it has also been one of my most rewarding journeys undertaken. With this in mind, I would like to express my heartfelt gratitude to the following people:

- Associate Professor Avani Sebastian - an amazing supervisor. Your patience and support helped get me through the toughest of times with this dissertation. I was blessed to have a supervisor who really worked well with me and guided me in producing my best work.
- My husband Jivesh Dhanraj - my greatest rock and source of strength. Your constant motivation and belief in me helped me get through so many sleepless nights and days.
- My beautiful kids, Kiara and Avishay - who sat by my side through this entire process. Kiara, you played next to me as I attended my online night lectures and Avishay, you arrived in this world just as I finished year 1 of this study. Thank you for being so patient with Mummy and allowing me to complete this dissertation.
- My energetic chihuahua, Chewie Barker Dhanraj - you were the best study buddy that anyone could ever ask for. You sat by my side as I typed up this thesis and your constant alertness and (sometimes) barking definitely kept me more awake than the coffee and midnight oil.
- My Mum, Leela and Dad, the late Jaaps Lutchman, for your constant motivation and support throughout my life, which has enabled me to go beyond all my boundaries. Your wise words have constantly encouraged me to better myself, both from an academic and personal perspective. I could not have done this without you both.
- Mr Jan Brits, Head of Capital Management at Standard Bank Group- you were a great boss, who really taught me a lot on a very tough technical topic in the banking field. I am extremely appreciative of the inspiration, guidance and support which you provided to me whilst working as part of your team and in researching this topic.
- My other family members, including my amazing sister Jess, respected brothers Terence and Gerald, and my kind parents-in-law, Dees and May Dhanraj- your support has been invaluable in completing this thesis. To my nephews - Rishal, Raheel, Jordan and Aarav- I hope that this serves as an inspiration in your academic journeys.

This thesis is dedicated to my late father, Mr Sewdayal 'Jaaps' Lutchman. Fifteen years ago, you sat on the little stoep of our veranda and asked, "Shaina, when will you be finishing your Masters?" Well Dad, I am almost there… and one day, I hope to adorn myself with that "red coat" which you dreamed we would achieve!

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF KEY DEFINITIONS

Term	Definition
Basel III	An internationally agreed set of measures developed by the Basel Committee on Banking Supervision in response to the financial crisis of 2007-09. The measures aim to strengthen the regulation, supervision and risk management of Banks (Bank for International Settlements, 2010a, p.1).
Capital	The financial resources a Bank has that act as a cushion or shock-absorber against unexpected losses. For example, if someone fails to repay their loan (Bank of England, 2021, p.1).
Common equity tier 1 (CET1)	Sum of common shares (equivalent for non-joint stock companies) and stock surplus, retained earnings, other comprehensive income, qualifying minority interest and regulatory adjustments. It represents the highest quality of regulatory capital, as it absorbs losses immediately when they occur (Bank for International Settlements, 2010a, p.1).
Additional Tier 1 (AT1)	Sum of capital instruments meeting the criteria for AT1 and related surplus, additional qualifying minority interest and regulatory adjustments (Bank for International Settlements, 2010a, p.1).
Tier 1	Sum of CET1 and AT1 (Bank for International Settlements, 2010a, p.1).
Tier 2	Sum of capital instruments meeting the criteria for Tier 2 and related surplus, additional qualifying minority interest, qualifying loan loss provisions and regulatory adjustments. When a Bank fails, Tier 2 instruments must absorb losses before depositors and general creditors do (Bank for International Settlements, 2010a, p.1).
Regulatory Capital	Sum of Tier 1 and Tier 2 (Bank for International Settlements, 2010a, p.1).
Agency costs	Internal costs arising from competing interests of management and a company's shareholders (Corporate finance Institute, 2021).
Capital Adequacy Ratio (CAR)	The capital adequacy ratio is calculated as eligible capital divided by risk-weighted assets (APRA, 2021, p.1).
Market capitalisation	Market price per share multiplied by number of shares issued by a company (Bloomberg|Quint, 2021, p.1).
Liquidity	Liquidity is the ability of a bank to fund increases in assets and meet obligations as they come due, without incurring unacceptable losses (Bank for International Settlements, 2008g, p.1).
Risk-weighted assets	Refers to loans and other assets of a Bank, weighted (that is, multiplied by a percentage factor) to reflect their respective level of risk of loss to the bank. For example, mortgages secured by residential property are generally considered to be lower risk than unsecured credit card lending (APRA, 2021, p.1).
Credit Risk	Credit risk is most simply defined as the potential that a bank borrower or counterparty will fail to meet its obligations in accordance with agreed terms (Bank for International Settlements, 2021i, p.1).

Operational Risk	Operational risk is defined as the risk of loss resulting from inadequate or failed internal processes, people and systems or from external events. This definition includes legal risk,1 but excludes strategic and reputational risk (Bank for International Settlements (b), 2019, p.1).
Market risk	Market risk is defined as the risk of losses in on and off-balance-sheet positions arising from movements in market prices. The risks subject to this requirement are: (1) The risks pertaining to interest rate related instruments and equities in the trading book; and (2) Foreign exchange risk and commodities risk throughout the bank (Bank for International Settlements (a), 2019, p.1).
Return on assets (ROA)	Return on assets compares the value of a business's assets with the profits it creates over a set period of time (Forbes, 2021(a), p.1).
Return on equity (ROE)	Return on equity is a ratio of a public company's net profits to its shareholders' equity, or the value of the company's assets minus its liabilities (Forbes, 2022(b), p.1).

ABSTRACT

Background and Purpose: Banks are required to hold minimum capital amounts due to in-country regulation, which reflects the ability of the Bank to absorb unexpected losses and demonstrate resilience. This is driven by a function of risk-weighted assets and the Bank's risk profile and appetite.

Method: A quantitative research approach, utilising descriptive statistics and panel regression analysis was run on data over a twenty-year period (2002 – 2022), for 14 locally controlled Banks in South Africa. In addition to the afore-mentioned evaluation, the following relationships with profitability were also assessed: size, liquidity, management efficiency, implicit costs, cost efficiency, inflation and business cycle.

Results: The analysis revealed a statistically significant positive relationships between capital adequacy ratios and profitability in South Africa; specifically, a statistically significant positive relationship between Tier 1 and Total Regulatory Capital ratios with ROA.

Implications: The significant positive relationship mentioned above is attributed to strong resilience in the South Africa Banking sector, with high capital buffers over regulatory minimums and the ability to earn revenue during uncertain times. Continued oversight by Regulators on capital adequacy and macroeconomic indicators and risks is encouraged and Bank management is urged to continue to maintain healthy capital ratios and metrics, and effectively stress test and manage risks.

Significance: This study contributes to the limited research on capital holdings and profitability of South African banks. The insights on capital holdings make a practical contribution to decision-making by bank management, investors and regulators regard capital holdings.

Keywords: capital adequacy, profitability, South African banking sector, panel data regression, liquidity

CHAPTER I
INTRODUCTION

To date, there is an age-old debate that exists at an international level, illustrating the tensions which exists in the banking industry between investors and regulators, pertaining to over-regulation (Michaels, 2015). The 2007-2009 Global Financial Crisis brought this debate to the fore, where international regulators felt that the levels and quality of capital bases were inadequate and contributed to the banking system not being able to absorb systemic losses which occurred (Bank for International Settlements, 2010). The crisis highlighted the gaps which existed in terms of capital regulation and gave rise to a revised Basel III standard, which had the specific focus of strengthening capital and liquidity resilience (Bank for International Settlements, 2010). South Africa was no exception to this rule, having applied the Basel III principles into its Bank's Act effective 2013 (South African Reserve Bank [SARB], 2021).

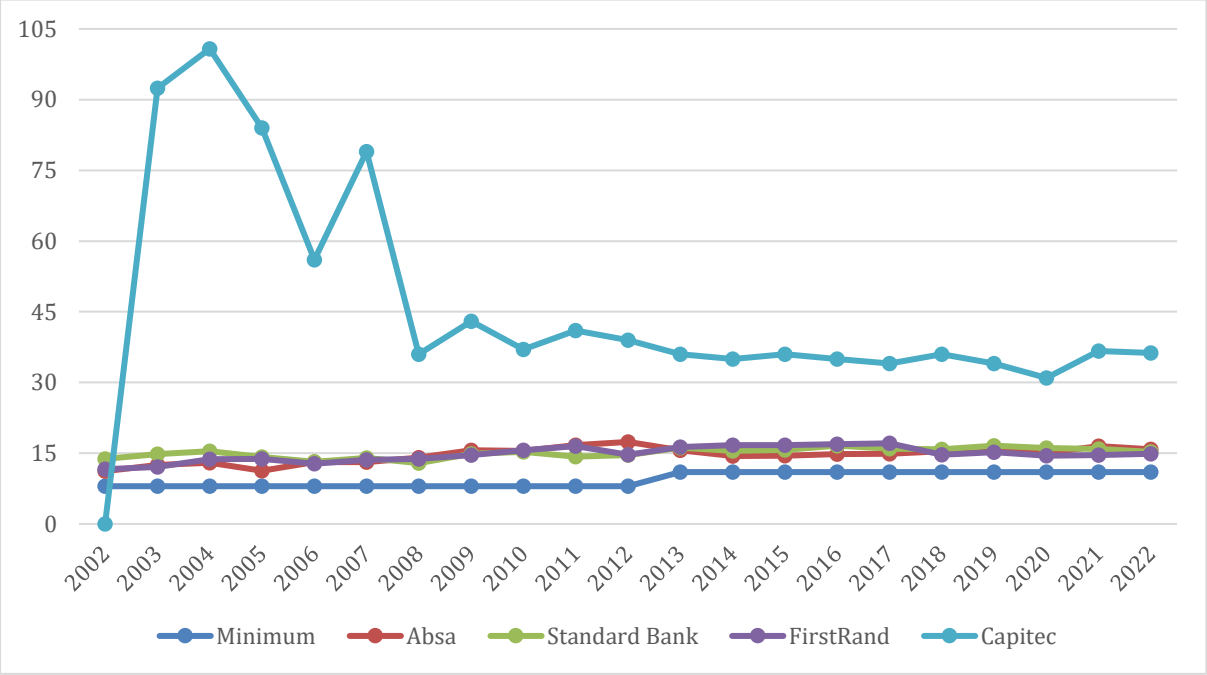
Banks are required to hold minimum capital amounts due to in-country regulation, which reflects the ability of the bank to absorb unexpected losses and demonstrate resilience. The amounts which are required to be held are a function of risk-weighted assets and the Bank's risk profile (APRA, 2021). The Bank's risk profile is reflected per risk type, namely Credit Risk, Operational Risk and Market Risk. Essentially, higher amounts of riskier assets result in higher risk-weighted assets and required capital (and ratios) that needs to be held (APRA, 2021), resulting in capital being an important consideration in a Bank's risk appetite (Deloitte, 2021a). How far a bank takes on risk is further defined by its risk appetite framework and capital that needs to be allocated (Deloitte, 2021a). It is expected that in times of stress the bank may hold higher levels to compensate for the riskiness of loans advanced.

Yet, whilst the importance of adequate regulation and the need for it is understood, a countering view to this sees overregulation and holding excessive capital reserves as a trade-off to generating profit (Michaels, 2015). This is because a Bank who chooses to retain additional levels of capital, would not lend it out, resulting in a decrease in the potential revenue that it would have earned. Therefore, a balance needs to be reached between retaining adequate amounts of capital and pursuing profitability opportunities, in order to achieve aligned objectives between the two. From a bank management perspective, an incorporation of the optimal levels at which to operate is considered in its strategic management plans, whilst for the regulator, the requirements percentage set must incorporate a safe level for a resilient banking system, whilst not impeding economic benefits arising from free trade. For the investor, this balance provides an indication of the bank's margins of safety for liquidity and capital when they evaluate them as part of their potential /current investments.

Yet, a question remains as to whether holding higher capital reserves leads to decreased profitability. Literature on this topic has yielded mixed results for different countries, which generally indicates that these countries have set different minimum requirements (in line with Basel requirements) and the banking groups which operate within these environments have different levels of buffers over and above the minimums at which they choose to operate. An example of this is the study in India (Baneejee and Velamuri, 2015), which found a negative relationship between capital and profitability, and this was attributed to banks operating well above the minimum levels and shying away from lending due to the perception that higher capital indicates a stronger, resilient entity.

The following graph represents the top 4 South African Banking groups, based on market capitalisation (Businesstech, 2020) and their capital adequacy ratios over the period 2002-2022, with the impacts of Basel I (pre-2008), Basel II (2008-2012) and Basel III (2013) incorporated.

Figure 1: Capital Adequacy Ratios trendline- Four Major South African Banks



**Source: Author's compilation from financial reports of the various institutions [Ref no. B1]*

The graph above highlights that South African Banks tend to operate well above the regulatory minimums as set out by its regulatory authority, the South African Reserve Bank. This implies that the sector tends to operate in excess of its regulatory capital requirements and that these additional levels of holding capital requires a careful consideration in a Bank's strategic plans,

so as to maintain a balance between holding too much capital and foregoing profitability opportunities.

It is also interesting to note that Capitec is an outlier between 2002-2007, likely due to this period being linked to its start up.

1.1 Statement of the problem

The Basel Committee of Bank Supervision noted the following during the introduction of Basel III in December 2009:

> *A strong and resilient banking system is the foundation for sustainable economic growth, as banks are at the centre of the credit intermediation process between savers and investors. Moreover, banks provide critical services to consumers, small and medium-sized enterprises, large corporate firms and governments who rely on them to conduct their daily business, both at a domestic and international level.* (Bank for International Settlements, 2010b, p.1)

As such, in its responsibility to service its clients, a Bank must carefully balance its regulatory and intermediary requirements. Therefore, there is an onus which exists, which compels a Bank to evaluate a trade-off between holding higher levels of regulatory capital and pursuing profitability opportunities. This trade-off is due to capital being held in reserves rather than reinvested in the business to generate profit e.g. through the issuance of new loans (credit /counterparty credit risk) to customers.

As such, in consideration of the trade-off above, the research question for this study is stated as follows:

RQ – *What is the relationship between capital holdings and profitability for South African Banks?*

1.2 Purpose of the study

This study evaluates the implications of the trade-off between holding capital and pursuing profitable opportunities, in line with existing theory and literature on the South African banking sector. To this end, the researcher assesses the relationship between the capital reserves held and how it impacts profitability of South African banks over a 20-year period. In addition, the following relationships are included in the study as they have been established in prior literature:

1. Impact of size on profitability
2. Impact of liquidity on profitability
3. Impact of management efficiency on profitability
4. Impact of implicit costs rate on profitability
5. Impact of cost efficiency on profitability
6. Impact of inflation on profitability
7. Impact of business cycle on profitability

A series of hypotheses supporting the above are developed in the chapters that follow.

1.3 Significance of the study

This study provides new insights on capital holdings. It makes a practical contribution as it facilitates decision-making by bank management, investors and regulators. The research also makes a contextual contribution. The literature landscape is currently rich from an international perspective, with few studies being undertaken in South Africa. Given the lack of publications relating to South Africa and timeframes involved in the studies which have been done, there is a re-affirmed opportunity for research, in the South African context, to be explored. The proposed research also extends existing capital adequacy studies by using a longer, more recent timeframe.

In addition to identifying the relationship between the two, the study provides insight into other impacts which may also contribute to the relationship held. e.g. does the size of the bank and loan book size impact the relationship between capital and profitability.

Basel III revisions (also commonly referred to as Basel IV) is expected to be introduced on 1 July 2025 and the main impact of this on capital requirements is through changes in the calculation methodology of risk-weighted assets under credit, market and operational risk (which is an input factor into the capital reserves required to be held) (Deloitte, 2021b). This topic is relevant as the transition is made between Basel III and Basel IV, as firms may now be required to indirectly hold more capital due to changes in the methodology. A study of the impact on capital adequacy reserves of profitability will be useful to this discussion.

1.4 Assumptions, limitations, delimitations

The following limitations/ assumptions were considered as part of this study:

Assumption 1: The timing of financial reports is not anticipated to have any impact on profitability e.g. if Capitec has a financial year end of 28 February 2022, whilst Absa has a

year end of 31 December 2022, both items would be considered under the year “2022” for the purposes of this study. This assumption is considered reasonable, given that International Financial Reporting Standards require line items in the financial statements to belong to a specific year under review, therefore the line items sourced from the database to populate dependent and independent variables are already related to a specific year, per Bank. These variables do not impact another Bank’s variables and the different timing of the reports is not expected to impact the regression. In addition, macroeconomic factors are also sourced and applied on an annualised basis, making this assumption reasonable for the study.

Assumption 2: Bank data extracted from data sources (e.g. BankFocus) are complete, valid and accurate. This assumption is considered reasonable due to the database used being credible, with checks being applied by the database administrator.

Assumption 3: A lagged profitability independent variable is included in the study to demonstrate profit persistence (Naceur and Kandil, 2009). This is reasonable, as assessed against the relevant literature relating to this topic.
Limitation 1: Some banks which have been liquidated over the period are still included in the study for the time period that financials were available e.g. VBS Bank.
Limitation 2: New banks e.g. Tyme Bank, whose data was not available over the whole twenty-year period, are incorporated as at the date of the first available financial statements.
Limitation 3: Banks who have had a change in structure (e.g. African Bank) will be ignored in the years pre- the change to ensure comparable bases.
Limitations 4: Other limitations include any possible lack of availability of the public data available for the study.

1.5 Chapter outline of the study

Chapter 1 introduces the study and positions the statement of the problem, purpose, significance, assumptions, limitations and delimitations of the study.
Chapter 2 provides a comprehensive review of the associated literature of this topic.
Chapter 3 describes the research methodology and design associated with the study.
Chapter 4 presents the results of the study.
Chapter 5 analyses the results of the study.
Chapter 6: concludes the study and provides recommendations for future research.

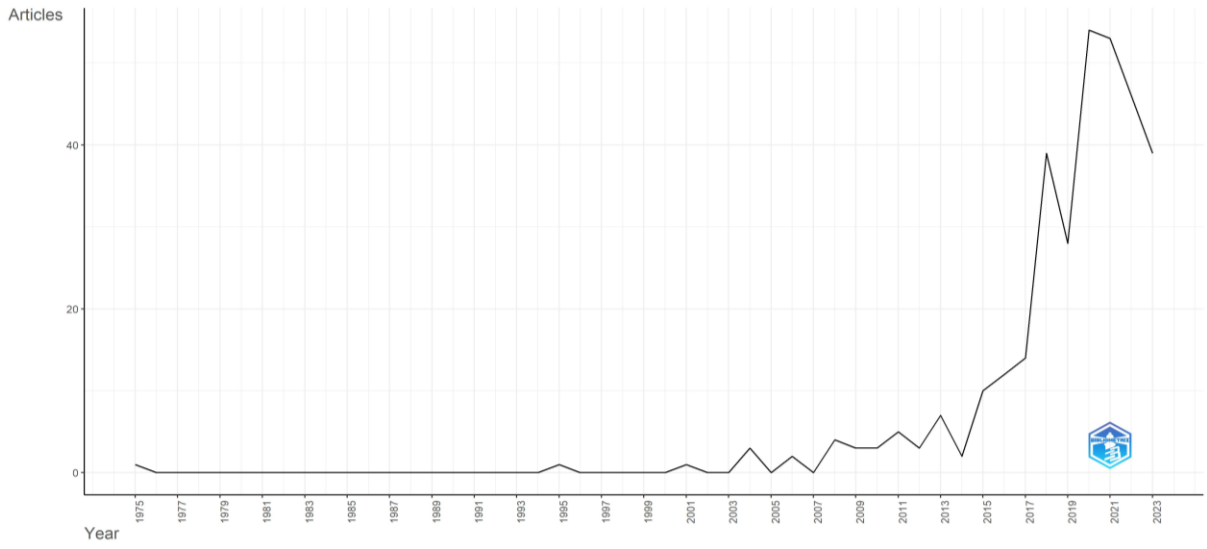
CHAPTER II
LITERATURE REVIEW

2.1 Overview of Academic Landscape

The academic literature relating to capital requirements and profitability is rich internationally, with few articles published on a local scale. Studies of South African Banks have generally been centred on regulatory change impacts (e.g. Basel III impacts in van Vuuren, 2010), risk and technology matters (e.g. in Matsepe and Lingen, 2022), and macroeconomic research (e.g. in Bernstein et al., 2016). Further, capital studies (in instances other than investigating the impacts on profitability) are largely tied to bank lending capacity (e.g. in Akinbaode and Makina, 2009) and risk management (e.g. in Adesina and Mwamba, 2016). The South African studies undertaken on capital and profitability are covered in the sections which follow.

To get a sense of the complete international and local academic landscape associated with this topic, a bibliometric analysis was conducted and the data presented below. A bibliometric analysis refers to a process whereby a researcher analyses a large amount of data using a statistical tool, to understand evolutionary nuances and emerging areas of the field of study (Donthu et al., 2021). To perform the required trends on the body of literature related to this study, relevant data was extracted from the Web of Science database (accessed through the Wits University Library), using specific keywords of “bank capital” and “profitability”. It was then processed through the “Bibliometrix” software, to produce the graphs which follow:

Figure 2: Historical Production Trends



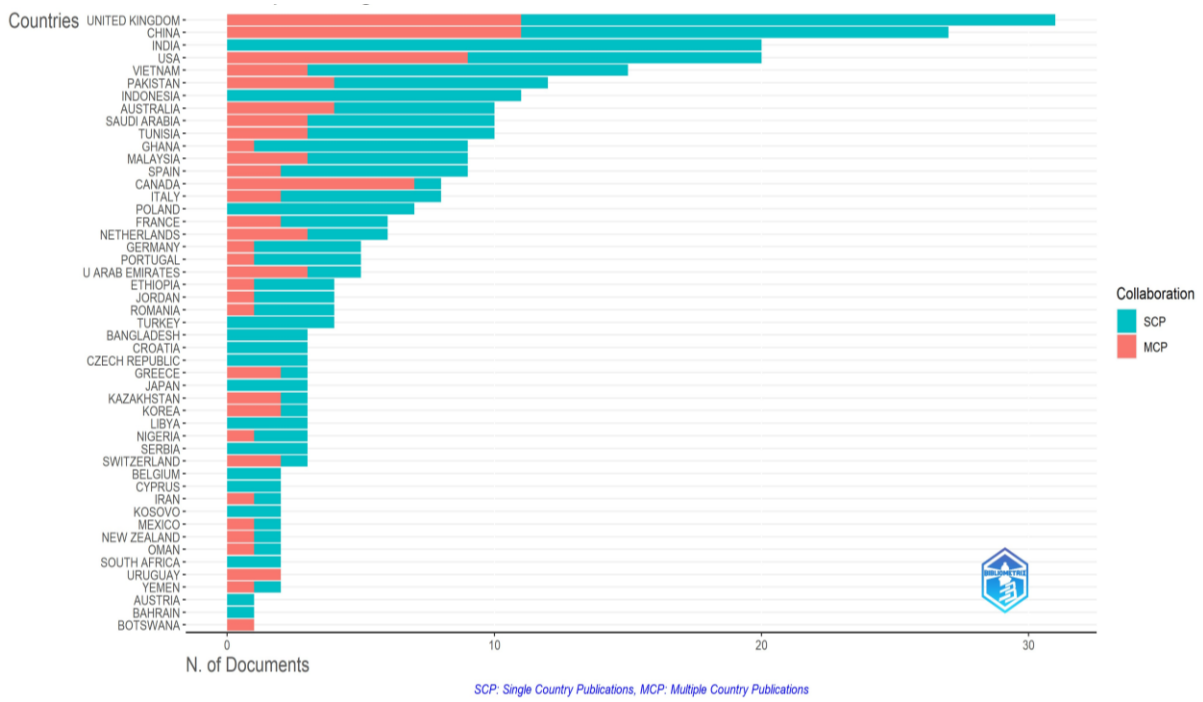
Source: Bibliometrix

As can be seen from the above, interest in this topic gained traction post the 2007-2009 Financial Crises, with accelerated momentum post 2015, and a peak in 2021. Increased academic interest during the crisis could be attributed to research required for uncertainties which arose in the interplay between capital, credit extension and asset prices, which was perceived to have fuelled the crises (Sacasa, 2008). Sacasa (2008) references two impacts that the role of inadequate capital played in the crises, the first relating to procyclical market upswings, which increased mark-to market assets and lowered impairment allowances, thereby boosting equity values. The second related to inverse market conditions, which eroded low capital buffers when losses materialised. These impacts prompted much debate amongst academic authors, who strove to understand these causative factors behind the crises, in the context of the US and other countries. In addition to understanding the past contributing impacts of capital, specific regulatory responses to the crises in the years post crisis warranted academic exploration e.g. the implementation of the Dodd Frank Act in the U.S and the issuance of Basel III regulations, which both had specific provisioning around capital requirements (Mohanty et al., 2018). These regulations introduced stronger capital requirements through the application of minimum capital floors (an amended Dodd Frank Act) and higher capital buffers (Basel III) (Paskelian and Bell, 2013). The potential impacts of these regulations on the banking industry were rigorously investigated by academic researchers in the years post the crises.

The EU sovereign debt crises of 2010-2012 (Mohanty et al., 2018) continued to add to the academic interest, as researchers aimed to understand the sovereign spread impacts on the weakened EU financial sector and the capital implications thereof (Mody and Sandri, 2011). In 2017, further articles were published by the Basel Committee of Bank supervision relating to the Basel III reforms (informally known as Basel IV) (Bank for International Settlements, 2017), which prompted a renewed focus for the area of capital regulation. Mujtaba et al. (2022) references academic research undertaken over the period relating to the crises and its impacts on capital as part of their study, further noting an increased academic interest relating to intensifying equity levels in capital management and its associated impacts on profitability, over the period.

Publications remain significantly higher post 2015, although is its observed to be on a decreasing trend from 2021 onwards.

Figure 3: Literature by Country



Source: Bibliometrix

As can be seen from the research author's countries above, the studies have been heavily centred around economies in the United Kingdom (UK), China, India and USA. This is expected, given that the UK contributed significantly to shaping the European Union Regulatory Framework post-2008 (Petit and Beck, 2023). In addition, China and India have been increasingly focused on from a policy perspective, given its booming emerging economies and growth (Syed and Walsh, 2012). Researchers have sought to understand the impact of bank capital on economic growth, especially from the perspective of higher capital requirements. Bank for International Settlements (2016) references two possible impacts which higher bank capital requirements can have on growth, the first being a decreased lending capacity, which leads to lower economic growth (as businesses are not able to take up credit and pursue growth opportunities) and the second, is increased lending rates, which leads to higher costs of borrowing and lower economic growth. Bank for International Settlements (2016) also notes an opposite viewpoint, stating that strong capital ratios can signal resilient entities and effectively reduce the risk and cost of systemic crises. These viewpoints show how researchers have been encouraged to understand the impacts of capital requirements on economic growth.

At the time of writing, very few studies have been done on the impacts of capital on profitability from a South African perspective, with only two articles being obtained from the research database. The first article was published in 2019 in the Comparative Economic Research,

Central and Eastern Europe publication and was titled “Bank Capital and Profitability: An Empirical Study of South African Commercial Banks,” by Charles Nyoka. This was studied over the period 2006- 2015. The second article was published in 2016 by Kudzai Marandu and Athenia Sibindi, titled: “Capital Structure and Profitability: An Empirical Study of South African Banks” in the Corporate Ownership & Control journal. The period studied was 2002-2013. The results of these studies are covered in the sections that follow.

The relationship between capital and profitability has further been covered as an ancillary measure in other studies dealing with determinants of bank profitability. Examples of these include Ifeacho and Ngalawa (2014), who studied the SA Bank performance from 1994, and included capital as an independent variable in the study. A further example includes Maredza (2014), who investigated the internal determinants of bank profitability in South Africa and also included capital as an independent variable. However, these studies do not go into the depth of capital adequacy and its impact on profitability, which this study is anticipated to achieve.

2.2 Theoretical Framework and Empirical Review of Existing Literature

As set out in the introduction (under section 1.1: statement of the problem), this study aims to evaluate the relationship between regulatory capital and profitability, within the South African Banking sector. Two fundamental schools of thought underpinning this evaluation relate to:

1. A negative relationship owing to trade-off between holding higher capital and profitability opportunities. This is mainly attributed to the perception that higher regulatory requirements would reduce bank lending, in effect tying up capital in reserves, as opposed to being lent out and earning a return for the funds (Thamae and Odhiambo, 2022). Examples of studies who have investigated this and found a negative relationship between capital and profitability due to lending include Mésonnier and Monks (2015), Eickmeier et al. (2018), Gropp et al. (2016), Amidu (2014), Hsieh and Lee (2020), Madugu et al. (2019) and Baneejee and Velamuri (2015).
2. A positive relationship owing to well capitalised positions, which offer resilience and opportunities to invest. Banks with higher capital ratios are seen to be safe investments with strong risk profiles for borrowing and are able to withstand severe crises and times of stress. This allows the entity to receive favourable benefits from reduced interest rates when borrowing and more funds from investors for expansion activities etc. Examples of studies who have investigated this and found a positive relationship between capital and profitability include Naceur and Kandil (2009), Sanyaolu et al.

(2019), Ifeacho and Ngalawa (2014), Zhang et al. (2020) and Marandu and Sibindi (2016).

Whilst the above schools of thoughts would appear to be clear in terms of the direction of relationship (i.e. either a positive or negative relationship), there have been mixed results from an academic perspective in analysing the relationship, especially when considering an optimal level. There are different elements of interplay between impacting variables, on a macro-economic level and entity level, which will be covered in detail in the rest of this chapter.

The following sections represent the major themes emerging from the body of literature, along with its supporting studies and insights derived.

2.2.1 Resilience

A prominent theme emerging from academic literature is the concept of resilience, with Banks focusing on maintaining a well-capitalised position to show this. Banks play a critical function in an economy and are closely monitored by its respective central bank, who ensures safety and soundness of its regulated institutions (South African Reserve Bank, 2024). Resilience is required to reduce shocks which are systemically transmitted between financial institutions in times of stress (Bank for International Settlements, 2010b). One of the ways which regulators have tackled this is by strengthening the capital framework and improving the quality of the capital base (Bank for International Settlements, 2010).

There are however mixed views on how a well-capitalised position impacts profitability, both directly and indirectly. The author's assessment of the literature suggests it to be more heavily weighted towards a positive impact/relationship between the two, with fewer studies finding a negative/ no impact on the relationship. There is an increasing trend noted relating to Banks holding onto strong capital ratios, however this is expected given the regulatory changes that have taken place over the last few years. In addition, there is also a perception that the purpose of higher capital ratios is to signal resilience (Hollander and Havemann, 2021), which may contribute to the increasing trend mentioned above.

Research studies which show a negative trade-off relationship between profitability and capital adequacy include the Madugu et al. (2019) and Baneejee and Velamuri (2015). The authors found that banks who chose a more prudent approach of keeping a well-capitalised position, shied away from increased lending and risk-taking, with the intention of being considered a safe and resilient investment. This reduced profitability.

Furthermore, it is worth mentioning that, when considering the financial system as a whole on a macroeconomic level, higher capital ratios could improve resilience of the entire financial system in which a Bank operates, thereby reducing systemic losses when crises occur (Bank for International Settlements, 2016). This is however negated by the higher funding costs passed on to households by the Banks for holding the additional capital, leading to a reduction in borrowing by the households (Bank for International Settlements, 2016). This implies that whilst an increase in net interest margin would be seen through the receipt of higher interest, the overall loans and advances base, which generates profitability for a Bank, would reduce.

On the other hand, Naceur and Kandil (2009) argue that well capitalised banks face lower bankruptcy costs and decreased borrowing costs, thereby improving profitability. This concept is supported by Ahokpossi (2013) and Swamy (2018), who note that higher capitalisation would lead to debt holders accepting lower interest repayments for the lower risk advanced, thereby increasing profitability and return on equity. Swamy (2018) also notes various authors who found that higher capitalised banks generally have a higher market share and survival rate.

Novokmet and Pavic (2021) references a moral hazard theory as part of their study. This theory articulates that with higher capital requirements, and a natural anticipation of a decrease in profitability due to perceived trade-off between the two, as a response, a bank would choose to accept riskier assets and pass the associated costs onto the customer. This would result in higher recognition of net interest margin and return on assets. Naceur and Kandil (2009) supports this, finding that the costs of financing higher capital is generally passed on to clients, thereby boosting profitability through an increased net interest margin (as mentioned earlier). Novokmet and Pavic (2021) based a study on Banks in Croatia. Croatia has a strong market concentration in Banking with 5 overseas owned banks (Fojcik, 2022), that is profitable and well-capitalised (International Monetary Fund, 2023c). Croatia became a member of the Eurozone in January 2023, which improved the resilience of the country through better sovereign ratings and reductions in foreign exchange risks (International Monetary Fund, 2023c). Novokmet and Pavic (2021) found a trade-off between ROE and CAR for the Banks in Croatia, and a positive relationship for ROA and NIM, noting that the costs associated with higher capital was most often being transferred to clients, as opposed to the bank approaching costs in a more efficient manner internally.

Sanyaolu et al. (2019) notes that higher capital adequacy ratios signal that the entity is profitable and in essence would have sufficient resources to grow the business and leverage economies of scale. Growth can also be encouraged through the implementation of higher

capital requirements by regulators, which creates barriers to entry for smaller banks (Banker et al., 2010). Banker et al. (2010) undertook a study of Korean banks, focussing on the impact of higher capital adequacy ratios and productivity in a period post regulatory reforms (1998-2005), and noted a positive relationship between capital and efficiency, which was attributed to the regulatory reforms implemented post the 1997 crises.

In South Africa, Ifeacho and Ngalawa (2014), as part of a study of SA bank performance, found that capital adequacy (based on a leverage ratio) had a negative relationship with ROA, and a positive and significant relationship with ROE. The ROA and ROE were based on ratios reflected in the bank financial statements. The ROE was noted as reflecting a stable and resilient banking sector, with a diverse non-interest revenue stream and favourable efficiency ratios contributing to the ROE. South Africa is often seen to have a resilient banking sector owing to its strong regulatory oversight, policy frameworks and consumer laws (National Treasury, 2011), which has resulted in it being able to recover well during the 2007-2009 Financial Crisis and Covid-19 pandemic (PWC, 2020).

Whilst a view is shown in various studies of higher capital levels being perceived as a large contributor to the perception of a resilient bank, it must be noted that there may be other considerations which need to be taken into account when determining the overall resilience of a Bank and whether it would survive a banking crisis. Examples of these include economic factors (interest rate spreads, yield curves and inflation) and country structure (Joy et al., 2017). This will be further taken into consideration as part of the study below.

2.2.2 Capital Buffers

A pertinent category of capital regulation which is frequently discussed in literature is the “capital buffer”. This refers to the regulatory capital which a Bank holds over and above its regulatory minimum, which can be used during times of need (Bank for International Settlements, 2019b). According to Novokmet and Pavic (2021), from a practical perspective, banks generally hold capital buffers in excess of regulatory requirements. This is referred to as the Capital Buffer Theory (Novokmet and Pavic, 2021). Pillay and Makrelov (2024), cite three possible reasons why a bank may choose to keep capital buffers over and above required minimums:

1. In instances where deposits are not insured, it can reduce deposit costs.[1]

[1] To note, South Africa is in the process of implementing depositor insurance in the country (South African Reserve Bank, 2023)

2. To preserve monopoly rents.
3. To prevent excessive costs associated with regulatory breaches.

From a depositor perspective, increased capital buffers can contribute to reduced deposit costs (in instances where the deposits are not insured), as depositors would be willing to receive a lower rate of interest, due to the reduced risk taken (Fonseca and González, 2009). This implies that the bank, by paying out lower interest on deposits, would have a higher profitability. Monopoly rents reference profits earned due to banks being in a position of market power (Fonseca and González, 2009). A bigger capital buffer is expected to reduce probability of failure and prevent the destruction of reputational value arising from monopoly power (Fonseca and González, 2009). This concept is intricately linked to “legitimacy theory”, where Banks increase capital ratios to demonstrate institutional legitimacy and improve its reputation (Zhang et al., 2021). Costs associated with regulatory breaches include supervisory restrictions and reputational damage (Pillay and Makrelov, 2024).

Another aspect to consider in relation to capital buffers, is size. Novokmet and Pavic (2021) note this, quoting studies which state that whilst capital buffers could improve profits due to a signalling effect by demonstrating resilience, too large buffers can negate these benefits due to the opportunity costs of not being able to lend out, leading to decreased profitability. Obadire et al. (2022) further note in its literature review that banks with small/inadequate capital buffers, tend to avoid risks that generate higher returns, so as to preserve capital, which may lead to inefficient operations and (by implication) decreased profitability. Ajayi et al. (2019) however references authors who negates this view, noting that these low capitalised banks may on the contrary be incentivised to engage in more riskier activities, in the hopes that this would yield higher returns that can be used to bolster capital and profitability.

Risk management and operating efficiency is another angle seen contributing to a positive relationship with profitability. In Obadire et al. (2022), of which the main focus was on African Banks, the author notes that capital buffers are seen to improve the operating efficiency of a Bank, signalling a more resilient institution that would withstand financial crises, which leads to improved profitability. In agreement is Lee and Hsieh (2013) and Bitar et al. (2016), who found that higher capitalised banks tend to invest in their risk management processes and maintain stronger oversight, leading to better lending processes and reduced agency costs. This leads to them to being more profitable. Gavalas and Syriopoulos (2018) however contrasts with this view, noting that even banks who have lower capitalisation, would have an urgency to enhance its risk management process, given the need to protect its lower capital buffers, and this would lead to better profitability.

From a South African perspective, Holly and Havemann (2021) study the impacts of SARB's application of capital buffers and macroeconomic and monetary policies over the period 2003 to 2013, which focus on the 2007/2008 Financial Crisis. The authors affirm the usefulness of having the additional capital held to rely on during credit cycles and further highlight the stance which the SARB had taken to strengthen financial sector resilience in an attempt to reduce credit constraints during times of crises and curb excessive lending during upswings in the credit cycle. However, the authors do caution regulators on being too restrictive with requiring Banks to hold higher capital, as this may lead to reduced credit extension especially in times of crises, further exacerbating economic distress and reducing recovery. A concept of fiscal risk (from the macro economy) and its impacts on capital buffers was mentioned further in Makrelov et al. (2023), who note that the size of a capital buffer is linked to the stage in which the macroeconomic cycle is in. The authors found that increased fiscal risks were linked to increased capital buffers and further found an association between external macroeconomic environments and the impact on capital and risk taking. These factors will be considered as part of this study.

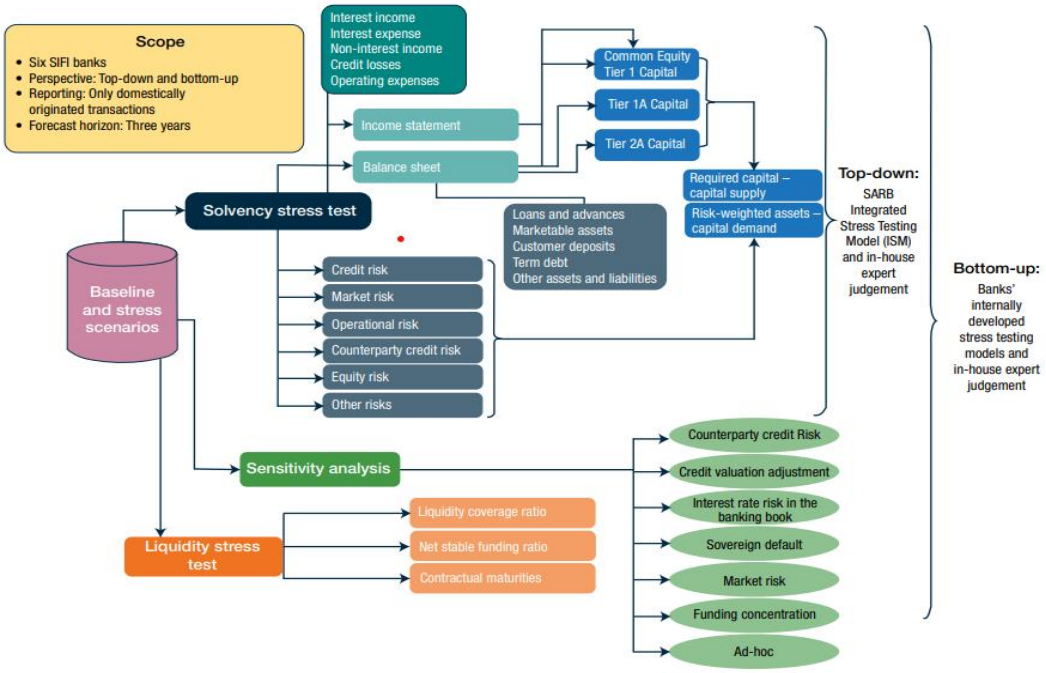
2.2.3 Times of uncertainty and stress testing

There is much debate on how a Bank accounts for the uncertainty of future losses in its capital decisioning. In Valencia (2016), the author tests a hypothesis to assess if banks, when uncertain of the impact of events which would cause substantial loss to the entity, would look to increase its capital base as a self-insurance mechanism to shield itself against losses. The author finds statistically significant evidence in support of this, noting that the uncertainty contributes significantly to capital buffers held in U.S Commercial Banks. The author focused on lending (and inability of customers to pay) as the event of uncertainty. In Tran et al. (2023), the authors find similar results, focussing on economic policy as the event of uncertainty. Whilst these authors find uncertainty contributing to higher capital ratios held by Banks, it is interesting to note that, in a speech relayed by Kerstin Jochnick (2022) ("member of the Supervisory Board of the ECB", European Central bank, 2022), that Banks in the EU were able to weather the uncertainty of Covid-19, without having to materially drop capital bases. This was in contrast to the 2008 Global financial crises and could be attributed to the benefits of the stronger capital regulation introduced by Basel III (European Central bank, 2022). Valladares (2023) also notes that during times of uncertainty, well-capitalised banks may in fact lend more, owing to strong capital bases in place and this view is supported by the Bank for International Settlements (2016). Beltratti and Stulz (2009) further shows that larger, well capitalised banks, demonstrated higher returns in the 2007 -2009 Financial crisis, as part of their study.

Banks test for uncertainty during its stress testing processes. Stress testing has become an important focus area from a bank risk management perspective over the last few years. Bank for International Settlements (2016) notes that with the changes in complexity and the diverse operations in which a Bank operates, there has been a move to strengthen internal stress testing, which takes into account the capital positions of large firms based on different scenario analysis. South African Banks have undergone numerous changes over the past few years, with complexity shown in new product offerings, technology and diversity shown by geographical expansion into other Southern African Development Community (SADC) countries (European Investment Bank, 2015). The impacts of these stress tests may have an impact on profitability, as based on the results, regulatory supervisors may choose to request more capital in anticipation of extreme events (Bank for International Settlements, 2017b). Valladares (2023) also notes that in stress simulations, for poorly capitalised banks, those banks may choose to reduce lending, even in portfolios of loans which performed well under the stressed scenarios. This highlights the importance which Banks place on stress tests as part of capital decisioning processes.

A capital stress testing framework generally considers two underlying elements of scenario analysis (both regulator and internally based) and forward-looking assessments (Moody's, 2023). From a South African Banking regulatory perspective, the SARB implements a "Common Scenario Stress Test" to test the sufficiency of capital ratios of banking participants under stressed conditions, as well as assess the health of the overall financial sector (SARB, 2023-i). Using a population of six of the most systemically important banks in the industry, they apply a top down "Integrated Stress Test" (SARB, 2023, p.40) model, which is validated using a bottom up-approach, comprising internal stress models by the banks. A framework with the stress test factors is outlined as follows (SARB, 2023, p.40):

Figure 4: Elements of the 2023 CSST Framework



The results of the last CSST relayed that at a point of significant stress on the industry, the selected banks would be sufficiently capitalised. A major contributor to the stressed capital deterioration, would materialise from credit losses, particularly in the retail sector. Capital and stress testing models and its implications remain a developing area from a practical perspective and therefore presents a future research opportunity in the field.

2.2.4 Cost of Equity/Debt Theory

The Miller and Modigliani Theorem (1958) is quite often evaluated in literature studies under this topic, due to equity being a significant component of regulatory capital. It theorises that under ideal conditions, increases in the proportion of equity (traded off for debt) would have no impact on the firm's total cost (Bank for International Settlements, 2016). One such study which supported this was Ngo (2006), who found no relationship between capital and profitability, attributed to any benefit in borrowing costs being offset by a higher cost of equity. However, there has been varying views on the impact of capital structure on profitability, across academic literature.

Kundid (2012) focussed on a capital structure approach in Croatia and found that banks with more equity financing showed higher profitability, attributable to the accounting cost of equity being almost zero, versus that of debt financing. The author notes that this is inconsistent with literature, which argues that the cost of equity is an expensive funding source and will

essentially lead to a reduction in profit due to the higher shareholder required return (García-Herrero et al., 2009). Further, Demirguc-Kunt and Huizinga (1999) found that by increasing capital requirements, there is a trade-off as equity decreases and deposits from customers increases, essentially forcing a rise in the cost of financial intermediation to support profitability (higher interest margins for the intermediation service rendered).

The above is however opposing to the view of Pratomo and Ismail (2006) and Berger and Di Patti (2006) and who found that a higher cost of equity decreased profit and found that by reducing the dependency of equity financing (higher leverage), agency costs between management and shareholders are reduced, which leads to an increase in value as intentions are aligned. This is reference as attributable to “agency costs hypothesis” (p.1066) which encourages management to act in the best interests of the entity, due to perceived impacts on salaries and reputation and the need to pay borrowing costs associated with leverage.

2.2.5 Optimal Capital Structure

Bank for International Settlements (2016) notes that some studies have found that Banks generally choose to not keep capital buffers constant, yet rather aim to keep it at an optimal capital ratio. This is supported by a study conducted by Haris et al. (2020). The findings note an “inverted U-shaped relationship” (Haris et al., 2020) between capital adequacy and profitability, which implies that there is an optimal level of capital adequacy that increases profitability, and beyond this point there may be no additional benefit to holding additional capital. Naceur and Kandil (2009) also noted in their study that any benefit derived from higher capital adequacy on profitability is short term.

Some studies have aimed to capture the level at which the optimal capital structure occurs. Bank for International Settlements (2016) notes studies which aimed to estimate an optimal level. Examples cited include Miles et al. (2011) which suggest 16-20% of a bank’s risk weighted assets and De-Ramon et al. (2012) which found a range of an increase of 22% above capital requirements, after which there are no additional benefits. This implies that the provisioning of the percentages above the minimum ratios would have to be assessed from a trade-off on profitability perspective.

Berger (1995), who assessed the US Banking system between 1983-1989, mentions that optimal ratios can change based on the cycle in which the economy is in e.g. during downturns, bankruptcy costs rise thereby increasing the optimal ratio and efforts a bank would take to maintain this (foregoing revenue opportunities). Malherbe (2020) echoes this dependency

between cycle and capital in their study and further adds on the importance of regulators applying “a time-varying capital requirement” (p.31) in response to changing business cycles and capital investment efficiency.

Kundid (2012) references “the pecking order theory” (p.57) when considering the optimal capital ratio, noting that when a bank raises debt or equity, it prefers to finance from internal means, so it could create a signalling effect to the market on future prospects of the Bank. This implies that an option that banks may choose would be to operate at lower capital adequacy ratios and relay a message that it expects to fund from higher profits in future.

According to Harding et al. (2006), there is an impact of depositor insurance schemes which reduces the optimal capital ratio that a Bank would keep, due to the perception of safety net being in place in the event of a crisis (moral hazard), which would imply a higher profitability in line with the trade-off concept. South Africa has not yet introduced a depositor insurance scheme and is in the process of operationalising it in 2024 (South African Reserve Bank, 2023). The impact of this on capital adequacy would be a potential area of study for future research.

2.2.6 Profitability trade-off with low yielding forms of revenue

Another aspect of consideration coming through the academic literature relates to profitability trade-offs. Obadire et al. (2022) cites the study by Berger and Di Patti (2006), which highlighted a negative relationship between capital adequacy and bank efficiency and explained that higher capitalisation reduces the bank’s ability to explore other investments opportunities that generate profit, leading to reduced operational efficiency and in turn profitability. In addition, Swamy (2018) argues that higher capital requirements may prompt banks to invest in low yield instruments, as opposed to conventional lending practices, and this change in asset types would thereby decrease profitability.

2.2.7 Geographical implications

The geographical location and specific country-factors are another aspect which might factor into the profitability and capital adequacy structure debate. Obadire et al. (2022) highlights that studies of efficiency (based on Basel III requirements) would not necessarily yield the same outcome for African countries as compared to developed countries owing to country-specific factors such as geopolitical and macroeconomic environments.

From a study perspective, Masindi and Singh (2022), who specifically focussed on African countries, found and negative relationship to CAR that was not statistically significant to profitability. This result was attributed to poor financial conditions on the continent in combination with unacceptable profiles of risk. A similar concept could be seen from an emerging markets perspective. A study by Lee and Hsieh (2013) focussed specifically on countries in the Asian market. The authors note the following relationships between capital and profitability (risk):

- Lower income countries- higher impact
- Low to middle income countries- “highest reverse (opposite) effect of capital on risk” (Page 251)
- Higher income countries - smallest impact

The authors attribute the impacts for higher income countries to sound regulatory oversight and implementation of sophisticated technologies (Lee and Hsieh, 2013).

This study will assess to see if this viewpoint (based on the Asian emerging market) holds true from a South African perspective. South Africa is considered an upper middle-income country (The WorldBank, 2024b), however it also has strong regulatory oversight and technologies, which is mentioned to have impacted the higher income countries above. It further presents an opportunity for further research, by benchmarking South Africa against other countries and assessing impacts thereof.

2.2.8 Capital adequacy calculation and risk-weighted assets

The capital adequacy ratio is calculated as (Bank for International Settlements, 2003m):

$$CAR = \frac{Regulatory\ Capital}{Risk\ weighted\ assets}$$

Banks can attain higher capital adequacy ratios, in response to higher regulatory capital requirements, by either increasing the numerator or decreasing the denominator for the above equation (Valladares, 2023) and not necessarily by cutting back lending (Hyun and Rhee, 2011). The numerator can be increased through the issuance of equity and debt instruments (Tier 1 or Tier 2) or a reduction in dividend pay-outs or share buybacks. Hyun and Rhee (2011) note that, based on academic research, banks generally prefer to reduce lending as compared to issuing new capital, due the costs and signalling effects associated with new issuances. The authors in addition note that lending is generally also reduced during economic

downturns. Shaw et al. (2013), however presents opposing evidence when testing CAR and capital consumption, noting an inverted-U-shaped relationship, which holds true when banks are able to easily raise capital to increase the numerator.

A denominator reduction can be achieved through risk optimisation initiatives such as use of derivatives and adjusting the lending portfolio in terms of categories which attract certain risk-weights (Valladares, 2023). In terms of guidance issued by the Basel Committee on Banking Supervision for the calculation of credit risk weighted assets (2023), there are two approaches which can be followed, being the standardised and internal ratings-based approaches. Percentages of weightings (under the standardised approach) are assigned to a category of exposure e.g. loans to a sovereign entity with a rating of AAA to AA- would be risk weighted at 0%, whilst certain retail exposures would be rated at 100% (Bank for International Settlements reference to CRE20&22). From an internal ratings-based approach, a Bank is allowed to calculate its own estimates of risk weights based on internal systems, for eligible asset classes (Bank for International Settlements reference to CRE30). This composition of a Bank's lending portfolio composition, which impacts its total risk weighted asset calculation, is another element which literature considers having an impact on capital and its relationship to profitability. Ozili (2017) purports that diversification in a banks' loan portfolio will tend to demonstrate better resilience and profitability, as opposed to banks whose primary client base are individuals and high-risk sectors. In Lee and Hsieh (2013), the results also showed investment banks having a low, but positive impact profitability impact, and commercial banks had a "highest reverse effect of capital on risk" (p,251). Valladares (2023) further references other mechanisms for risk optimisation, which include initiatives which focus on improved data quality. Bank of International Settlements (2021i) emphasizes the importance of a Bank having appropriate controls and systems in place to allocate the correct risk weights to counterparties.

2.3 Hypotheses development

For the purposes of this study, the trade-off between holding higher levels of capital and profitability, as outlined in the sections above is stated as follows:

H(1) the greater the capital adequacy ratio, the lower the profit

In addition to (H1), there are generally a set of bank specific and macroeconomic variables which previous studies have incorporated into their methodologies, which is hypothesised to have an impact on profitability. One such factor relates to ***bank size,*** which is expected to reflect the ability of a bank to generate higher profit due to it leveraging its economies of scale (Naceur and Kandil, 2009). Sanyaolu et al. (2019) attribute this to larger banks having the

ability to advance more loans and accept more risk. Bashir et al. (2020) support this, noting further that larger banks are able to easily source a variety of external funding. There have been varying results assessing the relationship between size and profitability, with studies such as Naceur and Omran (2011 and Sanyaolu et al. (2019) reporting a significant positive relationship whilst Ngo (2006) and Batten and Vo (2019) reporting a negative relationship. Batten and Vo (2019) cites this as possibly due to larger banks encountering inefficiencies in processes due to disaggregated management because of its size.

For the purposes of this study, the relationship is hypothesised as follows:

H(2) the greater the size of a Bank, the greater the profit

Liquidity reflects the cash position of the bank, to cover all its withdrawals. Naceur and Kandil (2009) refers to two impacts on profitability in its literature review, the first being a negative effect as banks choose to reduce costs of intermediation through reducing non-earning assets, and the second is where they attempt to raise profitability where the credit demand in the market is limited. The study however reports no significant relationship for this. Sanyaolu et al. (2019) adds to the above point by referring to a trade-off where banks retain more liquid assets to fulfil the liquidity requirements and forego lending leading to a reduction in profitability. The result of the study supports this. Ifeacho and Ngalawa (2014) produces the opposite result, with positive relationship between liquidity and profitability being reported. The authors attribute this in the literature review to liquid assets improving asset quality and profitability. For the purposes of this study, the relationship is hypothesised as follows:

H(3) the greater the liquidity of a Bank, the lower the profit

Another factor incorporated into prior studies relates to “management efficiency.” It is expected that this factor translates to higher profitability as it is expected that management would aim for higher earnings (Naceur and Kandil, 2009). The study reports a positive relationship between the two. The study in Ifeacho and Ngalawa (2014) also reports this relationship. For the purposes of this study, the relationship is hypothesised as follows:

H(4) the greater the management efficiency metric, the greater the profit

Two additional factors considered in prior literature relates to the impacts of non-interest cost and non-interest revenue (implicit costs) as well the cost efficiency of the bank. Higher non-interest costs relative to non-interest revenues are anticipated to reduce profit (Naceur and Kandil, 2009). Naceur and Kandil (2009) find a negative relationship for this. In Madugu et al.

(2019), the authors focussed on the relationship between non-interest revenue and profitability, which is noted to be higher.

Obadire et al. (2022) note that a cost-containment strategy is ideal in keeping a bank operationally efficient. Mechanisms to achieve this include digitisation, innovation, physical location reduction (whilst moving to a digital environment such as digital banking) and improved corporate governance. Higher cost efficiency is generally anticipated to increase profit, as banks charge high costs of intermediation to cover the additional expenses (Naceur and Kandil, 2009). The study notes an insignificant relationship. Madugu et al. (2019) notes a positive relationship in their study. For the purposes of this study, the relationships are hypothesised as follows:

H(5) the greater the implicit costs of a Bank, the lower the profit and,

H(6) the greater the cost efficiency rate of a Bank, the greater the profit

The two macroeconomic factors considered as part of this study relates to inflation and business cycles. There are two opposing views as to the relationship between inflation and profitability. One view notes it as a macroeconomic variable which may decrease bank profit, due to the uncertainty it drives, which leads to customers choosing to save rather than take out loans (Naceur and Kandil, 2009). The study supports this negative relationship. Other studies with the same findings include Madugu et al. (2019), Ngo (2006) and Naceur and Omran (2011).

The second view notes inflation as an addition to the cost of intermediation which a bank on sells to customers. Batten and Vo (2019) support this view and finds a positive relationship in the study. Sanyaolu et al. (2019) reports no significant relationship.

It is also anticipated that changes in the business (economic cycle) of a country can impact the profits of a Bank (Naceur and Kandil, 2009). The study finds that the business cycle measure has a significant impact on profitability, and that during “booms,” banks have higher profitability and during downturns, it has the opposite.

Ercegovac et al. (2020) note that from a macroeconomic perspective, profitability metrics of a bank are linked to the cycle of the economy that the country is in due to the impacts of credit demand and investment potential.

It is also interesting to note that Masindi and Singh (2022), in their literature review, note a contrast on the interplay between inflation and profitability, based on geographical location. They note that higher inflation, in Europe, increases the interest rate and interest received on products leading to more profitability. This contrasts with Africa, which sees higher interest rates increasing impairments through higher defaults and non-performing loans which lowers profitability, reflecting a “heterogeneous nature” of banking regulation in Africa.

For the purposes of this study, the relationships are hypothesised as follows:

H(7) the greater the inflation rate of a country, the lower the profit

H(8) if an economy is in a greater part of business cycle, the greater will be the profit and vice versa

The following table contains a summarised list of some of the studies conducted in the research area (specifically focussing on the capital adequacy ratios and profitability), as well as its methodologies and results:

Table 1: Summarised research studies for Capital Adequacy Ratios vs Profitability

No.	Author	Country in focus	Sample	Period	Capital Measure	Profitability measure	Methodology	Relationship	Result
1	Ifeacho and Ngalawa (2014)	South Africa	4 largest banks	1994-2011	Leverage ratio-debt/equity (CAMEL bank performance methodology)	ROE and ROA	Panel data regression with Generalized Method of Moment (GMM) estimator : Fixed Effects model	+ with ROE -with ROA	Both
2	Zhang et al. (2021)	China	44 Chinese listed banks	2005-2018	Regulatory Capital Pressure (RCP) - difference between actual capital and implied trigger capital	ROA (NI/average 2 most recent years total assets) and Tobin's Q (total assets minus the book value of equity, plus the market value of equity divided by the book value of total assets)	Panel data regression with Generalized Method of Moment (GMM) estimator	+with ROA and TQ	Positive
3	Kundid (2012)	Croatia	28 commercial banks	2003-2008	Growth of regulatory capital (RASTJK) and capital adequacy	ROA (ROE stated as function of ROE)	Panel data regression with first-order autoregression	-with ROA	Negative
4	Naceur and Kandil (2009)	Egypt	28 banks	1984-2004	Capital to total assets	ROA, ROE, NIM1, NIM2	Panel data regression with Generalized Method of Moment (GMM) estimator: Fixed Effects model	+ROE	Positive
5	Madugu et al. (2019)	Ghana	11 banks	2006-2016	CAR	ROE	Panel data regression with : Fixed Effects model	-ROE	Negative
6	Baneerjee and Velamuri (2015	India	75 banks	2000-2013	CAR	ROE and ROA	Panel data regression with : Random Effects model	-ROE and ROA	Negative

7	Naceur and Omran (2011)	ten middle east and north Africa countries	173 banks	1988-2005	Noninterest earning assets divided by total assets	ROA	Panel data regression with Generalized Method of Moment (GMM) estimator: Fixed Effects model	+ROA	Positive
8	Ngo (2006)	US	2500 banks	1996-2005	CAR	ROA ROE	Panel data regression with Generalized Method of Moment (GMM) estimator: Fixed Effects model	+ROA +ROE	Positive
9	Sanyaolu et al. (2019)	Nigeria	15 Banks	2008-2017	CAR	ROA	Panel data regression: Fixed Effects model	+ROA	Positive
10	Haris et al. (2020)	Pakistan	29	2007-2018	CR: Total shareholder equity/total assets CAR	Return on average assets (ROAA) Return on average equity (ROAE) Net interest Margin (NIMR) Profit Margin (NMAR)	T-test, tabulation, graphical methods + GMM estimator	Inverted U shape	Inverted U shape
11	Pratomo et al. (2006)	Malaysia	15	1997-2004	CAP: Equity Capital to gross total assets	ROE	Unit root test and Fixed Effects model	-ROE	Negative
12	Batten and Vo (2019)	Vietnam	35	2006-2014	Capital asset ratio	ROAA ROAE NIM	Panel data regression with Generalized Method of Moment (GMM) estimator: Fixed Effects model	+ROAA +NIM -ROAE	Both
13	Marandu and Sibindi (2016)	South Africa	6	2002-2013	Bank specific equity and capital	ROA ROE	Multiple regression	+ROA -ROE	Both
14	Ahokpossi (2013)	Sub-saharan Africa	456 banks	1995-2008	Equity/Total Assets	NIM	Unbalanced panel regression	+NIM	Positive

15	Novokmet and Pavic (202)	Croatia	24	2011-2016	CAR	ROA ROE NIM	Panel data using Blundell-Bond estimator	+ROA +NIM -ROE	Both
16	Obadire et al. (2022)	Banks operating in six African nations (South Africa, Nigeria, Kenya, Tanzania, Uganda and Malawi)	45	2010-2019	CAR	OETA (measures of efficiencies) NIMR	Panel data and Data envelopment analysis	+OETA and NIMR	Positive
17	Masindi and Singh (2022)	South Africa, Uganda, Kenya, Tunisia, Egypt, Namibia, Zambia, Nigeria and Ghana,	33	2009-2019	CAR	ROA ROE	Two-step dynamic panel data approach that was pioneered by Blundell and Bond (1998)	ROE and ROA not significant.	Negative and statistically insignificant
18	Ozili (2017)	Banks across African countries (listed and unlisted)	200	2004-2013	Total Regulatory Capital	ROA	Regression analysis	+ROA	Positive and statistically significant

19	Ercegovac et al. (2020)	Banks in the EU	22	2007-2019	TCaP_Ratio	ROA ROE	Dynamic panel regression model, using the GMM estimator.	ROA and ROE not statistically significant	Not statistically significant
20	Khan (2022)	Gulf Cooperation Council) countries	59	2011-2017	CAR	ROA ROE	Unbalanced panel data and pooled OLS	+ROA -ROE	Positive with ROA and negative with ROE
21	Kumar and Bird (2022)	India and China	58	2004-2019	CAR	ROA	GMM estimator	+ROA	Positive impact
22	Nyoka (2019)	South Africa	13	2006-2015	CAR	ROA ROE	Generalised Methods of Moments (GMM), and Panel Two Stage Least Squares (2SLS) or Pooled IV method	+ROA +ROE	Significant and positive effect
23	Saniç and Şendeniz-Yüncü (2021)	Turkey	26	2007-2016	CAR	ROA ROE	Fixed Effects model	+ROA +ROE	Positive

The table above highlights the following key trends in literature:

1. There is a mix of both negative and positive results The studies do however show a heavier weighting towards a positive relationship, as mentioned in section 2.2.1: resilience, above.
2. Panel data regression analysis (with a GMM estimator) is a popular statistical method used for testing.
3. ROA and ROE are favoured measures of profitability (by most authors).
4. The CAR ratio is a preferred indicator of capital measurement. Ifeacho and Ngalawa, (2014) note two other metrics which can be considered, such as the leverage ratio, as well as net worth protection.
5. The studies in South Africa have the lowest sample size due to the higher market concentration of significant Banks in the country.
6. The studies are generally conducted over a longer-term period. This is probably to add some level of reliability over time from a statistical perspective.

These trends will be further considered under the methodology chapter which follows.

2.4 Methodologies in the relevant literature

As illustrated in the summary table above, there are a large number of studies which have focused the use of panel data and regression in the testing, with a GMM estimator, which controls for omitted variable bias and endogeneity (Ifeacho and Ngalawa (2014), Naceur and Kandil (2009), Zhang et al. (2021), etc.). Most researchers have employed a fixed effects model for the regression analysis. It is also noted that Madugu et al. (2020) does not use a GMM estimator in their study, noting that its use is dependent on the size of cross-sectional data (n), which must be larger than the time period data under review (t). This highlights the importance of applying a model that's specific to the population that's being tested.

Kundid (2012) cautions that the choice of methodological approach and performance metrics may have impacted the outcomes of some of the studies undertaken. A potential instance where this could be seen is in the articles published on South Africa, by Ifeacho and Ngalawa (2014) and Marandu and Sibindi (2016). The chosen capital metric was a leverage ratio which differed from Nyoka (2019), who made use of regulatory capital adequacy ratios. Ifeacho and Ngalawa (2014) and Marandu and Sibindi (2014) studies yields similar results to each other (positive relationship to ROA and negative relationship to ROE) as compared to Nyoka (a positive relationship for both). These considerations will be taken into account in as part of the methodology in the next chapter.

CHAPTER III
METHODOLOGY

The following chapter provides an overview of the methodology and research design undertaken in this study. The study sets out to assess the relationship between capital holdings and profitability, for South African Banks, over the period 2001-2022. A restatement of the hypotheses is reiterated below, for reference:

Table 2: Hypotheses

H(1)	*the greater the capital adequacy ratio, the lower the profit*
H(2)	*the greater the size of a Bank, the greater profit*
H(3)	*the greater the liquidity of a Bank, the lower the profit*
H(4)	*the greater the management efficiency metric, the greater the profit*
H(5)	*the greater the implicit costs rate of a Bank, the lower the profit*
H(6)	*the greater the cost efficiency rate of a Bank, the greater the profit*
H(7)	*the greater the inflation rate of a country, the lower the profit*
H(8)	*if an economy is in a greater part of business cycle, the greater will be the profit and vice versa*

The sections which follow provide more detail around the research design, methodology and steps taken.

3.1 Research design

This study employs a quantitative research approach, utilising a panel data approach and regression analysis over a twenty-year period. A quantitative research approach assesses data metrics that are measured numerically, as opposed to descriptive characteristics (Leedy and Ormrod, 2021). It is further best applied in identifying relationships between variables (Leedy and Ormrod, 2021). Given this, a quantitative approach was considered appropriate for this study, due to the relationship testing which the study aims to assess (between capital adequacy and profitability, and other hypotheses above).

Leedy and Ormrod (2021) references two study designs that may be used to assess changes in variables, namely cross-sectional studies (data compared to each other) and longitudinal studies (data compared over time). Naceur and Kandil (2009) however caution that regressions based on cross-sectional studies may have inconsistent results due to “omitted variable and endogeneity bias” (Naceur, 2009, p.80). A way to solve for this is through employing panel data methodology. Obadire et al. (2022) notes the following advantages to utilising a panel data approach:

1. It allows for a variable that’s included in a study to be repeated over time.

2. Further combines cross-sectional data with time-series data, thereby increasing amount of data that passes through the regression and
3. Improves econometric estimation through decreased collinearity between variables.

Based on the above, it would appear that a panel data approach would be suited to the South African context, given the small number of Banks in the sector (n=14) and the ability for the methodology to take into account an increased data set. A similar approach is undertaken in other studies, which include Naceur and Kandil (2009), Baneerjee and Velamuri (2015), Ozili (2017), Novokmet and Pavic (2021), Masindi and Singh (2022) and Obadire et al. (2022).

In terms of the regression model and variables, this study leverages off a previous study by Naceur and Kandil (2009), titled “The impact of capital requirements on banks’ cost of intermediation and performance: The case of Egypt”. Whilst the academic landscape and methodologies surrounding this topic are quite vast, it was important to align this study with one that has well reputed authors. It was noted that the:

1. Article is cited 105 times according to the ScienceDirect multidisciplinary database (accessed through the Wits Library electronic sources database).
2. Authors are well reputed and are affiliated with the International Monetary Fund (as per author profiles in Naceur and Kandil, 2009, p.70).
3. In terms of comparability, Egypt could be seen as having strong similarities to South Africa. Allen et al. (2011) highlights that from an African perspective, both countries have the oldest established markets with high liquidity. This comparability is further reiterated by GDP statistics in achieved in October 2023, with Egypt showing $357.83bn and South Africa $389.25bn (International Monetary Fund, 2023).

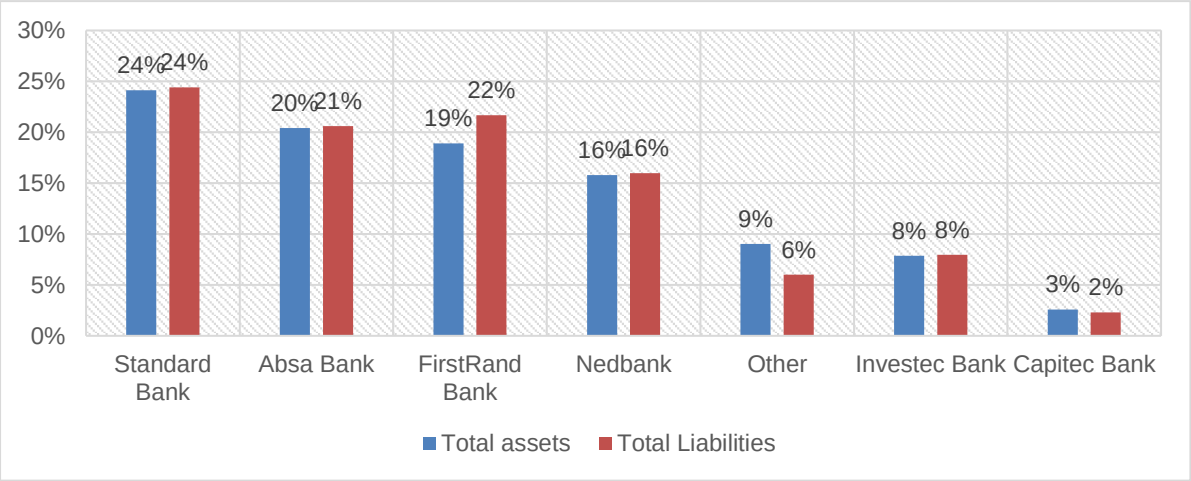
Amendments were however made to variables, based on nuances in the South African banking sector, where necessary. The variables and regression model are detailed in the sections which follow.

3.2 Data sample

A total of 14 locally controlled Banks were selected for this study. This data was obtained from a listing of registered banks on the South African Reserve Bank website (2024b). The total South African Banking population, in addition to locally controlled banks include Branches of Foreign Banks, Foreign Bank Representatives, Foreign Controlled Banks and Mutual Banks. According to Claessans and van Horen (2012), the impact of a contribution from foreign banks

to a local economy is limited, especially where the markets have barriers to entry and the foreign banks are smaller, specialised institutions that focus on niche markets. The make-up of the South African Banking sector (by asset and liability size) is as follows:

Figure 5: South African Banking Sector Composition, by Total Assets and Liabilities



Source: Author's own compilation [2] Ref no. [B2]

The above graph depicts that the market is concentrated to a few large participants with asset contributions as follows: Standard Bank (24%), Absa Bank (20%), FirstRand (19%) and Nedbank (16%). Included in "Other" are the foreign branches and mutual banks, which form part of a contribution to a small (9%)[3] value to the overall total banks' asset size total in South Africa. This illustrates that the market could be viewed as having barriers to entry. Based on this, and in consideration of Claessans and van Horen (2012) above, only locally controlled Banks were considered for this study and not any foreign owned Banks. This exclusion is consistent with other studies undertaken on the SA banking sector, including Ifeacho and Ngalawa (2014) and Nyoka (2019). This area of research can however be extended to include foreign owned banks in the population of a study in future.

The total of 14 locally controlled Banks and associated datapoints were included in the sample as follows:

Table 3: Datapoints

Row Labels	Sum of Count

[2] Compiled from "Total Banks" data available on SARB website, and BA900 returns for locally controlled banks as at August 2023.

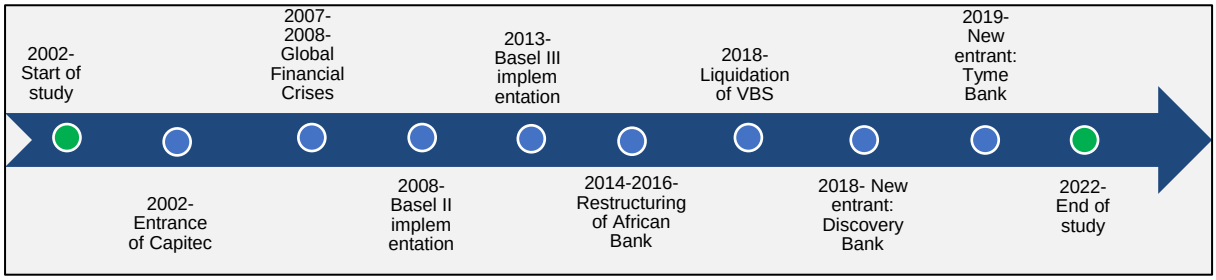
[3] This value is inclusive of Ithala, a government owned bank.

Absa Bank Limited	21
African Bank	7
Bidvest Bank Limited	19
Capitec Bank Limited	21
Discovery Bank Limited	6
FirstRand Bank Limited	21
Grindrod Bank Limited	10
Investec Bank Limited	21
Nedbank Limited	21
Sasfin Bank Limited	19
The Standard Bank of South Africa Limited	21
Tyme Bank Limited	5
UBANK Limited	14
VBS Bank	4
Grand Total	210

3.3 Time period

The variables for this study were traced back over a historical period of 20 years (2002-2022). Naceur and Kandil (2009) employed a 16-year period, to allow for thorough analysis and focus on structural breaks over the period. This is similarly applied in this study, and the longer time period applied reflects significant changes in the banking sector, namely the incorporation of Basel II (2008) and III (2013) changes, as well as the introduction of key market players (such as Capitec Bank in 2002 and exit/restructure of other key market participants (e.g. African Bank in 2016). A brief timeline is depicted below:

Figure 6: Timeline of study



Source: Compilation of author's own research. *Ref no. [B3]*

3.4 Data collection

The data used in the study was extracted from the BankFocus database (accessed via the Wits University Library website), which excluded inflation and business cycle indicators, that were extracted from the WorldBank database. The BankFocus database is a reputable database managed by Moody's Analytics and merges content from "the Bureau van Dijk and Moody's Investors Service" (Moody's Analytics, 2023, p.2) databases. The BankFocus database was preferred over other databases (such as IRESS), as it had detailed bank-specific ratios and calculations (such as capital adequacy ratios) available. There was, however, a limitation on it as there were certain variables not available for the earlier years of the period under review. To mitigate the risk of having a reduced data set, the missing data inputs were sourced manually and entered/calculated (see section 3.6 below) from published financial statements, housed on the respective Banks' websites. Once all data was available, all sheets extracted were consolidated into excel, with one overall sheet for input into R, that was used to test the regression for fixed effects (see section 3.8 below). Once the Hausman results were confirmed, the data was entered into IBM Statistical Package for Social Sciences (SPSS), for regression analysis.

3.5 Regression model and variables

The final equation for testing was based off the model by Naceur and Kandil (2009) and is stated as follows:

$$Profitability\ (Y_{ij,t}) = \beta 0 + \delta Y_{ij,t-1} + \sum_{k=1}^{n} \beta 1.CAR + \sum_{k=1}^{n} \beta 2.Size + \sum_{k=1}^{n} \beta 3.Liq + \sum_{k=1}^{n} \beta 4.MgmtEff + \sum_{k=1}^{n} \beta 5.ImplictCost + \sum_{k=1}^{n} \beta 6.CostEff + \sum_{k=1}^{n} \beta 7.Inflation + \sum_{k=1}^{n} \beta 8.BusCycle + \delta Yi + \varepsilon i$$

As 4 different profitability indicators were used to test as dependant variables in this study, the above model was run 4 times as Model 1, Model 2, Model 3 and Model 4 (refer below).

The following table depicts variable descriptions of this study:

Table 4: Variable descriptions

Category	Variable description
$Profitability\ (Y_{ij,t})$	*Model 1*- Return on Assets (ROA)
	Model 2- Return on Equity (ROE)
	Model 3- Net Interest Margin 1 (NIM1, calculation defined below)
	Model 4- Net Interest Margin 2 (NIM2, calculation defined below)
$\beta 0$	Intercept
$\delta Y_{ij,t-1}$	Lagged profitability variable
CAR	Tier1 Capital Adequacy Ratio, Total Regulatory Capital
$Size$	Size
Liq	Liquidity
$MgmtEff$	Management Efficiency
$Implicit\ Cost$	Implicit Cost
$CostEff$	Cost Efficiency
$Inflation$	Inflation
$BusCycle$	Business Cycle
$\delta Yi + \varepsilon i$	Model- based on fixed effects test (refer section 3.8 below)

The following table summarises the variable formula/s, inputs, sources, expected relationships as well as studies which have used these variables.

Table 5: Summary Table- variables, formulas and expected relationships

Variable	Formula	Inputs	Source	Variable type	Expected relationship	Study Citation
Return on Assets (ROA)	Profit (loss) after tax ÷ Total Assets	Profit (loss) after tax; Total Assets	Bankfocus	Dependent – Model 1	n/a	Ifeacho and Ngalawa (2014), Zhang et al. (2021), Kundid (2012), Naceur and Kandil (2009) and Naceur & Omran (2011).
Return on Equity (ROE)	Profit (loss) after tax ÷ Total Owner's interest	Profit (loss) after tax; Shareholders Equity	Bankfocus	Dependent – Model 2	n/a	Ifeacho and Ngalawa (2014), Naceur and Kandil (2009) and Madugu et al. (2019).
Net Interest Margin 1 (NIM1)	Ratio of net interest revenue over average interest-bearing assets	Net interest income (expense); Average Interest-Bearing Assets	Bankfocus	Dependent – Model 3	n/a	Naceur and Kandil, 2009, p. 77.
Net Interest Margin 2 (NIM2)	Ratio of net interest income over average total assets	Net interest income (expense); Average Total Assets	Bankfocus	Dependent – Model 4	n/a	Naceur and Kandil, 2009, p. 77.
Tier 1 Capital Adequacy Ratio	Metric	Tier 1 ratio (as reported) %	Bankfocus	Independent (applied to models separately from Total Regulatory Capital Ratio)	-	As reflected in the published financial reports
Total Regulatory Capital Ratio	Metric	Total capital adequacy ratio (as reported) %	Bankfocus	Independent(applied to models separately from Tier 1 Capital Adequacy Ratio)	-	As reflected in the published financial reports
Size	Log of total assets in a bank	Total Assets	Bankfocus	Independent	+	Naceur and Kandil, 2009, p.79.
Liquidity	Ratio of net loans over deposits and short-term borrowings	Net loans & advances to banks; Net loans & advances to customers; Customer deposits; Bank deposits; Other wholesale deposits;	Bankfocus	Independent	-	Naceur and Kandil, 2009, p.79.

		Short-term borrowings and debt securities at historical cost < 1 year				
Management Efficiency	Ratio of earning assets to total assets	Earning assets; Total assets	Bankfocus	Independent	+	Naceur and Kandil, 2009, p79.
Implicit Cost	Non-interest expenses relative to non-interest revenues	Total operating expenses; Non-interest revenue	Bankfocus	Independent	+	Naceur and Kandil, 2009, p79.
Cost Efficiency	Cost of overhead to total assets	Total operating expenses; Total assets	Bankfocus	Independent	+	Naceur and Kandil, 2009, p79.
Inflation	Metric- a macroeconomic statistic	Inflation %	WorldBank	Independent	+	Naceur and Kandil, 2009
Business Cycle	the output gap such that an increase indicates a boom	percentage was calculated based in the yearly change of GDP.	Worldbank	Independent	+	Naceur and Kandil, 2009)

3.6 Other considerations

As mentioned previously, for metrics which were not available on the database, calculations were done to ensure that the same basis of information was used for the comparison periods. An example of this was the calculation of Absa's average interest-bearing assets, which was not available on BankFocus prior to 2005. As a check, the supporting calculation was viewed in BankFocus for 2006 and manually recalculated from a set of the 2006 financial statements to ensure that the same inputs were being used. Only once the recalculated balance tied to the BankFocus value, was it safely assumed that the formula could be recalculated for the missing periods and the 2005 balance was recalculated. A similar approach was taken for all the Banks where there was missing information.

In addition, where there were changes in accounting disclosures during the time period (and a metric needed to be calculated), these metrics were still calculated using the formula that was consistent with the most recent time period. An example of this was also related to average interest earning assets, which in the earlier years disclosed investment securities separately in notes such as "statutory liquid asset portfolio" and "capital market assets". The database already restated for these changes where applicable, however a gap existed where data was not available. This was recalculated by taking into account an existing calculation from the database, extracting the data manually from the financial statements and consistently mapping it to a calculation to ensure comparability across the timeframe.

The earnings calculation was calculated as "total assets - intangible assets - "other tangible assets"" (Calomiris and Nissim, 2007, p.50). For the purpose of this dissertation, tax assets were not considered as an earning asset, due to it not being a category that's utilised to generate revenue in the ordinary course of a Bank's business. In addition, overheads were populated as operating expenses, given guidance as per the Worldbank (2024a) guidance.

From a SPSS data perspective, where Banks did not exist in some of the years under review, the associated blank variable rows were removed e.g. for Discovery Bank, which has established in 2018. In addition, where there was no available way to access information for an entity, these were taken into account as a blank into SPSS. e.g. Bidvest Bank, which was previously Rennies Bank, where there was no available financial statements to extract results from.

Furthermore, there were also certain years incorporating data that had new entrants with volatile profits e.g. Discovery Bank. These observations were not treated as outliers as they were considered representative of a change in dynamics of the banking industry with the entry

of new participants. In addition, this dynamic was necessary to capture because it represents the birth stage in the life cycle of a firm, which tends to have cash outflows and low profitability as the firm undertakes expansion activities, leading to an impact on the firm's capital structure (Zhang et al., 2015).

A dummy capital variable was created in the dataset to take into account changes in regulatory capital requirements for Basel II and III. For years where the new regulation was implemented, "1" was inserted and for years there was no change, a "0" was reflected. This was in accordance with Naceur and Kandil (2009). An additional lagged profitability variable was created as an independent variable to show an impact for profit persistence (Naceur and Kandil, 2009).

3.7 Deviations from base study

The independent variables were based off the study conducted by Naceur and Kandil (2009). The following deviations from the study were noted:

- Reserves: "banks' reserves at the central bank" (Naceur and Kandil, 2009, p.77). In South Africa, a bank would keep the minimum required reserves at the central bank, which may not necessarily result in a need to charge more for cost of intermediation. Therefore, this variable is excluded from the study.
- Market power: measured as market share in terms of total assets and serves as a proxy for the degree of monopoly (Naceur and Kandil, 2009). South Africa is highly concentrated to four main banks (as depicted earlier under section 3.2) and for the purpose of this study this concept was considered to be captured under the "Bank size" variable.
- Bank concentration: "the size of banks' assets in the three largest banks to total assets which indicates monopoly power "(Naceur and Kandil, 2009, p.77). Due to the size of the Egyptian Banking industry (52) vs South Africa (14), it was found that this variable should also be captured under the "Bank size" variable.
- Interaction dummy: "one if the ratio of equity to total assets is equal or larger than the median, zero otherwise. The dummy variable interacts with the ratio of equity to total assets to test whether the impact of bank capitalization on performance depends on its level" (Naceur and Kandil, 2009, p.77). For the purpose of this study this variable was also considered under the "Bank size" variable.
- Financial structure (Fts): "banks' assets relative to assets in the stock market. The higher this ratio the more dominant banks are in the financial structure" (Naceur and Kandil, 2009,

p.77). South Africa's JSE sector is fairly diverse in terms of industry split, hence this variable was not included in the study.

- Interest liberalization (Irlib): "a dummy variable that marks the change in interest rate management by the Egyptian Central Bank" (Naceur and Kandil, 2009, p.77). For the purpose of this study, this variable is considered to be specific to the Egyptian Banking landscape.
- The GMM estimator was not used in this study, following guidance from Madugu et al. (2020), as the cross-sectional data (n)= 14, which is less than the time period data under review (t) =20 (see section 2.3: hypothesis development, above). Omitted variable bias and endogeneity is covered in section 3.9: tests for validity and reliability, below.

3.8 Test for fixed effects (Hausman Test)

Gujarati and Porter (2009) note that a fixed effects model or random effects model that can be used in panel data. The authors further note that under the fixed effects model "each cross-sectional unit has its own (fixed) intercept value" (p.603) and in random effects models "the (common) intercept represents the mean value of all the (cross-sectional) intercepts and the error component εi represents the (random) deviation of individual intercept from this mean value" (p.603). Gujarati and Porter (2009) further note that a Hausman Test can be used to test model appropriateness. Masindi and Singh (2022) provide other common tests that can be utilised to check for model appropriateness e.g. the "Chow test" and "the Lagrange multiplier test" (Masindi and Singh, 2022, p. 22). For the purposes of this study, the Hausman test was selected.

The Hausman Test was performed in statistical software package "R". In a Hausman test, a fixed effects model is chosen if the null hypothesis is rejected and the p-value is statistically significant (Gujurati and Porter, 2009). The results of the test run in "R" is as follows:

Table 6: Hausman Test Results

Tier 1 Capital Metric		
Model	**P-Value**	**Result**
Model 1 – ROE	<2.2e-16	p- value is not statistically significant- use Fixed Effects Model
Model 2 – ROA	5.985e-09	p- value is not statistically significant- use Fixed Effects Model
Model 3 - NIM1	7.134e-15	p- value is not statistically significant- use Fixed Effects Model

Model 4 - NIM2	<2.2e-16	p- value is not statistically significant- use Fixed Effects Model

Total Regulatory Capital Metric		
Model	**P-Value**	**Result**
Model 1 - ROE	<2.2e-16	p- value is not statistically significant- use Fixed Effects Model
Model 2 - ROA	0.05036	Further consideration needed (see below)
Model 3 - NIM1	6.241e-15	p- value is not statistically significant- use Fixed Effects Model
Model 4 - NIM2	<2.2e-16	p- value is not statistically significant- use Fixed Effects Model

The results above indicate that all p-values were less than 0.05, with the exception of the test done for Model 2 against the ROA and Total Regulatory Capital variables. The p-value is noted to be marginally over the 0.05 threshold. To keep a consistent approach with the other models, one model approach was adopted for this study, i.e. the fixed effects model. To support this view, it is also noted that Naceur and Kandil (2009) also applied a fixed effects model.

3.9 Tests for validity and reliability

To ensure a robust testing model and improve validity and reliability over the model, the following tests were conducted in SPSS (the results of which can be found in Chapter IV, Presentation of Results, Section 4.1: Validity and Reliability):

Test of normality – Gujarati and Porter (2009) provides three tests of normality than can be applied to a population, namely (1) histogram of residuals; (2) normal probability plot (NPP), a graphical device; and (3) the Jarque–Bera test." (p.131). For the purposes of this study, the normal P-P plots (NPP) is used. Gujarati and Porter (2009) further note that if the NPP depicts a line that is approximately straight, it can be concluded that the sample follows a normal distribution. The NPP and Histogram was generated in IBM SPSS and assessed for normality.

Heteroskedasticity refers to an "unequal spread or variance" (Gujarati and Porter, 2009, p. 365). The authors note that a graphical informal method (scatterplot) can be used to assess for heteroskedasticity. This involves checking the residuals (squared) for a systematic pattern against predicted values.

According to Gujarati and Porter (2009), multicollinearity refers to independent variables being correlated with each other. The authors suggest using the variance inflation factor (VIF) to

assess for multicollinearity. This measure is generally inflated when there is multicollinearity present in a model.

Omitted variable bias (endogeneity, risk that not all variables which should have been included, are (Gujarati and Porter (2009)) represents a risk that all required variables have not been included. For the purposes of this study, this risk has been reduced through the use of variables which are included in previous literature studies (Naceur and Kandil, 2009), as well as a thorough review of the existing literature supporting this topic. In addition to this, validity of data was ensured by using a reputable database (BankFocus).

This chapter provided a view of the research methodology and design undertaken in this study. The next chapter will focus on providing the results of the study.

CHAPTER IV
PRESENTATION OF RESULTS

The overall intention of this chapter is to provide the results of the regression model run in response to the research question posed: What is the relationship between capital holdings and profitability for South African banks?

The hypotheses are restated for reference once more as follows:

Table 7: Summary of hypotheses restated

H(1)	*the greater the capital adequacy ratio, the lower the profit*
H(2)	*the greater the size of a Bank, the greater profit*
H(3)	*the greater the liquidity of a Bank, the lower the profit*
H(4)	*the greater the management efficiency metric, the greater the profit*
H(5)	*the greater the implicit costs rate of a Bank, the lower the profit*
H(6)	*the greater the cost efficiency rate of a Bank, the greater the profit*
H(7)	*the greater the inflation rate of a country, the lower the profit*
H(8)	*if an economy is in a greater part of business cycle, the greater will be the profit and vice versa*

The regression model restated (and linked to the hypothesis above) is as follows:

$$Profitability\ (Y_{ij,t}) = \beta 0 + \delta Y_{ij,t-1} + \sum_{k=1}^{n} \beta 1.CAR + \sum_{k=1}^{n} \beta 2.Size + \sum_{k=1}^{n} \beta 3.Liq + \sum_{k=1}^{n} \beta 4.MgmtEff + \sum_{k=1}^{n} \beta 5.ImplictCost + \sum_{k=1}^{n} \beta 6.CostEff + \sum_{k=1}^{n} \beta 7.Inflation + \sum_{k=1}^{n} \beta 8.BusCycle + \delta Yi + \varepsilon i$$

4.1 Validity and Reliability

4.1.1 Tests of Normality

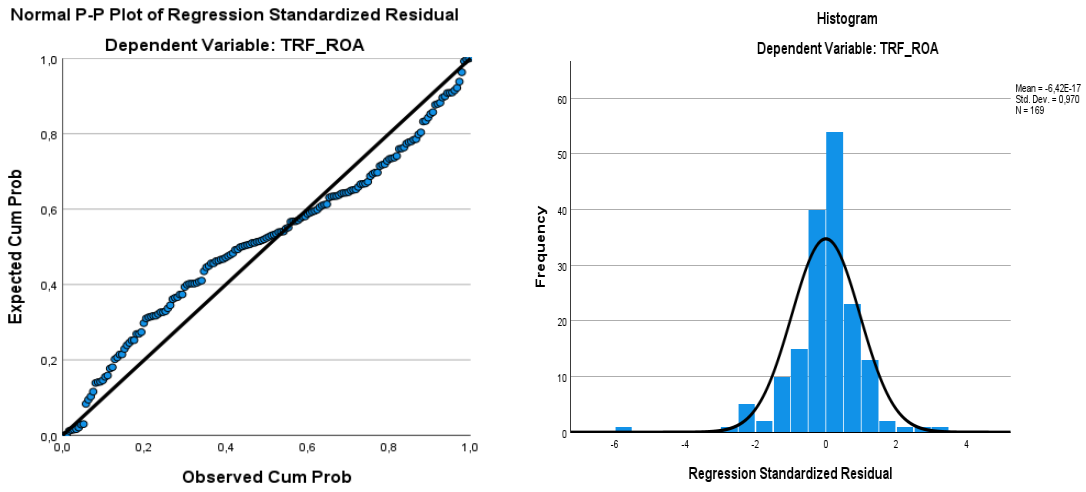
The initial tests of normality were run on the dataset in SPSS and normal P-P plots and histograms were visually presented (Gujarati and Porter, 2009). The following concerns were at first noted with the graphs that were visually presented (both for Tier 1 and Total Regulatory Capital as separate regressors):

1. ROA– the P-Plot did not follow a close line to expected values. A significant portion of observations fell outside of the normality range.
2. ROE – the P-Plot did not follow a close line to expected values.
3. NIM1 – the P-Plot did not follow a close line to expected values. A significant portion of observations fell outside the normality range.
4. NIM2 – the P-Plot did not follow a close line to expected values. A significant portion of observations fell outside the normality range.

The results of the initial graphs have been added to the Appendix under Figure A1. To reduce the variability seen in the data, a logarithmic transformation was applied to each profitability metric (Gujarati and Porter, 2009). A logarithmic transformation is noted to be a potential way of reducing skewness in a regression (Gujarati and Porter, 2009). These transformations were achieved by calculating a computed variable in SPSS and taking the natural logarithm of each of the profitability variables resulting in the following variables being used in the dataset: TRF_ROA, TRF_ROE, TRF_NIM1 and TRF_NIM2.

The final tests of normality are depicted graphically as follows:

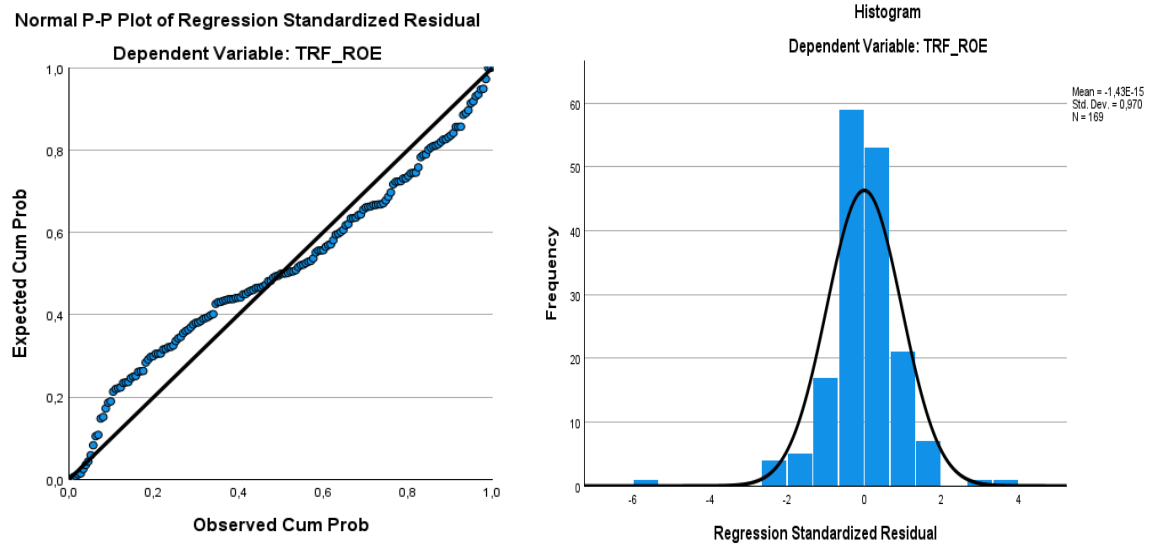
Figure 7: Normality tests - TRF_ROA regressed against Tier 1



Source: SPSS

For the dependant variable **TRF_ROA**, which was regressed against the independent variables representing the (Constant), Business Cycle, Cost Efficiency, Implicit Cost, Dummy Variable, Liquidity, Inflation, LAG_ROA, Management Efficiency, Size, and **Tier1**, the P-P plot reflects an upward sloping line that is close to expected values. The histogram reflects a graph which shows a normal distribution, with a standard deviation of 0.970 from the mean. These visual representation passes the tests of normality.

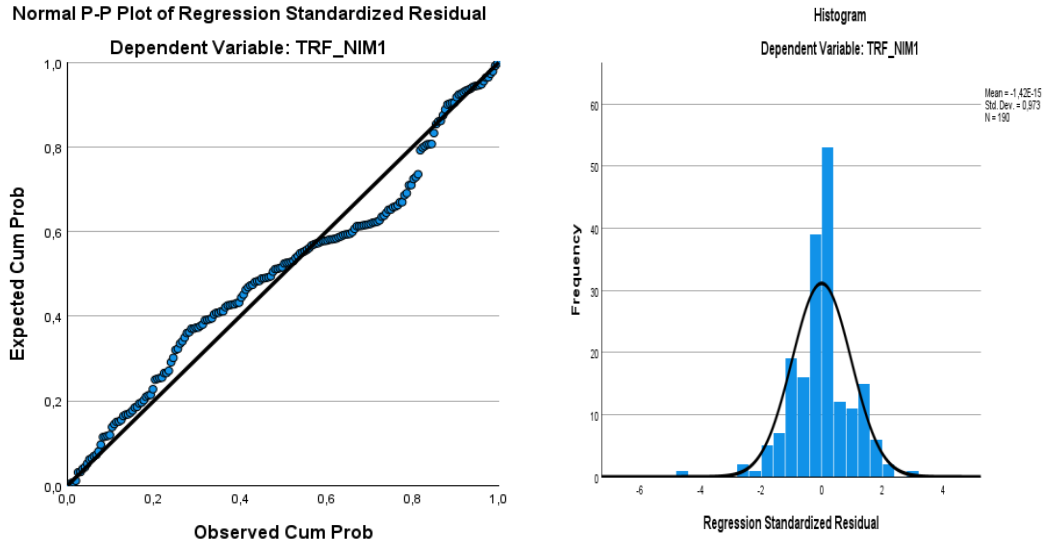
Figure 8: Normality tests - TRF_ROE regressed against Tier1



Source: SPSS

For the dependant variable **TRF_ROE**, which was regressed against the independent variables representing the (Constant), Business Cycle, Cost Efficiency, Implicit Cost, Dummy Variable, Liquidity, Inflation, LAG_ROE, Management Efficiency, Size, and **Tier1**, the P-P plot reflects an upward sloping line that is close to expected values. The histogram reflects a graph which shows a normal distribution, with a standard deviation of 0.970 from the mean. These visual representations pass the tests of normality.

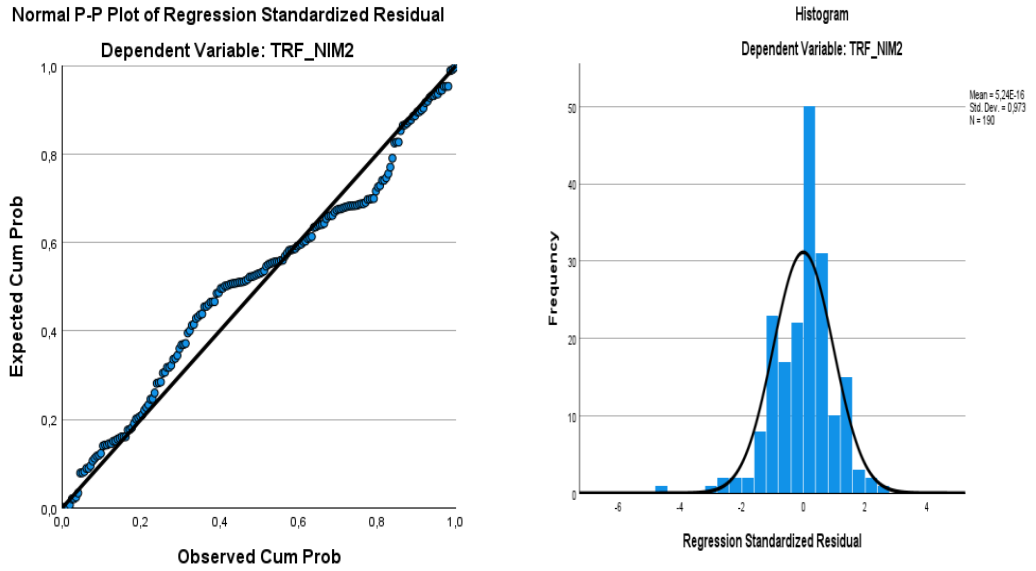
Figure 9: Normality tests – TRF_NIM1 regressed against Tier1



Source: SPSS

For the dependant variable **TRF_NIM1**, which was regressed against the independent variables representing the (Constant), Business Cycle, Cost Efficiency, Implicit Cost, Dummy Variable, Liquidity, Inflation, LAG_NIM1, Management Efficiency, Size, and **Tier1**, the P-P plot reflects an upward sloping line that is close to expected values. The histogram reflects a graph which shows a normal distribution, with a standard deviation of 0.973 from the mean. These visual representations pass the tests of normality.

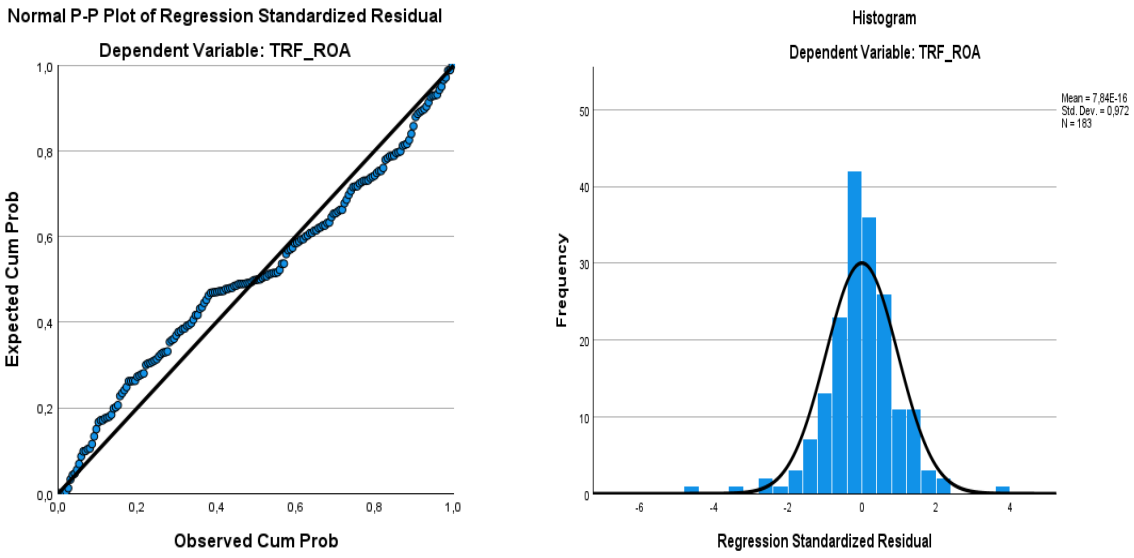
Figure 10: Normality tests - TRF_NIM2 regressed against Tier1



Source: SPSS

For the dependant variable **TRF_NIM2**, which was regressed against the independent variables representing the (Constant), Business Cycle, Cost Efficiency, Implicit Cost, Dummy Variable, Liquidity, Inflation, LAG_NIM2, Management Efficiency, Size, and **Tier1**, the P-P plot reflects an upward sloping line that is close to expected values. The histogram reflects a graph which shows a normal distribution, with a standard deviation of 0.973 from the mean. These visual representations pass the tests of normality.

Figure 11: Normality tests - TRF_ROA regressed against Total Regulatory Capital

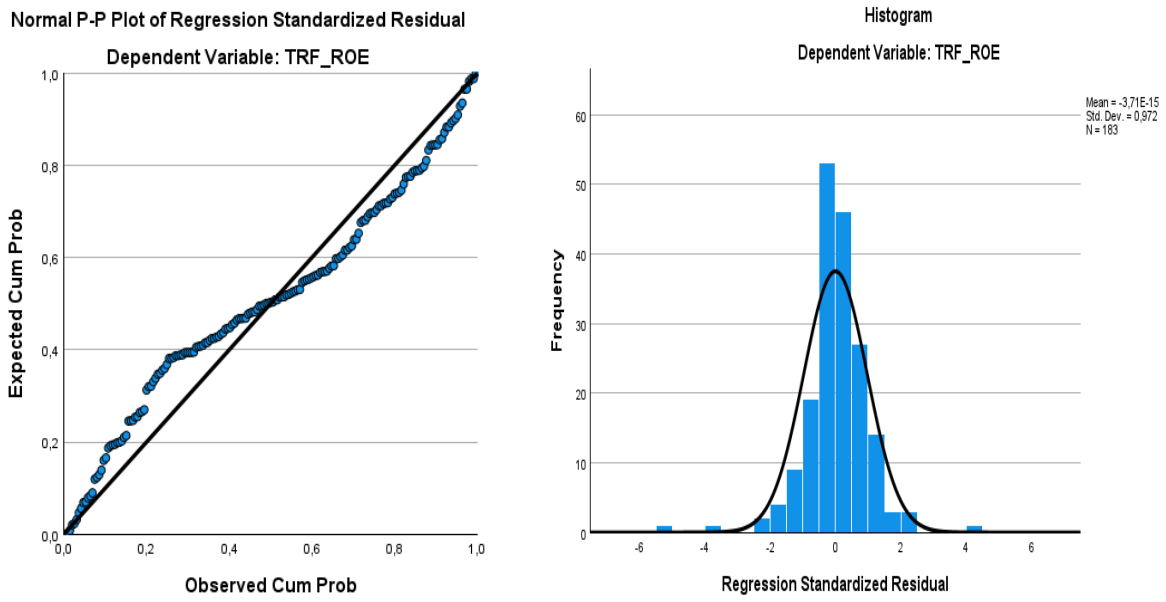


Source: SPSS

For the dependant variable **TRF_ROA**, which was regressed against the independent variables representing the (Constant), Business Cycle, Cost Efficiency, Implicit Cost, Dummy

Variable, Liquidity, Inflation, LAG_ROA, Management Efficiency, Size, and **Total Regulatory Capital**, the P-P plot reflects an upward sloping line that is close to expected values. The histogram reflects a graph which shows a normal distribution, with a standard deviation of 0.972 from the mean. These visual representations pass the tests of normality.

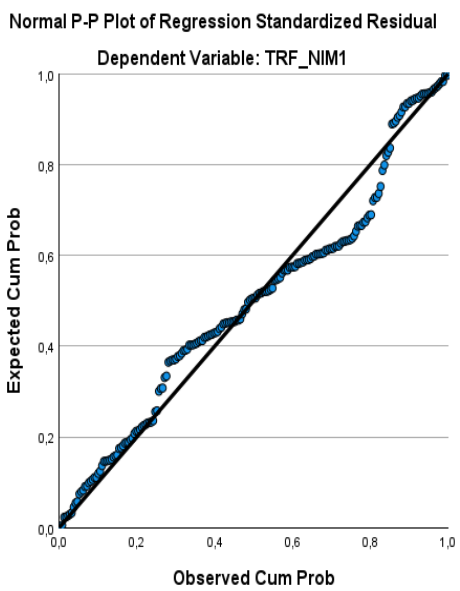
Figure 12: Normality tests - TRF_ROE regressed against Total Regulatory Capital

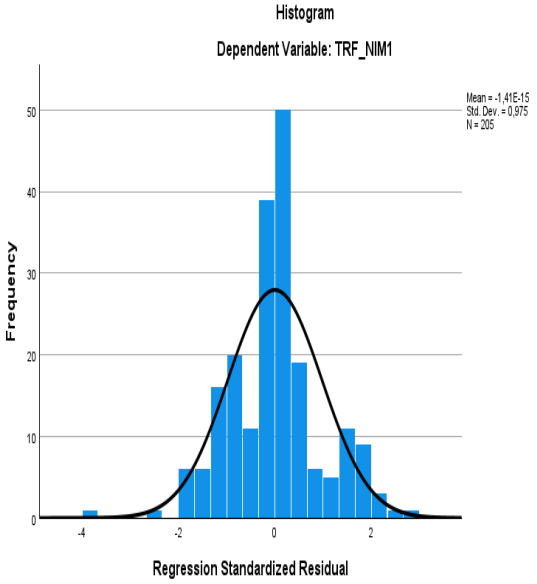


Source: SPSS

For the dependant variable **TRF_ROE**, which was regressed against the independent variables representing the (Constant), Business Cycle, Cost Efficiency, Implicit Cost, Dummy Variable, Liquidity, Inflation, LAG_ROE, Management Efficiency, Size, and **Total Regulatory Capital**, the P-P plot reflects an upward sloping line that is close to expected values. The histogram reflects a graph which shows a normal distribution, with a standard deviation of 0.972 from the mean. These visual representations pass the tests of normality.

Figure 12: Normality tests - TRF_NIM1 regressed against Total Regulatory Capital

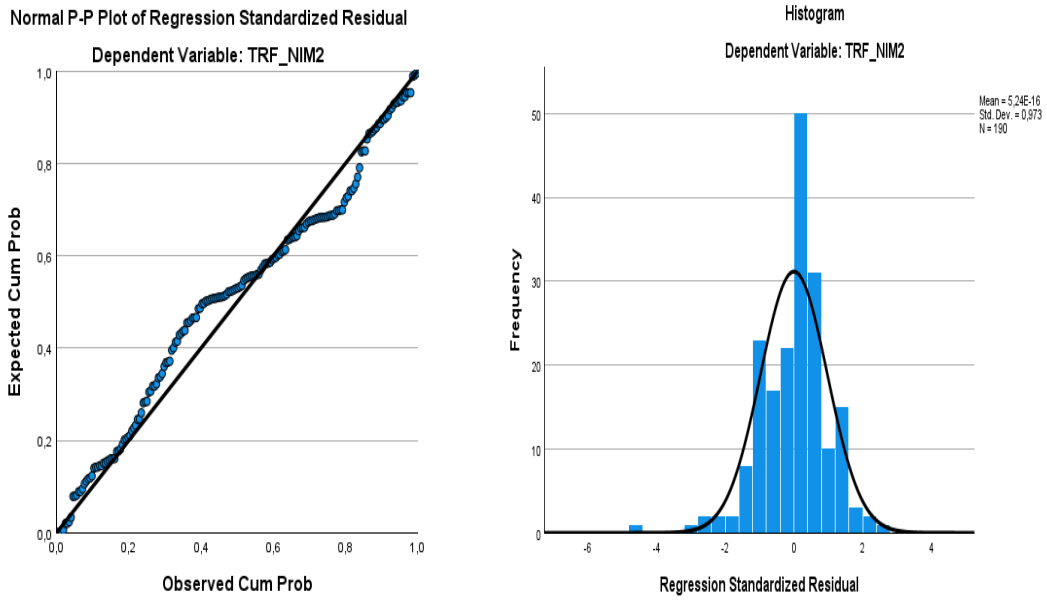




Source: SPSS

For the dependant variable **TRF_NIM1**, which was regressed against the independent variables representing the (Constant), Business Cycle, Cost Efficiency, Implicit Cost, Dummy Variable, Liquidity, Inflation, LAG_NIM1, Management Efficiency, Size, and **Total Regulatory Capital**, the P-P plot reflects an upward sloping line that is close to expected values. The histogram reflects a graph which shows a normal distribution (even though there are some gaps on the graph, there is a peak noted), with a standard deviation of 0.975 from the mean. These visual representations pass the updated tests of normality.

Figure 13: Normality tests - TRF_NIM2 regressed against Total Regulatory Capital



Source: SPSS

For the dependant variable **TRF_NIM2**, which was regressed against the independent variables representing the (Constant), Business Cycle, Cost Efficiency, Implicit Cost, Dummy Variable, Liquidity, Inflation, LAG_NIM2, Management Efficiency, Size, and **Total Regulatory Capital**, the P-P plot reflects an upward sloping line that is close to expected values. The histogram reflects a graph which shows a normal distribution, with a standard deviation of 0.973 from the mean. These visual representations pass the updated tests of normality.

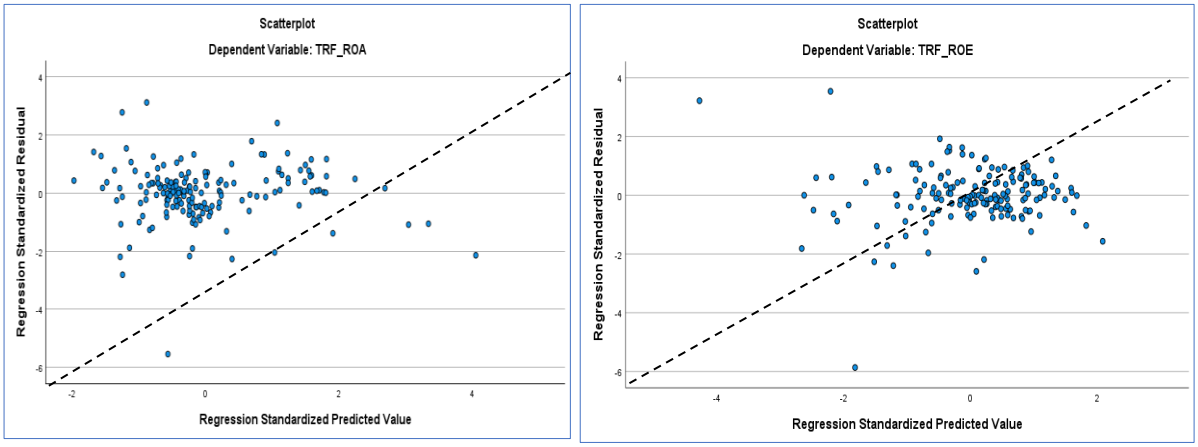
Based on the above depictions, it was evident that there was normal distribution is present in each graph. The normality requirement is considered appropriate and the approach was continued to use descriptive statistics and panel regression in assessing the data.

4.1.2 Test for Heteroskedasticity

As mentioned under Chapter 3 “Methodology”, the test for heteroscedasticity involves checking the residuals (squared) for a systematic pattern (Gujarati and Porter, 2009). This test was conducted post the logarithmic transformation applied during normality tests above. The following visuals are presented:

Figure 14: Scatterplot- TRF_ROA (Tier1 as a regressor)

Figure 15: Scatterplot- TRF_ROE (Tier 1 as a regressor)

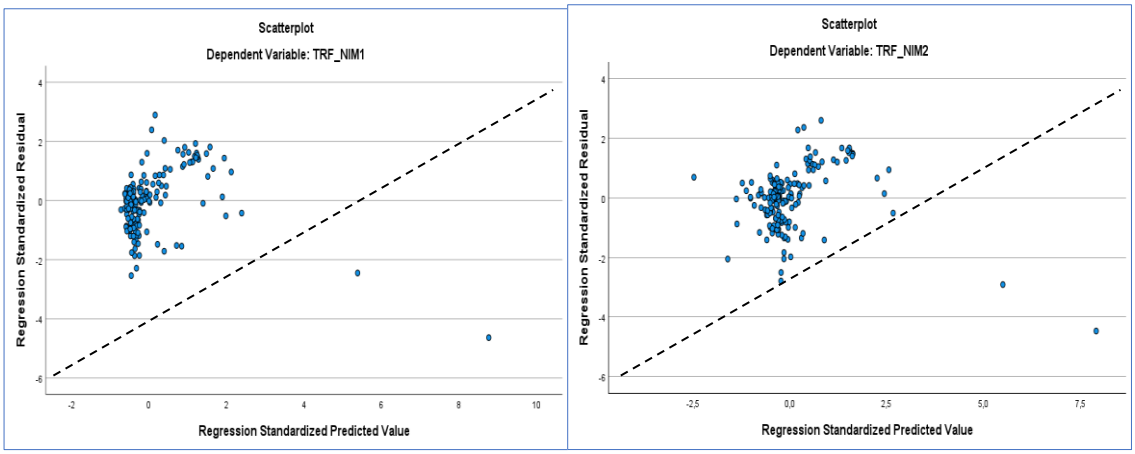


Source: SPSS

The scatterplots above have been extracted from SPSS and plotted with the standardised residual as the y axis and standardised predicted value as the x axis. A relationship line was drawn to assess any points that came close enough to the line, which would demonstrate the pattern of a linear relationship. For TRF_ROA, the points did not come close enough to display any linear pattern. For TRF_ROE, there are a few points which came close to the line, however a majority of the points are concentrated to an area under the line, hence no specific linear relationship is seen.

Figure 16: Scatterplot- TRF_NIM1(Tier1 as a regressor)

Figure 17:Scatterplot- TRF_NIM2(Tier1 as a regressor)

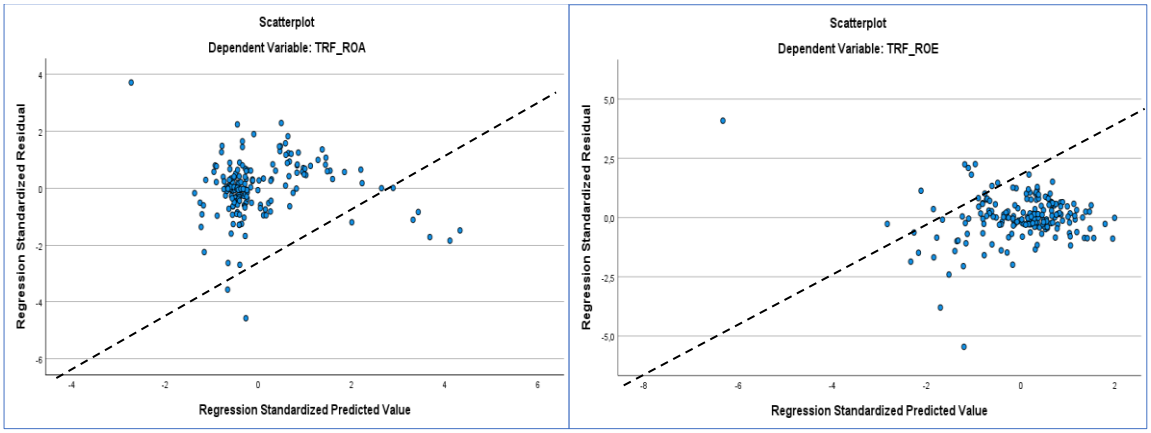


Source: SPSS

For both TRF_NIM1 and NIM2, the points did not come close enough to display any linear pattern and the respective data points are concentrated above the line. There are two outliers under the line, which are (by volume) not material enough to adjust out. There are no specific linear relationships seen.

Figure 18: Scatterplot- TRF_ROA (Total Regulatory Capital as a regressor)

Figure 19: Scatterplot- TRF_ROE (Total Regulatory Capital as a regressor)

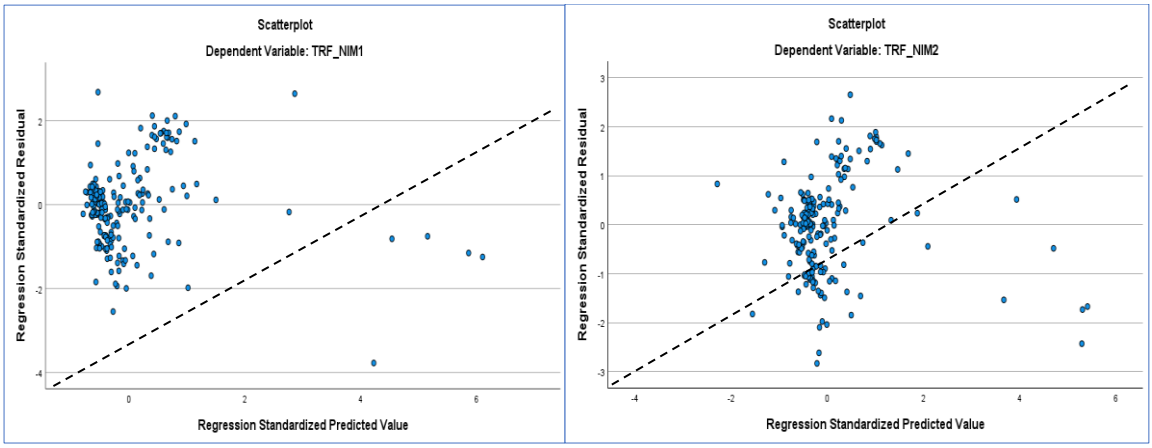


Source: SPSS

For TRF_ROA and TRF_ROE, the points did come close enough to display any linear pattern, hence no specific linear relationship is seen.

Figure 20: Scatterplot- TRF_NIM1(Total Regulatory Capital as a regressor)

Figure 21: Scatterplot- TRF_NIM2(Total Regulatory Capital as a regressor)



Source: SPSS

For TRF_NIM1 and TRF_NIM2, the points did not come close enough to display any linear pattern, hence no specific linear relationships were seen.

As can be seen from the scatterplots above, there were no specific definitive relationships observed that would create a linear pattern. Therefore, the heteroscedastic test is met and the approach to use the defined regression model is appropriate.

4.1.3 Test for Multicollinearity

As previously mentioned, to evaluate for collinearity between variables (as per Gujarati and Porter, 2009), VIFs were calculated in SPSS to understand the impact of any potential correlations between variables.

The results are presented as follows:

Table 8: Variance Inflation Factors (VIFs)

	VIFs for independent Variable- Tier 1 Capital Metric	VIFs for independent Variable- Total Regulatory Capital Metric
Model 1 - ROA		
Dummy Variable	1,322	1,289
LAG_ROA	1,589	1,591
Tier1	2,377	
Total Regulatory Capital		4,235
Size	2,088	1,812
Liquidity	1,191	1,065
Management Efficiency	1,917	2,121
Implicit Cost	1,499	1,259
Cost Efficiency	4,241	6,053
Inflation	1,376	1,352
Business Cycle	1,045	1,08
Model 2 - ROE		
Dummy Variable	1,327	1,29
LAG_ROE	1,259	1,086
Tier1	2,289	
Total Regulatory Capital		4,139
Size	2,201	1,898
Liquidity	1,191	1,065
Management Efficiency	1,914	2,041
Implicit Cost	1,461	1,259
Cost Efficiency	4,061	5,970

Inflation	1,37	1,36
Business Cycle	1,039	1,078
Model 3 - NIM1		
Dummy Variable	1,273	1,252
LAG_NIM1	2,557	1,964
Tier1	2,483	
Total Regulatory Capital		2,886
Size	1,693	1,607
Liquidity	1,067	1,032
Management Efficiency	1,344	1,446
Implicit Cost	2,361	1,621
Cost Efficiency	2,636	3,369
Inflation	1,259	1,272
Business Cycle	1,033	1,036
Model 4 - NIM2		
Dummy Variable	1,274	1,252
LAG_NIM2	1,24	1,361
Tier1	2,541	
Total Regulatory Capital		2,907
Size	1,625	1,607
Liquidity	1,086	1,032
Management Efficiency	1,347	1,445
Implicit Cost	1,167	1,244
Cost Efficiency	2,633	3,299
Inflation	1,261	1,265
Business Cycle	1,034	1,036

As per statistical literature, there is no defined threshold as to what constitutes a high VIF and some authors apply a threshold of 5 and whilst others 10 (Chatterjee and Simonoff, 2013). A threshold of 5 was applied in this study, as a conservative approach. The VIFs reflected were below the applied threshold of 5, with the exception of Cost Efficiency (in the regression with TRF_ROA and Total Regulatory Capital), which had a VIF of 6.053. The same variable regressed in the regression with TRF_ROE and Total Regulatory Capital had a VIF of 5.970. All remaining VIFs were considered within range and the test for multicollinearity was satisfied. Therefore, the approach to use the model could continue, from a validity and reliability perspective.

4.1.4 Goodness of Fit Measures (R-squared)

Table 9: Summary of R-squared

No.	Model	R	R Square	Adjusted R Square	Capital Regressor
1	1 -TRF_ROA	0,831	0,691	0,671	Tier 1
2	1 -TRF_ROA	0,759	0,576	0,554	Total Regulatory Capital
3	2- TRF_ROE	0,667	0,445	0,409	Tier1
4	2- TRF_ROE	0,584	0,341	0,307	Total Regulatory Capital
5	3 - TRF_NIM1	0,755	0,571	0,547	Tier 1
6	3 - TRF_NIM1	0,768	0,590	0,568	Total Regulatory Capital
7	4 - TRF_NIM2	0,81	0,656	0,637	Tier 1
8	4 - TRF_NIM2	0,846	0,716	0,702	Total Regulatory Capital

The above results reflect the following:

1. With predictor variables: (Constant), Business Cycle, Cost Efficiency, Implicit Cost, Dummy Variable, Liquidity, Inflation, LAG_ROA, Management Efficiency, Size and Tier 1, TRF_ROA has an adjusted R-squared of 0.671. This is considered a high predictive model and suggests 67.1% of changes in TRF_ROA is predicted by the model.
2. With predictor variables: (Constant), Business Cycle, Implicit Cost, Liquidity, Dummy Variable, Size, LAG_ROA, Inflation, Management Efficiency and Total Regulatory Capital, TRF_ROA has an adjusted R-squared of 0.554. This is considered a moderate predictive model and suggests 55.4% of changes in TRF_ROA is predicted by the model.
3. With predictor variables: (Constant), Business Cycle, Cost Efficiency, Implicit Cost, Dummy Variable, Liquidity, LAG_ROE, Inflation, Management Efficiency, Size and Tier 1, TRF_ROE has an adjusted R- squared of 0.409. This is considered a moderate predictive model and suggests 40.9% of changes in TRF_ROE is predicted by the model.
4. With predictor variables: (Constant), Business Cycle, LAG_ROE, Implicit Cost, Liquidity, Dummy Variable, Size, Inflation, Management Efficiency and Total Regulatory Capital, TRF_ROE has an adjusted R- squared of 0.307. This is considered a moderate predictive model and suggests 30.7% of changes in TRF_ROE is predicted by the model.
5. With predictor variables: (Constant), Business Cycle, LAG_NIM1, Inflation, Liquidity, Management Efficiency, Tier 1, Dummy Variable, Size, Implicit Cost and Cost Efficiency, TRF_NIM1 has an adjusted R- squared of 0.547. This is considered a

moderate predictive model and suggests 54.7% of changes in TRF_NIM1 is predicted by the model.

6. With predictor variables: (Constant), Business Cycle, Management Efficiency, Liquidity, Inflation, Total Regulatory Capital, Implicit Cost, Dummy Variable, Size, LAG_NIM1, and Cost Efficiency, TRF_NIM1 has an adjusted R- squared of 0.568. This is considered a moderate predictive model and suggests 56.8% of changes in TRF_NIM1 is predicted by the model.
7. With predictor variables: (Constant), Business Cycle, Implicit Cost, LAG_NIM2, Inflation, Liquidity, Management Efficiency, Dummy Variable, Tier 1, Size and Cost Efficiency, TRF_NIM2 has an adjusted R- squared of 0.637. This is considered a high predictive model and suggests 63.7% of changes in TRF_NIM2 is predicted by the model.
8. With predictor variables: (Constant), Business Cycle, Management Efficiency, Liquidity, Inflation, LAG_NIM2, Implicit Cost, Dummy Variable, Size, Total Regulatory Capital, and Cost Efficiency, TRF_NIM2 has an adjusted R- squared of 0.702. This is considered a high predictive model and suggests 70.2% of changes in TRF_NIM2 is predicted by the model.

All models are moderately predictive, with the exception of the TRF_ROA (when regressed with independent variables, including Tier 1), TRF_NIM2 (when regressed with independent variables, including Total Regulatory Capital) and TRF_NIM2 (when regressed with independent variables, including Tier 1). These models are noted to have high predictive power. Additions to predictive power are generally based on adding new independent variables to the model, to the point where there is no additional increase from adding these variables on (Hair et al., 2009). The higher predictive power is hence attributed to the high number of the independent variables included for this model, the inclusion of which is appropriate given the reliance placed on model variables which were based off the study by Naceur and Kandil (2009). In addition, all other tests of validity and reliability are satisfactory. Therefore, the use of the model is still considered appropriate.

4.2 Descriptive statistics

The following table reflects the descriptive statistics obtained from SPSS for the study:

Table 10: Summarised descriptive statistics

	Independent variable - Tier 1 Capital Metric			Independent variable - Total Regulatory Capital Metric		
	Mean	**Std Deviation**	**N**	**Mean**	**Std Deviation**	**N**
Model 1 - ROA						
TRF_ROA	0,45	0,73	164	0,52	0,85	178
Dummy Variable	0,11	0,31	164	0,10	0,30	178
LAG_ROA	1,93	2,88	164	2,23	3,20	178
Tier 1	0,16	0,09	164			
Total Regulatory Capital				0,22	0,17	178
Size	8,14	1,00	164	7,97	1,13	178
Liquidity	0,98	0,32	164	1,09	0,69	178
Management Efficiency	0,96	0,08	164	0,95	0,09	178
Implicit Cost	1,24	0,38	164	26,58	337,31	178
Cost Efficiency	0,06	0,06	164	0,08	0,11	178
Inflation	0,05	0,02	164	0,05	0,02	178
Business Cycle	0,02	0,03	164	0,02	0,03	178
Model 2 – ROE						
TRF_ROE	2,62	0,50	164	2,61	0,55	178
Dummy Variable	0,11	0,31	164	0,10	0,30	178
LAG_ROE	13,71	13,82	164	13,77	13,54	178
Tier 1	0,16	0,09	164			
Total Regulatory Capital				0,22	0,17	178
Size	8,14	1,00	164	7,97	1,13	178
Liquidity	0,98	0,32	164	1,09	0,69	178
Management Efficiency	0,96	0,08	164	0,95	0,09	178
Implicit Cost	1,24	0,38	164	26,58	337,31	178
Cost Efficiency	0,06	0,06	164	0,08	0,11	178
Inflation	0,05	0,02	164	0,05	0,02	178
Business Cycle	0,02	0,03	164	0,02	0,03	178
Model 3 - NIM1						
TRF_NIM1	1,63	0,76	184	1,72	0,88	199
Dummy Variable	0,10	0,31	184	0,10	0,29	199
LAG_NIM1	9,11	18,53	184	12,45	29,90	199
Tier 1	0,19	0,20	184			
Total Regulatory Capital				0,24	0,23	199
Size	8,00	1,05	184	7,84	1,16	199
Liquidity	5,77	62,58	184	5,50	60,17	199
Management Efficiency	0,94	0,10	184	0,94	0,11	199
Implicit Cost	20,74	238,00	184	41,95	391,57	199
Cost Efficiency	0,08	0,14	184	0,10	0,16	199
Inflation	0,05	0,02	184	0,05	0,02	199
Business Cycle	0,02	0,03	184	0,02	0,03	199

	Independent variable - Tier 1 Capital Metric			Independent variable - Total Regulatory Capital Metric		
	Mean	**Std Deviation**	**N**	**Mean**	**Std Deviation**	**N**
Model 4 - NIM2						
TRF_NIM2	1,19	0,69	184	1,28	0,81	199
Dummy Variable	0,10	0,31	184	0,10	0,29	199
LAG_NIM2	4,86	7,41	184	6,33	12,40	199
Tier 1	0,19	0,20	184			
Total Regulatory Capital				0,24	0,23	199
Size	8,00	1,05	184	7,84	1,16	199
Liquidity	5,77	62,58	184	5,50	60,17	199
Management Efficiency	0,94	0,10	184	0,94	0,11	199
Implicit Cost	20,74	238,00	184	41,95	391,57	199
Cost Efficiency	0,08	0,14	184	0,10	0,16	199
Inflation	0,05	0,02	184	0,05	0,02	199
Business Cycle	0,02	0,03	184	0,02	0,03	199

The results above reflect the standard deviation and mean of the sample which are all within range with the following notable observations for liquidity and implicit costs:

1. Liquidity ratios are calculated as the ratio of net loans over deposit and short-term borrowing. Observations affecting this data include:
    a. Discovery Bank 2018- the firm had little customer deposits at inception. This is expected as depositor confidence for start-up Banks is anticipated to be low, with improvements noted once the Bank grows reputationally (life cycle of a firm).
    b. Tyme Bank 2018- the firm had fewer deposits at year of inception. This is expected as depositor confidence for start-up Banks is anticipated to be low, with improvements noted once the Bank grows reputationally (life cycle of a firm).
2. Implicit costs are calculated non-interest expenses relative to non-interest revenues (NIR). Observations affecting this data includes,
    a. Capitec Bank 2002-2004- the firm had no/limited other separate sales values disclosed for the period, therefore NIRs are low.
    b. Discovery Bank 2017- 2018 – The firm's operating expenses were higher than NIR.
    c. Tyme Bank 2018-2020- The firm's operating expenses higher were than NIR.

The above items have not been adjusted in the regression model, due to them being considered realistic in terms of the expectation of new start-up Banks, who often have higher costs at inception versus revenue streams (life cycle of a firm).

4.3 Final Co-efficients and Relationships

The following tables reflect the final results of the statistics run from SPSS, which details the final beta co-efficient, t statistics and significance (p-value). A 5% significance level was set for the purpose of this study. A students t distribution table was followed with a two-tailed approach and 10 degrees of freedom (as obtained from SPSS).

Table 11: Co-efficients and relationships – ROA (Tier 1)

Dependent Variable: TRF_ROA	Standardized Coefficients-Beta	t	Sig.	Correlations-Zero-order	Collinearity Statistics-VIF
(Constant)		- 0,53	0,60		
Dummy Variable	0,00	0,04	0,97	0,12	1,32
LAG_ROA	0,15	2,65*	0,01	0,54	1,59
Tier 1	0,47	6,86*	0,00	0,58	2,38
Size	0,11	1,77	0,08	- 0,41	2,09
Liquidity	0,04	0,76	0,45	0,08	1,19
Management Efficiency	- 0,02	- 0,30	0,76	- 0,41	1,92
Implicit Cost	- 0,40	- 7,31*	0,00	- 0,34	1,50
Cost Efficiency	0,31	3,36*	0,00	0,65	4,24
Inflation	0,12	2,40*	0,02	0,21	1,38
Business Cycle	0,11	2,43*	0,02	0,10	1,04

** Significant at 5% level*

For the dependant variable TRF_ROA (with Tier 1 as an independent variable), a statistically significant result was noted for LAG_ROA, Tier 1, Implicit Cost, Cost Efficiency, Inflation and Business Cycle. This results and co-efficients support the following hypotheses:

1. The greater the implicit costs rate of a Bank, the lower the profit.
2. The greater the cost efficiency rate of a Bank, the greater the profit.
3. If the economy is in a greater part of business cycle, the greater will be the profit and vice-versa.

The result and co-efficient does not support the following hypotheses:

4. The greater the inflation rate of a country, the lower the profit (direction was opposite)
5. The greater the capital adequacy ratio, the lower the profit

Table 12: Co-efficients and relationships - ROA (Total Regulatory Capital)

Dependent Variable: TRF_ROA	Standardized Coefficients-Beta	t	Sig.	Correlations-Zero-order	Collinearity Statistics-VIF
(Constant)		2,39*	0,02		
Dummy Variable	0,03	0,60	0,55	0,07	1,28
LAG_ROA	0,35	5,66*	0,00	0,62	1,57
Total Regulatory Capital	0,40	5,74*	0,00	0,61	2,01
Size	- 0,02	- 0,29	0,77	- 0,44	1,62
Liquidity	0,01	0,18	0,86	0,06	1,04
Management Efficiency	- 0,21	- 3,38*	0,00	- 0,44	1,51
Implicit Cost	- 0,11	- 2,06**	0,04	0,16	1,25
Inflation	0,15	2,66*	0,01	0,01	1,35
Business Cycle	0,13	2,59*	0,01	0,22	1,08

** Significant at 5% level*

***Significant at 10% level*

For the dependant variable TRF_ROA (with Total Regulatory Capital as an independent variable), a statistically significant result was noted for LAG_ROA, Total Regulatory Capital, Management Efficiency, Inflation and Business Cycle. This results and co-efficients support the following hypotheses:

1. If the economy is in a greater part of business cycle, the greater will be the profit and vice-versa.

The result and co-efficient does not support the following hypotheses:

2. The greater the capital adequacy ratio, the lower the profit
3. The greater the management efficiency metric, the greater the profit
4. The greater the inflation rate of a country, the lower the profit

Table 13: Co-efficients and relationships - ROE (Tier 1)

Dependent Variable: TRF_ROE	Standardized Coefficients-Beta	t	Sig.	Correlations-Zero-order	Collinearity Statistics-VIF
(Constant)		0,28	0,78		
Dummy Variable	0,01	0,19	0,85	0,11	1,33

LAG_ROE	0,22	3,36*	0,00	0,39	1,26
Tier 1	0,27	2,97*	0,00	- 0,00	2,29
Size	0,40	4,53*	0,00	0,24	2,20
Liquidity	- 0,09	- 1,44	0,15	- 0,16	1,19
Management Efficiency	0,11	1,28	0,20	0,02	1,91
Implicit Cost	- 0,39	- 5,42*	0,00	- 0,42	1,46
Cost Efficiency	0,14	1,16	0,25	- 0,01	4,06
Inflation	0,15	2,17**	0,03	0,12	1,37
Business Cycle	0,25	4,18 *	0,00	0,26	1,04

** Significant at 5% level*

***Significant at 10% level*

For the dependant variable TRF_ROE (with Tier 1 as an independent variable), a statistically significant result was noted for LAG_ROE, Tier 1, Size, Implicit Cost and Business Cycle. These results and co-efficients support the following hypotheses:

1. The greater the size of a Bank, the greater profit
2. The greater the implicit costs rate of a Bank, the lower the profit
3. If the economy is in a greater part of business cycle, the greater will be the profit and vice-versa.

The results and co-efficients do not support the following hypotheses:

4. The greater the capital adequacy ratio, the lower the profit

Table 14: Co-efficients and relationships - ROE (Total Regulatory Capital)

Dependent Variable: TRF_ROE	**Standardized Coefficients-Beta**	**t**	**Sig.**	**Correlations-Zero-order**	**Collinearity Statistics-VIF**
(Constant)		2,31*	0,02		
Dummy Variable	0,07	0,96	0,34	0,10	1,29
LAG_ROE	0,36	5,64*	0,00	0,41	1,09
Total Regulatory Capital	0,23	2,78*	0,01	0,06	1,74
Size	0,32	3,97*	0,00	0,22	1,71
Liquidity	- 0,13	- 2,06**	0,04	- 0,14	1,03
Management Efficiency	- 0,07	- 1,03	0,31	- 0,00	1,35
Implicit Cost	- 0,06	- 0,94	0,35	- 0,01	1,25
Inflation	0,13	1,79	0,08	0,04	1,36
Business Cycle	0,28	4,42*	0,00	0,28	1,07

** Significant at 5% level*

***Significant at 10% level*

For the dependant variable TRF_ROE (with Total Regulatory Capital as an independent variable), a statistically significant result was noted for LAG_ROE, Total Regulatory Capital, Size and Business Cycle. These results and co-efficients support the following hypotheses:

5. The greater the size of a Bank, the greater profit.
6. If the economy is in a greater part of business cycle, the greater will be the profit and vice-versa.

The result and co-efficient does not support the following hypotheses:

7. The greater the capital adequacy ratio, the lower the profit.

Table 15: Co-efficients and relationships - NIM1 (Tier 1)

Dependent Variable: TRF_NIM1	**Standardized Coefficients-Beta**	**t**	**Sig.**	**Correlations-Zero-order**	**Collinearity Statistics-VIF**
(Constant)		3,49*	0,00		
Dummy Variable	0,02	0,40	0,69	0,07	1,27
LAG_NIM1	0,95	12,17*	0,00	0,56	2,56
Tier 1	0,13	1,63	0,11	0,33	2,48
Size	-0,10	-1,63	0,10	-0,37	1,69
Liquidity	0,09	1,87	0,06	0,19	1,07
Management Efficiency	0,01	0,15	0,88	-0,06	1,34
Implicit Cost	-0,66	-8,76*	0,00	0,08	2,36
Cost Efficiency	-0,06	-0,69	0,49	0,23	2,64
Inflation	0,04	0,78	0,44	0,12	1,26
Business Cycle	-0,01	-0,11	0,91	-0,01	1,03

** Significant at 5% level*

For the dependant variable TRF_NIM1 (with Tier 1 as an independent variable), a statistically significant result was noted for LAG_NIM1 and Implicit Cost. These results and co-efficients support the following hypotheses:

1. The greater the implicit costs rate of a Bank, the lower the profit

Table 16: Co-efficients and relationships - NIM1 (Total Regulatory Capital)

Dependent Variable: TRF_NIM1	Standardized Coefficients-Beta	t	Sig.	Correlations-Zero-order	Collinearity Statistics-VIF
(Constant)		3,83	0,00		
Dummy Variable	0,02	0,34	0,73	0,03	1,25
LAG_NIM1	0,76	11,82*	0,00	0,70	1,96
Total Regulatory Capital	0,18	2,34*	0,02	0,45	2,89
Size	- 0,20	- 3,50*	0,00	- 0,44	1,61
Liquidity	0,07	1,44	0,15	0,15	1,03
Management Efficiency	0,05	0,93	0,36	- 0,21	1,45
Implicit Cost	- 0,21	- 3,60*	0,00	0,26	1,62
Cost Efficiency	- 0,15	- 1,75	0,08	0,42	3,37
Inflation	0,07	1,44	0,15	- 0,02	1,27
Business Cycle	- 0,01	- 0,17	0,86	0,08	1,04

** Significant at 5% level*

For the dependant variable TRF_NIM1 (with Total Regulatory Capital as an independent variable), a statistically significant result was noted for LAG_NIM1, Total Regulatory Capital, Size and Implicit Cost. These results and co-efficients support the following hypotheses:

1. The greater the implicit costs rate of a Bank, the lower the profit.

The result and co-efficient does not support the following hypotheses:

2. The greater the capital adequacy ratio, the lower the profit.
3. The greater the size of a Bank, the greater profit.

Table 17: Co-efficients and relationships – NIM2 (Tier 1)

Dependent Variable: TRF_NIM2	Standardized Coefficients-Beta	t	Sig.	Correlations-Zero-order	Collinearity Statistics-VIF
(Constant)		- 0,25	0,81		
Dummy Variable	0,01	0,16	0,87	0,08	1,27
LAG_NIM2	0,67	13,77*	0,00	0,76	1,24
Tier 1	0,14	1,94**	0,05	0,31	2,54
Size	- 0,13	- 2,38*	0,02	- 0,26	1,63
Liquidity	0,09	1,95**	0,05	0,21	1,09

Management Efficiency	0,23	4,56*	0,00	0,20	1,35
Implicit Cost	- 0,03	- 0,64	0,52	- 0,08	1,17
Cost Efficiency	- 0,09	- 1,22	0,22	0,14	2,63
Inflation	0,06	1,13	0,26	0,15	1,26
Business Cycle	- 0,04	- 0,80	0,43	- 0,03	1,03

**Significant at 5% level*

***Significant at 10% level*

For the dependant variable TRF_NIM2 (with Tier 1 as an independent variable), a statistically significant result was noted for LAG_NIM2, Size and Management Efficiency. These results and co-efficients support the following hypotheses:

1. The greater the management efficiency metric, the greater the profit.

The result and co-efficient does not support the following hypotheses:

2. The greater the size of a Bank, the greater profit.

Table 18: Co-efficients and relationships - NIM2 (Total Regulatory Capital)

Dependent Variable: TRF_NIM2	**Standardized Coefficients-Beta**	**t**	**Sig.**	**Correlations-Zero-order**	**Collinearity Statistics-VIF**
(Constant)		- 0,03	0,98		
Dummy Variable	0,01	0,34	0,73	0,04	1,25
LAG_NIM2	0,79	17,66*	0,00	0,80	1,36
Total Regulatory Capital	0,15	2,28*	0,02	0,41	2,91
Size	- 0,16	- 3,32*	0,00	- 0,35	1,61
Liquidity	0,09	2,32*	0,02	0,17	1,03
Management Efficiency	0,23	4,96*	0,00	0,01	1,44
Implicit Cost	0,01	0,15	0,88	0,16	1,24
Cost Efficiency	- 0,13	- 1,90**	0,06	0,34	3,30
Inflation	0,06	1,38	0,17	0,00	1,27
Business Cycle	- 0,04	- 1,12	0,27	0,06	1,04

**Significant at 5% level*

***Significant at 10% level*

For the dependant variable TRF_NIM2 (with Total Regulatory Capital as an independent variable), a statistically significant result was noted for LAG_NIM2, Total Regulatory Capital, Size, Liquidity and Management Efficiency. These results and co-efficients support the following hypotheses:

1. The greater the management efficiency metric, the greater the profit.

The results and co-efficients do not support the following hypotheses:

2. The greater the capital adequacy ratio, the lower the profit.
3. The greater the size of a Bank, the greater profit.
4. The greater the liquidity of a Bank, the lower the profit.

This chapter presented the results of the study. The next chapter will go into an analysis of the above presented results.

CHAPTER V
ANALYSIS OF RESULTS

The following chapter represents an analysis of the results of this study, which was conducted to evaluate the relationship between Banks' regulatory capital adequacy ratios and profitability in the South African banking sector. The chapter breaks down each hypothesis set, re-presents the summarised findings (as per the previous chapter) and then delves into a critical analysis of the associated literature, with support from various graphical data that contextualises the current state of the South African banking sector. It also concludes with an inclusion of a short section which aims to provide some consideration for policy makers who regulate capital adequacy in the country, and well as position insights for future studies on the subject matter.

5.1 The Relationship between Capital Adequacy and Profitability

The following table presents the results from the regression model run against profitability metrics: ROA, ROE, NIM1 and NIM2, and independent regressors: Tier 1 Capital Adequacy Ratio and Total Regulatory Capital Ratio.

Table 19: Summarised results- Capital Adequacy Ratio vs Profitability

No.	Hypothesis stated as:	Independent Variable tested	Profitability Metric	Expected relationship	Actual relationship	Statistically significant?
1a	the greater the capital adequacy ratio, the lower the profit	Tier 1 Capital Adequacy Ratio	Return on Assets (ROA)	-	+	a
			Return on Equity (ROE)	-	+	a
			Net Interest Margin 1 (NIM1)	-		r
			Net Interest Margin 2 (NIM2)	-		r
1b	the greater the capital adequacy ratio, the lower the profit	Total Regulatory Capital	Return on Assets (ROA)	-	+	a
			Return on Equity (ROE)	-	+	a
			Net Interest Margin 1 (NIM1)	-	+	a

			Net Interest Margin 2 (NIM2)	-	+	a

As part of the literature review, there were two contrasting viewpoints presented, the first theorising a negative relationship between capital adequacy and profitability due to a trade-off between holding higher capital and profitability opportunities and the second, a positive relationship between the two, owing to well capitalised positions which offer resilience and opportunities to invest. This study took a stance of hypothesising a negative relationship between the two, in alignment with the trade-off view. However, the result of this study evidences the opposite, illustrating a statistically significant positive relationship between capital adequacy ratios (Tier 1 and Total Regulatory Capital ratios) and the profitability measures ROA and ROE. In addition, a statistically significant positive relationship was noted between capital adequacy (Total Regulatory Capital ratio) and the profitability measures NIM1 and NIM2. The test was inconclusive for the Tier 1 ratio, as there was not enough evidence to accept or reject the null hypothesis.

In terms of the literature consulted, the positive results were consistent with the following academic studies as follows:

1. CAR and ROA: Zhang et al. (2021), Naceur and Omran (2011), Novokmet and Pavic (2021) Ozili (2017), Nyoka (2019), Saniç and Şendeniz-Yüncü (2021), Sanyaolu et al. (2019).
2. CAR and ROE: Ifeacho and Ngalawa (2014), Naceur and Kandil (2009), Nyoka (2019), Saniç and Şendeniz-Yüncü (2021), Sanyaolu et al. (2019) Ahokpossi (2013), Swamy (2018) and Beltratti and Stulz (2009).
3. CAR and NIM: Novokmet and Pavic (2021) and Obadire et al. (2022).

Notwithstanding the alignment of the results with the outcomes of the studies above, it is important to further substantiate the authors' supporting arguments within the South African context. This is due to the majority of the studies taking place across different jurisdictions, where there are specific nuances applied to each country, as well as the impacts of different time periods involved in the respective studies. The sections which follow reflect some of the supporting statements made by the various authors on the topic, and further compares it to a South African perspective.

5.1.1 Resilience

In Chapter 2 (the literature review), one of the fundamental principles introduced related to "resilience" and how a well-capitalised bank would have a strong ability to "weather a storm" during tough economic conditions. This criterion, bolsters investor confidence and leads to improved profitability, due to the Bank having additional access to funds to grow the business, and the ability to lend out during periods of crisis. Studies which supported this include Sanyaolu et al. (2019), Beltratti and Stulz (2009) and Naceur and Kandil (2009).

The first supporting statement, in favour of the statistically significant positive relationship between CAR and profitability (ROA and ROE) found in this study, is attributed to the strong resilience and contribution that the South African banking industry has to the South African economy (as mentioned in Ifeacho and Ngalawa, 2014). It plays a crucial role in the economy, contributing 23,6% in Q3 2023 (23,1% in Q3 2022) to its GDP*[4] and providing in excess of 22,9% of employment for the country[5]. This highlights the industry's systemic importance within South Africa. The application of robust risk management practices and oversight (Lee and Hsieh (2013) and Bitar et al. (2016)) is imperative for South African Banks as they are subject to strict regulatory oversight by its governing authority, the South Africa Reserve Bank (South African Reserve Bank, 2024c), who ensures overall soundness in the country's financial system through implementation of monetary policy and supervision.

In comparison to its peers in Africa, South Africa is advanced in many regards, with specific reference to markets and regulation. One of the regulatory advancements includes the rapid adoption of the Basel III Framework, in comparison with most African countries, who are still on the Basel 2 Accord (Obadire et al., 2022). For this reason, South Africa is generally seen competing with developed countries in terms of its regulatory oversight, which technically boosts investor and depositor confidence (Obadire et al., 2022 and Ifeacho and Ngalawa, 2014). A link between being considered "top" in the continent and capital adequacy bases (Tier 1) was in the African Business Top 100 Banks in South Africa survey in 2023, as shown below:

[4] Derived from South African Reserve Bank website, and inclusive of insurance and real estate.

[5] Derived from Stats SA website, and inclusive of insurance and real estate. Total employment on the website excludes agricultural staff employment.

Figure 22: Africa's Top 100 Banks in 2023

Ranking 2023	Ranking 2022	Bank	Country	Date	Tier 1 capital ($m)	Assets ($m)	Net profit ($m)
1	1	Standard Bank Group	South Africa	Dec, 2022	13,212	169,858	2,320
2	2	National Bank of Egypt	Egypt	Jun, 2021	7,276	167,407	957
3	3	Banque Misr	Egypt	Dec, 2021	7,235	118,316	1,487
4	7	Nedbank	South Africa	Dec, 2022	5,928	73,800	908
5	4	FirstRand	South Africa	Jun, 2022	5,463	93,365	1,578
6	5	Attijariwafa Bank	Morocco	Dec, 2022	5,366	60,337	714
7	6	Absa Bank	South Africa	Dec, 2022	5,345	87,134	718
8	8	Banque Centrale Populaire	Morocco	Dec, 2022	4,742	47,915	336
9	11	Banque Extérieure d'Algérie	Algeria	Dec, 2021	3,627	29,966	516
10	12	Banque Nationale d'Algérie	Algeria	Dec, 2021	2,991	32,229	336

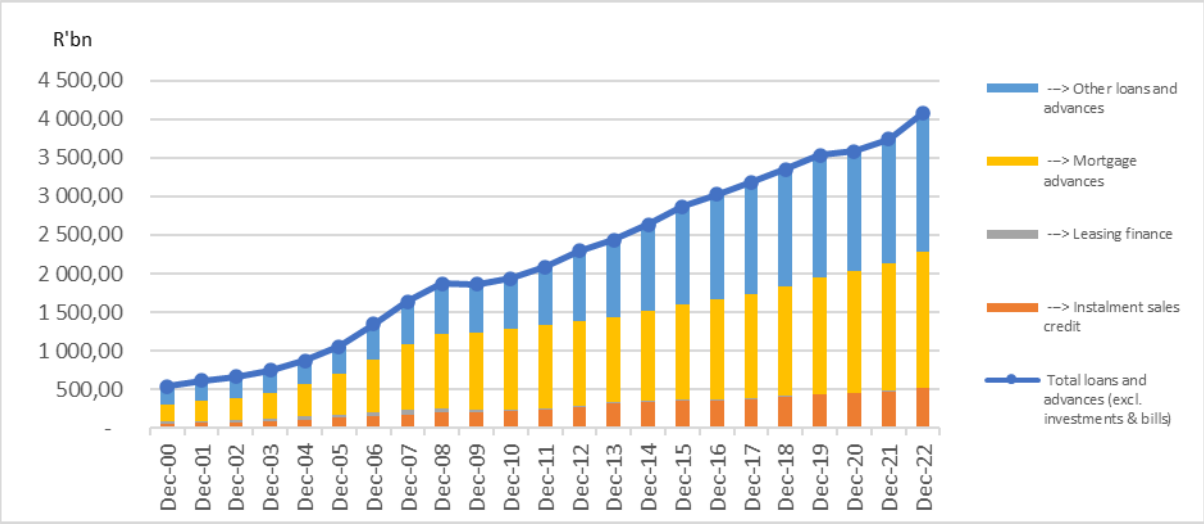
Source: (Minney, 2023)

South Africa had four of its main Bank's in the top ten of the survey, which demonstrates the strength of the sector. From a risk management perspective, the continent is currently facing tough macroeconomic challenges, which includes geopolitical tensions, sovereign risk crises, high inflation and interest rates and hard-currency liquidity challenges (International Monetary Fund, 2023b). Therefore, this survey illustrates an important part of the perceived resilience of South African banks, despite the macroeconomic challenges mentioned above. For this reason, one of the substantiating factors supporting the positive relationship between CAR and profitability metrics (ROA and ROE), is resilience.

As mentioned under the literature review of this study, Beltratti and Stulz (2009) introduced another academic perspective, relating to performance of well capitalised banks during crises (the author noted higher returns in the 2007-2009 Financial crisis). These returns are attributed to a Bank being able to advance credit during times of stress, due its higher capital buffers, which can act as a cushion during uncertain times. To assess this perspective from a South African perspective, a graph was constructed from detailed statistics available on the SARB

website (see appendix for link), which shows the total credit advanced for the SA banking sector for the period under review as follows:

Figure 23: Credit Advanced: SA Banking Sector



Source: author's own *compilation. Ref no. [B4]*

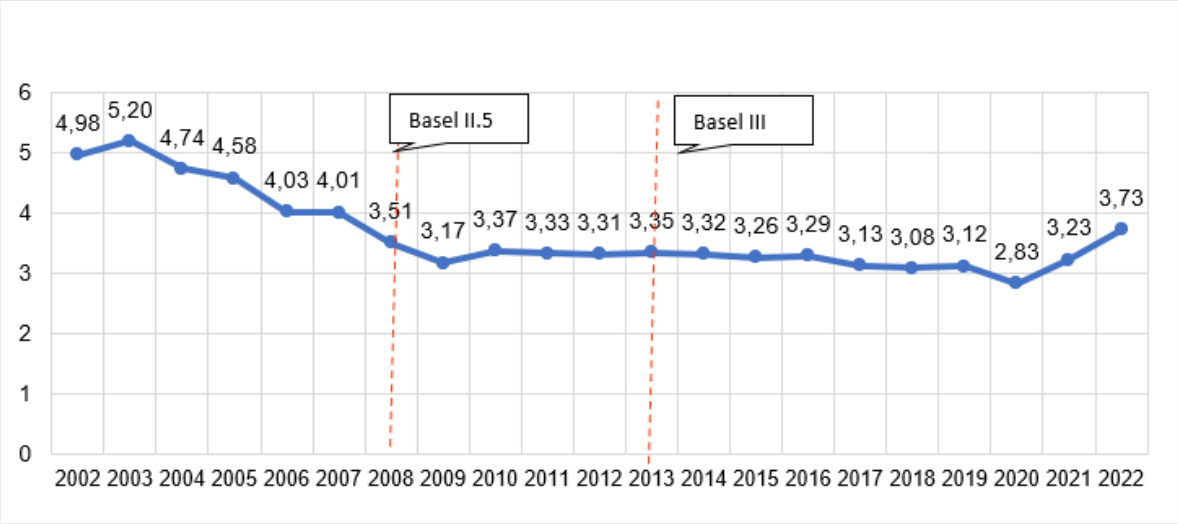
The two notable times of stress for the period under review, included the 2007-2009 Global Financial Crises and Covid-19 pandemic in 2020 (SARB, 2024d). The graph above depicts a continued upward trend in credit advances over the period under review, with the advances dropping only marginally by 1% during the 2007-2009 global financial crisis and still increasing during the Covid-19 pandemic. This illustrates the ability of the sector to advance credit during times of stress. The reduced impact of the severe crisis (in 2008/9) is attributed to the combination of increased capital buffers, strong regulatory oversight, policy frameworks and consumer laws (National Treasury, 2011). The ability to extend credit during crises is the second supporting statement, in favour of the statistically significant positive relationship between CAR and profitability (ROA and ROE) found in this study.

The graph above also contradicts the literature review point raised by the Bank of International Settlements (2016), referencing a macroeconomic impact of new (higher) capital requirements on funding costs, which are passed on by the Banks to households, leading to a reduction in borrowing by the households, the overall loans and advances base and profitability for the Bank. With the application of Basel 2.5 in 2008 and Basel 3 in 2013, one would expect, based on this premise, that a contraction in the loans and advance would have occurred. The graph, however, shows increase in advances for both 2008 and 2013 (years of Basel implementation). This could be attributed to other heavier weighted factors, besides additional

higher capital requirements, which is country specific and play a larger role in the application for credit by a household e.g. lower interest (prime) rates, which were seen to drop 50bps between 2012/2013 (SARB, 2024e). This shows that the overall impact of regulatory capital increases on profitability must be viewed in conjunction with all relevant country factors impacting household borrowing to assess the complete impact. This would be an important consideration for regulatory policy makers.

On a separate but linked note on the transfer of costs to customer, Novokmet and Pavic (2021) and Naceur and Kandil (2009) referenced a moral hazard theory (as per the literature review) to show how a bank, in anticipation of higher capital requirements, would accept riskier assets and pass the associated costs onto the customer, resulting in higher NIM and ROA. Given the statistically significant positive relationship between CAR and NIM, a graph of interest rates spread was derived from statistics available on the WorldBank website (2024), showing the difference between the average lending rate that Banks in SA lend out at, less the deposit rates which they pay, as follows:

Figure 24: Interest Rate Spread (lending rate minus deposit rate, %)



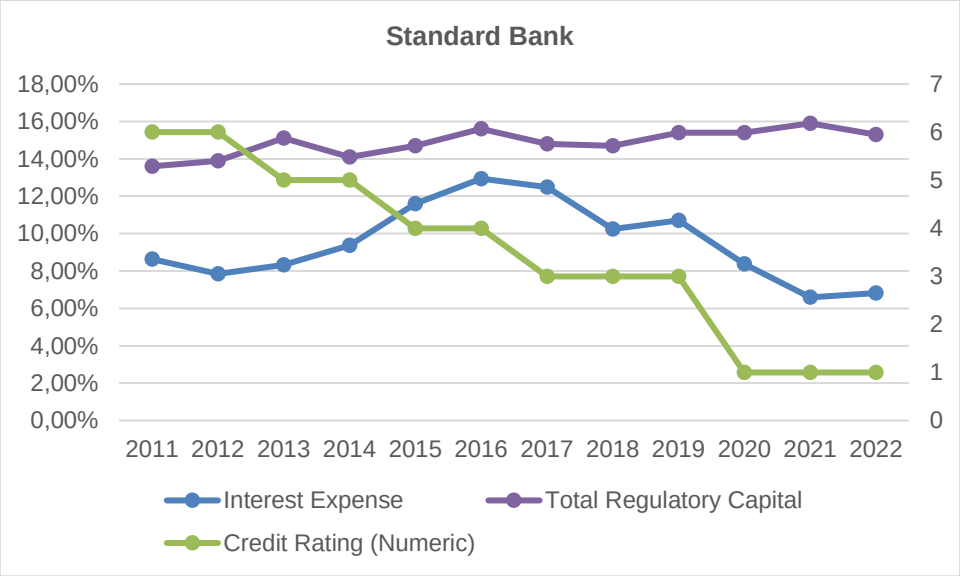
Source: Author's own compilation. Ref no. [B5]

Should the moral hazard theory hold true, a significant increase in this spread would be seen when higher capital requirements were effected i.e. 2008 (Basel 2.5) and 2013 (Basel 3). As can be seen from the above, this relationship is not evident, and the spread drops in 2008 and has a marginal increase in 2013, which is not conclusive form of evidence for the moral hazard theory in relation to anticipated regulatory capital requirements. There may however be other impacting factors on the spread in these years.

On related note to Beltratti and Stulz (2009) above, it is however interesting to note that in the times of crises (2007-2009, 2020) the spread increased from 2009 onwards, with higher drastic increases post 2020. The steep increase from 2020 onward could signal the ability of the Banks to charge higher rates during crises and earn a higher NIM and ROA, as even though interest rates were lower, the Banks could be compensating for increased credit risk and uncertainty during the period. This statement supports the significant relationship seen in this study, between Total Regulatory Capital Ratios and NIM1 and NIM2.

Another argument put forward in the literature review, by Naceur and Kandil (2009), Ahokpossi (2013) and Swamy (2018), purported that well capitalised banks face lower bankruptcy costs and decreased borrowing costs, leading to improved profitability. Whilst this may theoretically lead to an improvement in profitability, from a practical perspective it is not the only consideration taken into account when assessing the credit risk profile of a Bank issuing a Tier 2 bond. In reality, there are other considerations that impact borrowing costs and credit ratings (which informs a borrowing cost), which include the country's sovereign rating, liquidity and funding profiles, interest rates and the general macroeconomic uncertainties facing the country. To demonstrate this concept, the following graphs were constructed for Standard Bank and First Rand Group, based on latest available Long-Term Issuer Default Ratings credit ratings (from the FitchConnect database, converted into a numeric rating), a simplistic calculation of interest expense on subordinated debt (total interest paid ÷ total subordinated debt (Tier 2 Bonds), as disclosed in BankFocus), and Total Regulatory Capital ratios (from BankFocus).

Figure 25: Standard Bank- Interest Expense, Credit Rating and Total Regulatory Capital



Source: Author's own compilation. Ref no. [B6]

If credit ratings (and the resultant interest expense) were predominantly driven by higher capitalisation of banks, we would see a distinct relationship between credit ratings, interest expense and total regulatory capital ratio, with credit ratings improving when capital goes higher, and the resultant interest expense dropping. As can be seen from the above, total regulatory capital remained fairly stable over the period, with increases shown in 2013 (onset of Basel 3), 2016, and 2019 onward (most likely a conservative approach in response to Covid-19) and 2021. A decline is however noted for credit ratings for the Bank over the period. Interest expense has also not followed suit with higher CAR's as can be seen in 2013 and 2016, but has reduced from 2019 onward, more likely due to the lower prevailing interest rates seen in the country at the time (SARB, 2024e). No distinct relationship is seen between the variables. The following explanation was obtained from FitchRatings (2022b) on the allocation of the credit rating in 2022:

> *SBG's and SBSA's IDRs are driven by their standalone creditworthiness, as expressed by their Viability Ratings (VRs) of 'bb-'[6]. The VRs reflect a leading domestic franchise and revenue diversification, acceptable asset quality, strong profitability, and comfortable capital buffers and liquidity coverage. However, the VRs are one notch below the implied VR of 'bb' due to the following constraint: Operating Environment/Sovereign Rating. This reflects the concentration of activities in South Africa and high sovereign-related exposure relative to capital (206% of SBSA's total equity at end-1H22). The Stable Outlook on the Long-Term IDRs mirrors that on South Africa.*

[6]As at 2024, the Fitch IDR rating for Standard Bank remains at "bb-" (FitchRatings, 2024-d)

and

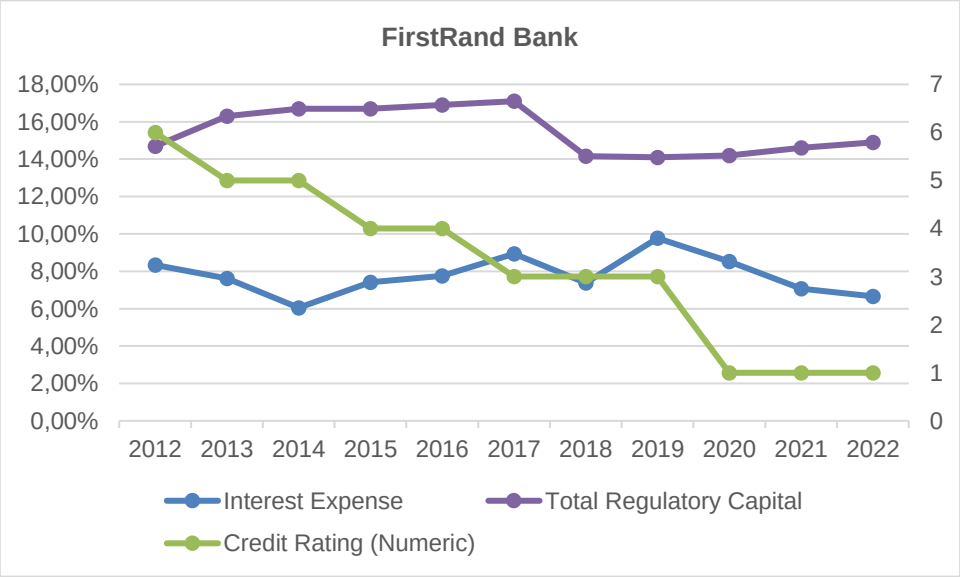
A downgrade of the VRs and Long-Term IDRs could also result from a material weakening in capitalisation, as indicated by the CET1 ratio declining below 10%, which could stem from greater-than-expected asset-quality deterioration or more aggressive shareholder distributions

and

An upgrade of the VRs and Long-Term IDRs would require a sovereign upgrade while maintaining healthy financial metrics.

The extract shows that whilst capital buffers for Standard Bank are contributing to a favourable impact on its credit rating and acting as a preventative measure on a further downgrade, a larger part of the rating is still driven by the environment in which the bank operates (for e.g., the impacts of load shedding on the economy, high inflation etc.). In addition, there is an impact of the South African sovereign rating on the credit rating, which would have to be significantly improved to improve the credit rating. A corresponding graph was created for the FirstRand Group as follows:

Figure 26: FirstRand Bank- Interest Expense, Credit Rating and Total Regulatory Capital



Source: Author's own compilation. Ref no. [B7]

As can be seen from the above, total regulatory capital remained fairly stable over the period with a notable increase in 2013 (Basel 3), 2016 and 2019 onward (most likely a conservative approach in response to Covid-19). There was a significant decrease shown in 2018 due to an acquisition of a new entity, Aldermore, which dropped the capital adequacy ratio (Firstrand Group, 2018). An overall decline was noted for credit ratings for the Bank over the period.

Interest expense has also not followed suit with higher CAR's as can be seen in 2013 and 2016 and has also shown a decrease in 2018 (when CAR decreased) and reduced from 2019 onward, possibly attributable to the lower prevailing interest rates seen in the country (SARB, 2024e). The following explanation was obtained from FitchRatings (2022a)[7] on the allocation of the allocation of the rating in 2022:

> *FRB's IDRs are driven by its standalone creditworthiness, as expressed by its Viability Rating (VR) of 'bb-'. The VR reflects the bank's solid domestic business profile, strong profitability, comfortable capital buffers to absorb asset-quality risks, and stable funding and liquidity. However, the VR is one notch below the implied VR of 'bb' due to the following constraint: Operating Environment/Sovereign Rating. This underlines the concentration of the bank's activities in South Africa and high sovereign-related exposure relative to equity of about 2.8x.*
>
> and
>
> *A downgrade of the Long-Term IDR and VR may also result from a material weakening in capitalisation, as indicated by a decline in the CET1 ratio below 10%, which could stem from greater-than-expected asset-quality deterioration or more aggressive shareholder distributions.*
>
> and
>
> *An upgrade of FRB's Long-Term IDR and VR would require a sovereign upgrade while maintaining a healthy financial profile.*

The extract above aligns to the extract for Standard Bank, showing how higher CAR is contributing with a positive impact of the rating, however, there are other macroeconomic factors taken into account when determining an overall rating. For both Banks, the South African sovereign rating would have to be improved to improve the credit ratings of the Banks (and borrowing costs).

To summarise, the graphs and extracts above provide some evidence in support of Naceur and Kandil (2009), Ahokpossi (2013) and Swamy's (2018) viewpoints that higher capitalised banks may have a have decreased borrowing cost (due to positive impacts on credit ratings), but the improvement to profitability is not conclusive. This is owing to the credit rating being linked to other factors such as sovereign ratings, which in the case of SA, had worsened over the time period under review. This has implications for capital management functions in Banks as it would be imperative to firstly ensure that the capital buffers are maintained to prevent further downgrades in credit ratings, and further to continually assess the economic landscape and manage this from a capital and liquidity perspective, to prevent further downgrades. Understanding the interplay between capital, credit ratings and borrowing costs is a potential

[7] As at 2024, the Fitch IDR rating for FirstRand Bank remains at "bb-"(FitchRatings, 2024-c)

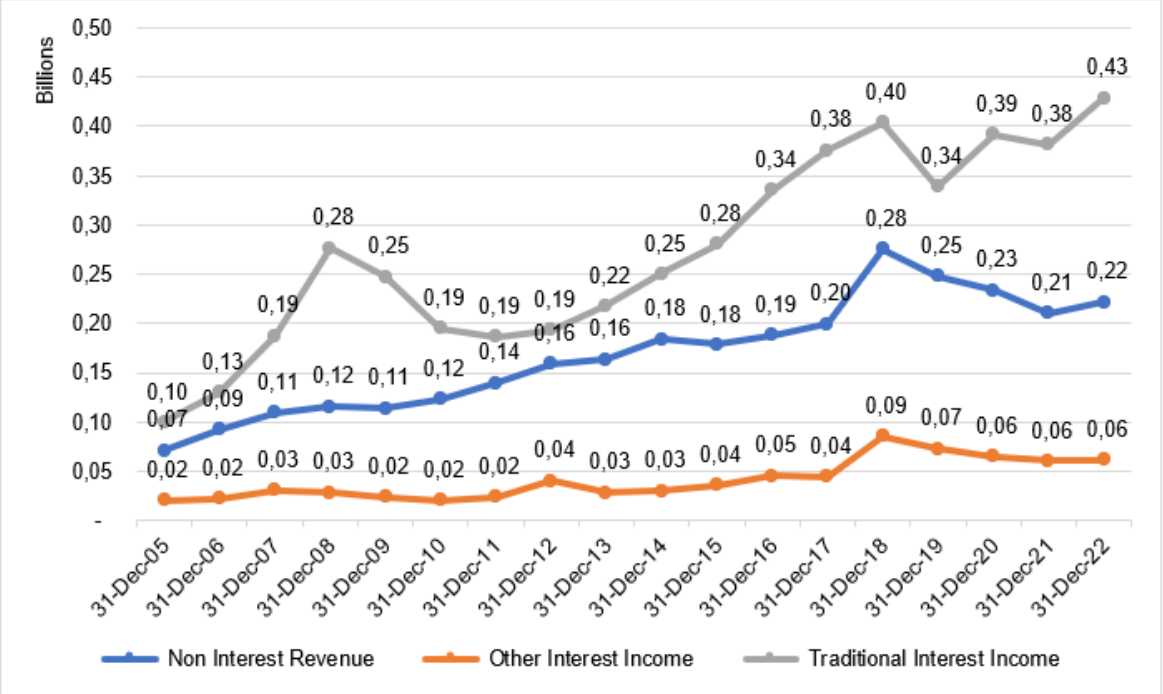
area for future research that's recommended, as it would be valuable to bank management to understand the relative impacts that capital and other factors have on the credit rating and borrowing costs in general.

As previously mentioned in the literature review, Ifeacho and Ngalawa (2014), attributed a positive and significant relationship between CAR and ROE to resilience and a diverse non-interest revenue stream with favourable efficiency ratios contributing to the ROE. From a capital perspective, there are certain income generating products e.g. certain bonds, which would not be risk weighted as heavily as loans and advances to customers, leading to a lower demand on capital and higher capital adequacy ratios (South African Banks Act, Regulation Part C). Essentially, if this holds true, a migration to other less capital consuming revenue streams would be relied on to boost capital adequacy ratios and improve ROA for the time period under review. In December 2022, on a total Banks level, interest income from loans and advances to customers constituted 88% of the total interest income.[8]

To assess an example in the South African context, the following graph for Absa was constructed from the inputs from the BankFocus database and mapped to show the traditional forms of revenue generation (loans and advances) versus non-interest revenue and other forms of interest income. Whilst the Bank does show some growth in non-interest revenue activities, traditional forms of revenue generation still seem more favoured by the Banking sector, as evidenced by the higher proportion of total income it contributes to, and the significant increases which it has had over the time period under review. This, in combination with the 88% portion of interest income contributed by loans and advances, suggests that there is insufficient evidence to attribute higher ROEs and margins to diverse revenue streams.

[8] As calculated from BA 120 data, available on SARB website

Figure 27: Absa- Interest Income vs Non-Interest Revenue

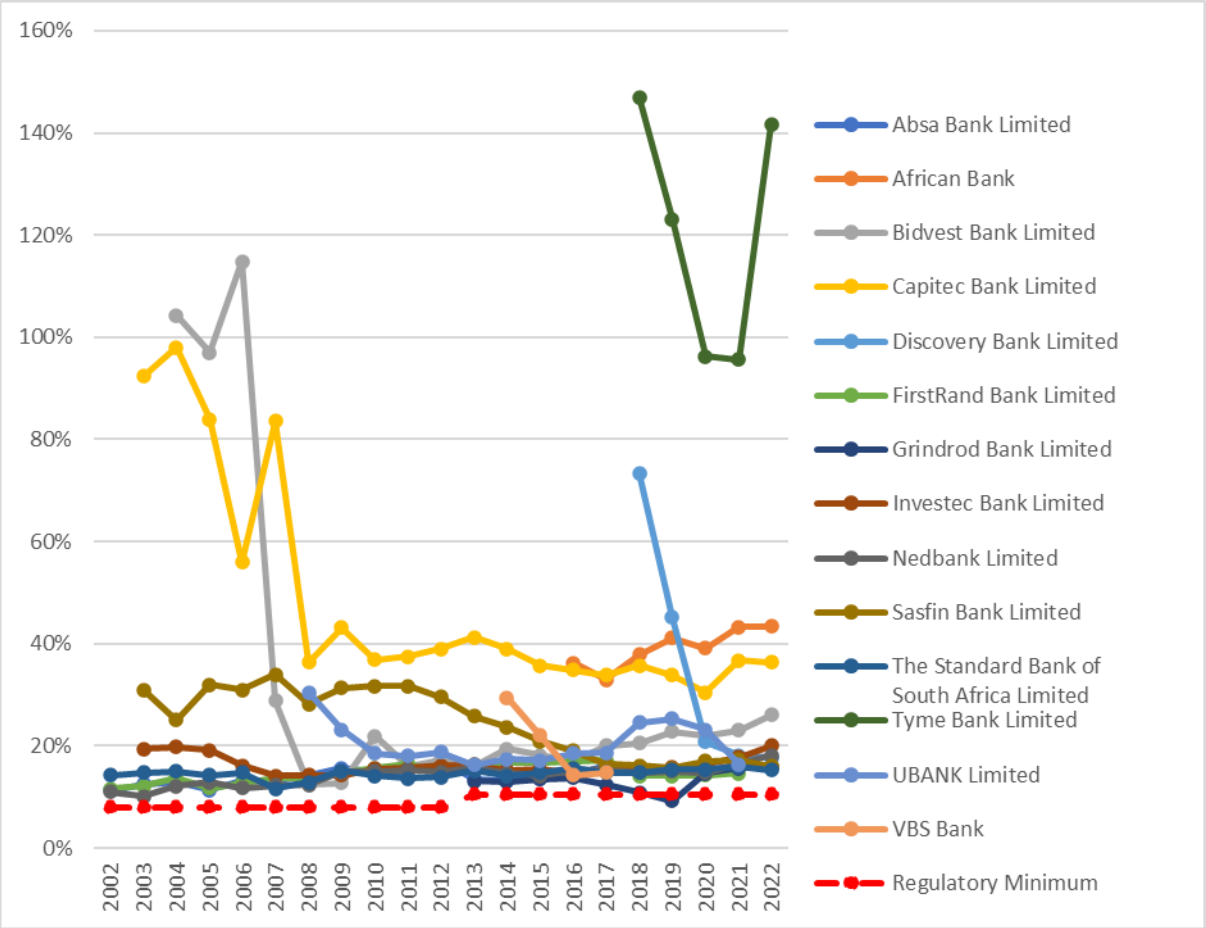


Source: Author's own compilation. Ref no. [B8]

5.1.2 Capital Buffers

As mentioned as part of the literature review, Novokmet and Pavic (2021) note that from a practical perspective, banks generally hold capital buffers in excess of regulatory requirements to demonstrates resilience. Zhang et al. (2021) further links this to "legitimacy theory," where Banks increase capital ratios to demonstrate institutional legitimacy and improve its reputation. The below graph portrays the capital adequacy ratios which SA banks hold over the regulatory minimums ("buffers"):

Figure 28: South African Banks' Capital Buffers (Total Regulatory Capital)



Source: Author's compilation of metrics from BankFocus

As can be seen from the above, South African Banks tend to generally operate above regulatory minimums. Higher ratios are seen especially in the years where there are new entrants to the markets (Capitec, Tyme Bank and Discovery Bank). The SARB requires new banks to have higher CARs for the formative years, based on its risk profile, in order have a banking license (SARB, 2021b). Also to note, Banks such as African Bank and Bidvest Bank also had higher capital ratios in 2016 and 2004, respectively. For Bidvest, this is attributed to its former structure of Rennies Bank, who was fairly new and provided highly specialised services in foreign exchange (IOL, 2007). For African Bank, it was due to its launch as a new independent with a high capital base (African Bank, 2016). These views are consistent with Obadire et al. (2022), who noted that capital buffers are seen to improve the operating efficiency of the Bank, signalling a more resilient institution that would withstand financial crises that leads to improved profitability.

In addition, Pillay and Makrelov (2024), also cited three reasons why a bank would choose to keep capital buffers over and above required minimum. The most relevant (in this author's opinion) is to be able to prevent excessive costs associated with regulatory breaches. The South African Banks have generally operated at higher than minimums, with the exception of Grindrod Bank in 2018/2019, who breached its capital adequacy ratios. As per the Bank's disclosures, a revision to the interpretation of IFRS 10 resulted in two additional subsidiaries being consolidated to the Bank, which was previously not done, and this led to an additional capital requirement being levied. In this case, the SARB (PA) condoned the breach and the Bank remediated in the following year (GCR Ratings, 2020).

From a calculation perspective, it needs to be noted that there is a limitation as to the split of the capital buffers when assessing them against minimum requirements, as Banks may be separately required to hold additional capital due to its own estimates of capital adequacy processes (ICAAP) over minimums (agreed with the regulator) and what they truly intend on holding over minimums. These are not publicly disclosed Pillar 2B requirements (Intellidex, 2022). This may explain some of the higher buffers held over the capital ratio. Regardless of this lack of availability, the additional buffers added from an ICAAP perspective still shows the resilience of the industry and oversight applied by authorities on the sector.

5.1.3 Cost of Equity/Debt Theory

Understanding the balance between the cost of debt and cost of equity and its resultant impact on CAR and profitability is an important part of capital management in a bank. The arguments in favour/not in favour of this have been referred to under the literature review of this study. To assess if the debt/equity composition has an impact on CAR and ROE, graphs were constructed, based on inputs from BankFocus, plotting the aforementioned data as follows:

Figure 29: Absa Debt to Equity and ROE

Figure 30: Standard Bank Debt to Equity and ROE

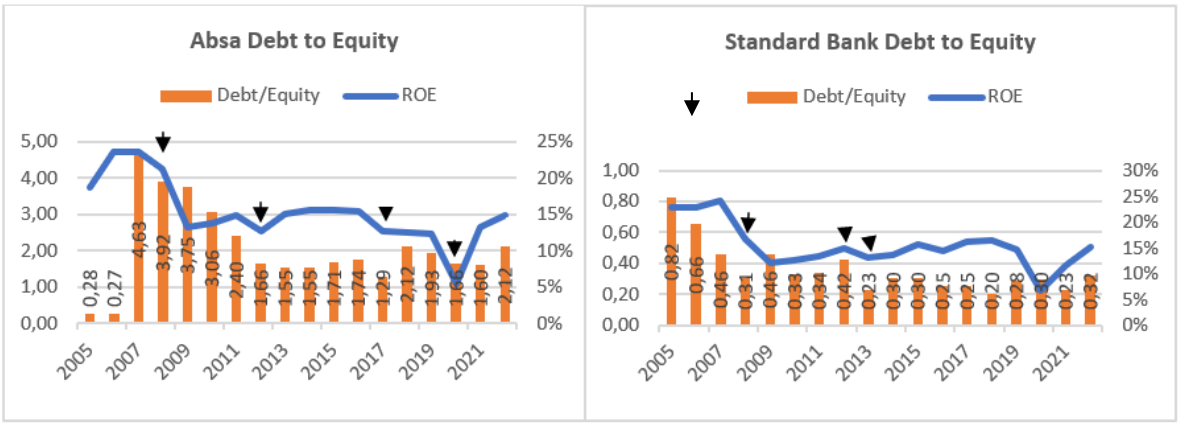
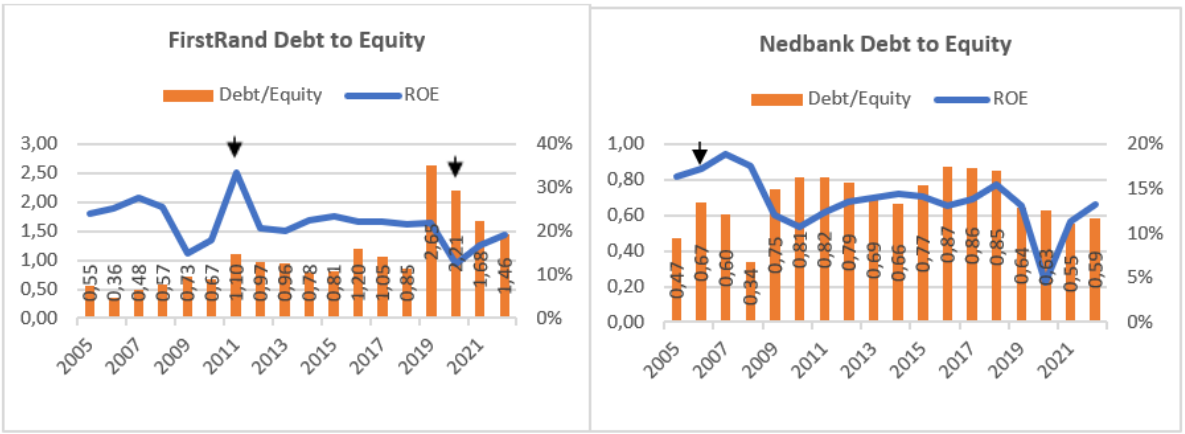


Figure 31 FirstRand Debt to Equity and ROE

Figure 32 Nedbank Debt to Equity and ROE



Source: Author's own compilation. Ref no. [B9]

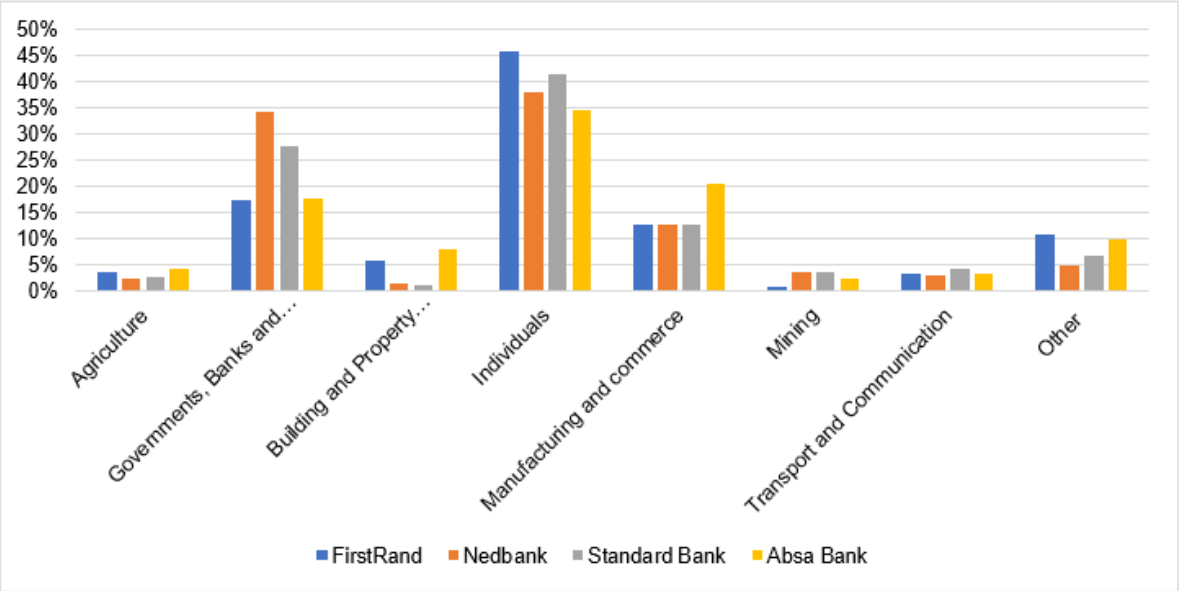
The arrows represent instances where a reduction in debt has had lowered ROEs for the year (and vice versa). This illustrates that there is no clear link that is visible between the debt/equity calculation and ROE. This may be attributed to various other factors impacting ROE, which would need to be broken down to assess the impacts. This is a potential area for research for the future.

5.1.4 Industry composition of the lending portfolio

As per the literature review of this study, Ozili (2017) purports that a diverse lending portfolio will tend to demonstrate better resilience and profitability, as opposed to banks whose primary

client base are individuals and high-risk sectors. The following tables were extracted from the financial statement disclosures of four of the major banks in South Africa and shows the diverse sectors which South African Banks lend to:

Figure 33: Industry split



Source: Author's own compilation. Ref no. [B10]

As can be seen from the graph above, there is a diverse industry portfolio which the big four South African Banks lend out to, and this which aligns to the view in Ozili (2017). South African Banks are seen to show resilience as per the analysis in section 5.1.2 above. It must however be noted that there is still a higher weighting of the loans to individuals. This is likely in line with business strategies and target markets for the sector.

5.2 The Relationship Between Size and Profitability

The summarised results for size and profitability are as follows:

Table 20: Summarised results: size and profitability

No.	Hypothesis stated as:	Independent Variable tested	Profitability Metric	Expected relationship	Actual relationship	Statistically significant?
2	the greater the size of a Bank, the greater profit	Size	Return on Assets (ROA)	+		
			Return on Equity (ROE)	+	+	✔

			Net Interest Margin 1 (NIM1)	+	-	✔ for Total Reg Cap ✕ for Tier 1
			Net Interest Margin 2 (NIM2)	+	-	

Two arguments were put forward in the literature review, which dealt with the relationship between size and profitability. The first, showed a positive relationship, due to economies of scale and ability to advance more loans and source funding (Naceur and Kandil, 2009). Sanyaolu et al. (2019), Bashir et al. (2020), Ngo (2006) and Batten and Vo (2019) report a negative relationship attributed to inefficiencies due to large scale. This study hypothesized a positive relationship between size and profitability. The results show a statistically significant positive relationship between size and ROE. It also shows the opposite, with a statistically significant negative for NIM2 and NIM1 (for Total Regulatory Capital only). The statistical positive relationship aligns with the findings by Naceur and Omran (2011). The positive result between size and ROE is not surprising, given the concentration of the sector to the following market participants due to size referenced under Methodology, Figure 4. This suggests that the sector, through its main contributing Banks, are able to leverage from size and advance more loans, which is inadvertently driven by reputation (customers would want to bank with a bigger bank) and multi-geographic presence (which allows to them grow their reach).

The negative relationships may be explained by bigger size of balance sheets, without the corresponding growth in net interest income. Further investigations will have to be done in this regard.

5.3 The Relationship Between Liquidity and Profitability

The summarised results for liquidity and profitability are as follows:

Table 21: Summarised results- liquidity and profitability

No.	Hypothesis stated as:	Independent Variable	Profitability Metric	Expected relationship	Actual relationship	Significance Level
3	the greater the liquidity of a Bank, the lower the profit	Liquidity	Return on Assets (ROA)	-		
			Return on Equity (ROE)	-		

			Net Interest Margin 1 (NIM1)	-		
			Net Interest Margin 2 (NIM2)	-	+	✔

Two arguments were put forward in the literature review, which dealt with the relationship between liquidity and profitability. The first, showed a trade-off where banks retain more liquid assets to fulfil the liquidity requirements and forego lending, leading to a reduction in profitability (Sanyaolu et al., 2019). The second, was a positive relationship due to liquid assets improving asset quality and profitability (Ifeacho and Ngalawa, 2014). This study hypothesized a negative relationship between liquidity and profitability. The results show no conclusive evidence supporting a negative relationship for ROA, ROE and NIM1. Surprisingly, the study showed a statistical positive relationship between liquidity and NIM2 (in alignment with Ifeacho and Ngalawa, 2014). The calculation for liquidity was reflected as the ratio of net loans over deposit and short-term borrowing. The positive result could be related to the previous point under "resilience" which showed that during times of crises (2007-2009, 2020) interest rate spreads were seen to have drastic increases post 2020, essentially signalling the ability of the Banks to lend out more and charge higher rates during crises and earn a higher margin and profit. This study supports the positive relationship seen in this study, between liquidity and NIM2.

5.4 The Relationship Between Management Efficiency and Profitability

The summarised results for management efficiency and profitability are as follows:

Table 22: Summarised results- Management Efficiency and Profitability

No.	Hypothesis stated as:	Independent Variable	Profitability Metric	Expected relationship	Actual relationship	Significance Level
4	the greater the management efficiency metric, the greater the profit	Management Efficiency	Return on Assets (ROA)	+	-	✔ for Total Reg Cap ✕ for Tier 1)
			Return on Equity (ROE)	+		✕
			Net Interest Margin 1 (NIM1)	+		✕
			Net Interest Margin 2 (NIM2)	+	+	✔

As per the literature review, it was expected that this factor would translate into higher profitability, as it is expected that management would aim for higher earnings (Naceur and Kandil, 2009). This study hypothesized a positive relationship between management efficiency and profitability. The results surprisingly show a statistically significant negative relationship between management efficiency and ROA (when using Total Regulatory Capital), with no conclusive evidence supporting a positive relationship for ROE and NIM1. The study also reported a statistical positive relationship between management efficiency and NIM2, in alignment with (Naceur and Kandil, 2009). This metric is calculated as a ratio of earning assets to total assets. The positive relationship between management efficiency is expected, given the strong regulatory adherence and risk management practices that South African Banking sector exhibits (earlier point on resilience is referred to). Further investigation would have to be performed on the negative relationship noted on ROA, given this was not an expected outcome.

5.5 The Relationship between Implicit Cost /Cost Efficiency and Profitability

Table 23: Summarised results - implicit cost/cost efficiencies and profitability

No.	Hypothesis stated as:	Independent Variable	Profitability Metric	Expected relationship	Actual relationship	Significance Level
5	the greater the implicit costs rate of a Bank, the lower the profit	Implicit Cost	Return on Assets (ROA)	-	-	✔
			Return on Equity (ROE)	-	-	✔ for Tier 1 ✘ for Total Reg Cap)
			Net Interest Margin 1 (NIM1)	-	-	✔
			Net Interest Margin 2 (NIM2)	-		✘
6	the greater the cost efficiency rate of a Bank, the greater the profit	Cost Efficiency	Return on Assets (ROA)	+	+	✔ for Tier 1 ✘ for Total Reg Cap as removed due to high VIFs
			Return on Equity (ROE)	+		✘
			Net Interest Margin 1 (NIM1)	+		✘
			Net Interest Margin 2 (NIM2)	+		✘

As mentioned earlier in the literature review, it was expected that these implicit costs would translate into lower profitability, as higher non-interest costs relative to non-interest revenues

are anticipated to reduce profit. This study hypothesized a negative relationship between implicit costs and profitability. The results show a statistically significant negative relationship between implicit costs and ROA, NIM1 and ROE (when using regressor Tier 1 capital), with no conclusive evidence supporting a negative relationship for NIM2. The negative relationship aligns with Naceur and Kandil (2009).

A positive relationship was expected for cost efficiency and profitability, as described by Obadire et al. (2022), who note that a cost-containment strategy is ideal in keeping a bank operationally efficient and further that a higher cost efficiency is generally anticipated to increase profit, as Banks charge higher costs of intermediation to cover the additional expenses (Naceur and Kandil, 2009). The study reported a statistical positive relationship between cost efficiency and ROA (when using regressor Tier 1) and no conclusive evidence supporting a negative relationship for ROE, NIM1 and NIM2. The positive relationships between these are expected, given the current environment which has cost pressures that many Banks are facing, and in an effort to improve profits, they focus on reducing costs (Deloitte, 2020b). The on-charge of intermediary costs were described under capital and liquidity sections above and are not seen to be majorly applicable for this metric. Therefore, the statistical positive relationship between cost efficiency and ROA (when using regressor Tier 1) is attributed to strong cost containment strategies by South African banks.

5.6 The Relationship between Inflation /Business Cycle and Profitability

Table 24: Summarised results- Inflation /Business Cycle and profitability

No.	Hypothesis stated as:	Independent Variable	Profitability Metric	Expected relationship	Actual relationship	Significance Level
7	the greater the inflation rate of a country, the lower the profit	Inflation	Return on Assets (ROA)	-	+	✔
			Return on Equity (ROE)	-		
			Net Interest Margin 1 (NIM1)	-		
			Net Interest Margin 2 (NIM2)	-		
8	if an economy is in a greater part of business cycle, the greater will	Business Cycle	Return on Assets (ROA)	+	+	✔
			Return on Equity (ROE)	+	+	✔
			Net Interest Margin 1 (NIM1)	+		

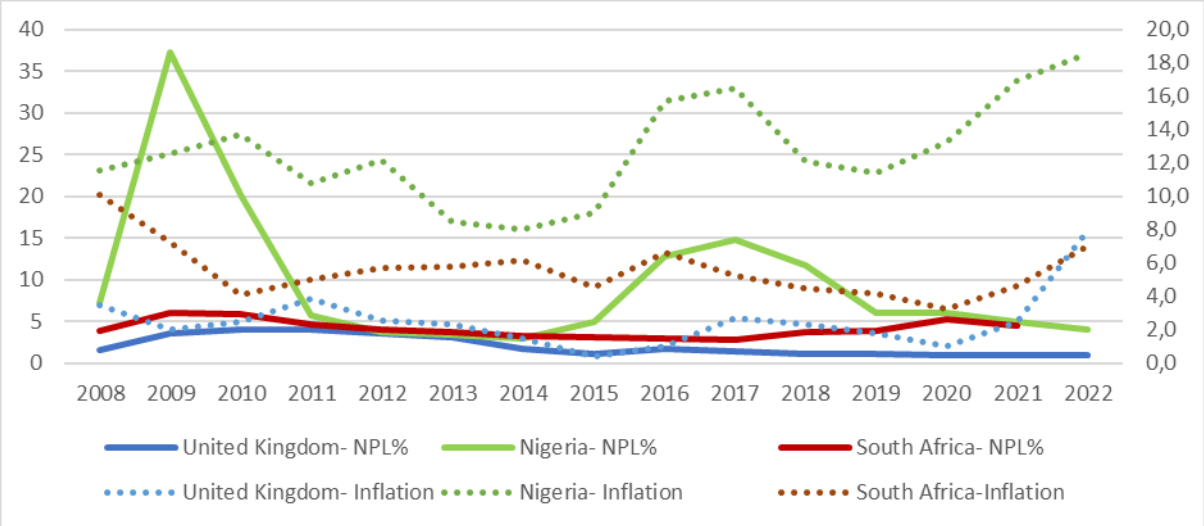
	be the profit and vice versa		Net Interest Margin 2 (NIM2)	+		

As mentioned earlier in the literature review there were two arguments for the impact of inflation on profitability, with the first being decrease bank profit, due to the uncertainty it drives, which leads to customers choosing to save rather than take out loans (Naceur and Kandil, 2009) Madugu et al. (2019), Ngo (2006) and Naceur and Omran (2011). The second view notes inflation as an addition to the cost of intermediation which a Bank on sells to customers (Batten and Vo, 2019). This study hypothesized a negative relationship between inflation and profitability. The results surprisingly show a statistically significant positive relationship between inflation and ROA, with no conclusive evidence supporting a negative relationship for ROE, NIM1 and NIM2. The positive relationship aligns with (Batten and Vo, 2019). International Monetary Fund (2022d) references inflation as “a self-fulfilling prophecy”, noting that customers may, in anticipation of rising prices, purchase items today, which leads to increased inflation.

In response to Masindi and Singh (2022), who note a contrast on the interplay between inflation and profitability, based on geographical location. They note that higher inflation, in Europe, increases the interest rate and interest received on products leading to more profitability. This contrasts with Africa, which sees higher interest rates increasing impairments through higher defaults and non-performing loans which lowers profitability, reflecting a “heterogeneous nature” of banking regulation in Africa.

The following graph was constructed based on NPL %’s and loans and advances from the WorldBank database. It plots inflation and NPL% to gross loans and advances for both a developed nation (UK), and Emerging economies (SA and Nigeria). For Nigeria, the NPL % generally moves in line with inflation from 2011 until 2020, in alignment with Masindi and Singh (2022). For the UK, inflation rates are generally lower and there is no pattern noted in the relationship between the direction of the NPL% and inflation. The same seems to apply from a South African perspective, showing a more or less constant NPL %, when compared to inflation.

Figure 34: NPLs % to gross loans and advances



Source: Author's own compilation. Ref no. [B11]

It was also noted that changes in the business (economic cycle) of a country can impact the profits of a Bank positively when in a boom (Naceur and Kandil, 2009). This study hypothesized a positive relationship between the boom in a business cycle and profitability (and vice versa). The results show a statistically significant positive relationship between the business cycle (when in boom) and ROA and ROE, with no conclusive evidence supporting a positive relationship for NIM1 and NIM2. The positive relationship aligns with Ercegovac et al. (2020) who notes metrics being linked to the cycle of the economy that the country is in due credit demand and investment potential. This concept was illustrated in the earlier graph under the resilience section, which showed the credit advances move with the cycle, and when periods of stress were encountered during 2007-2009 and 2020, advances declined in line with the economy. This supports a statistically significant positive relationship between the business cycle (when in boom) and ROA and ROE.

5.7 Implications for Policy Makers and Bank Management

The study has shown a positive relationship between both capital adequacy and profitability. From a regulatory oversight perspective, it is suggested that minimum ratios be maintained. Creating higher minimums will not significantly impede South African Bank profitability, given the industry already does operate with higher buffers. However, close monitoring of smaller Banks, who do not maintain high buffers, should continue. The South African Banking industry is admired for its resilience and the recommendation to policymakers would be to continue with this strong oversight function. Higher buffers (which are required for new entrants who

need a banking license) should continue to be applied, to reduce any possible systemic risk to the system and protect depositors.

The regulator should in addition continue with inflation and interest rate targeting as part of monetary and fiscal policy efforts. Even though the study provides a view that increased inflation improves profit, from a rationality perspective, this could end off hurting the economy, due to macroeconomic pressures on consumers which will surface with increased inflation. Close monitoring should also continue to be placed on the sovereign risk rating of the country and work undertaken to improve it where possible. There are several macroeconomic pressures seen building on the continent due to sovereign risk and currency liquidity shortages and other Regulators have been promoting higher capitalisation and liquidity buffers for safety (Bloomberg, 2023).

From a Bank management perspective, Management should continue to keep capital at optimum level, and ensure heathy metrics to reduce any adverse impacts on credit rating. Effective risk management and monitoring is critical for emerging risks and the risks present in the operating environment of the country, which if not managed appropriately will erode the capital base. Risk mitigation plans should look into stress testing, reducing risks relating to the operating environment (e.g. loadshedding, cyber risks etc). Impairments and distressed debt should be monitored proactively to prevent losses which reduce capital adequacy and profitability.

CHAPTER VI
CONCLUSION

6.1 Overview of Study and Results

This study was undertaken with the intention of evaluating the relationship between Banks' regulatory capital adequacy ratios and profitability in the South African Banking sector. The research question was posed as: what is the relationship between capital holdings and profitability for South African banks? To answer this, the author firstly undertook a comprehensive review of the associated literature and developed a series of hypotheses to answer the research question as follows:

Table 25: Hypotheses restated for conclusion

H(1)	*the greater the capital adequacy ratio, the lower the profit*
H(2)	*the greater the size of a Bank, the greater profit*
H(3)	*the greater the liquidity of a Bank, the lower the profit*
H(4)	*the greater the management efficiency metric, the greater the profit*
H(5)	*the greater the implicit costs rate of a Bank, the lower the profit*
H(6)	*the greater the cost efficiency rate of a Bank, the greater the profit*
H(7)	*the greater the inflation rate of a country, the lower the profit*
H(8)	*if an economy is in a greater part of business cycle, the greater will be the profit and vice versa*

The study then progressed to employ a quantitative research approach, utilising a panel data obtained for locally controlled banks in South Africa and a regression run over a twenty-year period (2002-2022). Variables were aligned to a reputable study of the Egyptian Banking industry (Naceur and Kandil, 2009) and tests for validity and reliability (normality, heteroskedasticity, multicollinearity) were run. Omitted variable bias was addressed through the use of the Naceur and Kandil (2009) model. A Hausman Test was used to test for fixed effects and the statistics were run through SPSS software.

The study evidences a statistically significant positive relationship between capital adequacy ratios (Tier 1 and Total Regulatory Capital ratios) and the profitability measures ROA and ROE. In addition, a statistically significant positive relationship was noted between capital adequacy (Total Regulatory Capital ratio) and the profitability measures NIM1 and NIM2. The test was inconclusive for the Tier 1 ratio, as there was not enough evidence to accept or reject the null hypothesis. This result is attributed to the strong resilience which the Banking sector in South Africa exhibits, high capital buffers over regulatory minimums and the ability to charge higher rates during crises and earn a higher NIM and ROA.

In addition, the results show a statistically significant positive relationship between size and ROE. It also shows the opposite, with a statistically significant negative for size with NIM2 and NIM1 (for Total Regulatory Capital only). The positive result is attributed to bank market concentration and size, suggesting that contributing banks, are able to leverage from size and advance more loans. The negative result on NIM1 and NIM2 warrants further investigation.

The results show no conclusive evidence supporting a negative relationship for liquidity and ROA, ROE and NIM1. The study showed a statistical positive relationship between liquidity and NIM2 attributed to times of crises (2007-2009, 2020) where Banks were able to lend out more, charge higher rates and earn a higher margin and profit.

Further, the results show a statistically significant negative relationship between management efficiency and ROA (when using Total Regulatory Capital), with no conclusive evidence supporting a positive relationship for ROE and NIM1. The study also reported a statistical positive relationship between management efficiency and NIM2. The positive relationship between management efficiency and NIM2 is expected, given the strong regulatory adherence and risk management practices that SA banking sector exhibits (earlier point on resilience is referred to). The negative result on ROA warrants further investigation.

The results show a statistically significant negative relationship between implicit costs and ROA, NIM1 and ROE (when using regressor Tier 1 capital), with no conclusive evidence supporting a negative relationship for NIM2. The negative relationship aligns with the expectation that higher costs reduce profit.

In addition, the results show a statistically significant positive relationship between inflation and ROA, with no conclusive evidence supporting a negative relationship for ROE, NIM1 and NIM2. Inflation is a macroeconomic concept, which unlike the other variables which is seen not to pass on to customers, will be passed onto customers as part of pricing models.

The results show a statistically significant positive relationship between the business cycle (when in boom) and ROA and ROE, with no conclusive evidence supporting a negative relationship for NIM1 and NIM2. The positive relationship is expected as the metrics would be linked to the cycle of the economy that the country is in due credit demand and investment potential.

Continued oversight by Regulators on capital adequacy and macroeconomic indicators and risks (such as sovereign risks) are encouraged. Bank management is urged to continue to maintain healthy capital ratios and metrics and continue to effectively stress test and manage risks relating to the business.

6.2 Limitations of Study

This study, in addition to the items listed in the introductory chapter, had the following limitations which could not be addressed:

1. Limited publicly available information for Pillar 2B information for additional buffers agreed with regulators by Banks, and the inputs to calculate detailed WACCs for analysing debt-equity impacts.
2. Whist the regression was able to show a relationship between capital and profitability, there are various other factors which impact the supporting statements for the relationship, which could not be assessed. To mitigate this, descriptive calculations were used e.g. for interest expense, to illustrate the supporting points but further investigation will be warranted.
3. As South Africa is highly concentrated in its banking sector (to about 4 banks), a lot of the analysis was done based on their contribution to the data set and their size. The effects of smaller banks' contribution may have been diluted in the process and further work would have to be done to focus on them.

6.3 Areas for Future Research

Whilst the study has illustrated a positive relationship between both capital adequacy and profitability, with an attributable factor identified being that of a resilient banking sector, a potential area of further research would be to understand if the South African Banking sector is in fact resilient, through stress testing potential capital impact scenarios. Given this study focussed specifically only on historic data and variables over the 20-year period, research can be expanded in future to take into these stressed scenarios and factors by incorporating a forward-looking view and scenario modelling to ascertain the impact of stressed scenarios (e.g. profitability under stressed scenarios) and capital implications.

The findings of this study provide the basis for further research on the optimal capital structures. This will be particularly useful to propose an optimal debt/equity position and assess its associated impacts on ROE (see section 5.1.3 above). In addition, a view of the

impacts of an optimal capital structure in the long run and short run would add further value to the research.

This study was only able to identify an impact on the relationship between CAR and credit ratings (borrowing costs), however there are additional complexities which would need to be considered to understand the full impact on credit ratings and borrowing costs (see section 5.1.2 above). Therefore, further investigation into the impact of higher capital ratios on borrowing costs, and the combined impacts of credit rating, bank capital and borrowing costs, would be useful.

Due to the market concentration of large Banks in South Africa, the study was largely weighted towards their metrics as part of the regression. Focussed research on smaller banks in South Africa, and their capital impacts on profitability were not drawn out in the study. A potential area of research would be to run an analysis on the smaller Banks in South Africa, to understand the buffers, regulatory requirements and capital decisioning they make. In addition, further work can be done for Banks with specific product type offerings, such as retail versus commercial/investment banks, as seen in Lee and Hsieh (2013) above.

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Figures derived as follows:

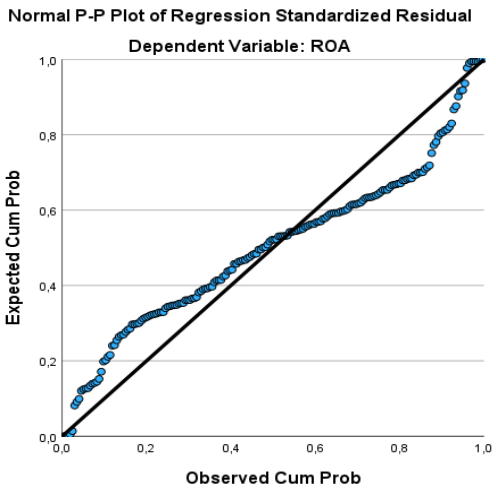
Ref no.	Figure	Content	Available
[B1]	1	1. Absa. *Financial Reports 2001-2020.* 2. Capitec. *Financial Reports 2003-2020.* 3. First Rand. *Financial Reports 2001- 2020.* 4. Standard Bank. *Financial Reports 2001- 2020.*	Absa Group | Investor Relations Investor Centre | Investor Relations | Capitec Bank Financial results- FirstRand Standard Bank Investor Relations s
[B2]	4	BA 900 Economic Returns. August 2023	https://www.resbank.co.za/en/home/what-we-do/Prudentialregulation/Sector_data/banks-ba900-economic-returns
[B3]	5	History from SARB + selected dates of entry for new entities from Bankfocus	https://www.resbank.co.za/en/home/about-us/history
[B4]	23	SARB selected monthly statistics August 2023	https://www.resbank.co.za/en/home/what-we-do/statistics/releases/selected-statistics
[B5]	24	Worldbank website 2024	https://data.worldbank.org/indicator/FR.INR.RINR?locations=ZA
[B6]&[B7]	25&26	FitchConnect database + simplistic calculation of interest expense on subordinated debt (total interest paid ÷ total subordinated debt (Tier	

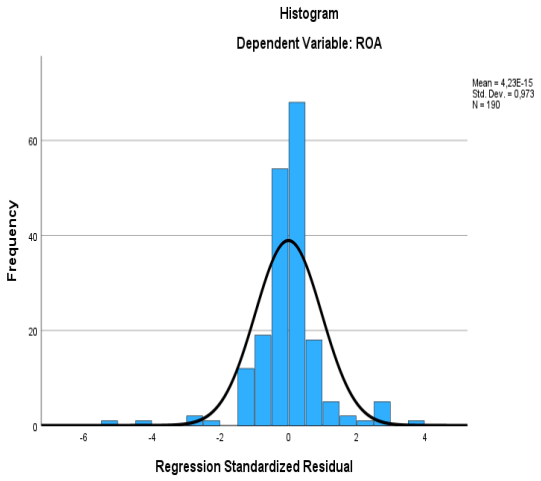
		2 Bonds), as disclosed in BankFocus), and Total Regulatory Capital ratios (from BankFocus).	
[B8]	27	Figure 27: Absa-Interest Income vs Non-Interest	As obtained from BankFocus database
[B9]	29-32	debt/equity composition has an impact on CAR and ROE, graphs were constructed, based on simple inputs of subordinated debt to equity	As obtained from BankFocus database
[B10]	33	IFRS segmental split as derived from financial reports available	Absa Group | Investor Relations Investor Centre | Investor Relations | Capitec Bank Financial results- FirstRand Standard Bank Investor Relations s
[B11]	34	NPL %'s and loans and advances from the WorldBank database	https://databank.worldbank.org/metadataglossary/world-development-indicators/series/FB.AST.NPER.ZS

APPENDIX

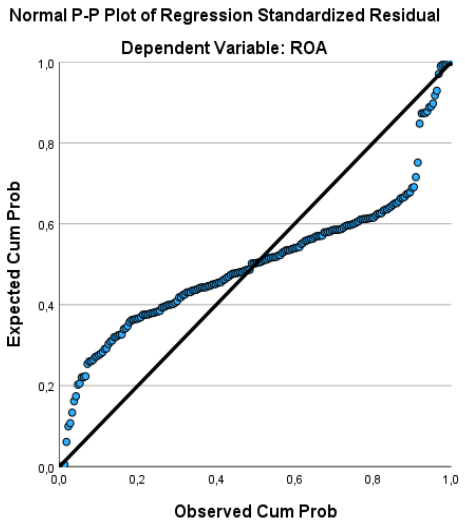
Figure A1: Supplementary NPP and histogram items

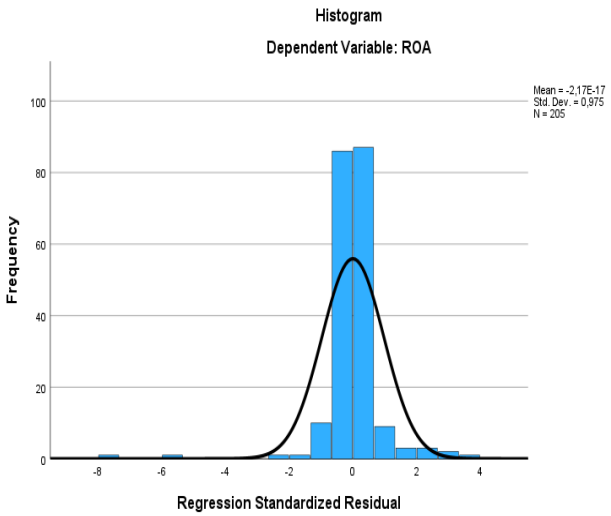
For Capital Regressor: Tier 1 Capital:



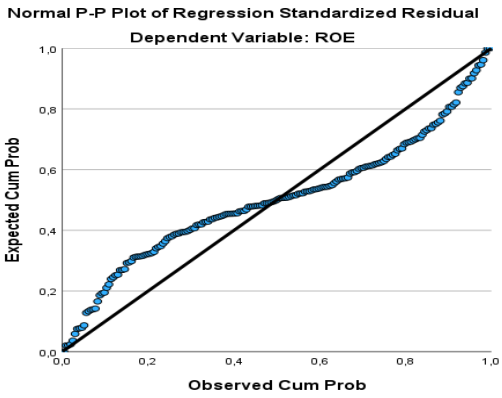


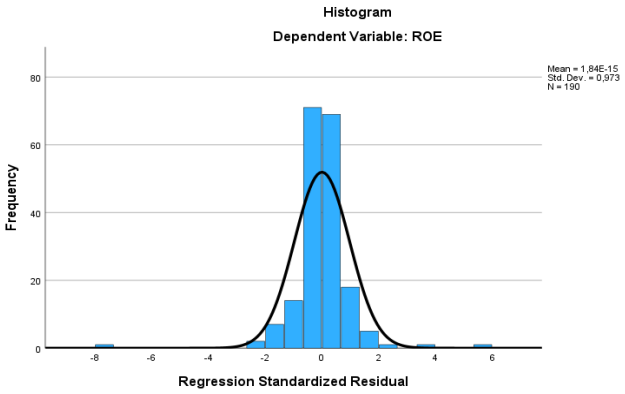
For Capital Regressor: Total Regulatory Capital:



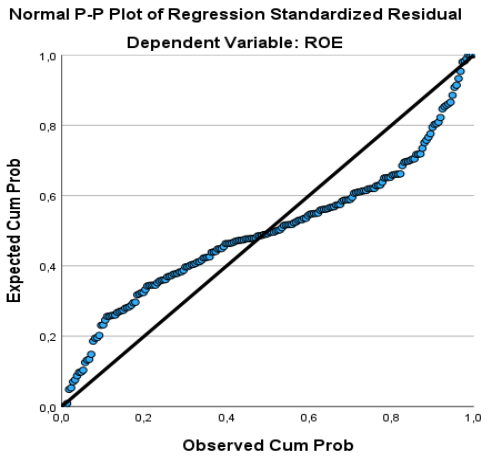


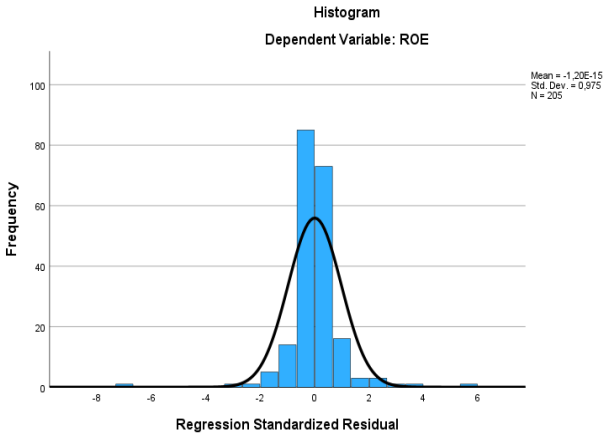
For Capital Regressor: Tier 1 Capital:





For Capital Regressor: Total Regulatory Capital:





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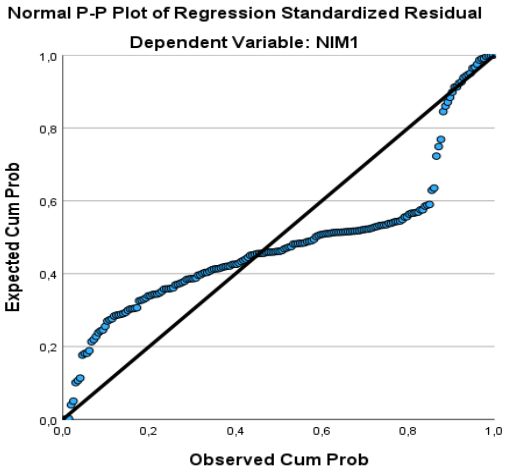

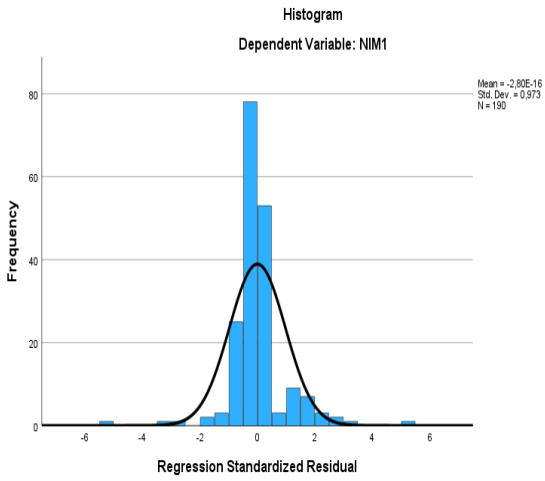

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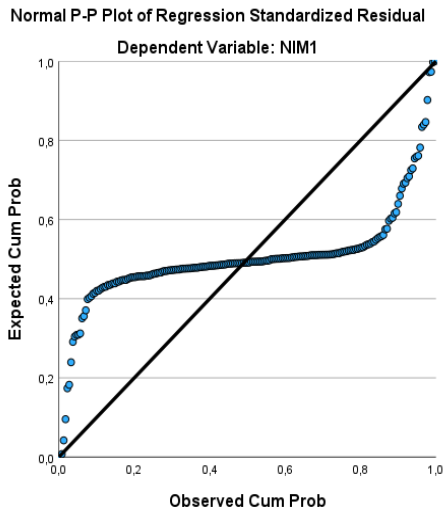

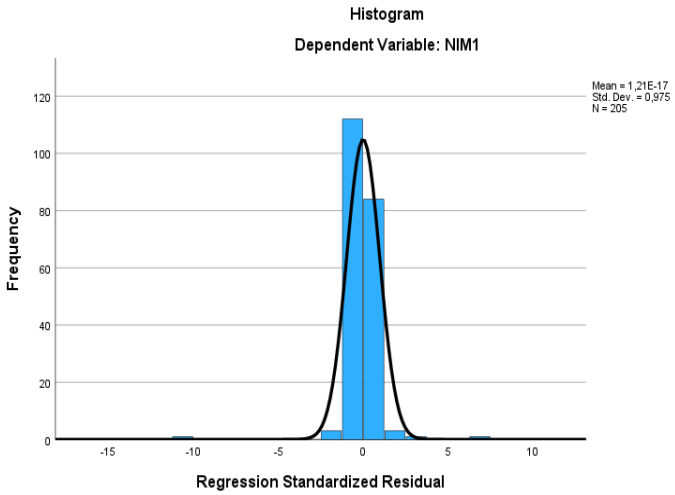

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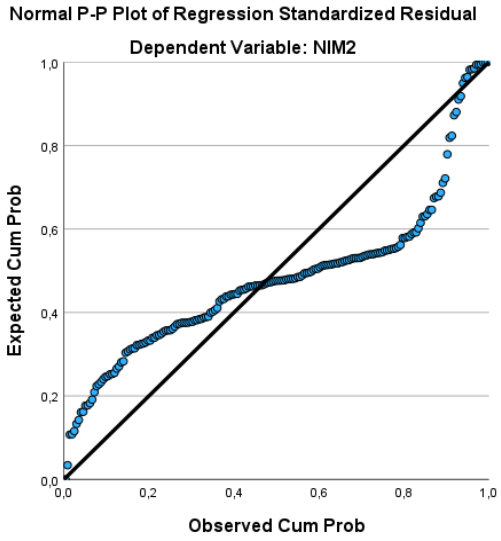

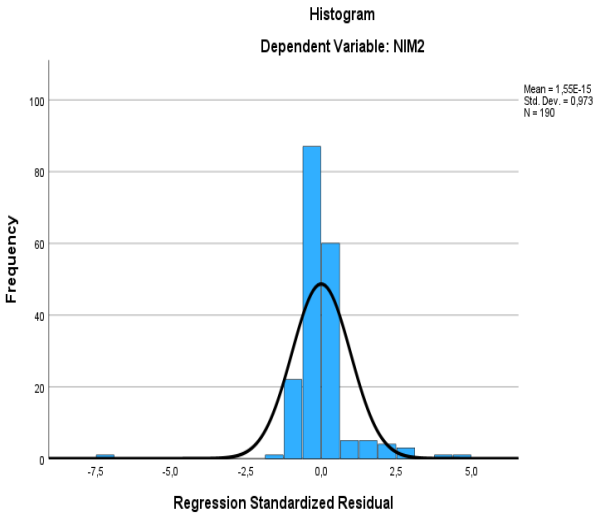

For Capital Regressor: Total Regulatory Capital: